

## **Appendix IV**

# **DWQ Water Quality Monitoring Programs in the Hiwassee River Basin**



## DWQ Water Quality Monitoring Programs in the Hiwassee River Basin

Staff in the Environmental Sciences Section (ESS) and Regional Offices of DWQ collect a variety of biological, chemical and physical data. The following discussion contains a brief introduction to each program, followed by a summary of water quality data in Hiwassee River basin for that program. For more detailed information on sampling and assessment of streams in this basin, refer to the *Basinwide Assessment Report* for the Hiwassee River basin, available from the Environmental Sciences Branch website at <http://www.esb.enr.state.nc.us/bar.html> or by calling (919) 733-9960.

### *DWQ monitoring programs for the Hiwassee River Basin include:*

- Benthic Macroinvertebrates
- Fish Assessments
- Aquatic Toxicity Monitoring
- Lake Assessment
- Ambient Monitoring System

### **Benthic Macroinvertebrate Monitoring**

Benthic macroinvertebrates, or benthos, are organisms that live in and on the bottom substrates of rivers and streams. These organisms are primarily aquatic insect larvae. The use of benthos data has proven to be a reliable monitoring tool, as benthic macroinvertebrates are sensitive to subtle changes in water quality. Since macroinvertebrates have life cycles of six months to over one year, the effects of short-term pollution (such as a spill) will generally not be overcome until the following generation appears. The benthic community also integrates the effects of a wide array of potential pollutant mixtures.

Criteria have been developed to assign a bioclassification to each benthic sample based on the number of different species present in the pollution intolerant groups of Ephemeroptera (Mayflies), Plecoptera (Stoneflies) and Trichoptera (Caddisflies), commonly referred to as EPTs. A Biotic Index (BI) value gives an indication of overall community pollution tolerance. Different benthic macroinvertebrate criteria have been developed for different ecoregions (mountains, piedmont, coastal plain and swamp) within North Carolina and bioclassifications fall into five categories: Excellent, Good, Good-Fair, Fair and Poor.

### *Overview of Benthic Macroinvertebrate Data*

Based on benthic macroinvertebrate data, water quality in the Hiwassee River basin is Excellent to Good. Since 1999, 34 benthic macroinvertebrate basinwide samples have been collected with one (3%) receiving a Good-Fair bioclassification, nine (26%) resulting in Good bioclassifications, and 24 (71%) receiving Excellent bioclassifications. Comparisons of benthos data from 1999 to 2004 between repeat sites show that one site (Valley River at SR 1555) improved from Good-Fair to Good, while five sites (Shooting Creek at SR 1370, Brasstown Creek SR 1104, Hiwassee River at US 64, Junaluska Creek at SR 1505, South Shoal Creek at SR 1314) improved from Good to Excellent. All remaining sites were Excellent in both 1999 and 2004 while the Nottely River maintained a Good bioclassification from 1999 to 2004. Overall, water quality in this basin has improved since 1999.

Several rare invertebrate taxa were collected in the Hiwassee River basin in 2004 including the mayflies *Serratella spiculosa* (Persimmon Creek, Beaverdam Creek, Big Tuni Creek, Junaluska Creek), *Rhithrogena fuscifrons* (Big Tuni Creek, Welch Mill Creek), Nixe (Fires Creek), the caddisflies *Molanna tryphena* (Hiwassee River), *Molanna blenda* (Fires Creek), *Micrasema*

rickeri (Welch Mill Creek), Agarodes (Brasstown Creek) and the stoneflies Beloneuria (Welch Mill Creek) and Agnetina (Fires Creek). The collection of Molanna tryphena at the Hiwassee River represents a significant range extension for this species as it has only previously been collected in the coastal plain and sandhills ecoregions of North Carolina. Two particularly noteworthy benthos sites (Shuler Creek SR 1323, and Tusquittee Creek at SR 1300) set the highest total taxa and EPT taxa diversities ever recorded in the Hiwassee River basin. For detailed information regarding the samples collected during this assessment period, refer to the tables at the end of this appendix.

### Assessing Benthic Macroinvertebrate Communities in Small Streams

The benthic macroinvertebrate community of small streams is naturally less diverse than the streams used to develop the current criteria for flowing freshwater streams. The benthic macroinvertebrate database is being evaluated and a study to systematically look at small reference streams in different ecoregions is being developed with the goal of finding a way to evaluate water quality conditions in such small streams.

Presently, a designation of Not Impaired may be used for flowing waters that are too small to be assigned a bioclassification (less than 4 meters in width) but meet the criteria for a Good-Fair or higher bioclassification using the standard qualitative and EPT criteria. This designation will translate into a use support rating of Supporting. However, DWQ will use the monitoring information from small streams to identify potential impacts to small streams even in cases when a use support rating cannot be assigned.

DWQ will use this monitoring information to identify potential impacts to these waters even though a use support rating is not assigned. DWQ will continue to develop criteria to assess water quality in small streams.

### **Fish Assessments**

In 2004, 13 sites were sampled in the Hiwassee River basin in mid June. No previous fish community assessments have been performed by DWQ in any of these mountain streams. The most commonly collected species in 2004 was the mottled sculpin, which was collected at all 13 sites and comprised almost 50 percent of all individuals collected in this watershed. The second most abundant species was the central stoneroller, collected at 12 of 13 sites, making up roughly eight percent of all individuals collected in the basin.

Nine of the 13 stream sites were evaluated using the North Carolina Index of Biotic Integrity (NCIBI) (Appendices F2 – F5). Four of the sites were not rated with the NCIBI because “Trout stream” specific criteria and metrics have not yet been developed for the mountain ecoregions of North Carolina. Furthermore, criteria should be considered “tentative” for the Hiwassee River basin because no previous fish community data exists for this basin. More reference site data is needed to verify that the present metrics being used are appropriate for the Hiwassee River basin.

The NCIBI ratings for the nine ratable streams ranged from Poor to Excellent with scores that varied from 20 to 58. Although Martin Creek qualified as a regional reference site based on its abiotic characteristics, its rating was Fair. This inconsistency warrants further monitoring efforts including a site further upstream from the mouth of the Hiwassee River with slightly higher gradient and more riffles.

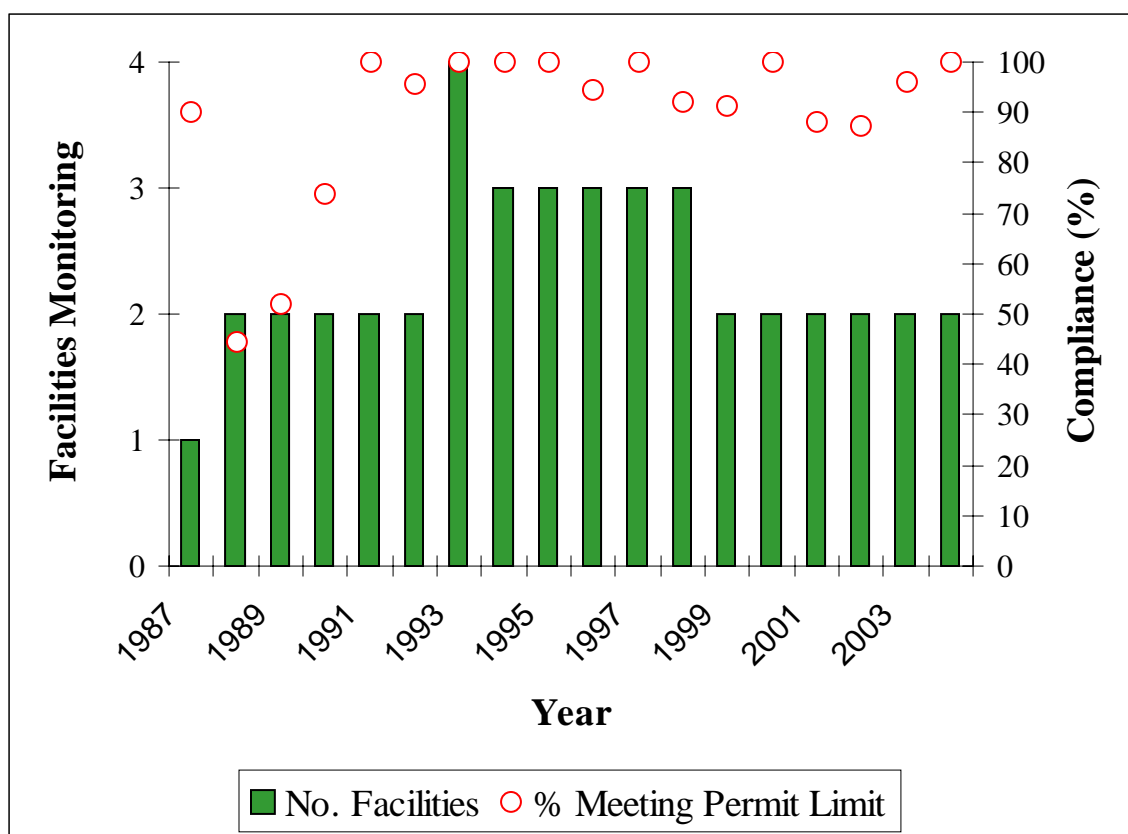
For detailed information regarding the samples collected during this assessment period, refer to the tables at the end of this Appendix.

### **Aquatic Toxicity Monitoring**

Acute and/or chronic toxicity tests are used to determine toxicity of discharges to sensitive aquatic species (usually fathead minnows or the water flea, *Ceriodaphnia dubia*). Results of these tests have been shown by several researchers to be predictive of discharge effects on receiving stream populations. Many facilities are required to monitor whole effluent toxicity (WET) by their NPDES permit or by administrative letter. Other facilities may also be tested by DWQ's Aquatic Toxicology Unit (ATU). Per Section 106 of the Clean Water Act, the ATU is required to test at least 10 percent of the major discharging facilities over the course of the federal fiscal year (FFY). However, it is ATU's target to test 20 percent of the major dischargers in the FFY. This means that each major facility would get evaluated over the course of their five-year permit. There are no requirements or targets for minor dischargers.

The ATU maintains a compliance summary for all facilities required to perform tests and provides monthly updates of this information to regional offices and DWQ administration. Ambient toxicity tests can be used to evaluate stream water quality relative to other stream sites and/or a point source discharge.

Two facility permits in the Hiwassee River basin currently require whole effluent toxicity (WET) monitoring. Both facility permits have a WET limit. Across the state, the number of facilities required to perform WET has increased steadily since 1987, the first year that WET limits were written into permits in North Carolina. Consequently, compliance rates have also risen. Since 1996, the compliance rate has stabilized at approximately 90 percent. The following graph summarizes WET monitoring compliance in the Hiwassee River basin from 1987 to 2002. Facilities with toxicity problems during the most recent two-year review period are discussed in subbasin chapters.



### Lakes Assessment Program

Three lakes were sampled in the Hiwassee River Basin during 2004 –Chatuge, Hiwassee and Appalachia Lakes. These three water bodies are all oligotrophic with good water clarity. All of these lakes were sampled three times during the summer (June, July and August). Lakes with noted water quality impacts are discussed in the appropriate subbasin chapter.

### Ambient Monitoring System

The Ambient Monitoring System (AMS) is a network of stream, lake and estuarine stations strategically located for the collections of physical and chemical water quality data. North Carolina has more than 378 water chemistry monitoring stations statewide, including 2 stations in the Hiwassee River basin. Between 23 and 32 parameters are collected monthly at each station. The locations of these stations are listed in the following table and shown on individual subbasin maps. Notable ambient water quality parameters are discussed in the subbasin chapters. Refer to *2005 Hiwassee Basinwide Assessment Report* at <http://www.esb.enr.state.nc.us/bar.html> for more detailed analysis of ambient water quality monitoring data.

#### Locations of Ambient Monitoring Stations in the Roanoke River Basin by Subbasin

Subbasin/ Station ID	Location	Class	Lat.	Long.	County	Map ID
<i>01</i>	<b>Hiwassee River (upper)</b>					
	No Stations					
<i>02</i>	<b>Hiwassee River (lower) and Valley River</b>					
F2500000	Hiwassee River beside US 64 above Murphy	WS-V	35.0788	-84.0254	Cherokee	A1
F4000000	Valley River at US 74/19/129 at Tomotla	C Tr	35.1373	-83.9796	Cherokee	A2

Benthic Macroinvertebrate Data Collected in the Hiwassee River Basin, 1999 – 2004  
 (Current basinwide sampling sites are in **bold print**.)

Waterbody	Location	County	Index No.	Date	ST	EPT	BI	EPT BI	Bioclass
<b>01</b>									
<u>Shooting Cr</u>	SR 1340	Clay	1-5	8/04	----	39	----	2.6	Excellent
				8/99	----	30	----	2.5	Good
<u>Big Tuni Cr</u>	SR 1311	Clay	1-21-5	8/04	----	48	----	1.5	Excellent
				8/99	----	45	----	1.6	Excellent
<u>Tusquitee Cr</u>	SR 1300	Clay	1-21-(16.5)	8/04	119	51	4.0	2.7	Excellent
				8/99	84	39	3.4	2.7	Excellent
<u>Fires Cr</u>	SR 1334	Clay	1-27-(5.5)	8/04	118	53	3.7	2.6	Excellent
				8/99	77	44	2.9	2.4	Excellent
<u>Brasstown Cr</u>	SR 1104	Clay	1-42	8/04	108	53	4.8	3.7	Excellent
				8/99	77	44	4.6	3.8	Good
<b><u>Webb Cr</u></b>	SR 1428	Cherokee	1-42-1-1	8/99	58	37	3.2	2.8	Good
	Off SR 1384	Cherokee	1-42-1-1	6/02	63	45	2.4	2.0	Not Impaired
<b>02</b>									
<b><u>Hiwassee R</u></b>	US 64	Cherokee	1-(43.7)	8/04	100	46	4.4	3.5	Excellent
				8/99	73	36	4.4	3.5	Good
<u>Peachtree Cr</u>	SR 1537	Cherokee	1-44	8/04	----	49	----	2.5	Excellent
				8/99	----	38	----	2.9	Excellent
<u>Martin Cr</u>	SR 1558	Cherokee	1-49	8/04	----	30	----	3.1	Good
<u>Valley R</u>	SR 1554	Cherokee	1-52	8/04	101	36	5.0	3.9	Good
		Cherokee		8/99	80	33	5.0	4.1	Good-Fair
<b><u>Valley R</u></b>	Main Street, Andrews	Cherokee	1-52	6/02	94	52	4.6	3.6	Excellent
<b><u>Valley R</u></b>	Stewart Rd.	Cherokee	1-52	6/02	99	51	4.0	3.2	Excellent
<b><u>Valley R</u></b>	Off SR 1515	Cherokee	1-52	6/02	92	40	5.0	4.2	Good
<b><u>Valley R</u></b>	Off SR 1515	Cherokee	1-52	8/99	63	28	5.2	4.4	Good-Fair
<b><u>Valley R</u></b>	Main Street, Andrews	Cherokee	1-52	8/99	----	24	----	4.7	Good-Fair
<b><u>Gipp Cr</u></b>	SR 1409	Cherokee	1-52-23	6/02	76	44	2.7	2.2	Excellent
<b><u>Worm Cr</u></b>	SR 1393A	Cherokee	1-52-24	6/02	62	35	3.6	3.0	Not Impaired
	SR 1502	Cherokee	1-52-24	6/02	53	31	2.5	1.8	Not Impaired
<u>Junaluska Cr</u>	SR 1505	Cherokee	1-52-25	8/04	----	41	----	2.2	Excellent
				8/99	----	31	----	3.2	Good
<b><u>Tatham Cr</u></b>	US 19 Business	Cherokee	1-52-28	6/02	85	40	4.0	3.3	Excellent
<b><u>Collet Cr</u></b>	SR 1507	Cherokee	1-52-28-2	6/02	63	36	3.2	2.6	Not Impaired
<b><u>Beaver Cr</u></b>	SR 1388	Cherokee	1-52-30-(1)	6/02	49	29	2.8	2.4	Not Impaired
<b><u>Taylor Cr</u></b>	SR 1515	Cherokee	1-52-39	6/02	96	41	4.3	3.0	Not Impaired
<b><u>Colvard Cr</u></b>	SR 1426	Cherokee	1-52-39-1-1	6/02	60	41	2.8	2.0	Not Impaired
<b><u>Colvard Cr</u></b>	US 19/74	Cherokee	1-52-39-1-1	6/02	62	35	3.0	2.1	Not Impaired
<u>Welch Mill Cr</u>	SR 1381	Cherokee	1-52-40	8/04	----	44	----	1.9	Excellent
				6/02	----	43	----	1.8	Excellent
<b><u>Welch Mill Cr</u></b>	SR 1428	Cherokee	1-52-40	6/02	60	34	3.4	2.8	Not Impaired
<b><u>Hvatt Cr</u></b>	SR 1428	Cherokee	1-52-43	6/02	80	45	2.9	2.1	Excellent
<b><u>Hvatt Cr</u></b>	SR 1379	Cherokee	1-52-43	6/02	----	49	----	2.0	Excellent
<b><u>Vengeance Cr</u></b>	Off NC 141	Cherokee	1-52-45	6/02	92	50	4.1	3.3	Good
<u>Hanging Dog Cr</u>	SR 1331	Cherokee	1-57	8/04	----	41	----	2.4	Excellent
				8/99	----	40	----	2.5	Excellent
<u>Owl Cr</u>	SR 1331	Cherokee	1-57-6	8/04	----	44	----	2.5	Excellent
<u>Nottely R</u>	SR 1596	Cherokee	1-58	8/04	----	32	----	2.6	Good
				8/99	----	33	----	3.5	Good
<u>Persimmon Cr</u>	SR 1127	Cherokee	1-63	8/04	----	40	----	3.0	Excellent
				8/99	----	40	----	3.6	Excellent
<u>Beaverdam Cr</u>	SR 1326	Cherokee	1-72	8/04	----	50	----	2.5	Excellent
				8/99	----	38	----	2.7	Excellent
<u>South Shoal Cr</u>	SR 1314	Cherokee	1-77	8/04	----	38	----	2.3	Excellent
				8/99	----	33	----	3.5	Good
<u>Shuler Cr</u>	SR 1323	Cherokee	1-86	8/04	----	54	----	2.7	Excellent
				8/99	----	40	----	2.7	Excellent
<b><u>Morris Cr</u></b>	SR 1383	Cherokee	1-86-6	6/02	56	34	3.1	2.5	Not Impaired
<b><u>Morris Cr</u></b>	US 19/74	Cherokee	1-86-6	6/02	74	36	4.2	3.6	Not Impaired

Fish Community Structure Data Collected in the Hiwassee Basin, 1993 – 2003  
 (Current basinwide sampling sites are in **bold print**.)

<b>Subbasin/Waterbody</b>	<b>Location</b>	<b>County</b>	<b>Index No.</b>	<b>Date</b>	<b>NCIBI Score</b>	<b>NCIBI Rating</b>
<b>040501</b>						
<b>Shooting Cr</b>	SR 1340	Clay	1-5	06/14/04	40	Good-Fair
<b>Tusquittee Cr</b>	SR 1330	Clay	1-21-(0.5)	06/15/04	---	Not Rated
<b>Fires Cr</b>	SR 1300	Clay	1-27-(5.5)	06/15/04	---	Not Rated
<b>Brasstown Cr</b>	SR 1111	Clay	1-42	06/14/04	46	Good-Fair
<b>Little Brasstown Cr</b>	SR 1565	Cherokee	1-42-11	06/17/04	44	Good-Fair
<b>040502</b>						
<b>Peachtree Cr</b>	US 64	Cherokee	1-44	06/15/04	58	Excellent
<b>Martin Cr</b>	SR 1558	Cherokee	1-49	06/17/04	38	Fair
<b>Valley R</b>	SR 1409	Cherokee	1-52	06/18/04	---	Not Rated
<b>Taylor Cr</b>	SR 1515	Cherokee	1-52-39	06/18/04	44	Good-Fair
<b>Vengeance Cr</b>	NC 141 / SR 1520	Cherokee	1-52-45	06/17/04	56	Good
<b>Hanging Dog Cr</b>	off SR 1342	Cherokee	1-57	06/16/04	56	Good
<b>Persimmon Cr</b>	SR 1127	Cherokee	1-63	06/16/04	20	Poor
<b>S Shoal Cr</b>	SR 1314	Cherokee	1-77	06/16/04	---	Not Rated