Appendix 1B

Biological Assessment
Macroinvertebrate and Fish Site Sample Results

The full report is available on the DWQ Environmental Sciences Section website:
http://portal.ncdenr.org/web/wq/ess/reports

Appendix S-1

Benthic Macroinvertebrate and Fish Community

Site Summaries for the Hiwassee Basin

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
SHOOTING CR	SR 1340	FB60	08/20/09	Excellent

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
CLAY	1	06020002	35.022222	-83.682222	1-5	Broad Basins

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
C; Tr	22.2	2100	7	0.3

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	60	20	30	10 (Road)

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
None	---	---

Water Quality Parameters

Temperature (°C)	21.0
Dissolved Oxygen (mg/L)	7.0
Specific Conductance (µS/cm)	36
pH (s.u.)	6.5
Water Clarity	clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	16
Bottom Substrate (15)	15
Pool Variety (10)	6
Riffle Habitat (16)	14
Bank Erosion (7)	6
Bank Vegetation (7)	6
Light Penetration (10)	10
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	88

Site Photograph

Substrate Mostly cobble and gravel with small amounts of boulder and sand

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
07/06/09	10691	---	37	---	1.86	Excellent
08/16/04	9487	---	39	---	2.66	Excellent
08/11/99	7943	---	30	---	2.42	Good
08/29/94	6700	68	37	2.89	2.11	Good

Taxonomic Analysis

EPT taxa richness has remained essentially unchanged between the 1994 and 2004 sampling events. The 2009 sample contained a slightly more intolerant benthic community than the 2004 sample resulting in a lower EPT biotic index in 2009. Species collected for the first time at this location include: the pollution sensitive mayflies, *Drunella lata* , *Rhithrogena spp* , *Stenacron pallidum* , and *Habrophlebiodes spp,* the stonefly *Isoperla holochlora* and the moderately tolerant caddisfly *Nectopsyche exquisita* .

Data Analysis

Shooting Creek, a tributary to Chatuge Lake, is located in eastern Clay County. The watershed is mostly forest with scattered areas of low density housing, row crops and pasture. A road parallels large portions of this waterbody and resulted in impacts to the riparian zone and produced notable areas of erosion along the stream banks. Despite these habitat issues, the 2009 assessment resulted in the lowest biotic index ever recorded for this stream.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
BIG TUNI CR	**SR 1311**	**FB13**	**07/06/09**	**Good**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
CLAY	1	06020002	35.096111	-83.706389	1-21-5	Southern Metasedimentary Mountains

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
C; Tr, HQW	5.3	2240	7	0.3

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	90	0	10	

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
None	---	---

Water Quality Parameters

Temperature (°C)	16.6
Dissolved Oxygen (mg/L)	8.1
Specific Conductance (µS/cm)	16
pH (s.u.)	6.0
Water Clarity	clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	19
Bottom Substrate (15)	8
Pool Variety (10)	6
Riffle Habitat (16)	15
Bank Erosion (7)	7
Bank Vegetation (7)	6
Light Penetration (10)	10
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	86

Site Photograph

Substrate Good mix of boulder, cobble, gravel with small amounts of sand

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
07/06/09	10692	---	35	---	1.83	Good
08/16/04	9488	---	48	---	1.59	Excellent
08/11/99	7941	---	45	---	1.61	Excellent
07/13/94	6574	62	37	2.09	1.55	Excellent
03/31/89	4895	83	45	2.89	2.11	Excellent

Taxonomic Analysis

A dramatic drop in EPT richness occurred since 2004 driven mostly by a decrease in mayfly and caddisfly taxa. Mayfly taxa not collected in 2009 but collected previously include *Baetis flavistriga* , *B. pluto* , *Ephemerella spp* , *Eurylophella spp* , *Serratella spiculosa* and *Leucrocuta spp* . Caddisfly taxa include *Nyctiophylax* , *Lype diversa* , *Rhyacophila atrata* and *R. carolina* . Five of the aforementioned taxa are very sensitive to pollution with tolerance values of 2.0 or less. The remaining five are moderately tolerant with tolerance values ranging from 2.4 to 6.9.

Data Analysis

Big Tuni Creek is located in northern Clay County and drains a portion of the Nantahala National Forest. The watershed is predominantly forested. Big Tuni Creek rated Excellent from 1989 to 2004 but dropped to Good in 2009. However, only two more taxa were needed for an Excellent rating. At the time of sampling, water levels were low which may have contributed to a lower taxa richness. Given the protected nature of this watershed, the borderline Good bioclassification is likely the result of less habitat being available for invertebrate colonization as a result of drought effects and in all likelihood is not attributable directly to anthropogenic influence.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
TUSQUITEE CR	**SR 1300**	**FB68**	**08/16/04**	**Excellent**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
CLAY	1	06020002	35.070278	-83.816667	1-21-(16.5)	Broad Basins

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
C; Tr	42.8	1825	12	0.3

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	20	60	20	

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
None	---	---

Water Quality Parameters

Temperature (°C)	18.2
Dissolved Oxygen (mg/L)	8.7
Specific Conductance (µS/cm)	20
pH (s.u.)	6.4

Water Clarity	clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	20
Bottom Substrate (15)	12
Pool Variety (10)	6
Riffle Habitat (16)	12
Bank Erosion (7)	6
Bank Vegetation (7)	9
Light Penetration (10)	7
Left Riparian Score (5)	1
Right Riparian Score (5)	3
Total Habitat Score (100)	75

Site Photograph

Substrate A mix of bedrock, boulder, cobble, gravel and sand

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/25/09	10714	105	45	3.73	2.44	Excellent
08/16/04	9489	119	51	4.07	2.75	Excellent
08/11/99	7942	84	39	3.49	2.70	Excellent
03/30/89	4890	90	47	3.10	2.35	Excellent

Taxonomic Analysis

The 2009 benthic community composition was diverse, containing many pollution sensitive taxa, and as similar to previous collections. However, many taxa were new records for this site and included the mayflies *Plauditus punctiventris* , *Baetisca berneri* , *Ephemera spp* ; the caddisflies *Ceratopsyche morosa* , *Molanna tryphena* , *Polycentropus spp* and the Chironomids *Diamesa spp* , *Paracladopelma spp* , *Paratendipes spp* , *Procladius spp* and *Rheocricotopus robacki* .

Data Analysis

This site on Tusquitee Creek is approximately 0.5 miles above the confluence with the Hiwassee River. Despite very narrow riparian vegetation and some bank erosion along both banks, Tusquitee Creek has never rated lower than Excellent. It maintained an Excellent rating in 2009 indicating the water quality remains stable.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
FIRES CR	**SR 1344**	**FB11**	**08/17/04**	**Excellent**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
CLAY	1	06020002	35.095000	-83.858611	1-27-(5.5)	Southern Metasedimentary Mountains

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
WSIV; Tr, ORW	20.6	1900	9	0.4

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	90	0	0	10 (Picnic area)

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
None	---	---

Water Quality Parameters

Temperature (°C)	17.6
Dissolved Oxygen (mg/L)	8.7
Specific Conductance (µS/cm)	12
pH (s.u.)	6.3
Water Clarity	clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	20
Bottom Substrate (15)	15
Pool Variety (10)	6
Riffle Habitat (16)	16
Bank Erosion (7)	7
Bank Vegetation (7)	6
Light Penetration (10)	10
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	95

Site Photograph

Substrate Mix of boulder, cobble, and gravel

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/25/09	10715	71	43	3.12	2.75	Excellent
08/17/04	9493	118	53	3.72	2.57	Excellent
08/11/99	7940	77	44	2.91	2.39	Excellent
08/29/94	6702	81	36	3.51	2.25	Good

Taxonomic Analysis

The benthic community composition was relatively similar to previous collections. However, midge diversity decreased from 37 taxa in 2004 to seven taxa in 2009, the lowest ever recorded at this location. This reduction contributed to a lower BI in 2009 compared to the BI recorded in 2004. Taxa collected at this location for the first time include the mayfly, *Habrophlebioides spp* and the dragonfly, *Hagenius brevistylus* .

Data Analysis

The entire Fires Creek watershed is undisturbed forest and drains a portion of the Nantahala National Forest in northwestern Clay County. Thirteen samples have been collected from this location since 1985. Of those, only 2 samples have rated lower than Excellent. Both samples, which were taken in 1994 (July and August) immediately after severe flooding, rated Good. The lower bioclassifications were most likely due to scour effects.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
BRASSTOWN CR	**SR 1104**	**FB18**	**08/14/04**	**Good**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
CLAY	1	06020002	34.999444	-83.926944	1-42	Broad Basins

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
WS-IV	3.1 (NC Portion)	1625	9	0.6

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	70	0	30	

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
None	---	---

Water Quality Parameters

Temperature (°C)	21.6
Dissolved Oxygen (mg/L)	8.4
Specific Conductance (µS/cm)	39
pH (s.u.)	7.3

Water Clarity	clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	16
Bottom Substrate (15)	7
Pool Variety (10)	10
Riffle Habitat (16)	7
Bank Erosion (7)	6
Bank Vegetation (7)	4
Light Penetration (10)	7
Left Riparian Score (5)	4
Right Riparian Score (5)	4
Total Habitat Score (100)	70

Site Photograph

Substrate A mix of bedrock, boulder, cobble, gravel and sand

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/24/09	10693	84	40	4.96	4.34	Good
08/14/04	9498	109	53	4.83	3.68	Excellent
08/11/99	7944	77	44	4.55	3.74	Good
07/28/94	6625	---	18	---	4.75	Fair

Taxonomic Analysis

The biotic index here has gradually increased since 1999 suggesting a slight shift to a more tolerant invertebrate community. This is mostly seen by an increase in abundance of moderately tolerant or tolerant taxa and a decrease in abundance of intolerant taxa compared with previous samples. For example, tolerant taxa that increased in abundance include the mayflies *Baetis flavistriga* , *Pseudocloeon propinquum* , *Caenis spp* and the caddisfly *Hydroptila spp* . Intolerant taxa that decreased in abundance include the mayflies *Serratella deficiens* , *Heptagenia marginalis* , *Stenacron pallidum* , the long-lived stonefly *Acroneuria abnormis* , and the caddisflies *Micrasema watauga* and *Ceratopsyche morosa* .

Data Analysis

Brasstown Creek is located in the southwest corner of Clay County near the Georgia state line. This reach drains small portions of the Chattahoochee National Forest in Georgia but its watershed also contains areas of low density housing, pasture and row crops in North Carolina that lie outside of the national forest boundary. Overall, water quality is better than that of 1994 and has remained fairly stable since 1999 but the increasing biotic index suggests a shift to a more pollution tolerant benthic community.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
HIWASSEE R	**US 64**	**FB15**	**08/27/09**	**Good**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
CHEROKEE	2	06020002	35.080556	-84.002778	1-(43.7)	Broad Basins

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
WS-V (upstream); C (downstream)	210.2	1600	50	0.5

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	50	40	10	

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
None	---	---

Water Quality Parameters

Temperature (°C)	19.8
Dissolved Oxygen (mg/L)	9.5
Specific Conductance (µS/cm)	27
pH (s.u.)	7.8
Water Clarity	clear

Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	20
Bottom Substrate (15)	10
Pool Variety (10)	8
Riffle Habitat (16)	12
Bank Erosion (7)	5
Bank Vegetation (7)	6
Light Penetration (10)	3
Left Riparian Score (5)	3
Right Riparian Score (5)	4
Total Habitat Score (100)	75

Site Photograph

Substrate Mostly boulder and cobble with small amounts of gravel and sand

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/27/09	10724	82	37	4.73	3.82	Good
08/18/04	9497	100	46	4.47	3.53	Excellent
08/10/99	7936	73	36	4.36	3.43	Good
08/08/90	5364	79	38	4.36	3.28	Good

Taxonomic Analysis

Other than minor shifts in abundance or presence of taxa, no major changes in the benthic community have occurred. Species collected for the first time at this site include the mayflies, *Heterocloeon anoka* , *Heterocloeon david* , *Maccaffertium mediopunctatum* and the caddisfly *Neophylax consimilis.*

Data Analysis

Due to safety and access issues, the 2009 assessment at this site was moved two river miles downstream of the previous location and is approximately 200 meters upstream of the new highway US 64 bridge. The stream classification changes from WS-V upstream of the bridge to C downstream of the bridge. A hydroelectric power station, located approximately seven miles upstream near Mission, regulates this portion of the river. This segment of the Hiwassee River has been sampled on eight occasions since 1983 and has been rated Good since 1987. With the exception of the 2004 sample, EPT richness has been fairly stable (36-38); however, the gradually increasing biotic index since 1999 suggests the benthic community is becoming slightly more tolerant.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
PEACHTREE CR	**SR 1537**	**FB12**	**08/25/09**	**Good**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
CHEROKEE	2	06020002	35.089722	-83.930556	1-44b	Broad Basins

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
C	8.2	1675	6	0.3

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	90	0	0	10 (road)

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
None	---	---

Water Quality Parameters

Temperature (°C)	20.5
Dissolved Oxygen (mg/L)	7.7
Specific Conductance (µS/cm)	26
pH (s.u.)	6.5

Water Clarity	clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	20
Bottom Substrate (15)	12
Pool Variety (10)	6
Riffle Habitat (16)	16
Bank Erosion (7)	7
Bank Vegetation (7)	4
Light Penetration (10)	7
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	87

Site Photograph

Substrate Mostly cobble with small amounts of boulder and gravel

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/25/09	10717	---	35	---	2.77	Good
08/17/04	9494	---	49	---	2.87	Excellent
08/10/99	7939	---	38	---	2.78	Excellent
07/12/94	6573	---	37	---	2.47	Excellent

Taxonomic Analysis

Small changes in rare and in some cases common taxa were the main differences between the 2009 collection and past collections although the stonefly composition of the 2009 sample is identical to the 1999 and 2004 collections. *Ceratopsyche alhedra* , a caddisfly, was the only taxa collected in 2009 that had not been collected previously.

Data Analysis

Peachtree Creek is located in eastern Cherokee County. The watershed is predominantly forested but has some low density residential areas and agriculture present. Although this site rated Good in 2009 and represents a decrease from previous Excellent bioclassifications, the EPT biotic index was similar to values recorded in 1999 and 2004. Although EPT taxa richness was lower in 2009 compared to previous collections, this assessment was was short of receiving an Excellent rating by only one EPT taxon. This slight decrease in EPT diversity may have been related to drought induced reductions in colonizable habitat and is likely not a result of direct anthropogenic inputs.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
MARTIN CR	**SR 1558**	**FB14**	**08/26/09**	**Good-Fair**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
CHEROKEE	2	06020002	35.075278	-84.020833	1-49	Broad Basins

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
C	8.9	1560	7	0.4

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	80	0	0	20 (road)

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
None	---	---

Water Quality Parameters

Temperature (°C)	21.4
Dissolved Oxygen (mg/L)	7.1
Specific Conductance (µS/cm)	65
pH (s.u.)	7.2

Water Clarity	clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	16
Bottom Substrate (15)	11
Pool Variety (10)	8
Riffle Habitat (16)	7
Bank Erosion (7)	6
Bank Vegetation (7)	5
Light Penetration (10)	5
Left Riparian Score (5)	4
Right Riparian Score (5)	4
Total Habitat Score (100)	71

Site Photograph

Substrate Some boulder, cobble and sand that is heavily coated iwith silt

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/26/09	10721	---	25	---	3.51	Good-Fair
08/18/04	9499	---	30	---	3.15	Good

Taxonomic Analysis

The EPT taxa richness has declined from 30 taxa collected in 2004 to 25 taxa in 2009. Many sensitive taxa that were collected as abundant or common in 2004 were absent in 2009 and included the mayflies *Serratella deficiens* , *Epeorus vitreus* , *Heptagenia marginalis* and the caddisflies *Triaenodes ignitus* and *Rhyacophila carolina* . Other sensitive species (the stoneflies *Leuctra spp* , *Acroneuria abnormis* and the caddisfly *Pycnopsyche spp*) were abundant in 2004 but decreased to common or rare in 2009.

Data Analysis

Martin Creek at SR 1558 is approximately 400 meters upstream of its confluence with the Hiwassee River. The watershed is forested but still contains many residential areas associated with the town of Murphy. This water body missed receiving a Good bioclassification by three taxa and the slight decrease in bioclassification in 2009 is likely the result of a drought induced reduction in instream habitat.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
VALLEY R	SR 1554	FB10	08/17/04	Good

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
CHEROKEE	2	06020002	35.138889	-83.980556	1-52c	Broad Basins

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
C; Tr	102.3	1590	18	1.0

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	30	30	40	

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
Andrews WWTP	NC0020800	1.5

Water Quality Parameters

Temperature (°C)	21.0
Dissolved Oxygen (mg/L)	8.4
Specific Conductance (µS/cm)	52
pH (s.u.)	6.9

Water Clarity: slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	12
Bottom Substrate (15)	12
Pool Variety (10)	4
Riffle Habitat (16)	10
Bank Erosion (7)	6
Bank Vegetation (7)	5
Light Penetration (10)	6
Left Riparian Score (5)	4
Right Riparian Score (5)	1
Total Habitat Score (100)	64

Site Photograph

Substrate: A mix of bedrock, boulder, cobble, gravel, sand and silt

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/26/09	10718	78	38	4.50	3.91	Good
08/17/04	9492	100	36	5.03	3.97	Good
08/10/99	7928	80	33	5.08	4.12	Good-Fair
07/11/94	6588	77	29	5.02	4.31	Good-Fair

Taxonomic Analysis

There were several pollution intolerant taxa collected at this location; including the mayflies *Serratella serratoides* , *Epeorus dispar* , *E. vitreus* and *Heptagenia marginalis* ; the stonefly *Paragnetina immarginata* ; and the caddisflies *Ceratopsyche sparna* and *C. morosa* . The number of EPT taxa has increased slightly during the 15 years of sampling, but midges continue to be the dominant group. The mayflies *Heterocloeon davidi* , *Pseudocloeon frondale* , *Stenacron interpunctatum* ; the stonefly *Paragnetina immarginata* ; and the caddisfly *Nectopsyche exquisita* and *Dolophiloides spp* were added to this site's taxa list in 2009.

Data Analysis

The Valley River is a large tributary to the Hiwasse river. It flows from the Cherokee/Graham County line through the towns of Andrews and Murphy to the Hiwassee River. Land use in the watershed includes extensive commercial and residential areas associated with the town of Andrews., row crops throughout the valley and some scattered tracts of forest. The sampling site at SR 1554 is approximately 8 miles downstream of Andrew's WWTP, which has a permitted discharge of 1.5 MGD. Despite some nonpoint source runoff from urban areas and a point source discharger higher in the watershed, EPT richness has gradually increased and the biotic index has decreased, suggesting that water quality is improving at this location.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
JUNALUSKA CR	**SR 1505**	**FB7**	**08/26/09**	**Excellent**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
CHEROKEE	2	06020002	35.181389	-83.786944	1-52-25a	Southern Metasedimentary Mountains

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
C; Tr	6.7	1950	6	0.3

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	70	30	0	

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
None	---	---

Water Quality Parameters

Temperature (°C)	17.2
Dissolved Oxygen (mg/L)	8.5
Specific Conductance (µS/cm)	31
pH (s.u.)	6.5
Water Clarity	clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	19
Bottom Substrate (15)	12
Pool Variety (10)	4
Riffle Habitat (16)	16
Bank Erosion (7)	7
Bank Vegetation (7)	6
Light Penetration (10)	10
Left Riparian Score (5)	2
Right Riparian Score (5)	5
Total Habitat Score (100)	86

Site Photograph

Substrate Good mix of boulder, cobble and gravel

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/26/09	10719	---	37	---	2.87	Excellent
08/17/04	9490	---	40	---	2.26	Excellent
08/12/99	7946	---	31	---	3.09	Good
08/31/94	6678	---	22	---	2.51	Good-Fair

Taxonomic Analysis

EPT taxa richness has remained essentially unchanged between the 2004 and 2009 sampling events. Intolerant taxa common or abundant from both the 2004 and 2009 collections include the mayflies *Baetis tricaudatus* , *Leucrocuta spp* , the stoneflies *Acroneuria abnormis* , *Paragnetina immarginata* , *Leuctra spp* , *Tallaperla spp* , and the caddisflies *Ceratopsyche sparna* , *Dolophilodes spp* , *Pycnopsyche spp* and *Neophylax consimilis* .

Data Analysis

Junaluska Creek is a small tributary to the Valley River. It drains some low density residential areas on the outskirts of Andrews but still most of the watershed remains forested. Since the initial 1994 Good-Fair bioclassification, this site has improved to Excellent. In general, the improvement seen in 2004 from the 1994 and 1999 samples has been maintained through 2009 and indicates that water quality in this catchment remains stable.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
WELCH MILL CR	**SR 1381**	**FB6**	**08/26/09**	**Good-Fair**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
CHEROKEE	2	06020002	35.195000	-83.903889	1-52-40	Southern Metasedimentary Mountains

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
C; Tr	2.8	1660	4	0.3

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	90	0	0	10 (fish farm)

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
None	---	---

Water Quality Parameters

Temperature (°C)	17.7
Dissolved Oxygen (mg/L)	8.7
Specific Conductance (µS/cm)	13
pH (s.u.)	6.4

Water Clarity	clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	20
Bottom Substrate (15)	12
Pool Variety (10)	10
Riffle Habitat (16)	16
Bank Erosion (7)	7
Bank Vegetation (7)	7
Light Penetration (10)	10
Left Riparian Score (5)	3
Right Riparian Score (5)	5
Total Habitat Score (100)	95

Site Photograph

Substrate Mostly bedrock with some boulder, cobble, gravel and sand.

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/26/09	10720	---	27	---	1.46	Good-Fair
08/30/04	9505	---	44	---	1.94	Excellent
06/26/02	8822	---	43	---	1.88	Excellent

Taxonomic Analysis

EPT richness decreased by more than 60% from that measured in 2004. Mayflies which generally require habitats with sufficient flow decreased by 50%. Taxa not collected in 2009 but were collected previously include the mayflies *Baetis pluto* , *Plauditus dubius* group, *Heptagenia spp* , *Leucrocuta spp* , *Maccaffertium modestum* , *Rhithrogena spp* and the caddisflies *Cheumatopsyche spp* and *Neophylax consimilis* . Although still present in the sample, many other taxa declined in abundance from that collected in 2004.

Data Analysis

Upstream from SR 1381, the Welch Mill Creek watershed is entirely within the Nantahala Gamelands and completely forested. Habitat was excellent but flows appeared far below normal. Approximately 150 meters upstream of the bridge, much of the stream water (estimated at 70-80%) was being diverted to a fish farm that was constructed in 2006 and located just downstream of the bridge. In addition, substrate had been arranged to encourage water flow to the water intake. The 2009 sample was collected upstream of the water intake. EPT taxa richness drastically decreased from 44 taxa in 2004 to 27 taxa in 2009. It is likely that the dramatic decrease in EPT taxa collected in 2009 was the result of a drought induced reduction in available habitat and a reduction in flow. This is supported by the absence of the taxa noted above, many of which require robust flow. Nevertheless, the extremely sharp reduction in taxa here greatly exceeds anything observed elsewhere in the Hiwassee basin and warrants further investigation. Resampling this site, as well as sampling below the fish farm is recommended.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
HANGING DOG CR	**SR 1331**	**FB8**	**08/17/04**	**Excellent**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
CHEROKEE	2	06020002	35.166944	-84.045000	1-57	Southern Metasedimentary Mountains

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
C	8.4	1750	8	0.4

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	30	50	0	20 (Road)

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
None	---	---

Water Quality Parameters

Temperature (°C)	20.0
Dissolved Oxygen (mg/L)	7.7
Specific Conductance (µS/cm)	17
pH (s.u.)	6.5

Water Clarity	slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	18
Bottom Substrate (15)	8
Pool Variety (10)	4
Riffle Habitat (16)	16
Bank Erosion (7)	6
Bank Vegetation (7)	4
Light Penetration (10)	4
Left Riparian Score (5)	3
Right Riparian Score (5)	3
Total Habitat Score (100)	70

Site Photograph

Substrate Mix of boulder, cobble, gravel and sand

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/26/09	10722	---	40	---	3.05	Excellent
08/17/04	9495	---	41	---	2.47	Excellent
08/10/99	7937	---	40	---	2.50	Excellent
07/12/94	6570	---	46	---	2.70	Excellent

Taxonomic Analysis

Small differences exist (mainly among the caddisflies) with the taxa collected at this site between 2004 and 2009 and overall the benthic community here remains diverse, pollution-sensitive, and quite stable. However, several EPT taxa were reported for the first time at the site in 2009 including the mayfly *Maccaffertium ithaca and the caddisflies Apatania spp* , *Hydroptila spp* , and *Hydatophylax spp* .

Data Analysis

Hanging Dog Creek is a tributary to Hiwassee Lake and drains a portion of the Nantahala National Forest north of Murphy, NC. Although much of the watershed is forested, a road follows almost the entire main stem of this water body and has resulted in residential development along much of the stream channel. This along with a few erosional areas and narrow riparian vegetation along both banks resulted in a moderate habitat score. Bottom substrate was diverse but it appears the amount of sand has increased from that noted in previous habitat assessments.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
NOTTELY R	**SR 1596**	**FB3**	**08/27/09**	**Good-Fair**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
CHEROKEE	2	06020002	35.010278	-84.111667	1-58	Broad Basins

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
C	238.0	1600	19	0.5

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	90	10	0	

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
None	---	---

Water Quality Parameters

Temperature (°C)	12.1
Dissolved Oxygen (mg/L)	9.9
Specific Conductance (µS/cm)	31
pH (s.u.)	6.2

Water Clarity	clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	20
Bottom Substrate (15)	8
Pool Variety (10)	4
Riffle Habitat (16)	7
Bank Erosion (7)	5
Bank Vegetation (7)	7
Light Penetration (10)	7
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	73

Site Photograph

Substrate Mostly gravel and cobble with small amounts of boulder and sand

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/27/09	10723	---	26	---	2.98	Good-Fair
08/19/04	9500	---	32	---	2.60	Good
08/12/99	7947	---	33	---	3.36	Good
07/12/94	6571	---	36	---	2.86	Excellent

Taxonomic Analysis

The EPT taxa richness at this location has declined steadily since 1994. Taxa not collected in 2009 that were previously common or abundant include the stoneflies *Tallaperla spp, Perlesta spp* , and the caddisflies *Glossosoma spp* and *Neophylax oligius* .

Data Analysis

The Nottely River, a large tributary to the Hiwassee River, is impounded upstream in Georgia to form the Nottely Reservoir. This site is located downstream of Nottely Lake and receives hypolimnetic discharge from a dam upstream. Based on decreased EPT taxa richness, water quality appears to be declining. The site rated Excellent in 1994, dropped to Good in 1999 and 2004, and continued to drop in 2009 to Good-Fair.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
LITTLE BRASSTOWN CR	SR 1565	06/23/09	FF11	Good-Fair

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
CHEROKEE	1	06020002	35.03333333	-83.96277778	1-42-11	Broad Basins

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
WS-IV	9.1	1595	5.5	0.4	No

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	50	0	50	0

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
None	---	---

Water Quality Parameters

Temperature (°C)	18.9
Dissolved Oxygen (mg/L)	8.1
Specific Conductance (µS/cm)	47
pH (s.u.)	5.9

Water Clarity	Clear

Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	14
Bottom Substrate (15)	5
Pool Variety (10)	6
Riffle Habitat (16)	3
Bank Erosion (7)	4
Bank Vegetation (7)	4
Light Penetration (10)	8
Left Riparian Score (5)	3
Right Riparian Score (5)	4
Total Habitat Score (100)	**55**

Site Photograph

Substrate sand, silt, boulder

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
06/23/09	2009-70	19	40	Good-Fair
06/17/04	2004-91	20	44	Good-Fair

Most Abundant Species Creek Chub

Exotic Species Redbreast Sunfish, Green Sunfish

Species Change Since Last Cycle

Gains: Largemouth Bass, Black Redhorse. **Losses:** Banded Darter, Golden Redhorse, Telescope Shiner (pollution intolerant).

Data Analysis

Watershed - drains the southeast corner of Cherokee County. Site is located less than a half mile above the confluence with Brasstown Creek. **Habitats** - Atypical mountain stream with embedded instream habitats due to historical sedimentation of alluvial soils. Primarily sandy runs with boulder and cobble pools; very few riffles. The riparian corridor is intact but consists mostly of overgrown exotic vegetation and is bordered by agricultural fields. More than half of this stream's total length has undergone habitat restoration efforts that began 10 years ago under the direction of the Hiwassee River Watershed Coalition. **2009** - a diverse, yet relatively sparse (total n = 138) assemblage of primarily intermediately tolerant cool and warm water fish was collected, including 1 intolerant species (Rock Bass). **2004-2009 -** all changes (i.e. species gains and losses) in the fish community were among fish species represented by one or two individuals. The NCIBI metrics have remained stable between sampling cycles and indicate little change in water quality.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
VENGEANCE CR	**NC 141/SR 1520**	**06/25/09**	**FF6**	**Good**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
CHEROKEE	2	06020002	35.16	-83.92027778	1-52-45	Broad Basins

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C;Tr	7.2	1650	5	0.3	No

	Forested/Wetland	Rural Residential	Agriculture	Other (describe)
Visible Landuse (%)	45	35	20	0

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
None	---	---

Water Quality Parameters

Temperature (°C)	17.5
Dissolved Oxygen (mg/L)	9.6
Specific Conductance (µS/cm)	29
pH (s.u.)	6.0

Water Clarity	Clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	18
Bottom Substrate (15)	12
Pool Variety (10)	6
Riffle Habitat (16)	16
Bank Erosion (7)	6
Bank Vegetation (7)	5
Light Penetration (10)	9
Left Riparian Score (5)	3
Right Riparian Score (5)	3
Total Habitat Score (100)	**83**

Site Photograph

Substrate cobble, boulder, gravel, sand

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
06/25/09	2009-76	14	48	Good
06/17/04	2004-93	18	56	Good

Most Abundant Species	Mottled Sculpin	**Exotic Species**	Rainbow Trout

Species Change Since Last Cycle **No Gains. Losses:** Bigeye Chub, Bluegill, Mirror Shiner, Telescope Shiner (pollution intolerant).

Watershed - located in east-central Cherokee County, and flows north to its confluence with the Valley River less than a mile downstream. **Habitats** -the high gradient instream habitats include short riffles, and runs with a few deeper boulder pools. The riparian corridor is thin but relatively dense, and continues to provide good shade to the stream. **2009** - a moderately rich assemblage of fish was collected, including 2 intolerant species (Rock Bass and Rainbow Trout). **2004 - 2009** - Fewer total fish were collected in 2009 (639 vs 1013 in 2004), but the proportions of species were similar between sample years. Mottled Sculpin remain as the most frequently collected species in this stream (56% of 2009 sample, 47% in 2004); this is likely a response to an abundance of benthic macroivertabrates as a food source and little predation from larger piscivorous species. Altough 4 fewer species were collected in 2009, 3 of these changes were only represented by one individual. The NCIBI score has dropped 8 points since 2004, but the fish community has not changed since the last basin cycle. Nutrient enrichment may be having an effect on the fish community of Vengeance Creek, but overall, water quality remains Good.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
TAYLOR CR	**SR 1515**	**06/25/09**	**FF4**	**Good-Fair**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
CHEROKEE	2	06020002	35.1775	-83.88805556	1-52-39	Broad Basins

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C;Tr	5.7	1685	5	0.4	No

	Forested/Wetland	Rural Residential	Agriculture	Other (describe)
Visible Landuse (%)	40	30	30	0

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
None	---	---

Water Quality Parameters

Temperature (°C)	17.7
Dissolved Oxygen (mg/L)	9.1
Specific Conductance (µS/cm)	27
pH (s.u.)	5.8

Water Clarity	Slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	16
Bottom Substrate (15)	10
Pool Variety (10)	6
Riffle Habitat (16)	12
Bank Erosion (7)	3
Bank Vegetation (7)	6
Light Penetration (10)	7
Left Riparian Score (5)	1
Right Riparian Score (5)	1
Total Habitat Score (100)	**67**

Site Photograph

Substrate cobble, bedrock, gravel, silt

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
06/25/09	2009-77	15	44	Good-Fair
06/18/04	2004-94	15	44	Good-Fair

Most Abundant Species Mottled Sculpin

Exotic Species None

Species Change Since Last Cycle **Gains:** Bigeye Chub, Black Redhorse. **Lossses:** Banded Darter, Rainbow Trout (intolerant exotic).

Data Analysis

Watershed - located in the northeast corner of Cherokee County; the site is located about one-third of a mile upstream of the Valley River, just west of Andrews. The headwaters of this watershed are primarily forested; however, this part of the catchment is largely in agricultural land use. **Habitats** - instream habitats include riffle runs, with side snags and a few bedrock shelves. This stream is a good candidate for cattle exclusion fencing; cattle access throughout this reach has resulted in numerous breaks in the riparian, instability of the banks, and sedimentation. **2009** - a moderately rich and abundant assemblage of fish (n=646) was collected, including one intolerant species (Rock Bass), but no trout (stream is classified as Tr). **2004 - 2009** - the fish community of Taylor Creek has not changed much between sampling cycles; species changes are represented by only 1 to 4 individuals. Livestock sedimentation and nutrient enrichment continues to occur in this watershed. However, the fish community does not seem to be indicating any obvious changes in water quality since the last basin cycle.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
HANGING DOG CR	**off SR 1342**	**06/24/09**	**FF5**	**Good**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
CHEROKEE	2	06020002	35.15194444	-84.06111111	1-57	Southern Metasedimentary Mountains

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	21.7	1665	12	0.4	No

	Forested/Wetland	Rural Residential	Agriculture	Other (describe)
Visible Landuse (%)	50	30	20	0

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
None	---	---

Water Quality Parameters

Temperature (°C)	21.5
Dissolved Oxygen (mg/L)	8.9
Specific Conductance (µS/cm)	17
pH (s.u.)	6.1

Water Clarity	Clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	18
Bottom Substrate (15)	12
Pool Variety (10)	6
Riffle Habitat (16)	16
Bank Erosion (7)	5
Bank Vegetation (7)	5
Light Penetration (10)	7
Left Riparian Score (5)	3
Right Riparian Score (5)	2
Total Habitat Score (100)	**79**

Site Photograph

Substrate cobble, bedrock, gravel, sand

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
06/24/09	2009-75	15	50	Good
06/16/04	2004-88	15	56	Good

Most Abundant Species	Tennessee Shiner	Exotic Species	None

Species Change Since Last Cycle **Gains:** Smallmouth Bass, Black Redhorse. **Losses:** Bluegill, Rainbow Trout (exotic).

Data Analysis

Watershed - drains a portion of north central Cherokee County; landuse is primarily forest with agriculture in the lower valleys. **Habitats** - moderate quality instream habitats including good riffles, runs with bedrock veins, a few big pools, and side snags. Vegetation on the right bank in the lower half of the reach has been completely removed with herbicides, leaving the bank prone to erosion during high flow events. The upper part of the right riparian corridor is in much better shape with good quality Rododendron coverage. The riparian corridor on the left is thin but intact and bordered by agriculture. **2009** - a moderately abundant (n=521) fish community with good species richness was collected, including 3 intolerants (Rock Bass, Smallmouth Bass, and Gilt Darter). **2004 - 2009** - All species changes between collections were represented by only 1 individual. NCIBI metrics have remained stable here, with only a slight increase in the percentage of insectivores collected in 2009. Overall, the fish community in this watershed shows healthy characteristics and reflects good water quality.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
VALLEY R	**SR 1409**	**06/25/09**	**FF3**	**Not Rated**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
CHEROKEE	2	06020002	35.20361111	-83.79361111	1-52b	Southern Metasedimentary Mountains

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C;Tr	16.8	1845	8	0.4	Yes

	Forested/Wetland	Rural Residential	Agriculture	Other (describe)
Visible Landuse (%)	65	35	0	0

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
None	---	---

Water Quality Parameters

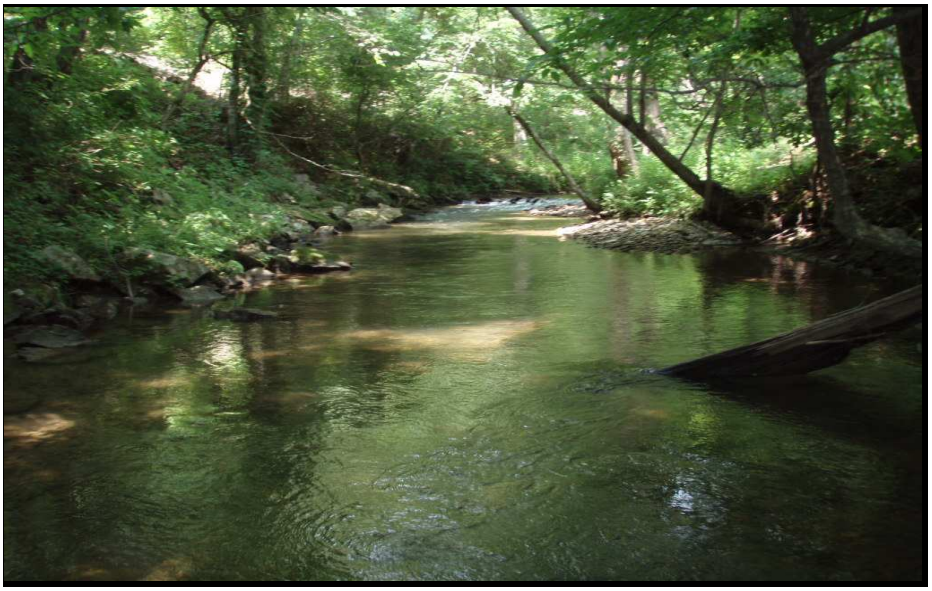
Temperature (°C)	20.3
Dissolved Oxygen (mg/L)	9.0
Specific Conductance (µS/cm)	34
pH (s.u.)	6.4

Water Clarity	Clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	20
Bottom Substrate (15)	12
Pool Variety (10)	10
Riffle Habitat (16)	16
Bank Erosion (7)	7
Bank Vegetation (7)	6
Light Penetration (10)	10
Left Riparian Score (5)	5
Right Riparian Score (5)	2
Total Habitat Score (100)	**93**

Site Photograph



Substrate cobble, boulder, bedrock, gravel

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
06/25/09	2009-79	13	---	Not Rated
06/18/04	2004-95	11	---	Not Rated

Most Abundant Species	Mottled Sculpin	**Exotic Species**	Redbreast Sunfish, Rainbow Trout

Species Change Since Last Cycle **Gains:** Redbreast Sunfish (exotic), Warpaint Shiner, River Chub. **Losses:** Greenside Darter.

Data Analysis

Watershed - Hatchery Supported Trout Waters; drains the easternmost part of Cherokee County; the site is located just east of Andrews. **Habitats** - high quality instream habitats consisting of great riffles, runs with chutes, and pools. The riparian coverage is good throughout most of the sample segment, and provides adequate shading to the stream. **2009** - a moderately rich and abundant (n=652) assemblage of primarily cool water fish was collected. This included 2 intolerant species (Rock Bass, and Rainbow Trout - multiple cohorts). Five Hellbenders of various sizes were also collected and released at this site. **2004 - 2009** - Other than the few species changes (represented by a maximum of 3 individuals per species), the fish community in 2004 and 2009 are very similar. Although Not Rated with the NCIBI, the fish community, and the perserverance of Hellbenders in this catchment are indicatave of high quality water.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
FIRES CR	**SR 1300**	**06/23/09**	**FF10**	**Not Rated**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
CLAY	1	06020002	35.07722222	-83.86444444	1-27-(5.5)	Broad Basins

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
WS-IV;Tr, ORW	23	1775	12	0.3	Yes

	Forested/Wetland	Rural Residential	Agriculture	Other (describe)
Visible Landuse (%)	80	20	0	0

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
None	---	---

Water Quality Parameters

Temperature (°C)	18.8
Dissolved Oxygen (mg/L)	8.4
Specific Conductance (µS/cm)	13
pH (s.u.)	5.7

Water Clarity	Clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	20
Bottom Substrate (15)	15
Pool Variety (10)	8
Riffle Habitat (16)	16
Bank Erosion (7)	7
Bank Vegetation (7)	7
Light Penetration (10)	10
Left Riparian Score (5)	4
Right Riparian Score (5)	5
Total Habitat Score (100)	**97**

Site Photograph

Substrate cobble, boulder, bedrock, gravel

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
06/23/09	2009-69	11	---	Not Rated
06/15/04	2004-86	11	---	Not Rated

Most Abundant Species Mottled Sculpin

Exotic Species Rainbow Trout

Species Change Since Last Cycle None, same exact species collected in 2004 and 2009.

Data Analysis

Waterbody - located in west-central Clay County, draining the counties' western-most edge. The site is about 1 mile upstream of the Hiwassee River confluence. Managed by NCWRC as Wild Trout Waters and Hatchery Supported Trout Waters. **Habitats** - high quality instream habitats including fast riffles and chutes, runs, and bedrock pools. The riparian corridors are very high quality and wide, consisting of Rhododendron and Hemlock stands. The left riparian score dropped 1 point because of a new house along the left bank. **2009** - identical to the fish fauna present here in 2004, an assemblage of cool and cold water species was collected, including three intolerant species (Rock Bass, Telescope Shiner, and Rainbow Trout); Mottled Sculpin represented 70% of the sample; 1 Hellbender and several young-of-year Rainbow Trout were also collected. **2004 - 2009** - Although not yet ratable with the NCIBI, this trout stream continues to exhibit a very stable fish community that is indicative of high quality water and habitats.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
PEACHTREE CR	**old US 64**	**06/23/09**	**FF8**	**Excellent**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
CHEROKEE	2	06020002	35.0775	-83.97444444	1-44b	Broad Basins

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	18.4	1560	8	0.4	No

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	50	0	30	20 (Fill Dirt Operation)

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
None	---	---

Water Quality Parameters

Temperature (°C)	20.4
Dissolved Oxygen (mg/L)	8.8
Specific Conductance (µS/cm)	44
pH (s.u.)	6.3

Water Clarity	Clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	16
Bottom Substrate (15)	10
Pool Variety (10)	10
Riffle Habitat (16)	10
Bank Erosion (7)	6
Bank Vegetation (7)	5
Light Penetration (10)	7
Left Riparian Score (5)	3
Right Riparian Score (5)	2
Total Habitat Score (100)	**74**

Site Photograph

Substrate cobble, gravel, boulder, silt

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
06/23/09	2009-71	24	58	Excellent
06/15/04	2004-85	22	58	Excellent

Most Abundant Species Mottled Sculpin

Exotic Species Redbreast Sunfish, Green Sunfish, Yellow Perch

Species Change Since Last Cycle **Gains:** Silver Shiner, Yellow Perch (exotic), Longnose Dace. **Losses:** Rainbow Trout (exotic).

Data Analysis

Watershed - located east of Murphy about 1/2 mile above the Hiwassee River confluence; drains the mid-eastern edge of Cherokee County. **Habitats** - Instream habitats include runs, riffles, and side snag pools. The riparian widths remain thin but intact, except where soil was being pushed over the right bank from the adjacent field. The total habitat score has improved by 16 points since 2004, mostly due to higher bank stability and vegetation scores; scoured banks from high flows just prior to the 2004 sample have since healed. **2009 -** an extremely rich and trophically balanced assemblage of cold, cool, and warm water species was collected, including three intolerants (Rock Bass, Silver Shiner, Gilt Darter). Almost twice the total abundance as collected in 2004 (n= 982 vs 535), mostly due to increases in Tennessee Shiner (n=284 vs 77) and Mottled Sculpin (n=327 vs 197). Two hellbenders (pollution intolerant) were also collected in 2009. **2004 - 2009** - the NCIBI metrics have remained stable; despite the elevated specific conductance, the fish community here continues to suggest excellent water quality.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
MARTIN CR	**SR 1558**	**06/23/09**	**FF7**	**Fair**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
CHEROKEE	2	06020002	35.07527778	-84.02083333	1-49	Broad Basins

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	9	1560	6	0.25	Yes

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	60	0	0	40 (powerline)

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
None	---	---

Water Quality Parameters

Temperature (°C)	24.3
Dissolved Oxygen (mg/L)	7.8
Specific Conductance (µS/cm)	53
pH (s.u.)	6.3

Water Clarity	Clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	18
Bottom Substrate (15)	8
Pool Variety (10)	4
Riffle Habitat (16)	5
Bank Erosion (7)	5
Bank Vegetation (7)	7
Light Penetration (10)	10
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	**72**

Site Photograph

Substrate flat cobble, sand, boulder, bedrock

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
06/23/09	2009-72	22	38	Fair
03/23/06	2006-03	20	46	Good-Fair
06/17/04	2004-92	19	38	Fair

Most Abundant Species Highlands Shiner (pollution intolerant)

Exotic Species Redbreast Sunfish, Green Sunfish, Yellow Perch

Species Change Since Last Sample **Gains:** Spotted Bass, Largemouth Bass, Golden Redhorse, Yellow Perch (exotic - present in '04). **Losses:** Black Redhorse, Bluntnose Minnow.

Data Analysis

Watershed - drains part of the southeast corner of Cherokee County; the site is located just below Murphy, about 400 meters above the Hiwassee River confluence. The urban and agricultural land uses of this catchment is reflected in the relatively high conductivity at this site. **Habitat -** instream habitats consist of moderately embedded shallow runs, bedrock shelves, and some side root snags and short riffles. A slight increase in fine silts upon substrates was observed in 2009. Although crossed by the newly constructed US 64 just upstream, the riparian corridor is densely vegetated here, primarily with Rhododendron. **2009** - a moderately abundant (n = 449) and rich assemblage of cool and warm water fish was collected at this regional reference site, including three top predator species (Largemouth Bass, Spotted Bass and young of year Walleye). However, no Rock Bass, Smallmouth Bass or trout were collected. These additions, and the 10 fold increase in the intolerant Highland Shiner in 2009 (n=233 vs 22 in 2006, and 26 in 2004) are likely due to the recruitment opportunities provided by the nearby river. 2004 - 2009 - The fluctuations in ratings here seem to be the result of trophic shifts within the fish community between insectivores and omnivores + herbivores, which may be due to the forementioned recruitment potential. Overall, the cause of impairment is unclear.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
SHULER CR	**SR 1323**	**06/24/09**	**FF17**	**Good**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
CHEROKEE	2	06020002	35.18321	-84.28017	1-86	Southern Metasedimentary Mountains

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	17.6	1239	8	0.5	No

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	100	0	0	0

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
None	---	---

Water Quality Parameters

Temperature (°C)	18.8
Dissolved Oxygen (mg/L)	8.8
Specific Conductance (µS/cm)	20
pH (s.u.)	5.6

Water Clarity	Slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	18
Bottom Substrate (15)	10
Pool Variety (10)	10
Riffle Habitat (16)	14
Bank Erosion (7)	6
Bank Vegetation (7)	6
Light Penetration (10)	9
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	**88**

Site Photograph

Substrate cobble, bedrock, gravel, sand, silt

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
06/24/09	2009-73	17	50	Good

Most Abundant Species	Tennessee Shiner	**Exotic Species**	Redbreast Sunfish, Rainbow Trout

Species Change Since Last Cycle N/A

Data Analysis

New Site. **Watershed -** almost the entire catchment is managed as Hatchery Supported Trout Waters. Drains the primarily forested, northwestern tip of Cherokee County. **Habitats** - high quality instream habitats consist of cobble and boulder runs, riffles, and a few deep rock vein pools holding trout. The upper portion of the reach consists of one long run-pool. The riparian corridor in this section of the stream is intact and wide. **2009** - a rich and moderately abundant (n=453) community of fish were collected, including three intolerant species (Rock Bass, Rainbow Trout, and Brook Trout). Three darter species and 6 minnow species were also collected. Two hellbenders measuring 201 and 240 mm were also collected and released, indicating high quality water in this catchment. Overall, the NCIBI metrics indicate no apparent issues with water quality in this watershed, and the fish community appears healthy.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
BRASSTOWN CR	**SR 1111**	**06/22/09**	**FF13**	**Good**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
CLAY	1	06020002	34.98805556	-83.89472222	1-42	Broad Basins

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
WS-IV	37.3	1710	8.5	0.4	No

	Forested/Wetland	Rural Residential	Agriculture	Other (describe)
Visible Landuse (%)	50	5	45	0

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
None in North Carolina	---	---

Water Quality Parameters

Temperature (°C)	22.6
Dissolved Oxygen (mg/L)	7.6
Specific Conductance (µS/cm)	42
pH (s.u.)	6.1

Water Clarity	Clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	18
Bottom Substrate (15)	12
Pool Variety (10)	8
Riffle Habitat (16)	12
Bank Erosion (7)	6
Bank Vegetation (7)	7
Light Penetration (10)	10
Left Riparian Score (5)	3
Right Riparian Score (5)	3
Total Habitat Score (100)	**84**

Site Photograph

Substrate cobble, gravel, boulder, sand

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
06/22/09	2009-68	17	50	Good
06/14/04	2004-84	18	46	Good-Fair

Most Abundant Species Mottled Sculpin

Exotic Species Green Sunfish

Species Change Since Last Cycle **Gains:** Black Redhorse, Creek Chub. **Losses:** Bigeye Chub, Warpaint Shiner, Largemouth Bass.

Data Analysis

Watershed - located in the southwest corner of Clay County, just above the Georgia state line. Drainage is primarily from Towns County and Union County GA. **Habitats** - instream habitats are primarily shallow riffles and runs with side snag pools, and some undercuts. The riparian corridor is thin but functional, and bordered by agricultural fields. **2009** - the fish community continues to be dominated by intermediately tolerant cool and cold water species, including Mottled Sculpin and Tennessee Shiner, which comprise 34% and 25% of the sample, respectively; 2 intolerant species (Rock Bass and Gilt Darter) were also collected here for the second time; Green Sunfish are still the only exotic fish collected here. **2004 - 2009** - 20 fish species are known from this watershed. The conductivity of Brasstown Creek (40 µS/cm in 2004) continues to imply agricultural and municipal inputs from GA. However, with a few exceptions related to species richness, the NCIBI metric scores between sampling years are very similar, with ratings that may suggest a slight improvement to water quality.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
SHOOTING CR	SR 1340	06/22/09	FF12	Good-Fair

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
CLAY	1	06020002	35.02194444	-83.68222222	1-5	Broad Basins

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C;Tr	22.5	2000	9	0.3	No

	Forested/Wetland	Rural Residential	Agriculture	Other (describe)
Visible Landuse (%)	60	10	30	0

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
None	---	---

Water Quality Parameters

Temperature (°C)	21.6
Dissolved Oxygen (mg/L)	7.8
Specific Conductance (µS/cm)	30
pH (s.u.)	6.2

Water Clarity	Clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	18
Bottom Substrate (15)	12
Pool Variety (10)	6
Riffle Habitat (16)	16
Bank Erosion (7)	7
Bank Vegetation (7)	6
Light Penetration (10)	7
Left Riparian Score (5)	4
Right Riparian Score (5)	3
Total Habitat Score (100)	**84**

Site Photograph

Substrate	cobble, boulder, sand, bedrock

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
06/22/09	2009-67	11	40	Good-Fair
06/14/04	2004-83	16	40	Good-Fair

Most Abundant Species	Mottled Sculpin	Exotic Species	Redbreast Sunfish, Rainbow Trout

Species Change Since Last Cycle

Gains: Creek Chub. **Losses:** Yellow Bullhead (exotic), Brown Bullhead, Largemouth Bass, Black Redhorse, Yellow Perch (exotic), Gilt Darter.

Data Analysis

Watershed - Hatchery Supported Trout Waters located in the southeast corner of Clay County; drains to Chatuge Lake. Restoration efforts (installation of rock veins) have been completed in this reach since last cycle. **Habitats** - good quality instream habitas consisting of riffles, runs, and side snag pools. The riparian corridor of this stream is thin, but intact. **2009** - a mixed assemblage of cold, cool, and warm water species was collected with Mottled Sculpin and Central Stonerollers comprising 64% and 21% of the sample, respectively. Two cohorts of intolerant Rainbow Trout were also observed. **2004 - 2009** - species richness dropped from 16 to 11 species, but 5 of 6 losses were represented by only 1 or 2 fish in 2004. A slightly more balanced trophic function was observed in 2009 with an increase in percentage of omnivores + herbivores from 7 to 21%. Reproductive function also increased from 56 to 82% of the fish assemblage with multiple age classes. Overall the fish community in this stream appears to be moderately healthy and stable as indicated by its' repeated bioclassification.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
TATHAM CR	**US Bus 19**	**06/25/09**	**FF19**	**Not Rated**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
CHEROKEE	2	06020002	35.20023	-83.81293	1-52-28	Broad Basins

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C;Tr	8.24	1800	7	0.3	No

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	35	25	25	5 (power sub-station), 10 (commercial)

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
None	---	---

Water Quality Parameters

Temperature (°C)	20.9
Dissolved Oxygen (mg/L)	9.0
Specific Conductance (µS/cm)	42
pH (s.u.)	6.7

Water Clarity	Clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	20
Bottom Substrate (15)	14
Pool Variety (10)	4
Riffle Habitat (16)	16
Bank Erosion (7)	7
Bank Vegetation (7)	6
Light Penetration (10)	7
Left Riparian Score (5)	2
Right Riparian Score (5)	5
Total Habitat Score (100)	**86**

Site Photograph

Substrate flat cobble, boulder, gravel

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
06/25/09	2009-78	8	---	Not Rated

Most Abundant Species Mottled Sculpin

Exotic Species Redbreast Sunfish, Rainbow Trout

Species Change Since Last Cycle N/A

Data Analysis

New Site. **Watershed** - located in the northeast corner of Cherokee County, just south of Andrews. Landuse in the lower portions of the catchment is a mix of urban and agriculture (reflected in the elevated conductivity); the headwater tributaries are largely forested. **Habitats** - high quality instream habitats consisting of riffles and runs with side snag pools; substrate embeddedness is low. Riparian coverage is good and provides adequate shading for most of the sample reach; the upper part of the reach is in full sun as the stream runs behind a trailer park off of US 19 Business. **2009** - this high gradient trout stream is supporting a highly abundant fish community (n=1072) with relatively low species richness. Mottled Sculpin (representing 77% of the collected sample) may be indirectly influenced by nutrient enrichment through food source abundance. However, this stream is supporting multible age classes of Rainbow Trout, considered pollution intolerant. The existing NCIBI is not applicable to this trout stream because of naturally occuring, low species richness; therefore, the site is Not Rated.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
BEAVERDAM CR	**off SR 1331**	**06/24/09**	**FF18**	**Not Rated**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
CHEROKEE	2	06020002	35.20549	-84.11877	1-72	Southern Metasedimentary Mountains

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C;Tr	12.4	1801	6	0.4	No

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	70	0	30	0

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
None	---	---

Water Quality Parameters

Temperature (°C)	19.0
Dissolved Oxygen (mg/L)	9.0
Specific Conductance (µS/cm)	17
pH (s.u.)	5.9

Water Clarity	Clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	18
Bottom Substrate (15)	10
Pool Variety (10)	10
Riffle Habitat (16)	14
Bank Erosion (7)	6
Bank Vegetation (7)	5
Light Penetration (10)	5
Left Riparian Score (5)	2
Right Riparian Score (5)	1
Total Habitat Score (100)	**76**

Site Photograph

Substrate cobble, gravel, boulder, silt, sand

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
06/24/09	2009-74	11	---	Not Rated

Most Abundant Species	Mirror Shiner	**Exotic Species**	None

Species Change Since Last Cycle	N/A

Data Analysis

New Site. **Watershed** - a good portion of the catchment above this site is managed as Hatchery Supported Trout Waters. Drains part of the primarily forested northern edge of Cherokee County just south of the Tennassee line. **Habitats** - instream habitats consist primarily of cobble and boulder runs, riffles, and silty side pools. This section of Beaverdam Creek would be a good candidate for watershed restoration efforts with the installation of cattle exclusion fencing. Breaks in the riparian corridor were abundant on both sides of the stream due to cattle access. **2009** - a moderately rich and abundant mix of intermediately tolerant cool and cold water species was collected. The fish community was skewed towards a high percentage of insectivores, with no intolerant species collected. Also, no top predator species were observed, including Rock Bass, Smallmouth Bass and trout (yet the stream is classified as Tr). Contrary to the sedimentation issues observed in this creek, one intolerant hellbender at 340 mm was collected and released. Application of the current NCIBI is not appropriate for this particular medium diversity mountain stream, so the site is Not Rated. However, there are no obvious water quality issues other than the forementioned agricultural influences.