

# A Conservation Plan for the Riparian and Floodplain Corridor of the Upper Pigeon River Valley from Lake Logan to Canton



*Photos (clockwise from upper left): Lake Logan; prime farmland along the Pigeon River; the water intake facility for the Town of Canton; a proposed riverfront development. All photos by George Ivey.*

Produced by the Bethel Rural Community Organization,  
in association with the Southwestern NC RC&D Council  
Written by George Ivey, [georgeivey@earthlink.net](mailto:georgeivey@earthlink.net), (828) 648-2710  
September 2008

<b>Table of Contents</b>	<b>Page #</b>
<b>EXECUTIVE SUMMARY</b>	4
<b>ACKNOWLEDGEMENTS</b>	5
<b>THE PROJECT AREA</b>	6
• Where Are We?	6
• How Did We Select the Boundaries of the Project Area?	8
• Why Is the Project Area Important?	12
○ Water Supply III Status	
○ Rare Species and Natural Communities	
○ One North Carolina Naturally	
○ Trout Waters	
○ Floodplains	
○ Prime Farmlands and Agricultural Operations	
○ Proximity to Other Places of Interest	
• Water Quality in the Project Area	17
○ Erosion and Sedimentation	
○ Hydrological Alteration	
○ Marginal and Inadequate Streambank Vegetation	
○ Chemicals	
○ Nutrients	
○ Fecal Coliform	
• Conclusions from the Water Quality Analysis	22
<b>PRIORITY SETTING</b>	24
• Priority Lands for Prevention/Protection Work	24
○ Streams	
○ Rare Species and Natural Communities	
○ Wetlands	
○ Hydric Soils	
○ Proximity to Protected Lands	
• Summary of Priorities for Prevention/Protection Activity	32
• Priority Lands for Restoration Work	34
○ Erosion and Sedimentation	
○ Hydrological Alteration	
○ Marginal and Inadequate Streambank Vegetation	
• Summary of Priorities for Restoration Activity	40

<b>Table of Contents (continued)</b>	<b>Page #</b>
<b>THE THREE-LEGGED STOOL OF OPPORTUNITY</b>	41
<b>SOLUTIONS</b>	42
• Prevention/Protection Strategies	42
○ Short-term Protection Tools	
○ Mid-term Protection Tools	
○ Long-term Protection Tools	
▪ Working Land Easements vs. Natural Area Easements	
○ Funding	
○ Regulatory Approaches to Reducing Future Development Impacts	
○ Containing Catastrophic Spills	
• Restoration Strategies	51
○ Erosion and Sedimentation	
○ Hydrological Alteration	
○ Marginal and Inadequate Streambank Vegetation	
○ Other Water Quality Concerns	
○ Partners	
• Education Strategies	53
• Coordination and Facilitation	53
<b>CONCLUSION</b>	54
<b>APPENDIX A – DATA SOURCES FOR MAPS</b>	55
<b>APPENDIX B – WATER QUALITY DATA</b>	56
<b>REFERENCES</b>	59

## Table of Contents (continued)

### **MAPS**

All maps in this plan were produced by Glen Locascio, GIS Specialist in the Asheville office of the North Carolina Division of Community Assistance, and Ryan Manning, GIS Specialist with the Haywood Soil and Water Conservation District. Further information on the sources of data for these maps is included in Appendix A.

<u>Map #</u>	<u>Title</u>	<u>Page #</u>
1	Haywood County, NC	6
2	Project Area and Upper Pigeon River Watershed	7
3	Project Area	11
4	One NC Naturally - Biodiversity and Wildlife Habitat Ratings	14
5	Livestock Access and Eroding Streambanks	19
6	Streams and Trout Waters	27
7	Rare Species and Natural Communities	28
8	Wetlands	29
9	Hydric Soils	30
10	Protected Lands	31
11	Combined Map of Prevention/Protection Priorities	33
12	Sources of Erosion	37
13	Hydrological Alteration Features	38
14	Marginal and Inadequate Streambank Vegetation	39
15	Combined Map of Funding Priorities	49
16	Water Quality Data Collection Sites	58

## **EXECUTIVE SUMMARY**

This plan details the priorities and strategies for protecting and restoring water quality and aquatic life in part of the Upper Pigeon River watershed in Haywood County in Western North Carolina. The North Carolina Clean Water Management Trust Fund supported this effort through a grant to the Southwestern NC Resource Conservation and Development Council.

The project area stretches from Lake Logan to the drinking water supply intake in the town of Canton, including 7.5 miles of the West Fork, 5.1 miles of the main stem of the Pigeon River, and 23 miles of smaller streams. In addition to providing water to 5,500 residents of Canton and Clyde and to the county's largest private employer, Evergreen Paper, these waterways provide habitat for one endangered species, the Appalachian elktoe mussel; three species of conservation concern, the wavy-rayed lampmussel, the hellbender salamander, and the olive darter; and three species of trout. The One North Carolina Naturally program gives the West Fork and the Pigeon River through the project area its maximum conservation value (10 out of 10), and Blue Ridge Forever includes the project area in its 28 regional priorities.

The project area includes 1,575 acres, and it differs from other river corridor planning efforts by including not only the standard 300-foot riparian buffer width, but also the entire width of the 100-year floodplain. These floodplain areas merit inclusion because of their important role in protecting water quality, maintaining the natural flood regime, and providing wildlife habitat.

Data collected by three different groups and agencies show that water quality and aquatic life in the project area rate very well, perhaps to the surprise of those who assume that extensive farmlands always lead to poor water quality. Existing areas of erosion and sedimentation, hydrological alteration, and inadequate streambank vegetation provide some reasons for concern, but the threat of development presents a much greater long-term risk.

In terms of strategies, this plan focuses primarily on minimizing development through a suite of land conservation tools that include everything from the present use value program to land acquisition and conservation easements. In particular, the plan embraces working land conservation easements as the most cost-effective, long-term tool for maintaining water quality, while also protecting all the community benefits associated with these farmlands, including farm jobs, fresh food, and tax revenue for the county, region, and state.

This document does not include a list of specific parcels to "target" for conservation action. Instead, it acknowledges the reality that successful implementation can occur only when we bring together ecological priorities, interested landowners, and financial resources. By focusing on these complementary elements of implementation, we believe we have selected a more realistic approach to achieving our water quality objectives.

Other strategies in this plan include cost-effective restoration activities to reduce existing water quality concerns; education and outreach; and general project coordination to maintain the overall effort. Together, these strategies provide a comprehensive yet practical plan to protect water quality, aquatic life, and the area's rich agricultural heritage.

## ACKNOWLEDGEMENTS

Numerous agencies, organizations, and individuals contributed to this plan in many different ways: one-on-one conversations, group discussions, e-mail correspondence, sharing of research data, mapping, and more.

North Carolina's Clean Water Management Trust Fund provided the funding for the research, writing, and publication of this report through Grant #2006A-818. They also allowed us to explore certain issues not previously emphasized in the Trust Fund's work: the potential for floodplains and agricultural lands to contribute to the goals of protecting clean water. We are thankful for their willingness to consider these issues.

The Southwestern NC Resource Conservation and Development (RC&D) Council applied for and managed the funds from the Clean Water Management Trust Fund, as well as related grants from other agencies. Haywood Waterways Association convened their Technical Advisory Committee to help provide the data and analysis included in this report. The Bethel Rural Community Organization and its Rural Preservation Committee provided the essential perspective of local residents and landowners. North Carolina's Division of Community Assistance and the Haywood Soil and Water Conservation District assisted with mapping and other analysis. The North Carolina Natural Heritage Program provided crucial information on the natural elements and natural processes of importance in the project area. The Pigeon River Fund approved a grant to support implementation of this plan.

Specifically, we would like to recognize the following individuals: Tim Garrett, Coordinator to the Southwestern NC RC&D Council; research assistant Anne Lancaster; Leslie Smathers and Ryan Manning with Haywood Soil and Water Conservation District; Glen Locascio, NC Division of Community Assistance; Marilyn Westphal, Volunteer Water Information Network Coordinator; Angie Rodgers, North Carolina Natural Heritage Program; Ron Moser and Eric Romaniszyn, Haywood Waterways Association; Bryan Tompkins, U.S. Fish and Wildlife Service; Ed Williams, North Carolina Division of Water Quality; and the many people of the Bethel Community of Haywood County who offered their suggestions and other feedback.

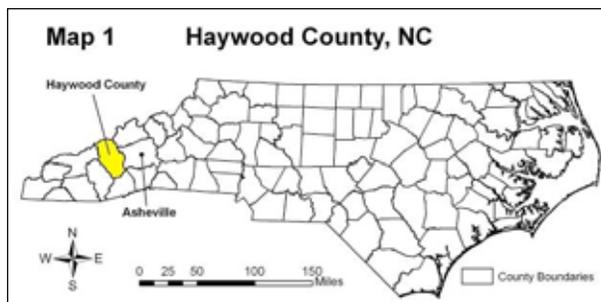
Last and certainly not least, we must acknowledge the effort, analysis, text, and maps of the March 2008 *Upper Pigeon River Flood Protection Plan*, which identifies the land characteristics and tools needed to help maintain the area's natural ability to hold heavy rains and floodwaters. That effort was funded by the North Carolina Division of Water Resources, through a grant to Haywood County. While the flood protection plan considered the entire Upper Pigeon River watershed and focused on water quantity issues (rather than water quality), the overall setting and many of the specific issues and ideas addressed in that plan are very relevant to the issues discussed throughout this document. Quite simply, that plan helped make this plan possible.

## THE PROJECT AREA

### Where Are We?

The Pigeon River watershed begins in Haywood County in Western North Carolina before continuing on into Tennessee, where it meets the French Broad River. Haywood County and the Pigeon River watershed in North Carolina are in fact nearly identical in terms of land coverage, because all water flowing in Haywood County originates in Haywood County, and almost all of that water flows into the Pigeon River. (A very small portion of the eastern edge of Haywood County drains into Hominy Creek toward Buncombe County and into the French Broad River.)

Map 1 – Haywood County and the Pigeon River watershed in North Carolina are nearly identical in terms of land coverage.



The Pigeon River flows generally south to north from its high-elevation headwaters along the Blue Ridge Parkway on the southern edge of Haywood County to the town of Canton. The river then turns west toward the town of Clyde and then north-northwest toward Tennessee.

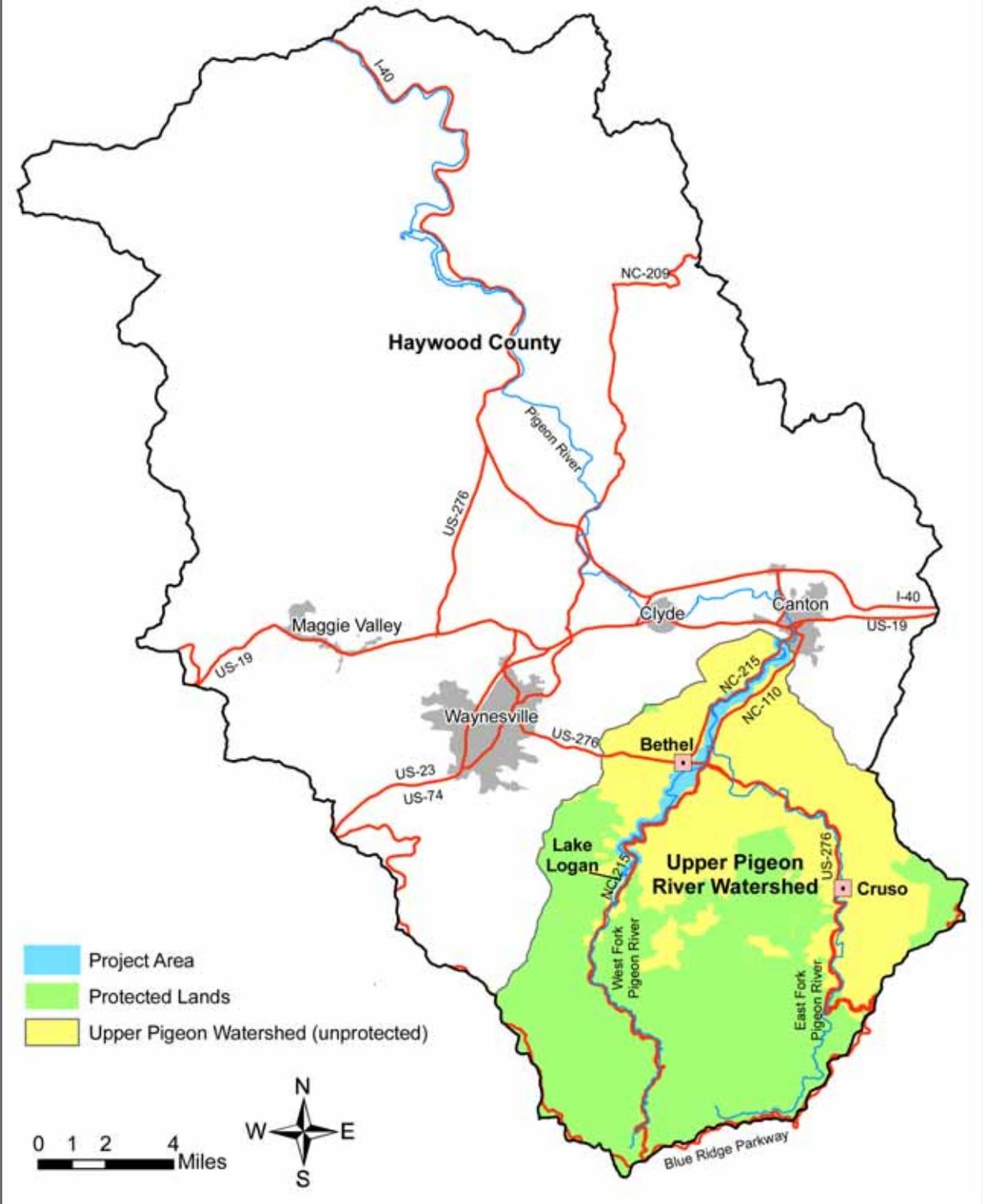
This plan focuses on a small portion of the Upper Pigeon River watershed. While various agencies and individuals offer different definitions of the “Upper Pigeon River” watershed, we define it here as all lands upstream of the public drinking water intake on the southwestern edge of the town of Canton.

As will be explained in greater detail in the next section of this plan, the project area includes only the area between Lake Logan and Canton. This section of the Upper Pigeon River watershed includes approximately 7.5 miles of the West Fork of the Pigeon River and 5.1 miles of the main stem of the Pigeon River. The project area extends outward to include approximately 1,575 acres of riparian and floodplain lands, which include another 22.7 miles of smaller streams. This land area represents only 1.9% of the 83,177 acres of the Upper Pigeon River watershed (Locascio).

---

*Next Page: Map 2 delineates the project area within the Upper Pigeon River watershed in Haywood County.*

## Map 2 Project Area and Upper Pigeon River Watershed



## **How Did We Select the Boundaries of the Project Area?**

Our project area has fairly clear and obvious upstream and downstream boundaries that are defined by two other Clean Water Management Trust Fund projects: a previous land conservation project around Lake Logan (Grant #1998B-007) and a newer land conservation project stretching from Canton to Clyde (Grant #2006A-014). Our project fills the gap of river miles between these two projects, starting at Lake Logan and continuing to the town of Canton.

While the length of the project area was easy to select, the proper width was far more challenging to determine. The Clean Water Management Trust Fund usually embraces a 300-foot buffer in order to protect water quality, but the scientific literature reveals a wide variation in recommended buffer widths. One analysis reports that most studies recommend minimum buffer widths of 50 to 100 feet (Wenger & Fowler 2000). Another review of the research literature suggests an even wider range of 25- to 375-foot buffers to achieve water quality objectives (Johnson & Buffler 2008). Several studies also recommend extending the buffer to include the entire floodplain (Wenger 1999, Schueler 1995, Gregory & Ashkenas 1990).

Variables at play in these analyses include different management objectives (e.g., water quality vs. migratory bird habitat); topography (e.g., steeper slopes require wider buffers for water quality protection); soil types; the amount of precipitation; and much more. No two watersheds are alike, and even within a watershed, factors like topography and soil types may differ from one river mile to the next. With so much complexity both between and within watersheds, it is difficult to determine a general rule that addresses all conditions.

Various government agencies sometimes set regulations based on these scientific issues, such as a 25-foot “buffer” between developed areas and trout waters. We should make it clear that we are focused here on the scientific and ecological bases for buffers and effective buffer widths, rather than using the scientific literature to create additional regulations and required buffer widths.

To determine the proper width of our own project, we returned to our primary objectives of protecting water quality and habitat for aquatic species of special concern. With those goals in mind, we focused on a variety of relevant buffer functions, such as filtering runoff, stabilizing streambanks, maintaining or restoring shade, providing woody debris, and maintaining the land’s ability to hold and store heavy rains and floodwaters (Allan 2004).

In the end, we have chosen to hybridize the Clean Water Management Trust Fund’s standard of 300-foot buffers with a variation based on floodplain width. More specifically, we are including the *entire* floodplain, even when it extends more than 300 feet from the river. In those areas where the floodplain extends less than 300 feet from the river, we maintain a minimum project width of 300 feet. Therefore, the project area reaches at least 300 feet along each side of the West Fork and Pigeon River, or further if the floodplain extends beyond 300 feet.

While flooding is a natural event, decreases in floodplain size and function can exacerbate a wide variety of water quality and stream habitat concerns, including flood height

and frequency, changes in base flow, processing of pollutants, bank scouring, bank failure, sedimentation, and other stream channel alterations (Wenger 1999, Allan 2004, Wang et al 2001, Paul & Meyer 2001). Protection of the floodplain helps minimize these stream impacts, and for that reason, we believe it both wise and necessary to include the entire floodplain in any river corridor protection effort, including this one.

While several scientific papers address these issues of buffer widths and floodplains, Wenger's *Review of the Scientific Literature on Riparian Buffer Width, Extent and Vegetation* (1999) provides several excellent summaries that demonstrate significant support for the comprehensive floodplain approach (we have placed some of this text in bold type in order to emphasize the most relevant points):

“Flooding is a natural feature of aquatic and riparian ecosystems. The frequency, duration and magnitude of floods helps [sic] to determine both the physical and biological characteristics of the riparian zone (Junk et al 1989). ... [M]any riparian plants rely on cycles of flooding for seed dispersal and recruitment, while many fish species use riparian zones as nurseries, spawning grounds or feeding areas during high flows. A healthy riparian zone and a healthy stream system requires [sic] the maintenance of the natural flow regime (Poff et al 1997)...

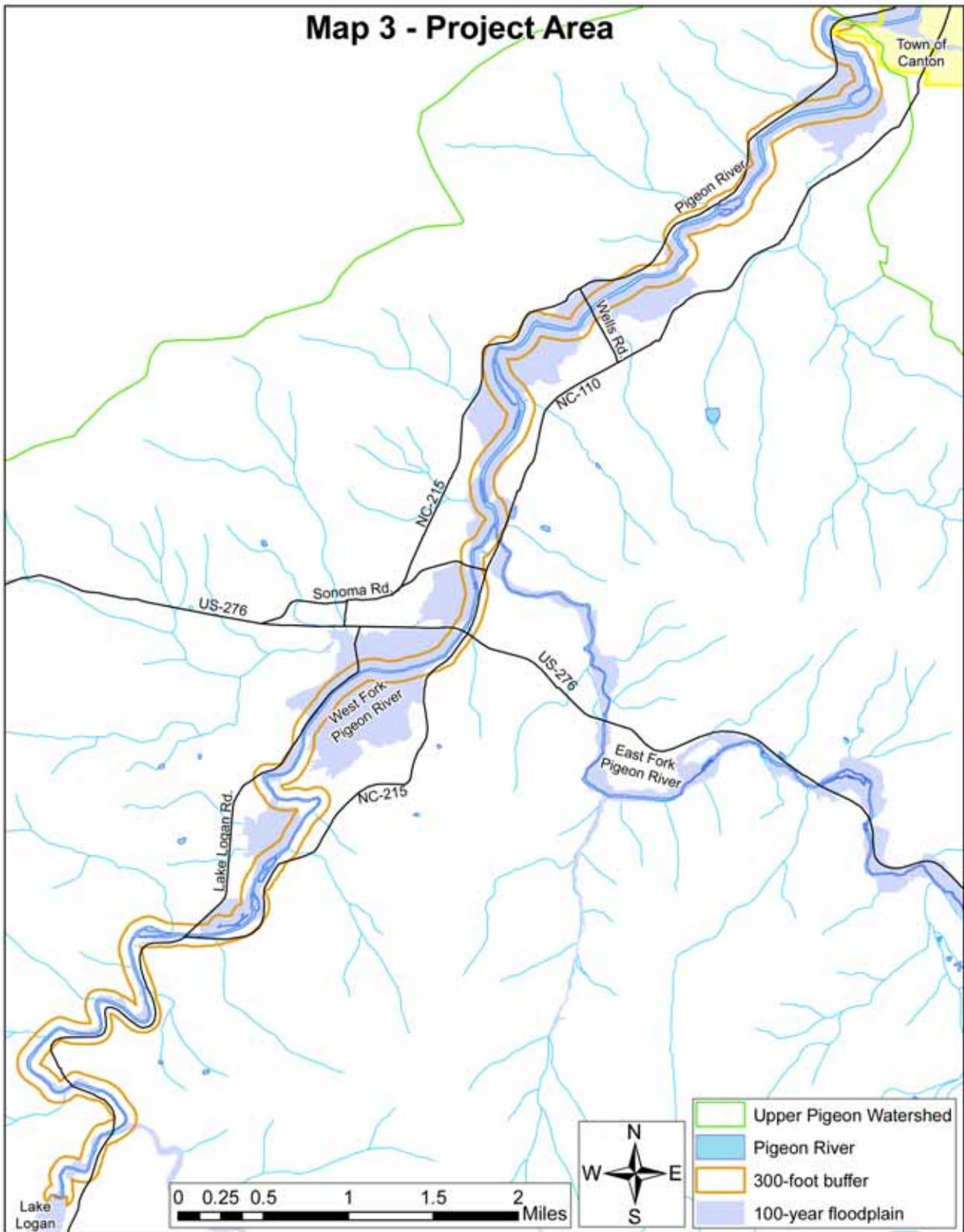
“The Federal Interagency Floodplain Management Task Force now discourages... structural controls on flooding and promotes the preservation of floodplains in a natural state (FIFMTF 1996). ... **To provide maximum protection from floods and maximum storage of flood waters, a buffer should include the entire floodplain...**

“The floodplain represents the region of material interchange between land and stream, as well as the limits of stream channel migration. **Studies reviewed above have shown that the entire floodplain can be a site of significant contaminant removal. For this reason, it makes sense to extend the buffer to the edge of the floodplain whenever possible.** In their buffer guidelines for Willamette National Forest, Gregory and Ashkenas (1990) declare that ‘the riparian management zone should include the entire [100-year] floodplain. **Failure to do so will seriously jeopardize the riparian management objectives during major floods.**’ Schueler (1995) also recommends including the floodplain. **Including the entire floodplain is, naturally, also the best way to minimize damage from floods. Therefore, whenever feasible, the riparian buffer should be extended to the edge of the 100-year floodplain.**” (Wenger 1999)

While flooding may be an isolated occurrence in some watersheds, floods have in fact inundated parts of the project area 17 times in the last 132 years, an average of one flood every 7.8 years (TVA 1966; USGS), including two major floods in September 2004. As a result of the 2004 floods, the North Carolina Division of Water Resources provided a grant to Haywood County to identify and protect those lands that do the most to help absorb and hold heavy rains and floodwaters in the Upper Pigeon River watershed. The resulting *Upper Pigeon River Flood Protection Plan* identified lands in the 100-year floodplain as among the most critical lands to be protected.

Looking at the project area between Lake Logan and Canton, we find that a strict 300-foot buffer approach would include 1,046 acres, but exclude 529 acres of 100-year floodplain. Meanwhile, a floodplain-only approach would include 1,145 acres, but exclude 430 acres of higher and usually steeper land that sits within 300 feet of the river. If we combine both layers, we end up with 1,575 acres, including 616 acres where the 300-foot buffer and 100-year floodplain perfectly overlap (Locascio).

By addressing both water quality and water quantity issues, the hybrid 300-foot/100-year-floodplain buffer approach presents a more holistic approach to river corridor conservation that addresses everything from steep slopes to floodplain function. We have organized the rest of this planning document around this more comprehensive river corridor area, as detailed in Map 3.



## **Why is the Project Area Important?**

Although it includes only 1,575 acres, the project area holds tremendous value for both people and nature, including Water Supply III status; rare species and natural communities; areas of “maximum conservation value,” as determined by One North Carolina Naturally; trout waters; floodplains; prime farmlands and strong agricultural operations; and proximity to other places of conservation interest. Each of these aspects of the project area is discussed briefly below.

### **Water Supply III Status**

The entire Upper Pigeon River watershed serves as a water supply area for 4,100 residents of Canton and 1,400 residents of Clyde. It also provides more than 20 million gallons of water per day to Evergreen Paper, Haywood County’s largest private employer. The area is rated by the state as a Water Supply III (WS-III) area, a status reserved for only 5% of the state’s watersheds. As such, the State of North Carolina has placed certain development restrictions on the area in order to limit the amount of impervious surface, especially in the area immediately upstream and surrounding the actual intake for the drinking water supply. The project area includes more than 35 miles of water supply streams, as well as a large portion of the land in the intake area.

### **Rare Species and Natural Communities**

The North Carolina Natural Heritage Program has identified four aquatic species of interest within the project area:

- Appalachian elktoe mussel (*Alasmidonta raveneliana*)
- Wavy-rayed lampmussel (*Lampsilis fasciola*)
- Hellbender salamander (*Cryptobranchus alleganiensis*)
- Olive darter (*Percina squamata*).



Appalachian elktoe mussel  
Photo by Brian Tompkins, USFWS



Wavy-rayed lampmussel  
Photo by Brian Tompkins, USFWS

The Appalachian elktoe is listed as endangered by both the federal government and the State of North Carolina. The wavy-rayed lampmussel is a North Carolina species of special concern. The hellbender and the olive darter are species of special concern for both the State of North Carolina and the federal government.

Given this assemblage of rare species and other aquatic diversity in the area, the North Carolina Natural Heritage Program has identified the West Fork of the Pigeon below Lake Logan and the main stem of the Pigeon River above Canton as an aquatic Significant Natural Heritage Area. These same areas have been designated by the U.S. Fish and Wildlife Service as critical habitat for the endangered Appalachian elktoe mussel.



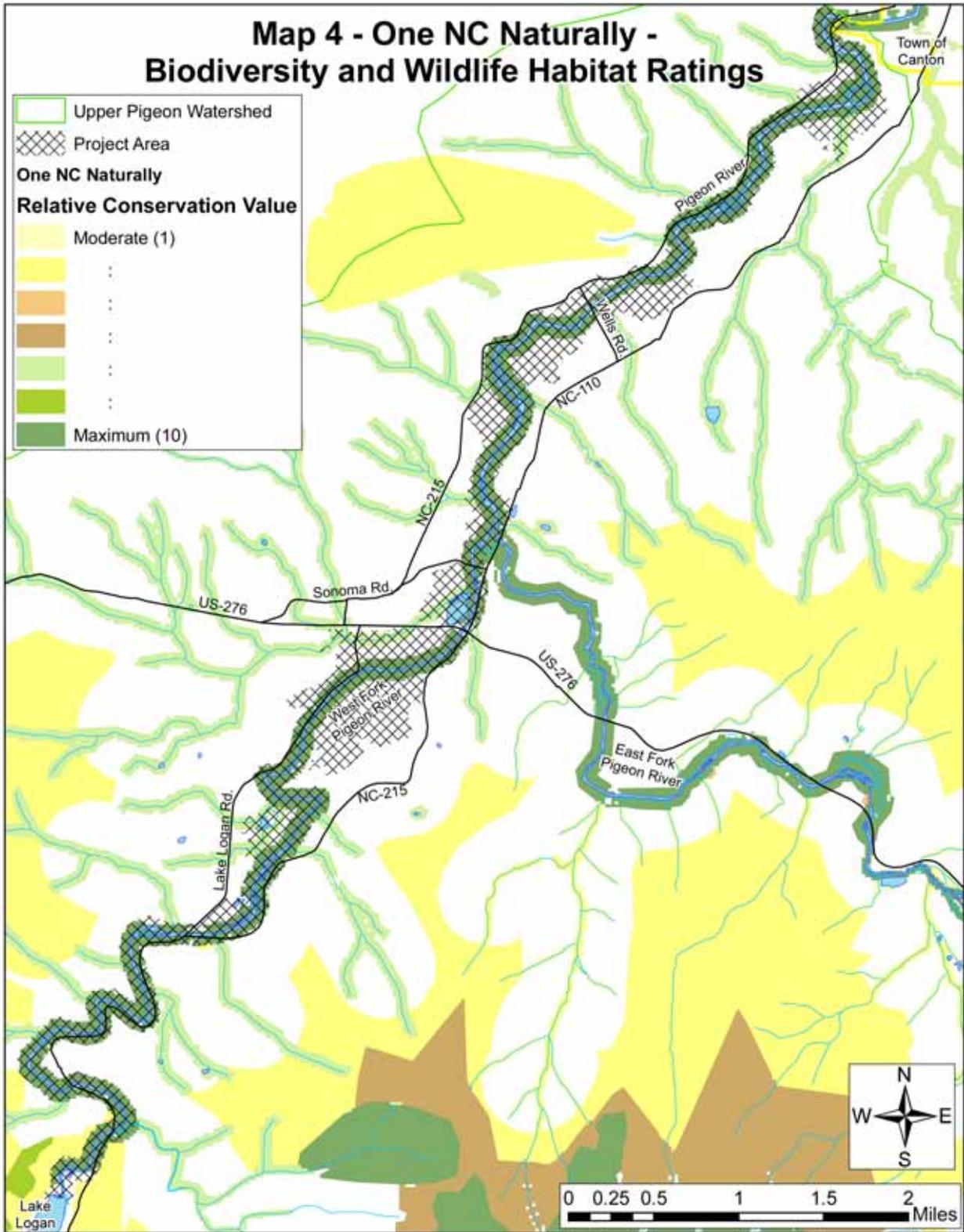
Hellbender salamander  
Photo by Nikki Maxwell, Univ. of Tennessee

Last but not least, the lands surrounding Lake Logan, including several acres of the project area, have been identified as terrestrial Significant Natural Heritage Areas by the North Carolina Natural Heritage Program for their extensive Low Elevation Acidic Glade community, as well as smaller examples of mature Chestnut Oak Forest and Rich Cove Forest.

### **One North Carolina Naturally**

The North Carolina Department of Environment and Natural Resources (NCDENR) has developed the One NC Naturally program to help coordinate land conservation efforts throughout the state. As part of that effort, they have developed a “Planning Tool” to help identify and prioritize certain lands and waters in North Carolina that have been deemed essential for conservation, and it currently includes six different assessment maps (One NC Naturally).

While their Biodiversity and Wildlife Habitat Map addresses a wide range of rare species and natural communities, it is worth noting that most of our project area matches up very closely with their maximum conservation value (i.e., 10 on a scale of 10). (See Map 4 for details.) Given the literature cited on pages 8 and 9 of this plan, we are hopeful that NCDENR will consider revising their maps to give the entire floodplain priority status rather than stopping at the 300-foot buffer width. Regardless, Map 4 clearly demonstrates that our plan features one of the highest priority areas in One NC Naturally’s conservation planning effort.



## Trout Waters

In addition to its rare aquatic species, the project area plays host to brook, rainbow, and brown trout, as well as many residents and visitors who enjoy fishing. The North Carolina Division of Water Quality has identified 15 miles of waterways in the project area as official “trout waters” (Locascio).

## Floodplains

The project area includes 1,145 acres of 100-year floodplain (Locascio). These lands play an important role in the life-cycle of many species and natural communities (Allan 2004, Wenger & Fowler 2000, Wenger 1999), with resulting impacts on everything from water quality to human life to economic activity (Scott 2006, Brody et al 2007). Floods have inundated parts of the project area 17 times in the last 132 years, an average of one flood every 7.8 years (TVA 1966, USGS), including two major floods in September 2004. Any reduction or loss of floodplain function in the project area can have significant negative impacts on both the people and nature of the area.



Two major floods occurred in September 2004.  
Photo by Haywood County Planning Department

## Prime Farmlands and Agricultural Operations

The flooding frequency of the river and the lowland geography of the floodplain contribute to the high concentration of rich farmland soils within the project area, including 960 acres of prime farmlands and 53 acres of statewide important farmlands – a total of more than 64% of the project area (Locascio). As a result, the project area hosts extensive agricultural activity, especially produce production (primarily tomatoes, peppers, and cucumbers).

In one very clear indication of the significance of these agricultural riches, this farming area has been included as part of the 28 regional priorities of Blue Ridge Forever, a cooperative effort by 10 local land trusts and three national organizations that are working together to prioritize and protect important landscapes in a 25-county region of Western North Carolina (Blue Ridge Forever).

While agriculture is viewed by some as the greatest threat to water quality, several studies suggest that future development presents the greater risk (Scott 2006, Paul & Meyer 2001, Wenger 1999). Development also threatens the other benefits

provided by these highly productive farmlands, including fresh food, farm jobs, cultural heritage, scenic views, tourism, tax revenue, and more (Mathews 2008).

### **Proximity to Other Places of Interest**

The upper end of the project area starts at Lake Logan, which was the site of recent land protection efforts totaling 4,400 acres (funded in part by Clean Water Management Trust Fund Grant #1998B-007). In turn, the areas around Lake Logan border vast sections of the Pisgah National Forest and the nearby Middle Prong and Shining Rock Wilderness Areas. The Shining Rock Wilderness borders the Crawford Creek conservation area, which drains into the East Fork and which the Clean Water Management Trust Fund helped protect through a 1998 grant to the Conservation Fund (Grant #1998A-201). The Blue Ridge Parkway guards the very top of the watersheds of both the East Fork and the West Fork.



The lands above Lake Logan include thousands of acres of protected lands, including portions of the Pisgah National Forest and Blue Ridge Parkway. Photo by George Ivey.

Also, the Clean Water Management Trust Fund recently approved a \$1 million grant (Grant #2006A-014) to protect the Pigeon River corridor between Canton and Clyde, and this section of the watershed lies immediately downstream of our project area.

By planning for and implementing the effective conservation of the river corridor in this section of the Upper Pigeon River Valley, we will help fill a critical gap in the sequence of protected lands running from the Blue Ridge Parkway all the way to Clyde.

## **Water Quality in the Project Area**

We have established a clearly defined project area, and we have listed the many reasons it deserves conservation attention. Next we must determine the current and future threats that may place these resources at risk.

We began this threat analysis by evaluating recent water quality data collected in or immediately upstream of the project area, including direct analysis of the water's physical and chemical properties, as well as the biological assessments of the benthic macroinvertebrate fauna and fish communities (please see Appendix B for additional details on collection points and results). The data collected present a generally positive picture:

- The Haywood Waterways Association's Volunteer Water Information Network (VWIN) has two sites in or immediately upstream of the project area; both sites have rated excellent overall for nine years in a row (Romaniszyn; Westphal et al 2007).
- The most recent biological surveys conducted by the North Carolina Division of Water Quality (NCDWQ) indicate a generally healthy benthic community. The lower end of the project area (Pigeon River at Hwy 215 above Canton) received a Good rating in 2006, and the upper end (West Fork Pigeon River at Lake Logan) was rated Excellent in 2007 (NCDENR 2008a).
- NCDWQ also conducts ambient monitoring of physical and chemical attributes. Both the Canton and West Fork sites have the highest Use Support Rating of "Supporting" for Aquatic Life, Water Supply, Fish Consumption, and Recreation purposes (NCDENR 2005).
- The Tennessee Valley Authority's biological samples from the project area have generally been among the best in Haywood County (HWA 2002). TVA's May 2008 biological samples at two sites within the project area resulted in ratings of fair and good (Vaughn 2008).

While these results and standards are not entirely consistent across agencies, sampling methodology, sampling locations, or time, they paint a picture of a river that is in fairly good health. As a result, it should come as no surprise that none of the streams in the Upper Pigeon River watershed are listed as impaired by the U.S. Environmental Protection Agency.

In addition to this general water quality analysis, we reviewed other data and consulted with a variety of experts to determine whether there are existing water quality concerns due to erosion and sedimentation, hydrological alteration, inadequate streambank vegetation, chemicals, nutrients, and fecal coliform bacteria.

One key source of information for this analysis included the Tennessee Valley Authority's Integrated Pollutant Source Identification program, or IPSI. The IPSI system utilizes aerial photography and infrared imaging to identify features that impact water quality within a watershed, such as eroding roads and streambanks and inadequate streamside vegetation. We have also consulted with the members of Haywood Waterways Association's Technical Advisory Committee, a collection of agency and other experts, both individually and as a group. We have briefly summarized this research below.

## Erosion and Sedimentation

Erosion and sedimentation have risen to the top as the most significant stresses to the aquatic system in the project area. The Haywood Waterways Association states that, “As in so much of the nation, sediment from non-point sources is the most significant pollutant [in the Pigeon River watershed]” (HWA 2002). An official with NCDWQ agrees that this is true for the section of the Pigeon River watershed that is the focus of our project, saying that “sedimentation from development, road erosion, streambank erosion, and agriculture would likely be the main water quality issues in the Upper Pigeon” (Williams 2008).

The 2006 IPSI analysis confirms these statements by determining that sources of sediment in the entire Pigeon River watershed in Haywood County include the following:

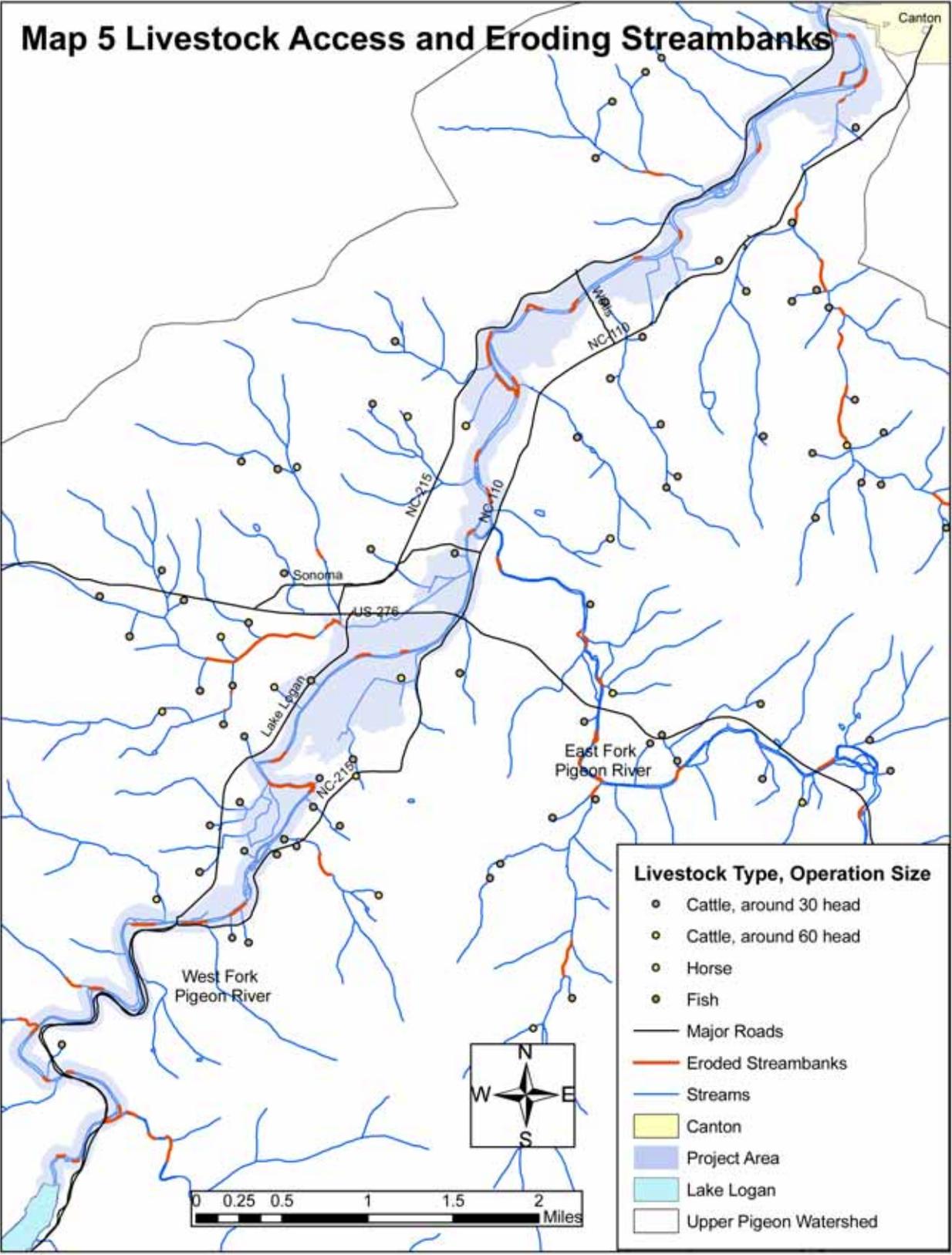
- roads (road banks and unpaved roads) – 46%
- eroding streambanks – 36%
- pasture – 6%
- livestock access points – 4%
- row crops – 3%.

It is reasonable to expect that our small project area would yield similar results.

Since eroding streambanks have such direct impacts on turbidity and sedimentation in our waterways, we are particularly concerned with this issue. Approximately 4% of the Upper Pigeon River watershed streambanks are eroding, compared with a watershed average of 5% (Romaniszyn). Curiously, through further analysis, we find that there is zero correlation in the project area between eroding streambanks and livestock access to streambanks, as shown on Map 5.



Eighty-two percent of all sedimentation in the Pigeon River watershed results from roads and eroding streambanks. Left photo by George Ivey; right photo by Haywood Waterways Association.



Therefore, it is more likely that the eroding streambanks result largely from a combination of hydrological alteration and streambank scouring, as well as areas of inadequate streamside vegetation to help stabilize the streambanks. The issues of hydrological alteration and streamside vegetation are both discussed in greater detail below.

It is important to keep in mind that erosion and sedimentation are not major or catastrophic concerns at this time. Though the project area definitely has some areas in need of attention, this portion of the Upper Pigeon River watershed is in generally good shape, especially compared to similar sub-watersheds (HWA 2002).

### **Hydrological Alteration**

Changes to the natural hydrological system present a number of stresses to the project area, including increased rates of stormwater; lower base water flows; alterations of the natural height, frequency, and duration of flood events; streambank scouring, failure, and resulting sedimentation; and more. The sources of this alteration include an increase in impervious surfaces (paved and gravel roads, parking lots, houses, businesses, and other structures); dams; residential groundwater withdrawals; raised roadways and other earthen berms that constrict or otherwise alter the floodplain; and placement of fill in the floodplain. Water used for crop irrigation can also affect base water flows, since irrigation occurs most when water is scarcest; however, the switch to drip irrigation within the project area has significantly reduced the amount of farm-related water withdrawals compared to twenty years ago (Smathers 2008).

Various regulations limit certain types of hydrological alteration. Using flood insurance rate maps developed by the Federal Emergency Management Agency, Haywood County places various development restrictions on both the floodways and floodplains (Haywood County). Floodways are those portions of the floodplain that are closest to the river or stream that continue to carry floodwater downstream, even during a flooding event. In other words, the floodway has flowing water in a flood event rather than still water. The floodplains, on the other hand, are those areas that tend to hold and store floodwaters. County ordinances place development restrictions on both floodplain and floodway lands, with the most stringent restrictions reserved for the floodways.

Also, since the Upper Pigeon River watershed has Water Supply III status, state and county regulations generally limit impervious surface throughout the Upper Pigeon River watershed to 24% of each property. This regulation has certainly helped limit the amount of development in the project area.

However, several different studies show that impervious surface cover of only 10-20% can double rates of runoff and degrade streams in numerous ways, from enlarged stream channels to reduced biological diversity and increased nutrient loading (Wenger et al 2008, Scott 2006, Tong & Chen 2002, Paul & Meyer 2001, Walsh et al 2001, Booth & Jackson 1997). Paul and Meyer found that some of these impacts appear when only 1% to 4% of a watershed is impervious (2001). Wenger and others

discovered that some fish species approach an occurrence probability of zero in streams where the watershed is only 2% impervious (2008).

With IPSI data indicating that approximately 5% of the Upper Pigeon River watershed is already impervious, the project area is undoubtedly already seeing the effects of hydrological alteration. Add in an upstream dam (at Lake Logan), groundwater pumping from hundreds of homes in or near the project area, several miles of earthen berms, a variety of buildings, and truckloads of fill already placed in the project area, and you have a system that is already stressed from a hydrological standpoint.

Despite the WS-III, floodplain, and floodway regulations, additional development and additional hydrological alteration is likely, both in the floodplain outside the floodway and in the upland areas surrounding the project area. These ongoing land use changes are a source of great concern for water quality in the Upper Pigeon River.

### **Marginal and Inadequate Streambank Vegetation**

Streamside vegetation provides numerous benefits to aquatic systems, including filtering of runoff; shade and moderation of water temperatures; stabilization of streambanks due to deeper root systems; inputs of woody debris; and much more (Allan 2004, Buffler 2005, Wenger & Fowler 2000, Wenger 1999, Johnson & Buffler 2008). Marginal or inadequate streamside vegetation, on the other hand, can lead to unfiltered runoff, greater extremes in water temperature, less stable streambanks, less diverse aquatic habitat, and more.

The IPSI analysis includes an evaluation of streamside vegetation. Their analysis includes three categories: adequate, marginal, and inadequate. Factors used to determine these ratings include the type of vegetation (e.g., woody or grassy), the percentage or quality of cover, and the width of the vegetation (0 to 100 feet). (See charts on page 36 for additional detail.) Their figures, based on 2006 data, indicate that 17% of the streams studied in the project area have marginal or inadequate streamside vegetation on one or both banks (Locascio).

While we are encouraged to know that the vast majority of the streams studied in the project area have adequate vegetation on both banks, we clearly have room for improvement in terms of bringing streamside vegetation up to the “adequate” standard. Further, in areas with steeper slopes, it may be desirable to extend the width of streamside vegetation beyond the “adequate” standard, because IPSI considers most vegetation adequate at widths of only 67-100 feet, regardless of slope.

### **Chemicals**

NCDWQ prepared a 2003 basinwide assessment report for the French Broad River basin that states, “Agricultural areas with heavy insecticide use (especially

orchards or tomato farming) often had Fair or Poor benthos ratings” (NCDENR 2003). However, their Canton sampling site, which lies downstream of significant areas of produce operations, shows consistent bioclassification ratings of Good-Fair and Good (and one Excellent) over the last 15 years (NCDENR 2003, NCDENR 2008a). Farmers in this area have in fact been very progressive in implementing a number of efforts to reduce the threat from chemicals, from improved handling facilities to changes in pesticide choices (Smathers 2008). Furthermore, the Technical Advisory Committee of the Haywood Waterways Association did not think that chemicals would be a major source of concern (HWA 2008), and none of NCDWQ’s samples of metals or nutrients at the Canton site exceeded acceptable standards (NCDENR 2007).

Of course, we still have a variety of chemical inputs to consider, from the reduced, but regular use of biocides on farms to increasing biocide use on ever-expanding residential areas to potential catastrophic spills from tankers on roadways or accidents at area gas stations. However, the threat from chemicals is clearly not seen as a high priority for action.

### **Nutrients**

We know of at least three National Pollutant Discharge Elimination System (NPDES) permits in or near the project area that involve nutrient-rich discharge; scores of locations of septic systems near streams; and numerous locations near the project area where cattle have direct access to streams. All of this data suggests that excess nutrients could be a source of major concern for water quality in the project area. However, we have found no suggestion from the data or agency officials that nutrients are creating any significant water quality problems at this time.

### **Fecal Coliform**

Neither of NCDWQ's ambient monitoring sites in the project area exhibited problems with fecal coliform bacteria (NCDENR 2003). More recently, an official with NCDWQ agreed with this finding that fecal coliform is not a current concern within the project area (Williams 2008).

## **Conclusions from the Water Quality Analysis**

We see from the data and from subject experts that stresses to the aquatic system do exist (especially erosion and sedimentation, hydrological alteration, and inadequate streamside vegetation). However, since water quality in the project area is still good, we conclude that these stresses do not have a *significant* impact on the Pigeon River at this time. We can certainly take steps to address these existing impacts in a prioritized and cost-effective manner, and we will detail those restoration strategies later in this plan.

However, we also see a system that is subject to tremendous development potential that would likely, significantly, and irreversibly damage the project area and the resources that make

it so worthy of conservation attention. Haywood County's population is expected to grow by 18% from 2000 to 2020, or roughly 12,000 people and literally thousands of additional home sites (NCDENR 2005).

For that reason, we conclude that the primary strategy for maintaining water quality and aquatic resources is to minimize future development of lands in the project area, rather than to address existing water quality concerns. We will not ignore the need for restoration, but we must focus first on prevention/protection.

This emphasis on prevention/protection is embraced by Scott in his recent article in *Biological Conservation*:

“A more holistic and proactive conservation effort to sustain southern aquatic ecosystems must involve identification of early impacts and their causes on a landscape scale, then setting policies and establishing management practices that prevent degradation of habitat and loss of ecological integrity from occurring” (Scott 2006).

The next section of this plan identifies those areas that deserve the lion's share of the prevention/protection activity, as well as those lands that should receive priority consideration for restoration work.

## **PRIORITY SETTING**

The project area includes only 1,575 acres, or 1.9% of the 83,177 acres of the Upper Pigeon River watershed. As discussed earlier, this corridor has numerous values that make the entire area worthy of conservation attention (see “Why Is the Project Area Important?” starting on page 12). However, due to variations within the project area, as well as the continuing bottleneck of conservation funding, it is both possible and necessary to prioritize some of the project area lands for prevention/protection activity and restoration activity.

Before getting to the differences, however, it is worth noting some commonalities shared by all waters and lands within the project area. For instance, all 35 miles of rivers and streams in the project area are Water Supply III waters. Also, all lands in the project area have relevance to water quality protection, because they lie within 300 feet of either the West Fork or the main stem of the Pigeon, and/or because they lie within the 100-year floodplain of the river. These common conservation values serve as the foundation upon which we determine higher priorities.

### **Priority Lands for Prevention/Protection Work**

We can utilize five variables to help determine which lands deserve priority attention for protection from the many impacts of development:

- streams (especially trout waters and the water supply intake area)
- rare species and natural communities
- wetlands
- hydric soils
- proximity to protected lands.

While Maps 6 through 10 identify the locations of these features, we want first to provide a narrative discussion of each item.

#### **Streams**

As stated above, all streams in the project area are Water Supply III streams. However, two features justify priority consideration of properties that border or include certain stream segments: state-designated trout waters and the critical area immediately upstream of the water supply intake.

NCDWQ uses the “trout water” classification to protect streams and rivers that “have conditions which shall sustain and allow for trout propagation and survival of stocked trout on a year-round basis” (NCDENR 2008b). Fifteen of the 35 miles of streams and rivers in the project area have been designated by the state as trout waters (Locascio).

NCDWQ also designates distinct locations as “critical areas” for each drinking water supply. These critical area rules apply to the area within a half mile of a WS-III

water supply intake, and they include strict limitations on impervious surfaces and other land uses – certainly much more strict than the rules for the rest of a WS-III watershed (NCDENR 2008c). Although these regulations substantially limit activities that can degrade water quality, they do not entirely prohibit these activities. Common sense suggests that the critical area should be given priority conservation attention if and when the opportunity arises. Furthermore, the critical area above the Canton intake is also among the 15 miles of trout waters in the project area.

All lands bordering trout waters deserve higher conservation priority, with the critical area near the water supply intake deserving the highest priority. See Map 6 for additional detail.

### **Rare Species and Natural Communities**

Areas with or bordering habitat for rare aquatic species also deserve higher consideration. Within the project area, these areas include lands along the West Fork of the Pigeon below Lake Logan, a small portion of the East Fork that lies in the project area, and the main stem of the Pigeon River down to the town of Canton, a total of approximately 12.6 river miles.

The project area also includes 35 acres of terrestrial Significant Natural Heritage Areas near Lake Logan (Locascio). However, terrestrial features are not a primary focus of this plan, especially since these lands have already been protected by the State of North Carolina. Their value in this priority-setting exercise will be incorporated later in the discussion of proximity to protected lands. See Map 7 for additional detail.

### **Wetlands**

Wetlands are valuable in terms of holding heavy rains and stormwaters and filtering runoff. The mountains of Western North Carolina have never had extensive wetlands, and where they have existed, many acres have been converted to agricultural use. As such, they have lost some of their ecological values. Nevertheless, the National Wetlands Inventory (NWI) suggests that 110 acres of wetlands remain in the project area (Locascio), including everything from seepage areas to abandoned stream channels (Rodgers). Ground-truthing may be necessary to confirm the presence or absence of wetlands in these areas, because the NWI data was based on aerial photo interpretation, and therefore, may be somewhat inaccurate (Rodgers). Regardless, wherever wetlands occur in the project area, they deserve priority conservation attention. See Map 8 for additional detail.

### **Hydric Soils**

The USDA Natural Resources Conservation Service separates soils according to several different characteristics, such as slope and existing plant cover. They also group soils in terms of their runoff-producing characteristics. Hydric soils have the highest infiltration rate when thoroughly wet, and therefore, also have the lowest runoff

potential. These soils are deep, well-drained, and usually consist of sandy or gravelly soil. Other soil groups, such as clay soils or those that have bedrock close to the surface, are much more likely to produce runoff (USDA 1997).

*The Upper Pigeon River Flood Protection Plan*, published in March 2008, places priority status on hydric soils, because they have the greatest potential to hold heavy rains and floodwaters. Given the close ties between runoff, flooding, and water quality, we believe we are justified in giving priority to hydric soils in this plan, too.

Our project area includes five hydric soil types, which encompass 991 of 1,575 acres of the project area (Locascio). See Map 9 for additional detail.

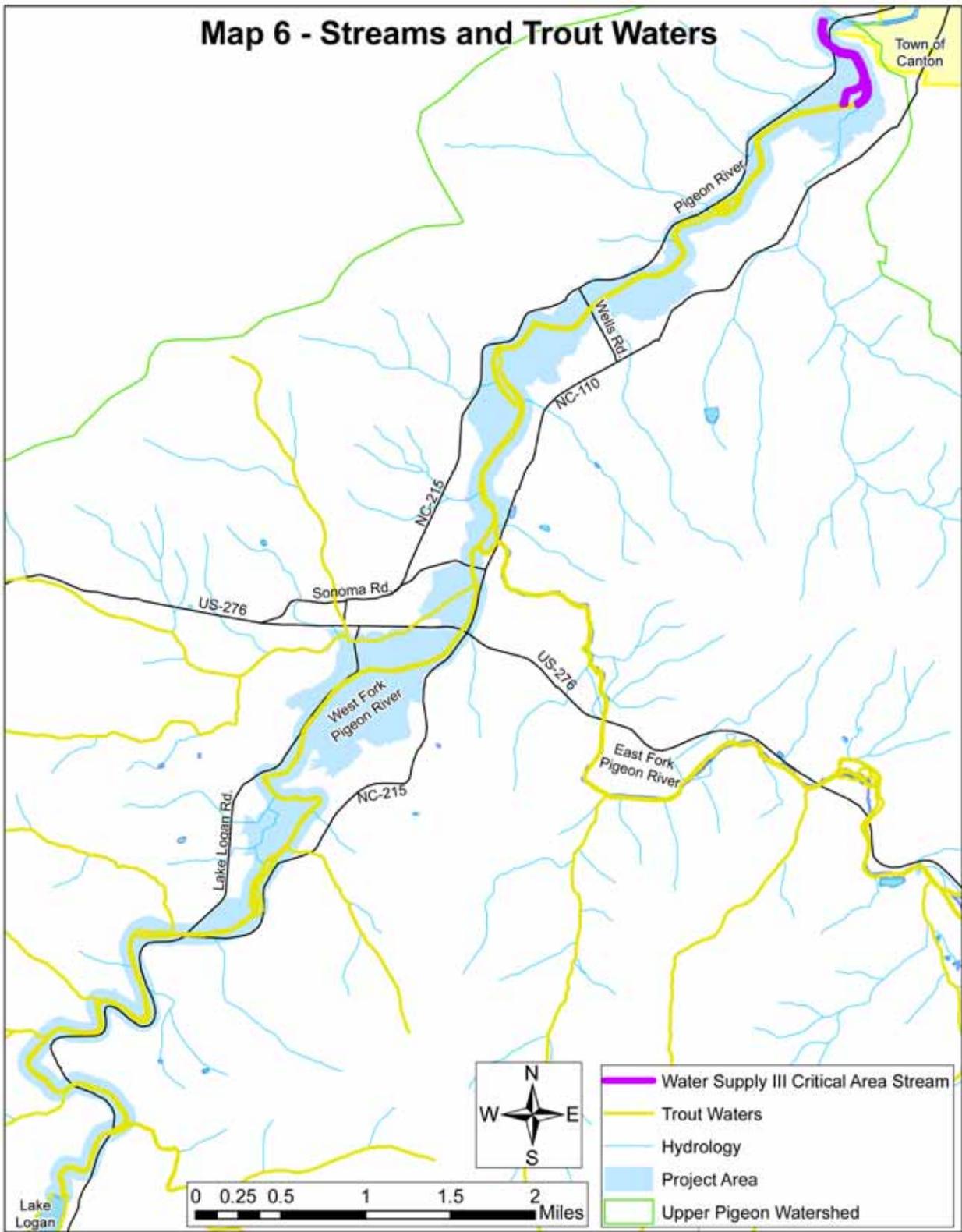
### **Proximity to Protected Lands**

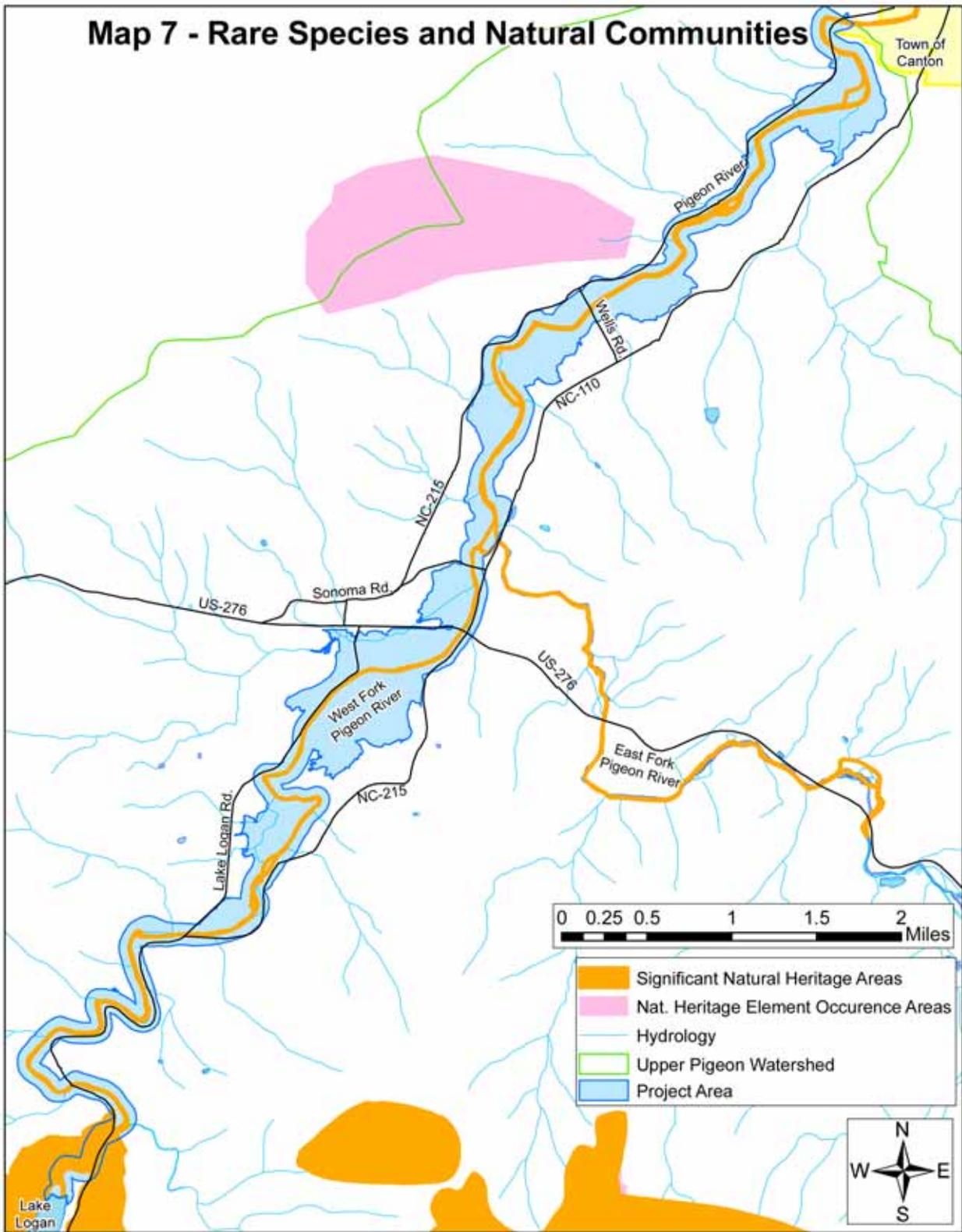
Lands that border previously protected lands deserve some added consideration, because large blocks of protected land are preferable to an equal amount of isolated parcels. The benefits of consolidated protected areas range from ecological (e.g., birds that nest in interior forest areas need large blocks of contiguous forest) to administrative (e.g., fewer borders to monitor).

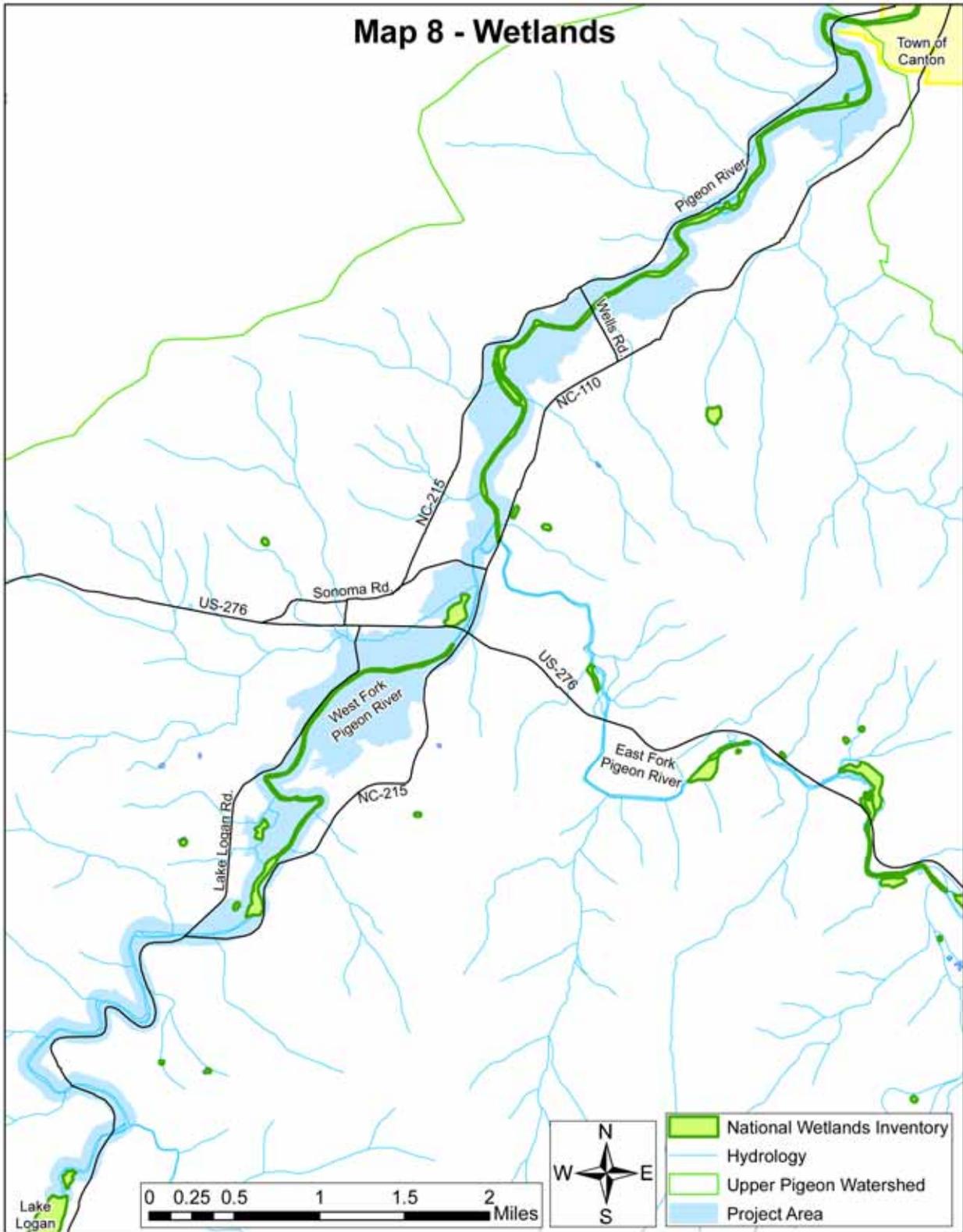
Within the project area, permanently protected lands are few. The State of North Carolina owns 35 acres of land near Lake Logan, which it considers a Significant Natural Heritage Area. Haywood County owns five small tracts totaling approximately 6.5 acres that were secured through buyouts of flood-damaged properties following the 2004 floods; these buyout lands are located in two clusters, one near the confluence of the East and West Forks and the other much closer to Canton.

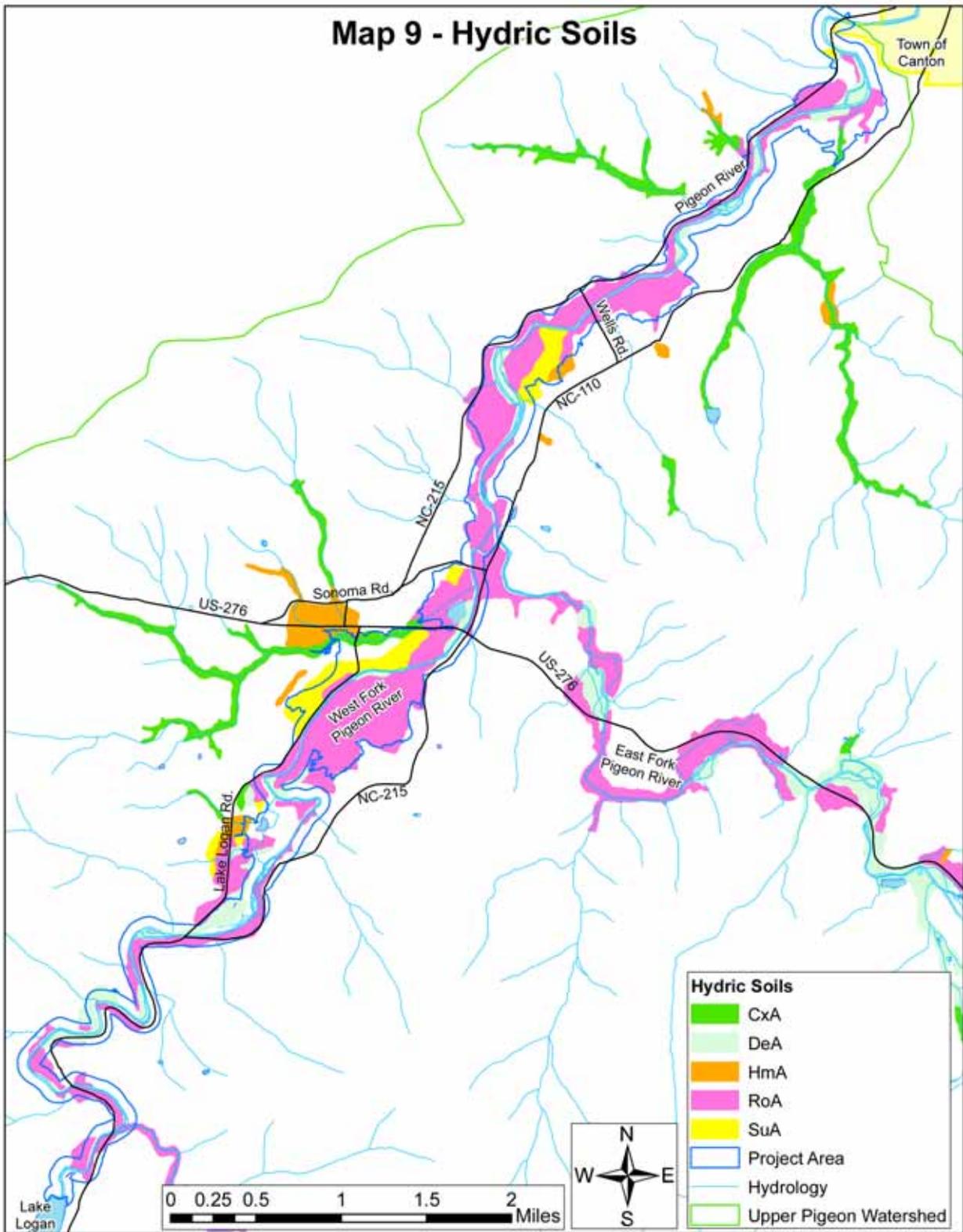
Through a relatively new conservation tool, the Enhanced Voluntary Agricultural District (EVAD) ordinance, several landowners have voluntarily restricted development on their lands for irrevocable 10-year terms. While this designation is not permanent, it represents an interest in long-term land conservation that may become permanent over time. As such, these lands (which currently total approximately 586 acres in the Upper Pigeon River watershed, including approximately 47 acres in the project area (Locascio)), and the lands near them, may form core areas for protecting large swaths of the project area for the long term.

See Map 10 for additional details regarding protected lands in or near the project area.

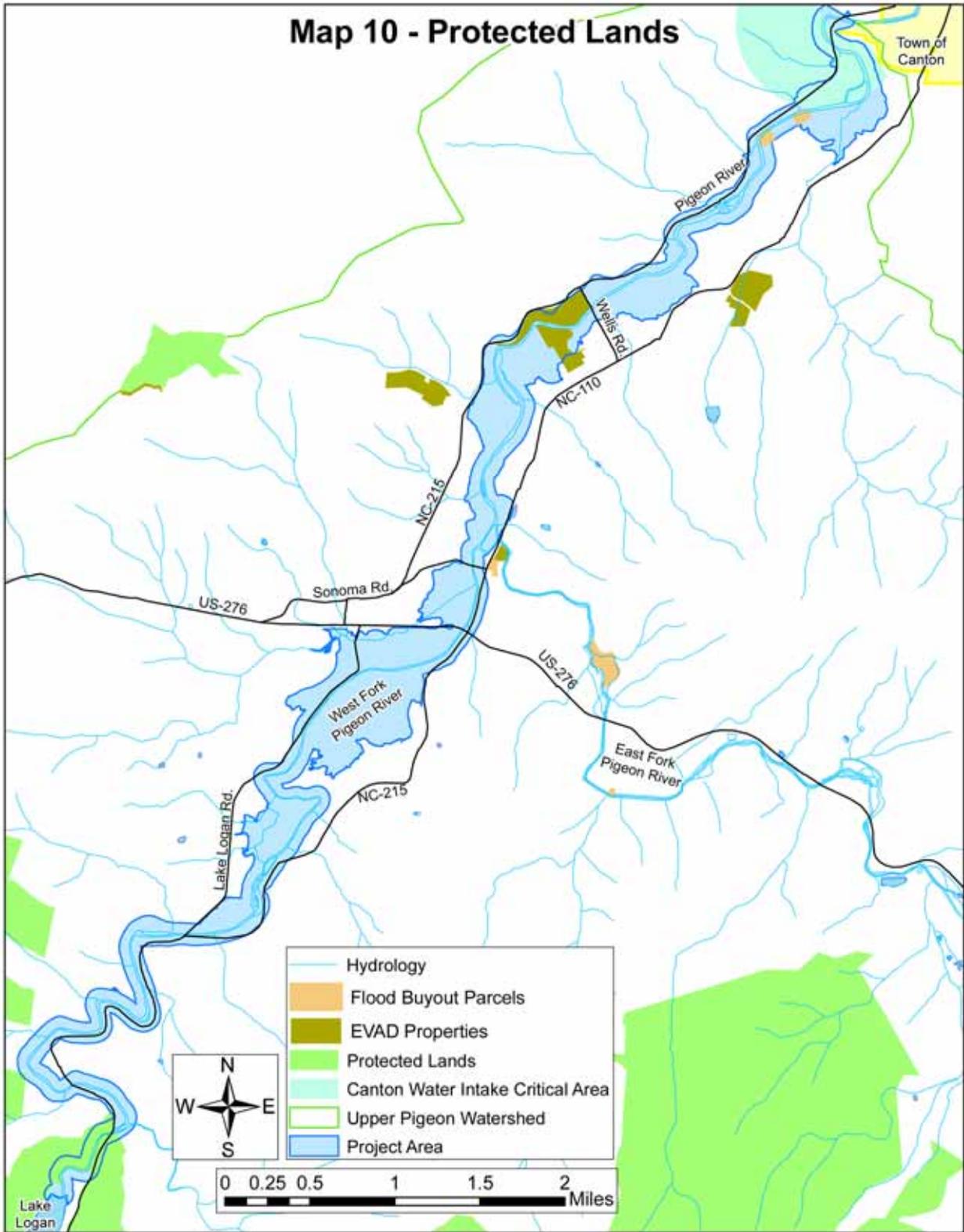








Additional details on each of these hydric soil types are available in the *Soil Survey of Haywood County Area, North Carolina, USA 1997*.



## **Summary of Priorities for Prevention/Protection Activity**

### *Highest Priority Conservation Areas*

Through these maps, we can see that the lands along the West Fork and main stem of the Pigeon River enjoy the strongest case for conservation, including:

- water supply waters (especially the ½-mile critical area near the water supply intake)
- trout waters
- significant areas for rare aquatic species.

No other parts of the project area enjoy such a strong overlap of priority-setting factors. Therefore, the lands along these 5.1 miles of the West Fork and 7.5 miles of the Pigeon River deserve the greatest conservation attention, with the critical area above the water intake deserving the very highest consideration.

### *Medium Priority Conservation Areas*

On a second tier are those lands that contain or border other areas of conservation interest:

- all other project area streams (approximately 23 miles), especially the 2.5 miles that serve also as trout streams
- wetlands
- hydric soils.

Proximity to previously protected lands should not be considered a priority-setting factor in and of itself. However, proximity to protected lands may serve as a useful tie-breaker when resources for conservation are scarce.

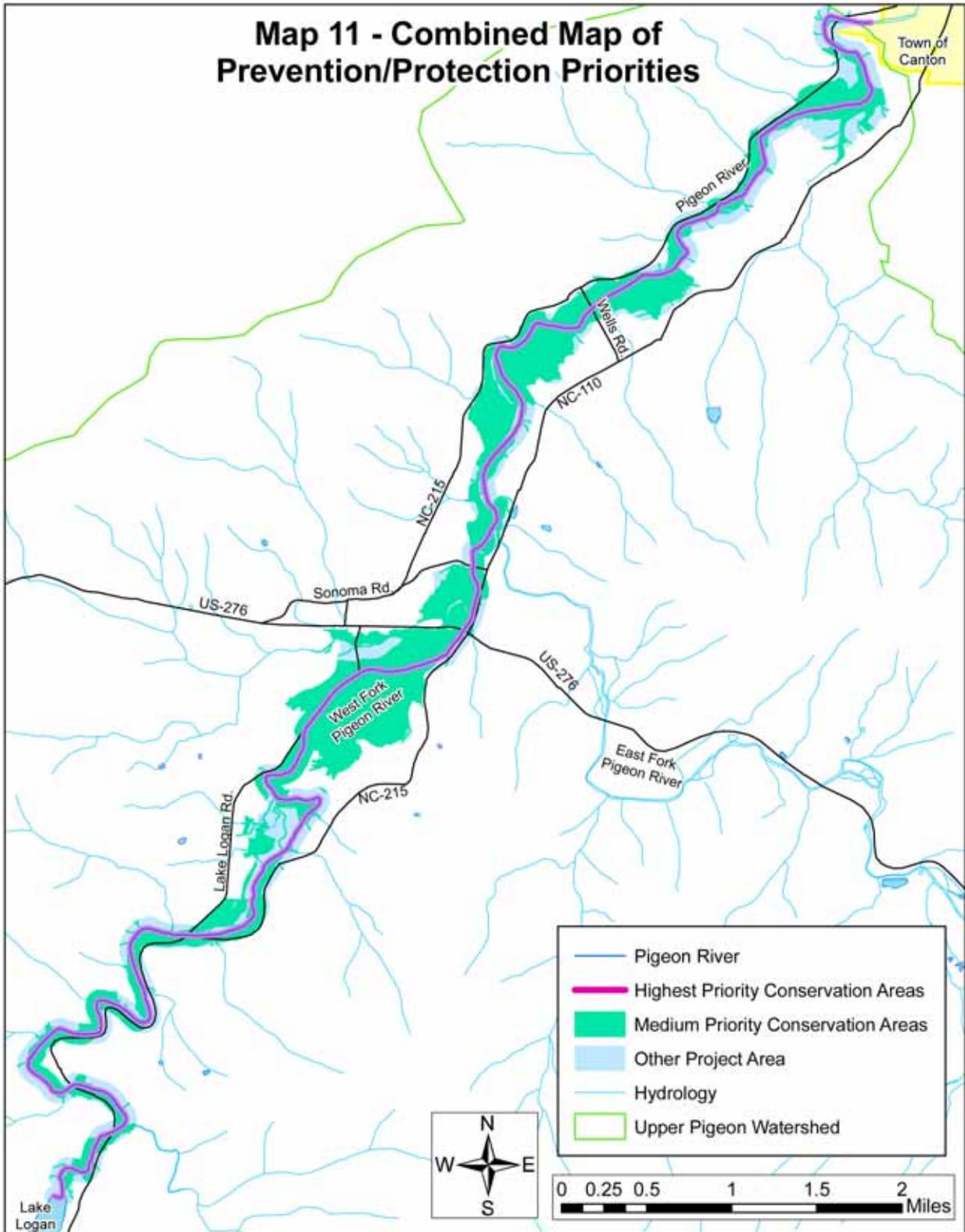
### *Non-Priority Areas*

Approximately 126 acres within the project area have none of the values listed above (Locascio), so they rank the lowest in terms of conservation priorities.

Last and least, any lands anywhere in the project area that have extensive development features (e.g., roads, parking lots, permanent structures) should not be (and, logically, cannot be) a subject of significant prevention/protection work. Of course, some of these developed lands may deserve attention in terms of restoration activity, but that is a topic for the next section of this plan.

Please see Map 11 for a spatial display of these prevention/protection priorities.

# Map 11 - Combined Map of Prevention/Protection Priorities



## **Priority Lands for Restoration Work**

As discussed earlier, water quality remains very good in the project area, so we are more focused on a strategy of preventing degradation from future development rather than addressing existing water quality concerns. However, we should not entirely ignore current sources of pollution.

We can prioritize our restoration activities based on the three primary water quality issues listed earlier in this plan:

- Erosion and sedimentation
- Hydrological alteration
- Marginal and inadequate streambank vegetation

In the following pages we will discuss each of these water quality concerns in greater detail. We have also provided maps of some of the specific locations that deserve restoration attention. However, it is important to remember that some of these water quality concerns occur broadly over the project area (e.g., erosion), and therefore, they cannot be perfectly mapped.

Also, while this plan focuses on the 1,575 acres of the project area, we must keep in mind that a large percentage of these stresses to the system originate in the 33,000 acres of private lands that lie upstream of the project area. Those lands are beyond the scope of this plan, but they deserve analysis and attention at some point in the future.

### **Erosion and Sedimentation**

Sources of erosion include eroding streambanks, unpaved roads and eroding road banks, pasture, cropland, and construction sites. Some of these erosion sources, such as eroding roads and streambanks, have been mapped with precision through the IPSI program, while others are non-point sources that are difficult to map or are temporary in nature, such as construction sites. The IPSI analysis suggests that eroding streambanks are the source of 36% of the sedimentation in the Pigeon River watershed, and erosion from these areas has the most direct impact on turbidity and sedimentation in the river. Therefore, we rate eroding streambanks as the most important threat to address, especially in those areas that rank highest in the prevention/protection discussion above (i.e., the lands along the West Fork and main steam of the Pigeon River). At the same time, cost-effective strategies for reducing erosion and sedimentation exist for other sources of sediment as well, so it is feasible to address almost any source of sediment in or upstream of the project area. See Map 12 for additional details.

### **Hydrological Alteration**

Changes to the natural flow of water upstream of and within the project area are numerous, including dams, earthen berms, and a variety of impervious surfaces that

range from roads and parking lots to houses and other buildings. Our primary concerns with these changes include increased stormwater flows and altered flooding patterns.

Many of these alterations can be mapped, such as dams and earthen berms along farm edges and underneath major roads in the floodplain. The project area includes approximately 5.5 miles of earthen berms (Manning). See Map 13 for additional details on these areas. While these areas are easy to locate, reducing or at least breaching these earthen berms may prove politically or financially infeasible, as we will discuss in greater detail in the strategy section later in this plan. When possible, though, these efforts should focus first on the highest priority sections of the project area (i.e., the West Fork and the main stem of the Pigeon River).

We do not have the resources to map out all of the impervious surfaces within or upstream of the project area, but aerial photography illustrates how these lands have already been altered.



This aerial photograph demonstrates the mixture of land use within the project area boundary (shown by the yellow line), as well as the amount and variety of impervious surfaces, including roads, parking lots, driveways, and rooftops. Fortunately, large areas of pervious lands remain, including forests and farmlands.

If natural areas can be thought of as sinks for heavy rains and floodwaters, then impervious surfaces can be considered as faucets. As natural areas are converted to impervious surfaces, sinks become faucets, so that more water is running off and less

area is available to receive it. Unlike earthen berms, however, impervious surfaces can affect water quality during the countless less-than-flood events, but they can also be addressed at fairly low cost. For these reasons, efforts to reduce runoff from impervious surfaces (vs. an effort to eliminate dams and earthen berms) should prove to be the more practical way to reduce existing hydrological alterations in the project area and thus protect water quality.

### **Marginal and Inadequate Streambank Vegetation**

The lack of adequate streamside vegetation can reduce the filtering of runoff, increase thermal pollution, and reduce inputs of woody debris into the streams and river.

Through the IPSI program, researchers have already identified those areas that have only marginal or inadequate streamside vegetation. They use the following chart to determine their rankings:

#### Woody Vegetation

	Cover (%)		
	0-33	34-66	67-100
Width (in feet)			
0-25	I	M	A
26-100	I	M	A
>100	I	M	A

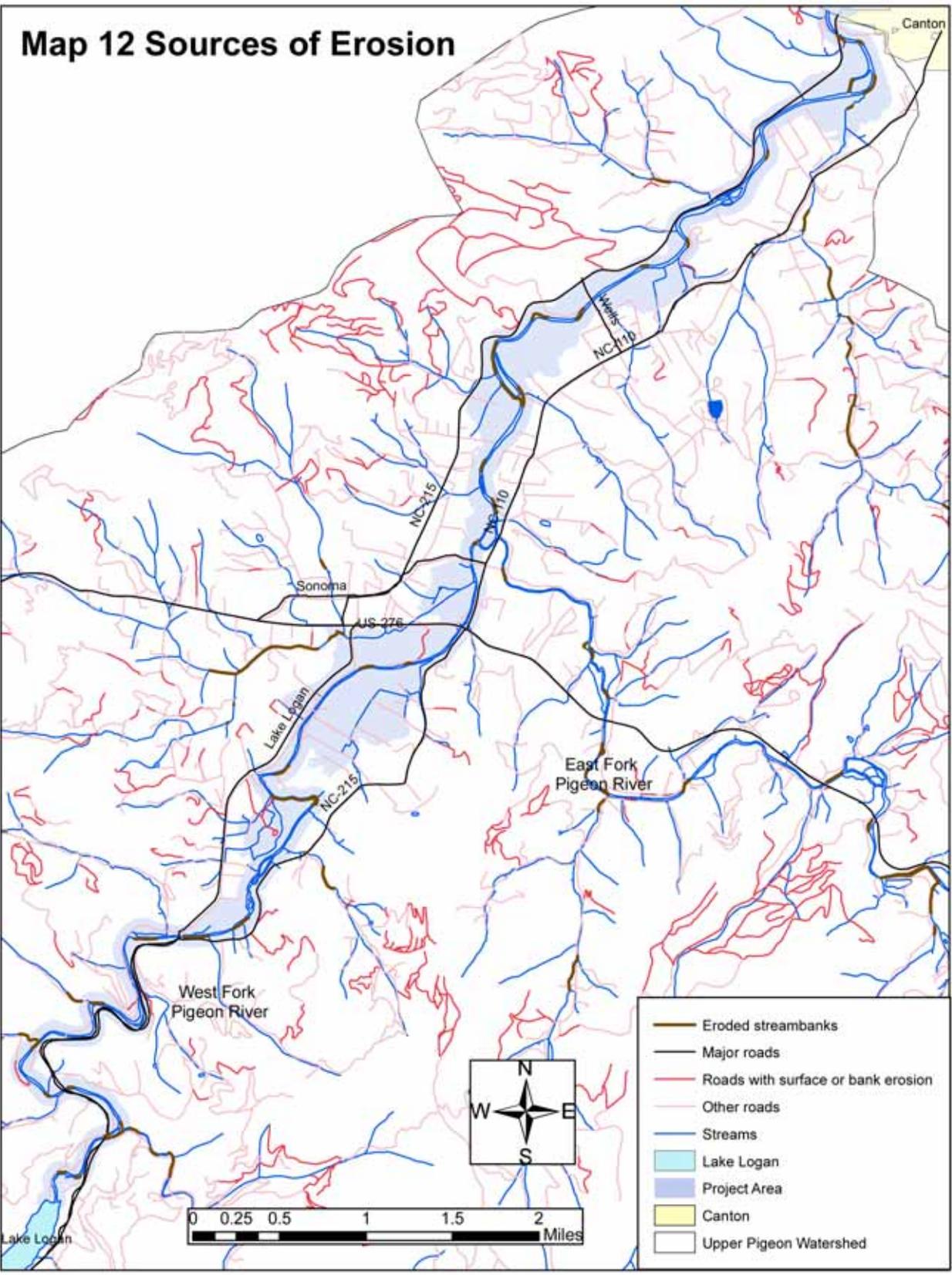
#### Grass Vegetation

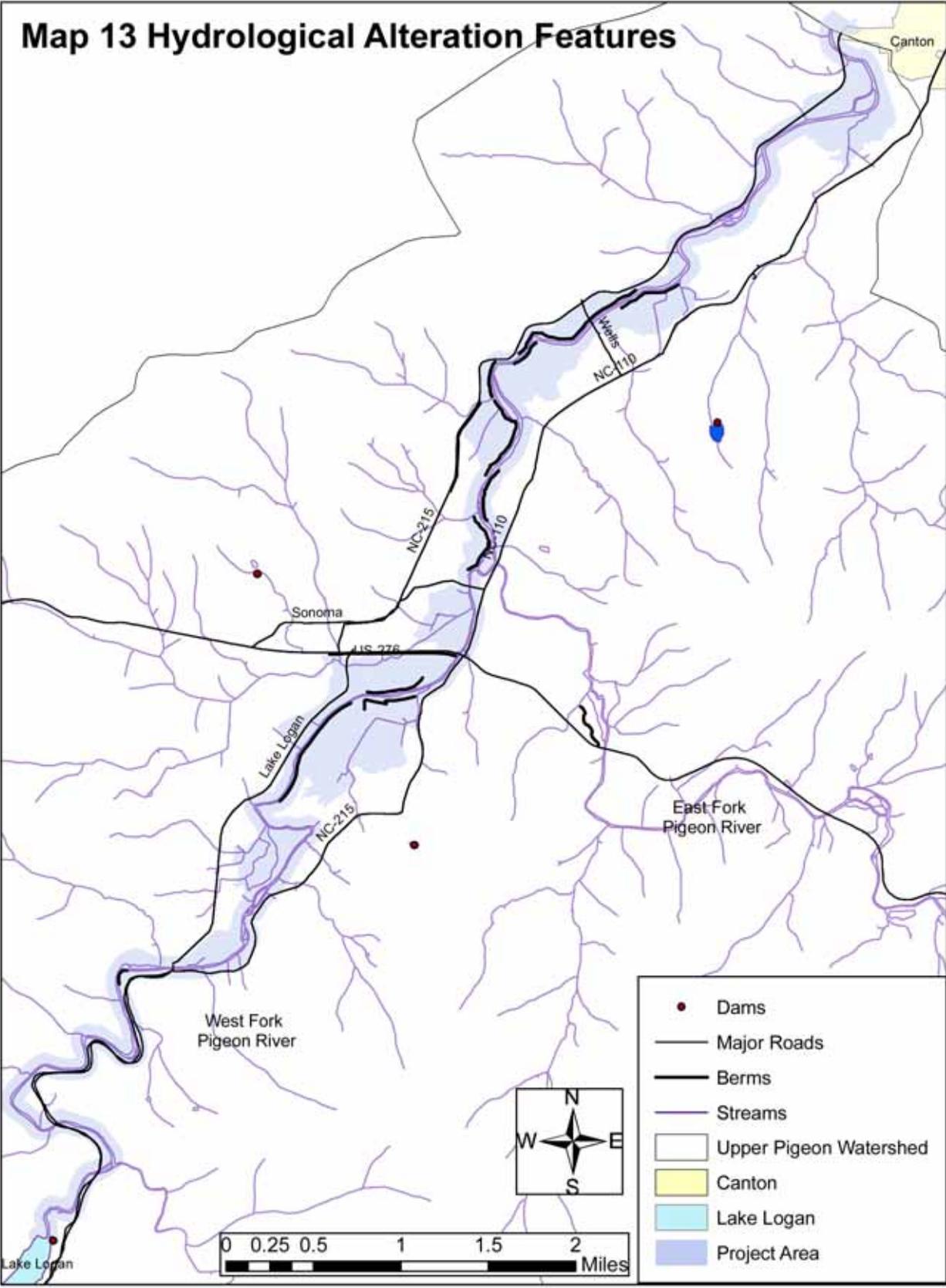
	Cover (%)		
	Poor	Moderate	Good
Width (in feet)			
0-25	I	M	M
26-100	M	M	A
>100	M	M	A

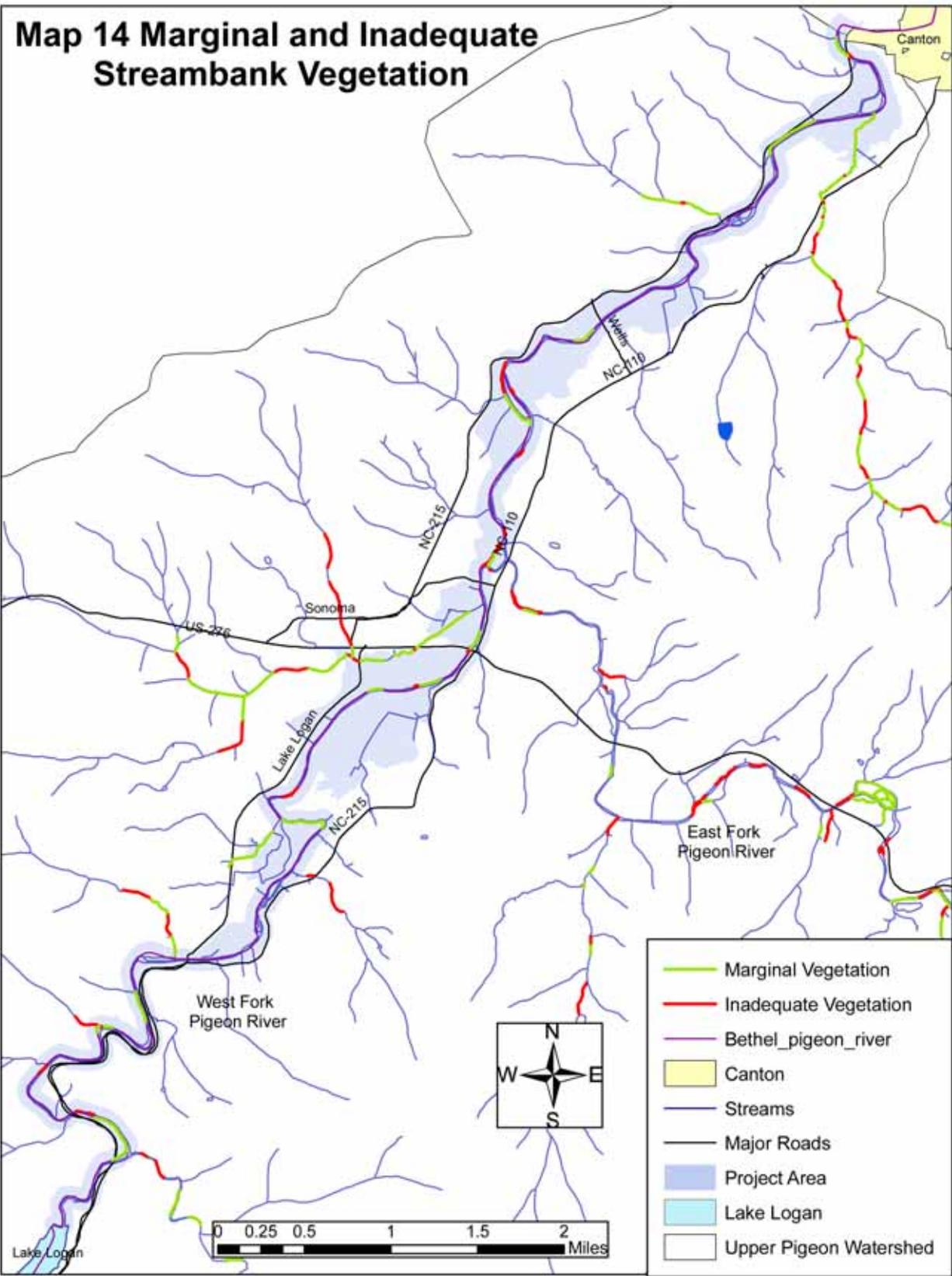
I = inadequate; M = marginal; A = adequate

Further, they have analyzed the streams throughout the Pigeon River Watershed on each side of each streambank. As a result, we have very detailed information to guide any efforts to improve streambank vegetation. See Map 14 for additional details.

Of the major stresses to the system, this one is perhaps the easiest and most cost-effective to address, although establishing tall woody vegetation does take time. These efforts should focus first on those lands along the West Fork and the main stem of the Pigeon River, especially for those areas deemed “inadequate.”







Please note that areas with “adequate” vegetation are not detailed above, because this map focuses only on those areas that might be suitable for restoration work.

### **Summary of Priorities for Restoration Activity**

Earlier in this plan, we reasoned that lands along the West Fork and main stem of the Pigeon River enjoy the strongest case for prevention/protection activity. The same logic applies to the restoration discussion. We should focus restoration activity on those same areas, especially in terms of fixing eroding streambanks and improving streamside vegetation. These areas include a total of 3.1 miles of eroding streambanks, 5.4 miles of marginal streambank vegetation, and 1.4 miles of inadequate streambank vegetation (Manning). (Please note that some of the areas of eroding streambanks and less-than-adequate vegetation overlap.)

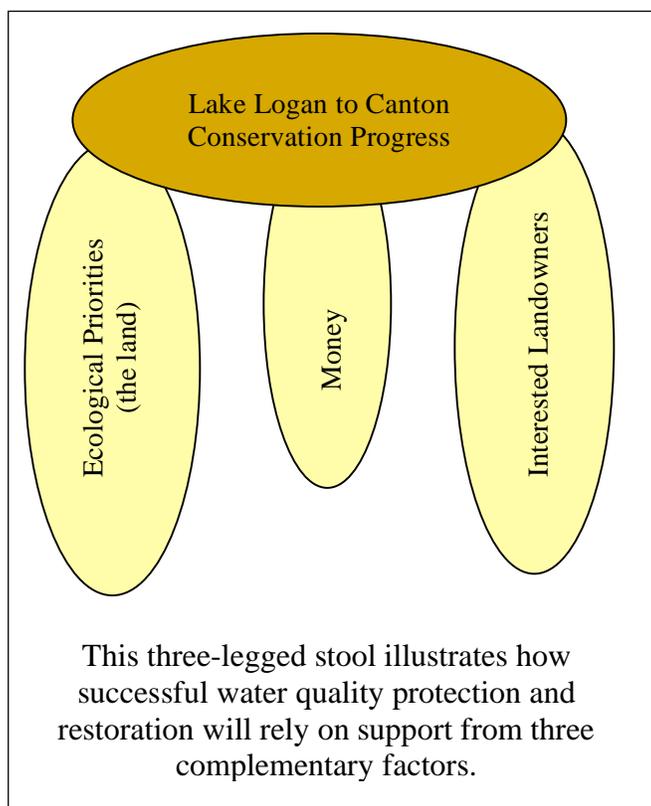
In terms of hydrological alteration, we should focus our efforts on reducing stormwater runoff from existing impervious surfaces throughout the project area, especially impervious surfaces near streams.

At the same time, we must acknowledge these stresses on the system extend well beyond the project area. We will have opportunities to address other sources of erosion and sedimentation, hydrological alteration, and inadequate streamside vegetation in the uplands as well, and those opportunities should be acted on when resources allow.

## THE THREE-LEGGED STOOL OF OPPORTUNITY

Although many river corridor protection plans specify individual parcels for priority action, this one does not. We have clearly identified several general areas for attention, such as the lands along the West Fork and the main stem of the Pigeon River. However, we feel that any further stratification of these lands is meaningless if the individual landowners have no interest in protecting or restoring these lands, and/or if financial resources for such work are lacking. In reality, these variables of landowner intention and financial capacity are largely unknown and likely to change. Furthermore, we do not want to suggest in any way that there is any plan to “target” individual land parcels or individual landowners for any forceful action to protect or restore these lands, because the local community does not support any such approach.

Using a concept first presented in *The Upper Pigeon River Flood Protection Plan*, we have adopted the image of a three-legged stool to show a less specific but more realistic approach to achieving our water quality objectives. As shown in the diagram below, all three variables – the land, the landowners, and the money – must be considered together. We cannot protect priority ecological features without willing landowners and adequate financial resources. Meanwhile, if a landowner is interested, but wants to protect non-priority lands, efforts to protect such lands will only distract attention from projects that are more feasible and more effective. Lastly, if we have an interested landowner, who has land with priority ecological features, but we can’t find the necessary funding, forward progress is very unlikely. These three factors – the land, the landowners, and the money – are complementary, and effective implementation of this plan will rely on combining these factors consistently from property to property and year to year.



## **SOLUTIONS**

We have identified four key areas of action to safeguard water quality and aquatic life in the project area:

- Prevention/protection
- Restoration
- Education
- Coordination/facilitation.

The text below includes more detailed discussions of each of these priority strategies. In order to highlight and emphasize certain issues and action items, we have underlined any text that suggests particular points of emphasis, specific actors, and/or particular actions.

### **Prevention/Protection Strategies**

Because future development poses the greatest threat to water quality in the project area, we believe our primary activities must focus on protecting project area lands from more intensive land uses. To achieve these goals, we will employ a wide variety of protection tools that go beyond the standard ideas of easements and acquisition.

Also, we will embrace agricultural lands as a key part of this prevention/protection strategy. The majority of the lands in the project area are agricultural, including cropland, pasture, hayfields, horticulture operations, aquaculture operations, and forest lands. Local people rely on these lands for income, jobs, and maintenance of their cultural heritage. The wider community benefits from their fresh food, scenic views, support for tourism, and tax revenue (Mathews 2008).

In terms of both water quality and water quantity issues, these agricultural lands provide a much better alternative to the many water quality impacts associated with development (Allan 2004). The North Carolina Division of Water Quality states it quite succinctly: “Urban growth poses one of the greatest threats to aquatic resources more than any other human activity” (NCDENR 2005). Meanwhile, Crawford & Lenat (1989) concluded that for all indicators (sediment, nutrients, metals, fish, and invertebrates), urban streams are more heavily impacted than either forested or agricultural streams. These differences are especially true if best management practices are in place, including the maintenance of an adequate vegetated buffer between the land activity and the nearest waterways (Moore & Palmer 2005, Wang et al 2001).

In addition, “impacts of urban land use are clearly experienced at considerably lower percentages of catchment area than is true for agricultural land use” (Allan 2004) and are not linearly related to development rate. According to Paul & Meyer (2001), “although total urban land use occupies a smaller area globally, it is having disproportionately large effects on biota when compared with agriculture.” Thus, losing agricultural tracts to development will almost certainly result in declining water quality.

Agricultural lands also present a more cost-effective approach to land conservation than exclusively “natural” areas, especially in terms of easements, as we will explain a little later.

(Author’s note: Much of the text below can be found in similar form in *The Upper Pigeon River Flood Protection Plan*, which addresses the same general geographic area, suggests a similar range of strategies, and was written by the same primary author. Due to these commonalities, the narrative text regarding strategies in these two plans is necessarily similar in many places, though not identical.)

### **Short-term Protection Tools**

“Protection” can take many forms, and we are fortunate to have several low-cost and voluntary tools available to help initiate land protection discussions and activities. Haywood County, the Bethel Rural Community Organization, landowners, and other partners must make maximum use of these low-cost, voluntary, short-term land protection tools:

- Present Use Tax Valuation – This program helps reduce property taxes on land that supports agriculture or wildlife. Four categories of land (agricultural, forestry, horticultural, and wildlife) have specific criteria for the tax break.
- Voluntary Agricultural Districts – VADs are county-based programs that allow farmers to voluntarily keep their farms as part of a local agricultural district in exchange for certain benefits that mostly address possible development pressures. Lands in “basic” VAD status are enrolled for 10-years, but the landowner can withdraw the land from the program with a simple written notice.
- State and Federal Conservation Programs – Through a variety of cost-share programs, government agencies will pay landowners to implement certain best management practices on their farmlands and forestlands. The length of the agreement can vary, from only a few years to 15 years or more.

One disadvantage of these tools is that they are generally very short-term in nature. Landowners may be able to leave each of these programs with as little as a 30-day written notice, although they may incur some sort of financial expense for doing so (e.g., having to pay several years of property taxes or having to reimburse some of the expenses of certain cost-share practices). However, when a developer offers a high price to purchase such land, the sales price will likely dwarf these “early withdrawal” penalties.

On a more positive note, though, these short-term land protection tools encourage landowners to think about the future and to give protection a trial run. Whereas moving from no protection to permanent protection may seem like too much change too fast, these short-term tools can serve as stepping stones to longer commitments. A few months can turn into a few years, and then the idea of a more permanent conservation commitment is not as daunting.

These short-term measures offer two other primary benefits. First, they are voluntary. The landowner is not forced to accept any of these measures. Therefore, when landowners choose one of these options, they have done so because they think it's a good idea, not because someone forced their hand. And if they choose short-term protection, they are more likely to consider longer-term solutions.

Second, these voluntary, short-term protection terms provide time for partner agencies and organizations to identify other resources for longer-term solutions. Even when the landowner is interested in long-term solutions, it can take months or years to find the necessary funds to protect a particular piece of land through acquisition or a conservation easement. These short-term tools can help stabilize the land use while the other pieces fall into place.

### **Mid-term Protection Tools**

Two land protection tools, one short-term and one long-term, have been modified in order to create mid-term options. As with the short-term options, these are voluntary, not permanent, and do not require a lot of money to implement. Also, these mid-term options help stabilize land use while the landowner considers permanent approaches and while partner organizations and agencies search for funding and other resources for permanent protection. As with the long-term options, these mid-term tools require the landowner to make a longer commitment.

- Enhanced Voluntary Agricultural Districts – Enhanced VADs are similar to the basic VADs, except that EVADs have a few additional benefits, and the 10-year commitment is irrevocable.
- Term Agreements (also called Term Easements) – Similar to conservation easements (discussed in greater detail below), term agreements are voluntary and legally binding agreements that limit certain development on a property for a certain number of years in exchange for a cash payment (either annual or lump-sum). Term agreements can be designed to maintain the landowner's right to use the land for agricultural or forestry activities. Payment for a term agreement is much less than the payment for a permanent conservation easement. For example, a 20-year term agreement may be valued at only 20% of a permanent conservation easement, a 30-year term at 30%, and so on. Unlike a conservation easement, term agreements offer no tax breaks.

Agencies and organizations should give greater attention and priority consideration to lands enrolled in these Enhanced VAD and term-easement programs, because these landowners are clearly interested in long-term protection. In the case of the Enhanced VAD program, the landowners are willing to go so far as to voluntarily restrict development on their land without any cash compensation for at least 10 years. These sorts of commitments merit higher consideration over others who have taken no such voluntary action. As a matter of fact, North Carolina law encourages state grant-

making agencies to give priority consideration to landowners participating in EVAD programs (North Carolina General Assembly 2005).

### **Long-term Protection Tools**

Since landowners and land regulations can and will change over time, the most effective strategy to protect flood-friendly lands involves acquiring a legal right to those lands in order to ensure limited development – or no development at all. Two primary tools will achieve this legal protection:

- **Fee Title Acquisition** – Acquisition involves a conservation agency or organization buying or receiving complete title to a property. Many lands in the Upper Pigeon River watershed have already been acquired in this manner, including federal lands for the Blue Ridge Parkway and Pisgah National Forest and state wildlife management lands. These agencies may be interested in pursuing additional acquisitions, especially on or near their existing borders. Other groups and agencies may also be interested in acquiring land for recreation, historic preservation, protection of rare species, or other purposes. However, fee title acquisition is expensive (unless a bargain sale or donation is possible), so many groups and agencies are focusing on conservation easements as a more cost-effective land protection tool.
- **Conservation Easements** – A conservation easement is a voluntary, legally-binding, and permanent agreement that limits certain development on a property in exchange for certain federal and state tax benefits and/or cash. Conservation easements can be tailored to suit the landowner’s present and future needs. Through a “working land” easement, for example, a property owner still owns the land and can continue activities related to farming and forestry.

### ***Working Land Conservation Easements vs. Natural Area Conservation Easements***

Since conservation easements, even at full market value, are less expensive than fee title acquisition, they present a more cost-effective approach to land protection. Also, conservation easements on working lands are usually less expensive than easements to protect natural areas, since the landowner is giving up fewer rights with a working land conservation easement (AFT 2008; Lassner 1998). If adequate vegetated buffers are in place, then working land conservation easements may provide many or most of the water quality benefits of a natural area conservation easement, but for a lower cost.

This cost differential is most pronounced in the floodways along the river, which can extend anywhere from almost 0 to 1,000 feet from the riverbank (Locascio). Because development is already almost entirely prohibited in these areas, appraisers may assign a \$0 value to working land easements in floodways, because agricultural and forestry activity already represents the highest and best use of those lands, and a working land easement might not curtail those uses at all (Jacobs; Moore).

Meanwhile, floodplain lands outside the floodway and higher and steeper lands within 300 feet of the river have tremendous development potential and only modest regulations to limit the type and extent of development. The expense of easements in these areas should be higher than in the floodways, but working land conservation easements in these areas should continue to cost less than natural area conservation easements (Lassner 1998).

We believe it is reasonable to expect that natural area conservation easements could cost thousands of dollars per acre more than working land conservation easements throughout the project area. When you multiply that per-acre difference times more than 1,500 acres in the project area, you quickly find that it could cost millions of dollars more to protect the entire project area as a natural area rather than as working lands. Meanwhile, we would lose some of the nation's most productive farmlands, fresh food, jobs, tax revenue, and more. Because water quality in this agricultural area remains in the good range currently, it appears that working land conservation easements present a much more cost-effective approach to protecting the area from the real threat of land development.

For all of these reasons, project partners should focus on working land conservation easements as the most cost-effective, long-term strategy for protecting lands and waters in the project area.

## **Funding**

Having a clearly defined project area and a suite of protection tools isn't enough. We must also have interested landowners, and last but not least, we must also attract the resources necessary to finance these conservation efforts.

As we finish this plan, we have available \$110,000 from the North Carolina Division of Water Resources to protect "flood-friendly" lands in the Upper Pigeon River valley, as well as \$4,500 in protection assistance funds through a grant from the Pigeon River Fund. Some of these monies may be used in the project area, while other funds may benefit lands upstream of the project area. These two grants will allow us to begin to move this plan beyond paper to actual implementation. However, we must identify and secure additional resources if we hope to work with additional landowners to make a meaningful, long-term difference in the Upper Pigeon River watershed.

Below we have summarized some of the resources we might bring to the table:

The Landowner - To begin the cost discussion, we must begin with the landowner and determine what sort of protection he or she wants to pursue (e.g., sale of part or all of the property; conservation easement on part or all of the property; term agreement on part or all of the property). The degree or extent of desired protection will then determine the total potential cost of the project. Further, the landowner must decide whether to seek full market value for the land or easement; to conduct a "bargain sale,"

whereby the landowner sells the land or easement for less than fair market value; or to donate the land or easement. Not every landowner is able to consider a bargain sale or donation. At the same time, it is simply not realistic for all landowners to expect to receive payments for the full market value for every property or easement, because grant money is very limited, with many people competing for the same few dollars. The more the landowner can donate, the more cost-effective – and more feasible – the transaction will be.

State and Federal Grants – There are several state and federal grant programs available to support land protection, including the protection of both natural areas and working lands. Many of these programs focus on water quality and rare species. Others concentrate on other issues that overlap with large portions of our project area (e.g., prime farmlands and scenic viewsheds). In either case, if agency priorities match up with the areas outlined in this plan, land protection has the greatest potential for success, provided that the landowner is interested in pursuing such a project.

A few of the most relevant funding sources include:

- North Carolina Clean Water Management Trust Fund – Properties with significant frontage on streams that support drinking water, endangered species, and trout waters are of greatest interest to the Clean Water Management Trust Fund.
- North Carolina Natural Heritage Trust Fund – Those lands that host the state’s rarest species and rarest natural communities may attract grant funds to help protect those features.
- USDA-NRCS Emergency Watershed Protection Floodplain Easement Program – Through this voluntary program, NRCS may purchase floodplain easements to restore, protect, maintain, and enhance functions of the floodplain and advance other conservation goals such as water quality. Any lands that have a history of repeated flooding (i.e., flooded at least two times during the past 10 years) are eligible. Some timber harvest, periodic haying, and grazing may be allowed under certain conditions (USDA).
- USDA-NRCS Wetlands Reserve Program – This voluntary program provides for long-term conservation agreements to protect, restore, and enhance wetlands on private property. Although the program has not been used much in Haywood County, it is a potential source of support for protecting remaining wetland areas in the project area – and perhaps restoring some marginal wetlands or prior-converted wetlands.
- North Carolina Agricultural Development and Farmland Preservation Trust Fund – Active farm lands, especially those with “prime farmland” or “farmland of statewide importance” may attract a grant for a term agreement (e.g., a 20-year agreement) or a conservation easement. Fortunately, two of the area’s hydric soil types (RoA and

SuA) are also prime farmlands, and one hydric soil type (HmA) is a farmland of statewide importance.

- USDA Farm and Ranchland Protection Program – Similar in effect to North Carolina’s farmland preservation program, this federal program funds easements to help protect active farm operations, especially those with prime farmland.
- Scenic Byway Grants – Lands in the project area that provide scenic views from the Forest Heritage Scenic Byway (Highway 215) may attract a grant for a “scenic viewshed” easement.
- Adjacent landowners (esp. government agencies) – Adjacent landowners may also serve as funding partners, because they have a vested interest in what happens on neighboring lands. This is true for both public and private landowners, though government agencies tend to have more resources available for such work.

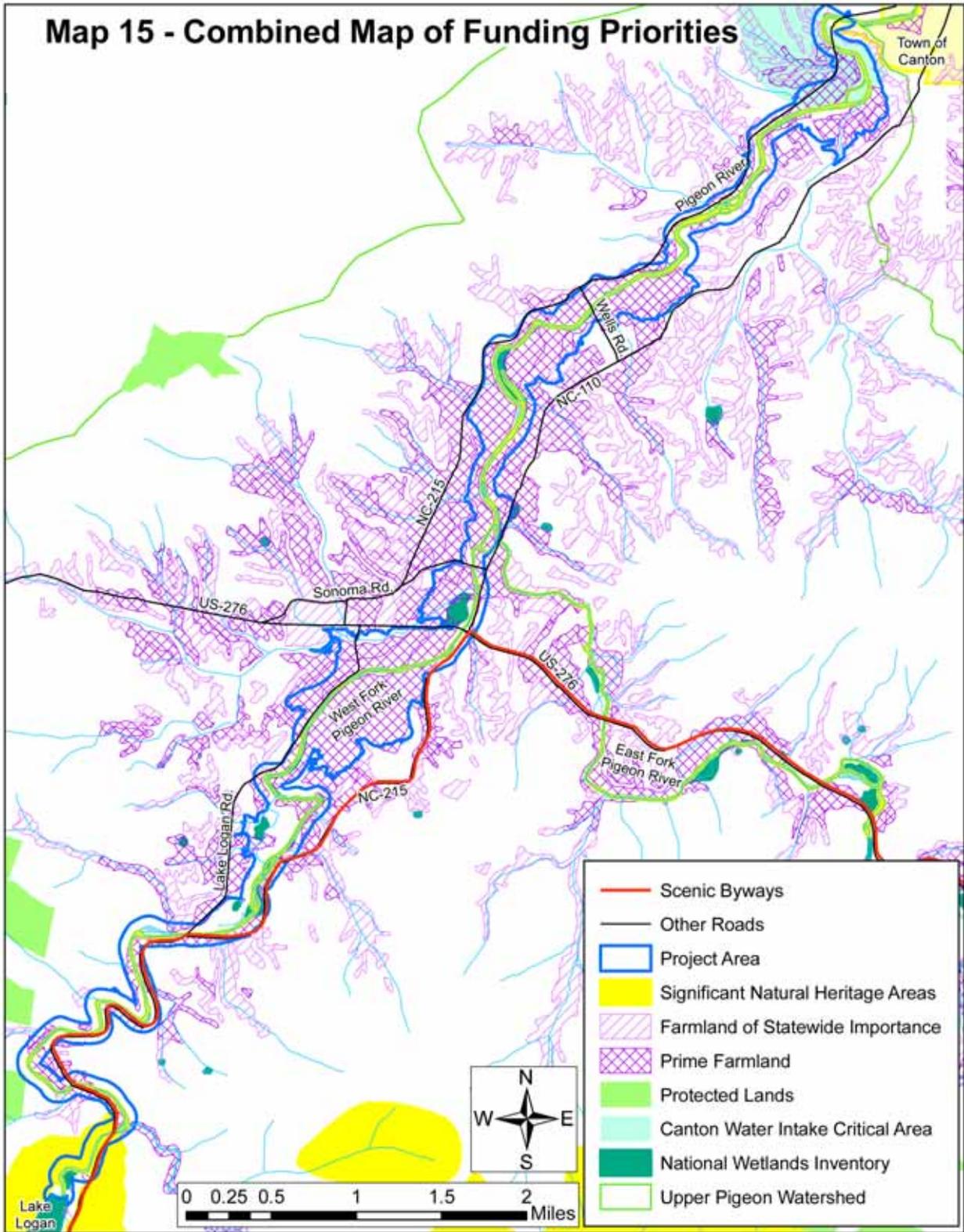
By summarizing these different funding priorities, Map 15 on page 49 helps indicate those areas that are most likely to attract protection/preservation funding.

Of course, state and federal grants rarely pay all the costs of a land protection transaction. Meanwhile, some properties do not currently match up well with the specific priorities of state and federal grant programs. Therefore, it will be necessary to identify and secure additional resources to help fill these gaps, including:

- The Pigeon River Fund
- Haywood County
- The Bethel Rural Community Organization
- Designated funds from federal and/or state appropriations bills
- Individual donors.

While these funding ideas do not include every possible funder, they demonstrate that creative approaches to fundraising can help achieve long-term protection of specific properties.

It’s also worth noting that the land itself and land ownership patterns have roles to play in determining the cost of protecting each property. For instance, the steepest slopes and the lowest floodplain areas have a lower per-acre value compared to flat or rolling land outside the floodplain. Also, in terms of transaction costs, it is more cost-effective to protect one large property than several small ones of similar combined size. These cost variables are not likely to play a major role in protecting lands within the project area, but they must be considered, especially when determining which properties of willing landowners would be the most cost-effective to protect.



## Regulatory Approaches to Reducing Future Development Impacts

Certain regulations already limit development in and upstream of the project area. With some exceptions, the WS-III designation limits development to no more than two dwelling units per acre and limits impervious surfaces to no more than 24 percent of a property. Through other county regulations, developments on or near the floodway are severely restricted, and developments near designated trout streams require certain setback distances from those streams.

These are not the only regulations currently in effect. For a more complete discussion of development regulations in Haywood County, landowners and developers should ask the Haywood County Planning Department for a copy of “What Regulations Affect Land Disturbing, Land Clearing, Development, and Construction Projects?” which was produced by Haywood County and the Haywood Waterways Association. It is also available online at [www.haywoodwaterways.org/wappdf/regulationsaffect.pdf](http://www.haywoodwaterways.org/wappdf/regulationsaffect.pdf).

While regulatory approaches are generally unpopular in the project area, they do help control the expansion of impervious surfaces, the increase of stormwater, and modification of some floodplain areas. Haywood County government may want to consider working with the communities in the project area to strengthen some of these ordinances. In particular, Haywood County might want to explore adopting some of the standards of the more protective Water Supply II designation; providing additional limits on development and/or the placement of fill within any areas of the 100-year floodplain; placing reasonable limits on housing density; and/or adopting stronger stormwater management controls. Any or all of these efforts would help maintain the land’s ability to absorb heavy rains and floodwaters. Many of these issues were discussed and addressed during the recent series of Haywood County Growth Readiness workshops, and the recommendations from that open, county-wide process may provide a useful starting point for exploring these matters further. Copies of this Growth Readiness report, as well as other informative materials from the workshops, are available online at [www.ncsu.edu/WECO/haywood](http://www.ncsu.edu/WECO/haywood).

## Containing Catastrophic Spills

With three state highways, numerous county and private roads, and three gas stations located in or very near the project area, the river faces a small but ongoing threat of a catastrophic spill of gasoline or other hazardous materials. While these events cannot be prevented, they can be contained in a manner that limits damage to aquatic resources. It seems worthwhile to discuss these issues with local emergency response officials, volunteers, and associated businesses, and to work as needed to secure appropriate training and containment materials in order to reduce the chance of a bad situation turning much worse.



Oil on the West Fork. Photo by G. Ivey.

## **Restoration Strategies**

While restoration is not the highest priority strategy for the project area, we do have a few existing water quality concerns that can be addressed in cost-effective ways. We prefer to emphasize voluntary measures, though we recognize that regulatory approaches have been used to help address some of these issues.

### **Erosion and Sedimentation**

The primary concern here is eroding streambanks, while unpaved roads, eroding road banks, cropland, pasture, and construction sites also contribute to these problems. Haywood County does have an erosion control ordinance in place in an effort to reduce some of these problems going forward, but we still must find ways to address existing problems. Fortunately, several partners and funding programs are in place to help address these sources of sedimentation and erosion.

### **Hydrological Alteration**

Existing hydrological alterations in the project area are quite numerous, including everything from dams and earthen berms to impervious surfaces. It is neither desirable nor feasible to eliminate many of these changes to the hydrological system. For instance, we don't anticipate any efforts to remove the dam at Lake Logan, to bridge the entire span of Highway 276 as it crosses through the project area, or to initiate a large-scale program to buy and remove houses, businesses, and other impervious structures.

However, we can work with willing landowners to implement several low-cost measures to reduce the impacts of these alterations, such as:

- breaching earthen berms, especially along the West Fork and the Pigeon River, to restore some of the natural floodplain function of those areas
- installing rain barrels or rain gardens to better manage most of the stormwater runoff from rooftops and parking lots
- varying the releases of water from Lake Logan to better approximate natural fluctuations in seasonal flow and temperature in order to improve hydrological conditions and habitat for certain aquatic species and natural communities.

It's worth noting an irony about berms along farms, in that they hold back the floodwaters that help enrich the farm soil. Unfortunately, almost every flood of the last 132 years has occurred during the growing season, so the floodwaters have also been responsible for destroying many acres of crops. Breaching some of these earthen berms would provide an inexpensive way to restore some of the floodplain function in these areas, but without some sort of compensation for this heightened risk of crop destruction, farmers may, understandably, not embrace this approach.

## **Marginal and Inadequate Streambank Vegetation**

This threat has one of the simplest and least expensive solutions of all of our strategies: plant grasses, shrubs, and trees to extend the height and width of streamside vegetation, especially along the West Fork and Pigeon River.

## **Other Water Quality Concerns**

While chemicals, nutrients, and fecal coliform are not shown to be major water quality concerns in the project area, several best management practices already exist to help reduce these water quality concerns. These issues do not warrant a very pro-active emphasis in our outreach and activities, but there is no reason to ignore these issues when opportunity arises.

## **Partners**

Fortunately, several partners and funding programs are in place to help address these existing water quality concerns. We will continue to work with these partners, especially the USDA-Natural Resources Conservation Service, Haywood Soil and Water Conservation District, Haywood Waterways Association, the Clean Water Management Trust Fund, and the Pigeon River Fund, to identify and fund these restoration efforts, especially those areas along the West Fork and main stem of the Pigeon River.

Of course, landowners can be partners, too, and interested and motivated landowners may be able to implement some of these best management practices on their own (e.g., installing a rain barrel). An excellent web-based resource on this topic, “Stormwater Management for Homeowners,” produced by NC Cooperative Extension, can be found online at [www.p2pays.org/ref/26/25197.htm](http://www.p2pays.org/ref/26/25197.htm). Another great resource is “Stewardship Begins in Our Own Backyards, A Landowner’s Guide to Protecting Our Land and Streams,” published by Haywood Waterways and available online at [www.haywoodwaterways.org/wappdf/stewardship.pdf](http://www.haywoodwaterways.org/wappdf/stewardship.pdf). Landowners can also consult with the agencies and organizations listed above.

As more people consider and adopt these measures, their positive impacts will become more and more substantial. Furthermore, voluntary action to mitigate the impacts of development will also reduce both the likelihood and perceived need for regulatory approaches.

## **Education Strategies**

This plan includes useful information about both the problems at hand and the possible solutions to those problems, but the plan itself is only one stepping stone toward effective conservation of the project area. We must share the ideas in this plan with elected officials; with a variety of federal, state, and local agencies and organizations – especially those with financial resources to help implement the land protection strategies; with more than 400 landowners; and with other interested individuals. All of these people and groups have a role to play in turning this plan from sheets of paper into actual land conservation and water quality protection.

From press releases and brochures to group meetings and presentations to one-on-one landowner contact and assistance, outreach on both the challenges and solutions must continue. Fortunately, many agencies and organizations are already working and will continue to work to spread the word about many of the ideas included in this plan, through both financial and in-kind support. These groups and agencies include the Bethel Rural Community Organization, Haywood County (especially the Haywood County Planning Department and the Haywood Soil and Water Conservation District), USDA-Natural Resources Conservation Service, Southwestern NC RC&D Council, the Haywood Waterways Association, the Southern Appalachian Highlands Conservancy, the NC Division of Water Resources, the Clean Water Management Trust Fund, the Pigeon River Fund, others named throughout this plan, and a few we may not have mentioned here.

## **Coordination and Facilitation**

The strategies outlined above don't happen on their own. They require coordinated action. For 2008 and part of 2009, the Pigeon River Fund has provided a \$25,000 grant to the Southwestern NC RC&D Council to aid the Bethel Rural Community Organization in its efforts to conduct group and one-on-one outreach on water quality issues and land conservation options; these funds also enable additional fundraising to assist landowners in achieving their land conservation goals. Meanwhile, through government allocations and additional grant funding, the Haywood Soil and Water Conservation District and the Haywood Waterways Association (among others) help coordinate a wide number of protection, restoration, and educational activities that have numerous positive impacts on the project area.

Funding for these catalyzing activities beyond 2008 and 2009 is less certain, and without continued funding for these coordination and facilitation efforts, project implementation will likely lose its impetus and focus, and many land protection possibilities that are in discussion will stall and perhaps fail. The Bethel Rural Community Organization, Haywood County, the Southwestern NC RC&D Council, the Pigeon River Fund, and other federal, state, and local partners will need to work together to ensure adequate funding for basic project coordination and facilitation until this plan has been successfully implemented.

## **CONCLUSION**

This plan has a lot in common with other riparian corridor conservation plans, including a focus on aquatic resources and the protection and restoration of water quality. It differs from other plans by considering the entire 100-year floodplain in the planning area (rather than only a 300-foot buffer); by focusing on agricultural areas as part of the solution rather than part of the problem (using scientific data and research to support this approach); and by focusing on practical implementation strategies (like finding interested landowners and adequate financial resources), rather than a pie-in-the-sky list of parcels to “target.” Again, we are thankful that the Clean Water Management Trust Fund has shown some flexibility to allow us to explore these issues, and we are hopeful that other projects and other funders will review these discussions and consider a more comprehensive attitude toward floodplains, farmlands, and implementation.

In the end, we believe our planning approach results in a more realistic plan to achieve the goals of protecting water quality and aquatic life while also sustaining a vibrant agricultural community that provides fresh food, jobs, tax revenue, scenic views, rich cultural heritage, and more. By finding ways to work together, we can achieve our shared goals.

## **APPENDIX A – DATA SOURCES FOR MAPS**

All maps and related spatial data in this plan were produced by Glen Locascio, GIS Specialist in the Asheville office of the North Carolina Division of Community Assistance, and Ryan Manning, GIS Specialist, Haywood Soil and Water Conservation District, both using ArcGIS/ArcInfo 9.2 software.

Additional details on the sources of mapping data and related information are included below. For further information, please contact Mr. Locascio at (828) 251-6914 or [glocascio@nccommerce.com](mailto:glocascio@nccommerce.com), or Mr. Manning at (828) 452-2741, extension 3, or [ryan.manning@nc.nacdnet.net](mailto:ryan.manning@nc.nacdnet.net).

<u>Data</u>	<u>Data Source</u>	<u>Date</u>
Base Data	NC CGIA*/www.nconemap.com	various
Floodplain/Floodway	NC Emergency Management	2008
Hydrology	NC Stream Mapping Program	2006
Wetlands	National Wetlands Inventory	various
EVADs	Haywood Soil and Water Cons. District	2008
Farmland and Hydric Soils	USDA-Natural Resources Cons. Service	1975
Natural Heritage Data	NC Natural Heritage Program	2008
State/Federal Lands	NC CGIA*/www.nconemap.com	various
Parcel Data/Easements	Haywood County GIS	2008
IPSI	Tennessee Valley Authority	2006
One NC Naturally	NC Dept. of Environment and Natural Resources	2008

\* - North Carolina Center for Geographic Information and Analysis

## APPENDIX B – WATER QUALITY DATA

Below you will find a summary of recent data from sites in or near the project area, including data from Haywood Waterways Association’s Volunteer Water Information Network (VWIN), North Carolina Division of Water Quality (DWQ)<sup>1</sup>, and Tennessee Valley Authority (TVA). See Map 16 on page 58 for the location of each data collection site.

Data Source	Site ID	Date of Most Recent Sample	Location	Sediment	Nutrients	Metals	Bacteria (Fecal coliform)	BioClass (Benthic Macroinv./ EPT)	Fish Community (IBI)	Habitat	Overall
VWIN	1	2007	West Fork Pigeon River at Bethel	100	100	100	X	X	X	X	100 Excellent
	2	2007	East Fork Pigeon River at Bethel	100	100	100	X	X	X	X	100 Excellent
DWQ	A-14, B-2	2007	West Fork Pigeon River at Lake Logan	Supporting	Supporting	Supporting	nce	Excellent	X	X	X
	A-15, B-1	2006	Pigeon River at NC 215 above Canton	Supporting	Supporting	Supporting	nce	Good	X	X	X
TVA	11798	2008	West Fork Pigeon River at Riverside Baptist Ch.	X	X	X	X	Good	Fair	33 Low to Poor	X
	8708	2008	Pigeon River at NC 215	X	X	X	X	Good	Fair/ Good	31 Low to Poor	X

As noted earlier in the report, each organization uses different sampling methods and evaluation systems. Listed below are explanations of *some* of the measures included in the table above. For more detail about specific measures, please refer to documents from each sampling organization (Westphal et al 2007, NCDENR 2003, NCDENR 2008, Vaughn 2008).

### Sediment

There are two primary measures for sedimentation: turbidity and Total Suspended Solids (TSS). Turbidity measures reflection of light through the sample, and TSS measures the weight of particulate matter found in the sample.

### Physical and Chemical (Nutrients, Metals)

Physical properties include pH, alkalinity, temperature, conductivity, and dissolved oxygen. Measures of nutrients include nitrates and orthophosphates, both of which contribute to excessive algal growth. Sources of these nutrients are fertilizers, septic drainage, and runoff carrying livestock waste, among others. VWIN measures levels of conductivity, as well as the heavy metals copper, lead and zinc. NCDWQ measures all of those, as well as aluminum, arsenic, cadmium, chromium, iron, manganese, mercury, and nickel.

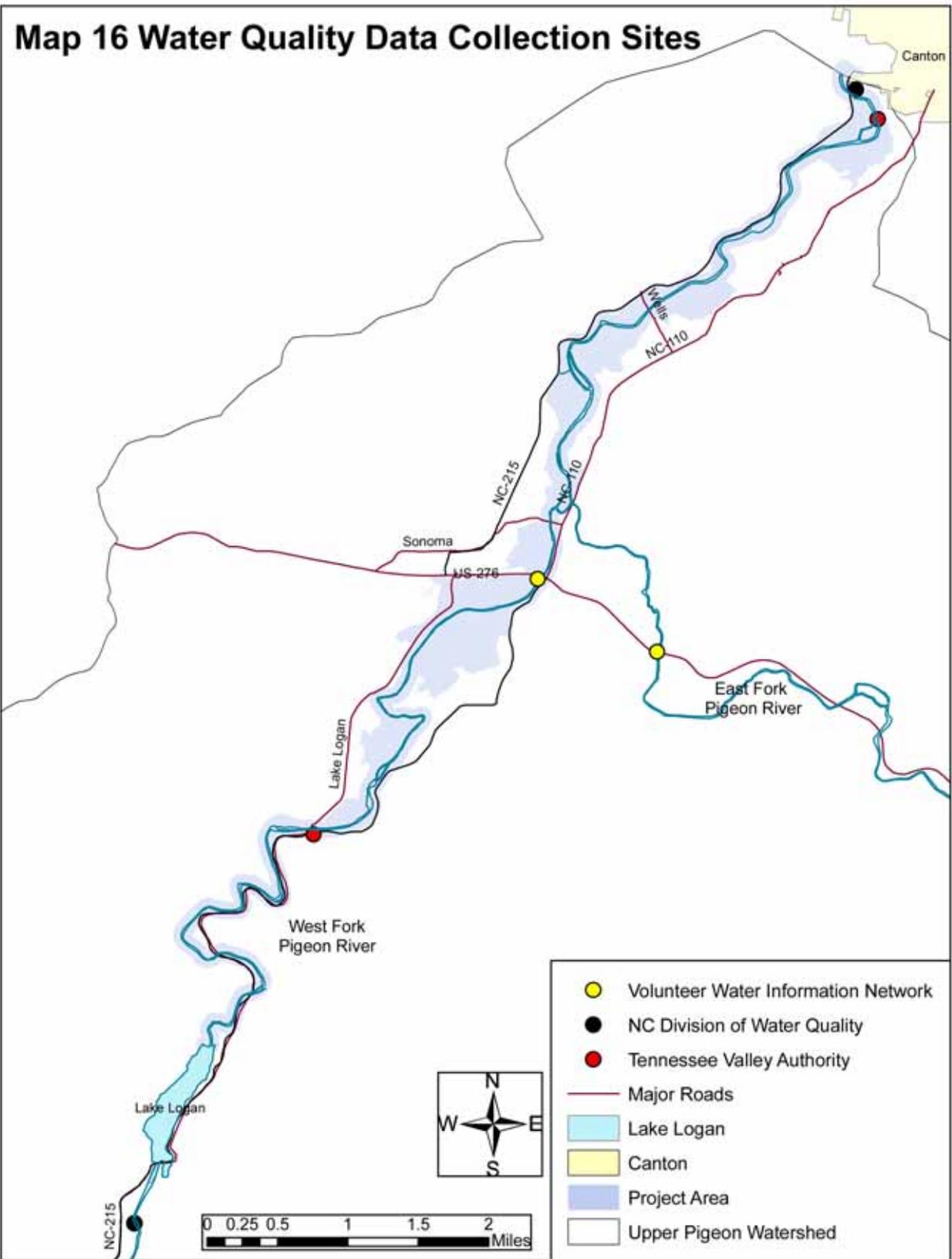
<sup>1</sup> NCDWQ rates streams according to whether their water quality level supports various uses, including Aquatic Life, Recreation, Water Supply, and Fish Consumption. Both NCDWQ sites in our project area are rated “Supporting” for all of these categories (other possible ratings are Impaired or Not Rated). Results for fecal coliform samples are expressed as “nce” (no criteria exceeded), meaning that samples did not exceed the Evaluation Level for fecal coliform. Evaluation Levels may vary according to stream classification.

### Biological (EPT, IBI)

Several indicators are used to measure the health of a stream's aquatic habitat, including the abundance and composition of insect and fish communities. Benthic monitoring measures the abundance of specific types of insects – Ephemeroptera, Plecoptera, and Trichoptera (EPT) – that are sensitive to declines in water quality, particularly those related to the presence of chemical pollutants (NCDENR 2003). The Index of Biological Integrity (IBI) measures the richness, composition, condition and abundance of fish species (NCDENR 2008). Regarding the IBI, a DWQ report suggests that “a change in fish abundance may be due to decreased energy supply or a decline in habitat quality, not necessarily a change in water quality” (NCDENR 2003). This statement leads us to conclude that TVA's Fair and Fair/Good IBI ratings may not be the most important measure of water quality in the project area.

### Habitat

Habitat scores evaluate several stream habitat characteristics, including channel modification, amount of instream habitat, type of bottom substrate, pool variety, riffle frequency, bank stability, light penetration and riparian zone width. Habitat scores less than 65 generally represent low to poor quality habitat sites (NCDENR 2008). Data from TVA reported above provides evidence of impaired habitat (though, again, not necessarily of impaired water quality).



## REFERENCES

- Allan, J. David. 2004. Landscapes and riverscapes: The influence of land use on stream ecosystems. *Annual Review in Ecology and Systematics* 35: 257-284.
- American Farmland Trust (AFT). June 2008. *Agricultural conservation easements: Fact sheet*. American Farmland Trust. Washington, D.C.
- Blue Ridge Forever. Public announcement of 28 regional conservation priorities. Blue Ridge Parkway Destination Center, September 4, 2008.
- Booth, Derek B. and C. Rhett Jackson. 1997. Urbanization of aquatic systems: Degradation, thresholds, stormwater detection, and the limits of mitigation. *Journal of American Water Resources* 33: 1077-90.
- Brody, Samuel. D., Sammy Zaharan, Praveen Maghelal, Himanshu Grover and Wesley. E. Highfield. 2007. The rising costs of floods. *Journal of the American Planning Association* 73(3): 330-345.
- Buffler, Susan. 2005. Synthesis of design guidelines and experimental data for water quality function in agricultural landscapes in the Intermountain West. Thesis. Utah State University. <http://www.unl.edu/nacresearch/2005Buffer.pdf> [accessed July 2008].
- Crawford, J. K. and D. R. Lenat. 1989. Effects of land use on the water quality and biota of three streams in the Piedmont Province of North Carolina. *Water Resources Investigation Report 89-4007*. Raleigh, NC: US Geological Survey.
- Federal Interagency Floodplain Management Task Force (FIFMTF). 1996. *Protecting floodplain resources: a guidebook for communities*. Federal Emergency Management Agency (FEMA 268).
- Gregory, S. and L. Ashkenas. 1990. *Field guide for riparian management: Willamette National Forest*. U.S. Department of Agriculture. Forest Service. Willamette National Forest. Eugene, OR.
- Haywood County. Haywood County Ordinances. *Chapter 155: Flood damage prevention*. [http://www.haywoodnc.net/ordinances/flood\\_damage\\_prevention.pdf](http://www.haywoodnc.net/ordinances/flood_damage_prevention.pdf) [accessed September 2008].
- Haywood Waterways Association (HWA). 2002. *A watershed action plan: Options for improving our water quality, Pigeon River watershed, Haywood County, North Carolina*. <http://www.haywoodwaterways.org/wappdf/wap.pdf> [accessed July 2008].
- . 2008. Technical Advisory Committee Meeting. May 19, 2008.

- Jacobs, Richard. Appraiser, Duckworth, Jacobs, Naeger, Swicegood & Thrash, LLC. Asheville NC. 2007. Bethel community working land conservation easement study.
- Johnson, Craig W. and Susan Buffler. 2008. *Riparian buffer design guidelines for water quality and wildlife habitat functions on agricultural landscapes in the Intermountain West*. Gen. Tech. Rep. RMRS-GTR-203. U.S. Department of Agriculture. Forest Service. Rocky Mountain Research Station. Fort Collins, CO.
- Junk, W. J., P. B. Bayley, and R. E. Sparks. 1989. The flood pulse concept in river floodplain systems. *Proceedings of the International Large River Symposium*. D. P. Dodge, ed. Canadian Special Publication of Fisheries and Aquatic Sciences 106: 110–127.
- Lassner, Janis. 1998. Valuing agricultural conservation easements. *The Appraisal Journal* 66(2): 145-50.
- Locascio, Glen. GIS Specialist, North Carolina Division of Community Assistance. Asheville, NC. Spatial analysis of project area data, March-September 2008. (Some figures presented in this plan have been rounded by the author in order to simplify presentation of the data.)
- Manning, Ryan. GIS Specialist, Haywood Soil and Water Conservation District. Waynesville, NC. Spatial analysis of project area data, March-September 2008. (Some figures presented in this plan have been rounded by the author in order to simplify presentation of the data.)
- Mathews, Leah Greden. Project Director, Farmland Values Project. UNC-Asheville. Personal communication, August 8, 2008.
- Moore, Aaron A. and Margaret A. Palmer. 2005. Invertebrate biodiversity in agricultural and urban headwater streams: Implications for conservation and management. *Ecological Applications* 15(4): 1169-1177.
- Moore, Joe. Appraiser, CDN Appraisals. Personal communication, August 2008.
- North Carolina Department of Environment and Natural Resources (NCDENR). 2008a. *Basinwide assessment report: French Broad River basin*. Division of Water Quality. Water Quality Section. Environmental Sciences Branch. Raleigh, NC. <http://h2o.enr.state.nc.us/esb/documents/2008FRBBAUWeb.pdf> [accessed August 2008].
- . 2008b. *Surface Water Classifications*. Division of Water Quality. Water Quality Section. Environmental Sciences Branch. Raleigh, NC. <http://h2o.enr.state.nc.us/csu/swc.html> [accessed August 2008].
- . 2008c. *Water Supply Watershed Protection Program*. Division of Water Quality. Water Quality Section. Environmental Sciences Branch. Raleigh, NC. <http://h2o.enr.state.nc.us/wswp/index.html> [accessed August 2008].

- . 2007. *Ambient monitoring system station summaries. Basinwide assessment report: 01/29/2003 to 12/19/2007*. Division of Water Quality. Water Quality Section. Environmental Sciences Branch. Raleigh, NC.
- . 2005. *French Broad River basinwide water quality plan*. Division of Water Quality. Water Quality Section. Environmental Sciences Branch. Raleigh, NC.  
[http://h2o.enr.state.nc.us/\\_basinwide/FrenchBroadRiverBasin.htm](http://h2o.enr.state.nc.us/_basinwide/FrenchBroadRiverBasin.htm) [accessed February 2008].
- . 2003. *Basinwide assessment report: French Broad River basin*. Division of Water Quality. Water Quality Section. Environmental Sciences Branch. Raleigh, NC.  
<http://h2o.enr.state.nc.us/esb/Basinwide/French%20Broad%202003%20Report.pdf> [accessed July 2008].
- North Carolina General Assembly. 2005. *Enhanced voluntary agricultural districts; additional benefits*. General Statutes, Section 106-743.4.  
<http://www.ncga.state.nc.us/sessions/2005/bills/house/html/h607v6.html> [accessed August 2008].
- One NC Naturally. *Conservation Planning Tool report chapters*. NCDENR. Office of Conservation and Community Affairs.  
[http://www.onencnaturally.org/pages/CPT\\_Details.html](http://www.onencnaturally.org/pages/CPT_Details.html) [accessed August 2008].
- Paul, Michael J. and Judy L. Meyer. 2001. Streams in the urban landscape. *Annual Review of Ecology and Systematics* 32: 333-365.
- Poff, N. LeRoy, J. David Allan, Mark B. Bain, James R. Karr, Karen L. Prestegard, Brian D. Richter, Richard. E. Sparks, and Julie E. Stromberg. 1997. The natural flow regime: A paradigm for river conservation and restoration. *Bioscience* 47(11): 769-784.
- Romaniszyn, Eric. Project Manager, Haywood Waterways Association. Personal communication. August 2008.
- Rodgers, Angie. Freshwater Ecologist, North Carolina Natural Heritage Program. Personal communication. July-September 2008.
- Schueler, Tom. 1995. The architecture of urban stream buffers. *The Practice of Watershed Protection*. 2000. T. Schueler and H. Holland, eds. Center for Watershed Protection. 39: 155-163. [http://www.cwp.org/Resource\\_Library/pwp.htm](http://www.cwp.org/Resource_Library/pwp.htm) [accessed August 2008].
- Scott, Mark C. 2006. Winners and losers among stream fishes in relation to land use legacies and urban development in the southeastern US. *Biological Conservation* 127(3): 301-309.

- Smathers, Leslie. Department Director, Haywood County Soil and Water Conservation District. Personal communication. September 2008.
- Tennessee Valley Authority (TVA). 1966. *Floods on the Pigeon River in vicinity of Canton & Clyde, North Carolina*. Division of Water Control Planning. Knoxville, Tennessee.
- Tong, Susanna T.Y. and Wenli Chen. 2002. Modeling the relationship between land use and surface water quality. *Journal of Environmental Management* 66: 377-393.
- United States Department of Agriculture (USDA). *Emergency Watershed Program – Floodplain Easement Option*. USDA-Natural Resources Conservation Service. <http://www.nrcs.usda.gov/programs/Floodplain/index.html> [accessed September 2008].
- . 1997. *Soil Survey of Haywood County Area, North Carolina*. USDA Natural Resources Conservation Service.
- United States Geological Survey (USGS). *Water Data for the Nation*. USGS National Water Information System Web Interface. <http://nwis.waterdata.usgs.gov/nwis> [accessed February 2008].
- The Upper Pigeon River Flood Protection Plan*. 2008. Produced by Haywood County Government, Bethel Rural Community Organization, and North Carolina Division of Water Resources.
- Vaughn, Dana. 2008. Watershed Specialist, Tennessee Valley Authority (TVA). Personal communication, July-August 2008.
- Volunteer Water Information Network (VWIN). 2006. Summary – Haywood County, 1996-2005.
- Wang, Lizhu, John Lyons, Paul Kanehl, and Roger Bannerman. 2001. Impacts of urbanization on stream habitat and fish across multiple spatial scales. *Environmental Management* 28(2): 255-266.
- Walsh, Christopher J., Andrew K. Sharpe, Peter F. Breen and Jason A. Sonneman. 2001. Effects of urbanization on streams of the Melbourne region, Victoria, Australia. I. Benthic macroinvertebrate communities. *Freshwater Biology* 46:535-51.
- Wenger, Seth. 1999. A review of the scientific literature on riparian buffer width, extent and vegetation. Institute of Ecology, University of Georgia. Athens, GA.
- Wenger, Seth and Laurie Fowler. 2000. Protecting stream and river corridors: Creating effective local riparian buffer ordinances. Carl Vinson Institute of Government, University of Georgia. Athens, GA.
- Wenger, Seth J., James T. Peterson, Mary C. Freeman, Byron J. Freeman, and David D.

Homans. 2008. *Canadian Journal of Fisheries & Aquatic Sciences* 65(7): 1250-1264.

Westphal, Marilyn, Steven C. Patch, Jillian D. Fishburn, Lauren E. Hodges. 2007. *Water Quality Trends of Haywood County: Year Ten Report*. Volunteer Water Information Network (VWIN). Technical Report #07-175.

Williams, Ed. Environmental Specialist, NCDENR. Division of Water Quality. Asheville Regional Office. Personal communication. July-August 2008.