Chapter 2
Hiwassee River Subbasin 04-05-02
Including: Hiwassee Lake, Apalachia Lake, and Valley River

2.1 Subbasin Overview

The North Carolina portion of this subbasin lies entirely within Cherokee County. Steeper relief, more precipitation, and greater forest cover characterize the north and eastern portions of the watershed. This area includes the catchments of Apalachia Lake, Hanging Dog, Owl, Beaverdam, and Shuler Creeks, as well as the headwaters of the Valley River including Junaluska, Welch Mill, and Hyatt Creeks. The Nantahala National Forest generally dominates land use in this section but residential development is increasing along ridges and in proximity to the Town of Andrews.

Subbasin 04-05-02 at a Glance

Land and Water Area

Total area:	458 mi²
Land area:	431 mi²
Water area:	27 mi²

Population Statistics

2000 Est. Pop.:	24,298 people
Pop. Density:	56.3 persons/mi²

Land Cover (percent)

Forest/Wetland:	69.4%
Surface Water:	6.4%
Urban:	2.0%
Cultivated Crop:	4.4%
Pasture/ Managed Herbaceous:	17.8%

Counties
Cherokee

Municipalities
Andrews and Murphy

Aquatic Life Monitored Streams Statistics

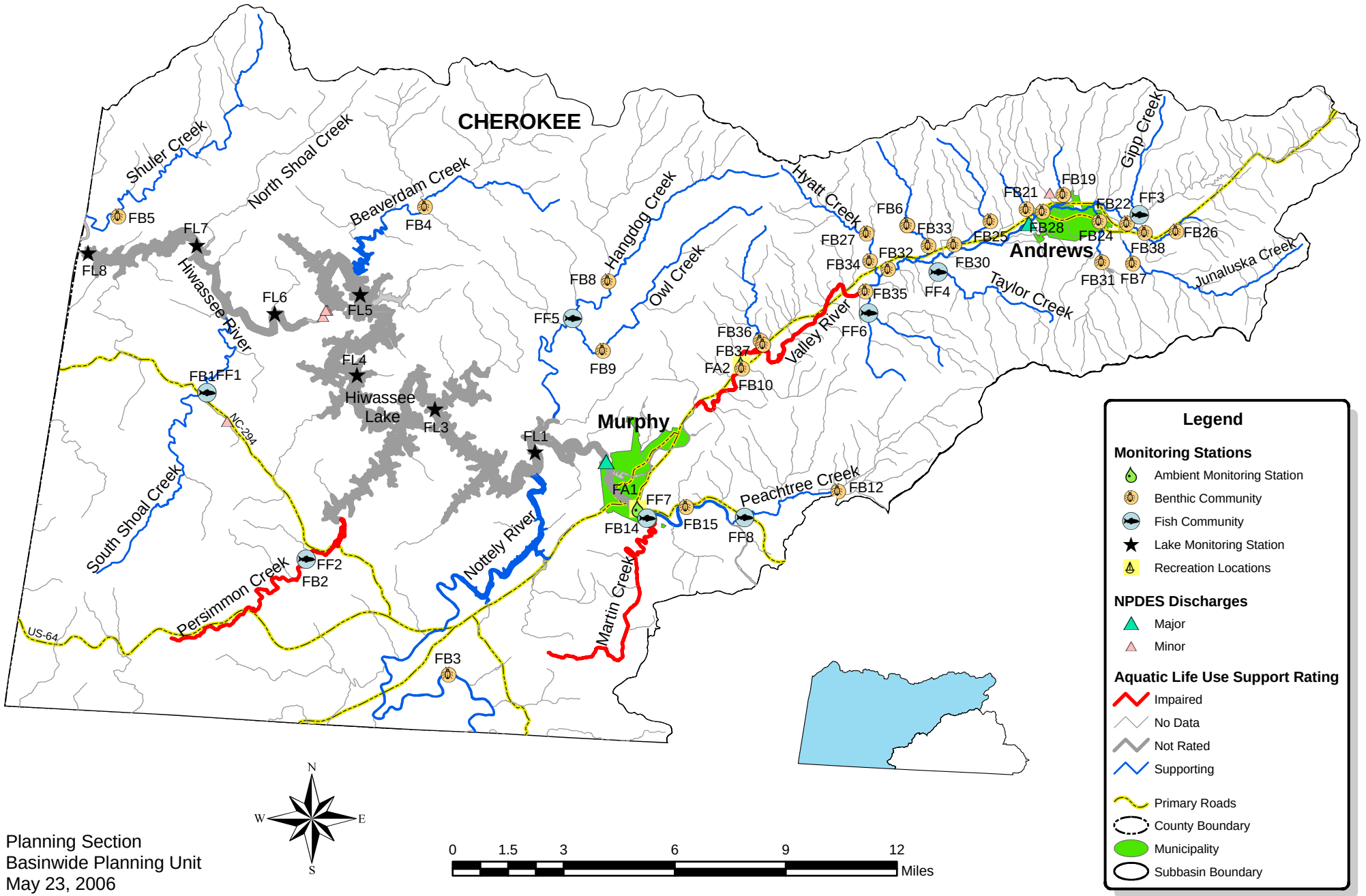
Total Streams:	184.3 mi
Total Supporting:	133.0 mi
Total Impaired:	23.6 mi
Total Not Rated:	27.7 mi

The southern and central portions of the watershed are characterized by broad valleys with lower elevations, less relief, less precipitation, and less forest cover. The Hiwassee River, Nottely River, Peachtree, Martins, Persimmon, and South Shoal creeks, along with Hiwassee Lake and the lower half of the Valley River are major waterbodies in this area. Agricultural lands in the broad Hiwassee River valley are still common, however conversion to residential development is on the rise. In addition, a new bypass is currently under construction in Murphy and residential and commercial development in the Peachtree and Martins Creek watershed is rapidly increasing as a result. Despite these changes, land use in Subbasin 04-05-02 remains largely forested. The vast majority of the Nottely River watershed lies in Georgia and includes the Town of Blairsville.

From 1990 to 2000, the population in Murphy remained fairly constant. However, Andrews saw a 37 percent decrease in population over the same period. Cherokee County as a whole grew approximately 17 percent from 1990 to 2000 and is expected to grow another 20 percent by 2020. Additional information regarding population and land use changes throughout the entire basin can be found in Appendix I and III, respectively.

There are two major NPDES dischargers in this subbasin and both are required to perform whole effluent toxicity testing. The Andrews WWTP (NC0020800, 1.5 MGD) discharges to the Valley River and has had three failing tests since 2001. The Murphy WWTP (NC0020940, 0.925 MGD) discharges to the Hiwassee River and has had no failing tests since January 2001. See Section 2.3.1 for more information. For the listing of NPDES permit holders, refer to Appendix V.

Figure 9 Hiwassee River Subbasin 04-05-02



Planning Section
Basinwide Planning Unit
May 23, 2006

Table 5 Hiwassee Subbasin 04-05-02

AU Number	Classification	Length/Area	Description	Aquatic Life Assessment					Recreation Assessment			Stressors	Sources
				AL Rating	Station	Result	Year/ Parameter	% Exc	REC Rating	Station	Result		
Beaver Creek													
1-52-30-(3)	C Tr	2.0 FW Miles		S					ND			Habitat Degradation	Unknown
	From Andrews Water Supply Intake to Valley River				FB19	NI	2002						
Beaverdam Creek													
1-72	C Tr	6.7 FW Miles		S					ND				
	From source to Hiwassee Lake				FB4	E	2004						
Colvard Creek													
1-52-58	C Tr	4.3 FW Miles		S					ND			Habitat Degradation	Pasture
	From source to Valley River				FB37	NI	2002						
					FB36	NI	2002						
Gipp Creek													
1-52-23	C Tr ORW	3.6 FW Miles		S					ND				
	From source to Valley River				FB20	E	2002						
Hanging Dog Creek													
1-57	C	13.2 FW Miles		S					ND			Habitat Degradation	Unknown
	From source to Hiwassee Lake				FF5	G	2004						
					FB8	E	2004						
HIWASSEE RIVER													
1-(43.7)	WS-V	4.2 FW Miles		S	FA1	NCE			S	FA1	NCE	Habitat Degradation	
	From Town of Murphy water supply intake to a point 0.3 mile downstream of Martin Creek				FB15	E	2004						

Table 5 Hiwassee Subbasin 04-05-02

AU Number	Classification	Length/Area		Aquatic Life Assessment					Recreation Assessment				
Description				AL Rating	Station	Result	Year/ Parameter	% Exc	REC Rating	Station	Result	Stressors	Sources
HIWASSEE RIVER (Apalachia Lake below elevation 1281)													
1-(75)	B	1,021.5	FW Acres	**NR**	FL6	ID			ND				
					FL8	ID							
					FL7	ID							
From River Mile 75 0.8 mile downstream from Hiwassee Dam at Hiwassee Reservation Boundary to Apalachia Dam													
HIWASSEE RIVER (Hiwassee Lake below elevation 1525)													
1-(53)	B	5,029.5	FW Acres	**NR**	FL4	ID			ND				
					FL5	ID							
					FL3	ID							
					FL1	ID							
From Laurel Creek to Hiwassee Dam													
Hyatt Creek													
1-52-43	C	4.9	FW Miles	**S**					ND			Sediment	Construction
From source to Valley River					FB34	E	2002						
					FB27	E	2002						
Junaluska Creek													
1-52-25a	C Tr	6.5	FW Miles	**S**					ND				
From source to Junaluska Road					FB7	E	2004						
Martin Creek													
1-49	C	8.8	FW Miles	**I**					ND			Habitat Degradation	Agriculture
From source to Hiwassee River					FF7	F	2004					Habitat Degradation	Stormwater Outfall
					FB14	G	2004						

Table 5 Hiwassee Subbasin 04-05-02

AU Number	Classification	Length/Area	Aquatic Life Assessment					Recreation Assessment				
Description			AL Rating	Station	Result	Year/ Parameter	% Exc	REC Rating	Station	Result	Stressors	Sources
Morris Creek												
1-52-36	C Tr	4.7 FW Miles	**S**					ND			Habitat Degradation	
From source to Valley River				FB29	NI	2002					Nutrient Impacts	Unknown
				FB25	NI	2002						
Nottely River												
1-58	C	18.7 FW Miles	**S**					ND			Habitat Degradation	
From North Carolina-Georgia State Line to Hiwassee Lake				FB3	G	2004						
Owl Creek												
1-57-6	C	8.5 FW Miles	**S**					ND				
From source to Hanging Dog Creek				FB9	E	2004						
Peachtree Creek												
1-44b	C	3.0 FW Miles	**S**					ND			Habitat Degradation	Unknown
From Pipes Branch to Hiwassee River				FF8	E	2004						
				FB12	E	2004						
Persimmon Creek (Lake Cherokee)												
1-63a	C	5.9 FW Miles	**I**					ND			Habitat Degradation	Unknown
From source to Lake Cherokee				FF2	P	2004						
				FB2	E	2004						
Shuler Creek												
1-86	C	11.9 FW Miles	**S**					ND				
From source to Hiwassee River				FB5	E	2004						

Table 5 Hiwassee Subbasin 04-05-02

AU Number	Classification	Length/Area	Description	Aquatic Life Assessment					Recreation Assessment			Stressors	Sources
				AL Rating	Station	Result	Year/ Parameter	% Exc	REC Rating	Station	Result		
South Shoal Creek													
1-77	C Tr	12.1 FW Miles	From source to Apalachia Lake	**S**	FF1	NR	2004		ND				
					FB1	E	2004						
Tatham Creek													
1-52-28	C Tr	1.8 FW Miles	From source to Valley River	**S**	FB31	NI	2002		ND			Habitat Degradation	Stormwater Outfall
					FB24	G	2002						
Taylor Creek													
1-52-39	C Tr	4.8 FW Miles	From source to Valley River	**S**	FF4	GF	2004		ND			Habitat Degradation	Pasture
					FB33	NI	2002						
Valley River													
1-52b	C Tr	9.8 FW Miles	From Gipp Creek above Andrews to Venegeance Creek near Marble	**S**	FF3	NR	2004		ND			Nutrient Impacts	
												Sediment	
					FB32	G	2002					Sediment	
					FB28	E	2002					Sediment	
					FB22	E	2002					Sediment	Pasture
1-52c	C Tr	7.7 FW Miles	From Venegeance Creek near Marble to Marble Creek above Murphy	**I**	FA2	CE	Turbidity	12.2	**S**	FA2	NCE	Turbidity	Impervious Surface
					FB10	G	2004					Turbidity	Pasture
												Turbidity	Stormwater Outfall

Table 5 Hiwassee Subbasin 04-05-02

AU Number	Classification	Length/Area	Description	Aquatic Life Assessment					Recreation Assessment			Stressors	Sources
				AL Rating	Station	Result	Year/ Parameter	% Exc	REC Rating	Station	Result		
Venegeance Creek													
1-52-45	C Tr	3.6 FW Miles		**S**					ND			Nutrient Impacts	Unknown
	From source to Valley River				FF6	G	2004						
					FB35	G	2002						
Webb Creek													
1-52-32	C Tr	1.6 FW Miles		**S**					ND			Habitat Degradation	Unknown
	From source to Valley River				FB21	NI	2002						
Welch Mill Creek													
1-52-40	C Tr	4.5 FW Miles		**S**					ND			Habitat Degradation	Impervious Surface
	From source to Valley River				FB6	E	2004						
					FB30	NI	2002						
					FB6	E	2002						
Worm Creek													
1-52-24	C Tr	2.6 FW Miles		**S**					ND			Nutrient Impacts	
	From source to Valley River				FB38	NI	2002					Nutrient Impacts	Unknown
					FB26	NI	2002					Nutrient Impacts	Agriculture
												Nutrient Impacts	Impervious Surface

Table 5 Hiwassee Subbasin 04-05-02

AU Number / Description	Classification	Length/Area	Aquatic Life Assessment					Recreation Assessment				
			AL Rating	Station	Result	Year/ Parameter	% Exc	REC Rating	Station	Result	Stressors	Sources

Use Categories:
AL - Aquatic Life
REC - Recreation

Monitoring data type:
FF - Fish Community Survey
FB - Benthic Community Survey
FA - Ambient Monitoring Site
FL- Lake Monitoring

Results:
E - Excellent
G - Good
GF - Good-Fair
F - Fair
P - Poor
NI - Not Impaired

Use Support Ratings 2005:
S - Supporting, I - Impaired
NR - Not Rated
NR*- Not Rated for Recreation (screening criteria exceeded)
ND-No Data Collected to make assessment

Miles/Acres
FW- Fresh Water

m- Monitored
e- Evaluated

Results
CE-Criteria Exceeded > 10% and more than 10 samples
NCE-No Criteria Exceeded
ID- Insufficeint Data Available

Aquatic Life Rating Summary

S	m	133.0	FW Miles
I	m	22.4	FW Miles
NR	m	6,051.0	FW Acres
NR	e	143.4	FW Acres
ND		464.7	FW Miles
ND		41.7	FW Acres

Recreation Rating Summary

S	m	11.9	FW Miles
ND		608.2	FW Miles
ND		6,236.1	FW Acres

Fish Consumption Rating Summary

I	e	620.1	FW Miles
I	e	6,194.4	FW Acres
		41.7	FW Acres

There are two ambient monitoring sites located in this subbasin. Ambient water chemistry values at the Hiwassee River (US 64) have been stable since 1999. At this location, three measurements (one turbidity and two copper measurements) in five years exceeded water quality standards or action levels. The second ambient site is on the Valley River (SR 1373). This location has also been stable since 1999. Seven measurements (six for turbidity and one for iron) exceeded water quality standards or action levels. The turbidity violations indicate the Valley River is Impaired.

DWQ collected 33 benthic macroinvertebrate samples in subbasin 04-05-02 between 1999 and 2004. All streams sampled for benthic macroinvertebrates in this subbasin were classified using mountain criteria. Samples were collected in both 1999 and 2004 at 13 locations. Bioclassifications were higher in 2004 at four of the 13 sites: Junaluska Creek, South Shoal Creek, and the Hiwassee River received Excellent bioclassifications (Good in 1999) and one site on the Valley River received a Good bioclassification (Good-Fair in 1999). Nine sites received Excellent bioclassifications in both years.

DWQ evaluated the fish community sites in this subbasin for the first time in 2004. Therefore, the 2004 basinwide assessment will serve as a baseline for the 2009 basinwide monitoring cycle. Fish community bioclassifications in 2004 varied from Poor (Persimmon Creek) to Excellent (Peachtree Creek). Four of the eight sites in this subbasin are classified as trout waters (Tr). The NC Wildlife Resources Commission manages the Valley River and Persimmon Creek as Hatchery Supported Trout Waters. Wild, not stocked, trout were collected from the Valley River, Peachtree, Taylor, Vengeance, Hanging Dog, and South Shoal Creeks.

A map including the locations of the NPDES facilities and water quality monitoring stations is presented in Figure 9. Table 5 contains a summary of assessment unit numbers (AU#) and lengths, streams monitored, monitoring data types, locations and results, along with use support ratings for waters in the subbasin. Refer to Appendix VIII for more information about use support ratings. Refer to the 2005 Hiwassee River Basinwide Assessment Report at http://h2o.enr.state.nc.us/esb/Basinwide/HIW2005.pdf and Appendix IV for more information on monitoring.

Waters in the following sections and in Table 5 are identified by an assessment unit number (AU#). This number is used to track defined segments in the water quality assessment database, list 303(d) Impaired waters, and is used to identify waters throughout the basin plan. The AU# is a subset of the DWQ index number (classification identification number). A letter attached to the end of the AU# indicates that the assessment is smaller than the DWQ index segment. No letter indicates that the AU# and the DWQ index segment are the same. For example, index number 11-3-(14) might be split into two assessment units 11-3-(14)a and 11-3-(14)b.

2.2 Use Support Assessment Summary

All surface waters in the state are assigned a classification appropriate to the best-intended use of that water. Waters are regularly assessed by DWQ to determine how well they are meeting their best-intended use. For aquatic life, an Excellent, Good, Good-Fair, Fair, or Poor bioclassification is assigned to a stream based on the biological data collected by DWQ. For more information about bioclassification and use support assessment, refer to Appendices IV and VIII, respectively. Appendix IX provides definitions of the terms used throughout this basin plan.

Table 6 Summary of Use Support Ratings by Category in Subbasin 04-05-02

Use Support Rating	Aquatic Life	Recreation
Monitored Waters		
Supporting	133.0 mi	11.9 mi
Impaired*	23.6 mi (13%)	0
Not Rated	27.7 mi	0
Total	**184.3 mi**	**0**
Unmonitored Waters		
Not Rated	2.4 mi	0
No Data	464.7 mi	639.5 mi
Total	**467.1 mi**	**639.5 mi**
Totals		
All Waters**	**651.4 mi**	**639.5 mi**

* The noted percent Impaired is the percent of monitored mile/acres only.
**Total Monitored + Total Unmonitored = Total All Waters.

In subbasin 04-05-02, use support was assigned for the aquatic life, recreation, fish consumption and water supply categories. Waters are Supporting, Impaired, Not Rated, and No Data in the aquatic life and recreation categories on a monitored or evaluated basis. Waters are Impaired in the fish consumption category on an evaluated basis based on fish consumption advice issued by the Department of Health and Human Services (DHHS). All waters are Supporting in the water supply category on an evaluated basis based on reports from Division of Environmental Health (DEH) regional water treatment plant consultants. Refer to Table 6 for a summary of use support for waters in subbasin 04-05-02.

2.3 Status and Recommendations of Previously and Newly Impaired Waters

The following waters were either identified as Impaired in the previous basin plan (2002) or are newly Impaired based on recent data. If previously identified as Impaired, the water will either remain on the state's 303(d) list or will be delisted based on recent data showing water quality improvements. If the water is newly Impaired, it will likely be placed on the 2008 303(d) list. The current status and recommendations for addressing these waters are presented below, and each is identified by an AU#. Information regarding 303(d) listing and reporting methodology is presented in Appendix VI.

2.3.1 Martins Creek [AU# 1-49]

Current Status

Martins Creek was sampled for the first time by DWQ in 2004 at a site 400 meters upstream from Martins Creek confluence with the Hiwassee River in the southeast corner of Cherokee County (FB14). The stream received a Good bioclassification based on benthic macroinvertebrate monitoring, but had the lowest species diversity of all the Hiwassee basin samples. Its watershed is the most developed of those sampled by DWQ in the Hiwassee River basin, with many new single-family homes under construction in addition to older, established residential neighborhoods associated with the town of Murphy. Conductivity was elevated in the stream, indicating runoff from residential development and/or agricultural areas. Habitat problems at this site included high percentages of sand (10 percent) and silt (20 percent) that resulted in poorly developed riffles and pools. Although the benthic community is not yet heavily impacted, Martins Creek is clearly showing adverse effects from upstream development. Fill has recently been deposited in one streamside area upstream of Hughes Road, reportedly to construct a recreational vehicle (RV) camping park.

The upper portion of the watershed is largely forested, although some ongoing residential development was evident, including new road construction. The middle portion of the watershed, from Tobe Stalcup Road to Postell Road, is characterized by extensive agricultural activity in and along the floodplain. Much of Martins Creek and many of its tributaries appear to have been channelized in this portion of the watershed. Recent and ongoing residential construction is particularly notable in the drainage of Right Prong Martins Creek (TVA, 2006).

Fish community sampling revealed a mixed community of cool and warm water species, dominated by mottled sculpin. Despite qualifying as a regional reference site, the fish community was rated Fair because of the low number of fish collected. The uniform depth and lack of habitat diversity may be contributing to the low numbers of fish in this reach of Martins Creek, but it is not totally clear what the impacts are. Because of the Fair bioclassification at site FF-7, Martins Creek is Impaired for aquatic life from its source to Hiwassee River (8.8 miles).

Special Studies

In July 2005, the North Carolina Ecosystem Enhancement Program (EEP), Hiwassee River Watershed Coalition (HRWC), and Equinox Environmental Consultation and Design started a local watershed planning process in the Peachtree-Martins Creek watershed. http://www.hrwc.net/peachtreemartinslwp.htm. Its goals are to: (1) assess stream quality in the watershed, identifying key sources of degradation and pollution, and (2) develop a comprehensive strategy to address watershed needs. The resulting Local Watershed Plan will address both ecological and community priorities. The project is being completed in three phases:

- Phase I. Existing information on stream health, watershed land use, and threats to stream integrity is gathered into a Preliminary Findings and Recommendations Report. A plan for further study is developed based on this existing information and the input of a Local Advisory Committee.

- Phase II. Detailed assessment of the watershed is performed, including intensive monitoring of stream organisms, water chemistry, habitat, and stability and detailed mapping of watershed attributes such as land use, impervious cover, and pollution sources. Much of this mapping work will be done by the Tennessee Valley Authority, which took low altitude aerial photographs of the Peachtree-Martins Creek watershed in 2005 and developed an Integrated Pollution Source Identification (IPSI) report.

- Phase III. A plan to protect and restore the watershed is developed, naming specific strategies to address causes of stream degradation and prioritizing restoration activities and areas. With the Local Advisory Committee's oversight, this Watershed Management Plan is developed to address both ecological and community priorities.

In conjunction with this local watershed planning project, the WaDE program will be surveying the project area. The NC Wastewater Discharge Elimination (WaDE) Program is actively helping to identify and remove straight pipes (and failing septic systems) in the western portion of North Carolina. This program uses door-to-door surveys to locate straight pipes and failing septic systems, and offers deferred loans or grants to homeowners who have to eliminate the straight pipes by installing a septic system.

DWQ assessed four fish sites, 23 benthic sites, and 33 physical/chemical water quality sites within the upper Hiwassee River watershed in Cherokee County in 2006 to support development of the Peachtree-Martins Creek Local Watershed Plan. Because this assessment falls outside the data window of this basinwide plan, the data cannot be used for Use Support Ratings. However, less than optimal instream and riparian habitat characteristics were observed at each site; this was especially so for upper Martins Creek and Slow Creek in the Peachtree Creek watershed. Nonpoint source runoff contributes to elevated specific conductivities at these sites. The fish community in the upper Martins Creek watershed at SR 1576 was Not Rated due to its small size, but it is clearly impacted by physical alterations in the watershed. The Fish community at lower Martins Creek (SR 1558) was Good-Fair.

2007 Recommendations

The final Peachtree-Martins Creek Watershed Management Plan is expected in mid-2007. DWQ expects it to be the best available strategy for restoration and will work with federal, state, and local parties to implement its recommendations.

2.3.2 Persimmon Creek [AU# 1-63]

Current Status

Persimmon Creek flows northeasterly through the southwestern corner of Cherokee County into Hiwassee Lake. US-64 parallels much of the upstream reach. DWQ collected fish and benthic samples (sites FF2 & FB2) in 2004. Persimmon Creek has received Excellent bioclassifications each time it has been sampled since 1994 based on benthic macroinvertebrate data; 2004 was no exception. However, the fish community received a Poor bioclassification when sampled for the first time in 2004. Aquatic life in Persimmon Creek is Impaired from its source to Hiwassee Lake (7.1 miles) as a result of these new data.

Habitat degradation is the primary stressor in Persimmon Creek. It received the lowest habitat score of all sites evaluated in the Hiwassee River basin in 2004. Biologists noted severely eroding banks, little riparian vegetation, and high percentages of silt (10 percent) and sand (20 percent) in the substrate. These habitat problems resulted in low fish species diversity and a small fish population. Additionally, 30 percent of the fish collected were pollution tolerant.

The Cherokee County Soil and Water Conservation District conducted a stream survey to evaluate water quality impacts in the watershed. The District determined pasture, road construction, and other construction activities are contributing to sediment and erosion problems in the creek.

Water Quality Initiatives

The Cherokee County SWCD completed a stream restoration project on Persimmon Creek in 2006. The project included stream bank stabilization and instream structures. The stream survey, design and plan were conducted with the help of engineers from NRCS. A total of 1,700 linear feet of streambank was stabilized using $50,000 of NC Ag Cost Share monies; the project included cooperation from five local landowners.

2007 Recommendations

It appears that substantial stream restoration and bank stabilization is needed in Persimmon Creek. DWQ supports the restoration efforts led by the Cherokee County Soil and Water Conservation District. Additionally, DWQ encourages the District to develop a watershed plan

for moving forward in order to insure that both water quality and watershed function are restored and to prevent a "band-aid" approach to restoration. DWQ will sample this stream again to evaluate the improvements to water quality as a result of these efforts.

2.3.3 Valley River [AU# 1-52c]

2000 Recommendations
19.6 miles of the Valley River downstream of Stewart Road appeared on the 2000 303(d) list because of a Fair bioclassification. Sampling for the 2002 assessment resulted in Good-Fair bioclassifications and the segment was removed from the 2002 303(d) list. The 2002 basinwide plan recommended intensive sampling to identify aquatic life stressors in the Valley River mainstem. DWQ also committed to work with the Hiawassee River Watershed Coalition and local natural resource agency staff to prioritize protection and restoration efforts in the watershed based on the results of biological monitoring.

Current Status
Aquatic life in the Valley River from Vengeance Creek to Marble Creek (7.7 miles) is Impaired because turbidity values exceeded the state standard in 12.2 percent of samples collected from site FA2 at Tomotla.

The Valley River originates in the Snowbird Mountains near the Cherokee/Graham County line and flows generally southwest into the Hiwassee River near Murphy. The entire 120-square mile watershed lies within Cherokee County and the county boundaries follow the watershed boundary for much of its length. The Valley River is one of the largest tributaries of the Hiwassee River and directly influences the water quality of Hiwassee Lake immediately downstream.

The Valley River watershed is predominantly forested, but the valley contains significant pastureland and row crops. A major highway, US 74/19/129, crosses the river several times as it follows the valley from Andrews to Murphy. Residential development is currently low density and generally not located directly on the banks of the river. Development is increasing, but the pace is relatively slow when compared to other parts of Cherokee and Clay counties.

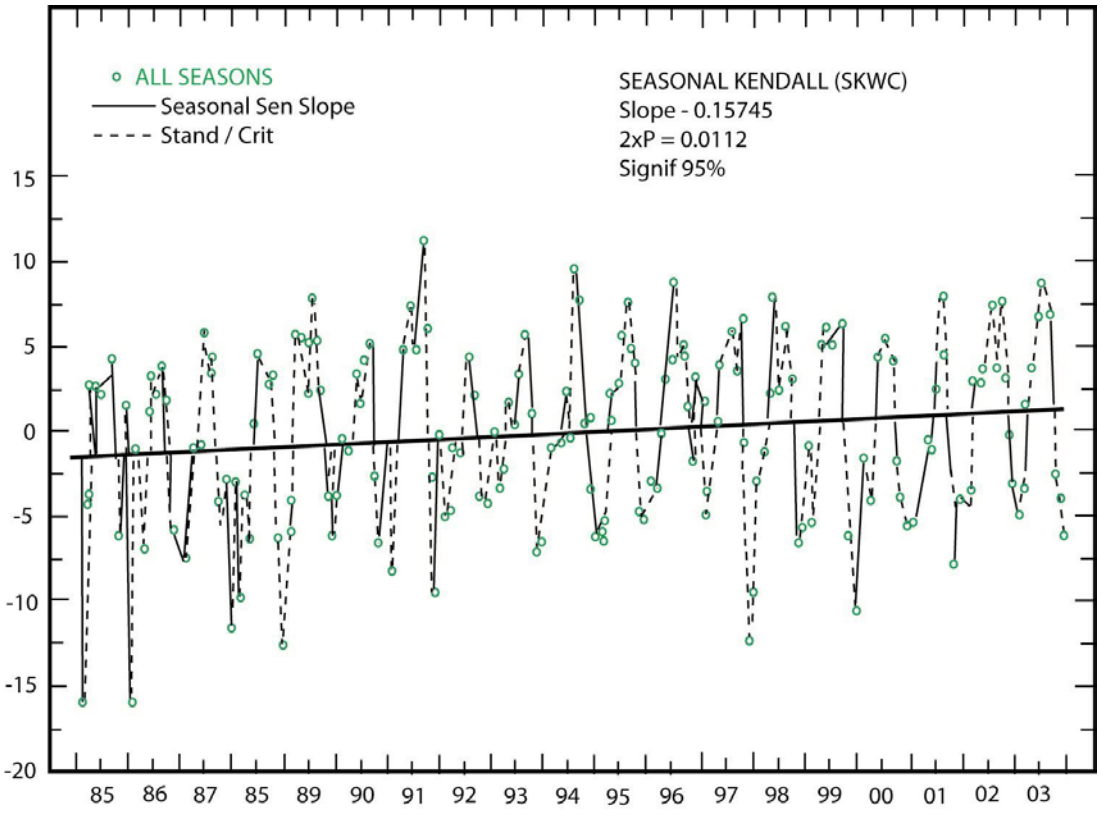
Major impacts to water quality and instream habitat include a lack of riparian vegetation, streambank erosion, livestock access, stream channel alterations, and runoff from the highway and urbanized areas. As a result, turbidity and sedimentation continue to stress the river. DWQ has conducted sampling in the vicinity of the old and new landfills on the Valley River and no impacts from these facilities were found.

Special Studies
In June 2002, benthic macroinvertebrate and fish communities were sampled at three sites on the Valley River mainstem and 23 sites on tributaries to the Valley River in support of the Hiwassee River Watershed Coalition's (HRWC) effort to prioritize streams in the watershed for future restoration work (see water quality initiatives below). DWQ staff collected benthic samples at all 26 sites, a volunteer crew led by HRWC collected fish community samples and TVA provided additional help with both fish and benthic data collection. The DWQ report determined that erosion and sedimentation are problems in most tributaries to the Valley River mainstem. Additionally, riparian vegetation has been removed from most streambanks within the valley. DWQ biologists suggest that the high gradient/high flow of headwater streams, coupled with the

rocky nature of mountain streams have kept the tributaries from becoming impaired despite poor land use practices; but note that their biological integrity will decline if land disturbing activities continue without appropriate best management practices and riparian buffer protection.

In a separate analysis, DWQ used the Water Quality / Hydrology Graphics / Analysis System (WQHYDRO) model to evaluate trends in TSS concentrations and water temperature in the Valley River at Tomotla (site FA2). The model is a multi-faceted computer program, capable of computing flow-adjusted concentration and Seasonal Kendall tests (Aroner, 2000). The analysis included data from 1985-2003 and revealed a significant upward trend in the flow-adjusted water temperature at a rate of approximately 0.15 ^{o}C/year. Over the 18-year analysis period, the average flow-adjusted water temperature increased 2.7^{o}C (4.9^{o}F) (Figure 10). Some possible causes of this temperature increase include a large-scale climatic shift or direct human induced changes such as increased impervious cover or riparian vegetation removal coupled with stream channelization. Despite some new development, impervious surfaces remain a relatively small percentage (<2 percent) of the landscape in the Valley River watershed. Therefore, the most likely causes of increasing water temperature include riparian vegetation removal and climate change. Changes due to riparian vegetation removal are relatively easy and inexpensive to correct by replanting the riparian zone with shade trees.

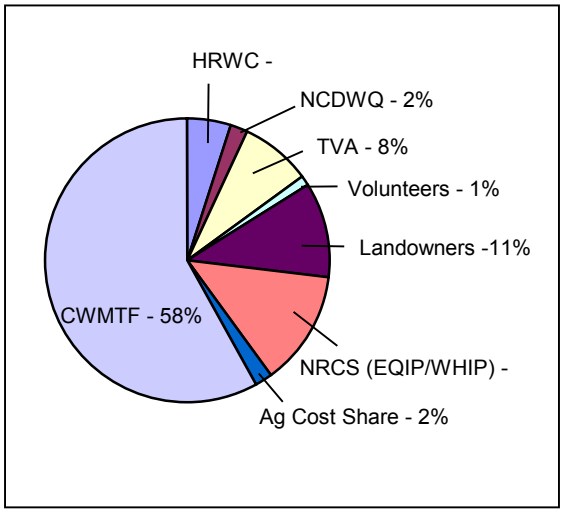
Figure 10 Flow and Seasonally Adjusted Temperature Trend in the Valley River



Water Quality Initiatives

In 2003, the Clean Water Management Trust Fund (CWMTF) provided a $400,000 grant to the HRWC to help support a restoration initiative in the Valley River watershed. Using this initial funding from CWMTF and funding from other partners in the watershed, HRWC began Phase I of a 6-year watershed restoration initiative. Work on the grant was completed in October 2004. The total project cost, including matching funds, was $679,656. Figure 11 shows the monetary contributions of project partners. In 2005, HRWC received funding from the CWMTF in the amount of $966,000 for an additional three years to continue restoration efforts in the Valley River watershed. (Figure 11)

Figure 11 Participant Contribution to Valley River Restoration Project



Phase I

Fish and benthic community data were collected at 26 sites in the watershed, including four sites on the Valley River proper, most of which were last sampled in 1993-94 by TVA. A report of these data with comparisons to historical data was published by HRWC in November 2004 and is available at: http://www.hrwc.net/valley_combined_2002data.pdf. HRWC was also able to begin restoration activities with a 5,600-linear foot project along the Valley River below Andrews (Wood Phase I) and a 960 foot project along the Town of Andrews Recreational Park (Andrews Rec Park).

Phase II

In 2003, HRWC began a more intensive effort to gain community support for continued restoration activities. Coalition staff reviewed the water quality data collected in 2002 and identified landowners along all streams with severely eroding streambanks identified during a nonpoint source pollution inventory. NRCS, local Soil & Water Conservation District staff, and HRWC staff visited all of the local landowners and sent packets by mail to those that do not live locally to explain the restoration program and gage interest in participation. Landowners were asked to complete a form to document their interest.

Of the 63 parcels identified as high to medium priority based on restoration/water quality need, 31 landowners were contacted and 22 interest forms were completed. In addition, 35 people were in attendance at a February 2004 public meeting to discuss the project. Following receipt of interest forms, five Valley River mainstem projects (18,050 linear feet) and eight tributary projects (19,000 linear feet) were identified for varying levels of restoration work. HRWC estimates that approximately five and a half years and $4.5 million will be needed to complete all of this work.

In 2004, CWMTF approved $966,000 (44 percent) of the Coalition's nearly $2.2 million grant request for Phase II of the Valley River Watershed Restoration Project. Work began on this grant in 2005, and is scheduled for completion in 2008.

2007 Recommendations
While HRWC has made significant progress towards reducing erosion and sediment inputs to the Valley River, much work remains to be done. HRWC has identified thirteen restoration projects that will address erosion and sedimentation problems in the Valley River watershed. These include approximately 18,050 feet of restoration on the Valley River mainstem and 19,000 feet on its tributaries. Projects to protect and restore riparian vegetation along the Valley River and its tributaries can slow the rate of water temperature increase and greatly reduce turbidity. The Valley River will be re-listed on the 2008 303(d) list of impaired waters because of turbidity standard violations at Site FA2. Therefore, funding agencies should prioritize funding for these projects. Aggressive funding and implementation strategies could result in a measurable reduction in total suspended solids, turbidity levels, and temperature at Site FA2.

2.4 Status and Recommendations for Waters with Noted Impacts

The surface waters discussed (alphabetically) in this section are not Impaired. However, notable water quality problems and concerns were documented for these waters during this assessment. Attention and resources should be focused on these waters to prevent additional degradation and facilitate water quality improvements. DWQ will notify local agencies of these water quality concerns and work with them to conduct further assessments and to locate sources of water quality protection funding. Additionally, education on local water quality issues and voluntary actions are useful tools to prevent water quality problems and to promote restoration efforts. The current status and recommendations for addressing these waters are presented below, and each is identified by an AU#. Nonpoint source program agency contacts are listed in Appendix VII.

2.4.1 Beaver Creek [AU# 1-52-30-(3)]

Current Status
Beaver Creek was sampled at Site FB19 as part of the 2002 Valley River Watershed Assessment. Riparian vegetation is absent from many of the banks and much of the stream has been channelized and hardened with riprap.

2007 Recommendations
Channel restoration is advised where feasible, but identifying restoration sites may be difficult due to the proximity of the road that parallels the creek for its entire length. Residential landowners along the creek can use a variety of techniques to reduce pollution caused by runoff from their property. Residents should refer to Chapter 5 and the document "Improving Water Quality in Your Own Backyard." This pamphlet is available free of charge through the Division of Water Quality and online at http://h2o.enr.state.nc.us/nps/documents/BackyardPDF.pdf. Copies can usually be obtained locally at the Hiwassee River Watershed Coalition office.

2.4.2 Britton Creek [AU# 1-52-29-(2)]

Current Status
TVA evaluated Britton Creek in 1993 and 2002. The stream was rated Good based on fish community data, but habitat was degraded. Habitat problems included: lack of well-developed riffle/run complexes, embedded substrate, heavy deposits of sediment, unstable banks, bank erosion, and a narrow riparian zone. Much of the bank damage, erosion, and sediment deposition are likely due to livestock access.

2007 Recommendations
The impacts from cattle access should be corrected through use of agricultural best management practices. There are a variety of funding sources that can be used to make installation of these improvements more affordable to farm owners. Chapter 7 describes many of these programs. The Cherokee County Soil and Water District and local NRCS staff can assist farm owners with choosing appropriate BMPs and identifying funding.

2.4.3 Camp Creek [AU# 1-82]

Current Status
Camp Creek was not sampled by DWQ during this assessment period, but the Cherokee County Soil and Water Conservation District conducted a stream survey to evaluate water quality impacts. Cherokee SWCD noted a sediment and erosion problem in the creek and identified pasture, road construction, and residential construction activities as possible sources. Water quality stressors originating from these sources include stream channelization, livestock access, and development.

2007 Recommendations
Less than twenty percent of the agricultural land is operating with a conservation plan. Agricultural landowners are encouraged to work with Cherokee SWCD to develop and implement conservation plans for the remaining agricultural land in the watershed. The following are also needed to reduce the sediment and erosion problem: streambank stabilization/repair, establishing vegetated riparian buffers, livestock exclusion, off-stream livestock watering locations, and better erosion and sediment control enforcement for new construction.

2.4.4 Colvard Creek [AU# 1-52-58]

Current Status
Colvard Creek was sampled at sites FB36 and FB37 as part of the 2002 Valley River Watershed Assessment. Habitat was severely degraded primarily due to poor cattle management practices. At the time the stream was sampled, livestock had direct access to the stream. During periods of high water, parts of a feedlot could be submerged.

2007 Recommendations
The impacts from cattle access should be corrected through use of agricultural best management practices. There are a variety of funding sources that can be used to make installation of these improvements more affordable to farm owners. Chapter 7 describes many of these programs. The Cherokee County Soil and Water District and local NRCS staff can assist farm owners with choosing appropriate BMPs and identifying funding.

2.4.5 Hanging Dog Creek [AU# 1-57]

Current Status
DWQ biologists sampled the fish (FF5) and benthic (FB8) communities in 2004. The sites received Good and Excellent bioclassifications, respectively. Large portions of the watershed lie within the Nantahala National Forest, although immediate land use near the sampling site consisted of sparse residences and pasture. Downstream, the riparian zone was narrow and provided insufficient shading.

2007 Recommendations
The riparian zone should be replanted and/or allowed to reestablish itself. Doing so will provide more shading to keep water temperature low and protect against bank erosion.

2.4.6 Hyatt Creek [AU# 1-52-43]

Current Status
Hyatt Creek is one of the larger tributary streams to the Valley River. The lower end passes through residential areas and follows SR 1379. Farther upstream some livestock (horses and cows) were noted in the riparian zone and excess sediment was noted in the stream. In 2002, DWQ sampled upstream at site FB27 and downstream at site FB34. Both sites received Excellent bioclassifications. Sediment was accumulating at site FB27, mostly due to streamside land disturbing activity conducted without the use of erosion control measures. This activity was reported to the DWQ Regional Office and the Division of Land Resources.

TVA biologists also evaluated Hyatt Creek fish populations and noted impacts. Addressing the habitat degradation discussed above would help the fish community at this site recover.

HRWC is helping to facilitate the development of an outdoor environmental education area on property adjacent to the Marble Elementary School in Cherokee County. The property, which was donated by NC Rep. Roger West, contains the original Marble Springs, Hyatt Creek (which is a designated trout stream), a wetland area, and an area of native pine forest.

2007 Recommendations
Land disturbing activities should be conducted using sediment and erosion control BMPs. Residential landowners along the creek can use a variety of techniques to reduce pollution caused by runoff from their property. Residents should refer to Chapter 5 and the document "Improving Water Quality in Your Own Backyard." This pamphlet is available free of charge through the Division of Water Quality and online at http://h2o.enr.state.nc.us/nps/documents/BackyardPDF.pdf. Copies can usually be obtained locally at the Hiwassee River Watershed Coalition office.

2.4.7 Junaluska Creek [AU# 1-52-25a]

Current Status
DWQ sampling at site FB7 resulted in an Excellent bioclassification. This site has improved from Good-Fair in 1994. TVA biologists sampled further downstream at Highway US-19 Business. Habitat evaluation there noted channelization, narrow riparian zones, and some sediment deposition. Citizen complaints indicate that instream mining (rock removal) is contributing to stream stability and habitat problems. HRWC has evaluated stream restoration and bank stabilization options and determined that public money should not be spent until the destabilizing activities are stopped and restoration projects will have better chance for long-term success.

2007 Recommendations
The Divisions of Land Resources and Water Quality should work together to ensure any illegal mining activities are stopped. Once these activities are under control, restoration activities should proceed.

2.4.8 Marble Creek [AU# 1-52-66-(3)]

Current Status
TVA evaluated Marble Creek as part of the 2002 Valley River Watershed Assessment. Severe habitat degradation affects the biological communities in this stream. The substrate was partially embedded, with cobble and boulders (25-50 percent) surrounded by fine sediment. The banks were moderately stable, but there were small areas of erosion. The channel of this stream was altered (channelized) in the past.

2007 Recommendations
Stream restoration and bank stabilization options should be evaluated.

2.4.9 Morris Creek [AU# 1-52-36]

Current Status
Morris Creek was sampled above (site FB25) and below (site FB29) the Andrews Airport during the 2002 Valley River Watershed Assessment. Both sites were rated Not Impaired based on the stream's small size (Refer to Appendix VIII for more information on Use Support methodology). There were several pollution intolerant species collected at the upstream site, but green algae and abundant aquatic worms indicated nutrient enrichment. The stream is channelized through the airport property and the downstream benthic community was more pollution tolerant. The streambanks are unstable due to the lack of riparian vegetation and channelization.

2007 Recommendations
Stream restoration and bank stabilization options should be evaluated.

2.4.10 Nottely River [AU# 1-58]

Current Status
DWQ sampled the Nottely River in the regulated reach below Lake Nottely. The benthic community received a Good bioclassification (site FB3), but the habitat was severely degraded. Bank erosion, substrate embeddedness, and a lack of well-developed pools and riffles were the primary habitat deficiencies. These combined to produce the worst habitat score in the Hiwassee River basin. Water released from Lake Nottely is hypolimnetic and is reflected by the lowest water temperature measured in the basin.

2007 Recommendations
DWQ supports efforts led by HRWC in Georgia to reduce nutrient loads to Lake Nottely. Nutrient reductions in the lake may lead to improved water quality in the regulated river reach. Options for bank stabilization should be evaluated and implemented if feasible. Doing so will likely reduce erosion and improve instream habitat.

2.4.11 Peachtree Creek [AU# 1-44b]

Current Status
Peachtree Creek was sampled near its confluence with the Hiwassee River (site FF8) and upstream (site FB12). Biologists noted severe bank erosion at both sites and suspect that the stream may be suffering from new erosion problems that have yet to be reflected in the biological communities. The cause of this erosion is unknown, but may be related to high stream

flows in spring 2004, coupled with poor riparian habitat. The dominant land use in this watershed is forest, but agriculture and scattered residences are also present.

Special Studies
In July 2005, the NC Ecosystem Enhancement Program (EEP) began a local watershed planning process in the Peachtree and Martins Creek watersheds. DWQ assessed four sites within the upper Hiwassee River watershed in Cherokee County in March 2006 to support development of the Peachtree-Martins Creek Local Watershed Plan. Because this assessment falls outside the data window of this basinwide plan, the data cannot be used for Use Support Ratings. However, less than optimal instream and riparian habitat characteristics were observed at each site; this was especially so for Slow Creek in the Peachtree Creek watershed and upper Martins Creek. Nonpoint source runoff contributes to elevated specific conductivities at these sites. Although the fish communities at Slow Creek and lower Martins Creek received Good-Fair bioclassifications, the community at Slow Creek was clearly more impacted. The fish community at upper Peachtree Creek, although Not Rated due to its small size seemed to be healthy, but perhaps slightly impacted by narrow riparian buffers. These data will be incorporated into Use Support Ratings during the next basinwide planning cycle.

2007 Recommendations
The final Peachtree-Martins Creek Watershed Management Plan is expected in mid-2007. DWQ expects it to be the best available strategy for restoration and will work with federal, state, and local parties to implement its recommendations.

2.4.12 Tatham Creek [AU# 1-52-28]

Current Status
Two sites (FB24 and FB31) were sampled on Tatham Creek during the 2002 Valley River Watershed Assessment. Much of the watershed is in residential land use. Instream habitat was generally good at both sites, but the riparian vegetation had been cleared for residential purposes. Periphyton growth was prolific and the creek bed was slightly embedded with silt and sand. These problems are likely due to a combination of leaky/failing septic systems, straight pipes, and runoff from lawns through the poor riparian habitat.

2007 Recommendations
There are several techniques residential landowners can use to reduce runoff from their property. These practices are generally low cost and easy to implement. Refer to Chapter 5 and the document "Improving Water Quality in Your Own Backyard." This pamphlet is available free of charge through the Division of Water Quality and online at http://h2o.enr.state.nc.us/nps/documents/BackyardPDF.pdf. Copies can usually be obtained locally at the Hiwassee River Watershed Coalition office.

2.4.13 Taylor Creek [AU# 1-52-39]

Current Status
Benthic and fish community samples (FB33 & FF4) were collected from Taylor Creek during the assessment period. This stream flows through pastureland where cattle have access to the stream and have caused breaks in the riparian zone, bank instability, and instream sedimentation. Despite its classification as trout water, the fish population indicated a mix of cool and warm water species.

2007 Recommendations
Both instream and riparian habitats could be improved if cattle were excluded from this stream. Riparian vegetation protection and restoration will provide shade and help to maintain cool water fish species, including trout. These habitat problems could be addressed through the Valley River Watershed Restoration project led by HRWC (Refer to Section 2.3.3).

2.4.14 Vengeance Creek [AU# 1-52-45]

Current Status
While sampling the fish community at site FF6, DWQ biologists noted many upstream residences with gardens and lawns along the streambanks. Residential activities may be contributing nutrients to the stream via runoff. Vengeance Creek received a Good bioclassification.

2007 Recommendations
There are a variety of easy and low cost practices residential landowners can use to reduce pollution caused by runoff from their property. Residents should refer to Chapter 5 and the document "Improving Water Quality in Your Own Backyard." This pamphlet is available free of charge through the Division of Water Quality and online at http://h2o.enr.state.nc.us/nps/documents/BackyardPDF.pdf.

2.4.15 Webb Creek [AU# 1-52-32]

Current Status
Site FB21 on Webb Creek was sampled in 2002 as part of the Valley River Watershed Assessment. The stream is Supporting aquatic life with good water quality and good habitat. However, the substrate was slightly embedded with sand that likely originated from the road that parallels it.

2007 Recommendations
The habitat degradation noted in Webb Creek demonstrates the need for careful road planning and maintenance. For more information on road impacts to stream health, refer to Chapter 5.

2.4.16 Welch Mill Creek [AU# 1-52-40]

Current Status
Three samples were taken from Welch Mill Creek during the assessment period. Two samples were collected from site FB6 near the Nantahala Game Lands boundary where water quality and habitat are excellent. One benthic sample was collected near US19 (site FB30) and indicated a more pollution tolerant aquatic community. The protective riparian zone was absent and conductivity was elevated, potentially by runoff from human activities.

2007 Recommendations
This stream is not impaired. However, the habitat problems noted by DWQ should be addressed through the Valley River Watershed Restoration project led by HRWC (Refer to Section 2.3.3).

2.4.17 Worm Creek [AU# 1-52-24]

Current Status
The benthic community in Worm Creek was sampled at sites FB26 and FB38 as part of the Valley River Watershed Assessment in 2002. The habitat at the upstream site (FB26) was good, but the conductivity was elevated. This suggests runoff from residential or agricultural land use. The downstream site (FB38) was plagued by several habitat and water quality problems. The stream was full of silt and muck due to severe erosion. Heavy equipment had been used to push trees and other woody debris into the creek, disrupting flow. The site was very productive with long filamentous algae, suggesting nutrient enrichment. Conductivity was also very high for a mountain stream. Field staff determined the source of this high conductivity was Rail Cove Creek, a very small tributary to Worm Creek. Rail Cove Creek runs along SR 1503 through a number of residences. Unidentified concrete structures with pipes discharging to the creek were located at these residences.

Biologists from TVA sampled the fish community in the upstream reach of Worm Creek in 1994 and 2002. These samples indicated that elevated temperature and nutrients were a concern, but their impact had lessened between 1994 and 2002.

2007 Recommendations
The purpose of the concrete structures should be identified. If these structures are indeed impacting water quality, options for their removal or replacement should be explored. Erosion and sedimentation problems should be addressed in order to prevent further habitat degradation that may result in aquatic life impairment. These habitat problems could be addressed through the Valley River Watershed Restoration Project. See Section 2.3.3 and Chapter 11 for more information on this initiative.

2.5 Additional Water Quality Issues within Subbasin 05-07-02

The previous sections discussed water quality concerns for specific stream segments. The following section discusses issues that may threaten water quality in the subbasin that are not specific to particular streams, lakes, or reservoirs. The issues discussed may be related to waters near certain land use activities or within proximity to different pollution sources.

This section also discusses ideas, rules, and practices in place to preserve and maintain the pristine waters of the Hiwassee River basin. In subbasins 05-07-01 (Chapter 1) and 05-07-02, this is particularly important since some of the waters are designated high quality or outstanding resource waters (HQW and ORW, respectively). Special management strategies, or rules, are in place to better manage the cumulative impact of pollutant discharges, and several landowners have voluntarily participated in land conservation, stabilization, and/or restoration projects.

2.5.1 Sediment, Erosion, and Stormwater Concerns

The Hiwassee River Watershed Coalition reports a marked increase in sedimentation and turbidity in the Cherokee County portion of the Hiwassee River Basin. Their reports are substantiated by the increase in turbidity standard exceedances at DWQ ambient monitoring station on the Valley River. The Coalition receives continuing complaints from citizens regarding runoff from construction sites, sediment build-up in local creeks, and pollution of wells and springs by poorly controlled stormwater. Coalition staff does not have the

enforcement authority over these issues and must pass the complaints on to DENR Water Quality and Land Quality staff. The citizens placing the complaints and District personnel are frequently unsatisfied and frustrated by a lack of enforcement actions after complaints are placed. They have determined that, due to resource constraints, state enforcement agencies are unable to effectively monitor land-disturbing activities associated with residential development, and are failing to prevent severe impacts to the water quality in the Hiwassee River Basin.

Clay and Cherokee Counties do not have local sediment and erosion control programs. The high rate of residential development in the Hiwassee River Basin, combined with this lack of erosion control ordinances and limited enforcement at the state level, has resulted in an apparent increase in sediment loads. This is visibly evident as the Hiwassee River changes appearance from clear to muddy after storm events. Clay and Cherokee Counties are encouraged to adopt a local Sediment and Erosion Control Ordinance and local enforcement program to prevent declines in the water quality in the Hiwassee River Basin. A model ordinance can be downloaded at: http://www.dlr.enr.state.nc.us/pages/sedimentlocalprograms.html.

Additionally, both counties and the municipal jurisdictions within the basin should implement the voluntary Universal Stormwater Management Program (USMP) to address stormwater runoff concerns. Under the USMP, a local government will be able to meet the different post-construction requirements for many existing stormwater strategies (HWQ, Phase 2 NPDES, etc) with just a single set of requirements. More information about the program can be found at: http://h2o.enr.state.nc.us/su/usmp.htm. The Counties are also encouraged to adopt local sediment and erosion control programs. The Division of Land Resources operates several assistance programs that provide technical advice and cost sharing opportunities to those interested in starting a local program. More information can be found at: http://www.dlr.enr.state.nc.us/pages/sedimentlocalprograms.html

2.5.2 Septic System Concerns

Development of rural land in areas not served by sewer systems is occurring rapidly in the upper Hiwassee River basin. Hundreds of permit applications for onsite septic systems are approved every year. Septic systems generally provide a safe and reliable method of disposing of residential wastewater when they are sited (positioned on a lot), installed, operated, and maintained properly. Rules and guidelines are in place in both Georgia and North Carolina to protect human health and the environment. Water quality is protected by locating the systems at least 50 feet away from streams and wetlands, limiting buildable lot sizes to a ¾-acre minimum, and installing drain fields in areas that contain suitable soil type and depth for adequate filtration; drinking water wells are further protected by septic system setbacks.

Septic systems typically are very efficient at removing many pollutants found in wastewater including suspended solids, metals, bacteria, phosphorus, and some viruses. However, they are not designed to handle other pollutants that they often receive such as solvents, automotive and lubricating oil, drain cleaners, and many other household chemicals. Additionally, some byproducts of organic decomposition are not treated. Nitrates are one such byproduct and are the most widespread contaminant of groundwater in the United States (Smith, et al., 2004).

One septic system generates about 30 to 40 pounds of nitrate nitrogen per year (NJDEP, 2002). Nitrates and many household chemicals are easily dissolved in water and therefore move through

the soil too rapidly to be removed. Nitrates are known to cause water quality problems and can also be harmful to human health (Smith, et al., 2004).

Proper location, design, construction, operation, and maintenance of septic systems are critical to the protection of water quality in a watershed. If septic systems are located in unsuitable areas, are improperly installed, or if the systems have not been operated and/or maintained properly, they can be significant sources of pollution. Additionally if building lots and their corresponding septic systems are too densely developed, the natural ability of soils to receive and purify wastewater before it reaches groundwater or adjacent surface water can be exceeded (Smith, et al., 2004). Nutrients and some other types of pollution are often very slow to leave a lake system. Therefore, malfunctioning septic systems can have a significant long-term impact on water quality and ecological health (PACD, 2003).

Local governments, in coordination with local health departments, should evaluate the potential for water quality problems associated with the number and density of septic systems being installed throughout their jurisdiction. Long-term county-wide planning for future wastewater treatment should be undertaken. There are water quality concerns associated with both continued permitting of septic systems for development in outlying areas and with extending sewer lines and expanding wastewater treatment plant discharges. Pros and cons of various wastewater treatment options should be weighed for different parts of the county (based on soil type, depth, proximity to existing sewer lines, etc.) and a plan developed that minimizes the risk of water quality degradation from all methods employed.

In addition, local governments, again in coordination with local health departments, should consider programs to periodically inform citizens about the proper operation of septic systems and the need for routine maintenance and replacement. Owners of systems within 100 feet of streams or lakes should be specifically targeted and encouraged to routinely check for the warning signs of improperly functioning systems and to contact the health department immediately for assistance in getting problems corrected.

2.5.3 Floodplain Protection

The riverside land that gets periodically inundated by a river's floodwaters is called the floodplain. Floodplains serve important purposes. They:

- temporarily store floodwaters,
- improve water quality,
- provide important habitat for river wildlife, and
- create opportunities for recreation.

Natural floodplains help reduce the heights of floods. During periods of high water, floodplains serve as natural sponges, storing and slowly releasing floodwaters. The floodplain provides additional "storage," reducing the velocity of the river and increasing the capacity of the river channel to move floodwaters downstream.

When the river is cut off from its floodplain by levees and dikes, flood heights are often increased. The construction of levees along the Lower Missouri River, for example, has increased flood heights by as much as twelve feet. By contrast, protected floodplain wetlands along the Charles River in Massachusetts store and slowly release floodwaters -- providing as much "storage" as a medium-sized reservoir.

Natural floodplains also help improve water quality. As water courses through the floodplain, plants serve as natural filters, trapping sediments and capturing pollutants. Nitrogen and phosphorus (found in fertilizers) that wash off farm fields, suburban lawns and city streets ignite a chemical chain reaction which reduces the amount of oxygen in the water, suffocating fish and other aquatic organisms.

Many floodplain plants use nitrogen and phosphorus before they can reach the river, thereby improving water quality. Many cities have built artificial wetlands to reduce water treatment costs. Studies of heavily polluted waters flowing through Tinicum Marsh in Pennsylvania, for example, have shown significant reductions in phosphorus and nitrogen. The water treatment value of Georgia's 2,300-acre Alcovy River Swamp is more than $1 million a year. Floodplains also play an important role in the recharging of groundwater supplies (American Rivers, 2006).

Cherokee County is strongly encouraged to adopt and implement comprehensive floodplain protection. Doing so will help protect its aquatic resources over the long-term. Guidance on floodplain ordinance adoption is provided by the Association of State Flood Plain Managers at www.floods.org.

2.5.4 Management Strategies for Water Quality Protection

Gipp Creek watershed is classified as High Quality Waters. High Quality Water (HQW) and Outstanding Resource Water (ORW) are supplemental classifications to the primary freshwater classification(s) placed on a waterbody. Management strategies are associated with the supplemental HQW and ORW classifications and are intended to protect the current use of the waterbody. Below is a brief summary of these strategies and the administrative code under which the strategies are found. More detailed information can be found in the document entitled *Classifications and Water Quality Standards Applicable to Surface Waters and Wetlands of North Carolina* (NCDENR-DWQ, 2004). This document is available on-line at http://h2o.enr.state.nc.us/admin/rules/. Definitions of the primary and supplemental classifications can be found in Chapter 3.

HQW is intended to protect waters with water quality higher than the state's water quality standards. In the Hiwassee River basin, waters classified as Water Supply I and II (WS-I and WS-II), ORW, and waters designated by the NC Wildlife Resources Commission (WRC) as native (wild) trout waters are subject to HQW rules. Streams petitioned for WS-I or WS-II or are which considered Excellent based on biological and physical/chemical parameters may qualify for the HQW supplemental designation.

New discharges and expansions of existing discharges may, in general, be permitted in waters classified as HQW provided that the effluent limits are met for dissolved oxygen (DO), ammonia/nitrogen levels (NH_3-N), and the biochemical oxygen demand (BOD_5). More stringent limitations may be necessary to ensure that the cumulative effects from more than one discharge of oxygen-consuming wastes will not cause the dissolved oxygen concentration in the receiving water to drop more than 0.5 milligrams per liter (mg/l) below background levels. Discharges from single-family residential structures into surface waters are prohibited. When a discharge from an existing single-family home fails, a septic tank, dual or recirculation sand filters, disinfection, and step aeration should be installed (Administrative Code 15A NCAC 2B .0224)

In addition to the above, development activities which require an Erosion and Sedimentation Control Plan under the NC Sedimentation Control Commission or an approved local erosion and sedimentation control program are required to follow stormwater management rules as specified in Administrative Code 15A NCAC 2H .1000 (NCDENR-DWQ, 1995). Under these rules, stormwater management strategies must be implemented if development activities are within one mile of and draining to waters designated as HQW. The low-density option requires a 30-foot wide vegetative buffer between development activities and the stream. This option can be used when the built upon area is less than 12 percent of the total land area or the proposed development is for a single-family residential home on one acre or greater. Vegetated areas may be used to transport stormwater in the low-density option, but it must not lead to a discrete stormwater collection system (e.g., constructed). The high-density option is for all land disturbing activities on greater than one acre. For high-density projects, structural stormwater controls must be constructed (e.g., wet detention ponds, stormwater infiltration systems, innovative systems) and must be designed to control runoff from all surfaces affected by one inch or more of rainfall. More stringent stormwater management measures may be required on a case-by-case basis where it is determined additional measures are needed to protect and maintain existing and anticipated uses of the water (Administrative Code 15A NCAC 2H .1006).

Many of the streams in this subbasin are classified as trout (Tr) waters, and therefore, are protected for natural trout propagation and maintenance of stocked trout. There are no watershed development restrictions associated with the trout classification; however, the NC Division of Land Resources (DLR), under the NC Sedimentation and Pollution Control Act (SPCA), has requirements to protect trout streams from land disturbing activities. Under G.S. 113A-57(1), "waters that have been classified as trout waters by the Environmental Management Commission (EMC) shall have an undisturbed buffer zone 25 feet wide or of sufficient width to confine visible siltation within the twenty-five percent of the buffer zone nearest the land-disturbing activity, whichever is greater." The Sedimentation Control Commission, however, can approve land-disturbing activities along trout waters when the duration of the disturbance is temporary and the extent of the disturbance is minimal. This rule applies to unnamed tributaries flowing to the affected trout water stream. Further clarification on classifications of unnamed tributaries can be found under Administration Code 15A NCAC 02B .0301(i)(1). For more information regarding land-disturbing activities along designated trout streams, see the DLR website at http://www.dlr.enr.state.nc.us/.