Appendix IV

DWQ Water Quality Monitoring Programs in the Little Tennessee River Basin

DWQ Water Quality Monitoring Programs in the Little Tennessee 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 Little Tennessee 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 Little Tennessee 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 Little Tennessee 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 Little Tennessee River basin is Excellent to Good. Since 1999, 80 benthic macroinvertebrate basinwide samples have been collected with 48 (60%) receiving Excellent bioclassifications, 24 (30%) resulting in Good bioclassifications, five (6%) receiving Good-Fair bioclassifications, and three (4%) receiving Fair bioclassifications. Comparisons of benthos data from 1999 to 2004 between repeat sites show that three sites (Cowee Creek, Whiteoak Creek, and the Tuckasegee River) improved from Good to Excellent, one site (Little Tennessee River off SR 1629) improved from Fair to Good-Fair, one site improved from Good-Fair to Good (Little Tennessee River at SR 1651), and Middle Creek improved from Good-Fair to Excellent. However, nine sites (Cullasaja River at US64/SR 1688 and at SR 1678, Cartoogechaye Creek, Conley Creek, Noland Creek, Panther Creek, Stecoah Creek, Tulula Creek, and Cheoah Creek) declined from Excellent to Good. Overall water quality in the Little Tennessee River is generally unchanged since 1999.

Several rare invertebrate taxa were collected in the Little Tennessee River basin in 2004 including the mayflies Serratella spiculosa (Turtle Pond Creek), Rhithrogena fuscifrons (Turtle Pond Creek, Bradley Fork, Hazel Creek), Rhithrogena exilis (Cullowhee Creek, Nantahala River, Whiteoak Creek, Deep Creek) Nixie, (Bradley Fork), the caddisflies Molanna tryphena, Agarodes (Iotla Creek), Mayatrichia ayama, Oecetis avara (Snowbird Creek), Rhyacophila amicis, Neotrichia (Hazel Creek), Micrasema rickeri (Cheoah River), and the stoneflies Agnetina flavescens (Oconaluftee River, Forney Creek, Hazel Creek, Deep Creek), and Beloneuria (Whiteoak Creek). Of particular interest, Caney Fork at SR 1740 set the second highest EPT diversity (54) and total species diversity (107) ever recorded in the Little Tennessee 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

Twenty two sites were sampled from mid-May to early June 2004; 19 of the sites had not been previously sampled. Fish communities in the basin were last sampled in 1995. The most commonly collected species in 2004 was the mottled sculpin (collected at all sites); the central stoneroller and the northern hog sucker were collected at 21 of the 22 sites. The mottled sculpin was also the most abundant species, representing about one-third of all the fish collected.

Seventeen of the 22 streams were evaluated using the North Carolina Index of Biotic Integrity (NCIBI). NCIBI ratings ranged from Fair to Excellent with the scores ranging from 38 to 58. The streams rated Fair and Excellent were the Little Tennessee River and Burningtown Creek, respectively. The remaining five streams were not evaluated using the NCIBI, were considered trout streams, and were not assigned a rating. However, Stecoah Creek did show signs of being degraded.

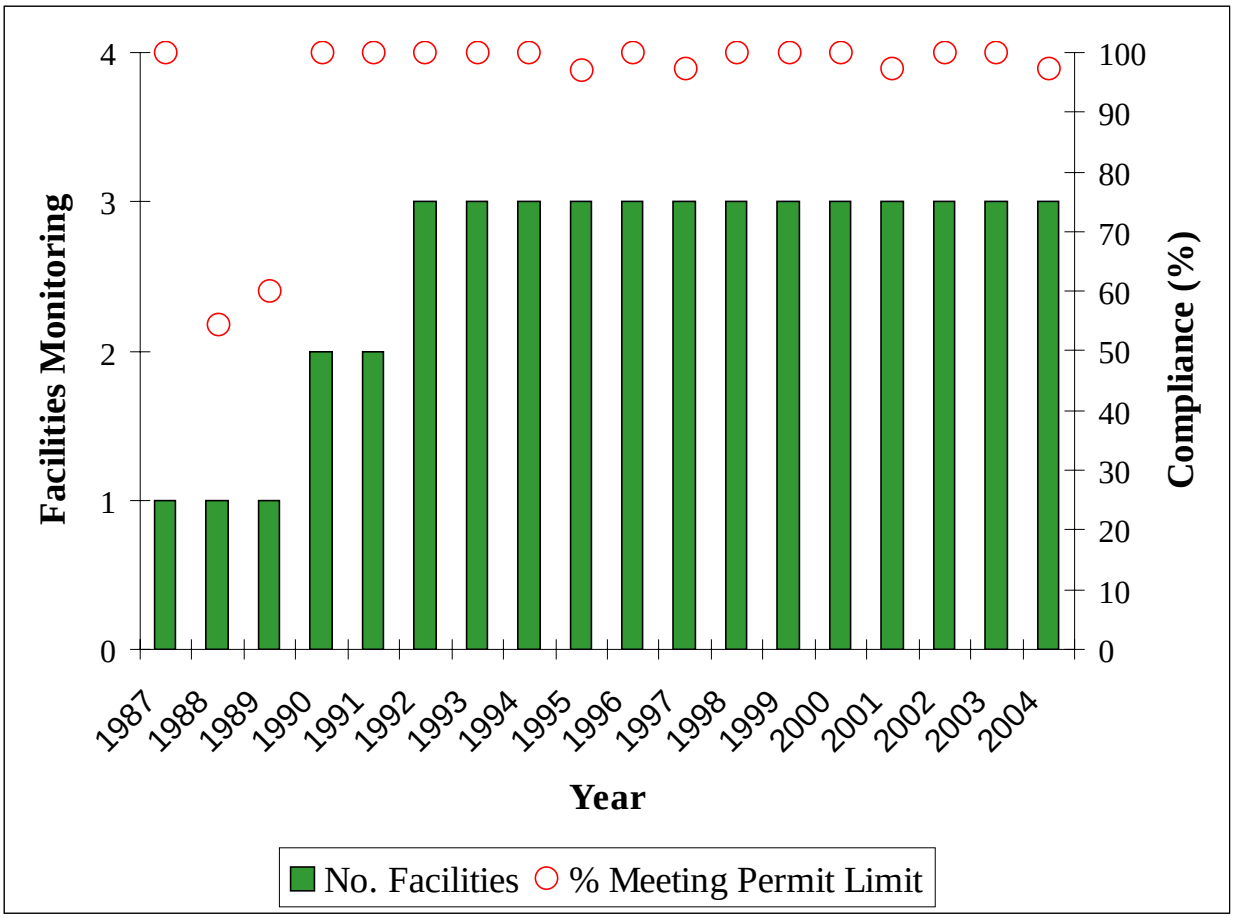
For detailed information regarding the samples collected during this assessment period, refer to the tables at the end of this Appendix.

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.

Three facility permits in the Little Tennessee River basin currently require whole effluent toxicity (WET) monitoring. All three 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 summaries WET monitoring compliance in the Little Tennessee 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

Ten lakes were sampled in the Little Tennessee River Basin by DWQ in 2004. All of these lakes were sampled three times during the summer (June, July and August). Lake Sequoyah and Wolf Creek Reservoir were also sampled in September as part of an extended sampling period special study. Data collected during this sampling effort determined sedimentation concerns related to construction are a factor at several of the lakes. Local efforts need to be directed towards preventing sedimentation into the tributaries of these lakes. 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 7 stations in the Little Tennessee River basin, although 2 of those stations were discontinued in 2000. 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 Little Tennessee 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
01	**Little Tennessee River, Cullasaja River, and Cartoogechaye Creek**					
G0035000	Little Tennessee River at SR 1651 near Prentiss	C	35.1221	-83.3743	Macon	A1
G0130000[1]	Cartoogechaye Creek at SR 1152 near Franklin	B Tr	35.1580	-83.3920	Macon	A2
G2000000	Little Tennessee River at NC 28 at Iotla	B	35.2349	-83.3958	Macon	A3
02	**Oconaluftee River, Tuckasegee River, Hazel Creek, and Deep Creek**					
G8550000[2]	Oconaluftee River at SR 1359 at Birdtown	C Tr	35.4610	-83.3540	Jackson	A4
G8600000	Tuckasegee River at SR 1364 at Bryson City	B	35.4284	-83.4460	Swain	A5
03	**Nantahala River**					
G3500000	Nantahala River at US 64 near Rainbow Springs	B Tr ORW	35.0942	-83.5599	Macon	A6
04	**Cheoah River**					
G9550000	Cheoah River at SR 1138 at Robbinsville	C Tr	35.3291	-83.8098	Graham	A7

[1]Station G0130000 ceased sample collection on 5/25/2000.
[2]Station G8550000 ceased sample collection on 5/23/2000.

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

Sub/Waterbody	Location	County	Index No.	Date	ST	EPT	BI	EPTBI	BioClass
040401									
L Tennessee R	SR 1629	Macon	2-(1)	7/21/2004	70	22	5.59	3.81	Good-Fair
				9/11/2000	67	15	6.29	3.99	Fair
				8/12/1999	60	14	6.23	4.75	Fair
L Tennessee R	SR 1651	Macon	2-(1)	7/22/2004	93	37	5.46	3.95	Good
				10/20/1999	62	29	4.42	3.49	Good-Fair
L Tennessee R	NC 28	Macon	2-(1)	7/22/2004	70	32	5.3	4.28	Good-Fair
				8/24/1999	86	32	5.3	3.75	Good-Fair
Middle Cr	SR 1635	Macon	2-(8)	7/22/2004	---	43	---	2.93	Excellent
				8/24/1999	---	25	---	4.15	Good-Fair
Tessentee Cr	SR 1684	Macon	2- 9	7/22/2004	---	47	---	3.02	Excellent
Coweeta Cr	SR 1114	Macon	2-10	7/22/2004	---	45	---	2.62	Excellent
				8/21/1999	---	39	---	3.01	Excellent
Cartoogechaye Cr	SR 1146	Macon	2-19-(1)	7/21/2004	---	31	---	3.70	Good
				8/24/1999	---	41	---	3.05	Excellent
Jones Cr	SR 1303	Macon	2-19-2	7/21/2004	---	38	---	3.07	Excellent
Cullasaja R	US 64	Macon	2-21-(0.5)	7/21/2004	58	14	5.74	4.67	Fair
				7/25/2001	41	10	6.55	5.93	Fair
				8/28/2000	65	18	6.34	5.13	Fair
				6/23/1999	47	14	5.70	4.97	Fair
Cullasaja River	River Court	Macon	2-21 (0.5)	7/26/2001	56	16	5.77	4.64	Not Rated
				5/16/2000	61	25	4.85	3.71	Not Impaired
Cullasaja River	US 64, ab Dry Falls	Macon	2-21 (0.5)	8/11/2000	20	20	4.17	4.17	Good-Fair
UT Cullasaja River	US 64	Macon		7/25/2001	46	23	3.32	2.39	Not Impaired
Salt Rock Branch	Highlands Falls	Macon	2- 21 1	7/26/2001	43	5	6.54	5.52	Not Rated
Ammons Branch	Spruce Lane	Macon	2-21 2	7/25/2001	47	20	2.94	1.15	Not Impaired
Mill Creek	5th Street	Macon	2-21 3	8/29/2000	41	11	6.14	5.36	Not Rated
				5/17/2000	37	13	5.54	4.51	Not Rated
Mill Creek	Brookside Lane	Macon	2-21 3	8/28/2000	47	17	5.48	4.51	Not Rated
Big Creek	SR1538	Macon	2-21 5 1 (0.5)	7/25/2001	49	29	2.86	2.22	Good
				8/29/2000	103	41	3.52	2.44	Excellent
Big Creek	SR 1548, Ab WTP	Macon	2-21 5 1(0.5)	9/11/2000	30	30	2.92	2.92	Good
Houston Branch	Simon Speed Rd	Macon	2-21 5 1 3 (2)	8/29/2000	47	25	2.65	1.95	Not Impaired
Cullasaja R	Off US 64, Jackson H	Macon	2-21 (5.5)	8/5/2004	77	36	4.21	3.44	Good
				6/22/1999		49	2.70	2.86	Excellent
Cullasaja R	US 64/SR 1668	Macon	2-21 (5.5)	8/5/2004	86	42	4.68	3.84	Good
				8/10/1999	99	51	3.94	3.32	Excellent
N Skitty Creek	N Cliffside Rec Area	Macon	2-21 6 1	8/29/2000	45	28	2.35	1.62	Not Impaired
Turtle Pond Cr	SR 1620	Macon	2-21 8	7/23/2004	---	49	---	2.10	Excellent

				6/22/1999	---	42	---	1.90	Excellent
Walnut Cr	SR 1533	Macon	2-21 17	8/6/2004	68	38	2.94	2.16	Excellent
				6/21/1999	34	34	2.04	2.04	Good
Iotla Cr	SR 1372	Macon	2-27	7/22/2004	73	32	4.8	3.94	Good
				8/10/1999	---	35	---	3.84	Good
Iotla Cr	SR 1485	Macon	2-27	7/22/2004	48	35	3.9	3.53	Good
Cowee Cr	NC 28	Macon	2-29	7/22/2004	---	38	---	3.24	Excellent
				8/10/1999	---	35	---	3.06	Good
Burningtown Cr	SR 1371	Macon	2-38	8/3/2004	---	43	---	3.12	Excellent
				8/10/1999	---	39	---	3.20	Excellent
Burningtown Cr	SR 1392	Macon	2 38	8/3/2004	68	34	3.18	2.51	Good
Tellico Cr	SR 1367	Macon	2 40	8/3/2004	93	44	3.62	2.68	Excellent
				8/9/1999	108	54	3.57	2.62	Excellent
040402									
L Tennessee R	off SR 1113	Swain	2-(1)	8/5/2004	95	42	4.33	3.35	Good
				8/9/1999	75	31	4.74	3.67	Good
Alarka Cr	SR 1185	Swain	2-69-(2.5)	8/2/2004	101	46	3.80	2.67	Excellent
				8/9/1999	86	51	3.66	3.11	Excellent
Tuckasegee R	SR 1140	Jackson	2-79-(0.5)	8/2/2004	36	36	1.83	1.83	Excellent
				7/19/1999	46	46	1.96	1.96	Excellent

Sub/Waterbody	Location	County	Index No.	Date	ST	EPT	BI	EPTBI	BioClass
Caney Fk	SR 1740	Jackson	2-79-28-(2.5)	8/2/2004	107	54	3.63	2.68	Excellent
				7/20/1999	97	53	3.68	3.03	Excellent
Moses Cr	SR 1739	Jackson	2-79-28-8	8/2/2004	46	46	1.71	1.71	Excellent
				7/20/1999	37	37	1.91	1.91	Excellent
Cullowhee Cr	SR 1001	Jackson	2-79-31	8/4/2004	---	47	---	2.61	Excellent
				7/20/1999	43	43	2.96	2.96	Excellent
Savannah Cr	SR 1367	Jackson	2-79-36	8/4/2004	91	40	4.15	3.11	Good
				7/21/1999	53	32	3.80	3.48	Good
Tuckasegee R	off SR 1378	Jackson	2-79-(38)	8/4/2004	84	44	4.27	3.44	Excellent
				7/21/1999	75	40	4.39	3.82	Good
Scott Cr	SR 1556	Jackson	2-79-39	8/4/2004	74	35	4.07	3.23	Good
				7/21/1999	70	36	4.14	3.22	Good
Conley Cr	off SR 1177	Swain	2-79-39	8/3/2004	34	34	2.82	2.82	Good
				7/21/1999	---	44	---	3.17	Excellent
Bradley Fk	off US 441	Swain	2-79-55-12-(11)	8/3/2004	79	47	2.59	2.02	Excellent
				7/22/1999	67	39	2.67	1.87	Excellent
Oconaluftee R	SR 1359	Swain	2-79-55-(16.5)	8/5/2004	106	51	3.96	2.97	Excellent
				7/22/1999	104	53	3.93	3.20	Excellent
Deep Cr	AB Campground	Swain	2-79-63-(16)	8/2/2004	---	43	---	2.13	Excellent
				8/9/1999	---	47	---	2.67	Excellent
Deep Cr	SR 1340	Swain	2-79-63-(21)	8/2/2004	---	38	---	2.18	Excellent
				8/9/1999	---	45	---	2.95	Excellent
Noland Cr	near mouth	Swain	2 90	8/3/2004	---	35	---	1.92	Good
				8/11/1999	---	40	---	1.98	Excellent
Forney Cr	near mouth	Swain	2 97	8/3/2004	78	44	2.58	1.80	Excellent
				8/11/1999	81	46	2.66	1.68	Excellent
Panther Cr	SR 1233	Graham	2 115	8/4/2004	---	35	---	2.07	Good
				8/10/1999	---	39	---	2.24	Excellent
Stecoah Cr	SR 1237	Graham	2 130	8/4/2004	---	30	---	2.94	Good
				8/11/1999	---	39	---	3.02	Excellent
Hazel Cr	near mouth	Swain	2-146-(19)	8/3/2004	96	46	3.26	2.17	Excellent
				8/11/1999	106	56	2.95	1.97	Excellent
Twenty Mile Cr	NC 28	Swain	2-178-(4)	8/4/2004	---	29	---	2.15	Good
040403									
Nantahala R	FSR 437	Macon	2-57-(0.5)	7/21/2004	92	49	3.2	1.93	Excellent
				8/24/1999	100	49	3.4	2.45	Excellent
Nantahala R	US 19/74	Swain	2-57-(22.5)	7/20/2004	83	35	4.2	2.26	Good
				8/23/1999	---	35	---	2.29	Good
Dicks Cr	off SR 1401	Macon	2-57-42	7/21/2004	---	27	---	1.59	Good-Fair
				8/13/1999	---	34	---	1.93	Good
Whiteoak Cr	SR 1397	Macon	2-57-45	7/21/2004	63	26	4.3	2.33	Good-Fair
Whiteoak Cr	off SR 1310	Macon		7/20/2004	78	34	3.5	1.68	Excellent
				8/13/1999	---	31	---	2.14	Good
040404									

Tulula Cr	SR 1275	Graham	2-190-2-(0.5)	7/19/2004	61	31	4.0	3.24	Good
Cheoah R	off SR 1138	Graham	2-190-(3.5)	7/19/2004	84	38	4.0	3.14	Good
				8/12/1999	89	48	3.5	2.84	Excellent
Snowbird Cr	SR 1120	Graham	2-190-9-(15.5)	7/20/2004	---	48	---	2.06	Excellent
				8/12/1999	---	52	---	2.56	Excellent
L Santeetlah Cr	Ab Footbridge	Graham	2-190-19-7	7/20/2004	59	32	2.9	1.65	Good
Cheoah R	SR 1147	Graham	2-190-(22)	7/4/2005	54	19	5.7	3.92	Fair
Cheoah R	At gauge	Graham	2-190-(22)	08/04/2004	---	42	---	3.00	Excellent

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

Subbasin/Waterbody	Location	County	Index No.	*Date*	NCIBI Score	NCIBI Rating
040401						
Little Tennessee R	off SR 1683	Macon	2-(1)	05/17/04	38	Fair
Middle Cr	SR 1635 - 2nd bridge	Macon	2-8	05/17/04	56	Good
Middle Cr	SR 1635 - 1st bridge	Macon	2-8	05/03/95	46	Good-Fair
Tessentee Cr	SR 1636	Macon	2-9	05/18/04	52	Good
				05/03/95	56	Good
Coweeta Cr	SR 1119	Macon	2-10	05/20/04	56	Good
Coweeta Cr	US 23/441	Macon	2-10	05/01/95	44	Good-Fair
Cartoogechaye Cr	SR 1146	Macon	2-19-(1)	05/18/04	56	Good
Cartoogechaye Cr	SR 1168	Macon	2-19-(10.5)	05/02/95	56	Good
Cullasaja R	SR 1677	Macon	2-21-(5.5)	10/19/99	50	Good
				10/15/96	52	Good
Cullasaja R	SR 1653	Macon	2-21-(5.5)	10/20/99	46	Good-Fair
				10/16/96	34	Fair
Walnut Cr	SR 1533	Macon	2-21-17	05/18/04	---	Not Rated
Ellijay Cr	SR 1524	Macon	2-21-23	05/20/04	56	Good
Rabbit Cr	SR 1504	Macon	2-23	05/20/04	44	Good-Fair
Iotla Cr	SR 1372	Macon	2-27	05/03/95	22	Poor
Iotla Cr	off SR 1378	Macon	2-27	05/19/04	44	Good-Fair
Cowee Cr	SR 1340	Macon	2-29	05/19/04	56	Good
Burningtown Cr	SR 1364	Macon	2-38	05/21/04	58	Excellent
Tellico Cr	SR 1367	Macon	2-40	05/21/04	50	Good
040402						
Brush Cr	off SR 1129	Swain	2-46	05/19/04	50	Good
Alarka Cr	SR 1185	Swain	2-69-(2.5)	06/03/04	46	Good-Fair
Caney Fk	SR 1738	Jackson	2-79-28-(2.5)	06/01/04	56	Good
Cullowhee Cr	SR 1545	Jackson	2-79-31	06/02/04	46	Good-Fair
Savannah Cr	NC 116	Jackson	2-79-36	06/02/04	50	Good
Scott Cr	SR 1527	Jackson	2-79-39	06/01/04	---	Not Rated
Conley Cr	SR 1183	Swain	2-79-52	06/02/04	---	Not Rated
Panther Cr	SR 1233	Graham	2-115	06/03/04	---	Not Rated
Stecoah Cr	SR 1237	Graham	2-130	06/03/04	---	Not Rated
040403						
Nantahala R	SR 1401	Macon	2-57-(22.5)	11/15/93	---	Not Rated
Whiteoak Cr	SR 1310/1404	Macon	2-57-45	11/15/93	---	Not Rated
Silvermine Cr	SR 1103	Swain	2-57-55	11/16/93	---	Not Rated
040404						
Tulula Cr	SR 1260	Graham	2-190-2-(0.5)	06/04/04	46	Good-Fair