Mills River Integrated Watershed Management Plan and Source Water Protection Plan

Henderson and Transylvania Counties North Carolina

Asheville and Hendersonville Water Systems
Public Water Supply Identification Numbers
01-11-010 and 01-45-010

Effective January 31, 2015

Mills River Partnership, Inc.
4139 Haywood Road
Mills River, North Carolina 28759

January 2015

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Table of Contents

List of Figures

Page

List of Tables

Page

Executive Summary

The length of the document reflects the complexities of the Mills River Watershed as well as the large number and diversity of stakeholders. About 70 percent of the watershed is owned by the U.S. Forest Service which is in the process of updating its management plan. The focus of this report is the remaining 30 percent of the watershed that is mostly privately owned. In addition to landowners and other residents of the watershed, the list of stakeholders includes nearly 90,000 drinking water users who are customers of the Hendersonville and Asheville public water systems.

Historical and potential water quality problems are identified and potential responses, preventions and solutions are proposed for a ten year time frame. While the Mills River Partnership is identified as the lead local organization for implementation of the plans, it is emphasized that MRP has no statutory authority. The Partnership is a nonprofit, non-governmental corporation using tools such as consensus-building, voluntary participation, outreach and education, and networking. A dozen or more local, state and federal agencies have statutory responsibilities in the watershed. In past activities, these agencies have shown a preference for voluntary, incentive-based approaches to solving water quality problems.

The known and potential water quality problems and solutions in the Mills River Watershed are described in physical and biological terms: 1500 feet of stream bank restoration or improvement of benthic biota from fair to excellent. Long-term care of Mills River will depend upon attitudes, beliefs, and behaviors of landowners, residents, and business operators within the watershed and the willingness of water users to provide financial support for watershed protection.

Currently, the Mills River Partnership is engaged in a three-year project designed to provide cost-share and technical assistance to farmer cooperators. This initiative is funded by an EPA-Section 319 Grant with matching funds from the Cities of Hendersonville and Asheville as well as cost sharing from cooperators. A full-time Watershed Coordinator collaborates with Henderson County Soil and Water Conservation District staff and farmers to identify sites for designing and installing best management practices for reducing stormwater runoff. Protocols have been designed to evaluate the effectiveness of these practices in reducing sediment in Mills River and its tributaries.

The Board of Directors of the Mills River Partnership includes farmers, citizens-at-large, leaders of environmental and agricultural organizations, representatives of the Town of Mills River, and the Cities of Hendersonville and Asheville (advisory), Henderson County government, and members of the Henderson County Soil and Water Conservation District Board of Supervisors. Meeting monthly for about three years, the Board members have gained understanding and respect for the watershed as a community in which competing needs and interests are difficult to balance. By adopting this plan, the Mills River Partnership accepts the challenge of providing local leadership in protecting this vital water resource for future generations.

Table ES-1 Proposed Management Strategies to Address Pollutants in the Mills River Watershed

Stressors[1]	Sources[1]	Functional Impacts	Recommendations (plan section links)
Excess Sediment Inputs	Agricultural fields	Habitat degradation--filling of pools, embedded riffles; increased turbidity	-Implement agricultural best management practices as part of recommendations from Farm Conservation Plans or SWCD/NRCS designs (Section 7.2) ○ Filter strips, field borders, grassed waterways, water diversions, livestock exclusion fencing, re-vegetate riparian areas, cover crops
Excess Sediment Input	Degraded stream channels due to dredging, berming, ditching, and flood events	Stream bank instability; poor shading; increased temperature; habitat degradation--insufficient woody and leaf material in streams; limited agrichemical removal	-Stabilize eroding stream banks (stream and buffer restoration and enhancement) (Section 7.3.1 & 7.3.2) -Restore riparian area vegetation communities with native species (Section 7.3.1) -Restore wetlands (Section 7.3.3) -Realign stream channels where roads cross streams (Section 7.3.4)
Channel Modification	Channel straightening, ditching, dredging, berming, beavers, and flood events	Stream channel and bank instability; habitat degradation--loss of riffle and pool habitat	-Implement stream restoration projects (Section 7.3.2)
Stormwater Runoff	Impervious surfaces in developed areas	Channel erosion and degradation of in-stream habitats due to increased stormwater discharge; aquatic life impacts from nutrients, toxic pollutants, and high flows	-Implement structural stormwater control measure retrofits (Section 7.4.5) -Encourage homeowners to install simple stormwater control measures (Section 7.4.4) -Retrofit unpaved roads and ditches to reduce erosion (Section 7.4.7) -Develop educational programs for general public and targeted audiences to control stormwater and reduce other pollutants (Section 7.7.4; Section 7.7.6)
Hazardous Materials	Agrichemical uses; storage facilities, mixing facilities. Other hazardous chemical users.	Degradation of aquatic insect communities in streams; contamination of drinking water supply	- Integrate use of IPM and agrichemical pollution prevention BMPs such as agrichemical handling facilities into Farm Conservation Plans (Section 7.2.2 and 7.2.3) -Develop educational materials for distribution to small businesses and landowners with volumes of hazardous chemicals not under regulatory control (Section 7.7.7)
Hazardous Materials	Chemical spills and vehicle accidents	Contamination of drinking water supply	-Relocate Hendersonville water intake to upstream of NC 191/280 Davenport bridge to reduce risk of contaminating the water system due to a hazardous materials incident (Section 7.5.1) -Construct containment structures adjacent to NC 191/280 to reduce risk of hazardous materials entering Mills River upstream of Hendersonville and Asheville water intake (Section 7.5.1)

[1] This table is not an exhaustive list of all potential stressors and sources of pollutants

Acknowledgements

The Mills River Watershed Management and Source Water Protection Plan project is a collaborative effort by many contributing agencies, organizations, and individuals. Funding for the plan was provided by the Clean Water Management Trust Fund and an EPA Section 319 Non Point Source Pollution Grant. The Carolina Mountain Land Conservancy was the fiscal agent for the project.

Guidance to the development of the watershed management plan was provided by the Mills River Partnership Executive Committee composed of Jere Brittain, Kieran Roe, Jimmy Cowan, and Darryl Fullam. The Mills River Partnership Board of Directors formed the core membership of the Stakeholder Group (SG).

Watershed Coordinators Alyssa Wittenborn and April Graham provided liaison communications with the MRP Board of Directors, members of the SG, and the general public. Their effort to coordinate the SG meetings and to provide background information for the management plan is appreciated.

Staff with the Henderson County Soil and Water Conservation District (HCSWCD) provided details on the current efforts to implement agricultural best management practices on farms within the Mills River Watershed. They also provided information on the potential pollution load reductions that could be achieved by installing the agricultural BMPs and provided a list of previously installed BMPs.

Ron Reid, Hendersonville Water Treatment Plant Superintendent, and Reggie Widemon, Supervisor of the Asheville Water Treatment Plant, provided information on plant operations, emergency response plans, and some historical perspectives regarding the water intake structure.

Forrest Westall (McGill Associates), Amber Vanderwolf (U.S. Forest Service), and Jenn Wood (Carolina Mountain Land Conservancy) provided valuable GIS data that strengthened the content of the watershed management plan.

Brett Laverty with NCDWR provided water quality, biological, and chemical data, as well as photographs for inclusion in the planning document.

Gregg Wiggins, Operations Manager, and Dean Ring, Engineering Technician, both with the Henderson County Utilities Department, provided information on the numbers and conditions of sewer line manholes within the Mills River Watershed.

Will Buie, WGLA Engineering, Inc., provided maps of the existing and proposed sewer system within the Mills River Watershed.

Jim Borawa, Kim Williams, Hunter Terrell, Fred Grogan, Dena Chandler, and Krista Leibensperger of Equinox provided assistance in compiling and analyzing existing date, conducting the stormwater analysis, and preparing maps for the WMP.

Development of this plan would not have been possible without the support of the cities of Hendersonville and Asheville, the North Carolina Agricultural Cost Share Program, Carolina Mountain Land Conservancy, and individual landowners who entered into cost share agreements for the implementation of agricultural BMPs on their farms. They contributed $182,250 of cash and in-kind services as match for the $200,000 provided by the NCDWR's 319 Non-point Source Pollution Grant Program. The current project adds to the $1.7 million secured by the Carolina Mountain Land Conservancy from the Clean Water Management Trust Fund in 2010 to conserve lands in the Mills River Watershed.

Where to Find the Key Elements in this Plan[1] (Sheet 1 of 2)

USEPA Watershed Plan Element	Source Water Protection Plan Element	Element Description	Element Location (Linked)
1		Identification of the causes (stressors) and sources or groups of similar sources that need to be controlled.	Table ES-1- Proposed Management Strategies to address pollutants Section 1.4 - Primary Stressors and Impairment History Section 3- Watershed conditions
2		Description of the Nonpoint Source Pollution (NPS) management measures that will need to be implemented to achieve potential load reductions and meet the goals of the watershed plan.	Table ES-1- Proposed Management Strategies to address pollutants Section 7.2 - Agricultural Best Management Practices Section 7.3 - Stream and Wetland Enhancement and Restoration Section 7.4 - Stormwater Control Measures Section 7.5 - Hazardous Materials Section 7.7 - Education and Outreach
3		Estimate of the pollutant load reductions expected for the management measures.	Section 7.8 - Estimated Pollutant Load Reductions Section 8- Management Plan Tables 8.2-8.9
4		Estimate of the amount of technical and financial assistance needed, including associated costs and or sources to implement the plan.	Section 8.4 - Implementation Schedule and Accomplishments Tracking, Tables 8.2-8.9 Action Plans Table 1.2 – MRP Board and SG Members Section 2.4.3 - Organizations in Watershed Table 8.9- Monitoring and Maintenance Plan
5		Information/education component to enhance public understanding of the project and encourage participation in management measures.	Section 7.7 - Education and Outreach Table 8.7-Education and Outreach Plan Table 8.15- Schedule for Edu. & Outreach Table 1.2 – MRP Board and SG Members
6		Schedule for implementing the NPS management measures that is reasonably expeditious.	Section 8.3 – Watershed Improvement Actions Section 8.4 - Implementation Schedules and Accomplishments Tracking
7		Description of interim, measurable milestones for determining whether NPS management measures or other control actions are being implemented.	Section 8.4 - Implementation Schedules and Accomplishments Tracking, Tables 8.10-8.14 Action Plans
8		Set of criteria that can be used to determine whether loading reductions are being achieved over time and substantial progress is being made towards attaining water quality standards.	Section 8.3 – Watershed Improvement Actions Section 8.4 - Implementation Schedules and Accomplishments Tracking, Tables 8.2-8.6 Action Plans
9		Monitoring component to evaluate the effectiveness of the implementation efforts over time measured against the criteria.	Section 7.10 - Watershed Monitoring, Table 7.6 Section 8.4 - Implementation Schedules and Accomplishments Tracking

Where to Find the Key Elements in this Plan[1] (Sheet 2 of 2)

	1	Source Water Protection Planning Team (Stakeholder Group).	Section 1.5 - Watershed Partners, the Planning Team, and the Planning Process
	2	Source Water Assessment Plan Content Summary.	Section 4.1 – Source Water Assessment Program Reports
	3	Potential Contaminant Source Inventory.	Section 4.2 - Potential Contaminant Assessment
	4	Source Water Protection Management Strategies.	Section 7.5 – Hazardous Materials
	5	Contingency Plan -Emergency Response Plan.	Section 5 - Emergency Response Plan
	6	Waters Supply Water Protection Program and Program Manager.	Section 2.4 - Jurisdictions and Existing Plans and Programs
	7	Implementing, Maintaining, and Updating the SWPP.	Section 5.4 - Contingency Plan Development and Maintenance Section 8.4 - Implementation Schedules and Accomplishments Tracking, Tables 8.10 and 8.17
Mills River Partnership Element		Adaptive management plan to address catastrophic events and project maintenance.	Section 6 - Planning for Uncertainty

[1]Elements as defined by USEPA and Source Water Protection Program guidelines (USEPA 2008, SWPP 2009)

Key to Acronyms and Abbreviations

BMP	Best Management Practice
BRP	Blue Ridge Parkway
CCAP	Community Conservation Assistance Program
CFU/100 mL	Colony forming units per 100 mL; fecal coliform density measurement
CMLC	Carolina Mountain Land Conservancy
CWMTF	Clean Water Management Trust Fund
CWP	Center for Watershed Protection
EBTJV	Eastern Brook Trout Joint Venture
ECO	Environmental and Conservation Organization (becomes MountainTrue. in 2015)
ERP	Emergency Response Plan
FEMA	Federal Emergency Management Agency
HUC	Hydrologic Unit Code
IBI	Index of Biotic Integrity
IPM	Integrated Pest Management
MRP	Mills River Partnership
NCDA&CS	North Carolina Department of Agriculture and Consumer Services
NCDEM	North Carolina Division of Environmental Management
NCDEMLR	North Carolina Division of Energy, Mineral, and Land Resources
NCDENR	North Carolina Department of Environment and Natural Resources
NCDOT	North Carolina Department of Transportation
NCDWQ	North Carolina Division of Water Quality (Pre-2013) - In August of 2013, Division of Water Quality ceased to exist and became known as Division of Water Resources.
NCDWR	North Carolina Division of Water Resources (2013 to present)
NCEEP	North Carolina Ecosystem Enhancement Program
NCNHP	North Carolina Natural Heritage Program
NCWRC	North Carolina Wildlife Resources Commission
NLCD	National Land Cover Dataset
NPDES	National Pollutant Discharge Elimination System
NPS	Nonpoint Source Pollution
NRCS	National Resource Conservation Service
NTU	Nephelometric Turbidity Units (turbidity measurement units)
PCS	Potential Contaminant Source
PWSS	Public Water Supply Section of the Division of Water Resources
SCM	Stormwater Control Measures (also known as Stormwater Best Management Practices – BMPs)
SG	Stakeholder Group
SMIE	Stream Monitoring Information Exchange
SNHA	State Natural Heritage Area
SWAP	Source Water Assessment Program
SWPP	Source Water Protection Program
HCSWCD	Henderson County Soil and Water Conservation District
TMDL	Total Maximum Daily Load
TSS	Total Suspended Solids
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
VWIN	Volunteer Water Information Network
WMP	Watershed Management Plan

1. INTRODUCTION

1.1 Planning Background

The Mills River Watershed supplies potable water to over 62,000 users in Henderson County and Hendersonville as well as up to 20,000 users in Buncombe County and Asheville. Since development as a drinking water supply by the City of Hendersonville in the early 1920s, the Mills River Watershed received much attention to preserve water quality as well as the historic community character. Beginning in the early 1980s demand for water increased as the area developed. To address those demands, a number of studies and plans were prepared that documented the watershed condition, threats of stream degradation, and efforts to protect ecological values for the community. Those plans included recommendations that balanced the need to preserve the water quality of the Mills River and the historic land uses, particularly farming, logging, and recreation (Figure 1.1). The history of those planning efforts and characteristics of the watershed are well documented in Eaker and Willett (1989), CMLC-LOSRCOG 2000, MRPP-LOSCRCOG (2002), and McGill (2012). Information from basin-wide planning documents (NCDWQ 1995, 2000, 2001, 2005, 2011a) also is used extensively. Those reports serve as background for this document.

View of Mills River Watershed from Blue Ridge Parkway

This document integrates the elements required for both an USEPA-compliant 9-Element Watershed Management Plan (WMP) and a North Carolina Division of Water Resources (NCDWR) Source Water Protection Plan (SWPP). These plans are intended to identify strategies and management measures which upon implementation will lead to improved water quality and lower risks of contamination of the water supply from hazardous materials. Preparation of these documents is required to access grants and loans from the North Carolina Nonpoint Source (NPS) Pollution program and the Clean Water Management Trust Fund (CWMTF) Drinking Water Protection Program. Throughout the remainder of this document the combined 9-Element Plan and Source Water Protection Plan are referred to as the Mills River Watershed Management Plan (WMP).

1.2 Guiding Principles

Implementation of the Mills River WMP will adhere to the following guiding principles:

- Effective date of the WMP is January 31, 2015;
- Actions described in the WMP are non-regulatory;
- Shared values of all stakeholders were considered;
- Private landowner involvement in implementing the WMP is voluntary;
- No authority to trespass on private lands is conveyed in implementing this plan;
- All landowners and businesses will be encouraged to participate;
- Approval of the WMP by the NCDWR 319 Program and Public Water Supply Section and adoption by the Mills River Partnership (MRP) conveys no regulatory authority;

- Numbers of accomplishments and implementation schedules are for planning purposes only and do not obligate the MRP for any specific deliverable;
- This plan is for the MRP with the purpose to improve and sustain the quality of water. Although governmental partners were involved in its development, it is not a regulatory document;
- The WMP is a dynamic document; accomplishments and work plans will be developed in conjunction with an annual review;
- Henderson County Emergency Management Coordinator will review the emergency response plan annually or following any hazardous material incident;
- Management action priorities and schedules will be revised as necessary; and
- Revision of the WMP will occur no later than 2024.

The voluntary nature of this plan cannot be stressed enough. MRP secured funding for this plan with the idea that it would be non-regulatory and that it would build on the shared values of all stakeholders and the mission of the Partnership, which is "to monitor, protect, and improve water quality in the Mills River through voluntary participation of stakeholders."

1.3 Mills River Watershed History

The first European settlers arrived in the Mills River Watershed in the late 1700s. Their approach to clearing and draining the land for settlement was described as "slash, burn, and channelize" (Brittain 2001). By the early 1900s much of the watershed, including the portion now in Pisgah National Forest, had been cleared. During that time, silt loads in streams must have been high and both fish and wildlife habitat severely damaged. Compounding these impacts was the use of "splash dams" on Big Creek to float logs downstream and the construction of railroads along the North and South Forks of the Mills River.

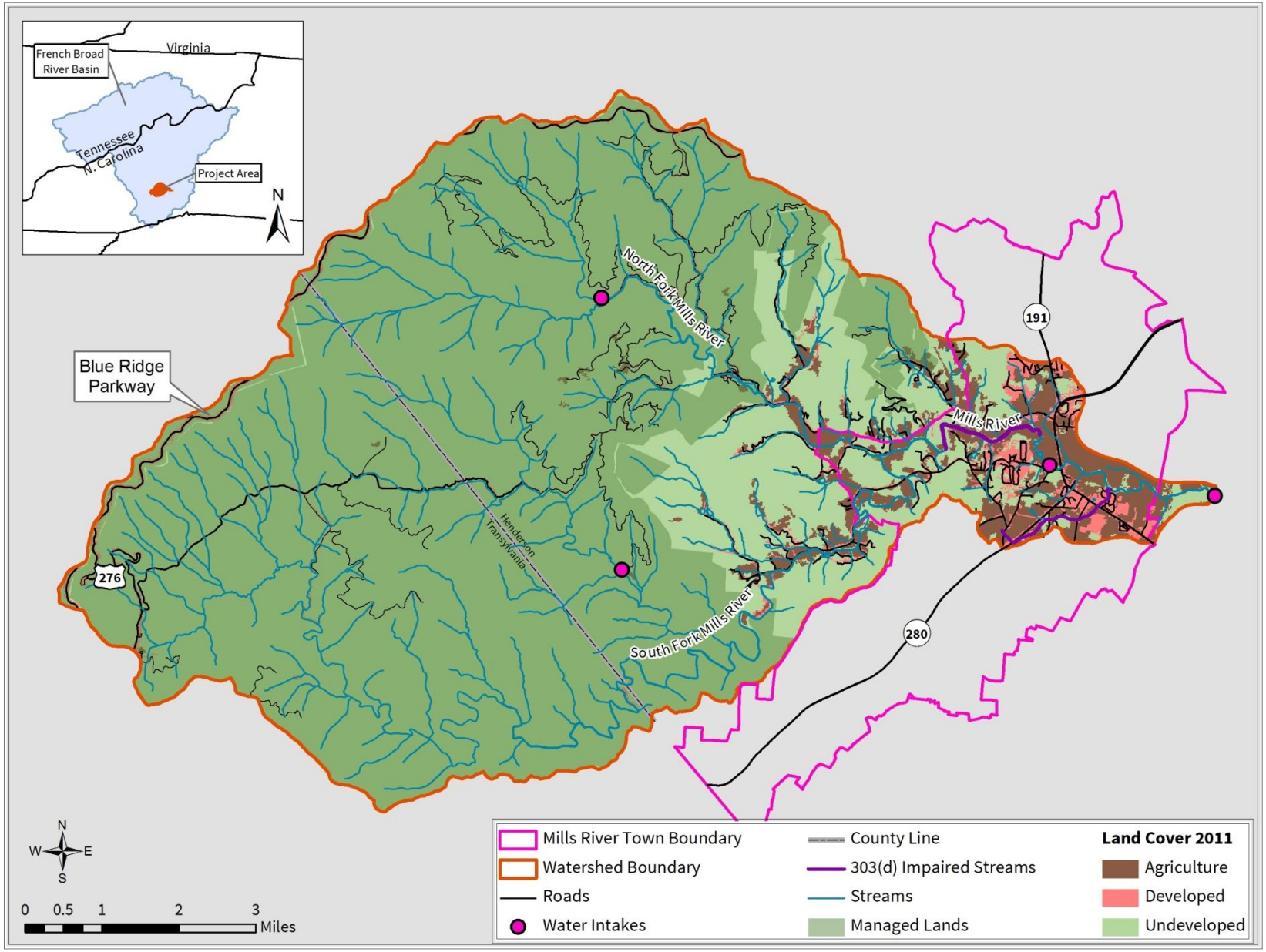
Splash dam on Big Creek, circa 1895; photo courtesy of USFS.

In 1922-23, the City of Hendersonville created a reservoir by constructing an impoundment at the confluence of Big Creek and Fletcher Creek, tributaries of the North Fork Mills River. More than 16 miles of cast iron pipe was installed to deliver water to City residents and businesses. A second impoundment was constructed on Bradley Creek, a tributary of the South Fork Mills River. During the mid- to late 20th century there were several attempts to build a dam on the Mills River as a way to provide more drinking water for the growing populations of Buncombe and Henderson counties. The strong sense of community among Mills River families as well as the heightened environmental awareness of the region's residents defeated those efforts. In 1963, citing increased demand for potable water, the City of Hendersonville constructed a water intake on the Mills River, 350 feet downstream of Davenport Bridge on NC 191/280, and a water treatment facility further downstream. In 1999, the City of Asheville constructed a water treatment facility downstream of the Hendersonville treatment plant and intakes on the Mills River and on the French Broad River near their confluence.

While much of the watershed is now forested, the remnants of what the original settlers and loggers did are still evident. Today, the headwaters of Mills River in Pisgah National Forest are almost entirely forested in second growth woodlands, having been purchased by the federal government during 1916-17. Outside Pisgah National Forest, roads within the watershed often parallel streams that have been straightened, and drainage ditches on agricultural fields are still maintained (Figure 1.1). Despite the improvements in watershed conditions, sediment continues to be the most obvious pollutant associated with water quality. Much of this history was excerpted from a book titled *Dam Sites, Gun Fights and Water Rights: Essays on the History of Henderson County and Vicinity* (Brittain 2001) of which more detail was described in *The Mills River Watershed Planning Management Strategy (*MRPPC-LOSRCOG 2002).

Sediment from tributary flowing into the river

Figure 1.1 Mills River Watershed Management Plan Project Area



1.4 Primary Stressors and Impairment History

Since the Clean Water Act was passed in 1972, the Mills River Watershed was noted as having many "Excellent" streams based on biological rating by the NCDWR, which was known as NC Division of Water Quality (NCDWQ) prior to 2013. However, as benthic macroinvertebrate community data were updated beginning in 1994, concerns began to grow regarding water quality in the watershed (NCDEM 1978?, 1994a, b; NCDWQ 2003). The primary stressors identified with these concerns were sediment and pesticides associated with runoff from agricultural operations. In the late 1990s, NCDWR recognized the lower North Fork, lower South Fork, and Mills River as being impaired. MRP worked with local farmers to install chemical handling stations and BMPs to control impacts on aquatic health. NCDWR found the results as supporting the designated use for the Mills River as a regional water supply.

Chemical handling facility

An observed downward shift in ecological conditions of these streams occurred again in the early 2000s. This caused NCDWR to refocus regulatory attention on the watershed due to its classification as a regional water supply. Since that time, portions of the Mills River, South Fork Mills River, and Brandy Branch have been added to or removed from the NC 303(d) impaired waters list (Table 1.1) based on data from additional monitoring efforts. Various field studies in the watershed showed benthic macroinvertebrate community ratings as varying from poor to excellent (NCDWQ 2005, 2011a; NCDWR 2013a).

Brandy Branch, a sub-watershed of the Mills River that drains the area south of the intersection of NC 191 and NC 280, has been on the impaired waters list since 2004. This sub-watershed consists of a mix of agricultural, commercial, and residential land uses. An effort to determine the cause for the impaired biological integrity of that sub-watershed was attempted by NCDWR in 2008, but the study could not be carried out due to insufficient flows caused by drought conditions (NCDWQ 2005). It should be noted that Brandy Branch is on the impaired waters list based on NCDWR data from 1994. Recent testing through the biomonitoring program of the Environmental and Conservation Organization (ECO) shows improvement over 1994 testing.

Because of the progress being made to address stressors NCDWR has not pursued more strict regulatory action, most notably the development of a Total Maximum Daily Load (TMDL) study for the Mills River watershed. Implementation of a TMDL would require landowners to reduce the loads of sediment entering the water courses. To date, NCDWR has pursued voluntary implementation of BMPs to address these issues.

This WMP provides a road map for the MRP, Henderson County Soil & Water Conservation District (HCSWCD), and the cities of Asheville and Hendersonville to collaborate on achieving further reduction of stressors in the Mills River Watershed.

Table 1.1 History of 303(d) Listed Streams within the Mills River Watershed

Years Listed	Stream	Reaches	Cause and Source of Impairment
2000-2006	Mills River	From SR 1337 to 0.5 mi. upstream of Davenport Bridge on NC 191. From 0.5 mi upstream of Davenport Bridge on NC 191 to Hendersonville water intake downstream of Davenport Bridge. From Hendersonville water intake downstream of Davenport Bridge to 0.7 mile upstream of the mouth of Mills River. From 0.7 mi. upstream of the mouth of Mills River to confluence with French Broad River.	Toxic chemicals (primary) and sedimentation. Potential source: specialty crop production. Removed in 2006 due to improved ecological conditions (NCDWQ 2005).
2010	South Fork Mills River	From the upstream side at the mouth of Queen Creek to the confluence with Mills River.	Impaired biological integrity – benthic community. Source unknown. Removed in 2012 due to improved ecological conditions (NCDWQ 2011a).
2004-2014	Brandy Branch	From source to Mills River.	Impaired biological integrity – benthic community Source unknown

1.5 Watershed Partners, the Planning Team, and the Planning Process

Local leaders, citizens, Asheville, Hendersonville, and the general public recognized the value of the Mills River and the threats to its water quality. As a community, these groups came together in 1998 to form the Mills River Partnership (MRP). This public-private partnership was "dedicated to restoring the water quality in the lower Mills River, Brandy Branch, and Wash Creek while maintaining the outstanding quality of other streams in the watershed" (McGill 2012). The original members of the MRP included the following:

- Carolina Mountain Land Conservancy (CMLC)
- City of Hendersonville
- Henderson County
- Henderson Soil and Water Conservation District
- Regional Water Authority of Asheville, Buncombe, and Henderson Counties (since dissolved)
- Land-of-Sky Regional Council
- U.S. Forest Service
- North and South Mills River Community Development Center

Since 2013, MRP has marked significant steps in its development. Board members from three partnering organizations -- Trout Unlimited, the Environmental and Conservation Organization (ECO), and Henderson County -- were appointed. It should be noted that the Henderson County representative is also the Henderson County Water Quality Administrator, who oversees the Water Supply Water Protection Program for the Mills River Watershed. The MRP also received its 501(c)(3) nonprofit tax exemption from the Internal Revenue Service, making it possible to pursue grant funding under its own name. Finally, to aid in achieving the MRP's mission, goals, and objectives, a Watershed Coordinator position was created and filled. The current focus of the MRP Watershed Coordinator is to fulfill the organization's commitment to the ongoing NCDWR 319 Grant, which enables farmers to install agricultural BMPs.

The MRP established the Mills River Watershed Planning Committee to develop a long-term watershed management strategy. Under contract with Land-of-Sky Regional Council a series of meetings were held during 2001-2002 to develop the strategy document. The input from those meetings and the general management goals are integrated into the current WMP. Collaboration among partners has resulted in the installation of numerous agricultural BMPs, which have helped reduce stormwater runoff and lowered the risk of toxic chemical spills.

The current Mills River watershed management and source water protection planning process was initiated in October 2013 with grants from the NCDWR 319 Program and the CWMTF. Continued concerns about the impact of sediment and runoff in the Mills River Watershed led to this plan of action to improve water quality and stream habitat.

A group of stakeholders comprised of the MRP Board of Directors and local representatives was assembled (Table 1.2) to develop the WMP. This Stakeholder Group (SG) served as the planning team for the combined 9-element and source water protection plan initiative. The SG met formally on five occasions; the meetings were open to the public. Five subgroups met once to review potential project maps associated with agricultural operations, degraded stream and riparian areas, stormwater management, hazardous materials management, and land conservation. The SG facilitation process was carried out by Equinox, a firm specializing in conservation planning that balances land use with protection of natural resources and water quality.

Stakeholder group meeting January 2014

Upon approval of the Mills River Watershed Management and Source Water Protection Plan by the NCDWR, the MRP will provide leadership for implementing the plan. It will collaborate with existing partners, nonprofit organizations, corporations, and local, state, and federal agencies to obtain funding and technical advice to implement on-the-ground projects that will lead to improved water quality and ecological conditions in the Mills River Watershed. The most critical component of the plan is to find landowners interested in volunteering to implement management measures identified in this plan. This would be achieved through a combination of cost-share incentives and educational initiatives.

In 1993, NCDENR required Henderson County to develop a Water Supply Water Protection Program, including ordinances to protect water quality in the Mills River Watershed. The program applies to all unincorporated areas of Henderson County, the portion of the Town of Mills River within the water supply watershed, the City of Hendersonville, and the Town of Laurel Park. Oversight of the program and ordinances adopted by the County is the responsibility of the Henderson County Water Quality Administrator.

Table 1.2 Mills River Partnership Board of Directors and Stakeholder Group Membership

Member Name	Organization	Current MRP Board Member[1]	Stakeholder Group Member Participation[2]
Jere Brittain	Citizen	✓	✓
Linda Brittain	Citizen/Schoolteacher		✓
Steve Caraker	City of Hendersonville	✓	✓
Wayne Carland	Town of Mills River	✓	✓
Jimmy Cowan	Henderson County Farm Bureau	✓	✓
Darryl Fullam	Town of Mills River Agricultural Advisory Committee	✓	✓
Damon Hearne	Trout Unlimited		✓
Dale Kluge			✓
Jim Czarnezki		✓	✓
Rachel Hodge	Environmental and Conservation Organization		✓
Seirisse Baker			✓
Evan Parker			
Mark Stierwalt		✓	
Greg Hoyt	Henderson County Soil and Water Conservation District	✓	✓
Jonathan Wallin			✓
Laurie Brokaw			✓
Shaun Moore			✓
Derek Ibarguen	U.S. Forest Service		✓
Lori Stroup			✓
Bert Lemkes	Citizen; Van Wingerden International	✓	✓
Rick Livingston	Mills River Fire and Rescue		✓
Jason Davis			✓
Kieran Roe	Carolina Mountain Land Conservancy	✓	✓
Jenn Wood			✓
Steve Shoaf	City of Asheville, Water Resources Department		✓
Lee Smith	City of Hendersonville, Water and Sewer Department		✓
Mark Williams	Henderson County Agricultural Advisory Board	✓	✓
Natalie Berry	Henderson County	✓	
Other Participants			
Ron Reid	City of Hendersonville Water Treatment Plant		
Keith Kirchner			
Steve Cannon	N.C. Department of Transportation		
Hartwell Carson	WNC Alliance		
Brett Laverty	N.C. Division of Water Resources		
Larry Rogers	Henderson County Partners for Economic Progress		
Rocky Hyder	Henderson County Emergency Management Director		
Alyssa Wittenborn	Mills River Partnership		
April Graham			
Jim Borawa	Equinox (facilitator)		
Kim Williams			

[1]Board membership as of November 1, 2014.

[2]Stakeholder Group member or participated as organization representative in at least one Stakeholder Group meeting.

1.6 Goals of the Watershed Planning Team

The overall goal of the WMP planning project was to develop an integrated watershed management and source water protection plan that meets the requirements of the NCDWR 319 Grant and Public Water Supply programs. The integrated WMP will allow the MRP to compete for grant and loan programs necessary to implement the WMP and, thus, resulting in improved water quality and watershed conditions. The Stakeholder Group agreed that the value of the plan goes beyond identifying projects. The WMP will be used to develop community support for the MRP and to engage partners who can assist with the implementation of the plan.

All but one (groundwater contamination) of the water quality issues identified in the 2002 Mills River Watershed Strategy (MRWPP-LOSRCOG 2002) are addressed in this document. The goals of each issue are still pertinent and are adapted for this document. With some modification the seven issues and associated goals of each issue are as follows:

1. Agriculture
   - Design and implement BMPs that reduce sediment loading to watershed streams.
   - Enhance and expand existing programs to address agricultural non-point source pollution in the watershed.

2. Stream Restoration and Riparian Area Enhancement
   - Work with willing landowners to restore and preserve effective riparian areas along all water bodies in the watershed.
   - Work with willing landowners to restore stream channels, stabilize stream banks, and improve aquatic habitat.

3. Stormwater Controls
   - Implement appropriate measures to prevent or mitigate stormwater runoff.

4. Hazardous Materials
   - Enhance programs to prevent and/or respond effectively to hazardous materials incidents.

5. Land Conservation
   - Implement appropriate measures to encourage and assist landowners to retain forestland, farmland, riparian areas, wetlands, and other open spaces.

6. Outreach and Education
   - Inform landowners of watershed protection issues, Best Management Practices (BMP), and seek their assistance in protecting water quality.
   - Inform students of the value of streams and their function.
   - Inform the general public on why they should care about the watershed and keep them informed about the watershed's issues and success stories.

Although groundwater was an issue outside of the scope of this planning document, implementation of the management measures recommended in the WMP likely will result in reduced risk of groundwater contamination.

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2. WATERSHED CHARACTERIZATION

2.1 Geographic Location

The Mills River is a tributary to the French Broad River. The Mills River Watershed encompasses 73.3 square miles (46,894 acres; Table 2.1) in northern Henderson and eastern Transylvania Counties. Approximately 76 percent of the watershed, comprising most of its headwaters, is within Pisgah National Forest. About 1,100 acres along the northern boundary of the watershed is owned by the National Park Service as part of the Blue Ridge Parkway (BRP; Figure 1.1). The remaining 10,000+ acres is in private ownership.

The Mills River flows from west to east and is catalogued with the 12-digit hydrologic unit codes (HUC) 060101050402 (South Fork Mills River) and 060101050403 (North Fork Mills River and the mainstem Mills River. This numbering system serves as a watershed address. The portion of the watershed within Pisgah National Forest has few roads. Most are gated logging roads not open to vehicular traffic. Hiking, hunting, fishing, horseback riding, and mountain biking are allowed; not all areas are open to all types of use.

The only major highway in the Mills River Watershed is NC 191/280. Approximately one mile of the highway crosses through the Mills River floodplain at Davenport Bridge, which is about two miles upstream from the confluence of Mills River with the French Broad River. The remaining public roads are secondary roads; most outside of the national forest are paved. There are also private roads, both paved and unpaved.

Elevations within the Mills River Watershed vary from 5,320 feet along the BRP to 2,040 feet at the confluence with the French Broad River. The watershed falls within three Level IV ecoregions (Griffith et al. 2002) which have the following characteristics:

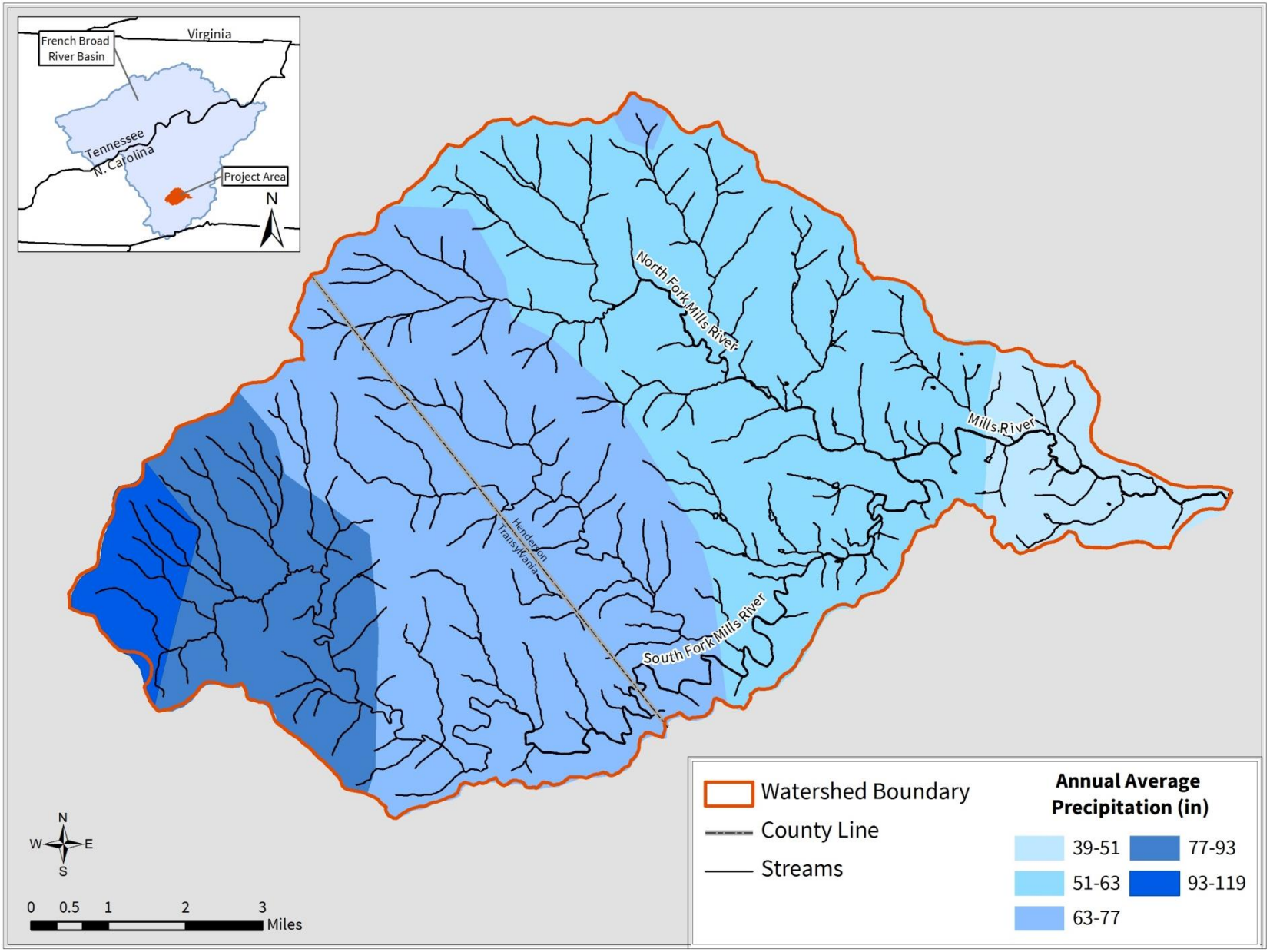
- Southern Crystalline Ridges and Mountains – Elevations generally 1,200-4,500 feet; mostly forested with chestnut oak dominating on most slopes and ridges.
- Broad Basins – elevations vary, but are generally lower, drier, and with less relief than other ecoregions of the Blue Ridge; has a mix of oaks and pines more similar to the Piedmont; overall it has more pasture, cropland, industrial uses and human settlement than other Blue Ridge ecoregions.
- High Mountain – Generally above 4,500 feet in elevation; red spruce and Fraser fir found at higher elevations; red oak forests and northern hardwood forests with beech, yellow birch, yellow buckeye, and sugar maple are common.

Rainfall within the Mills River Watershed varies significantly (Figure 2.1). The western portion of the watershed, located along a mountainous ridge, receives 93-119 inches of rainfall annually, whereas the easternmost portion, located in a broad valley, receives only 39-51 inches per year. Thus, base flow is primarily comprised of water from the undeveloped portion of the watershed in Pisgah National Forest.

Mills River Watershed has a generally temperate climate with four distinct seasons. As measured at the Asheville Regional Airport, which is approximately 3.5 miles northeast of the Town of Mills River,

summer high temperatures range between 76 and 84°F, whereas winter high temperatures range from 46 to 55°F. Low temperatures in summer average 61-65°F and in winter average 28-31°F. Cooler temperatures prevail at higher elevations in the watershed.

Figure 2.1 Variation of Average Rainfall within the Mills River Watershed



2.2 Population and Land Use Characteristics

Like many counties in western North Carolina, Henderson and Transylvania Counties were heavily logged in the late 19th and early 20th centuries. After the timber was gone, agricultural operations came to dominate the Mills River Watershed. Dairy and beef cattle farms were numerous, supported with production of corn to feed those animals. Today, those enterprises have given way predominately to vegetable crop production. A few small livestock farms still exist (HCT&T 2014); however, no Confined Animal Feeding Operations (CAFO's) currently are present.

Corn and tomato production in Mills River

Today, much of the land in the river bottoms in the lower portion of the watershed is used to grow tomatoes and peppers. Higher elevation lands have been used for residential purposes, including second homes and planned communities. A few medium to large commercial and industrial facilities are present, located mostly in the Brandy Branch sub-watershed. Brandy Branch, an impaired stream, drains into the Mills River about two miles upstream of the confluence with the French Broad and the water intake for the Asheville Water Treatment Plant.

While the Mills River community has a strong agricultural heritage, which remains a vital component of the local economy, urban, commercial, and residential development have also made their way to the area. Improved highway access, proximity to the Asheville Regional Airport, and increasing popularity of recreation in neighboring Pisgah National Forest have resulted in significant growth of population and tourism in the area. Based on census tract data that includes the Mills River Watershed and some adjacent areas, the population grew over 60 percent, from 8,221 to 13,261 residents, between 1990 and 2010 (USCB 2014).

To maintain its farming heritage and to protect against uncontrolled growth, the Town of Mills River was incorporated in 2003 (TOMR 2014). The Town covers 22 square miles and encompasses farmland in the lower portion of the Mills River Watershed (Figure 2.2).

As part of the watershed planning process, maps were developed using the 2011 National Land Cover Database (MRLC 2013) to spatially view land-use patterns in the watershed and to assist in the identification of stream impacts (Figure 2.2). Based on this analysis, 91 percent of the Mills River Watershed is undeveloped forested land (Table 2.1). Of the 42,490 acres in undeveloped land, 35,446 acres are part of Pisgah National Forest and 1,083 acres are associated with the BRP. These lands will not be subject to development pressures. Management of those lands is driven by the Pisgah/Nantahala Forest Management Plan (USFS 1994, under revision) and the BRP General Management Plan (BRP 2013). The U.S. Forest Service (USFS) is considered a partner in Mills River Watershed improvement.

Of the portion of the Mills River Watershed in private ownership, 10 percent is developed land (residential, commercial or industrial), 23 percent is in agricultural use, and the remaining 66 percent is undeveloped (Table 2.1). The 2013 Henderson County tax office data showed 1,798 privately-owned parcels having 1,413 unique property owner names. Most of the agricultural land is used for

the production of vegetables and row crops; a smaller amount is used to produce sod and for greenhouse production of plants.

Table 2.1 Land Use within the Mills River Watershed

Land Use[1]	Entire Watershed		Private Lands	
	Acres	Percent	Acres	Percent
Developed	**1,717**	4%	1,140	10%
Low Density	141	<1%	138	1%
Medium Density	125	<1%	125	1%
High Density	28	<1%	28	<1%
Open Space	1,423	3%	849	8%
Agriculture	**2,562**	5%	2,515	23%
Pasture/Hay	1,813	4%	1,766	16%
Cropland	749	2%	749	7%
Undeveloped	**42,491**	91%	7,196	66%
Deciduous Forest	40,556	87%	6,361	58%
Evergreen Forest	857	2%	286	3%
Mixed Forest	692	1%	242	2%
Shrub/Scrub	139	<%	82	1%
Herbaceous	247	1%	225	2%
Other	**124**	<1%	32	<1%
Open Water	8	<1%	8	<1%
Barren Land	25	<1%	14	<1%
Woody Wetlands	91	<1%	10	<1%
Total	**46,894**	**100%**	**10,892**	**100%**

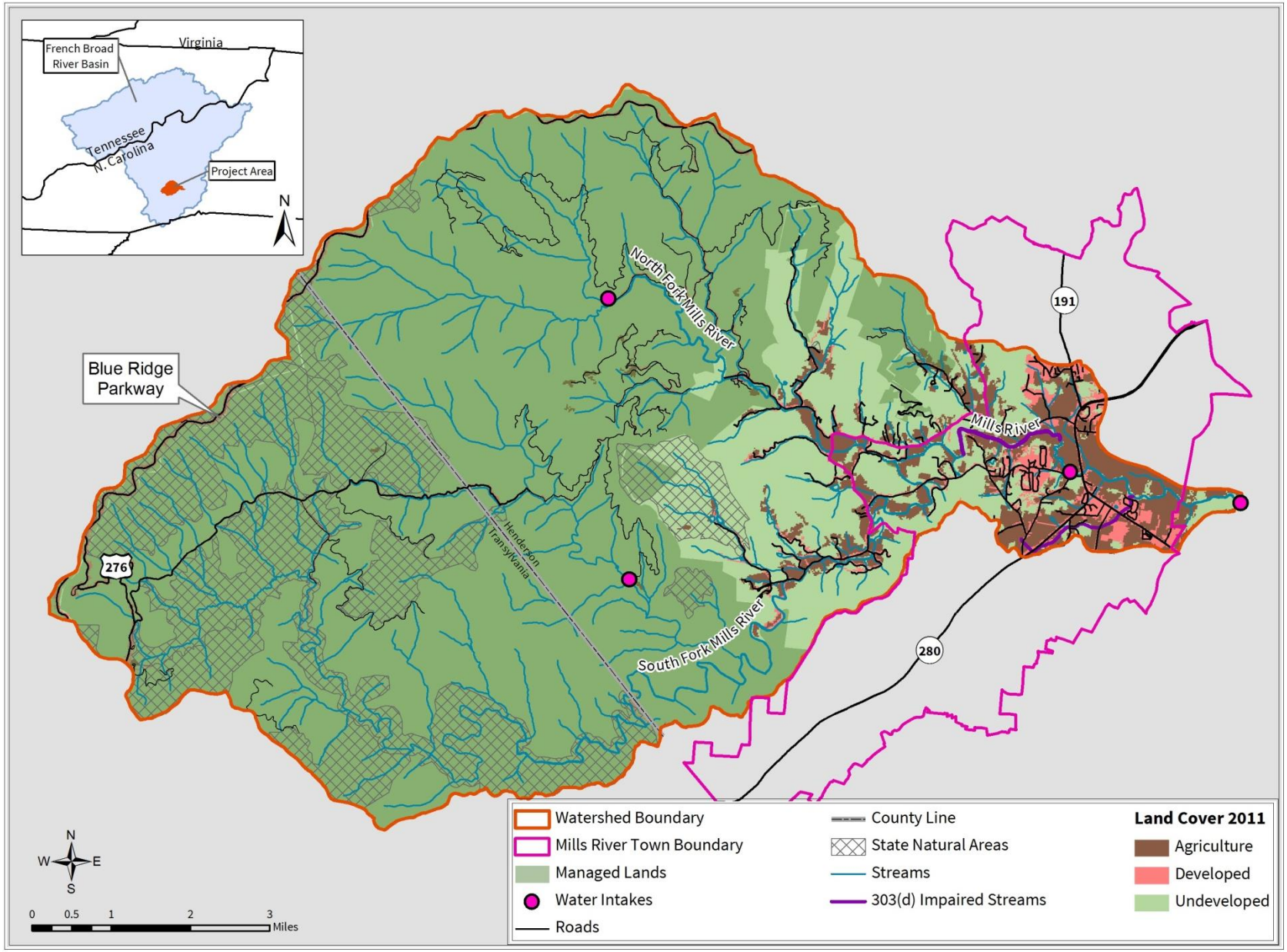
[1]Derived from 2011 National Land Cover Database (MRLC 2013).

Impervious surfaces cover approximately 305 acres or 2.8 percent of private lands (Appendix A). Most of the impervious surfaces are located in the commercial corridors along NC 191 and NC 280 in the Town of Mills River. The Town has developed plans to install sewer service to much of the core area along the NC 191/280 corridor. At the present time, two main lines have been installed; feeder lines are planned for the future. Sewer lines serving the area will be separate from the stormwater drainage system.

While the installation of sewer lines will benefit the water quality of Brandy Branch, it appears that stormwater runoff from existing development along with historic channel straightening may be the cause of streambank erosion and habitat degradation. Additional details regarding the impacts of stormwater runoff from the impervious surfaces in Brandy Branch sub-watershed are presented in Section 3.2.5. Henderson County was declared a Phase II stormwater community around 2009. Under this designation, local jurisdictions are required to implement post-construction stormwater management programs for new development. Henderson County adopted stormwater management ordinances in September 2010. Those ordinances cover the unincorporated portions of the county. The Town of Mills River has opted to defer administration of Phase II post-construction stormwater management program requirements to the North Carolina Division of Energy, Mineral, and Land

Resources (NCDEMLR). As such, stormwater permitting for new development is managed out of the Asheville Regional NCDEMLR office.

Figure 2.2 Land Use and Natural Areas



2.3 Natural Resource Characteristics

The Mills River Watershed is home to many features of biological and ecological significance. Areas containing populations of rare species and outstanding aquatic and terrestrial natural communities have been identified as Significant Natural Heritage Areas (SNHAs) by the North Carolina Natural Heritage Program (NCNHP). The NCNHP also tracks other lands in the watershed that are managed to conserve biological diversity and ecological function (NCNHP 2014).

> ***State Natural Heritage Areas*** - Terrestrial or aquatic sites that have special biodiversity significance due to the presence of a rare species, unique natural community, or other ecological

Within the Mills River Watershed, the NCNHP has identified 19 SNHAs covering over 10,000 acres (Figure 2.2; Table 2.2).

Table 2.2 N.C. Significant Natural Heritage Areas

Natural Area Name	Acres
Bradley Creek Swamp Forest-Bog Complex	43
Bryson Bog	1
Case Camp Ridge/Seniard Mountain	40
Clawhammer Mountain/Black Mountain	601
Flat Laurel Gap Bog	3
Foster Creek Bog	27
Frying Pan Gap	1,829
Funneltop Mountain	707
Mills River Aquatic Habitat	178
Mount Pisgah	406
Mullinax Cove	2
Pilot Rock/Pilot Cove	1,019
Queen Creek Forests	922
Seniard Creek Swamp Forest-Bog Complex	6
Soapstone Ridge	665
South Fork Mills River Riparian Area	2,051
South Mills River Scarlet Oak Area	139
Stony Bald	97
The Pink Beds	1,615
Total Acres	10,351

Some of the SNHAs are partially or wholly encompassed within federally-owned lands, lands owned by conservation organizations, or private lands on which conservation easements are in place (Figure 2.2). These lands are managed for conservation purposes and have legal protections. Other SNHAs are located on private land and may be managed for conservation purposes, but they have no legal protections and are at risk of development. The remaining private land within the SNHAs are not managed for conservation purposes, but are still of conservation interest because of the natural resources contained within them. Owners of those properties will be encouraged to voluntarily conserve those resources through education and outreach efforts.

Managed lands in the Mills River Watershed far exceed those contained within the SNHAs (Figure 2.2; Table 2.3). Lands in Pisgah National Forest are managed for multiple uses including maintaining forest

health and recreation as well as providing products such as timber and plants. Lands managed by the National Park Service along the Blue Ridge Parkway are managed primarily for their aesthetics and natural processes using more passive management actions.

Table 2.3 Managed Lands within the Mills River Watershed

Landowners	Acres
National Park Service – Blue Ridge Parkway	1,083
Carolina Mountain Land Conservancy	1,519
U.S. Dept. of Agriculture, Natural Resources Conservation Service	140
U.S. Forest Service	35,446
Total Acres Managed	38,188

The Mills River Watershed is home to four plant and eight animal species at varying levels of risk of being eliminated from the watershed due to degraded conditions of their habitats - streams and riparian areas (Table 2.4). One species of mussel, the Appalachian elktoe, is on both the Federal and State endangered species list (NCNHP 2012). It and three other species of mussels are found primarily in the main stem of Mills River.

Two fish and two amphibian species considered as Federal and State species of concern or significantly rare occur in the Mills River Watershed. The most notable of these is the eastern hellbender, a large salamander (Table 2.4). Four vascular plant species known to occur in riparian areas are also found within the project area. The swamp pink is on both the Federal and State threatened species list. Populations of brook trout, North Carolina's only native trout, while not threatened have also been greatly reduced and are now found mainly in the headwaters of the Mills River (EBTJV Undated).

Eastern hellbender

Table 2.4 At-Risk Animal and Plant Species

Taxonomic Group Common Name	Scientific Name	North Carolina Status[2]	Federal Status[2]
Freshwater Bivalves			
Appalachian Elktoe	*Alasmidonta raveneliana*	E	E
Slippershell Mussel	*Alasmidonta viridis*	E	
Tennessee Heelsplitter	*Lasmigona holstonia*	E	FSC
Creeper	*Strophitus undulatus*	T	
Fish[1]			
Mountain Blotched Chub	*Erimystax insignis eristigma*	SR	FSC
Olive Darter	*Percina squamata*	SC	FSC
Amphibians			
Common Mudpuppy	*Necturus maculosus*	SC	
Eastern Hellbender	*Cryptobranchus alleganiensis*	SC	FSC
Vascular Plants			
Purpleleaf Willowherb	*Epilobium coloratum*	SR-P	
Swamp Pink	*Helonias bullata*	T	T
Perennial Sundrops	*Oenothera perennis*	SC-V	
Small-leaved Meadowrue	*Thalictrum macrostylum*	SR-T	FSC

[1]Historical records exist for paddlefish (*Polyodon spathula*), blueside darter (*Etheostoma jessiae*), mooneye (*Hiodon tergisus*), but they are no longer known to exist in the Mills River Watershed.

[2]E = Endangered; T = Threatened; SR = Significantly Rare, but at the periphery of its range; SC = Special Concern; SR-P = Significantly Rare-Peripheral; SC-V = Special Concern-Vulnerable (likely to become Threatened within the foreseeable future; SR-T = Significantly Rare throughout its range; FSC = Federal Species of Concern

2.4 Jurisdictions and Existing Plans and Programs

The rural character of Henderson County and the Mills River Watershed did not necessitate significant regulation until the 1990s when development booms across western North Carolina occurred. Private lands within the Mills River Watershed fall under two local government jurisdictions, the Town of Mills River and Henderson County, and one state government agency, NCDEMLR. While a portion of the Mills River Watershed is in Transylvania County, all of that land is owned and managed by the U.S. Forest Service. Management of those lands is guided by Amendment 5 of the USFS Nantahala/Pisgah National Forest Management Plan (USFS 1994). The Town of Mills River jurisdictional boundary extends to the lower portions of the North and South Fork Mills River to the west, Hooper Lane to the east, Line Creek and High Vista Development to the north and the Brandy Branch sub-watershed to the south. The remainder of the watershed falls under Henderson County jurisdiction.

2.4.1 Henderson County

Erosion Control. Under authority given by the NCDEMLR, Henderson County administers the sedimentation and erosion control program in unincorporated portions of the Mills River Watershed. Erosion Control is part of the Water Quality Division of Henderson County Engineering Department. It is currently led by the Water Quality Administrator.

Farmland Preservation. Henderson County has a Farmland Preservation ordinance "to encourage the voluntary preservation and protection of farmland from nonfarm development, recognizing the importance of agriculture to the economic and cultural life of the County." The ordinance provides for the establishment of Voluntary and Enhanced Voluntary Agricultural Districts throughout the County, except in "designated growth areas" as delineated in the County Land Use Plan. Agriculture and related farm uses are exempt from the Henderson County Code of Ordinances, Article II –Zoning District Regulations, Article V – Landscape Design Standards, and Article VI – Off-Street Parking and Loading Standards.

In 2010, the County adopted an Agricultural Preservation Plan (HCAAB 2010). The plan provides for the use of the following voluntary programs to preserve the rural character of farmlands:

- Present Use Value tax incentives
- Voluntary and Enhanced Voluntary Agricultural Districts
- Conservation Easements
- Term Conservation Easements (Agricultural Agreements)
  Transfer of Development Rights

North Carolina's Right-to-Farm Laws protect farm and forestry operations from being declared a nuisance if they are operated properly and without negligence.

Funding for these voluntary programs can be applied for by government agencies and nonprofit organizations through the North Carolina Agricultural Development and Farmland Preservation Trust Fund (ADFP). Additionally the ADFP grants are available to support "programs that will promote profitable and sustainable family farms."

One of the primary purposes in the County's Agricultural Preservation Plan is to assist leaders "in preserving agriculture in Henderson County by promoting agricultural economic development and farmland protection." The plan recognizes the importance of profitability in preserving farmland and the necessity for large farms that can produce volumes necessary to survive on low profit margins. Profitability is cited in the plan as either a direct challenge or underlying problem to other challenges farmers face.

Stormwater Control. Since 2007, unincorporated areas of Henderson County have been designated a Phase II post-construction stormwater control community. Henderson County became a delegated local program in 2010 and adopted the state stormwater model ordinance. These regulations apply in the Mills River Watershed except for the portions in the Town of Mills River. The program is overseen by the Henderson County Water Quality Administrator.

The stormwater ordinance addresses the following issues to protect water quality:
Density of the project (i.e. low density, or high density)

- Low Density requirements are:
    - Has no more than two (2) *dwelling units per* acre or 24 percent *built-upon area* for all *residential* and *non-residential development*; and
    - The overall *density* of a project is at or below the relevant low-density threshold (and which may contain areas with a *density* greater than the overall project *density*, provided the project meets or exceeds the post construction model practices for *low-density projects* and, to the maximum extent practicable, locates the higher-density portion in upland areas and away from surface waters and drainage ways).
- High Density requirements are:
    - The measures shall control and treat *stormwater runoff* from the first inch of rain over a 24-hour period. Runoff volume drawdown time shall be a minimum of 48 hours, but not more than 120 hours.
    - All structural *stormwater* treatment systems used to meet these requirements shall be designed to have a minimum of 85% average annual removal for Total Suspended Solids (TSS).

NCDWR delegated Henderson County to administer the Stormwater Phase II Post-Construction run-off management program. To ensure compliance with stormwater rules, the County provides developers and residents with a website explaining the program.

Subdivision Regulations. Henderson County has subdivision regulations stating their purpose "is to promote, through proper planning, health, safety and general welfare by providing for the orderly *subdivision* of land in Henderson County." The County determined these regulations were necessary to:

- Establish procedures and standards for the *subdivision* of land;
- Provide for orderly growth and development;
- Protect and enhance property ownership and land values;
- Provide for dedication or reservation of *road right-of-way*;
- Assure the proper design and installation of *roads* and utilities;
- Assure proper legal description, identification and recordation of property boundaries to maintain an accurate, up-to-date land records management system;
- Promote environmental quality;
- Preserve areas of the County with productive soils for continued agricultural and *forestry use* by preserving blocks of land large enough to allow for efficient operation;
- Encourage the maintenance and enhancement of habitat for various forms of wildlife and to create new woodlands through natural succession and reforestation where appropriate;
- Minimize site disturbance and *erosion* through retention of existing vegetation and avoiding development on *steep slopes*; and
- Preserve open land, including those lands that contain *unique* (and sensitive) *natural areas*.

Water Supply Water Protection. Henderson County has a water supply water protection overlay district ordinance. As defined in the ordinance, the intent of the overlay district is to manage the *uses* of land and *structures* encompassed by *water supply watersheds* within the County in order to maintain the high quality of surface water in these *watersheds.* This overlay gives specifics on densities depending in which water supply watershed the project lies. Once the project location has been identified and the density has been determined, the regulation mirrors that of the stormwater control regulations mentioned above.

2.4.2 Town of Mills River

Erosion Control. The Town of Mills River regulations require anyone applying for a building permit to have a sedimentation and erosion control plan approved by NCDEMLR at the time of application. The Asheville Regional Office of NCDEMLR enforces the state sedimentation and erosion control rules for the Town.

Farmland Preservation. Mills River exempts bona fide farms and related uses from its general land use provisions. It does not restrict farms from participating in other farmland preservation programs such as those administered by Henderson County.

Stormwater Control. Because of its location in Henderson County, the Town of Mills River was required to comply with Stormwater Phase II post-construction runoff control rules beginning in 2007. However, the Town assigned the NCDEMLR Raleigh office to administer the Stormwater Phase II Post-Construction runoff management program. The State's requirements are identical to the requirements for Henderson County outlined in section 2.4.1 above.

Water Supply Water Protection. The Town of Mills River has assigned the Henderson County Water Quality Administrator to enforce the Water Quality Section of the Henderson County Land Development Code Chapter 42 to all streams within its jurisdiction. Agricultural and silvicultural uses are permitted, but certain additional restrictions apply. See Section 2.4.1 Water Supply Water Protection for specific requirements.

2.4.3 Organizations in the Watershed

Due to its rural nature and relatively small population, few civic groups, nonprofit organizations, or churches are in the Mills River Watershed. As a result, the MRP is the primary local environmental organization actively involved in improving the health of the watershed. [However, citizens and organizations within Henderson County but outside Mills River Watershed, have shown considerable interest in protecting drinking water supply and environmental quality in the watershed over time.] The list of organizations included in the stakeholder group of the Mills River Partnership reflects this. In addition, the following organizations have been identified as potential partners to assist in implementing this WMP. That is not to say that other organizations are not concerned about protecting the water supply; their participation has not been pursued. Although some of those organizations are not located in the watershed, residents of the watershed are members of many of those groups. It will take a directed outreach effort to engage them as project partners. The following organizations have been identified as potential partners that could assist the MRP in implementing this WMP. The Watershed Coordinator has already reached out to some of these potential partners.

- Mills River Fire Department (contacted and located within watershed)
- North and South Mills River Community Club (contacted and located within watershed)
- West Henderson High School FFA Club (potential partner)
- Rugby Middle School (potential partner)
- Glenn C. Marlow Elementary School (potential partner)
- Mills River Elementary School (potential partner)
- 4-H Clubs
- Boy Scout and Girl Scout Troops
- Naturally Grown Project (small private experiential school)
- Cradle of Forestry Interpretive Association (nonprofit organization)
- Communities of Faith affiliated organizations
- Mills River Community Center
- Mills River Business Association
- Environmental and Conservation Organization
- Trout Unlimited (Pisgah and Land of Sky Chapters)
- Homeschool groups

3. WATERSHED CONDITIONS

3.1 Water Quality Classifications and Designated Uses

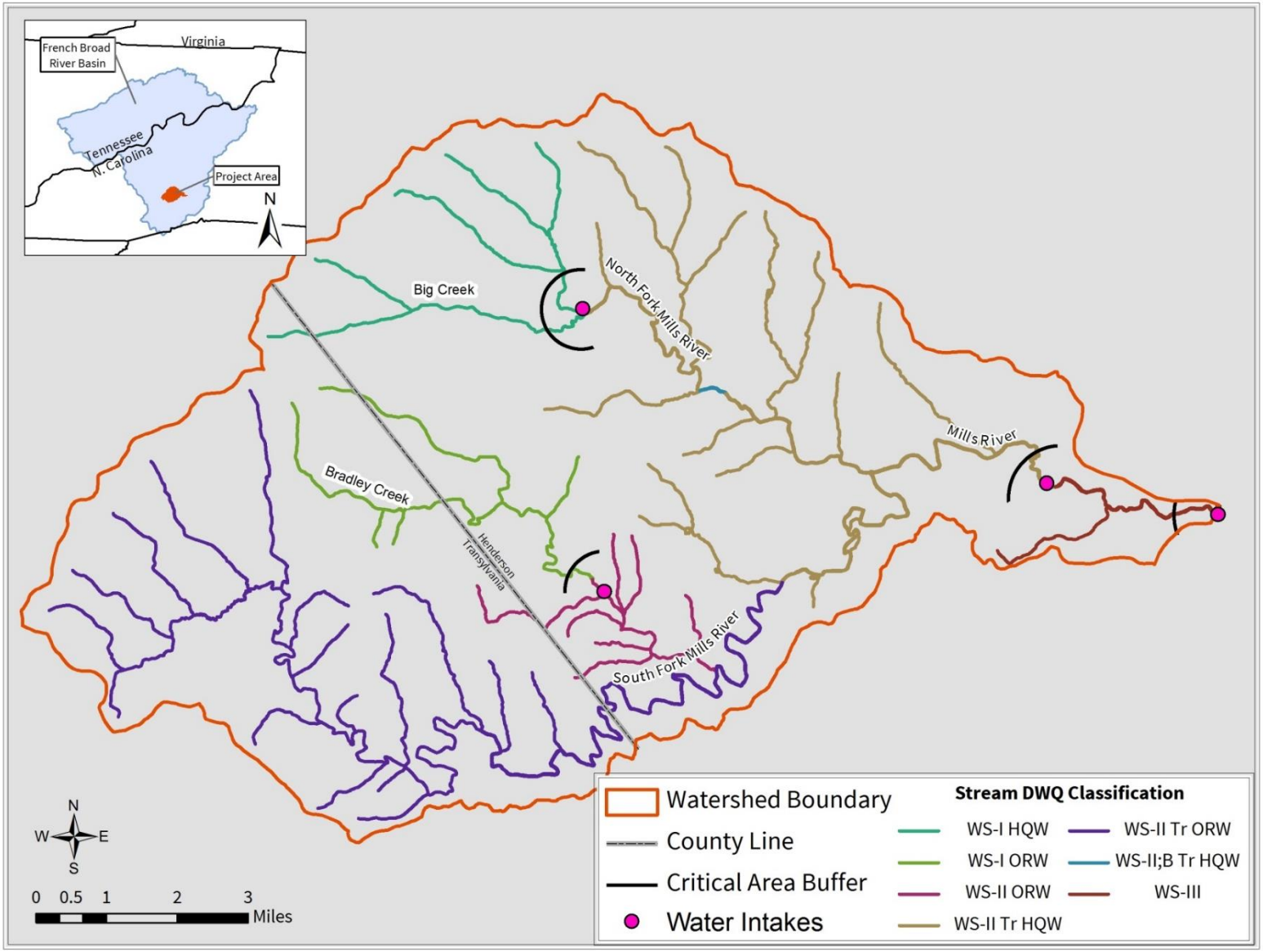
The Mills River Watershed contains approximately 211 miles of perennial stream. All streams within the watershed fall under one of three water supply water quality classifications (WS-I, WS-II, WS-III) and one general classification (Class B) (Figure 3.1 and Table 3.1). Furthermore, one or more of the supplemental classifications of Trout Waters (Tr), High Quality Waters (HQW), and Outstanding Resource Waters (ORW) only apply to streams that are upstream of Hendersonville water intake near Davenport Bridge on NC191/280. The most protective classifications are WS-I and HQW. These classifications (NCDWR 2013b) are intended to protect water quality by requiring limits on wastewater discharges and development activities as well as mandating the use of erosion and sediment controls. All classifications mandate the use of BMPs for agricultural and forestry activities; most require the use of BMPs for transportation related activities (for details see "Guide to Freshwater Classifications in North Carolina," 2011).

Table 3.1 Freshwater Water Quality Classifications[1]

Classification	Description
Water Supply (WS-I, WS-II, WS-III)	Waters used for drinking, culinary, or food processing purposes; amount of protection varies between subclasses
Class B	Waters used for primary recreational activities involving human body contact in an organized manner or on a frequent basis such as swimming and wade fishing, as well as other activities suitable for fishable, swimmable Class C waters.
Trout Waters (Tr)	Supplemental classification intended to protect freshwater for natural trout propagation and survival of stocked trout on a year-round basis.
High Quality Waters (HQW)	Supplemental classification intended to protect waters that are rated excellent based on biological and physical/chemical characteristics. By definition WS-I and WS-II waters are also HQW.
Outstanding Resource Waters (ORW)	Supplement classification intended to protect unique and special waters having excellent water quality and being of exceptional state or national, ecological or recreational significance. By definition all ORWs are also classified as HQW.

[1]Water quality classification descriptions from NCDWQ (2011b, 2013b).

Figure 3.1 Water Quality Classifications



3.2 Water Chemistry and Biological Conditions

The following sections summarize existing water chemistry and biological data. Those data are intended to serve as the baseline on which changes or general trends in these parameters will be measured as watershed improvement projects are implemented.

3.2.1 Water Chemistry

Water quality conditions in the Mills River Watershed are generally good as shown by data taken at one NCDWR ambient site and five Volunteer Water Information Network (VWIN) water quality monitoring sites (Figure 3.2; Tables 3.2 and 3.3). These sites were established to obtain long-term water quality data and are sampled monthly. Of the 23 parameters monitored by the NCDWR and VWIN programs only pH, Total Suspended Solids (TSS), and turbidity were found to have a significant proportion of samples falling outside of the established water quality standard. The NCDWR has included a portion of the Mills River on the draft 2014 303(d) impaired waters list for pH. The source of the pH variances is not completely clear, but NCDWR attributes it to equipment malfunction. The NCDWR and USEPA are working to resolve the issue. The highest levels of turbidity (100, 120, and 400 NTUs) were measured at the two sites on the Mills River and the one site on Brandy Branch. Brandy Branch has been on the 303(d) list since 2000 for having degraded aquatic life (benthic community), but the stressors in that sub-watershed have not been positively identified.

> ***Water Quality Standard*** **-** Level of a pollutant that must not be exceeded in order to protect human health and the aquatic environment.

Fecal coliform bacterial concentrations of up to 4,000 CFUs/100 mL were measured at the NCDWR ambient site; however, of the 149 samples taken, only 9 percent of them exceeded 400 CFUs.

Figure 3.2 Water Quality, Benthic, and Fish Sample Sites

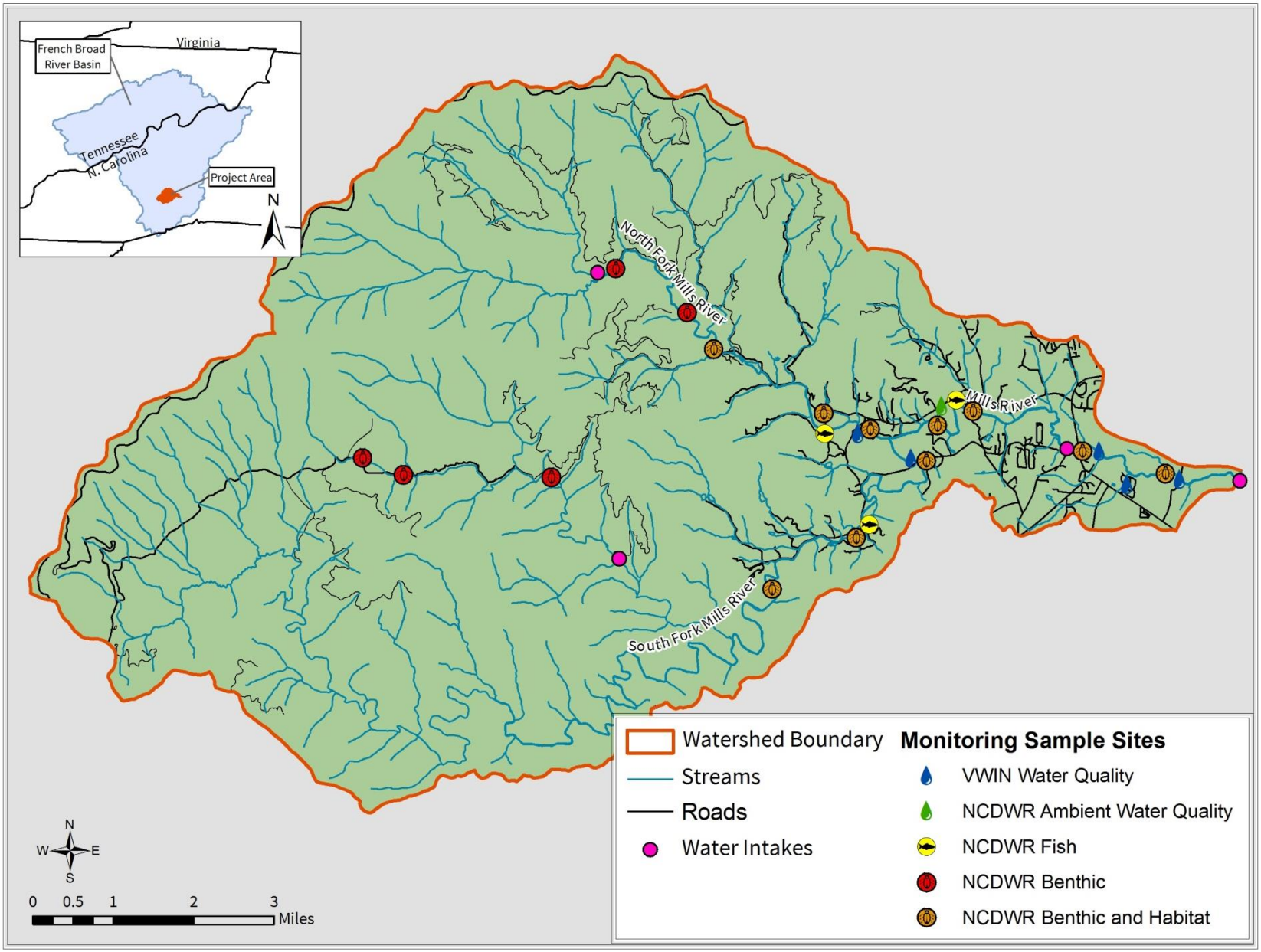


Table 3.2 Water Quality Characteristics at the NCDWR Ambient Monitoring Station, 2000-2013

Sample Characteristics				Results not meeting Evaluation Level		Minimum	Maximum	Percentiles				
Character Parameter	Number of Samples	Number Below Detection	Evaluation Level and Class[1]	Number	Percent			10th	25th	50th	75th	90th
Field Measures												
D.O. (mg/L)	113	N/A	Not <6.0	0	0	7.5	14.3	8.72	9.4	10.6	12	13.36
pH (SU)	112	N/A	6-9 AL	10	9	4.5	7.5	6	6.3	6.65	6.9	7.09
Conductivity (µS/cm)	112	N/A				12	30	13	14	15	17	18
Water Temp (C)	115	N/A	N/A			1	23	4.2	7.1	13	17.2	20
Other												
Hardness (mg/L)	22	0	100 WS	0	0	3	10	3.04	4	4.9	5	6.8
TSS (mg/L)	57	37	10 HQW	7	12	1	38	2	2.5	6.2	6.2	12.8
Turbidity (NTU)	154	16	10 Tr	9	6	0.8	60	1	1.425	2.3	3.975	7.1
Nutrients (mg/L)												
NH3 as N	125	117				0.01	0.20	0.02	0.02	0.02	0.02	0.02
NO2 + NO3 as N	124	3	10 WS 2.7 WS	0	0	0.02	0.55	0.03	0.04	0.06	0.08	0.1
TKN as N	124	97				0.1	0.5	0.2	0.2	0.2	0.2	0.2
Total Phosphorus	125	66				0.01	0.25	0.02	0.02	0.02	0.02	0.03
Metals (ug/L)												
Aluminum	31	4	6,500 WS	0	0	50	1,800	50	58.5	85	155	430
Arsenic	31	31	10 WS	0	0	5	10	5	5	10	10	10
Cadmium	31	31	2 N	0	0	1	2	1	1	2	4	4
Chloride (mg/L)	5	2	230 AL	0	0	1	4	3.8	4.6	5.4	6.4	7.3
Chromium	31	31	50 AL	0	0	10	25	25	25	25	25	25
Copper	31	25	7 AL	0	0	2	2.6	2	2	2	2	2.3
Iron	31	0	1,000 AL	1	3	53	1,500	65	75	110	195	370
Lead	31	31	25 N	0	0	10	10	10	10	10	10	10
Manganese	21	13	200 WS	0	0	10	120	10	10	10	11	14
Mercury	29	29	0.12	0	0	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Nickel	31	31	25 WS	0	0	10	10	10	10	10	10	10
Zinc	31	27	50 AL	0	0	10	18	10	10	10	10	10

Fecal Coliform Screening (Number of Colony Forming Units/100mL; CFUs/100 mL)

		Evaluation Level	Min Max	Geometric Mean	Number of Samples >400 CFUs/100 mL	Percent of Samples >400 CFUs/100 mL
	149	Geometric Mean >200 CFUs/100 mL >20% of samples exceed 400 CFUs/100 mL	1 4,000	39.6	14	9

[1]Evaluation level is the level at which further assessments are warranted to determine necessary actions; Classifications are the water classification level for which the evaluation level is associated; AL = aquatic life, WS = water supply, Tr = trout waters, N= narrative standard. Details are provided at: http://portal.ncdenr.org/c/document_library/get_file?uuid=dfc89f23-a372-4782-b3b0-60e6884b1696&groupId=38364.

Table 3.3 Water Quality Characteristics at the VWIN[1] Water Quality Monitoring Stations, 1992-2011 (Sheet 1 of 3)

Sample Characteristics				Results not meeting Evaluation Level		Minimum	Maximum	Percentiles				
Site[2] Location Parameter	Number of Samples	Number Below Detection	Evaluation Level and Class[3]	Number	Percent			10th	25th	50th	75th	90th
North Fork Mills River												
Alkalinity	229	0				3.2	26.0	6.0	8.0	9.0	11.0	13.0
Conductivity	229	1				4.6	24.1	13.3	14.2	15.4	17.5	19.5
pH (SU)	228		6-9 AL	7	3	5.6	7.5	6.4	6.6	6.8	6.9	7.1
TSS (mg/L)	226	213	10 HQW	13	6	0	209.6	0.4	0.8	2	4.4	8.2
Turbidity (NTU)	229	19	10 Tr	6	3	0	80.0	1.0	1.7	2.5	4.0	5.6
Ammonia (NH_3-)	213	46				0	0.2	0.01	0.02	0.03	0.05	0.07
Nitrate/Nitrite Nitrogen	227	35	10 WS 2.7 WS	0	0	0	1.1	0.0	0.1	0.1	0.15	0.2
Orthophosphate (PO_4)	215	80				0	0.32	0.01	0.01	0.02	0.04	0.07
Copper	198	16	7 AL	1	<1	0	7.9	0.0	0.2	0.5	1.3	2.3
Lead	199	191	25 N	0	0	0	8.1	0.0	0	0.2	0.5	1.0
Zinc	199	197	50 AL	0	0	0.0	49.6	0.0	0.1	1.5	3.9	7.0
South Fork Mills River												
Alkalinity	196	0				1.1	58.0	5.9	7.0	9.0	11.0	14.0
Conductivity	227	2				4.5	129.6	12.45	13.5	14.7	16.3	18.9
pH (SU)	226		6-9 AL	7	3	5.4	7.4	6.3	6.5	6.6	6.8	6.9
TSS (mg/L)	224	205	10 HQW	19	8	0.0	222.0	0.0	0.8	2.4	5.2	9.5
Turbidity (NTU)	227	12	10 Tr	13	6	0.0	83.0	1.2	2.0	3.0	4.5	7.1
Ammonia (NH_3-)	211	26				0.0	9.4	<0.1	<0.1	<0.1	<0.1	0.1
Nitrate/Nitrite Nitrogen	225	22	10 WS 2.7 WS	0	0	0.0	1.0	0.1	0.1	0.1	0.2	0.2
Orthophosphate (PO_4)	213	52				0.0	8.2	<0.1	<0.1	<0.1	<0.1	0.1
Copper	196	21	7 AL	1	<1	0.0	11.5	0.0	0.1	0.3	0.6	1.3
Lead	197	189	25 N	0	0	0.0	18.2	0.0	0.0	0.2	0.5	1.0
Zinc	197	192	50 AL	2	<1	0.0	123.0	0.0	0.0	1.1	3.5	6.3

[1]Samples generally collected once per month by volunteers from ECO and analyzed by the Environmental Quality Institute laboratory in Asheville; source of information - Traylor (2014) and unpublished data.

[2]Samples are listed in upstream to downstream order.

[3]Evaluation level is the level at which further assessments are warranted to determine necessary actions; empty cells indicate no action level has been established. Classifications are the water classification level for which the evaluation level is associated; AL = aquatic life, WS = water supply, Tr = trout waters, N= narrative standard.

Table 3.3 Water Quality Characteristics at the VWIN[1] Water Quality Monitoring Stations, 1992-2011 (Sheet 2 of 3)

Sample Characteristics				Results not meeting Evaluation Level		Minimum	Maximum	Percentiles				
Site[2] Location Parameter	Number of Samples	Number of BD	Evaluation Level & Class[3]	Number	Percent			10th	25th	50th	75th	90th
Mills River (upper)												
Alkalinity	201	0				2.1	62.0	6.0	7.9	9	11.1	13.6
Conductivity	225	1				4.5	62.0	13.64	14.4	15.7	17.8	20.06
pH (SU)	230		6-9 AL	9	4	5.4	7.4	6.3	6.5	6.7	6.8	7
TSS (mg/L)	230	204	10 HQW	26	11	0.0	150.0	0.4	0.8	2.4	5.1	10.8
Turbidity (NTU)	232	11	10 Tr	14	6	0.0	100.0	1.2	2	3	4.9	8
Ammonia (NH_3-)	217	43				0.0	0.3	0	0.02	0.04	0.07	0.1
Nitrate/Nitrite Nitrogen	231	22	10/2.7 WS	0	0	0.0	1.0	0.1	0.1	0.1	0.2	0.2
Orthophosphate (PO_4)	218	73				0.0	0.3	0.01	0.01	0.03	0.04	0.08
Copper	201	19	7 AL	3	1	0.0	53.8	6	0.1	0.3	0.7	1.4
Lead	202	195	25 N	1	<1	0.0	180	0.0	0.0	0.2	0.4	1.0
Zinc	202	199	50 AL	1	<1	0.0	847.4	0.0	0.0	1.15	3.8	7.98
Mills River (lower)												
Alkalinity	233	0				3.0	119.0	6.64	8	10	12	14
Conductivity	232	1				5.7	59.5	15.2	16.3	18.0	20.6	23.39
pH (SU)	233		6-9 AL	8	3	5.3	7.7	6.3	6.5	6.7	6.8	7
TSS (mg/L)	230	204				0.0	280.0	0.8	1.6	3.2	6	11.64
Turbidity (NTU)	234	9	50 FW	2	<1	0.0	120	1.4	2.1	3.3	5	8.2
Ammonia (NH_3-)	218	29				0.0	0.3	0.01	0.03	0.05	0.08	0.12
Nitrate/Nitrite Nitrogen	232	9	10/2.7 WS	0	0	0.0	1.0	0.1	0.1	0.2	0.2	0.3
Orthophosphate (PO_4)	220	56				0.0	0.32	0.01	0.01	0.03	0.05	0.09
Copper	203	18	7 AL	6	5	0.0	54.2	0.0	0.2	0.6	1.5	3.1
Lead	204	194	25 N	0	0	0.0	7.7	0.0	0.1	0.3	0.6	1.3
Zinc	204	199	50 AL	1	<1	0.0	119.0	0.0	0.8	2.5	5.4	8.8

[1]Samples generally collected once per month by volunteers from ECO and analyzed by the Environmental Quality Institute laboratory in Asheville; source of information - Traylor (2011) and unpublished data.

[2]Samples are listed in upstream to downstream order.

[3]Evaluation level is the level at which further assessments are warranted to determine necessary actions; empty cells indicate no action level has been established. Classifications are the water classification level for which the evaluation level is associated; AL = aquatic life, WS = water supply, Tr = trout waters, N= narrative standard.

Table 3.3 Water Quality Characteristics at the VWIN[1] Water Quality Monitoring Stations, 1992-2011 (Sheet 3 of 3)

Sample Characteristics				Results not meeting Evaluation Level		Minimum	Maximum	Percentiles				
Site[2] Location Parameter	Number of Samples	Number of BD	Evaluation Level & Class[3]	Number	Percent			10th	25th	50th	75th	90th
Brandy Branch												
Alkalinity	160	0				5.4	78	10.5	12	14.4	18	22.24
Conductivity	161					38.5	157.4	46	54.3	62.8	71.4	82.8
pH (SU)	159		6-9 AL	2	1	5.5	7.8	6.5	6.7	6.8	7	7.1
TSS (mg/L)	161	127				0.8	1383.2	2.2	3.2	5.6	8.8	21.6
Turbidity (NTU)	161	0	50 FW	7	4	1.3	400	2.3	3.1	4.6	8.3	22
Ammonia (NH_3-)	147	0				0.02	1.35	0.05	0.07	0.11	0.185	0.298
Nitrate/Nitrite Nitrogen	161	0	10 WS; 2.7 WS	0	0	0.1	1	0.3	0.6	1.1	1.4	2.1
Orthophosphate (PO_4)	150	6				0	2.02	0.02	0.05	0.1	0.18	0.301
Copper	133	6	7 AL	2	2	0	31.7	0.2	0.5	0.8	1.5	2.66
Lead	133	126	25 N	0	0	0	21.2	0	0.1	0.3	0.7	1.3
Zinc	133	115	50 AL	3	3	0	92.2	0	2.3	4.9	10.4	23.72

[1]Samples generally collected once per month by volunteers from ECO and analyzed by the Environmental Quality Institute laboratory in Asheville; source of information - Traylor (2014) and unpublished data.

[2]Samples are listed in upstream to downstream order.

[3]Evaluation level is the level at which further assessments are warranted to determine necessary actions; empty cells indicate no action level has been established. Classifications are the water classification level for which the evaluation level is associated; AL = aquatic life, WS = water supply, Tr – trout waters, N= narrative standard.

3.2.2 Biological Conditions

Benthic Macroinvertebrate Community. Benthic macroinvertebrate community monitoring has been conducted by NCDWR at various locations in the Mills River Watershed since 1984. Standardized sampling procedures (NCDWQ 2012) are used to rate the benthic communities based on the species and abundance of insects present as well as their tolerance to pollution. Data from 14 sample sites in the Mills River Watershed (Figure 3.2) reflect the high water quality of the watershed. All but one sample taken from the upper portion of the Mills River and North and South Forks were rated excellent (Table 3.4). Samples taken in the lower portion of the Mills River, at NC 191/280 Davenport Bridge and at Hooper Lane, were generally Good or Good-Fair. This area was the target of an intensive survey to determine the impacts of stormwater. The data was recently released and is summarized in Section 3.4.1

Benthic macroinvertebrate sampling using a kicknet

Volunteer benthic macroinvertebrate monitoring has been conducted at four sites in the Mills River Watershed. This monitoring has been coordinated by ECO as part of the Stream Monitoring Information Exchange (SMIE) program using a sampling procedure developed for volunteer citizen scientists (Traylor 2014). The procedure was designed to produce results comparable to the procedures of NCDWR. The data from those four sites is similar to that found by NCDWR with most samples rated as Good or Good-Fair. Ratings for sites on the North and South Forks were better than that for the site on the main stem Mills River. Some of the samples collected from the North and South Forks were rated as Excellent.

Fish Community. As with benthic macroinvertebrates, the makeup of a fish community provides an indicator of the ecological health of a stream. Similarly, they are monitored using standard methods (NCDWR 2013c) using 12 metrics that cover species richness and composition, abundance and condition, pollution tolerance, reproductive function, and feeding type that are used to rate the fish community. Generally, fish communities made up of species more tolerant of pollution indicate poorer ecological health of a stream. Fish community sampling has been conducted at two sites -- one each on the North Fork and the South Fork Mills River (Figure 3.1) in conjunction with NCDWR's basin-wide plan updates for the French Broad River (NCDWQ 2005, 2011a). Three additional samples were taken at one site on Mills River during the 1990s. All samples that were analyzed received ratings of Good or Excellent (Table 3.5), reflecting the good water quality and aquatic habitat that exists within the watershed.

Electrofishing used to stun fish to sample populations

Aquatic Habitats. Aquatic habitat data are normally collected at the same time as fish and invertebrate samples. Using standard methods (NCDWQ 2012), physical characteristics such as channel condition, presence of in-stream habitat (rocks, logs, sticks/leafpacks, and root mats), bottom substrate composition (sand, silt, gravel, cobble, etc.), pools, riffles, and riparian area vegetation are rated. These ratings are combined to provide an overall score for the site. Of the 52 aquatic habitat assessments made at 10 sites in the Mills River Watershed, five scored less than 70; a level at which NCDWR expects fish and benthic communities to be impacted (Table 3.6). Three of those ratings occurred during 2002; one at the lowermost South Fork Mills River, the others at the two lowermost sites on the Mills River. Although examination of the individual metric scores did not clearly indicate the cause of the lower scores in 2002, the fact that they occurred in the same year suggests that some type of incident caused degradation of the habitat. The subsequent improvement in aquatic habitat ratings at those same sites indicates that this was a temporary phenomenon.

Forested stream channel with intact aquatic habitat

Table 3.4 Benthic Macroinvertebrate Community Ratings by Site, 1984-2012 (Sheet 1 of 2)

Waterbody[1]	Location Detail	Month/Year Sampled	Ratings	Aquatic Habitat Rated
North Fork Mills River	On U.S. Forest Service land downstream of Hendersonville water intake structure (reservoir)	Sept/1997	Good	
	On U.S. Forest Service land upstream of Wash Creek	Jun/1993	Excellent	
	On U.S. Forest Service land upstream of Yellow Gap Road (FS 1206) bridge	Jun/2002 Jun/2007 Jun/2009 Aug/2009	Excellent Excellent Excellent Excellent	X X
	Whitaker Lane (SR 1341) bridge	Jul/1985 Jun/1993 Jun/2002	Excellent Excellent Good	 X
	Off River Loop Road (SR 1343)	Jun/2009 Aug/2009 Jun/2010 Aug/2010 May/2011 Sep/2011 Apr/2012 Aug/2012	Excellent Good-Fair Excellent Good Excellent Excellent Excellent Good	X X X X X X X
Bradley Creek (Tributary of South Fork Mills River)	Adjacent Yellow Gap Road (FSR 1206) above Darb Branch	Apr/1991	Excellent	
	Adjacent Yellow Gap Road (FSR1206) below Darb Branch	Apr/1991	Excellent	
	Off Yellow Gap Road (FSR 1206) upstream of Yellow Gap Creek	Apr/1991 July/1991	Excellent Excellent	
South Fork Mills River	Downstream of Nellie Cove	Jun/2009 Aug/2009 Aug/2010	Excellent Excellent Excellent	X X X
	South Mills River Road @ Wolf Pack Trail	Aug/2007	Excellent	X
	Dalton Road (SR 1340) bridge	Jun/1993 Jun/2002 Aug/2007 Jun/2009 Aug/2009 Jun/2010 Aug/2010 May/2011 Sep/2011 Apr/2012 Aug/2012	Good Fair Excellent Excellent Excellent Excellent Excellent Excellent Excellent Excellent Excellent	 X X X X X X X X X
	South Mills River Road (SR 1338)	Jun/2009 Aug/2009 Aug/2010 Apr/2012 Aug/2012	Excellent Excellent Excellent Excellent Excellent	X X X X X

Table 3.4 Benthic Macroinvertebrate Community Ratings by Site, 1984-2012 (Sheet 2 of 2)

Waterbody[1]	Location Detail	Month/Year Sampled	Ratings	Aquatic Habitat Rated
Brandy Branch	At NC 191	Oct/1994	Fair	
Mills River	Near end of Williamson Road (SR 1337)	Aug/1984	Excellent	
		Jul/1986	Excellent	
		Aug/1988	Excellent	
		Aug/1988	Good	
		Jul/1990	Excellent	
		Jul/1992	Excellent	
		Aug/1994	Excellent	
		Jul/1997	Excellent	
		Jun/2002	Good	X
		Aug/2007	Good	X
	NC 191/280 Davenport Bridge	Jun/2002	Good-Fair	X
		Jun/2009	Good	X
		Aug/2009	Good	X
		Aug/2010	Good	X
		May/2011	Excellent	X
		Sep/2011	Good-Fair	X
		Apr/2012	Excellent	X
		Aug/2012	Good-Fair	X
	Hooper Lane (SR 1353) bridge	Jul/1992	Good	
		Jun/1993	Good	
		Aug/1994	Poor	
		Jul/1997	Good-Fair	
		Oct/1998	Poor	X
		Nov/2001	Poor	
		Jun/2002	Good-Fair	X
		Aug/2007	Good	X
		Jun/2009	Good	X
		Aug/2009	Good	
		Jun/2010	Excellent	X
		Aug/2010	Good-Fair	X
		May/2011	Excellent	X
		Sep/2011	Good	X
		Apr/2012	Excellent	X
		Aug/2012	Good	X

[1]Samples are listed in upstream to downstream order.

Table 3.5 Fish Community Ratings by Site, 1993-2012

Waterbody	Location Detail	Month/Year Sampled	Ratings	Aquatic Habitat Rated
North Fork Mills River	Whitaker Lane (SR 1341) bridge	Jun/2007	Excellent	
		Jul/2012	Excellent	
South Fork Mills River	Dalton Road (SR 1340) bridge	Jun/2007	Good	
		Jul/2012	Excellent	
Mills River	Near end of Williamson Road (SR 1337)	Jun/1993	Not Rated[1]	
		Oct/1994	Not Rated[1]	
		Sep/1997	Excellent	

[1]Fish community sampled, but no rating calculated.

Table 3.6 Aquatic Habitat Ratings by Site[1] (Sheet 1 of 2)

Waterbody[1]	Location Detail	Month/Year Sampled	Ratings[2]
North Fork Mills River	On U.S. Forest Service land upstream of Yellow Gap Road (FSR 1206) bridge	Jun/2002 Aug/2009	81 90
	Whitaker Lane (SR 1341) bridge	Jun/2002	77
	Off River Loop Road (SR 1343)	Jun/2009 Aug/2009 Jun/2010 Aug/2010 May/2011 Sep/2011 Aug/2012	90 88 84 82 85 85 82
South Fork Mills River	Downstream of Nellie Cove	Jun/2009 Aug/2009 Aug/2010 May/2011	89 86 90 87
	South Mills River Road @ Wolf Pack Trail	Aug/2007 Sep/2011 Apr/2012 Aug/2012	80 87 83 88
	Dalton Road (SR 1340) bridge	Jun/2002 Aug/2007 Jun/2009 Aug/2009 Aug/2010 May/2011 Sep/2011 Apr/2012 Aug/2012	**67** 82 78 75 80 76 76 73 77
	South Mills River Road (SR 1338)	Jun/2009 Aug/2009 Sep/2011 Apr/2012 Aug/2012	75 84 **68** 83 76

[1]Sample sites are listed in order from upstream to downstream.
[2]The higher the score the better the habitat; scores <70 indicate impacted habitat. Impairment ratings for habitat assessment scores have not been established by NCDWR.

Table 3.6 Aquatic Habitat Ratings by Site, 1984-2011[1] (Sheet 2 of 2)

Waterbody[1]	Location Detail	Month/Year Sampled	Ratings[2]
Mills River	Near end of Williamson Road (SR 1337)	Jun/2002	78
		Aug/2007	82
	NC 191/280 Davenport Bridge	Jun/2002	**62**
		Jun/2009	83
		Aug/2009	87
		Aug/2010	78
		May/2011	76
		Sep/2011	76
		Apr/2012	80
		Aug/2012	70
	Hooper Lane (SR 1353) bridge	Oct/1998	73
		Jun/2002	**61**
		Aug/2007	**67**
		Jun/2009	80
		Jun/2010	77
		Aug/2010	80
		May/2011	82
		Sep/2011	85
		Apr/2012	88
		Aug/2012	91

[1]Sample sites are listed in order from upstream to downstream.
[2]The higher the score the better the habitat; scores <70 indicate impacted habitat. Impairment ratings for habitat assessment scores have not been established by NCDWR.

3.3 Ecological Conditions

3.3.1 Beavers

In 1939, beavers were reintroduced to North Carolina, after being trapped to almost extinction. Today beaver populations have expanded to levels where they can be in conflict with the safety and livelihood of people, including in the Mills River Watershed. Beavers can provide positive benefits to people including controlling erosion and sedimentation through pond building, recharging groundwater resources, and providing vaulable habitat for water fowl and wetland wildlife. However, beaver dams can cause flooding in agricultural fields and residential areas, and can destroy timber by chewing and felling. Henderson County participates in the USDA/North Carolina Wildlife Resources Commission (WRC) Beaver Management Assistant Program (BMAP) (NCWRC 2014). This program allows for cost share assistance to address beaver damage problems, and is administered through the Henderson County Engineering Department.

3.3.2 Hemlock Forests

Hemlock forests are frequently found in riparian areas in the forested areas of the Mills River Watershed. They have been shown to play an important role in buffering stream water temperatures and preventing erosion on steep banks. However, a small aphid-like insect, the hemlock wooly adelgid (HWA) beetle, which affects both the eastern hemlock and Carolina hemlock, has been noted in the Pisgah Forest since 2001. In the HWA's southern range, which includes the Mills River Watershed, affected hemlocks can decline and die in as little as three to six years. In 2005, the U.S. Forest Service began a program using biological and chemical treatment for the infestation in the Nantahala and Pisgah Forests (USFS 2005). In 2014, the Nantahala & Pisgah Forest Plan Revision – Watersheds, Hydrology & Soils recognized that the HWA may still have a "notable impact on water yield, large woody debris, stream shading, and riparian composition." It also noted that the loss of hemlocks "may have significant impacts on the timing and magnitude of stream discharge and may enhance the risk of flooding during large storm events in the dormant season" (USFS 2014).

Hemlock wooly adelgid infested forest

3.4 Stormwater Impacts

3.4.1 Agricultural Stormwater Impacts

Changes in the benthic communities have been observed in the Mills River Watershed where in 2008 over 1,000 acres of row crops were estimated to be in production (NCDWQ 2009, 2013b). There is heightened concern for the Mills River Watershed because of its use as a source of drinking water with two water intake structures located downstream of the prime production fields. Based on preliminary data, NCDWR initiated a three-year study in 2009 to determine the extent of the problem, with the goal of working with growers, local watershed groups, and water treatment plant operators to develop strategies for minimizing the impact of crop production on the ecology of the Mills River and source water quality.

Stormwater on agricultural field

The results of the 2009-2012 benthic macroinvertebrate study complemented surface water sampling for pesticide analysis (NCDWR 2013d). The results of this study revealed consistent declining benthic macroinvertebrate community ratings between late spring / early summer and late summer samples (Table 3.4) at the Davenport Bridge and Hooper Lane bridge sites.

Similar results were seen in some of the SMIE samples (Traylor 2014). No changes of this magnitude were seen for the reference station located upstream of farming activity.

The concurrent water quality study focused on stormwater runoff from agricultural operations. In many cases riparian areas along streams are narrow; whereas many field drainage ditches are essentially unvegetated. These conditions do not filter stormwater runoff.

> ***Adsorption*** **-** Weak physical bonding of chemicals to the surface of soil particles

NCDWR identified several agrichemicals present in water samples after storm events, which may result from adsorption and/or may reflect legacy chemicals.
Application of management measures described in this WMP should lead to decreased levels of sediment and concurrently less agrichemicals, thus resulting in improved water quality and ecological health of aquatic communities.

3.4.2 Urban Stormwater Impacts

Most data used in the development of this watershed plan was obtained from existing sources. The only field data collected were associated with an assessment of potential stormwater projects. The remaining data were generated using desktop GIS techniques that included aerial photographs and data in the GIS data layer attribute table analyses.

The volume and timing of stormwater runoff within a watershed is known to change as land cover changes. Not only can stormwater flow cause or expand channel erosion, it transports accumulated pollutants such as oil, gas, rubber from tires, and brake shoe dust. Since 2007, Henderson County was designated a Stormwater Phase II Post-construction run-off management area, which means the stormwater ordinance applies to all new construction and redevelopment in unincorporated areas. Early on, the ordinance was enforced in Henderson County by NCDWQ. But in 2010 Henderson County was delegated as a local program. Now Henderson County Water Quality Division is responsible for enforcement of the ordinance in the unincorporated areas of the county.

Henderson County Water Quality Division also has been delegated authority to enforce the water supply watershed ordinance in the designated water supply watershed areas within the Town of Mills River. The areas just outside of the designated water supply watershed but within the Town of Mills River town limits are designated Stormwater Phase II Post-Construction run-off management areas. NCDEMLR is responsible for enforcement of the state stormwater rules in this area.

Impervious Surface Analysis. To identify areas where stormwater runoff may be of concern in the Mills River Watershed, an analysis of impervious surfaces on privately-owned properties was conducted using the 2011 national land cover dataset (Appendix A). About 3 percent (300 acres) of the private land in the Mills River Watershed is considered impervious. In the Brandy Branch sub-watershed, 13 percent of the land has a reduced ability to absorb water, much of it being attributable to hardened areas such as building roofs and parking lots.

Stormwater Management Retrofit Survey. Stormwater runoff is currently received through storm drains located in roads and parking lots and then routed through pipes to an outfall, usually directly to a stream. Such a system does not treat or remove pollutants coming from the impervious surfaces, and the temperature of the stream may be increased. Furthermore, the concentrated flow of runoff increases the volume and velocity of stormwater into the stream, which often leads to stream bank erosion and increased turbidity.

The urban portions of the Town of Mills River as well as the adjacent developed areas along the NC 191/280 highway corridors were analyzed by Equinox in 2014 to determine potential locations for the installation of stormwater control measures (SCMs also known as BMPs; Appendix B). Members of the Stakeholder Groups of MRP also provided input on potential sites that were not identified in preliminary GIS analysis.

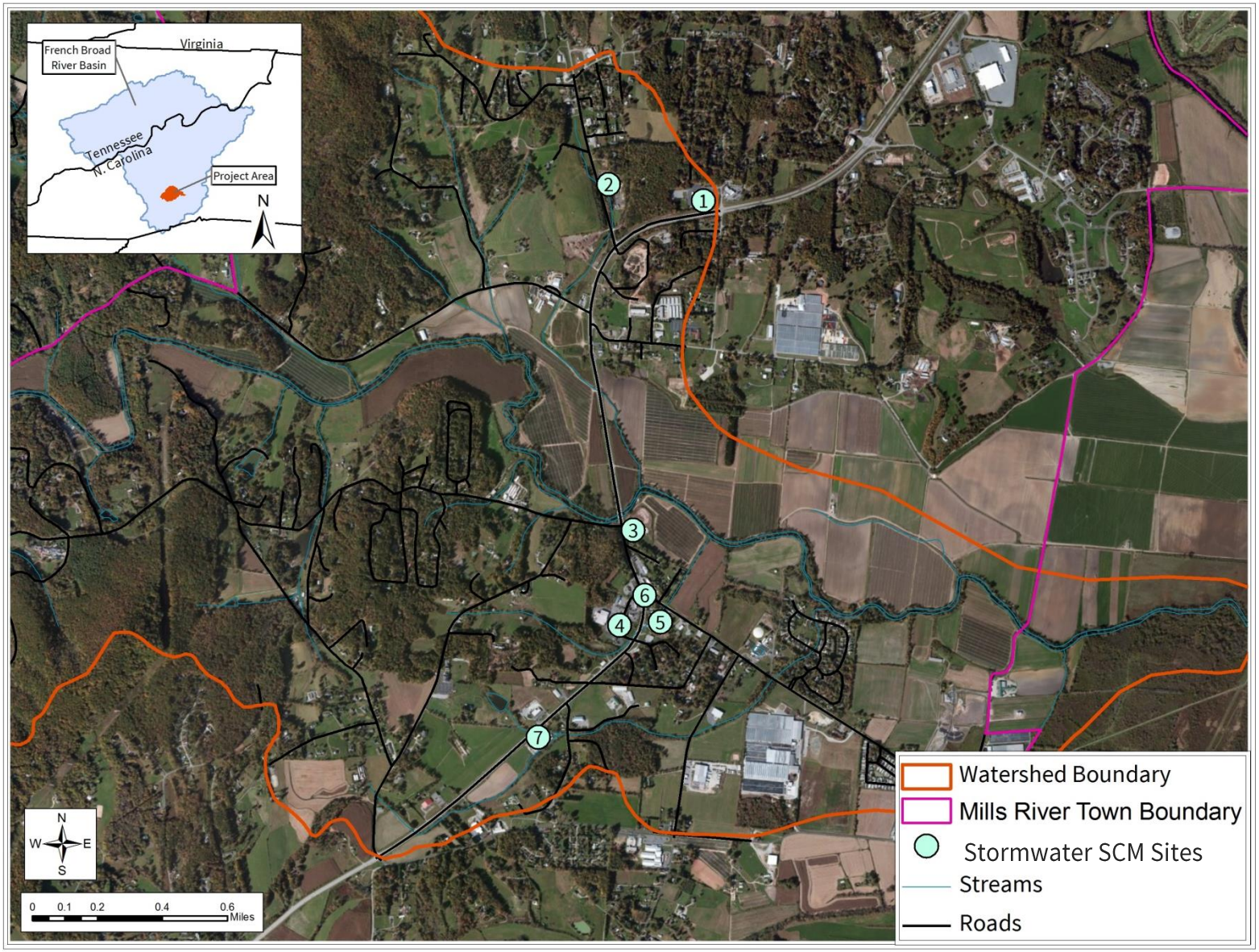
A total of 11 sites having potential for constructing SCMs were initially identified. All sites were visited to determine if installation of stormwater control features was feasible. Three of the sites appear to be of recent construction and have the required storm water controls in place; a fourth site, containing little other impervious surfaces, was having insignificant impact on the stream and dropped from consideration. Each of the remaining seven sites (Table 3.7; Figure 3.3) was analyzed to determine drainage area being addressed and the possible SCMs that may be appropriate (Appendix B). Such SCMs may include bio-retention and vegetated swales. Although extended detention ponds were considered, the urban portion of the Mills River Watershed is located within 5 miles of a public airport. The Federal Aviation Administration (FAA) highly discourages the use of detention ponds or any device which holds water, and can attract water fowl, which can be a hazard to planes.

The construction of stormwater control projects has the potential for treating a drainage area totaling almost 27 acres (Table 3.7). These features could lead to an estimated annual load reduction of 161 pounds of TSS, 2.6 pounds of phosphorus, 14.2 pounds of nitrogen, and 0.1 pound of zinc. These figures reflect stormwater treatment only and do not account for reduced erosion of stream banks downstream. Additional details of the potential projects are presented in Section 7.4.3 where Management Measures are described.

Table 3.7 Preliminary List of Potential Stormwater Control Projects

Site Number	Watershed	Drainage Area (acres)	Property Type
1	Mills River	6.82	Institutional
2	Mills River	6.94	Commercial
3	Mills River	2.29	Commercial
4	Brandy Branch	3.02	Commercial
5	Brandy Branch	2.80	Commercial
6	Mills River	1.58	Industrial
7	Brandy Branch	3.37	Commercial
	Total	26.82	

Figure 3.3 Potential Stormwater Control Measure Locations



3.5 Condition of Riparian Areas

Except for the portion in Pisgah National Forest, many riparian areas in the Mills River Watershed are less than 30 feet wide and have been documented as too narrow to effectively filter sediment, nutrients, and fecal coliform bacteria. Based on a previous field study (CMLC and LOSRCOG 2000) approximately 75 percent (21 miles) of the riparian areas on private land along the North Fork, South Fork, and main stem Mills River, excluding tributaries, had riparian buffers less than 25 feet wide. An additional 2.2 miles had buffers 26-49 feet wide. Only a small fraction of the 14 river miles (28 miles of stream bank) in the study area were wooded and considered to be in excellent condition. The data from that study was used to identify and prioritize properties for riparian preservation and restoration/enhancement projects. Priority rankings were based on vegetated riparian area width, vegetation condition, and adjacent land use. Thirty-one high-priority parcels were identified for preservation, and 30 high-priority restoration/enhancement sites were identified.

> ***Riparian Area*** – An area adjacent to a stream containing a mixture of trees, shrubs, and herbaceous plants that can effectively filter runoff from adjacent areas.

Recently, aerial photos of private lands were analyzed to determine the condition of vegetation within 30 feet of the top of stream bank, not only of the North Fork, South Fork, and main stem Mills River as was done in the previous study, but also the lower portions of their tributaries (Figure 3.4, Appendix A). Of the stream miles examined, about 56 percent were less than 30 feet wide on one or both banks (Table 3.8). When calculated on a streambank miles basis, 48 percent of all stream banks had vegetated riparian areas less than 30 feet wide. The Mills River and tributaries had the highest proportion of stream banks with less than ideal vegetation at 62 percent, whereas the North Fork and South Fork, including tributaries, had 37 percent and 39 percent, respectively, of less-than-ideal vegetated buffers. This compares to the 75 percent of stream banks less than 25 feet wide found in 2000 (CMLC-LOSRCOG 2000) for the main stem reaches only.

Most “unwooded” reaches were less than 1,000 feet long (Appendix A). There were more reaches with both sides unwooded than where only one side was unwooded. Fifteen unwooded reaches (one or both sides) 2,000-3,000 long were identified; nine of those were downstream of the confluence of the North and South Forks.

While it may be likely that some improvement in riparian area vegetation may have occurred, in recent years, there is evidence to suggest that the flooding caused by hurricanes Frances and Ivan in 2004 may have had lasting effects (Steve Fraley, NCWRC, personal communication). Stream banks were severely eroded and are unstable even today. In addition, in some areas where streams left their banks, trees and shrubs were destroyed. Even considering that the current study was limited to aerial photo analysis, it appears that less than ideal riparian area vegetation conditions still exist over much of the private land bordering streams in the Mills River Watershed.

Figure 3.4 Riparian Area Vegetation Conditions

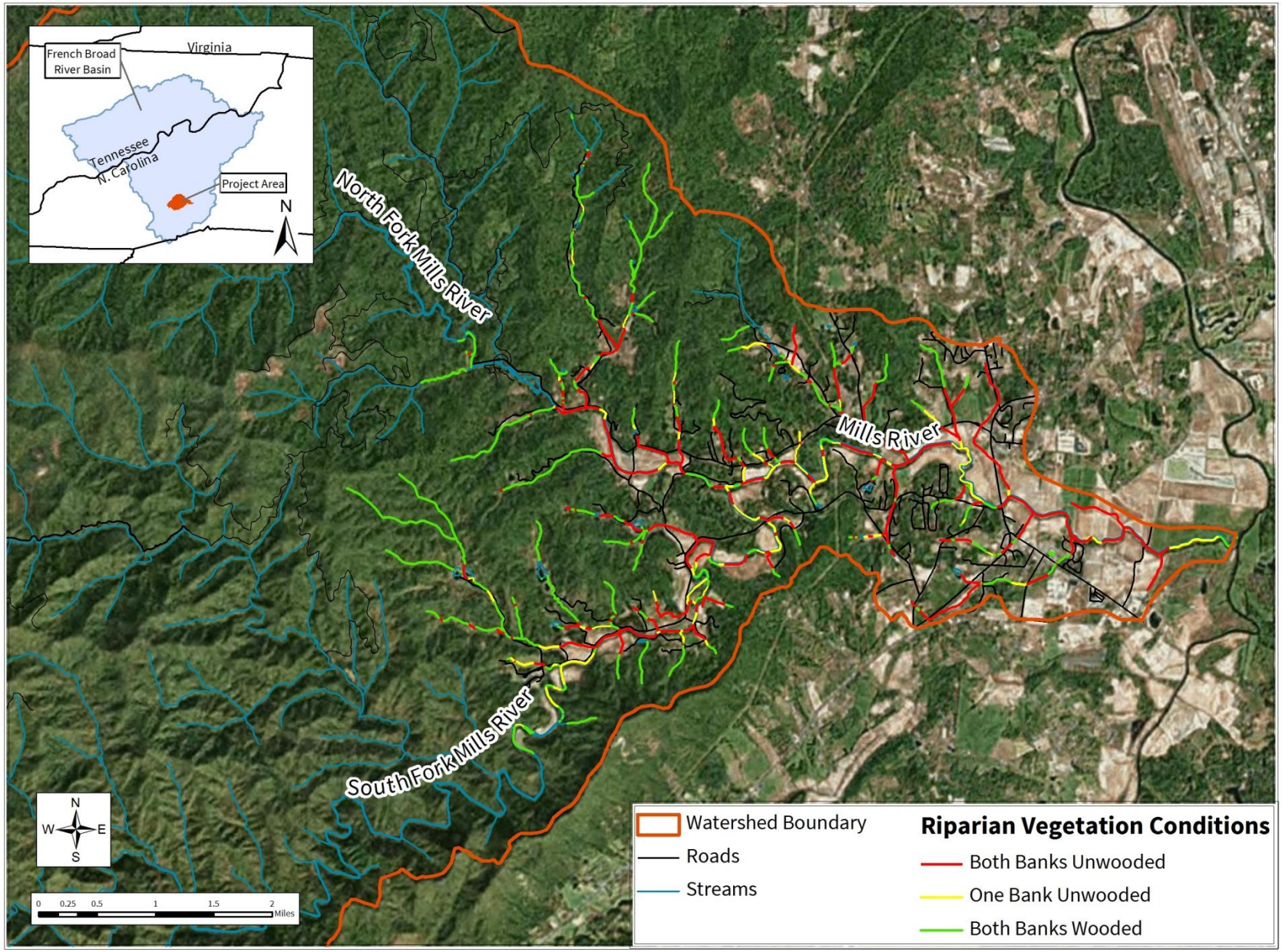
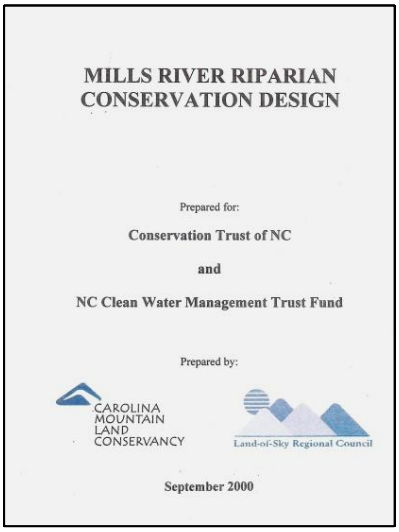


Table 3.8 Percentage of Unwooded[1] Riparian Areas

Subwatershed	Stream Miles	Percent of Stream Unwooded on One or Both Sides
North Fork and Tributaries	11.93	40
South Fork and Tributaries	19.76	48
Mills River and Tributaries	23.17	72
Totals	54.86	56
Subwatershed	**Streambank Miles**	**Percent Streambank Unwooded on One or Both Sides**
North Fork and Tributaries	23.87	37
South Fork and Tributaries	39.53	39
Mills River and Tributaries	46.33	63
Totals	109.73	48

[1]Areas less than 30 feet from the top of stream bank that appear to lack the mix of trees, shrubs, and herbaceous plants expected of a fully functioning riparian area... Riparian area vegetation conditions were derived from an analysis of aerial photos using GIS.

Since riparian area vegetation conditions still appear to be significantly degraded, MRP will use the 2000 Mills River Conservation Design report (CMLC-LOSRCOG 2000) as the basis for selecting preservation, vegetation enhancement, and stream restoration projects. . It will be necessary to prepare an updated parcel data list prior to seeking out landowners willing to voluntarily participate in riparian area improvement projects. The updated information will be used as an unpublished appendix to WMP.


MILLS RIVER RIPARIAN CONSERVATION DESIGN

Prepared for:

Conservation Trust of NC

and

NC Clean Water Management Trust Fund

Prepared by:

CAROLINA MOUNTAIN LAND CONSERVANCY

Land-of-Sky Regional Council

September 2000

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4. POTENTIAL CONTAMINANT SOURCE ASSESSMENT

4.1 Source Water Assessment Program Reports

The NCDWR Public Water Supply Section (PWSS) is responsible for implementing the Source Water Assessment Program (SWAP) and preparing assessments for all public drinking water supplies in North Carolina. A source water assessment is an evaluation of how susceptible a drinking water source is to contamination from a variety of sources such as underground storage tanks, animal operations, and hazardous materials storage sites among others. It takes into account the water supply watershed and the presence of potential contaminants within the watershed. Because the Mills River Watershed is a source of drinking water for both the City of Asheville and the City of Hendersonville, separate SWAP reports have been prepared for those systems and were recently updated (PWSS 2014a, b).

4.1.1 Drinking Water Systems

The Mills River Watershed supports drinking water systems for the City of Hendersonville and the City of Asheville. While the two systems are independent, the systems are interconnected in case of emergencies or drought. These interconnections are known as Fletcher/Cane Creek and Mills River/NC 191.

The City of Hendersonville (Public Water Supply Identification Number 01-45-010) obtains all of its drinking water from the Mills River Watershed. All water is treated at its treatment plant located on NC 191 in the Town of Mills River.

The City of Asheville (Public Water Supply Identification Number 01-11-010) obtains its water from four sources. Besides the Mills River, the City draws water from Bee Tree Creek and North Fork of the Swannanoa River located east of Asheville as well as directly from the French Broad River at a point just upstream of its confluence with the Mills River. The City of Asheville operates three treatment plants to provide water to its customers.

4.1.2 Water Supply Sources

Water is withdrawn from the Mills River Watershed at four locations (Figure 4.1); three intakes are owned by the City of Hendersonville and one by the City of Asheville. Hendersonville has impoundments with intakes on two headwater tributaries. One is located on the North Fork of Mills River at the confluence of Big Creek and Fletcher Creek, and the second is located on Bradley Creek, a tributary of the South Fork of Mills River. Water is piped approximately 16 miles from these intakes to the Hendersonville water treatment plant on NC 191/280. Hendersonville's third intake is directly on the main stem of Mills River just below NC 191/280 Davenport Bridge. All Hendersonville water is treated at the same water treatment facility.

Asheville Water Intake Structure

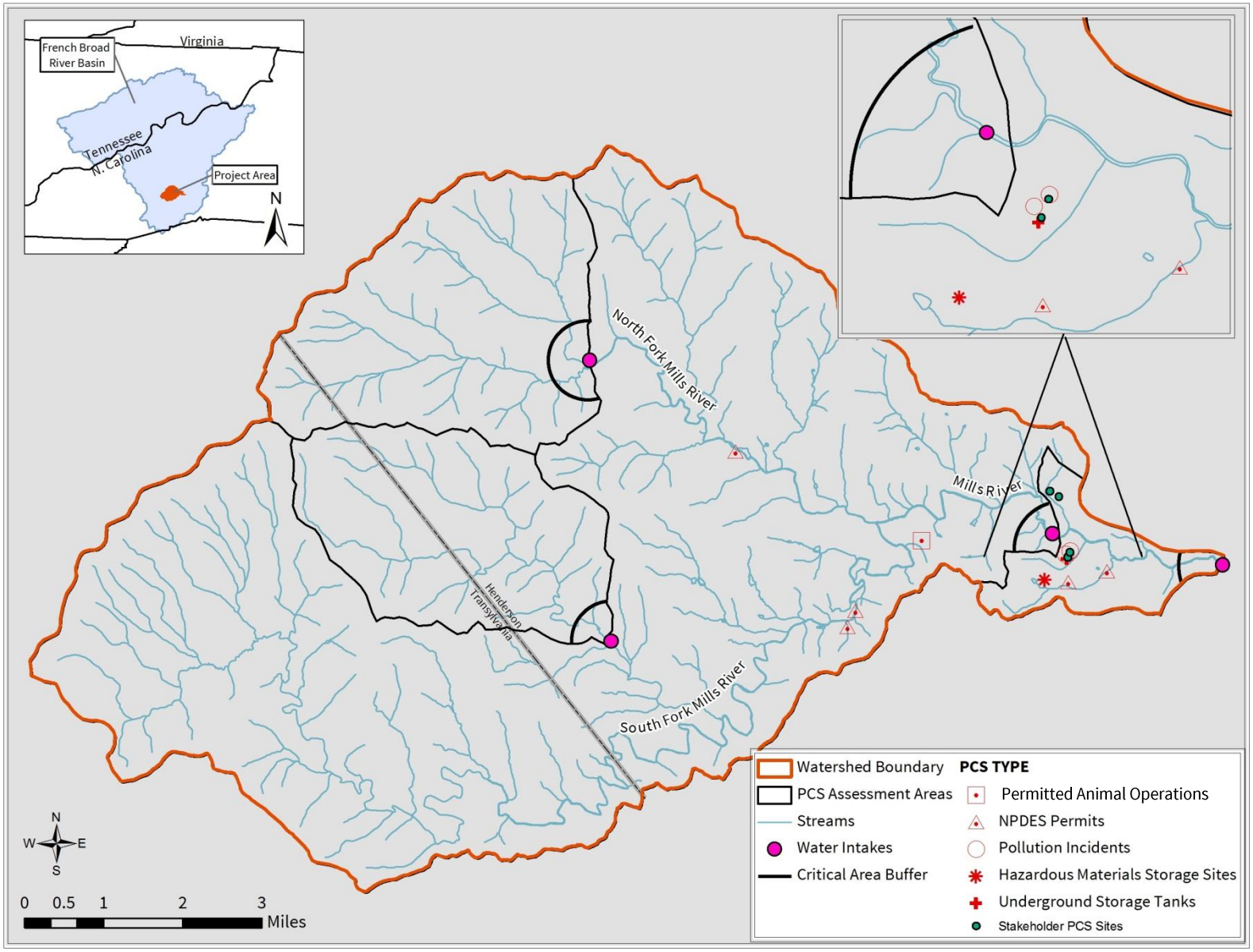
Hendersonville Water Intake Structure

North Fork Dam

Bradley Creek Dam

Similarly, the City of Asheville withdraws water directly from the Mills River just upstream of its confluence with the French Broad River. The water is piped approximately 4,500 feet to a settling pond adjacent to the Asheville water treatment facility.

Figure 4.1 Potential Contaminant Assessment Areas and Sources



4.1.3 Water Supply Susceptibility Rating

According to the Hendersonville and Asheville SWAP reports (PWSS 2014a, b) Mills River, as a water supply for two municipal systems, is rated as moderately susceptible for pollutant contamination from a variety of sources. This rating is based on two components -- a contaminant rating and an inherent vulnerability rating (Table 4.1). The contaminant rating is based on the number and location of known potential contaminant sources (PCSs) within the watershed. These sources are identified from existing databases obtained from other agencies. The inherent vulnerability rating of the Mills River Watershed refers to the geologic characteristics or existing condition of the surface water source. Characteristics considered in that rating include the following:

Contaminant Source Examples:

- Chemical storage sites
- Underground gas tanks
- Vehicle accidents
- Waste treatment plants
- Large animal operations

- Water supply watershed classification
- Surface water source location
- Watershed characteristics rating:
    - Size of watershed
    - Development activities
    - Allowable waste treatment and disposal practices
- Raw (untreated) water quality:
    - Turbidity
    - Total coliform bacteria levels

Note: The watershed characteristic rating is an assessment of the likelihood that contaminants will follow the path of overland flow or shallow subsurface flow to a surface water source.

Table 4.1 Susceptibility Rating Analysis Matrix

Source Name	Inherent Vulnerability Rating	Contaminant Rating	Susceptibility Rating
North Fork	Moderate	Lower	Moderate
Bradley Creek	Moderate	Lower	Moderate
Mills River (Hendersonville)	Higher	Lower	Moderate
Mills River (Asheville)	Higher	Lower	Moderate

According to the SWAP reports, the susceptibility rating is not a water quality rating, but an indication of the potential for the water supply to become contaminated by the identified PCSs within the watershed.

4.2 Potential Contaminant Source Inventory

4.2.1 Source Water Assessment Program (SWAP) Sources

Potential contaminant sources are compiled from available data at the federal, state, and local level by the PWSS to develop a susceptibility rating for the water system as described in Section 4.1.3. The contaminant inventory includes such things as underground storage tanks, hazardous materials storage facilities, and permitted wastewater outfalls (PWSS Undated).

Eleven sites (Figure 4.1; Table 4.2) in five PCS categories are in the Mills River Watershed and were used to complete the 2014 SWAP. All are considered high risk. Five of those sites require NPDES permits. A NPDES permit is required where treated wastewater from a facility is discharged directly to a stream or lake. As noted in Table 4.2, two animal operations are no longer operating.

Table 4.2 Potential Contaminant Sources

Potential Contaminant Source Name	PCS Identifier	PCS Type	PCS Risk Rating
Asheville Water System			
Hendersonville WTP	NC0042277	NPDES Permits	High
Mills River Elementary School	SW1080104	NPDES Permits	High
Ashe Property Group	28258	Pollution Incident	High
Mills River Texaco (now Marathon Gas)	12517	Pollution Incidents	High
G & B Energy – Mills River	4031147	Tier II Site	High
Family Mart	00-0-0000024461	Underground Storage Tank	High
Hendersonville Water System			
B & B Dairy[1]	AWC450018	Animal Operations	High
North Mills River Recreation Area	NC0020486	NPDES Permits	High
Camp Highlander[2]	NC0033251	NPDES Permits	High
James A. Blanton Residence	NCG550488	NPDES Permits	High

[1] No longer operating as a permitted facility

[2] Installed a non-discharge wastewater treatment system but retains NPDES permit.

4.2.2 Stakeholder Group-Identified Contaminant Sources

Based on individual knowledge, SG members identified additional potential PCS sites and provided their own priority/risk rating (Table 4.3; Figure 4.1). These sites are similar in type to those used by the NCDWR Source Water Protection Program (SWPP) in updating the SWAP reports for the Hendersonville and Asheville water systems (PWSS 2014a, b).

Table 4.3 Stakeholder-Identified Potential Contaminant Sources

Potential Contaminant Source Name	Potential Contaminant Source Description	Priority/Risk Rating
NC 191/280 and Davenport Bridge	Hazardous materials and chemical spills associated with vehicle accidents	High
Citgo Gas Station	Below ground petroleum storage	Low
Mills River Quality Plus Gas Station	Below ground petroleum storage	Low
Ingles Gas Station	Below ground petroleum storage	Low
Sewer lines[1]	Sewage overflows	Low
Various agrichemical storage sites[1]	Agrichemical spills	Low

[1]Sites identified by SG, but additional research indicated these are not significant PCSs; see text for explanations.

Previous management plans have recommended the following two additional management measures that would reduce the risk of contaminating the Asheville and Hendersonville water supplies.

Water Intake Relocation. Relocate the Hendersonville water intake from its current location approximately 350 feet downstream of Davenport Bridge on NC 191/280 to a

location upstream of the bridge. Doing so would greatly reduce the risk of hazardous materials reaching the water intake should a serious accident occur on the approaches to the bridge.

NC 191/280 Catch Basins. Construct catch basins on either side of the approaches to Davenport Bridge on NC 191/280 to catch hazardous materials resulting from a vehicle accident. A design incorporating drainage from the bridge itself would reduce contaminant risk even further.

Other SG- Identified Potential Contaminant Sources

Gas Stations. The SG identified three gas stations not listed in the SWAP PCS listings. The group feels that the best approach is to reach out to these business owners as part of the MRP outreach and education program. It is recognized that these businesses are regulated by the State and that these operations posed no immediate environmental threat.

Untreated Sewage Discharges. According to Henderson County Utilities Department there are 139 manholes in the Mills River Watershed (Dean Ring, Hendersonville Utilities Department, personal communication, 2014) of which 95 are located within the floodplain. All of the manholes within the floodplain are sealed or extend above the floodplain elevation and there have been no reported sewer line overflows in the Mills River area within the last five years.

Agrichemical Storage Sites. While agrichemical storage sites are of concern to the SG, members feel that the most productive approach to addressing this issue is to reach out to the owners of those locations to heighten their sensitivity to the risk of contaminating the water supply. This strategy is included in the Outreach and Education Program described in Section 7. Due to the small number and the strong Henderson County emergency response plan described in Section 5, it was felt that no prioritization of those sites was necessary.

While the SG also identified automobile repair/tire shops, septic systems, and car washes as PCSs, runoff from those locations is not likely to be a major source of hazardous materials. Runoff from those areas can be treated with SCMs or, in the case of septic systems, upgrades to existing systems or connection to the community sewer system that is planned for the Mills River area.

4.3 Priority Protection Areas

Priority areas for protecting the drinking water supply from contamination include the following:

- Brandy Branch sub-watershed – many of the commercial businesses in the Town of Mills River are in this sub-watershed.
- NC 191/280 Corridor – The portion outside of Brandy Branch is experiencing development and with it a higher risk that hazardous materials incidents may occur.
- Mills River from upstream of the mouth of Foster Creek – This is an area of concentrated vegetable crop production (See Section 3.3 for more detail) and the area receives more rainfall and more intense storms than areas lower in the watershed. While many agricultural BMPs are in place, installation of additional BMPs on these fields would further reduce sediment and runoff, resulting in improved water quality, aquatic habitat, and ecological function of the Mills River.

4.4 Watershed Monitoring and Priority Actions

Because this is a combined 9-element and source water protection plan, watershed monitoring and priority actions (management measures) for PCSs are integrated with those for non-point source pollutants. Priority actions addressing PCS are integrated into the Section 7.5, whereas the watershed monitoring program is presented in Section 7.1. Contents of those sections are based on input from the SG and recommendations found in the following documents:

- French Broad River Basinwide Water Quality Plans (NCDWQ 2000, 2005, 2011a)
- The Mills River Watershed Management Strategy (MRPPC-LOSRCOG 2002)
- A Review of the 2002 Mills River Watershed Management Strategy, Ten Years Later (McGill 2012)

4.5 Strategies

The Source Water Protection Strategies in this WMP address methods for managing the threats posed by PCSs identified in the inventory. These strategies are integrated into Sections 7- Management Measures and 8- Implementation Strategy of this plan.

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5. EMERGENCY RESPONSE PLAN

The information in the following sections is taken from the Henderson County Emergency Operations Plan and Hazard Materials Annex (Appendix; Henderson County 2010, 2013) and details the operational concepts, standard operating procedures, forms, and contacts applied to hazardous materials incidents that may impact the water supply.

5.1 Emergency Response Planning

Henderson County Emergency Response Plan (ERP; Henderson County 2013; Figure 5.1) addresses all potential hazards that could threaten the water supply sources of the Mills River Watershed, the Hendersonville and Asheville water intakes, and the residents and property in the watershed. The ERP serves as a guiding document to which supplemental documents (called annexes) addressing specific emergency issues or facilities were developed. The supplemental documents define the roles and responsibilities of each agency in order to reduce the potential for miscommunication and chaos in handling an emergency. Henderson County also adopted the National Incident Management System (FEMA 2008) approach in developing its emergency management plans. That system includes elements essential to the efficient management of emergencies and disasters that involve local, state, and federal response agencies.

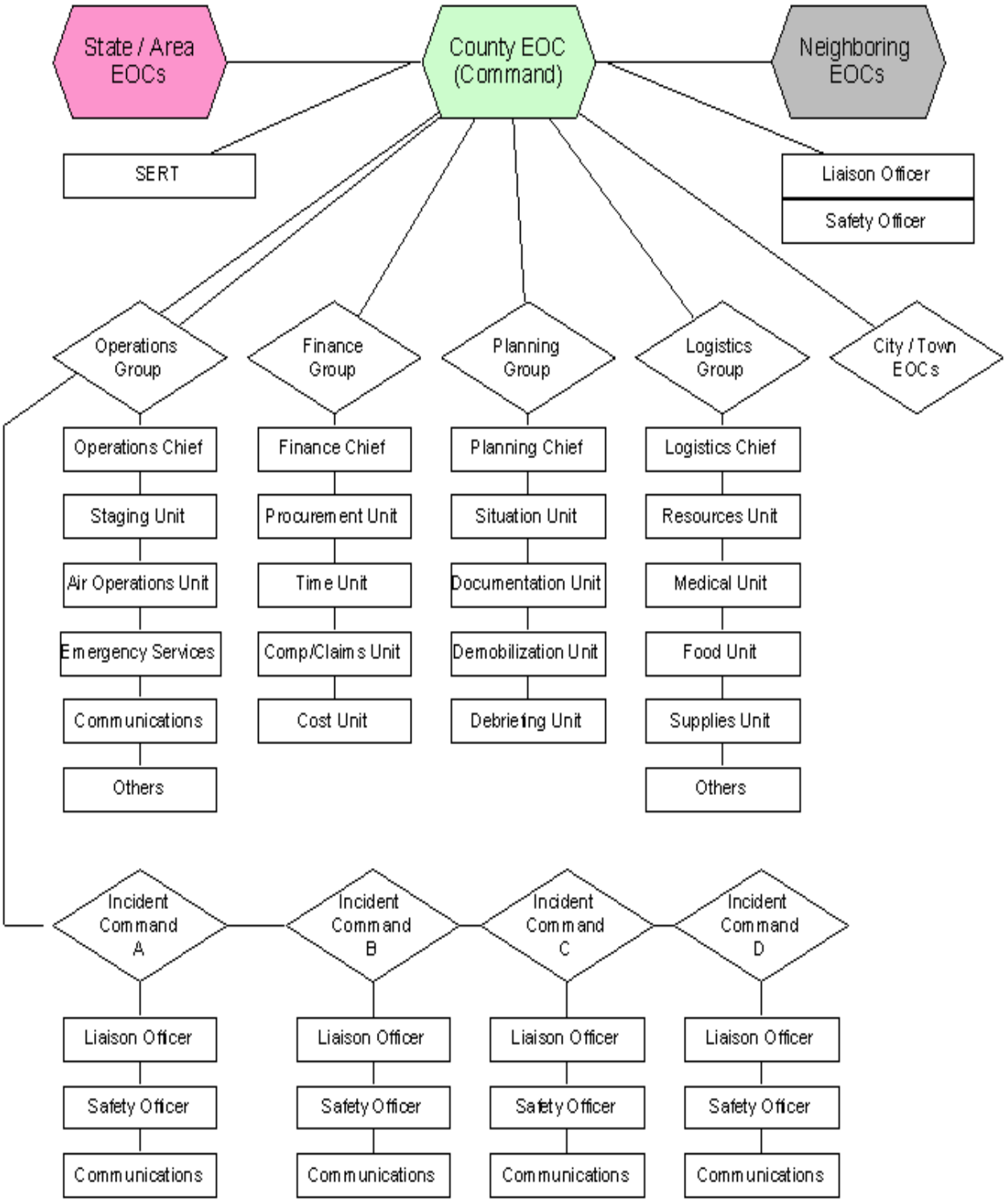
Emergencies related to the following special issues and facilities are believed to be significantly more complex and warranted plans that deal with those recognized complexities. Separate emergency plans were developed to address:

- Detention Facility
- Disaster Recover
- Hazard Mitigation
- School Emergency

For purposes of the Source Water Protection Plan element of this report, only the Hazard Mitigation Plan is relevant. A Hazardous Material (HAZMAT) is an item or chemical which is a “health hazard” or “physical hazard”. Under the Hazard Mitigation Plan, each facility with hazardous materials is required to have an emergency response plan. In the case of off-site hazardous incidents that may threaten the water supply, the Mills River Fire Department has a response plan that includes immediately contacting the water treatment plant operators so they can close their intakes.

The ERP and its components comply with the Federal Homeland Security Presidential Directive #5, and Homeland Security Presidential Directive # 8. In addition, the EOP meets the legal requirements of North Carolina General Statutes, Chapter 166-A. It provides the necessary elements to ensure that local government can fulfill its legal responsibilities for emergency preparedness.

Figure 5.1 Henderson County Emergency Response Plan Organization Structure



5.2 Hazardous Materials Response Plan

Henderson County has a rigorous hazardous material response plan. The County's general hazardous materials response plan is included as a supplement to the ERP (Henderson County 2013). A stand-alone multi-jurisdictional Hazard Mitigation Plan (Henderson County 2010) provides specific details of how the County deals with hazardous materials. The mitigation plan is the result of a collaborative effort of local government officials and staff, citizens, public agencies, and nonprofit organizations, as well as regional, state, and federal agencies. These two documents address the four primary phases of emergency management -- preparedness, mitigation, response, and recovery. Combined, these plans ensure that risks to the public are minimized before, during, and after a disaster of any kind that might threaten lives, safety, or property. Risks addressed in these plans include but are not limited to natural, man-caused, technological, terrorism, chemical, and materials shortages. The Source Water Protection Plan (SWPP) portion of this WMP deals specifically with potential surface water contaminants associated with hazardous materials.

The headwaters of the Mills River Watershed lie in adjacent Transylvania County and flow into Henderson County before entering the French Broad River. Because it is a water supply watershed for Henderson County, Transylvania County's Hazard Mitigation Plan applies to the headwaters area. A regional Emergency Operations Plan (Henderson, Polk, Rutherford, and Transylvania Counties participating) is currently under review by the Federal Emergency Management Agency (FEMA). Once it is approved, it will supplant the existing regional plan.

The Mills River Fire Department has responsibility for notifying staff at the Asheville and Hendersonville water treatment plants of hazardous materials incidents that threaten the water supply and treatment plant operations. Each facility is to be contacted immediately to allow the treatment plants to close their intakes to avoid contamination of the treatment facility and distribution system as well as to prevent human health hazards.

Both the Asheville and Hendersonville water treatment facilities have emergency response plans that address the foreseeable natural and human-caused emergency events. These plans contain the following elements:

- Identification and phone numbers of personnel responsible for emergency management, including water system, local, state, and federal emergency contacts;
- Identification of foreseeable natural and man-caused emergency events including water shortages and outages;
- Description of the emergency response plan for each identified event;
- Description of the notification procedures; and
- Identification and evaluation of all facilities and equipment where failure would result in a water outage or water quality violations.

The emergency response plan is especially important for the Hendersonville plant where the water is treated with chlorine, an extremely toxic gas. The Asheville plant uses a non-toxic ozonation treatment method that reduces the risk of harm to treatment plant personnel or local residents should a gas leak occur.

5.3 Emergency Operations Contingency Plan

The Henderson County Emergency Operations Center is activated upon the recommendation to the County Manager or the Chairman of the Board of Commissioners by the Emergency Management Coordinator. The Emergency Operations Coordinator is charged with planning, organizing, directing, and supervising all emergency operations.

Emergency Contacts – In the event of a hazardous materials incident within the Mills River Watershed, it is critical that the appropriate agencies be contacted in a timely manner. "Mills River Watershed" and "Water Supply Area" Department of Transportation (DOT) Highway signs are located along two major highways near the extents of the watershed. Any person observing a potential hazardous materials incident in or near the watershed, should immediately call the **Emergency 911** number. Doing so will set in motion communications with the Emergency Management Coordinator and possible activation of the Emergency Operations Center.

Subsequent to the initial incident report, representatives and agencies listed in Table 5.1 will be contacted. Depending on the severity and conditions surrounding the incident, the Emergency Management Coordinator will likely play the lead role in ensuring communications among the appropriate agencies occurs.

Table 5.1 Henderson County Hazardous Materials Incident Contact List

Agency or Representative	Office Number	Non-Business Hours
Emergency Calls – 24 hour operations	**911**	**911**
Henderson County Communications Center (non-emergency)	828-697-4911	
Henderson County Emergency Management	828-697-4728	
Henderson County Manager	828-697-4809	
Chair, Henderson County Board of Commissioners	828-697-4808	
Town of Mills River Mayor	828-890-2901	
Henderson County Sheriff Department	828-697-4596	
Mills River Fire and Rescue	828-891-7959	
Hendersonville Water Treatment Plant	828-891-7779	
Cane Creek Water & Sewer District	828-694-6608	
City of Asheville Water Treatment Plant	828-890-2835	
City of Asheville Water Resources Director	828-259-5959	
N.C. Department of Transportation	828-693-9553	
N.C. Emergency Management 24 hour operations	1-800-858-0368	
N.C. Emergency Management Western Branch Office	828-466-5555	
Pipeline & Hazardous Materials Safety Administration	1-800-467-4922	

5.3.1 Operations Concepts

Hazardous materials incidents can be categorized as being of known substances at fixed facilities, shipping incidents, and roadway or of unknown materials on waterways, roads, or on private or public lands. The level of response for an incident will be determined by the following factors:

- Quantity, quality, and toxic effects of the material involved;
- Population and property threatened;
- Type and availability of protective equipment required for the hazardous material; and
- Probable consequences should no immediate action be taken.

Based on the above criteria, incidents are classified according to the level of risk as determined by an Incident Commander's assessment. Those risk levels are as follows:

- **Level I (Potential Emergency Condition)** An incident that can be controlled by the first-response agencies does not require evacuation other than the involved structure or immediate outdoor area, and does not suggest that major environmental damage will occur.

- **Level II (Limited Emergency Condition)** An incident that involves a critical hazard with a potential threat to life or property, requires a limited evacuation of the surrounding area, or suggests that major environmental damage could occur. The jurisdiction's resources can adequately handle initial response to the incident.

- **Level III (Full Emergency Condition)** An incident that involves a severe hazard or large area, poses an extreme threat to life and property, and will probably require a large-scale evacuation. Level III includes an incident requiring a combination of expertise or resources from local, state, federal, and private agencies / organizations.

5.3.2 Organization and Responsibilities

To effectively plan for and implement the ERP as it applies to hazardous materials incidents, the Henderson County Emergency Response Plan conceptually addresses the actions and communications necessary to effectively respond to a hazardous event (Figure 5.1)

5.4 Contingency Plan Development and Maintenance

The ERP, under the direction of the Henderson County Manager, must be reviewed annually by the designated officials involved in its implementation. The annual review will include a critique of any actions associated with an incident and recommendations for revision. Substantive revisions to the documents will be prepared by the Emergency Management Coordinator under the direction of the County Manager. Those recommendations will be presented to the Board of Commissioners for consideration and approval.

The 2003 version of Henderson County Multi-Jurisdictional Hazard Mitigation Plan was incorporated into the Henderson County ERP. Subsequently, the Hazard Mitigation Plan was updated in 2005 and 2007. These updates were conducted by a "Mitigation Update and Revision Committee" composed of the Emergency Management Director and one representative from each governing jurisdiction that sits on the Monitoring and Evaluation Committee. The plan is to be updated every five years and

following every Presidentially Declared Disaster to evaluate how effective the mitigation strategies have been. The current version of the Hazard Mitigation Plan is being integrated into a regional plan that is currently under review by the Federal Emergency Management Agency. That plan will be updated as required by the Federal Emergency Management Agency (FEMA).

5.5 Incident Emergency Action Checklists

Field checklists for use by emergency response agencies cover both fixed location, the Fixed Facility Chemical Spill Checklist, and transportation related incidents, the Hazardous Material Checklist (see Appendix C). The Fire Department / Incident Commander are primarily responsible for ensuring the appropriate actions are taken. Emergency response agencies can use the hazard specific checklists to ensure they have taken the actions appropriate to prepare for and deal with a hazardous materials incident. The checklists are broken into the following four categories of actions:

- Preparedness. Identifying locations where hazardous materials incident risks may be high; develop procedures and ensure staff are properly trained.

- Planning. Ensuring that methods of informing the public about a hazardous material incident are in place, including broadcasts through the local media; coordinate with federal, state, and local agencies and share information about each agency's role when a hazardous material incident occurs (this may include practice exercises).

- Response. Knowing how to respond to a hazardous material incident, including identifying the materials, knowing the proper method of neutralizing the material, managing the scene to prevent injuries, and assisting with evacuations, if necessary.

- Recovery. Actions necessary to restore the area to a safe condition, critique of the response to be better prepared for the next incident, and shut-down of the incident command post and preparing reports detailing actions taken.

6. PLANNING FOR UNCERTAINTY

6.1 The Climate of Uncertainty

Even with a well-conceived WMP, the MRP recognizes that natural disasters in the Mills River Watershed are likely to occur during the 10-year period of the plan. Flooding and wind damage from severe storms and remnant hurricanes as well as drought are real possibilities. These events have occurred in the past and may be more frequent in the future. Log jams, which can occur after storms or steadily and naturally over an extended period of time, can cause blockages that lead to increased flooding and erosion, especially during extended rain events.

Log jam forming

About half of the Mills River Watershed receives over 63 inches of rain annually, with up to 119 inches per year falling in the upper reaches (Figure 2.1). Intense rainfall events and associated flooding can have devastating effects on the watershed. Property damage can be extensive, including damage to homes, farm buildings, equipment, fencing, crops, and stream channels. Additionally, much of the lower Mills River is located within a designated Federal Emergency Management Agency -FEMA floodplain (Figure 6.1). In some cases the storm events may even damage previously installed watershed improvement measures. While no one can predict the weather with certainty, the MRP believes it appropriate to assist in whatever way it can to help residents recover from a natural disaster.

6.2 Strategy for Natural Catastrophe

When a region is hit by a natural catastrophe the Governor of the State usually requests the President of the United States to formally declare disaster. Under such a declaration the FEMA is activated to assist property owners in recovering from the disaster. In such cases, property owners often qualify for low interest loans and federal and state governments provide funding to restore roads, utilities, and other infrastructure. Such funding usually does not cover damage to natural resources such as streams and wetlands that do not threaten life or structures and likely would not cover previously installed BMPs. To address this situation, the MRP may pursue funding to establish a reserve fund that would serve to repair previously constructed BMPs and to repair newly damaged areas within the watershed. Additionally, reserves for remediation of significant log jams as they occur will provide benefit by reducing long-term costs to repair compounded problems of streambank erosion and washing of pollutants into the river from flooding caused by blockages. The MRP believes such a fund would greatly benefit watershed residents and users to regain, in a timely manner, additional normality in their lives.

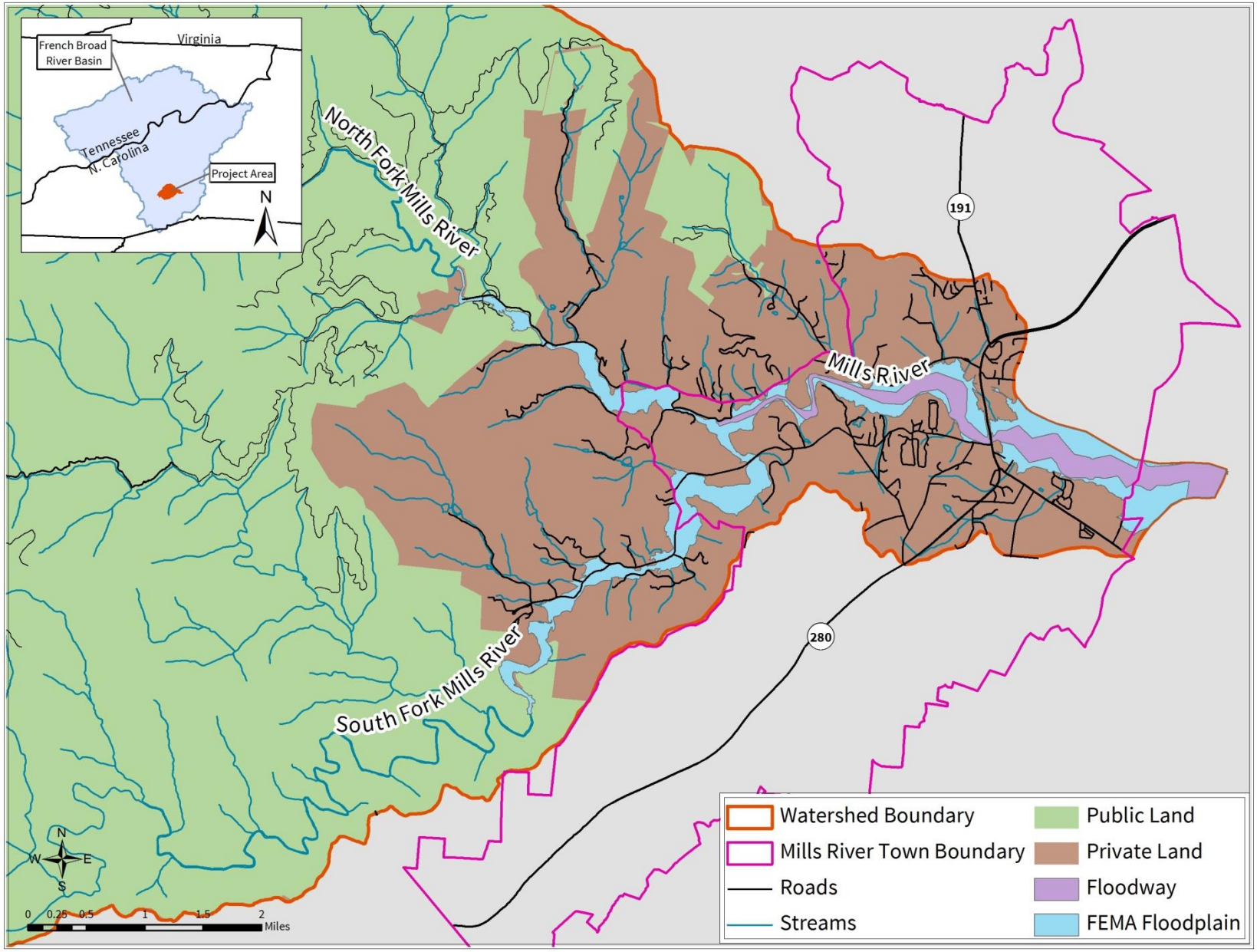
Photo from Bason et al. (Undated)

6.3 Watershed Management following a Natural Catastrophe

In the event of a catastrophic natural disaster that causes damage to streams and property, including previously installed watershed improvement projects and significant log jams, the MRP will reassess its project priorities. It will suspend planned projects and projects-in-progress related to the WMP. It will redirect its efforts and funding, to the extent allowable, to restore properties and stream channels that will allow residents to resume normal lives. It will collaborate with partners and funding agencies to identify ways to modify projects-in-progress to address immediate needs. It may be necessary to apply funding to reconstruct previously installed watershed improvement projects.

At which time the recovery efforts are completed, the MRP will review and revise the WMP to accommodate the changes in watershed conditions caused by the catastrophic event.

Figure 6.1 Designated Floodway and Floodplain



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7. MANAGEMENT MEASURES

7.1 Watershed Management Goals

The goal of this WMP is to improve water quality and ecological conditions of the Mills River and its tributaries by reducing sediment, nutrients, pesticides, and fecal coliform bacteria levels. Doing so will allow aquatic communities to thrive and enable the river to fully support designated uses. Achieving this goal will ultimately result in the removal of all portions of the Mills River and Brandy Branch from North Carolina's 303(d) list of impaired waters.

In the process of developing this WMP, goals and objectives from previous planning efforts were recognized and included as part of this plan. To achieve the watershed goal, the MRP aims to pursue the following:

- Engage the community in water quality awareness and education.
- Develop additional partnerships to facilitate better land stewardship among the state, county, and city governments and agencies, business community, and private citizens.
- Implement projects that support water quality improvement needs and objectives as described in the following planning documents:
  - *French Broad River Basinwide Water Quality Plan* (NCDWQ 2011a)
  - *French Broad River Basin Watershed Restoration Plan* (NCEEP 2005)
  - *French Broad River Basin Restoration Priorities 2009* (NCEEP 2009)
  - *Mills River Riparian Corridor Conservation Design* (CMLC-LOSRCOG 2000)
- Stimulate economic opportunities in the community and create jobs by using local businesses when management measures are implemented.

The GIS and aerial photograph assessment conducted for the Mills River Watershed (Figure 3.4) revealed the extent to which inadequate vegetation in riparian areas and adjacent upland disturbances exist.

The following section describes the steps or management measures that support these goals and that will continue the process of improving water quality of the Mills River Watershed. A brief discussion of why these steps are important is included. The implementation strategy for these measures is presented in Section 8.

7.2 Agricultural Best Management Practices

Agriculture is a major industry in the Mills River Watershed. Today, tomatoes and peppers have become the dominant commercial crops, along with sweet corn, grain and silage corn, other produce and field crops, and greenhouse-grown plants. A few livestock operations as well as a number of small hobby farms add to this economy. Hobby farms generally have one or more of the following – small-to- moderate-size vegetable gardens, and some livestock or horses for recreation.

Priority Areas. Agricultural land (Figures 2.2), as identified in the 2011 land use data and lying within the defined FEMA Flooplain (Special Flood Hazard Area) (Figure 6.1) will be targeted for installation of

BMPs. The majority of these lands lie adjacent to the North Fork, South Fork, and main stem of the Mills River, including the lower reaches of tributaries.

Project Screening Criteria. The following screening criteria will be considered in selecting and prioritizing projects on private land in the Mills River Watershed:

- Landowner and farm operators willing to participate.
- Farm Conservation Plan – farm operators implementing a farm conservation plan developed by the HCSWCD will be given a higher priority.
- Proximity to stream/river – higher priority will be given to projects that are closer to a perennial stream.
- Location in FEMA floodplain (Special Flood Hazard Area) or FEMA floodway will be given a higher priority.
- Slope of land and soil type – steeper slope and more erodible soil receive higher priority.
- Using crop management practices of low-till, no-till, and/or cover crops receive higher priority.
- Crop type, including fields where crops are grown on plastic mulch and that require more agrichemicals will be given a higher priority.
- Location in the watershed – projects located in the upper reaches of private lands will be given a higher priority.

7.2.1 Primary Agricultural Best Management Practices

Regardless of the type of land disturbing activity, most of these farms can benefit from the installation of agricultural BMPs to limit the loss of topsoil while reducing runoff from fields to adjacent waterways. For purposes of the WMP, the following BMPs are most applicable for implementation on agricultural operations within the Mills River Watershed. The list is not intended to limit the MRP or HCSWCD from using other BMPs when the need arises. Many of the descriptions are excerpted with modification from the North Carolina Department of Agriculture and Consumer Services (NCDA&CS) Division of Soil and Water Conservation Agricultural Cost Share Program Best Management Practices web site (NCDA&CS 2012) and the Agricultural BMP Handbook for Minnesota (MDOA 2012).

Farm Conservation Plans. Development of a conservation plan should be encouraged for each qualifying farm. The plan sets forth conservation goals that meet a farmer's production goals, whether for crops or livestock. The plan describes the specific BMPs necessary to achieve both improved production and reduced environmental impacts. Conservation plans are designed to apply appropriate agricultural BMPs down to the field level. They can be customized to match a specific year's crop when a crop rotation scheme is used. The following are the agricultural BMPs most likely to be applied in the Mills River Watershed. Conservation plans will be developed in cooperation with the HCSWCD and Natural Resource Conservation Service (NRCS).

Filter Strips and Field Borders. These two management measures function similar to vegetated riparian areas, but generally consist of only permanent herbaceous vegetation. By definition, filter strips are vegetated areas between fields and surface waters, whereas field borders are bands of permanent vegetation at the edge or around the border of a field. Filter strips located at the end of field rows help reduce erosion and sediment impacts on nearby waterways. Field borders and filter strips can be linked together and connected to grass waterways in a way that channels runoff from the field and at the same time filters sediment from that runoff.

Field border between corn field and riparian area

Livestock Exclusion (riparian area) Fencing. Where livestock have access to streams, destruction of stream side vegetation, erosion from trampling of stream banks, and pollution from animal waste typically occur. The preferred option is to permanently exclude livestock from streams. Fencing should be set back far enough from the stream to permit growth of woody vegetation. The HCSWCD uses the NRCS- Field Office Technical Guide (FOTG), which in water supply watersheds dictates specific setbacks. The greater the distance the fence is set back from the top of the stream bank, the more effective the vegetation will be at filtering sediment, nutrients, and other pollutants. A 30-foot setback from the top of the stream bank is recommended. Alternative water sources will need to be provided if livestock were dependent on the stream for drinking water.

Grass Waterways. Particularly useful in controlling erosion on fields with steeper slopes, these vegetated channels cross through fields where runoff is concentrated. These features not only reduce erosion but can trap sediment moving from upland areas, reducing peak discharge and absorbing pesticides. Design of grass waterways must be tailored to site specific conditions that include slope, soil type, and agricultural activity.

Grassed waterway installation

Water Diversions (from upstream of crop areas). Diverting water originating from upland areas around a cultivated field can be an effective method to maintain water quality. While it may reduce groundwater infiltration, it keeps water from running through cultivated fields and carrying with it sediment, nutrients, and agrichemicals. When the upland areas are disturbed, the water diversions that are grassed or otherwise vegetated can help reduce runoff of pollutants.

Re-vegetating Riparian Areas. Riparian area vegetation serves as a buffer between the upland area and streams. Fully functioning riparian areas include a mixture of grasses, forbs, sedges, shrubs, and trees to filter sediment, stabilize stream banks, absorb nutrients, regulate stream temperatures by providing shade, and providing food, nutrients, and habitat for aquatic organisms. The key to establishing a well-functioning riparian area is to match the plant species to the soil, its location on the stream bank, and climate conditions. In many cases all that may be necessary is to allow the stream bank vegetation to regrow. To reestablish woody shrubs and trees more quickly, install livestakes and plant containerized stock composed of native species. A 30-foot wide riparian area with a combination of trees, shrubs, and herbaceous plants is recommended.

7.2.2 Field Management BMPs

The following field management BMPs help to decrease soil erosion and nutrient losses. Through MRP outreach efforts, farm operators are encouraged to integrate them into farm operations where possible, where water quality benefits will accrue, and where site and weather conditions allow.

Conservation Crop Rotation. Involves planting crops in rotation on the same field in successive years, including at least one crop that conserves soil. Such crop rotation benefits the producer with reduced soil erosion, improved soil quality, and better pest control.

Cover Crops. Planting grasses, legumes, or forbs after the main crop has been harvested to cover and protect bare soil. In Mills River Watershed tomato farming predominates, so harvest can continue until the first frost. If the first frost occurs late in fall, germination of cover crop seeds can be poor. When feasible, farm operators are encouraged to plant cover crops early enough to allow them to become established.

Nutrient Management (nitrogen and phosphorus). Farm operators are encouraged to adopt the new NRCS "4Rs"standards for plant nutrient management and application: Right source, Right rate, Right time, and Right place. Proper application of fertilizers protects water quality and saves money.

Integrated Pest Management (agrichemical applications). Farm operators are encouraged to continue or adopt IPM programs balancing cost with pest damage to determine when pest treatments are necessary. Technical expertise and advice is locally available at Mountain Horticultural Crops Research and Extension Center, at the local Cooperative Extension Service, or through private pest management scouting services.

7.2.3 Supplemental Best Management Practices

The following agricultural BMPs are applied as complements to other BMPs typically included in farm conservation plans of the Mills River Watershed. Larger and more focused stream restoration plans will be implemented as stand-alone projects described under Section 7.3.

Streambank Restoration. In some cases, stream channels and banks are unstable and need restoration and stabilization. Such restoration projects restore floodplain function, reduce

sediment, and improve aquatic habitat. When combined with improved riparian area vegetation, reductions in nutrients can also be achieved. Addressing the cause of channel instability, using proper engineering techniques, and appropriate revegetation can improve water quality and habitat.

Sediment Basins. Installation of sediment basins with engineered outlets is an effective method to improve water quality; however, such structures may result in some loss of useable cropland. Basins can be designed in field areas where crops are difficult to grow.

Agrichemical Handling Facility. This facility is used to contain and mix on-farm agrichemicals in a specifically located area on the farm, where it will have the least impact on water resources and farm production. It creates an area where agrichemicals can safely be stored, mixed, loaded, unloaded, and equipment rinsed. The facility is designed to contain and isolate accidents from spillage through a sealed impervious surface, curbed mixing and loading pad, chemical collection sump pump, as well as tanks for storage of rinsate and contaminated runoff. The facility is designed to accommodate the largest storage tank served and the size of the equipment being used.

Chemical handling facility- interior

7.3 Stream and Wetland Enhancement and Restoration

Based on limited field observation, most stream channels in the Mills River Watershed outside of Pisgah National Forest appear to be moderately incised, likely a reflection of past land management practices. Especially in flatter areas of the watershed, water channels in farmed areas were historically straightened, and a large proportion of those channels have wooded riparian areas less than 30 feet wide. In almost all cases where woody vegetation is lacking, upland disturbances extend into the riparian area and contribute to bank instability. These conditions have resulted in erosion, sedimentation, and degraded aquatic habitat. Incised and historically straightened streams are particularly vulnerable to erosion as they are detached from their adjacent floodplains, which reduces or eliminates the ability of the floodplain to mitigate storm flow velocities and are subject to being constantly eroded.

To best rectify serious stream instability problems, it is necessary to apply stream restoration techniques that reestablish the proper dimension, pattern, profile, and riparian area vegetation to the stream channel wherever possible (NCSRI 2003; Figure 7.1; Table 7.1). Those areas with less serious stability problems may only require minor improvements and vegetation enhancement.

Priority Areas. Target areas for stream channel and wetland improvements include the following stream reaches:

- Mills River from the USGS gaging station to mouth of Foster Creek.
- Foster Creek downstream of North Mills River Road (SR 1345).
- Unnamed tributaries on the north side of Mills River in the vicinity of NC 191/280 Davenport Bridge.
- Mills River from NC 191/280 Davenport Bridge to the mouth.
- Unnamed tributary paralleling Hooper Lane (SR 1353) on the south side of Mills River.
- Brandy Branch

Some of the floodplain in the lower portion of the Mills River Watershed was likely wetland prior to conversion to agricultural uses, as evidenced by the extensive number of drainage ditches in the area. According to the U.S. Fish and Wildlife Service (USFWS) National Wetlands Inventory (USFWS 2014), two remnant wetlands still exist -- one at the mouth of Brandy Branch and one on the west side of the French Broad River just downstream of the mouth of the Mills River. Wetland restoration would mitigate flood events and enhance channel stability where stream restoration and riparian area vegetation improvements alone may not be successful. A combination of BMPs would achieve greater pollutant removal.

Project Screening Criteria. The following screening criteria will be considered in selecting and prioritizing projects:

- Landowner(s) willing to enter into a conservation easement or long-term maintenance agreement
- Number of landowners involved
- Condition of stream banks and riparian areas -– streams with the unstable stream banks and <30 feet of wooded riparian areas receive higher priority
- Possible development of upstream areas; areas at risk of being developed may receive lower priority
- Location – streams in Priority Areas and first-order streams receive high priority
- Potential for providing habitat for at-risk, endangered, threatened, or significantly rare aquatic species, such as hellbender, freshwater mussels, etc.

7.3.1 Stream and Wetland Enhancement

Stream and wetland enhancement projects are considered for sites with moderate stability, but where 1) physical constraints such as roads, structures, or utilities preclude a full restoration project, 2) only minor bank reshaping is required, or 3) where somewhat stable stream banks exist but no or little woody vegetation is in the riparian area (Figure 3.4; Table 3.8). Enhancing riparian area vegetation with native species (Table 7.1), removal of any non-native invasive plant species, and expansion of the riparian area width may be all that is needed or possible. The most common invasive exotic plants observed in the Mills River Watershed are Japanese knotweed (*Polygonum cuspidatum*), multiflora rose (*Rosa multiflora*), and privet (*Ligustrum* spp.). These invasives crowd out native plant species and do not have the root structure necessary to hold stream banks in place or to filter pollution.

Figure 7.1 Functions of Woody Riparian Area Vegetation

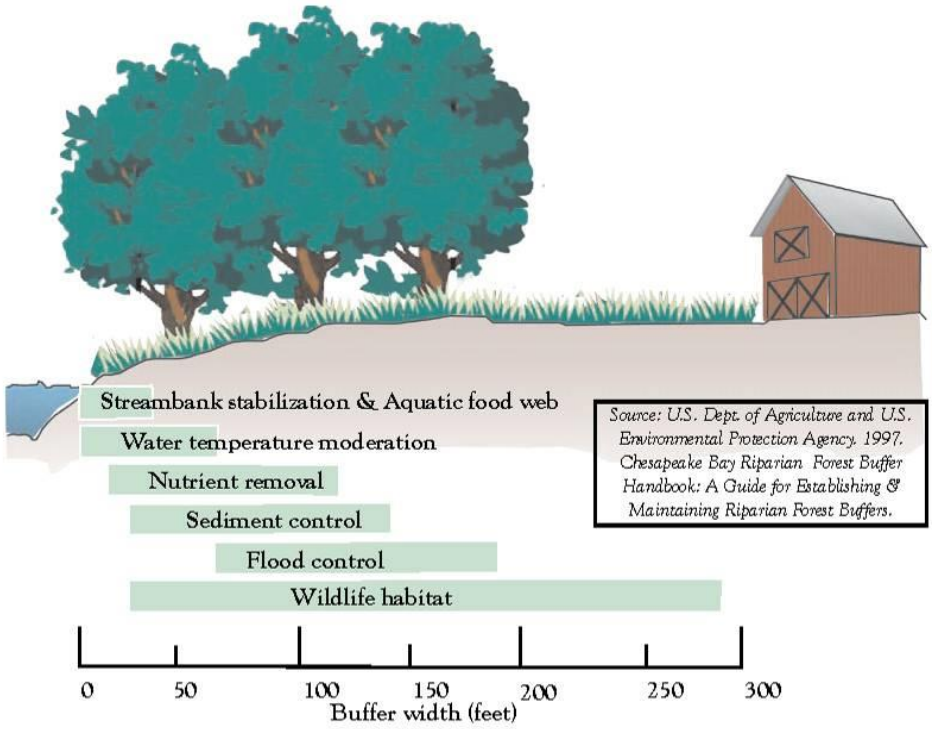


Table 7.1 Recommended Native Plants for Use in Stream Restoration and Enhancement[1]

Trees	*River Birch, Bitternut Hickory, Shagbark Hickory, Sugarberry, Persimmon, Green Ash, Blackgum, Sycamore, Black Cherry, Swamp Chestnut Oak, Water Oak, Shumard Oak, Black Willow, White Basswood*
Small Trees & Shrubs	*Southern Sugar Maple, Painted Buckeye, Tag Alder, Service Berry, Red Chokeberry, Common Paw Paw, Sweet Shrub, Ironwood, Buttonbush, Alternate Leaf Dogwood, Silky Dogwood, Hazelnut, Deciduous Holly, Winterberry, Virginia Willow*
Herbs	*Jack-in-the-Pulpit, Swamp Milkweed, Fringed Saxifrage, Bladder Sedge, Hop Sedge, Lurid Sedge, Broom Sedge, Tussock Sedge, Fox Sedge, Turtlehead, Umbrella Sedge, Bottlebrush Grass, Joe Pye Weed, Boneset, Jewel Weed, Soft Rush, Rice Cutgrass*

[1]Developed by the North Carolina Stream Restoration Institute at N.C. State University. This list is not exhaustive and is intended as a guide. Plants listed in the table may not be appropriate and revegetation plans should be developed for site specific conditions.

7.3.2 Stream Channel Restoration

Stream channel restoration is the re-establishment of the general structure, function, and self-sustaining behavior of the stream system that existed prior to disturbance. To best rectify stream instability, apply stream restoration techniques that reestablish the proper dimension, pattern, and profile to the stream channel wherever possible. Stream restoration designs take into account watershed size, stream slope, and soils among other geomorphological characteristics. Restoration not only reduces erosion, but improves sediment transport, the natural movement of organic and inorganic particles by water. Over the long term, this results in better in-stream habitat conditions. As with stream enhancement, restoration requires revegetation of the riparian area with native shrubs, trees, and herbaceous plants which will maximize the riparian ecological function and ability to filter sediment and other pollutants coming from upland areas. MRP works to identify potential stream restoration sites in the watershed.

> ***Stream/Wetland Restoration*** - Areas that require major stream channel grading and vegetation improvements to restore stream and wetland function.

7.3.3 Wetland Restoration

Wetland restoration is the restoration of the function of a wetland to filter water, recharge water supplies, reduce flood risk, and provide fish and wildlife habitat. Some floodplain areas of the Mills River Watershed were originally wetlands that were converted to farmlands. Restoration of such wetlands will not only improve water quality by reducing excess sediment, nutrients and other pollutants, but will lead to improved floodplain function. Wetland features are known to provide essential wildlife habitat for waterfowl and other birds, amphibians, and invertebrates. Wetland restoration should be considered for areas where crops cannot consistently be raised, are difficult to farm due to site conditions, or where they can be integrated into stream restoration projects. MRP works to identify potential wetland restoration sites in the watershed.

7.3.4 Stream Channel Realignment

Channel realignment is stream channel modification to align the stream to flow at the same angle as an existing culvert, so as to reduce erosion along the embankment and damage to the culvert. MRP has made no assessment of stream crossing conditions, but it appears likely that some erosion of stream banks occurs where the stream channel is not properly aligned with a stream crossing (assuming the structure is of the appropriate size). This condition can occur with metal pipe culverts, concrete box culverts, bridges, and fords. In cases where the structure cannot be replaced, realignment of the stream channel may be necessary. When conditions do not allow for either replacement of the structure or channel realignment, one option may be to armor the stream bank and channel.

7.4 Stormwater Control Measures in Developed Areas

7.4.1 Stormwater Impacts

During a rain event, stormwater flows across impervious surfaces, builds volume, and carries sediment and other pollutants with it into streams. The increased volume of runoff results in increased stream velocities that scour stream banks. These factors combine to cause increased turbidity. Stormwater control measures (SCMs) offset the impacts of impervious surfaces by capturing runoff and storing it on-site, which allows sediment and other pollutants to settle out of the water. Stormwater detention ponds allow runoff to slowly infiltrate into the ground, reducing the erosive effects of increased water volume and velocity on streams, and peak discharges of large rain events are reduced to match natural stream flow characteristics. Some stormwater detention designs also effectively reduce the levels of pollutants such as nitrogen, heavy metals, and phosphates in the effluent. In addition to reducing the potential for streambank erosion, SCMs also can provide improved wildlife habitat by enhancing open space, reducing elevated water temperatures caused by heat-absorbing pavement, and beautifying the landscape with the addition of water features and vegetation.

Impervious cover often contributes the greatest impact to water quality in developed watersheds. Guidelines from the Center for Watershed Protection (CWP) are used to gauge the status of a watershed's stability (Figure 7.2). Private land in Mills River Watershed encompasses 10,891 acres, of which approximately 305 acres, or slightly less than 3 percent, are considered impervious surface. Most impervious surfaces such as parking lots, roads, and rooftops are in the Brandy Branch sub-watershed, primarily along NC 191/280; therefore this sub-watershed received attention during a recent stormwater assessment (see Appendix B). The Brandy Branch sub-watershed encompasses 404 acres, of which about 50 acres are considered moderately impervious (allows for some water infiltration to the soil) and another four acres are considered highly impervious (does not allow significant water infiltration to the soil). Combined, this amounts to about 13 percent of the watershed. According to the Center for Watershed Protection, stream quality begins to be affected when watershed impervious cover reaches 5-10 percent (Figure 7.2; CWP 2005). At 20 percent impervious cover, a stream is considered impacted. This puts the Brandy Branch sub-watershed at the tipping point of being considered an impacted area. Retrofitting existing impervious sites with SCMs in combination with current post-construction stormwater requirements should improve water quality in this watershed, which could lead to the removal of Brandy Branch from North Carolina's 303(d) impaired waters list.

Figure 7.2 Relationship Between Impervious Cover and Stream Quality

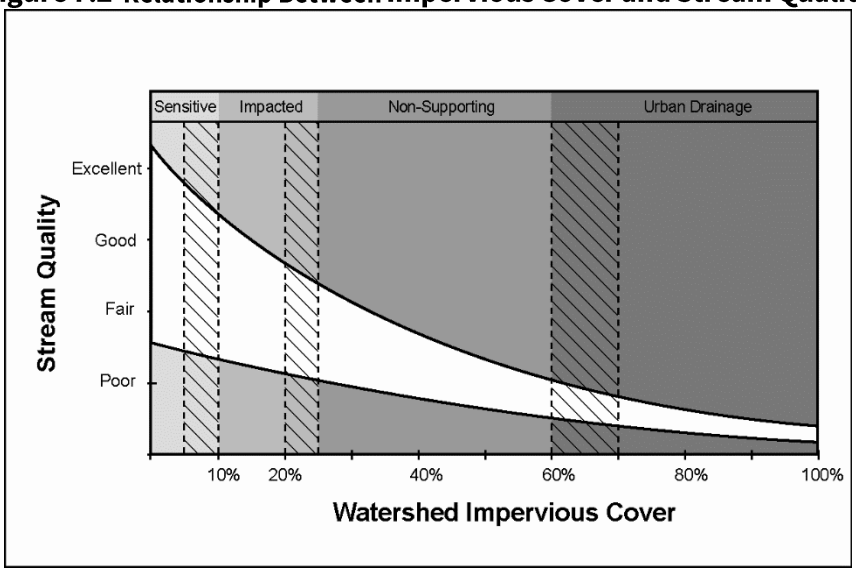


Figure taken from Schueler et al. (2009).

Priority Areas. The following developed areas are targeted for Stormwater Control Measures (SCM) and retrofit projects:

- Brandy Branch sub-watershed
- NC 191/280 corridor

Project Screening Criteria. Although the most significant stormwater retrofit project opportunities are identified as part of the stormwater assessment below in Section 7.4.2, the following project screening criteria identify additional projects and appropriate management measures to be applied:

- Proximity to waterways
- Amount of impervious surface
- Potential pollutant load
- Level of existing containment and treatment
- Located in the floodplain

Stormwater runoff in the developed (priority) areas of the Mills River Watershed is impacting stream quality. Facilities built prior to implementation of the Phase II stormwater regulations can be retrofitted with SCMs to reduce their impact on receiving streams. Siting and design plans for SCMs consider not only stormwater volume control, but pollutant load reductions, with emphasis on reduction in sediment. Designers of proposed SCMs also take into account aesthetics, enabling projects to blend into the landscape, making them more attractive, and increasing the likelihood that other owners will consider constructing SCMs on their property. Features constructed on public lands also can be used to educate landowners and the public about how SCMs work and the environmental benefits that can be achieved by their installation.

7.4.2 Stormwater Assessment

Sites in the watershed were recently identified where existing conditions may be suitable to retrofit stormwater control features. Retrofit practices not only provide water quality benefits, but help beautify the NC 191/280 corridor. Retrofit treatments also serve as model projects so that on-the-ground practices can be replicated and utilized for educational purposes.

Following a standard GIS stormwater assessment screening process (Appendix B), a preliminary list of sites was developed. Site visits were made to determine the potential for stormwater treatment. Several sites were found to be either inconsequential in size or were newer developments where existing stormwater treatments were observed (cleanout pipes, monitoring wells), implying that they have already complied with phase II requirements.

Determining the appropriate SCMs involves holistic consideration of factors such as slopes, soils, contributing hydrology, depth to bedrock, depth to seasonal high water table, targeted pollutants, and adequate space for installation. It is important to recognize that the siting and design of SCMs is as much of an art as a science (NCDWQ 2007a). Appropriately fitting treatments into the natural features of a site can not only help reduce impacts to water quality, but address community concerns, safety issues, community acceptance, and wildlife benefits (Table 7.2). Unfortunately, a majority of the sites within the Brandy Branch catchment are either within the floodplain, or located within immediate proximity to streams, making retrofitting sites challenging and limiting treatment types that can be used.

Table 7.2 Cost, Community, and Environmental Issues for Stormwater BMPs

	Construction Cost	Maintenance Level	Safety Concerns	Community Acceptance	Wildlife Habitat
Bioretention	Med-High	Med-High	N	Med-High	Med
Stormwater wetlands	Med	Med	Y	Med	High
Wet detention basin	Med	Med	Y	Med	Med
Sand filter	High	High	N	Med	Low
Filter strip	Low	Low	N	High	Med
Grassed swale	Low	Low	N	High	Low
Restored riparian buffer	Med	Low	N	High	Med-High
Infiltration devices	Med-High	Med	N	Med-High	Low
Dry extended detention basin	Low	Low-Med	Y	Med	Low
Permeable pavement system	Med-High	High	N	Med	N/A
Rooftop runoff management	Med	Med	N	High	Low

Source: NCDWQ Stormwater BMP Manual (NCDWQ 2007a)

7.4.3 Potential Stormwater Retrofit Opportunities

As discussed in the assessment process, potential sites were screened in GIS, ground verified, and analyzed to determine both feasibility and need. General approaches to address individual sites always begin with determining the potential for removing unnecessary impervious area. If impervious surface removal is possible, that area is then considered for use as part of the stormwater feature, if for no other reason than as a retention area that slows the runoff. Seven sites were identified as potential retrofit sites (Table 7.3; Figure 3.3).

Several sites have the possibility for construction of multiple bio-retention areas. As an example, at the Food Lion the existing planting islands could be converted to bio-retention features. Due to the proximity of the existing adjacent stormwater infrastructure, connectivity to this system should be straightforward.

No formal prioritization process was used in this assessment; however, field priority was based on professional judgment and considering perceived feasibility, visibility to the general public, and effectiveness of treatment possibility. Parking islands within the Food Lion parking lot (Site 4) provide such an opportunity and were used to exemplify the possibilities of this site. A photo mockup and plan is included to illustrate (Figures 7.3 and 7.4) the potential of this retrofit practice. Since this is a commercial property that relies heavily on highway visibility, low growing plant materials is preferred in the planting plan. However, to achieve temperature reductions for this large impervious area, large strategically-placed canopy trees will significantly add to the BMP design and function.

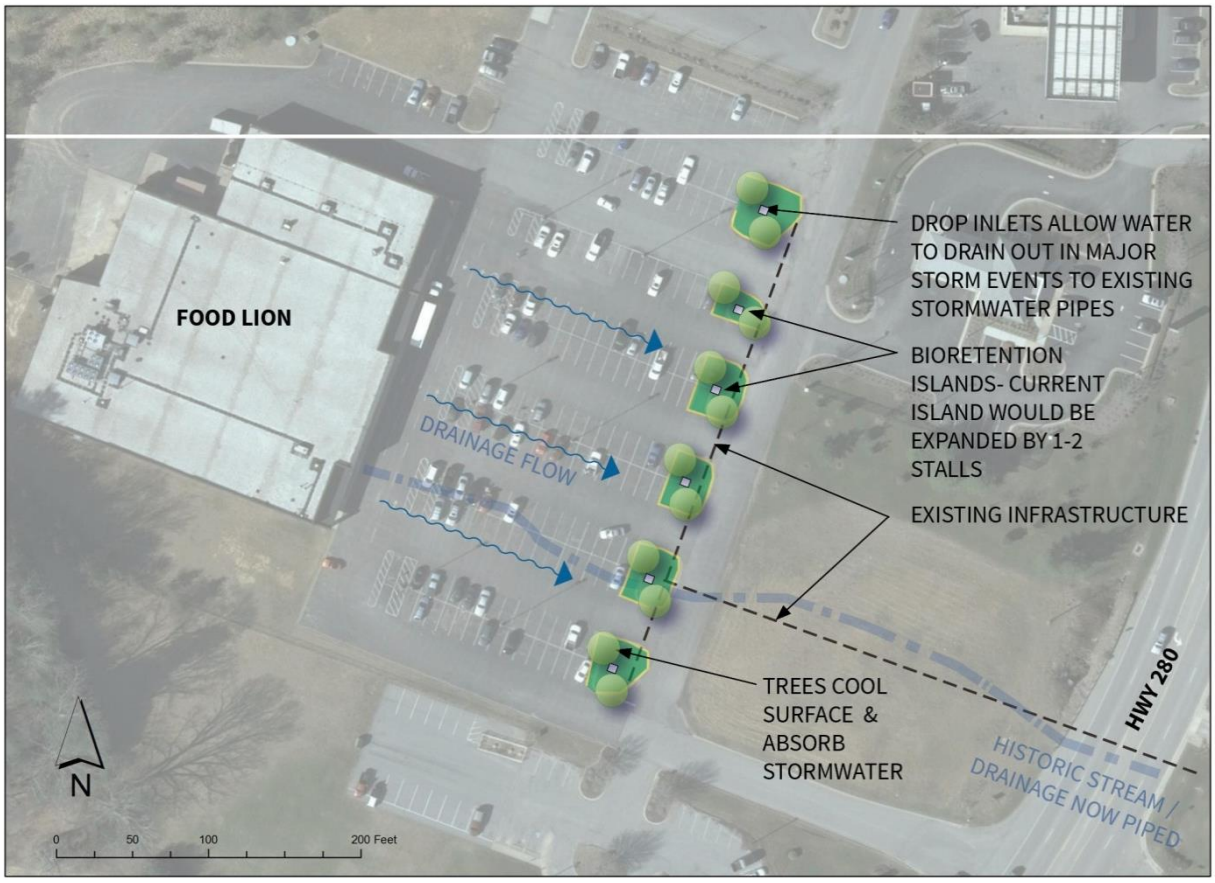
Table 7.3 Potential Stormwater Retrofit Site Characteristics

Site Number[1]	Property Type	Priority	Description of Problem	Potential Stormwater BMP	Drainage Area (acres)	Impervious Area (acres)	Percent Impervious
1	Institutional	Medium	Impervious over drainage, heat island	Bio-retention	6.82	3.69	54%
2	Commercial	Low	Impervious area within close proximity to stream(s)	Bio-retention	6.94	1.23	18%
3	Commercial	Medium	Stormwater from NC 280 drains into lot that drains directly into Mills River	Bio-retention	2.29	1.49	65%
4	Commercial	High	Parking lot drains directly into piped stream with no treatment.	Bio-retention	3.02	3.02	100%
5	Commercial	Medium	Parking lot & facility drains directly to stream. Available open space to create wetland shows to be different owner, but perhaps will be willing to increase buffer & improve treatment.	Constructed Wetlands	2.80	1.03	37%
6	Industrial	Low	All runoff from roadway drains directly to piped stream with no treatment.	Extended Detention	1.58	0.99	63%
7	Commercial	Medium	Impervious area with streams on both sides. No treatment & increased velocity to receiving waterways.	Infiltration	3.37	1.25	37%
				Totals	26.82	12.70	

[1]See Figure 3.3 for site locations.

Figure 7.3 Potential Stormwater Control Measures at the Food Lion Site

Figure 7.4 Plan View Illustrating Locations of Potential Treatment



7.4.4 Simple Stormwater Control Measures

In addition to the NCDWQ (2007a) BMP design manual definition of non-structural practices, simple SCMs include small, low-cost measures that cumulatively can significantly reduce the impact of stormwater runoff. Homeowners and small businesses owners can implement simple SCMs on their properties. Done properly, these practices beautify a property, protect basements and foundations from water seepage, and reduce water consumption and the cost of water utilities. Each property is unique. Prior to implementing any of these solutions, property owners should assess their site to ensure that their runoff will not cause or worsen storm runoff problems for neighbors or create or add to erosion and flooding conditions on their properties. Even though these solutions are referred to as 'simple,' professional assistance with design and construction may be needed. Proper installation techniques will be discussed through MRP outreach and education.

Downspout Disconnects. As the name implies, in cases that roof drains are tied into a closed system, the downspouts are physically disconnected from these systems. Downspouts from rooftop gutter systems can be re-routed to lawns and wooded areas to reduce runoff volume and stream velocity. People interested in helping streams through these practices should expect minimal investment in time and money. A homeowner with just a few downspouts will not incur as much cost as those who manage a large commercial facility. The site to which the downspout is re-routed should be assessed for its infiltration and erosion potential. Rerouting downspouts to steep slopes or clay soil areas may cause erosion or flooding. When these site conditions are unavoidable, use of stone, erosion control fabric, and vegetation can help control erosion and promote infiltration. The more complicated a site, the more likely assistance of a design professional is necessary. Many homeowners will find this solution easy and inexpensive to implement and can likely undertake such a project on their own.

Rain Barrels and Cisterns. Rain barrels and cisterns (Figure 7.5) provide a storage device to capture rooftop drainage for later use on- site. Many people capture and reuse this water for gardens and landscape plantings. Rain barrels come in a variety of sizes, shapes, and colors. It has become fairly commonplace to find 50 to 75-gallon barrels that make attractive additions to the landscape. A simple, 50-gallon plastic rain barrel typically cost around $100 or less. Users of this practice must make sure that they have screens over openings to keep mosquitoes from using the reservoir as a breeding ground. They also need to direct overflow to a suitable location to keep it from seeping into foundations and basements.

Figure 7.5 Rain Barrel and Cistern Setup

A rain barrel is attached to a downspout and collects rain water.

An above-ground cistern located at the City of Morganton Parks and Recreation maintenance building catches runoff from the roof. The water is used to clean equipment.

Dry Creek Beds. Dry creek beds (Figure 7.6) can be an attractive landscape amenity to re-route runoff from impervious rooftops, driveways, and parking lots into a yard area where infiltration can occur.

Figure 7.6 Dry Creek Beds in a Residential Setting

The rough edges of the stones and the open spaces between the rocks slow down runoff and allow it to be absorbed by the ground. Landscape plantings within and around the dry creek bed also slow the water and promote infiltration. The stones and plants also work together to create natural habitat for birds and small mammals.

Rain gardens. Rain gardens are intended to slow, treat, percolate, and promote evaporation of stormwater. Rain gardens are typically excavated areas located in low points of a property that are simply planted with native plant material.

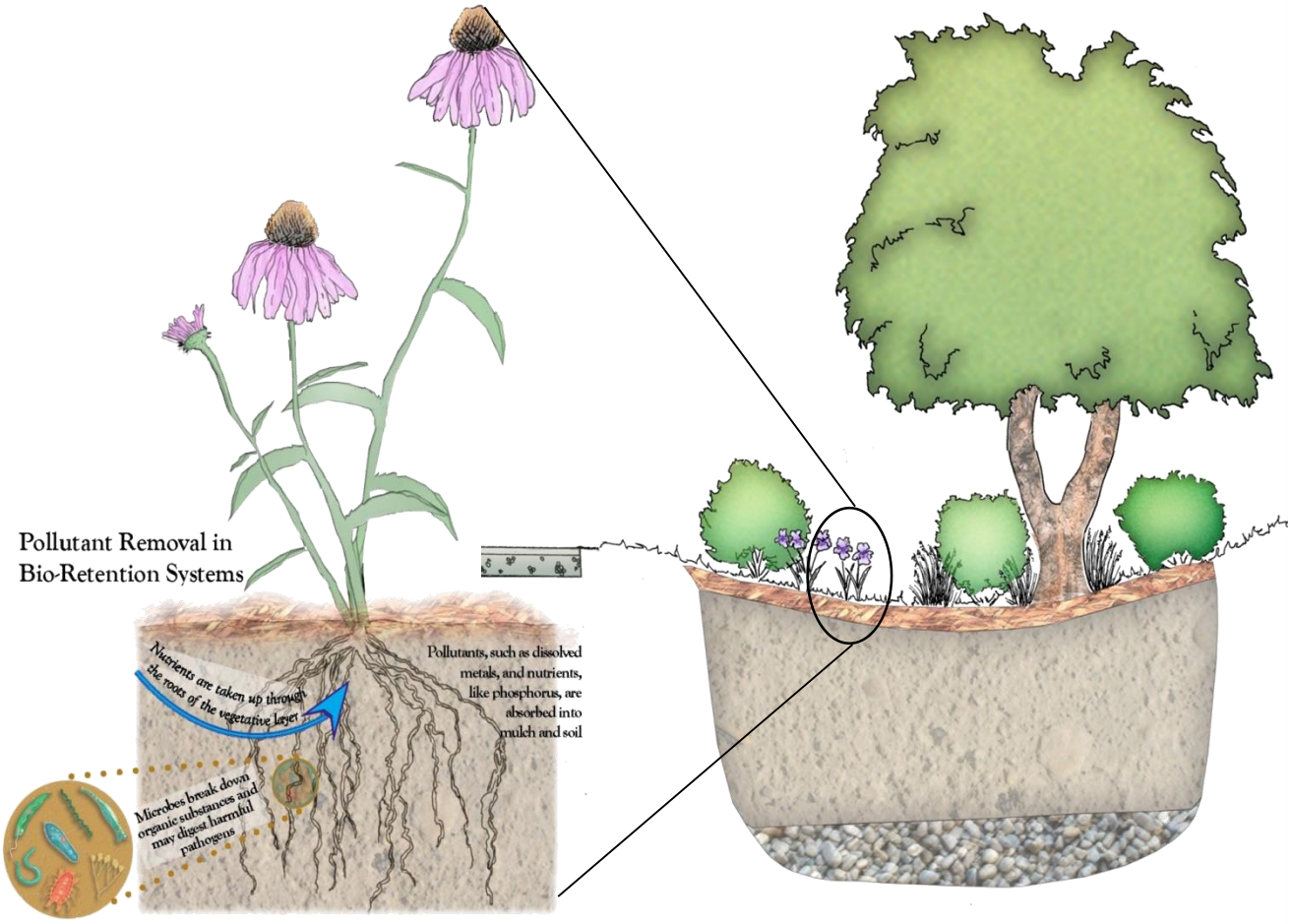
Because they lack drainage structures, soils in rain gardens must be highly permeable to function correctly. It is important to test the composition of existing soil to ensure the rain garden is able to "draw down" between rain events. Studies have found it useful to scarify, or loosen, the in-situ soils in the bottoms of rain gardens prior to planting.

7.4.5 Structural Stormwater Control Measures (SCM)

Engineered structures as, defined in NCDWQ (2007a) BMP manual, are ones that are intended to treat larger areas of impervious surface. They vary greatly in size, complexity, and function and typically incorporate plant material, soil mixes, and diversions that filter pollutants by natural processes. Common examples of engineered SCMs include bio-retention, constructed wetlands (also known as stormwater wetlands), regenerative stormwater conveyances, wet detention ponds, and bio-swales. Less common and more expensive alternatives include permeable paving, permeable weirs, underground storage chambers, and green roofs.

Bio-retention. As shown in Figure 7.7, stormwater flows into a bio-retention cell and pollutants are absorbed into the soil. Underdrain systems are located in the bottom of these cells to slowly release stormwater at pre-development rate. Nutrients are taken up by plants while microbes break down organic substances. These systems typically occur as vegetated depressions that capture runoff and allow plants to take up excess nutrients and water while filtering runoff through a soil medium.

Figure 7.7 Plant Uptake and Pollutant Removal Processes

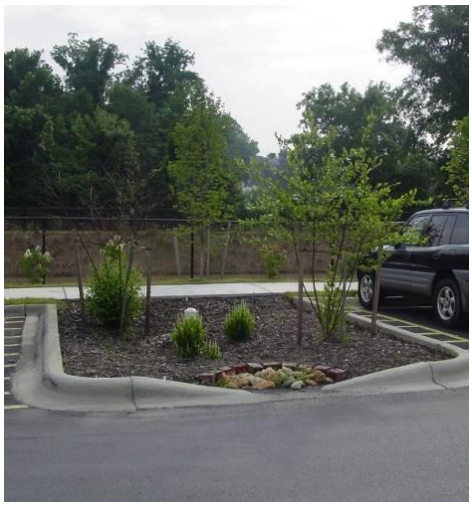


Bio-retention features are shallow landscape depressions that use soils and plants to treat stormwater runoff, using many of the water storage and pollutant-removal mechanisms that operate in healthy forests. During storms, water temporarily ponds on the surface of a sand/soil bed that then infiltrates through the bed into an underdrain system. Bio-retention areas can be designed to infiltrate water directly into native soils if those soils are sufficiently permeable. To reduce the sizing requirements of bio-retention features, use of a structure can be installed to limit the amount of water the bio-retention receives to the first inch of rain. Larger storms bypass the bio-retention cells protecting them from receiving excessive volumes of water beyond what they are designed to hold. Overflow structures are typically installed within the bio-retention cell, especially when a bypass structure is not feasible, such as curb cuts in a parking lot. Bio-retention can be used in a variety of topographic conditions,

although individual retention areas are usually small and can generally treat runoff from areas of one acre or less (Figure 7.8).

Bio-retention cells are intended to "draw down" or empty within 48 hours following a rain event, alleviating stagnant water and mosquito breeding.

Figure 7.8 Bio-retention Features in Commercial Applications



The median construction cost for bio-retention features is approximately $25,400 per impervious acre treated (CWP 2005). Development of designs for SCMs will increase this cost by about 33 percent. The advantage of bio-retention is that it makes a cost-effective complement to parking lot and streetscape improvements where improved landscape aesthetics are also a goal. Rain gardens can also fit nicely in common areas and as part of the stormwater management system of a residential development. Routine maintenance similar to landscape maintenance will be required, including replacement of top-most mulch every few years, removal of invasive exotic weeds, occasional pruning, and occasional replacement of approximate two inches of the uppermost horizon of the fill media if fine sediments have accumulated on the surface.

Regenerative Stormwater Conveyances (RSC). These features are essentially large drainage swales, but ones that do more than simply convey water from one point to another. They are designed to slow down water flow and allow infiltration. This innovative system utilizes open-channel, sand seepage filtering systems that incorporate a series of shallow aquatic pools, riffle weir grade controls, native vegetation, and an underlying carbon-rich sand channel to treat and safely detain and convey storm flow (Figure 7.9; Brown et al. 2010). In the process, stormwater is converted to groundwater through infiltration. An RSC system combines the features and treatment benefits of swales, infiltration, filtering, and wetland practices. Simple grass-lined swales have limited pollutant removal benefits, but are often utilized in conjunction with other SCMs.

Figure 7.9 Examples of Regenerative Stormwater Conveyances

At Construction

After One Growing Season

After Construction

Three Years After Installation

Costs for grass swales in the North Carolina mountain region average $1.24 per square foot (Hathaway and Hunt 2007). Swales on steep slopes may need turf reinforcement matting or other support, which would be an additional expense $0.50/square foot. Because this is a relatively new practice, historic cost models have not been developed. However, since RSCs employ some of the same materials and design considerations, it is logical that costs would align closely to bio-retention cells.

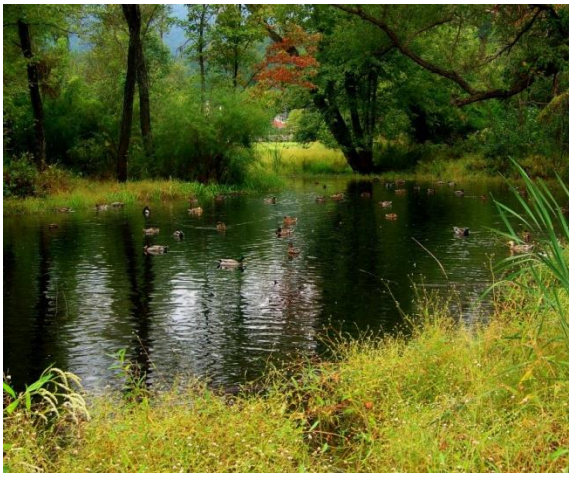
Constructed Wetlands (also known as stormwater wetlands). Constructed wetlands are shallow depressions constructed to mimic the functions of natural wetlands (Figure 7.10). They are intended to increase the flow paths of the stormwater and temporarily store stormwater in pools of varying depths that contain diverse wetland vegetation. The wetland uses physical, chemical, and biological processes to filter pollutants. They can also be designed to provide stormwater volume control.

A forebay is an important design feature placed near the inlet to the wetland. This allows coarser sediment particles that often accompany runoff to settle into a basin rather than enter the wetland and reduce the wetland's treatment capacity. The forebay also protects the physical integrity of the wetland by dissipating the energy of the incoming stormwater.

In contrast to rain gardens, wetlands can be used to treat runoff from a larger area. Because they are shallow, stormwater wetlands require more surface area than similar wet detention ponds.

Costs for retrofitted constructed wetlands, as reported by the CWP, can be upwards of $38,400 per impervious acre treated. Design costs of a constructed wetland will increase this by about 33 percent. Sediments that accumulate in the forebay of a constructed wetland need to be dug out every five years or when the depth of the forebay diminishes by 50 percent. Wetlands should also be monitored for the invasion of exotic plant species and removed promptly when found. Other maintenance requirements include periodic inspection of the flow delivery mechanisms upstream of the wetland to ensure that stormwater is able to get to the wetland as designed. Otherwise, the wetland plant species may die. Trash and other debris removal may also be needed periodically.

Figure 7.10 Examples of Constructed Wetlands

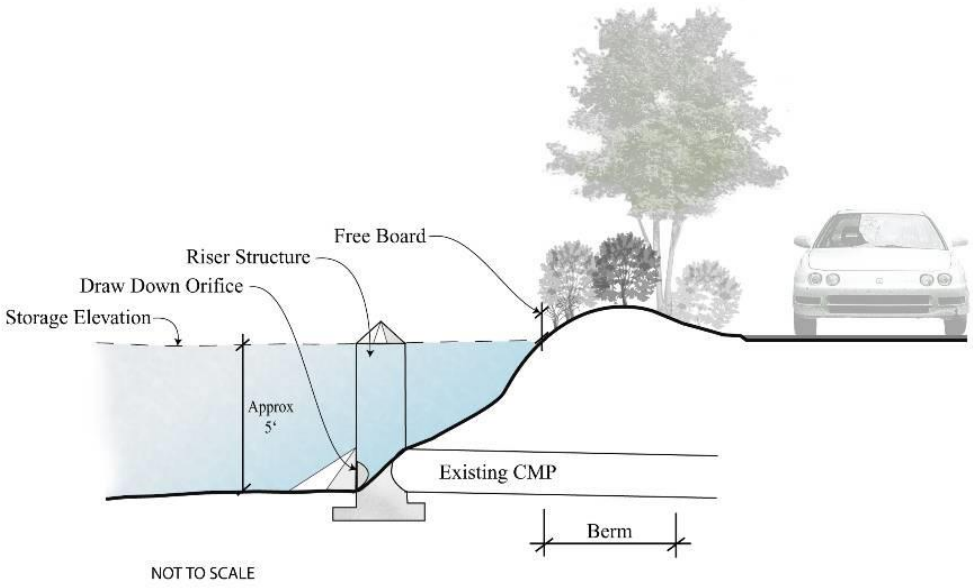


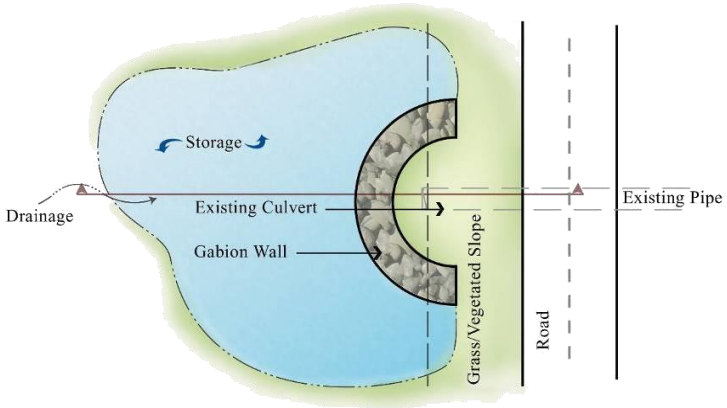
A constructed wetland at a city park

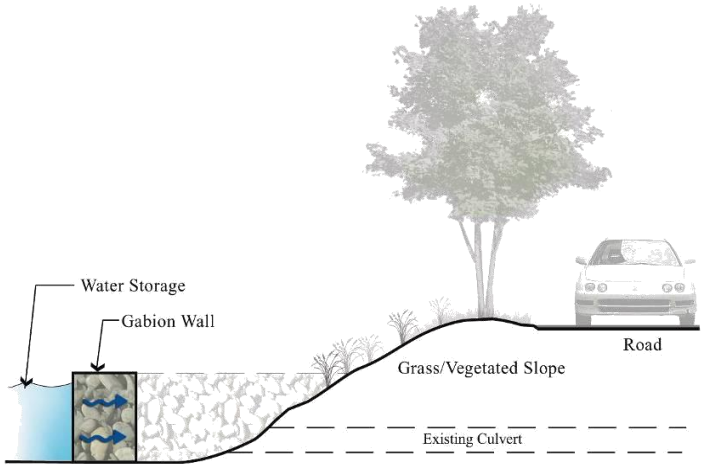
Detention and Retention Ponds. Wet retention ponds should be avoided in the Mills River Watershed since water temperature is a concern for trout streams. In addition, construction costs for wet pond retrofits can be upwards of $57,500 per impervious acre of treatment. Wet detention ponds are not allowed to be used within five miles of a public airport without airport authority approval, due to the attraction of birds to the pond (S.L. 2012-200 Part VI). For more information contact the Henderson County Water Quality Administrator.

Extended detention is designed to capture stormwater and temporarily store it for 12-24 hours allowing sediment and other pollutants to settle out before it slowly continues to follow its drainage pattern (Figure 7.12). While extended detention structures can be installed wherever water flows through a culvert, they must be sized to accommodate the upstream drainage area. A structure, such as a riser or gabion wall is installed upstream of the culvert and causes the water to backup. Over the course of extension time, the water slowly releases through the existing culverts or corrugated metal pipes. Since there is no long-term storage of the water, extended detention facilities do not have the same negative effects of increased water temperature as wet ponds. Furthermore, innovative use of these facilities can also provide open space and provide for recreational use of the surrounding area.

Figure 7.12 Examples of Extended Detention Pond Designs







7.4.6 Stormwater Control Feature Maintenance

Maintenance of SCMs is critical to function effectively and to maintain aesthetically pleasing landscapes. It is highly recommended that an operations and maintenance agreement be provided prior to approval of any stormwater application (Appendix 10-B). These agreements can be shared with contracted maintenance crews to help educate them on some of the specific needs of the treatment location. Generic operations and maintenance agreements can be found in the NCDWQ (2007a) BMP manual.

Inspections of the SCM should occur annually. Stormwater treatment methods, particularly structural features, require assessment by a design professional who attests to having a sound understanding of the intended functions of the SCMs and the complexities of the infrastructure involved.

Access easements are also required to be recorded at the Courthouse to provide the regulating entity access to the site for emergency repair if the owner defaults and the device is in need of immediate repair.

7.4.7 Unpaved Roads

Unpaved roads associated with private driveways, residential developments, and farm operations are common in the Mills River Watershed. Because these road surfaces are compacted, stormwater runoff from them is often channeled directly into streams, carrying with it sediment eroded from the road surface and adjacent unprotected ditches. While no assessment of unpaved roads was made in conjunction with the development of this plan, an Integrated Pollutant Source Identification (IPSI) study conducted by the Tennessee Valley Authority (TVA) in 2006 estimated that 43 percent of the soil losses in the Mills River Watershed came from unpaved roads and road banks (TVA Unpublished Data). To further address this issue, an on-the-ground inventory of unpaved roads not on farmlands should be done. Unpaved roads on farmlands will be assessed in conjunction with the development of Farm Conservation Plans for individual farm operations.

Owners of unpaved roads on non-farm lands are encouraged to improve them using techniques followed by the USFS. Such techniques include the following:

- Outslope the Road Surface -- direct runoff into wooded areas rather than stream channels.
- Install Road Dips -- funnel stormwater off roads and into forested areas to prevent an accumulation of stormwater and minimize erosion.
- Install Sediment Catch Basins -- use in conjunction with road dips to capture water from ditches and to allow sediment to settle before it reaches streams.
- Gravel Road Surfaces -- to reduce soil erosion.
- Rehabilitate Ditches -- reshape ditch banks, install check dams, and where possible establish vegetation to reduce the erosive power of stormwater runoff.

7.5 Hazardous Materials

Hazardous materials storage sites that do not fall under any regulatory program and that could pose a risk to the drinking water supply is of major concern to the MRP. Those concerns are listed here and will be addressed through outreach and education programs targeted at facility owners/operators. However, research of previous planning documents and discussions with individuals involved in those efforts identified two significant management measures that warrant inclusion in this plan: 1) relocation of the Hendersonville water intake and 2) construction of containment basins adjacent to NC 191/280 near the Davenport Bridge to protect the water intakes in the event of a vehicle accident involving hazardous materials.

7.5.1 Water Intake Protection

Hazardous Materials Storage. While facilities handling large volumes of hazardous materials are regulated and identified as Tier II PCSs, smaller facilities are not. (Volumes depend on toxicity, but generally, 500 pounds of extremely hazardous substances or 10,000 pounds of hazardous substances constitute large volume.) The SG identified several businesses and farms that store small amounts of hazardous materials. Information about how to safely store hazardous materials will be conveyed to these owners via the MRP outreach program.

Intake Relocation. The water intake structures for both the Hendersonville and Asheville water treatment plants are both located downstream of the NC 191/280 Davenport Bridge. The Hendersonville intake is approximately 350 feet downstream, while the Asheville intake is 2.6 miles downstream at the confluence with the French Broad River. This highway has seen a significant increase in traffic over the last 20 years and is now a five-lane thoroughfare from I-26 to its intersection with US 276/64 in Pisgah Forest. The Town of Mills River was incorporated in 2003 and is home to approximately 7,000 residents. These conditions have increased the risk that a hazardous materials incident could occur at or near the bridge. With the water intakes located so close, even the most rapid response would fail to avoid hazardous materials from entering the water intake structures. It has been recommended as long ago as 1989 to move the City of Hendersonville water intake upstream of the Davenport Bridge. That recommendation remains in place as part of this management plan.

Hazardous Materials Incident Protection. As mentioned above, the Hendersonville water intake is located very close to the NC 191/280 Davenport Bridge. Storm drains and roadside ditches drain to the Mills River at the bridge. A hazardous materials incident on the bridge and approaches would quickly drain to the river with little time to notify the treatment plan operators or to implement the Henderson County emergency response plan (see Section 5). Previous planning efforts have suggested working with the NC Department of Transportation (NCDOT) to install some type of containment structure to prevent hazardous materials from entering the water supply. This recommendation will be pursued as a way to reduce the risk of contaminating the Hendersonville and Asheville water systems.

7.6 Land Conservation

Land conservation of all types is an important element of any watershed plan. Protection of intact forests from development, conservation of unique habitats for rare species, ensuring historic uses of farmland remain, or maintaining open spaces are a few examples. Each has its own values that need safeguarding. While much of the Mills River Watershed is protected from development as part of the Pisgah National Forest, land conservation opportunities on private land still exist, both to protect water quality and maintain aquatic habitat. The MRP works in collaboration with Carolina Mountain Land Conservancy to identify such important lands and opportunities. Conservation of lands, regardless of the tool used, is 100 percent voluntary for private landowners.

Priority Areas. The table of North Carolina Significant Natural Heritage Areas (SNHA) (Figure 2.2; Table 2.2) identifies uniquely important conservation sites in the Mills River Watershed. These sites are identified by the NC Natural Heritage Program as locations of important habitats, plant communities, and species. In addition, the Stakeholder Group developed site-specific screening criteria for land conservation.

Project Screening Criteria:

- Proximity to important water resources
- Willing landowner
- Quality of land for existing use (i.e. does the land provide important habitat or is it highly productive agricultural land)
- Connection to existing protected area that are significant to protect water quality (i.e. to enlarge a conserved area)
- Potential for linking other protected areas (i.e. to provide conservation corridors)
- Likelihood of conversion to other uses that would substantially impair water quality
- Size of property
- Health of riparian area vegetation
- Percentage of intact forest
- Presence of wetlands

The land conservation toolbox will include the following options for consideration by landowners:

Conservation Easements. A legal agreement between a landowner and the conservation organization. Depending on the circumstances, the easement can be purchased from the landowner or donated to the conservation organization. While the landowner retains ownership of the easement area, certain land uses and disturbances are limited to protect the resource. Some terms of the easement are negotiable to meet the needs of the landowner while at the same time protecting the natural resource values. A conservation agreement is permanent, running with the deed when the property is sold or passed down to heirs. The easement holder is responsible for periodically monitoring the land to ensure that the terms of the agreement are being upheld.

Fee Simple Purchases. In certain circumstances, such as inholdings within the national forest, conservation organizations, often working in partnership with government agencies, can acquire properties for permanent conservation.

Deed Restrictions/Covenants. Developers of land containing important natural resources can protect them by placing restrictions on where building can occur within a tract of land. The restricted portions are often designated as community property for the enjoyment of the residents. This balance of development and natural resource protection not only enhances the quality of life for the residents, but often enhances property values.

Informal Landowner Agreements – Where landowners recognize natural resource values on their property but do not want the limitations that come with formal agreements, they may enter into non-binding agreements. One such example is to enter their land in the NCNHP Registry of Natural Heritage Areas. That program is solely voluntary, but provides the landowner with some assistance in managing the property to preserve the natural resources on the property. Under these agreements, the resource does not gain any additional legal protection; however, as part of the agreement the landowner may give the conservation organization an opportunity to purchase the land at some point in the future. Under that scenario the natural resources would then receive protection.

7.7 Education and Outreach

The purpose of the outreach plan is to encourage stream stewardship by involving specifically targeted stakeholders based on their ability to support and create positive changes in the watershed. In order for the outreach to be as effective as possible, it will follow these guiding principles:

- Personalize interactions as much as possible.
- Recognize "conservation stewards" in the community who are doing good things for the watershed.
- Be as transparent as possible with all activities.
- Use outreach in the next few years as a way to solidify the trust of individuals and organizations that will then step up to support the mission and projects of the MRP.

> *"Mills River binds together the lives of watershed residents and water consumers as closely as strands of DNA. Each resident or person with business interests has a share of responsibility for water stewardship."*

The key message to the right was pulled from marketing material and website of the MRP and can become the "elevator speech" in which partners reach out to the community. MRP has identified key outreach audiences for each of the management measures as well as over-arching outreach messages and projects.

The following sections describe the education and outreach activities that MRP will work to implement over the life of the WMP. Education and outreach activities are intended to reach all audiences with a vested interest in the ecological health and water quality of the Mills River Watershed. The actions listed for each section of the outreach and education plan are examples of activities that the MRP intends to pursue. They are not intended to keep the MRP from pursuing alternative or additional actions as opportunities arise. Since this is a dynamic watershed

management plan, that flexibility is necessary to achieve its overall goal of educating the public about the Mills River Watershed.

Increasing public awareness about the Mills River and its social, economic, and natural resources will lead to an appreciation by residents, those communities that use it as a source of drinking water, and visitors that use the area for recreation.

7.7.1 Overall Outreach -- Youth

Key Message: The watershed and water where you live IS the water you drink and it is our individual responsibility to keep our water clean. Message should demonstrate what individual youth and families can do to help.

Key Audience: Young people in the watershed and beyond

Existing or Potential Partners: Muddy Sneakers, Henderson County SWCD, and local schools with a focus on grades that emphasize water quality in the curriculum.

Actions:

- Short-Term; Ongoing
    - Kids in the Creek: Support and be involved with Kids in the Creek water quality program for Henderson County 8th graders
    - Muddy Sneakers Program: Continue to support and be involved with Mills River 5th graders Muddy Sneakers program
    - Conservation District Contest: Support and be involved in Soil & Water Conservation District educational contests on environmental issues.
    - Host Fun and Educational Booths at Public Events: Develop and host fun and educational booths at major events that draw families and children.

- Medium/ Long-Term
    - Produce Youth Orientated Materials: Develop coloring books or other materials that children will use and take home. This could also include development of an interactive piece on the MRP website.

7.7.2 Overall Outreach -- General Public

Key Message: Mills River is the primary drinking water source for Hendersonville and Henderson County and a secondary source for Asheville and South Buncombe County. Each resident or person with business interest has a share of responsibility for water stewardship. Clean water comes at a cost.

Key Audience: General Public, water consumers, media

Existing or Potential Partners: Town of Mills River, Trout Unlimited Pisgah Chapter, Trout Unlimited Land of Sky Chapter, Henderson County SWCD, CMLC, Van Wingerden International, Henderson County Agricultural Advisory Board, Henderson County, City of Hendersonville, the U.S. Forest Service Pisgah Ranger District, and others.

Actions:

- Short Term; Ongoing
    - Updates on MRP General Information and Projects in Partner's Publications and websites: Work with partners to celebrate MRP successes in annual reports, publications, and websites. Examples could include brief blurbs and hyperlinks to the MRP webpage, write-ups in annual reports like the Hendersonville Water and Sewer Annual Drinking Water Report, and others.
    - Have Presence at Mills River Day and Other Community Events: Continue to attend and reach out to public as well as explore other community events with a large local draw (i.e. events at Sierra Nevada Brewery, or partnering with the Cooperative Extension Service to host events).
- Medium-Long Term
    - Conduct Landowner Opinion Surveys: To determine landowner opinions, attitudes, beliefs, and behaviors with regards to implementation of the WMP, two surveys of all landowners will be taken.
    - Expand Educational Signage Program: MRP will create interpretive signage as projects are in place.

7.7.3 Local Government Practices and Programs Outreach

Key Message: Partner with agencies to improve water quality and assist in best practices within agency operations.

Key Audience: Governmental agencies, development permit applicants

Existing or Potential Partners: NCDOT, MSD, Town of Mills River

Actions:

- Short Term:
    - Advocate for better stormwater practices on NCDOT projects: Work with NCDOT to retrofit older projects with BMPs and work with them to use the best BMPs for current or future projects.
- Medium Term:
    - Partner with Town of Mills River to develop hand-out material for permit applicants: Offer to help develop brochures for applicants for sewer, septic, and water permits that illustrate best practices and who-to-call for hazard response.

7.7.4 Agricultural Operations

Key Message: The MRP supports farmers and applauds farmers in the community who are good stewards. The MRP can work with farmers to educate the public about the importance of agriculture to the local economy and food security, and to overcome any negative public misconceptions pertaining to agricultural practices. This public outreach effort makes it more likely that additional farmers in Mills River will cooperate on water quality projects. Emphasize the voluntary nature of engaging with the MRP to do projects.

Key Audience: Farmers and general public

Existing or Potential Partners: Henderson County Farm Bureau , Town of Mills River Agricultural Advisory Board, Henderson County SWCD, Henderson County Agricultural Advisory Board, Future Farmers of America, and the Mountain Horticultural Crops Research and Extension Center.

Actions:
Short-Medium Term

- Implement a Conservation Steward Recognition Campaign: This campaign highlights individuals, organizations, and businesses that help improve water quality by implementing BMPs. This campaign will be broadcast through local media as part of press releases, personal interest stories, and highlights when MRP projects are completed.
- Future Farmers of America Outreach: Conduct outreach work with FFA.
- Host Public Seminars: Host seminars, speaker panels, and presentations on agricultural and stormwater BMPs.
- Website and Newsletter Outreach: Include a section on farming and a farmer spotlight in the MRP newsletter and/or website.
- One-on-One Engagement: One-on-one interactions on agricultural BMPs. Recognized conservation stewards can help build credibility of the MRP.
- Website and Newsletter Outreach: Develop written or web content on agricultural BMPs.

7.7.5 Stream Restoration and Enhancement Outreach

Key Message: Protect your land, save your topsoil, and fight erosion.

Key Audience: General public, farmers, fishermen

Existing or Potential Partners: Henderson County HCSWCD, ECO/MountainTrue., and CMLC. Potential funding partners include NCEEP, CWMTF, the 319 Program, and organizations that have money for brook trout restoration work (e.g., the Trout and Salmon Foundation, Trout Unlimited).

Actions:

- Short Term
  - Mills River Day Outreach: Hand out materials about stream restoration at Mills River Day
  - Website and Newsletter Outreach: Include a section about streams in MRP newsletter and/or website.
- Medium Term
  - Host a Public Seminar: Host a seminar for residents of the watershed about streams and restoration opportunities.
  - Educational Signage: Include information about stream restoration in educational signs.

7.7.6 Stormwater Management Practices Outreach

Key Message: Understanding stormwater and why it is an important problem, and what can be done to control it. The MRP can help landowners with stormwater issues. Resources and information are available.

Key Audience: Landowners with potential for BMP project implementation.

Existing or Potential Partners: Local government stormwater management programs, Home Builder Associations, developers, local schools, Lowe's and/or Home Depot, and Van Wingerden.

Actions:

- Short Term
  - Stormwater Meeting and/or One-on-One Meeting: Invite owners of potential stormwater BMP sites to a meeting to provide education about stormwater issues and what MRP can do to help address these issues. Include commercial sites and residential areas.
  - Homeowner Association Outreach: Make presentations to homeowner associations.
- Medium-Long Term
  - Develop Demonstration Projects: Install demonstration projects, possibly at the Mills River Park and the Mills River Elementary School.
  - Educational Signage Installation: Install an educational sign at the Van Wingerden stormwater control pond that explains what it is, why it is there, and how it works. Install signage for other stormwater BMPs implemented.

7.7.7 Hazardous Materials Outreach

Key Message: Prevent hazardous waste problems that might impact the drinking water supply.

Key Audience: Businesses and landowners handling or storing hazardous materials, particularly those handling types and volumes not regulated.

Existing or Potential Partners: Cities of Asheville and Hendersonville, Town of Mills River, Henderson County Emergency Management, Mills River Fire Department.

Actions:

- Short Term-Ongoing:
    - Print Outreach: Develop informational materials for businesses and landowners that sell or store hazardous materials. Emphasize the significance of their location in a drinking water supply watershed; focus on "preventing a problem." Include information on proper storage and disposal of unused hazardous materials. Three key points to be addressed:
        - Prevention – Inspect storage facilities and containers regularly to prevent potential leakage of hazardous material that could reach waterways.
        - Action --Take immediate action if a spill occurs – call 911.
        - Contact an Expert for Help – Provide contact information for the Henderson County Emergency Response Coordinator and other partners with expertise in handling hazardous materials who can provide guidance on storage and safe handling of hazardous materials.

7.7.8 Land Conservation (Conserving Farming, Forest, and Riparian Areas)

Key Message: Conservation is beneficial to landowners and the watershed.

Key Audiences: General public and owners of 50+ acres of land.

Existing or Potential Partners: CMLC and Henderson County SWCD, which may be authorized to hold easements. CWMTF and other sources with funding to assist with conservation projects.

Actions:

- Short Term:
    - Endorse Land Conservation: The MRP will endorse land conservation as one of the practices it supports to protect water quality.
    - Identify Interested Landowners: Identify landowners interested in conservation and connect them with CMLC. Be strategic with outreach and education – for some, land conservation can be a sensitive topic.
    - Print Outreach: When meeting with landowners about water quality protection projects, present land conservation as one option. Work with CMLC to develop a fact sheet on land conservation to explain the different types of conservation options, the benefits of conservation, and where the landowner can obtain more information. Have this fact sheet available when meeting with landowners about water quality issues.
    - Pursue Funding: Pursue funding to help pay the costs associated with securing donated easements.
- Medium Term:
    - Host a Seminar: Host a community seminar on land conservation options. In addition to the public, invite owners of large parcels that rank high on the criteria. The seminar covers the same information as the fact sheet, but in more detail. Include landowners who have experience with conservation in the watershed.

7.8 Estimated Pollutant Load Reductions

The sources of sediment, the main non-point source pollutant of the Mills River watershed, is generally accepted to be originating from agricultural operations, unstable stream banks, and from stormwater runoff in developed areas. Agrichemicals, some of which adhere to soil particles and are transported with the sediments, also are of concern. A reduction in runoff is expected to reduce the levels of sediment in the water. The risk of point sources of agrichemicals reaching streams has been addressed by the construction of several agrichemical mixing and containment facilities and, therefore, improved handling of those chemicals.

The load reductions calculated for agricultural operations, streambank enhancement, and storm water are all based on preliminary design plans or GIS data. Load estimates for agricultural operations are based on the RUSLE2 model, whereas streambank and storm water potential pollutant load reductions are based on the STEPL watershed model (Appendix D).

7.8.1 Agricultural Operations

The MRP, in close collaboration with Henderson County SWCD, has identified nineteen potential agricultural improvement projects for its 2013-15 grant from NCDWR 319 program. Projects are prioritized based on criteria from Section 7.2 as well as alignment with the specific BMP goals of the grant.

At the writing of this WMP in late 2014, several BMPs have been installed on three farm sites. One new large agrichemical mixing facility was custom-designed to handle the large spray equipment which is starting to be used in the area. Several BMPs for sediment reduction and erosion control were installed on two other farm sites, as listed in Table 7.4. Preliminary assessments and designs for seven more sites indicate the need for additional sediment reduction and erosion control BMPs, which are planned for installation in 2015.

Table 7.4 BMPs Installed and Planned in the Watershed to Reduce Sediment Loss

	319 Grant Goals	Installed 2014[1]		Planned 2015[2]	
BMP Practice	Linear feet (Lf)	Linear feet (Lf)	% of goal	Linear feet (Lf)	% of goal
Grass waterway	3,685	1,160	31	3,275	89
Field border	6,920	0	0	17,250	249
Riparian area enhancement	3,670	1,100	30	4,725	129
Streambank stabilization	525	100	19	460	88
Agricultural road stabilization	175	115	66	1,360	777
Water diversion	800	0	0	930	116
BMPs not in Grant					
Protected Outlet		20		60	
Replace undersized culvert		20			
Terrace repair				100	

[1] BMPs installed are a subset of the BMPs planned for two BMP sediment reduction sites
[2] Design plans and actual numbers for each BMP are likely to change as on-site characteristics are assessed.

Using the RUSLE2 model, sediment load reductions of up to 32.4 tons per year can be achieved at the two sediment reduction BMP sites if all BMPs are installed and maintained. The RUSLE2 model estimates sediment load reductions by comparing current versus post-BMP installation conditions as described in a conservation plan. The model uses crop type, farming practice, soil type, slope, and climate data as inputs. The sediment load reduction estimates for the other seven sites will be made when designs are completed.

The farmers at the other ten prioritized sites that have been identified have shown interest; however, these sites have not yet been assessed to determine the types of BMPs that will be required. As design plans are formulated, the MRP will seek funding to install these addiontal BMPs.

7.8.2 Streambank Enhancements

As has been described earlier, streambank and riparian area conditions are assumed to be in similar conditions to those found in 2000 (CMLC-LOSRCOG 2000). Improvements to riparian areas are addressed under agricultural operations. Potential streambank improvement projects are listed in the 2000 report, but no estimates of load reductions were calculated. For purposes of the WMP, potential load reductions were modeled (Appendix D). Based on the model results, significant sediment loads are originating from stream banks (Table 7.4). Using the results of this model translates into a potential annual load reduction of 0.86-3.75 and 0.38-1.64 tons per 100 feet of restored stream bank for the main-stem streams and tributaries, respectively.

Table 7.5 Estimated Sediment Load Reduction from Streambank Stabilization

Reach	Stream Bank Length (feet)	Bank Height (feet)	"Slight" Lateral Recession (0.03 feet/year)		"Moderate" Lateral Recession (0.13 feet/year)		Load Reduction per 100 Feet	
			Annual Load (ton)	Load Reduction (ton)	Annual Load (ton)	Load Reduction (ton)	"Slight" Recession	"Moderate" Recession
Mills River								
Main stem	46,812	8	506	404	2,191	1,753	0.86	3.75
Tributary	106,783	3.5	505	404	2,186	1,749	0.38	1.64
North Fork Mills River								
Main stem	8,008	8	86	69	375	300	0.86	3.75
Tributary	15,738	3.5	74	59	322	258	0.38	1.64
South Fork Mills River								
Main stem	13,545	8	146	117	634	507	0.86	3.74
Tributary	23,509	3.5	111	89	481	385	0.38	1.64

Stormwater Control Measures

A pollutant reduction model was run for retrofitting seven sites to determine potential benefits of SCM installation. Nominal pollutant removal (relative to the entire watershed) will be realized if they are constructed and function as shown in Table 7.5.

Table 7.6 Pollutant Load Reductions from Potential Stormwater Projects

SITE	Type of BMP	Total Phosphorus				Total Nitrogen			
		Annual Load (lb)	Post Treatment Load (lb)	BMP Pollutant Removal Efficiency	Load Removed by BMP (lb/year)	Annual Load (lb)	Post Treatment Load (lb)	BMP Pollutant Removal Efficiency	Load Removed by BMP (lb/year)
1	Bio-retention	1.1	0.6	45%	0.5	9.1	5.9	35%	3.2
2	Bio-retention	1.4	0.8	45%	0.7	11.2	7.3	35%	3.9
3	Bio-retention	0.5	0.3	45%	0.2	4.0	2.6	35%	1.4
4	Bio-retention	0.8	0.4	45%	0.4	6.1	3.9	35%	2.1
5	Extended detention	0.6	0.3	50%	0.3	4.7	3.5	25%	1.2
6	Bio-retention	0.4	0.3	20%	0.1	2.9	2.2	25%	0.7
7	Bio-retention	0.7	0.3	60%	0.4	5.6	3.9	30%	1.7
	Totals	5.5	3.0		2.6	43.6	29.3		14.2

SITE	Type of BMP	Total Suspended Solids				Zinc			
		Annual Load (lb)	Post Treatment Load (lb)	BMP Pollutant Removal Efficiency	Load Removed by BMP (lb/year)	Annual Load (lb)	Post Treatment Load (lb)	BMP Pollutant Removal Efficiency	Load Removed by BMP (lb/year)
1	Bio-retention	158.6	23.8	85%	134.8	0.4	0.4	0%	0.0
2	Bio-retention	196.4	29.5	85%	166.9	0.7	0.7	0%	0.0
3	Bio-retention	70.2	10.5	85%	59.7	0.1	0.1	0%	0.0
4	Bio-retention	105.8	15.9	85%	89.9	0.4	0.4	0%	0.0
5	Extended detention	81.9	24.6	70%	57.3	0.1	0.1	40%	0.0
6	Bio-retention	51.4	7.7	85%	43.7	0.2	0.1	30%	0.1
7	Bio-retention	98.6	49.3	50%	49.3	0.0	0.0	90%	0.0
	Totals	762.9	161.3		601.6	1.9	1.8		0.1

7.9 Additional Watershed Assessments

7.9.1 Brandy Branch Sub-watershed Assessment

Brandy Branch has been on the North Carolina 303(d) impaired waters list since 2000. This listing is based on a Fair rating for the benthic macroinvertebrate community. A TMDL study was planned for the sub-watershed in 2008, but was not completed due to the drought conditions that occurred during that year. In order to determine the pollutant stressors and their sources for this sub-watershed, a complete assessment is needed. The assessment should consist of stream walks to document stream channel and riparian area conditions, windshield surveys to identify potential upland sources of pollutants, and an inventory of smaller potential stormwater retrofit sites that were not evaluated as part of this plan. Water quality sampling should continue under the VWIN program and a benthic-community monitoring station under the SMIE program would establish a baseline on which to determine how the health of the benthic community changes over time.

Watershed assessments should follow established methodologies such as those of the Center for Watershed Protection's Unified Stream Assessment (CWP 2005). The assessment should result in preparation of an action plan for addressing the stressors with the goal of having Brandy Branch being removed from North Carolina's 303(d) impaired waters list.

7.9.2 Aquatic Habitat Assessments

While aquatic habitat assessments are routinely conducted when benthic macroinvertebrate and fish community samples are collected on the North Fork, South Fork and main stem of the Mills River by NCDWR, no recent samples have been taken on any of the larger tributaries such as Foster Creek, McCall Branch, Sitton Creek, Rush Branch, Davie Branch, and Queen Creek. Collection of baseline data of aquatic habitat near the mouths of these creeks can be used to determine trends in their condition as watershed improvement projects are implemented.

Aquatic habitat assessments should follow established NCDWR procedures (NCDWQ 2012) and be repeated on the same schedule as other watershed monitoring (See Section 7.10).

7.9.3 Update the Mills River Riparian Area Conservation Design Study

The riparian area conservation design field study (CMLC-LOSRCOG 2000) completed in 2000 evaluated and rated streambank and riparian area conditions along the private lands portions of the North Fork, South Fork, and Mills River. As part of that study, a priority rating of individual properties was conducted. Since that time, not only is it likely there have been changes in property ownership, but stream channel and riparian area vegetation have also changed. Some of those changes can be attributed to changes in land use, but much of the stream channel instability can be attributed to damage caused by hurricanes Frances and Ivan in 2004, both of which caused devastating flooding in western North Carolina. By replicating the 2000 study and extending it to include major tributaries, an up-to-date priority listing of stream restoration and riparian area vegetation enhancement projects can be produced. The list can be appended to this WMP for implementation.

7.10 Watershed Monitoring

To determine the effectiveness of management measures being implemented, the physical and ecological conditions of the watershed should be monitored over time. As specific management actions are completed, turbidity, a primary water quality indicator, is expected to decline. Corresponding improvements in aquatic habitat and ecological function are expected to follow. Secondary indicators of improved water quality conditions include improvements in the benthic macroinvertebrate, fish, and mollusk communities. A standard suite of water chemistry parameters should also be monitored to ensure that other pollutants are not becoming a problem.

Monitoring activities, frequencies, benchmark levels, and target levels have been developed and are presented in Table 7.6. Benchmarks for fish and benthic macroinvertebrate communities and aquatic habitat are based on standard procedures and measured against NCDWR ratings (NCDWQ 2012; NCDWR 2013c).

7.10.1 Water Chemistry and Sediment Monitoring

Turbidity. Although sediment reduction goals have not been established for this watershed plan, sediment runoff from farm fields used to grow tomatoes, peppers, corn, and beans is known to be substantial. Major efforts to reduce sediment runoff from these fields are ongoing. In addition, there is a strong relationship between sediment and the transport of agrichemicals from farm fields to streams. As a consequence, monitoring turbidity is important in determining how well the watershed is responding to the implementation of management measures. The Division of Water Resources should continue its monthly ambient water quality monitoring sampling at the one established station on the Mills River (Figure 3.2). In addition, ECO should continue its VWIN (Voluntary Water Information Network) sampling program at its five established sites. Turbidity monitoring, recorded approximately every two hours, will also continue at the water intakes for Hendersonville and Asheville water treatment plants below Davenport Bridge. These data sets will be the basis for determining turbidity level trends. The MRP and ECO could also consider using grab samples or USEPA turbidity meters to collect in situ measurements for site specific or catchment level monitoring.

As part of the current set of agricultural BMPs being installed, the MRP Watershed Coordinator, using approved standard operating procedures, intends to implement the following site specific turbidity monitoring program.

- All sites
    - Model Sediment Runoff Reductions using RUSLE2 post-installation
    - Photo-document site conditions before and after BMP installation

- BMP evaluations -- case studies of two agricultural fields
    - Compare turbidity levels before and after BMP installation at field outlets during three rain events.
    - Compare turbidity levels in receiving stream at points upstream and downstream of field outlets during same field events as above.
    - Photo-document pre- and post-BMP installation.

Water Chemistry. A suite of other water chemistry parameters are measured at the one NCDWR ambient monitoring station located on Mills River (Figure 3.2 and Table 3.2). To ensure that other pollutants are not becoming a problem in the Mills River Watershed, the monthly sampling for these parameters should continue using following standard procedures (NCDWR 2013e) and tracked against established surface water standards (NCDWR 2013f). Complementary data collected through the VWIN program will strengthen the overall monitoring program and improve the probability of detecting long-term trends of each parameter measured.

7.10.2 Biological Monitoring

To determine if there are ecological effects from the watershed improvement projects, benthic macroinvertebrates, fish, and mollusk communities as well as aquatic habitats should be monitored.

Benthic Macroinvertebrates. The NCDWR has routinely collected benthic macroinvertebrate samples from six sites in the watershed. Because these communities appear to be impacted by runoff, sampling should be repeated at those sites at least every 4-5 years. These data can be supplemented by annual sampling by the Stream Monitoring and Information Exchange Program (SMIE; Traylor 2014). Where concentrations of watershed improvement projects are planned in sub-watersheds or small catchments, it may be necessary to establish monitoring sites at the catchment level to detect changes in the benthic community.

Fish Community. The NCDWR sampled fish communities at one site each on the North Fork and South Fork in 2007 and 2012 (Figure 3.1; Table 3.5) to establish fish Index of Biological Integrity (IBI) ratings for use in basin-wide planning efforts. A third site on the Mills River was sampled three times in the mid-1990s. Sampling at these sites should occur on the same schedule as the benthic macroinvertebrate sampling and should be coordinated with sampling conducted by the North Carolina Wildlife Resources Commission (NCWRC).

Mollusks – The NCWRC monitors freshwater mussel populations and distributions in the Mills River on a five-year cycle. This is done to monitor the freshwater mussel populations, particularly the Appalachian elktoe, which is listed on federal and state endangered species lists. The NCWRC has concern about the viability of this species in the portion of Mills River below the NC 191/280 Davenport Bridge.

Appalachian elktoe mussel

Aquatic Habitat. The NCDWR has assessed aquatic habitat at 10 sites in the Mills River Watershed for 25 years, providing a good perspective on how habitats have varied over time. These assessments provide a baseline from which to rate aquatic habitat improvements as watershed improvement projects are implemented. Habitat assessments at these sites should be conducted in association with benthic and fish sampling.

7.10.3 Stewardship Monitoring

Stewardship is an important component of the Mills River WMP, and all watershed improvements suggested in this document will require stewardship to ensure they are maintained and protected for the long term. This will not only maintain their effectiveness, but will protect the community investment in improving the watershed. As management measures are implemented throughout the watershed, it is necessary to monitor them on a regular basis to ensure structures are functioning properly, lands are being managed appropriately, and that encroachments into areas under legal protection (e.g. conservation easements) are not occurring. Stewardship monitoring of individual projects should be determined when the project is proposed and funded. Because most projects will be collaborative efforts, the Watershed Coordinator may work with participants to identify the stewardship needs and responsibilities.

> ***Watershed Stewardship*** – the process of ensuring investments in watershed conservation practices are protected and managed for purposes of maintaining water quality, wildlife habitat, and community awareness.

Table 7.7 Watershed Monitoring Plan

Parameter	Sites	Frequency	Benchmark Levels	Target Levels
Water Chemistry				
Turbidity	NCDWR Ambient monitoring site on Mills River	Monthly	Comparison with historic data	10 NTUs; <20% samples exceeding 10 NTUs
Turbidity	VWIN monitoring sites	Monthly	Comparison with historic data	10 NTUs; <20% samples exceeding 10 NTUs
Turbidity	Hendersonville Water Treatment Plant	In situ continuous - meter	To be established	Declining trends; 10 NTUs; <20% samples exceeding 10 NTUs
Turbidity	Asheville Water Treatment Plant	Daily	To be established	Declining trends; 10 NTUs; <20% samples exceeding 10 NTUs
Standard chemistry suite	NCDWR Ambient monitoring site on Mills River	Monthly or quarterly	Comparison with historic data	State Standards
pH	VWIN monitoring sites	Monthly	Comparison with historic data	State Standards
Nutrients	VWIN monitoring sites	Monthly	Comparison with historic data	State Standards
Conductivity and Heavy Metals	VWIN monitoring sites	Monthly	Comparison with historic data	State Standards
Biological				
Benthic macroinvertebrate community	NCDWR monitoring sites	2016, 2020, 2024	Comparison with historic data	Excellent ratings
Benthic macroinvertebrate community	SMIE monitoring sites	Biannually	Comparison with historic data	Excellent ratings
Fish Community	NCDWR monitoring sites	2016, 2020, 2024	Comparison with historic data	Excellent ratings
Mollusk population	Mills River	2016, 2020, 2024	Comparison with historic data	Expanded population and distribution
Physical				
Aquatic habitat	At NCDWR benthic and fish monitoring sites	2016, 2020, 2024	Comparison with historic data	All sites with metric scores ≥80
Stewardship				
Project structures and properties	Completed sites	Annually - for term of maintenance period	Post-project conditions	Stream stability, reduced erosion, no encroachments

7.12 Watershed Coordination

Continuous coordination and administration is a necessary component in carrying out a watershed action plan. This maintains momentum, ensures progress in implementing management measures, and tracks improvements in the watershed. Experience has shown, the most successful way to improve a watershed is to establish a Watershed Coordinator position. Significant goals have been achieved in the nearby Mud Creek Watershed of Henderson County (NCSU-CES Undated) and in the Hiwassee River (HRWC 2013) in far western North Carolina due to permanently funded Watershed Coordinator positions filled with qualified personnel

In 2013, the MRP established a Watershed Coordinator position, viewed as a key element in continuing the work it started in 1998 and in implementing this WMP. Rather than depend on grant funding, the MRP funds the position with help from its local partners, most notably the Cities of Hendersonville and Asheville. Stable funding for the Watershed Coordinator position is necessary to allow the individual in the Coordinator position to concentrate on implementing on-the-ground projects and outreach/education programs.

The Watershed Coordinator is responsible for the day-to-day management of watershed activities as well as assisting in securing project funding, maintaining project records, ensuring project reporting requirements are met, and documenting project accomplishments. It is also a responsibility of the Watershed Coordinator to facilitate communication among the MRP Board of Directors, its supporters, and other partners and agencies when necessary. The Watershed Coordinator organizes the annual review of the WMP in conjunction with the MRP Board of Directors and determines when revisions to the plan are necessary. The Coordinator is responsible for taking the appropriate actions in revising the plan.

8. IMPLEMENTATION STRATEGIES

8.1 Overview of Strategies

The Mills River WMP is intended to guide planning and restoration efforts in the Mills River Watershed for the next 10 years (2015-2015). Water quality in the watershed is currently considered "good," and the plan provides a road map to further reduce pollutants while improving ecological health and function of streams. The MRP has volunteered to implement this plan as a local sponsor seeking to balance current land uses, particularly farming, while improving and protecting the watershed as an important source of potable water for the larger community. This local sponsorship will encourage local landowners to voluntarily participate in watershed improvement projects.

Strategies to implement this plan were developed from input gathered during a series of meetings with a Stakeholder Group. The group included leaders from the business community, conservation organizations, local government agency representatives, and landowners. This planning process is intended to encourage local organizations such as the MRP to take leadership in addressing pollutant problems. The plan does not impose mandatory requirements on the MRP, but the NCDWR views MRP as well positioned to work with local landowners based on its past success in implementing watershed improvement projects. While MRP steps forward as a leader in implementing the plan, the State of North Carolina is ultimately responsible for addressing impaired waters. It is incumbent on the NCDWR to work with MRP to facilitate implementation of the WMP in whatever way possible. Such collaboration is the recipe for success in achieving water quality improvements that allow all streams within the Mills River Watershed to fully support uses associated with existing water quality classification.

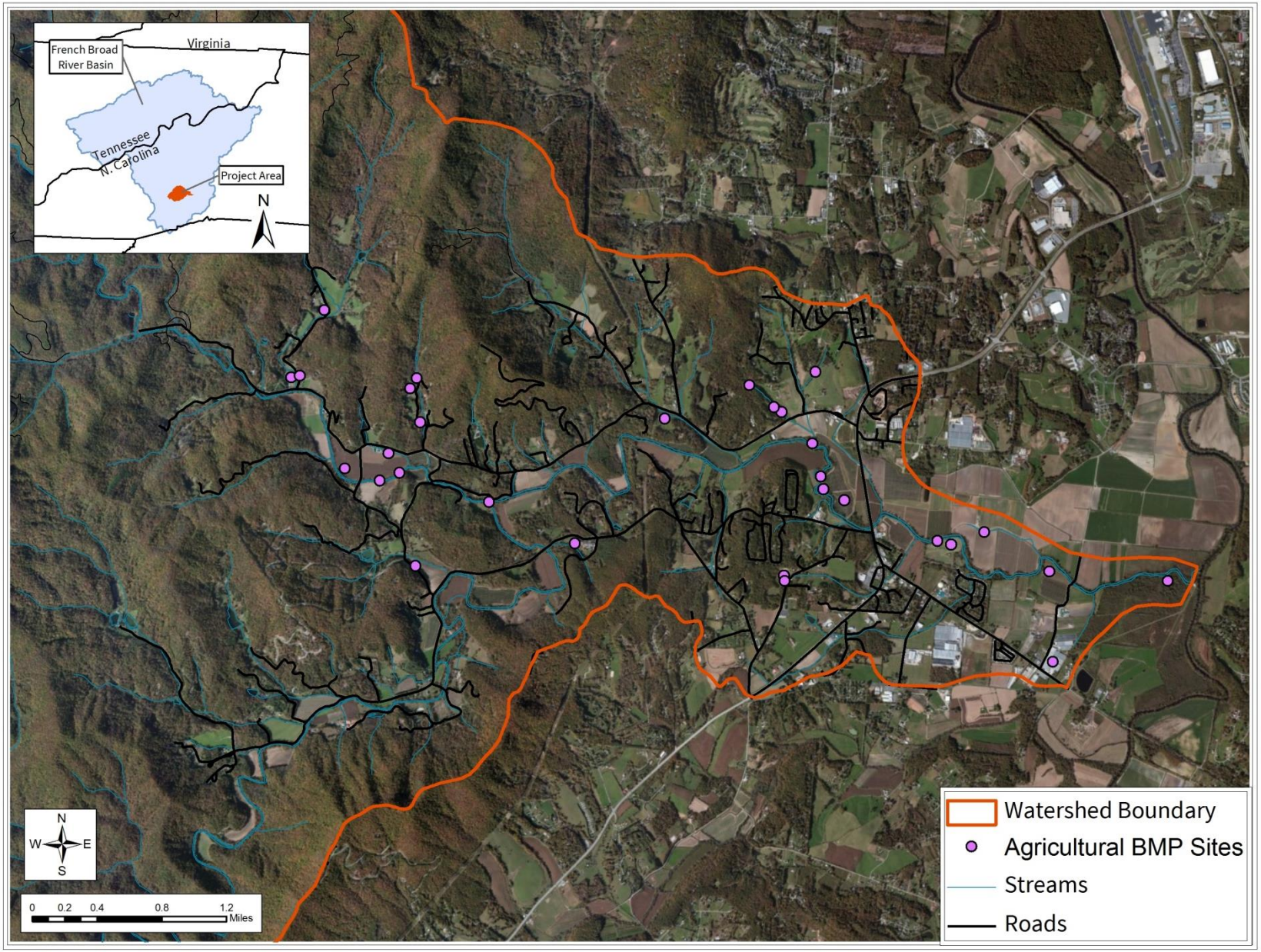
The implementation strategy has three parts: action plan, implementation schedule, and watershed monitoring plan. The action plan identifies specific management measures and activities. The implementation schedule presents the timeline for actions to be achieved and a tracking mechanism for management. The monitoring plan describes how water quality and ecological improvements are measured.

8.2 Watershed-Improvement Actions Implemented to Date

8.2.1 Agricultural BMP Projects

Previously Completed Projects. The original Mills River Partnership (MRP) was formed in 1998, and was instrumental in getting private landowners to install a variety of BMPs in at least 30 locations (Figure 8.1). The types of BMPs installed include streambank repair/restoration, streambank plantings, agrichemical handling facilities, field border improvements, grassed waterways, fencing, feed/waste storage areas, wetland/bog restoration, filter strips, and livestock exclusion fencing, among others (RWA 1999). The current WMP will help the current MRP build on those past successes and continue to improve water quality and aquatic habitat conditions within the watershed.

Figure 8.1 Agricultural BMP Projects Installed, 1998-2012



Projects Planned for 2014-2015. Under its current NCDWR 319 Grant, the MRP has nine projects planned. Preliminary designs call for the installation of multiple BMPs at each location (Table 8.1)

Table 8.1 Proposed Agricultural BMPs, 2014-2015

Project Number	BMP Type and Quantity[1]						
	Field Border	Grassed Waterways/ Diversion	Riparian Area Plantings	Streambank Repair	Agricultural Road Improvements	Mixing Stations	Culvert Replacement
1		725					
2	3348	630	2443	110	125		
3						1	
4	1400	750	370	20			
5	1975						
6	615						
7	2080	750		200			
8	4130	1160	1405	80	50		
9	3700	1200	520	150			
10							1

[1]All BMP quantities are in feet except for mixing station and culvert where quantity is in number installed or constructed.

Landowners at an additional 10 project sites are interested in BMPs when funding becomes available. These sites must be assessed to determine specific BMP needs and quantities. In collaboration with its partners, MRP will be seeking funding for those projects as part of the implementation of this plan.

8.2.2 Education and Outreach Activities

During 2013-2014 the MRP has reached out to schools, citizens, and businesses to heighten awareness of the Mills River Watershed and the work that has been done to improve water quality and streams. The following describes education and outreach accomplishments:

Mills River Day. The first-ever Mills River Day was organized by Mills River Partnership, CMLC, and HCSWCD as a public day-long event in June. This educational and environmental awareness event was hosted at North River Farms and supported by 27 sponsors. It featured educational displays, wagon tours of agricultural operations and installed BMPs, food, and entertainment. An estimated 600 people attended throughout the day. MRP had an information table, and 34 individuals signed up to receive the MRP newsletter. Water-related activities were enjoyed by 68 people, mostly children. The event received local television and newspaper coverage.

Signage. NCDOT has installed four informational signs along NC 191 and NC 280 informing motorists they are entering the Mills River Watershed. An educational kiosk is planned for the Town of Mills River town park, and others to be locate where watershed improvement projects have been completed.

Printed Materials. A brochure describing MRP and its activities was printed. Copies are available at Mills River Town Hall and Mills River library, and were distributed at Mills River Day event.

Website. A website has been created at www.millsriverwater.org, where updates on MRP and its activities are accessible to the public. The website includes the MRP mission statement, calendar of events, an informational brochure, and watershed planning resource materials.

Presentations. The Watershed Coordinator has made numerous presentations about MRP to various groups, including Mills River Fire Department, North and South Mills River Community Club, Hendersonville City Council, and Mills River Town Council.

8.2.3 U.S. Forest Service

As steward of almost 75 percent of the Mills River Watershed, the USFS is a major partner in maintaining the quality of the water. The USFS is currently updating the Nantahala-Pisgah National Forests Land and Resource Management Plan. This plan will guide management of the Nantahala and Pisgah National Forests for approximately 15 years, and is expected to be completed in August 2016. Originally published in 1987, the plan received a significant amendment in 1994. This plan will set management, protection, and use goals and guidelines. In 2014, the Watershed Working Group of the plan's Restoration Collaborative used criteria to prioritize watersheds in their jurisdiction for restoration activities. The North Fork and South Fork Mills River watersheds ranked in the top 30 out of over 160 in western North Carolina.

Although most of the USFS land is forested, some management activities are aimed at improving water quality. Some examples of that work are as follows:

Wastewater Management. The North Mills River campground and picnic area is a popular destination for locals and visitors. The facility has restrooms with hot showers and flush toilets. Wastewater from these facilities is treated on-site and discharged to the North Fork under an NPDES permit. The facility has been upgraded. In addition to the waste treatment facility improvement, the USFS has also installed two new vault toilets.

Stream Restoration/Enhancement. High recreational use and flood events had resulted in erosion of stream banks within the North Mills River campground. The USFS restored that reach of stream by reconfiguring the stream channel and constructing in-stream structures to stabilize the channel. In addition, fencing was installed along stream banks to direct foot traffic to stable paths leading to the stream. These improvements have resulted in decreased erosion. The USFS maintains the area as needed.

Campsite Obliteration. Streamside/roadside campsites were a source of erosion and sedimentation, particularly along Wash Creek Road (FSR 5000). To alleviate this problem USFS eliminated those campsites and restored natural vegetation.

Trail/Road Management. The USFS has an ongoing trail and road maintenance program intended to reduce erosion and prevent sediment from entering streams. In recent years, 16

miles of roads and 12 miles of trails have been improved. Those improvements included installation of sediment catch basins and the addition of gravel.

Dam Removal and Dredging. To improve aquatic organism passage, a low-head dam associated with a USGS gauging station was removed. In addition, the City of Hendersonville dredged sediment from the City reservoir in Pisgah National Forest.

Brushy Ridge Ecosystem Improvement Project. In 2014 the USFS began this ecosystem enhancement project, which will include harvesting 64 acres of timber to improve wildlife habitat, control non-native invasive plant species, improve fish habitat, and replace certain culverts and bridges. These projects are intended to improve water quality by reducing erosion and lead to improved wildlife and aquatic habitat.

8.3 Watershed Improvement Action Plans

The WMP implementation strategy identifies specific actions necessary to reduce erosion and transport of sediments to streams in the Mills River Watershed. It describes what will be done, the amount of each action targeted, who is primarily responsible for each action, potential funding sources, technical assistance resources, and success indicators. Implementation will lead to an overall improvement in the ecological health of the watershed, as well as identifying the causes for degradation of Brandy Branch and its eventual removal from North Carolina's 303(d) list of impaired waters. This action plan is designed to cover a 10-year period. The plan addresses management measures in the following categories:

- Agricultural Operations
- Stream Restoration and Riparian Area Enhancement
- Hazardous Materials
- Stormwater Control Measures
- Land Conservation
- Education and Outreach
- Additional Watershed Assessments
- Monitoring and Stewardship

Each management measure includes a series of recommended actions, which upon completion will contribute to improved watershed conditions. Water quality, aquatic communities and habitat are expected to show improvement as the actions are implemented. It may be necessary to modify the type, number, or priority of the management actions during the planning period. At the end of the 10-year span of this document, the plan will be updated.

An action plan for each management measure (Tables 8.2-8.9) has been developed that includes the following components:

- *Management Action* - what is to be done
- *Targets* - how much of each action is planned
- *Responsible Party* - who will take the lead in getting a specific action completed
- *Schedule for Implementation* - when will the work be completed: short-term 1-3 years, mid-term 4-6 years, long-term 7-10 years
- *Financial Resources* – where possible, estimated funding required to implement an action
- *Potential Funding Sources* - specific grant agencies; see Appendix E for a listing of funding programs available within individual agencies
- *Technical Resources Needed* - information or professional services needed to implement an action
- *Qualitative Success Indicators* - criteria to measure water quality improvements

Table 8.2 Mills River Action Plan for Agricultural Operations

Management Actions (what)	Targets (how much)	Responsible Party (who)	Schedule for Implementation (when)	Financial Resources (how much)	Potential Funding Sources	Technical Resources Needed	Qualitative Success Indicators
Prepare and Revise Farm Conservation Plans to incorporate various BMPs to address: • Sediment and nutrient management • Erosion and nutrient management • Stream Protection Management • Agrichemical Pollution Prevention	3-5 plans/year	Landowner, HCSWCD, NRCS	Ongoing throughout life of plan	Free to landowner	HCSWCD, NRCS	Agricultural specialist	Implementation of plan
Field Border Improvements (feet)	8,000 year 1; 9,000 years 2-10	Landowner, Farm Operator	Ongoing throughout life of plan	Varies depending on site characteristics	Landowner, MRP, HCSWCD, NRCS	Horticultural specialist	Reduction in amount of erodible surface; amount of ground cover reestablished
Vegetated Drainage Features (grassed waterways, water diversions; feet)	4,250 year 1; 9,000 years 2-10	Landowner, Farm Operator	Ongoing throughout life of plan	Varies depending on site characteristics	Landowner, MRP, HCSWCD, NRCS	Agricultural specialist	Reduction in amount of sediment reaching streams
Riparian Area Vegetation Improvements (feet)	4,725 year 1; 4,500 years 2-10	Landowner, Farm Operator	Ongoing throughout life of plan	Dependent upon extent of improvement required	Landowner, MRP, HCSWCD, NRCS	Agricultural specialist	Reestablishment of riparian vegetation; stable streambanks
Agrichemical Pollution Protection BMPs	1 mixing station	Landowner, Farm Operator	TBD	Varies	Landowner, MRP, HCSWCD, NRCS	Agricultural chemical specialist	Reduced risk of ecological damage due to accidental spills

Table 8.3 Mills River Action Plan for Stream Restoration and Riparian Area Enhancement

Management Actions (what)	Targets (how much)	Responsible Party (who)	Schedule for Implementation (when)	Financial Resources (how much)	Potential Funding Sources	Technical Resources Needed	Qualitative Success Indicators
Enhance and restore stream channels	6,000 feet	MRP, HCSWCD, Landowner	Mid- to long-term	$100-300 per stream foot for design, construction & monitoring	NCEEP, CWMTF, NCDWR, HCSWCD, NRCS, MRP	Engineering, Landscape Architect Design, Material Supplier	Stabilized stream channels, reduced erosion, reduced turbidity
Riparian area vegetation enhancement	20,000 linear feet (7 acres)	MRP, HCSWCD, Landowner	Mid- to long-term	$1,000-$5,000 per acre	NCEEP, CWMTF, NCDWR, HCSWCD, NRCS, MRP	Landscape Architect Design, Material Supplier	Reduced bank erosion, improved function to filter sediment
Restore Floodplain Wetlands	1 wetlands	MRP, Landowner	Long-term	Up to $30,000/acre	NCEEP, CWMTF, NCDWR, MRP	Engineering Assistance	Reduced floodplain scour, reestablished native wetland vegetation
Realign stream channel at bridge crossings	4 crossings	NCDOT and/or bridge owner	As bridges are upgraded or replaced	Dependent on site characteristics	NCDOT, USFWS, MRP	Engineering Assistance	Reduced bank erosion

Table 8.4 Mills River Action Plan for Stormwater Control Measures

Management Actions (what)	Targets (how much)	Responsible Party (who)	Schedule for Implementation (when)	Financial Resources (how much)	Potential Funding Sources	Technical Resources Needed	Qualitative Success Indicators
Install bio-retention SCMs	5 sites	MRP, Landowner, Business	Mid- to long-term	$25,400 per impervious acre treated (decreased unit cost will increase area treated)	HCSWCD, NCDWR, CWMTF, local govt's, landowner match	Engineer, Landscape Architect Design, Material Supplier	Reduced runoff volume, reduced sediment and other pollutant loads
Install extended detention structures	1 site	MRP, Landowner, Business	Mid- to long-term	$3,800 per impervious acre treated	HCSWCD, NCDWR, CWMTF, Local govt's, Landowner Match	Engineer, Landscape Architect Design, Material Supplier	Reduced runoff volume, reduced sediment and other pollutant loads; reduced streambank erosion
Install rain barrels cisterns	10 2	MRP, Landowner	Short- to Mid-term Mid- to Long-term	$100/barrel; Size dependent	HCSWCD, Local govt's; Non-profits	Design and Installation Assistance	Reduced runoff volume to streams
Dry creek beds/French drains	2	MRP, Public schools	Mid-term	Varies depending on site characteristics	HCSWCD, NCDWR, CWMTF, local govt's.	Landscape Architect	Established ground cover; reduction in exposed erodible surface
Unpaved road improvements	0.2 mile/year	Landowner	Ongoing throughout life of plan	Varies depending on site characteristics	Landowner HCSWCD, NRCS, NCDOT, USFS	Soil specialist	Reduction in amount of erodible surface; control of surface runoff

Table 8.5 Mills River Action Plan for Hazardous Materials

Management Actions (what)	Targets (how much)	Responsible Party (who)	Schedule for Implementation (when)	Financial Resources (how much)	Potential Funding Sources	Technical Resources Needed	Qualitative Success Indicators
Relocate Hendersonville water intake upstream of NC 191/280 Davenport Bridge	1	City of Hendersonville	Long-term	Depends on location	City of Hendersonville	Engineering	Reduced risk from hazardous materials spill at bridge.
Containment structures adjacent NC 191/280	Number/size based on design	MRP, NCDOT, Landowner	Short- to Mid-term	TBD	City of Hendersonville, City of Asheville, NCDOT, SWPP	Engineering Design and Construction Specialist	Reduced risk of hazardous materials incidents due to vehicle accidents

Table 8.6 Mills River Action Plan for Land Conservation

Management Actions (what)	Targets (how much)	Responsible Party (who)	Schedule for Implementation (when)	Financial Resources (how much)	Potential Funding Sources	Technical Resources Needed	Qualitative Success Indicators
Conservation Easements, Fee Simple Purchases, Deed restrictions/Covenants, Informal Landowner Agreements	8-16 (1-2/year)	CMLC, MRP	Short- to Mid-term, Long-term	Dependent on type of conservation method	Dependent on type of easement	Ecologist, Land Protection Specialist, Attorney	Aquatic and riparian area habitat conserved; improved ecological function

Table 8.7 Mills River Education and Outreach Plan (Sheet 1 of 4)

Management Actions (what)	Targets (how much)	Responsible Party (who)	Schedule for Implementation (when)	Financial Resources (how much)	Potential Funding Sources	Technical Resources Needed	Qualitative Success Indicators
General Activities							
General Public: Conduct opinion/knowledge surveys of all Mills River landowners	2 surveys	MRP	Year 3 and Year 8 of plan	$500 for materials	MRP	Opinion survey design specialist	Survey results align well with MRP initiatives; MRP uses data to modify plan
Youth Programs: Kids in the Creek, Muddy Sneakers, and HCSWCD contests	3 events annually	MRP, HCSWCD, ECO, Schools	Continuous over the life of the plan	Minimal	MRP, various partners and volunteers	K-12 educators and environmental educators	Number of students participating in programs about the Mills River Watershed
Youth & General Public: Host Fun and Educational Booths at Public Events	2-3 events annually	MRP in partner with ECO	Continuous over the life of the plan	$1,000 for one time investment of materials for booth	MRP, various partners and volunteers	Environmental educator to help develop booth and activities	Number of children and adults engaged at booth
Youth: Produce Youth Orientated Materials	Youth oriented web page; 1 coloring book	MRP	Medium to Long-term	$0 for website revision; $2,500 for coloring book production	MRP, various partners and volunteers	Graphic and/or web design, Webpage manager	Number of hits on children page of website; Number of coloring books distributed
General Public: Communications - MRP General Info and Projects in Partners' Publications and websites	6 website updates, 3 Newsletter / Annual Report features	All MRP partners	Short to Medium term	$0	N/A	Webpage manager	Number of hits on page and/ or clicks on MRP webpage; hyperlink from partnering webpages
General Public: Educational Signage	3 new signs in existing or new project locations	MRP, Partner agencies	Medium- to Long-term	Average of $1,500 for each sign. Total of $4,500	MRP, Partner agencies	Landscape Architect, Graphic Designer, Environmental Educator	Number of visitors viewing signage

Table 8.7 Mills River Education and Outreach Plan (Sheet 2 of 4)

Management Actions (what)	Targets (how much)	Responsible Party (who)	Schedule for Implementation (when)	Financial Resources (how much)	Potential Funding Sources	Technical Resources Needed	Qualitative Success Indicators
Government Practices and Programs							
Advocate for better stormwater practices on NCDOT projects	2 projects	MRP and NCDOT partnership	Short Term	MRP staff time	NCDOT	Watershed Coordinator, Landscape Architect, Engineering	Number of projects completed
Partner with Town of Mills River to develop hand-out material for permit applicants	300 brochures distributed to applicants	MRP, Town of Mills River, Henderson County	Medium Term	$500	Town of Mills River, MRP	Watershed Coordinator, Graphic Designer	Number of handouts, number of hazard response calls referred from handout
Agricultural Operations							
Implement a Conservation Steward Recognition Program	Recognition as warranted by individual or organization actions	MRP, work with Henderson County PR person to get press contact	Short-Medium Term	$0	N/A	Watershed Coordinator, Media Specialist	Number of individuals; coverage by the media
Support Future Farmers of America Outreach	1 event annually	MRP, Future Farmers of America	Short-Medium Term	$250 for materials	MRP	Watershed Coordinator, Educators	Number of students reached
Host Public Seminars on agriculture and agricultural BMPs	2 seminars	MRP	Short-Medium Term	$500 for event costs	MRP	Watershed Coordinator, Conservation District Staff, Ag. BMP Specialist	Number of attendees
One-on-One landowner engagement and BMP Implementation	25 Farmers engaged, 15 BMP projects initiated	MRP	Short-Long Term	$0	MRP	Watershed Coordinator, Conservation, Ag. BMP Specialist	Number of landowners engaged; number of landowners implementing BMPs
Website and Newsletter Outreach	Create and update MRP webpage on agricultural BMPs	MRP	Short Term	$1,500	MRP Sponsors	Watershed Coordinator, Ag. BMP Specialist	Number of “visits” to web page; feedback on content

Table 8.7 Mills River Education and Outreach Plan (Sheet 3 of 4)

Management Actions (what)	Targets (how much)	Responsible Party (who)	Schedule for Implementation (when)	Financial Resources (how much)	Potential Funding Sources	Technical Resources Needed	Qualitative Success Indicators
Stream Restoration and Enhancement							
Mills River Day Outreach (handouts on stream restoration)	200 handouts given to landowners	MRP	Medium - Long-term	$200 for printing	MRP; Event Sponsors	Watershed Coordinator	Number of handouts given, number of interested calls to Watershed Coordinator
Website / Newsletter Outreach on Stream Restoration and Enhancement	1 webpage on MRP website	MRP	Short Term	$0 for website revision	MRP	Watershed Coordinator	Number of hits on page
Public Seminars on "State of the Watershed"	2 seminars (2020; 2025)	MRP	Medium Term	$500 for event	MRP	Watershed Coordinator, Specialist on Stream Restoration	Number of attendees
Educational Signage	1 sign or kiosk	MRP, Partner organization	Long Term	$1,500	MRP; Partners	Landscape Architect, Graphic Designer, Environment Educator	Number of visitors to signage
Stormwater Management							
Public Meeting and/or one-on-one Meetings about stormwater BMP Implementation	5 sites/ landowners engaged	MRP and partnering owner of site	Short-Long Term	$0	MRP	Watershed Coordinator	Number of BMPs implemented
Homeowner Association Outreach	1-2 events	MRP and partnering owner of site	Medium-Long Term	$0	MRP	Watershed Coordinator	Number of BMPs implemented in residential areas
Develop Demonstration Projects (At Schools or Parks)	2 projects	MRP and partnering owner of site	Medium-Long Term	TBD	MRP, NCDWR	Watershed Coordinator, Landscape Architect, Engineer	Number of BMPs implemented
Educational Signage Installation	1 sign @ Van Wingerden Int'l.	MRP and Van Wingerden, Int'l.	Short-Long Term	$2,500 per sign	MRP, Partners	Watershed Coordinator, Graphic Designer	Number of visitors to signs

Table 8.7 Mills River Education and Outreach Plan (Sheet 4 of 4)

Management Actions (what)	Targets (how much)	Responsible Party (who)	Schedule for Implementation (when)	Financial Resources (how much)	Potential Funding Sources	Technical Resources Needed	Qualitative Success Indicators
Hazardous Materials							
Create outreach materials for owners of facilities handling small volumes of hazardous materials	10 facilities identified by SG	MRP and partnering owner of site	Short-Mid Term	$500	MRP, Sponsors	Watershed Coordinator	Number of owners/operators contacted; feedback.
Land Conservation (Conserving Farming, Forest, and Riparian Areas)							
Obtain Endorsement of Land Conservation	1 endorsement	MRP	Short Term	$0	N/A	None	One official endorsement
Identify and Recruit landowners in conserving natural resources on their properties	10-25 Identified landowners, 5 contacted and in discussion	MRP and CMLC	Short Term	$0 CMLC Staff Time	MRP, CMLC	Watershed Coordinator, C MLC Staff	Number of landowners engaged in conserving land
Print Outreach to landowners (1 on 1)	25 handouts given to landowners interested in conservation	MRP and CMLC	Short Term	$500	MRP, CMLC	Watershed Coordinator, Graphic Designer, CMLC Staff	Number of landowners engaged in conserving land
Pursue Funding for Conservation Costs	$10,000	MRP and CMLC	Short Term	$10,000	CWMTF, Private Individuals and Foundations	Watershed Coordinator, CMLC Staff	Number of landowners engaged in conserving land

Table 8.8 Mills River Plan for Additional Needed Assessments

Management Actions (what)	Targets (how much)	Responsible Party (who)	Schedule for Implementation (when)	Financial Resources (how much)	Potential Funding Sources	Technical Resources Needed	Qualitative Success Indicators
Brandy Branch Sub-watershed Assessment and Action Plan Streamwalk Water Quality Biological	Entire sub-watershed	MRP, NCDWR, NCDWR	Short-term	$30,000	NCDWR 319, CWMTF, SWPP	Watershed specialist; laboratory testing	Stressor and sources identified for remediation; action plan developed
Update Mills River Riparian Area Conservation Design Study; extend it to include tributaries	Assess private lands	MRP with landowner permissions	Short-term	$30,000 w/citizen scientists	NCDWR, CWMTF	Stream habitat specialist; biologist	Updated priority list of potential stream restoration and enhancement sites
Aquatic Habitat Inventory (representative sites for future trend analysis)	Mills River and major tributaries	MRP, State/Federal Agencies	Mid-term	$50,000	NCDWR 319, NCWRC	Biologist; habitat specialist	Improved groundcover management and stabilized access roads

Table 8.9 Mills River Monitoring and Maintenance Plan

Management Actions (what)	Targets (how much)	Responsible Party (who)	Schedule for Implementation (when)	Financial Resources (how much)	Potential Funding Sources	Technical Resources Needed	Qualitative Success Indicators
Water chemistry Ambient VWIN Hendersonville WTP (turbidity) Temperature and flow	Monthly @ 1 ambient 5 VWIN Continuous Continuous	NCDWR, ECO, Hendersonville, USGS	Short-, Mid-, Long-Term	None None	NCDWR, ECO, Hendersonville USGS	Laboratory testing	No parameters exceed state standards
Biological Monitoring Benthic macroinvertebrates SMIE Fish Mollusks	Repeat samples, 4 years apart @ existing sites	NCDWR, ECO, NCDWR, NCWRC, USFWS	Short-, Mid-, Long-Term	None	State & Federal agencies	Agency specialists	Presence of more tolerant species; improved populations
Aquatic Habitat Monitoring	3 samples, 4 years apart @ existing sites	NCDWR	Short-, Mid-, Long-Term	None	NCDWR	Agency specialists	Improved stream channel and aquatic habitat
Stewardship Monitoring	All project sites	MRP, Project Sponsor	Short-, Mid-, Long-Term	None	MRP, Project Sponsor	Stewardship Specialists	Partnership project investments protected
Establish a reserve fund for repairs associated with catastrophic natural events	$500,000	MRP	Accumulate over life of plan	$500,000	Asheville Hendersonville	None	Repairs completed at previously constructed sites; ecological function restored
WMP/SWPP Plan Review, Update and Revision	Annual Review/Update Revision - 2025	MRP, Henderson County	Short-, Mid-, Long-Term	None	NCDWR	None	Adapts actions to changing watershed conditions; reduces risk of hazardous materials incidents

8.4 Implementation Schedules and Accomplishments Tracking

The implementation schedule for the Mills River WMP presents the timeline over which each management action will be achieved during the 10-year planning period (Tables 8.10-8.17). Target numbers for each management action are taken from the management action plan tables in Section 8.3 and distributed across years based on SG input. The tables are also designed to compare actual versus planned accomplishments for each management action. The planned accomplishment numbers will serve as interim milestones against which progress in implementing the management measures will be evaluated. Significant deviations from the planned accomplishments will be an indicator that the action plan may need revision.

The main objective of the plan is to continue to improve watershed conditions that lead to improved water quality in Mills River. It is also designed to determine the pollutants and their sources that are the cause for the Brandy Branch sub-watershed remaining on the North Carolina 303(d) impaired waters list. Management actions included in the WMP are intended to lead to the removal of Brandy Branch from that list. By using outreach and education activities, we expect landowners will be motivated to implement management actions described in this plan and help achieve the goals of the MRP.

Table 8.10 Mills River WMP Implementation Schedule for Agricultural Operations

Management Action	Year	Short-Term			Mid-Term			Long-Term				Target
		1	2	3	4	5	6	7	8	9	10	
Prepare and revise Farm Conservation Plans to incorporate various BMPs that address: • Sediment and Nutrient Management • Erosion and Nutrient Management • Stream Protection Management • Agrichemical Pollution Prevention	Planned	3-5	3-5	3-5	3-5	3-5	3-5	3-5	3-5	3-5	3-5	30-50
	Actual											
Field Border Improvements (feet)	Planned	8,000[1]	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	17,000 acres
	Actual											
Vegetate drainage features (grassed waterways, water diversions; feet)	Planned	4,250[1]	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	13,250 feet
	Actual											
Riparian Area Vegetation Improvements (feet)	Planned	4,725[1]	500	500	500	500	500	500	500	500	500	9,225 feet
	Actual											
Agrichemical Handling Facility	Planned	1[1]										1 facility
	Actual											

[1]Estimated numbers proposed to be installed under an existing 319 Grant.

Table 8.11 Mills River WMP Implementation Schedule for Stream Restoration and Riparian Area Enhancement

Management Action	Year	Short-Term			Mid-Term			Long-Term				Target
		1	2	3	4	5	6	7	8	9	10	
Enhance and restore stream channels (feet)	Planned		500		1,000		1,500		2,000		2,000	7,000 feet
	Actual											
Restore riparian area vegetation (1,500 feet @ 30 feet ≈ 1 acre)	Planned	1,500		3,000	1,500	3,000	1,500	3,000	1,500	3,000	2,000	20,000 feet (13+ acres)
	Actual											
Restore floodplain wetlands	Planned								1			1 wetland
	Actual											
Realign stream channel at bridge crossings	Planned	Dependent on when bridges or culverts are upgraded or replaced										4 crossings
	Actual											

Table 8.12 Mills River WMP Implementation Schedule for Stormwater Control Measures

Management Action	Year	Short-Term			Mid-Term			Long-Term				Target
		1	2	3	4	5	6	7	8	9	10	
Install bio-retention SCMs	Planned				1	1	1		1		1	5 sites
	Actual											
Install extended detention structures	Planned							1				1 site
	Actual											
Install Rain barrels Cisterns	Planned	2	2	2	2 1	2			1			10 rain barrels 2 cisterns
	Actual											
Dry creek beds/French drains	Planned				1	1	1	1	1	1		6 installations
	Actual											
Unpaved road improvements (miles)	Planned	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	2 miles
	Actual											

Table 8.13 Mills River WMP Implementation Schedule for Hazardous Materials

Management Action	Year	Short-Term			Mid-Term			Long-Term				Target
		1	2	3	4	5	6	7	8	9	10	
Relocate Hendersonville water intake structure upstream of NC 191/280 Davenport Bridge	Planned										x	Intake relocated.
	Actual											
Containment structures at Davenport Bridge	Planned					x						Number/size to be determined based on engineering design
	Actual											

Table 8.14 Mills River WMP Implementation Schedule for Land Conservation

Management Action	Year	Short-Term			Mid-Term			Long-Term				Target
		1	2	3	4	5	6	7	8	9	10	
Conservation Easements Fee Simple Purchases Deed Restriction/Covenants Informal Landowner Agreements	Planned		1-2	1-2	1-2	1-2	1-2	1-2	1-2	1-2		8-16 transactions
	Actual											

Table 8.15 Mills River WMP Implementation Schedule for Education and Outreach (Sheet 1 of 3)

Management Action	Year	Short-Term			Mid-Term			Long-Term				Target
		1	2	3	4	5	6	7	8	9	10	
General Activities												
General Public: Conduct opinion/knowledge surveys of all Mills River landowners	Planned			X								Complete 2 surveys to document landowner opinions
	Actual											
Youth Programs : Kids in the Creek, Muddy Sneakers, and HCSWCD contests	Planned	3	3	3	3	3	3	3	3	3	3	30 programs
	Actual											
Youth & General Public: Host Fun and Educational Booths at Public Events	Planned	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	20-30 programs
	Actual											
Youth Orientated Educational Materials	Planned		1					1				Web site page created; coloring book created/printed
	Actual											
Communicate MRP General Info/Projects in Partner's websites and publications	Planned	1 3	1 3	1 3	1 3	1 3	1 3	1 3	1 3	1 3	1 3	10 web site updates; 30 features
	Actual											
General Public: Educational Signage	Planned		1				1	1				3 signs installed
	Actual											
Government Practices and Programs												
Advocate for better stormwater practices on NCDOT projects	Planned	2 projects										Obtain input on 2 projects
	Actual											
Partner with Town of Mills River to develop hand-out material for permit applicants	Planned		50	50	50	50	25	25	25	25		Distribute 300 brochures
	Actual											
Prepare a report on the economics of healthy streams; present to local officials (number of presentations)	Planned		Report (5)				Update (5)				Update (5)	Report complete/updated;
	Actual											

Table 8.15 Mills River WMP Implementation Schedule for Education and Outreach (Sheet 2 of 3)

Management Action	Year	Short-Term			Mid-Term			Long-Term				Target
		1	2	3	4	5	6	7	8	9	10	
Agricultural Operations												
Implement a Conservation Steward Recognition Program	Planned	Recognition to Occur as Necessary										No set number
	Actual											
Support Future Farmers of America Outreach	Planned	1	1	1	1	1	1	1	1	1	1	10 events
	Actual											
Host Public Seminars on agriculture and agricultural BMPs	Planned			1		1						Host 2 events
	Actual											
One-on-One landowner engagement and BMP Implementation	Planned	Will vary from year-to-year										25 farmers engaged; 15 BMPs initiated
	Actual											
Website and Newsletter Outreach	Planned	Create and load web page content; update regularly										Keep information current
	Actual											
Website / Newsletter Outreach on Stream Restoration and Enhancement	Planned	Compile web site content and update as needed; prepare electronic newsletter										Develop content and newsletters as needed
	Actual											
Stream Restoration and Enhancement												
Mills River Day Outreach (handouts on stream restoration to landowners)	Planned	20	20	20	20	20	20	20	20	20	20	200 handouts to landowners
	Actual											
Public Seminar on "State of the Watershed"	Planned					1					1	2 seminars
	Actual											
Educational Signage	Planned								1			Create content and install 1 sign
	Actual											
Stormwater Management												
Public Meeting and/or One-on-One Meeting about stormwater BMP Implementation	Planned	Will vary based on landowner interest										At least 5 landowners engaged
	Actual											
Homeowner Association Outreach	Planned				1			1				1-2 events
	Actual											
Develop Demonstration Projects (At Schools or Parks)	Planned					1			1			2 projects
	Actual											
Educational Signage Installation	Planned		1									1 sign installed
	Actual											

Table 8.15 Mills River WMP Implementation Schedule for Education and Outreach (Sheet 3 of 3)

Management Action	Year	Short-Term			Mid-Term			Long-Term				Target
		1	2	3	4	5	6	7	8	9	10	
Hazardous Materials												
Create outreach materials for owners of facilities handling small volumes of hazardous materials	Planned	2	3	3	2							10 owner/operators contacted; additional contacts as warranted
	Actual											
Land Conservation (Conserving Farming, Forest, and Riparian Areas)												
Obtain Endorsement of Land Conservation	Planned	Seek out endorsement of local agencies and organizations										Obtain at least 1 endorsement of land conservation initiative
	Actual											
Identify and Recruit Landowners in conserving natural resources on their properties	Planned	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	10-25 landowners identified; 5 contacted and in discussion
	Actual											
Print Outreach to landowners (1 on 1)	Planned	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	1-3	Number of landowners engaged in conserving lands
	Actual											
Pursue Funding for Conservation Costs	Planned		1									Funding accrued to offset transaction costs
	Actual											

Table 8.16 Mills River WMP Implementation Schedule for Additional Needed Assessments

Management Action	Year	Short-Term			Mid-Term			Long-Term				Target
		1	2	3	4	5	6	7	8	9	10	
Brandy Branch Assessment Streamwalk Water Quality Biological	Planned			X								Completed
	Actual											
Update Mills River Riparian Area Conservation Design Study; extend it to include tributaries	Planned		X									Completed
	Actual											
Aquatic Habitat Inventory (representative sites for future trends analysis)	Planned					X						Completed
	Actual											

Table 8.17 Mills River WMP Implementation Schedule for Monitoring and Maintenance

Management Action	Year	Short-Term			Mid-Term			Long-Term				Target
		1	2	3	4	5	6	7	8	9	10	
Water chemistry Ambient (NCDWR) Ambient (VWIN) Hendersonville WTP Temperature and flow (USGS)	Planned	X	X	X	X	X	X	X	X	X	X	See Table 7.6 for details
	Actual											
Biological Monitoring Benthic macroinvertebrates (NCDWR) Benthic macroinvertebrates (SMIE) Fish Mollusks	Planned		X				X				X	See Table 7.6 for details
	Actual											
Aquatic Habitat Monitoring	Planned		X				X				X	See Table 7.6 for details
	Actual											
Stewardship monitoring	Planned	X	X	X	X	X	X	X	X	X	X	See Table 7.6 for details
	Actual											
Establish a reserve fund for repairs associated with catastrophic natural events	Planned	Accumulate annually until needed										Accumulate $500,000 fund
	Actual											
WMP/SWPP Plan Review, Update and Revision	Planned	X	X	X	X	X	X	X	X	X	X	Annual reviews complete
	Actual											

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10. APPENDICES

Appendix A GIS Analyses

Two separate GIS analyses were conducted. One was completed to assess the condition of the riparian area, whereas the other was aimed at determining the amount of impervious surface in the Mills River Watershed.

Reference datasets used in these analyses included:

- USFWS Paved Roads Analysis Dataset - provided by USFWS
- North Carolina 2010 Orthoimagery (NCCGIA 2011)
- Streams from the North Carolina Stream Mapping Program (NCCGIA Undated)
- 2011 National Land Cover Dataset (NLCD 2011; MRLC 2013)

Riparian Area Vegetation Assessment

Introduction. To assess riparian area vegetation condition, aerial imagery analysis was conducted on streams flowing across private lands. The objective of the analysis was to assess the general condition of vegetation in the corridor of land within 30 feet of streams. This analysis focused on defining areas as "Wooded" or "Unwooded" on either right or left descending banks (i.e. facing downstream) within 30 feet of the stream. This analysis was strictly a desktop exercise and was not field verified. Due to the inherent subjectivity associated with visual analysis of aerial imagery, this data is intended to be used as a coarse estimate of total stream length classified as "Wooded" or "Unwooded" at a watershed scale and not to identify specific landowners or potential projects.

Methods. Wooded buffers were identified using NC OneMap 2010 Orthoimagery (NCCGIA 2011) provided by the State of North Carolina. "Wooded" riparian areas were defined as areas that were primarily forested over the entire 30-foot buffer. "Unwooded" riparian areas were defined as all combinations of trees, shrub/scrub, and herbaceous plants as well as road crossings that limited the riparian area to less than 30 feet.

Using the North Carolina Stream Mapping Program (NCSMP) data layer (NCCGIA Undated), a 30-foot buffer was generated around all streams within the study area. A copy of the NCSMP streams data was exported into individual datasets for each sub-watershed and fields for left- and right-descending banks generated. Starting at the downstream end of each sub-watershed and moving upstream, aerial images were visually examined and each stream segment in the exported stream datasets were classified as "Wooded" or "Unwooded" for left- and right-descending banks. In an attempt to maintain consistency, aerials were initially examined at 1:1000, zooming in if necessary to verify classifications. Left- and right-descending banks were classified and attributed separately. Note: The NC Onemap 2010 orthoimagery in the Mills River Watershed is "leaf-off"; in some cases making identification of forested areas difficult. When necessary, additional imagery was used -- primarily ESRI World Imagery (ESRI 2014) -- in order to verify the presence of forested areas within the buffer.

Quality control was performed by a second staff member who examined and verified imagery and "Wooded" Buffer classifications at a 1:3000 scale. Classification errors did not exceed 2 percent -- calculated by dividing total stream length classified by the misclassified stream length -- for any sub-watershed in this study.

Output from the GIS dataset was exported to a Microsoft Excel® format for further analysis. Percent "Unwooded" and "Wooded" bank length was individually calculated for right- and left-descending banks for each sub-watershed as well as a combined percentage. Additionally, a length-frequency distribution of segment length for "Unwooded" stream was generated for left- and right-descending banks.

Results. Percent of "Unwooded" buffer ranged between 40 percent and 72 percent across all sub-watersheds (Table A.1), with the lowest percentage falling in the North Fork and Tributaries sub-watershed and the highest in the main stem Mills River and Tributaries sub-watershed.

"Unwooded" bank segments ranged from 11 to 6,945 feet with the Mills River main stem sub-watershed having the most and longest "Unwooded" reach lengths. All three sub-watersheds examined had "Unwooded" reach lengths greater than 1,500 feet (Figures A.1 and A.2).
Detailed results and discussion of the implications of this analysis to the WMP are presented in Section 3.3.6.

Table A.1 Percent Stream Length of "Unwooded" and "Wooded" buffers by Sub-watershed; Left- and Right-Descending Banks Percentages Combined.

Subwatershed	Stream Miles	Stream Miles			Percent Stream Unwooded One or Both Sides
		Unwooded One Bank	Unwooded Both Banks	Wooded Both Banks	
North Fork Mills River and Tributaries	11.93	0.92	3.90	7.11	40
South Fork Mills River and Tributaries	19.76	3.33	6.02	10.42	48
Mills River and Tributaries	23.17	4.22	12.44	6.51	72
Totals	54.86	8.47	22.35	24.04	56
Subwatershed	**Streambank Miles**	**Streambank Miles**			**Percent Streambank Unwooded**
		Unwooded One Bank	**Unwooded Both Banks**	**Wooded Both Banks**	
North Fork Mills River and Tributaries	23.87	0.92	7.80	14.23	37
South Fork Mills River and Tributaries	39.53	3.33	12.03	20.83	39
Mills River and Tributaries	46.33	4.22	24.87	13.02	63
Totals	109.73	8.47	44.70	48.08	48

Figure A.1 Length Frequency of Stream Banks with One Side "Unwooded"

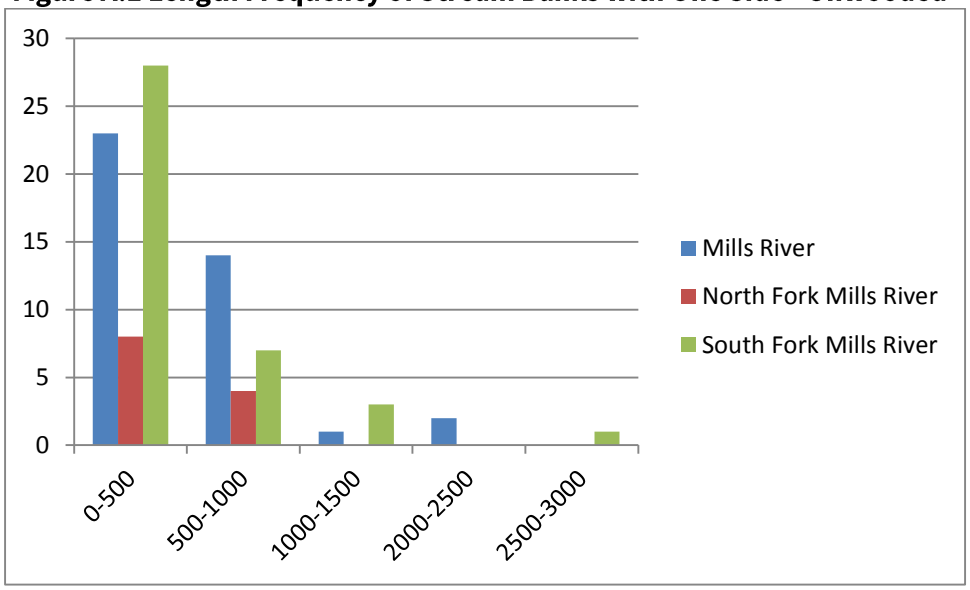
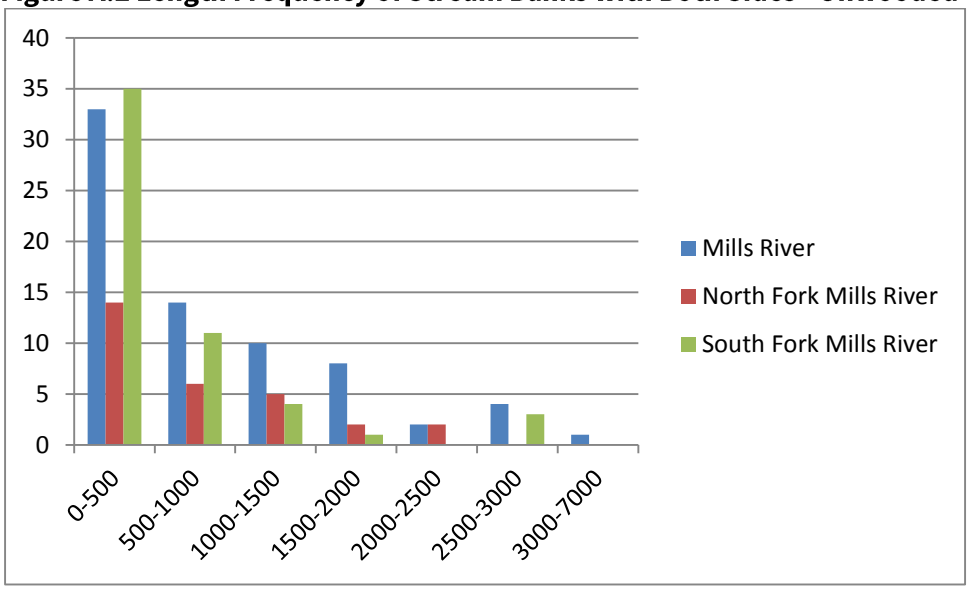


Figure A.2 Length Frequency of Stream Banks with Both Sides "Unwooded"



Impervious Area Assessment

Introduction

Imperviousness of developed land is generally defined as those surfaces through which little water can pass (such as buildings, roads, and parking lots), causing most rainfall to be accumulated as stormwater runoff. To determine the extent of impervious surface in the Mills River Watershed, a GIS analysis of the 2011 NLCD was conducted.

Methods. To estimate the area of impervious surface on private land within the watershed, impervious surface data was extracted for all private lands in the Mills River Watershed from the 2011 NLCD Impervious Surface Dataset. Since limited development of USFS and BRP lands currently exists and little is likely to be developed in the future, it was excluded from the analysis. The impervious surface data consists of a grid of 30 meter by 30 meter cells. Within each cell, the estimated proportion of four land cover categories, which are considered "impervious;" low-, medium-, and high-intensity "developed land;" and "barren land" was determined. For this analysis, a cell having an impervious surface value equal to or greater than 0.2 (20 percent) was selected and exported to a table. This level of impervious surface area is consistent with the area of impervious surface typically associated with "impacted" watersheds, according to the CWP (2005) (Figure 7.2). Microsoft Excel® was used to total the number of cells with impervious surface greater than 20 percent and to calculate the total area of imperviousness on private lands within the entire Mills River Watershed. An additional analysis was made to determine the impervious area within the Brandy Branch sub-watershed.

Results. Impervious surface area on private land in Mills River Watershed was found to be 304.8 acres (2.8 percent). Approximately 54.3 acres (13.4 percent) of Brandy Branch sub-watershed was found to be impervious. Detailed discussion of the implications of this analysis can be found in Section 3.4.2.

Appendix B Stormwater Control Measures

Introduction

Although new construction in the Mills River Watershed is now required to have post-construction stormwater control measures in place, the rules are not retroactive. Uncontrolled stormwater from previously constructed sites is a source of pollution and increased stream volume and velocity, causing damage to stream channels. To address impacts of stormwater from these sites a combination of GIS analysis and field data was used to identify potential locations where stormwater control measures could be constructed.

Methods

GIS Analysis. Land use data (MRLC 2013) and aerial photographs (NCCGIA 2011) were used to guide and expedite field identification of potential SCM project opportunities. Aerial photos of commercial, institutional, and industrial land uses were examined in closer detail in GIS. Based on aerial photo analysis, areas containing large impervious surfaces, poor land use practices, and potential pollutant-generating hot spots were flagged for field evaluation to assess potential impacts and opportunities for SCMs. Through GIS analysis, seven potential SCM project sites were identified. Locations for an additional four potential sites were provided by members of the Stakeholder Group.

Field Assessment. Field evaluations were made for the 11 potential stormwater retrofit sites. During the field assessment, observations were made on land-use draining to the site, existing stormwater management practices, and site constraints to determine whether or not a SCM was feasible. If a retrofit was determined to be feasible, a datasheet (Table B.1) was completed and photographs taken to document existing conditions. Site sketches were made of the site with the type of retrofit being proposed.

Stormwater Pollutant Reduction Calculations

Pollutant Load Reductions. An estimate of pollution reduction potential was calculated based on pollutant removal efficiencies of the individual SCMs, the percent of impervious surfaces draining to each SCM, the pollutant concentration in runoff based on land use, and the area of land draining to the SCM using the SIMPLE method (Schueler 1987). It should be noted that the calculations in this model are rough approximations of actual pollutant reductions. An in depth study of each site is required to accurately estimate pollutant reductions.

Results of this analysis are presented in Section 7.8.3.

Results

Based on the field evaluations, seven sites were determined to be feasible (Figure 3.3; Table 3.7). Preliminary site assessments indicate that it may be possible to install as many as 19 stormwater control features at these sites. The result of this analysis is discussed in Section 3.4.2.

The results of the potential pollutant load analysis are presented and discussed in Section 7.8.3.

Table B.1 Stormwater BMP Evaluation Datasheet

Subwatershed: _____ BMP (desktop) ID Type: _____ Staff:_____
Date_____ Site Location (Road):_____

Tracking Information

Waypoint _____ Lat_____ Long_____
Photo number(s) and description_____

Reason for Assessment (check one; describe if further details are deemed appropriate)
☐ Large developed area (e.g. mall, large strip development, industrial complex, large mixed use area)
_____
☐ Large area of land clearing or disturbance (note nature if obvious)_____
☐ Pollution potential (list if any are observed, e.g. storage tanks, trash receptors, etc.)
_____

Nature of Site
Name of Facility/Area (if obvious)_____
(Check all that apply)
☐ Commercial ☐ Gov't ☐ Pasture ☐ Land disturbance ☐ Institutional ☐ Transport-related ☐ Row crops
☐ Animal operation ☐ Other_____ ☐ Industrial ☐ Golf course ☐ Nursery ☐ Residential

Site Concerns (check all that apply):
Developed uses:
Vehicle Operations (circle): Fueled Washed Maintained Repaired Stored Sold None No Observation
Uncovered Outdoor Material Storage: ☐Yes ☐No ☐Unknown ☐ No Observation
Describe: _____
Waste Management: ☐Garbage ☐Construction ☐Hazardous ☐None ☐Other_____ ☐ No Observation
Dumpsters: ☐Leaking ☐Near storm drain ☐OK ☐ No Observation
Impervious Surface Condition: ☐Clean ☐Stained ☐Debris/Dirty ☐Breaking Up ☐ No Observation
☐ Other_____
Impervious Surface Size: ☐<1 acre ☐1-5 acres ☐5-10 acres ☐>10 acres
Type of impervious surface: ☐ Parking lot ☐ Rooftop ☐ Roadway ☐ Other…
☐ Open space between outfall and property boundary
☐ Area drains directly to storm sewers
☐ Area drains directly to adjacent property
☐ Area in immediate proximity to stream or drainageway (with / with no controls)-circle one

Site Constraints:
Possible conflicts with other site functions (e.g. traffic flow) ☐No ☐Yes
(describe)_____
Conflicts with existing utilities ☐ None

Yes	Possible	
☐	☐	Sewer
☐	☐	Water
☐	☐	Gas
☐	☐	Electric
☐	☐	Overhead utilities
☐	☐	Other_____

Access Constraints (construction and maintenance) ☐No ☐Yes (describe-slopes, structures)_____
Possible Conflicts with Adjacent Land Use ☐No ☐Yes describe)_____

ST Potential☐1 ☐2 ☐3 ☐4 ☐ 5 ☐6 ☐7 ☐ 8-specifically ☐ Other-explain on back

Appendix C Hazardous Materials Incident Forms

Hazardous Materials Checklist
Updated/Reviewed June 30, 2014

Primary Agencies:	**Fire Department / Incident Commander**
Support Agencies:	Fire Marshal Emergency Medical Service Law Enforcement Emergency Management RRT - 6 Others as required

Expedited Emergency Action Checklist - Hazardous Materials
(Refer to Field Operations Guidebook)

Emergency response agencies tasked with responding to the hazards identified as threats to Henderson County can use the hazard specific checklists contained in this attachment. These checklists are not all-inclusive, but they cover key points. Be sure, as a field responder, you refer to the Field Operations Guidebook.

This attachment may also contain suggested citizen instructions for major emergencies. These instructions can be used to expedite emergency public information measures. They contain general information for the threats.

Emergency Management

Preparedness

- ☐ Assist LEPC in planning for emergency response to a Hazardous Material Accident.
- ☐ Coordinate HAZMAT Training programs for responders.
- ☐ Ensure adequate protective and radiological equipment is available as needed.
- ☐ Assure all responders are trained to the HazMat Operations Level as a minimum.
- ☐ Ensure adequate mutual aid agreements.
- ☐ Ensure evacuation routes and shelters are designated.
- ☐ Provide overall Direction and Control in response to Hazardous Material accidents.
- ☐ Make decisions to evacuate personnel, as required.
- ☐ Make decisions on the use of shelters and ensure evacuees are sheltered.
- ☐ Develop plans for the recovery (containment and cleanup) period.

Response

- ☐ Determine the exact chemical or hazardous material involved.
- ☐ Notify the State Division of Emergency Management through the Area Coordinator.
- ☐ Ask for advice and assistance as necessary.
- ☐ Activate the EOC as required.

- [ ] Restrict the area of the accident and suggest to the County Commissioners evacuation of personnel as the situation dictates.
- [ ] Coordinate the rescue of injured or trapped persons.
- [ ] Coordinate the rerouting of traffic and the evacuation of personnel as required.
- [ ] Coordinate media releases to minimize public alarm and to keep the area clear.

Recovery

- [ ] Coordinate the recovery effort.
- [ ] Ensure the area is restored to a safe condition.
- [ ] Close out emergency operations and participate in the lessons learned critique.
- [ ] Ensure necessary reports are completed and final reports are submitted.
- [ ] Evaluate response, conduct a critique of actions taken, and ensure necessary improvements.

Sheriff

Preparedness

- [ ] Develop procedures for response to a Hazardous Material Accident.
- [ ] Train all LE personnel to a minimum of “First Responder - Awareness Level.”
- [ ] Equip each vehicle with current issue of US DOT Emergency Response Guidebook.
- [ ] Assist LEPC in pre-planning for response to hazardous materials incidents.

Response

- [ ] Secure the area of the HAZMAT accident.
- [ ] Keep all personnel upwind or upstream of the accident until the on-scene commander arrives.
- [ ] Reroute traffic and maintain traffic control as required.
- [ ] Assist in voluntary evacuation efforts if required. Execute evacuation orders.
- [ ] If EOC is activated, provide a representative to the EOC staff.
- [ ] Provide necessary assistance during the response phase.

Recovery

- [ ] Ensure corrective actions.
- [ ] Participate in the critique.

Fire Marshal/Fire Department

Preparedness

- [ ] Develop procedures and train for a Hazardous Material Accident.

- [ ] Identify risk areas for hazardous materials.
- [ ] Assure all responders are trained to HazMat Operations Level as a minimum.

Response

- [ ] Identify the chemical or hazardous material involved in the accident, or if unknown, treat the material as toxic and likely to have explosive reactions.
- [ ] Use established firefighting techniques (such as keeping personnel upwind) to control the situation.
- [ ] Assume on-scene command and establish a command post.
- [ ] Seek advice on the material involved and recommend evacuation and protective actions as necessary.
- [ ] Recommend restriction of the risk area to control the situation.
- [ ] Assist in the evacuation effort, if required.
- [ ] If requested, wash down the area, as required. Ensure no flammable or toxic material is washed into drains or water supplies.
- [ ] Provide information to officials so that media releases may be made to the public.
- [ ] If the EOC is activated, provide a representative to the EOC.

Recovery

- [ ] Restore the accident area to a safe condition.
- [ ] Participate in the critique.
- [ ] Close out emergency operations and complete final reports.

Hazardous Materials Release Notification Procedure
Citizens who determine that a release of hazardous materials has occurred should:
Call 911 and advise the location of the release along with a description of how the release was detected (odor, visible vapor cloud, etc.) **OR** report release in person to any emergency services facility (law enforcement office, fire station, ambulance base, etc.).
Facility personnel who have determined a release has occurred at their facility should:
Call _____ (insert 911 or other emergency phone number) and, to the extent allowed by the situation, advise the following information: 1. Chemical name of the substance released. 2. Quantity of substance released. 3. Date and time of release. 4. Duration of release. 5. Media to which release occurred (air, ground, surface water, sewer). 6. Anticipated acute or chronic health risks. 7. Advice on medical attention for exposed individuals. 8. Proper precautions to take (evacuation, shelter-in-place, etc.) 9. Name and phone number to contact for further information. 10. Actions taken by facility to contain the release. 11. Name and phone number of person making this notification. NOTICE: Facilities or transporters may be required by federal law to make other notifications.

Fixed Facility Chemical Spill Checklist

Updated/reviewed March 3, 2014

Primary Agency:	**Fire Department / Incident Commander**
Support Agencies:	Emergency Management Sheriff / Law Enforcement Fire Marshal Department of Public Health Emergency Medical Service Public Information Officer Rescue Others as required

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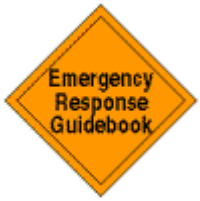
Planning:	
☐	Ensure the public is well informed through Community Right to Know.
☐	Coordinate with local plants, businesses or other facilities that have hazardous material and obtain information as allowed by Community Right to Know or SARA Title III (Code of Federal Regulations).
☐	Provide an avenue for such facilities to report chemical spills (i.e. 9-1-1).
☐	Coordinate with local broadcast media to ensure timely and accurate Emergency Alert System activation.
☐	Coordinate with Chemtrec (800-262-8200) for timely information regarding spills.
☐	Coordinate with schools, daycare centers, hospitals, etc. in proper precautions and emergency actions prior to a chemical spill or accident.
☐	Coordinate and plan at least one exercise (table top or practical) every six years or participate in an actual incident.
☐	Coordinate with local planning boards and inspections departments regarding building codes and code enforcement to minimize potential release of hazardous materials.
☐	Coordinate with State Title III Compliance Department.
☐	Conduct hazard analysis of vital facilities and the impact of a major chemical spill on one or more of those facilities.
☐	Procure or produce information pamphlets for distribution to the public, as appropriate.
☐	Coordinate with the facility for response and information.
☐	Establish or facilitate joint incident command with each extremely hazardous materials (EHS) facility.
☐	Establish or facilitate joint incident command with agencies likely to respond, such as fire departments, regional hazmat teams, etc.
☐	Determine the availability of shelters and obtain shelter agreements if the Red Cross (or other agency) has not.
☐	Coordinate with Red Cross, public agencies, and/or the Salvation Army for shelter operations.

Response:	
	
☐	Identify immediate action or response requirements. Refer to online Extremely Hazardous Substance (EHS) listing if needed.
☐	Refer to the facility listing for Extremely Hazardous Substances for the county if needed or appropriate.
☐	Immediately carry out those action requirements necessary to preserve life and/or property, including the deployment of required resources.
☐	Activate the EOC as appropriate.
☐	Organize or establish the EOC, based on operational procedure or guidelines.
☐	Issue alert and warning based on operational procedure or guidelines, as warranted.
☐	On order, evacuate affected areas with assistance from response or predetermined evacuation forces.
☐	Establish communications with responding agencies.
☐	Establish traffic control and security with law enforcement.
☐	Through communications with responding agencies determine as quickly as possible:
	☐ The location of any established command post: ☐ Has incident command been established? If not, establish incident command. ☐ Has the incident commander been appointed or assumed command? Who is it? ☐ Have incident communications been fully established? ☐ What is the two-way radio frequency being used by incident command? ☐ Number of killed or injured. ☐ General boundary of the affected area. ☐ The general extent of damages. ☐ The general extent of power or other utility disruption. ☐ Immediate needs of response forces. ☐ If voluntary evacuations of the population have begun. ☐ Location of any triage area. ☐ Location of any congregate care area established or ad hoc.
☐	Evaluate overall county situation (i.e. Are roads blocked? What is the weather and what effect will it have?).
☐	Establish communications with the facility reporting the spill or leak.
☐	Request a technical liaison from the facility report to the EOC (or command post).
☐	Establish communications with the State.
☐	Request hazardous materials team response if appropriate.

☐	Establish communications with and request a liaison from State Transportation and electric, telephone, and gas utilities as necessary.
☐	Establish communications with area schools, medical facilities, and/or businesses that might be affected.
☐	Establish ongoing reporting from the response forces, private agencies, and utilities.
☐	Establish command post(s) as needed.
☐	Coordinate with Red Cross (or designated lead agency) the opening of appropriate number of shelters in the appropriate areas, based on shelter procedure or guideline.
☐	Conduct first staff briefing as soon as practical after EOC activation.
☐	Activate or establish rumor control through the public information officer (PIO).
☐	Establish a schedule for briefings.
☐	Brief city/county/agency/utility executives.
☐	Provide PIO with updated information.
☐	Establish, as appropriate, a Joint Information Center (JIC) with the facility.
☐	Provide response forces with all updated information, as appropriate.
☐	Cause public information to be released, via the public information officer (PIO) as soon as practical.
☐	Issue action guidance as appropriate.
☐	Establish 24/7 duty roster for the EOC and/or command post.
☐	Develop and post any required maps or diagrams.
☐	Activate an events log.
☐	Ensure all appropriate forms (ICS) are being used to track personnel and resources.
☐	Review and follow resource procurement procedure or guideline.
☐	Inventory additional resources that may be used or called upon.
☐	Activate formal resource request procedure or guideline and resource tracking.
☐	Coordinate all resource requests being forwarded to the State.
☐	Activate financial tracking system coordinated by the Finance Officer.
☐	Activate damage assessment and follow damage assessment procedure or guideline.
☐	If the incident continues, develop a 12-hour incident action plan outlining actions that must be accomplished in the next 12 hours.
☐	Conduct a "second shift" or relieving shift briefing, if you are being relieved.
☐	Discuss with and present to your relief, the incident action plan for the next 12 hours.

Recovery:	
☐	Gather damage assessment information (public, housing, business) from damage assessment teams.
☐	Obtain information from technical sources regarding health effects duration.
☐	Obtain information from Red Cross (or designated lead agency) regarding number of shelters and support necessary for continued operation.

☐	Obtain from Red Cross (or designated lead agency) an estimated duration period for continued shelter operations, if any.
☐	Obtain information from utilities regarding outages, length of repair, safety, etc.
☐	Assess citizen / community needs for individual assistance and/or public assistance.
☐	Activate local unmet needs committee if appropriate.
☐	Gather financial information from the Finance Officer.
☐	As appropriate, gather additional information to include:
	☐ Personnel that responded and the time involved in the response. ☐ Time sheets or time logs. ☐ Supplies used. ☐ Contracts issued. ☐ Purchase orders issued. ☐ Any other expenditures. ☐ Damages to public buildings, equipment, utilities, etc. ☐ Loss of life or injury of any responder. ☐ Documents regarding economic impact.
Notation: It most cases the person responsible for the chemical leak or spill is responsible for cleanup and all costs associated with response as well. Volunteer resources and expenses may not be reimbursable unless under contract.	
☐	Develop or generate reports for the following, as appropriate:
	☐ FEMA ☐ State ☐ Local elected officials ☐ County/City /Town Managers ☐ Others requiring or requesting reports
☐	Coordinate recovery organizations including federal and state agencies and private or volunteer relief organizations.
☐	Establish donations management based on policy and procedure or guideline.
☐	If a Presidential declaration of disaster is made, file "Request for Public Assistance" to apply for assistance as soon as possible with the proper state or federal agency.
☐	Ensure public officials are made aware of the assistance application process, if applicable.
☐	Ensure the general public is made aware, through the public information officer, of the assistance application process, if applicable.
☐	Perform an incident critique as soon as possible with all possible response organizations.
☐	Review agency and self-performance.
☐	Review the weaknesses of the plan.
☐	Correct weaknesses.
☐	Implement hazard mitigation or modify hazard mitigation plan accordingly.
☐	Brief elected officials with updated information and disaster recovery progress.

Appendix D Streambank Sediment Loading

Lack of adequate buffers can contribute to eroding, unstable streambanks and an increase in sediment loads downstream. Sediment loads related to streambank erosion were calculated using data derived from GIS-based riparian area assessment of woody vegetation (Appendix A) and the USEPA's STEPL Model. STEPL is a spreadsheet model that uses simple algorithms to calculate nutrient and sediment loads. For purposes of this plan, STEPL was used to estimate annual sediment load contributed from streambank erosion based on the length of eroding banks and the potential load reduction if banks are stabilized. Technical information regarding calculations of sediment loading can be found in the STEPL User's Guide (USEPA 2005).

The model was split into three sub-watersheds—North Fork Mills River, South Fork Mills River, and Mills River main stem. Required model inputs included:

- Length of bank (ft.)
- Height of bank (ft.)
- Rate of lateral recession
- BMP efficiency
- Soil textural class

Using data from the GIS-based riparian area assessment of woody vegetation (Appendix A), the length of bank was derived by summing the stream bank length considered to have an "unwooded" buffer. Since no field assessments were performed for this plan, assumptions pertaining to bank height were made based on where the bank was located in the watershed and general knowledge of the watershed. If the bank was located on the main stem of the North Fork, South Fork, or Mills River, then the bank height was assumed to be 8 feet. If the bank was located on a lower-order tributary, then the bank was assumed to be 3.5 feet. Likewise, no data on lateral recession rate of the streambank were available since no field assessments were performed. Recession rates are the rate at which stream banks are expected to erode as measured horizontally from the stream channel. In order to gain insight into the potential loads under existing conditions and the potential reduction to be gained from stream restoration and enhancement, loads and potential load reductions were calculated for a range of lateral recession rates. "Slight" (0.03 feet/year) and "Moderate" (0.13 feet/year) lateral recession rates were the options selected for use in the model. Recession rate is the rate at which a streambank is expected to erode as measured horizontally from the stream channel.

To estimate the total sediment load reduction, the expected efficiency of streambank stabilization to remove sediment must be included in the model. Even in unimpacted natural stream systems, some level of background erosion is present. However, in impacted watersheds, erosion will be significantly reduced when severely eroding streambanks are restored or enhanced. For this analysis, we selected a BMP efficiency (% sediment load reduction) of 0.8 to allow for some level of background erosion even with a successful stream restoration project. The last input for the STEPL model is soil textural class, which can greatly affect the amount of soil loss due to differences in cohesion. A review of NRCS Soil Survey Data indicated that most of the study area consists of a mixture of loams and sandy clay loams.

Outputs from the STEPL Sediment loading model are summarized in Table D.1.

The results are discussed in Section 7.8.2.

Table D.1. STEPL Sediment Load Model Outputs for Streambanks on Privately Held Lands in the Mills River Watershed

Reach	Stream Bank Length (feet)	Bank Height (feet)	BMP Efficiency (0-1)	Soil Textural Class	Soil Dry Weight (ton/feet^3)	"Slight" Lateral Recession (0.03 feet/year)		"Moderate" Lateral Recession (0.13 feet/year)	
						Annual Load (ton)	Load Reduction (ton)	Annual Load (ton)	Load Reduction (ton)
Mills River									
Main stem	46,812	8	0.8	Loams, sandy clay loams	0.045	506	404	2,191	1,753
Tributary	106,783	3.5	0.8	Loams, sandy clay loams	0.045	505	404	2,186	1,749
North Fork									
Main stem	8,008	8	0.8	Loams, sandy clay loams	0.045	86	69	375	300
Tributary	15,738	3.5	0.8	Loams, sandy clay loams	0.045	74	59	322	258
South Fork									
Main stem	13,545	8	0.8	Loams, sandy clay loams	0.045	146	117	634	507
Tributary	23,509	3.5	0.8	Loams, sandy clay loams	0.045	111	89	481	385

Appendix E Funding Sources

The following table summarizes potential funding sources and programs that can be used to implement the Mills River Watershed Management Plan. Because grant requirements, allowable uses, matching requirements, and funding cycles often change, up-to-date details should be obtained from the agency before starting the application process. This list does not include loan programs that may be available to local government agencies.

Appendix Table E.1 Watershed Improvement Potential Funding Sources

Funding Source	Programs
Clean Water Management Trust Fund	Legislated funding for stream restoration
Conservation Trust of North Carolina	Provides grants to local land trusts to advance land conservation goals
Environmental Protection Agency	Five Star Grants
Henderson County Soil and Water Conservation District	Agricultural Cost Share Program Community Conservation Assistance Program
Local Governments – Asheville, Hendersonville, Buncombe County, Henderson County, Town of Mills River	Use funds from these agencies to meet required matches for federal grants.
Mills River Partnership	Provides base funding and match for projects
National Fish and Wildlife Foundation	Multiple lists of grant opportunities. See http://www.nfwf.org/whatwedo/programs/Pages/home.aspx#.VBrOUZRdWSp for details
N.C. Department of Justice	Environmental Enhancement Grants
N.C. Department of Transportation	Non-mitigation funding associated with road improvement projects. Special projects
N.C. Division of Parks and Recreation	Adopt-a-Trail Program Parks and Recreation Trust Fund (PARTF)
N.C. Division of Water Resources	USEPA 319(h) nonpoint source pollution watershed management and implementation funds USEPA 205(j) – Source Water Protection Planning Grants
N.C. Ecosystem Enhancement Program	Stream and wetland mitigation funding in targeted watersheds
N.C. Forest Service	Forest Management Plan Program for private landowners (free) Urban and Community Forestry Grants
N.C. Wildlife Resources Commission	No formal grant program, but can provide technical assistance some of which may be useable as match
Trout Unlimited	Embrace-A-Stream Grants to engage local TU chapter with other partners
USDA Natural Resource Conservation Service	Federal Farm Bill Programs – Environmental Quality Improvement Program (EQIP), Conservation Reserve Program (CRP), Conservation Reserve Enhancement Program (CREP)
U.S. Fish and Wildlife Service	Partners for Fish and Wildlife (PARTF), Shade Your Stream Program. Endangered Species Program, Wetlands Conservation Act Program
U.S. Forest Service	Challenge Cost Share Projects (can conduct projects within administrative boundary that can include private lands)
Z. Smith Reynolds Foundation	Provides funding for projects that improve air and water quality and preserve natural landscapes, but not land purchases, greenways, or plant species preservation