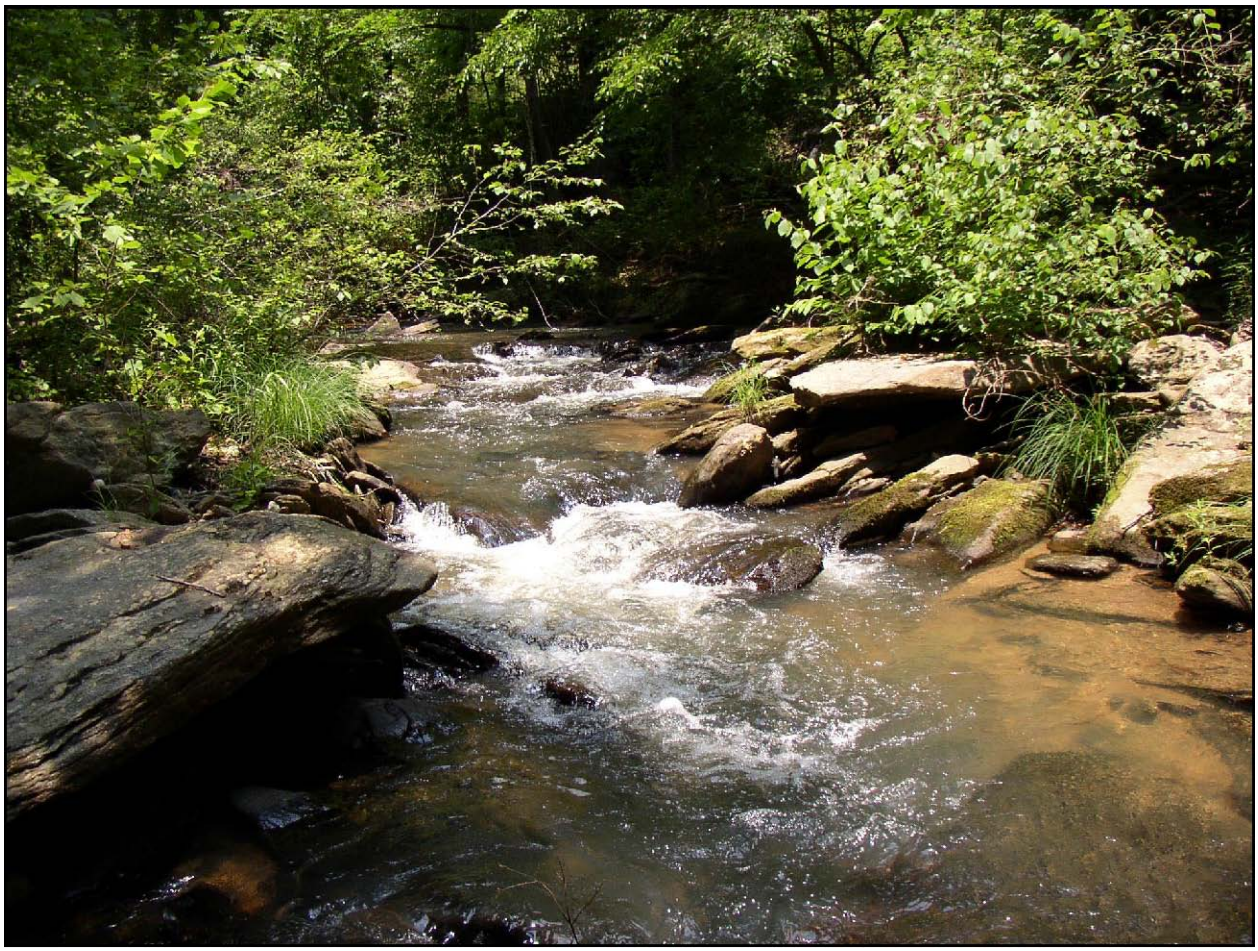
BASINWIDE ASSESSMENT REPORT
BROAD RIVER BASIN



NORTH CAROLINA
DEPARTMENT OF ENVIRONMENT
AND NATURAL RESOURCES
Division of Water Quality
Environmental Sciences Section

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INTRODUCTION TO PROGRAM METHODS

The Division of Water Quality uses a basinwide approach to water quality management. Activities within the Division, including permitting, monitoring, modeling, nonpoint source assessments, and planning are coordinated and integrated for each of the 17 major river basins within the state. All basins are reassessed every five years. The BroadRiver basin has been sampled by the Environmental Sciences Section (ESS) four times for basinwide monitoring: 1995, 2000, 2005, and 2010. For a complete list of all historic benthic macroinvertebrate samples obtained by the BAU (including data for the Broad River Basin) please refer to the following link: http://portal.ncdenr.org/web/wq/benthosdata. For fish community data please refer to the link here: http://portal.ncdenr.org/web/wq/ess/bau/ncibi-data.

The ESS collects a variety of biological, chemical, and physical data that can be used in a myriad of ways within the basinwide-planning program. In some program areas there may be adequate data to allow a fairly comprehensive analysis of ecological integrity or water quality. In other areas, data may be limited to one program area, such as only benthic macroinvertebrate data or only fisheries data, with no other information available. Such data may or may not be adequate to provide a definitive assessment of water quality, but can provide general indications of water quality. The primary program areas from which data were drawn for this assessment of the Broad River basin include benthic macroinvertebrates and fish community data. Details of biological sampling methods (including habitat evaluation), rating criteria, and biological assessment summaries can be found in Appendices 1-5. Technical terms are defined in the Glossary.

This document is structured with physical, geographical, and biological data discussions presented in hydrologic units (HUCs). General water quality conditions are given in an upstream to downstream format. Lakes data, ambient chemistry data and aquatic toxicity data, with summaries, are presented in separate reports.

BASIN DESCRIPTION

The Broad River Basin encompasses a 1,506 mi square mile watershed drained by 1,452 miles of streams (Figure 1). The three major tributaries to the Broad River are the Green, the Second Broad, and the First Broad Rivers. The headwaters of the Broad and its major tributaries are located within the Mountains and flow towards the Foothills before entering the Piedmont southeast and east of Lake Lure. From there, the Broad River flows through Rutherford and Cleveland counties, then into South Carolina. The basin encompasses most of Cleveland, Polk and Rutherford counties, and small portions of Buncombe, Henderson, Lincoln, and Gaston counties. Larger municipalities include the towns and cities of Forest City, Kings Mountain, Lake Lure, Rutherfordton, Shelby and Spindale. Many of these municipalities are concentrated along the US 74 corridor between the cities of Shelby and King's Mountain. Approximately one-half of the basin is covered in forests but agriculture is still widespread. Please refer to Figure 2 and Table 1 for a list of biological monitoring sites and bioclassifications.

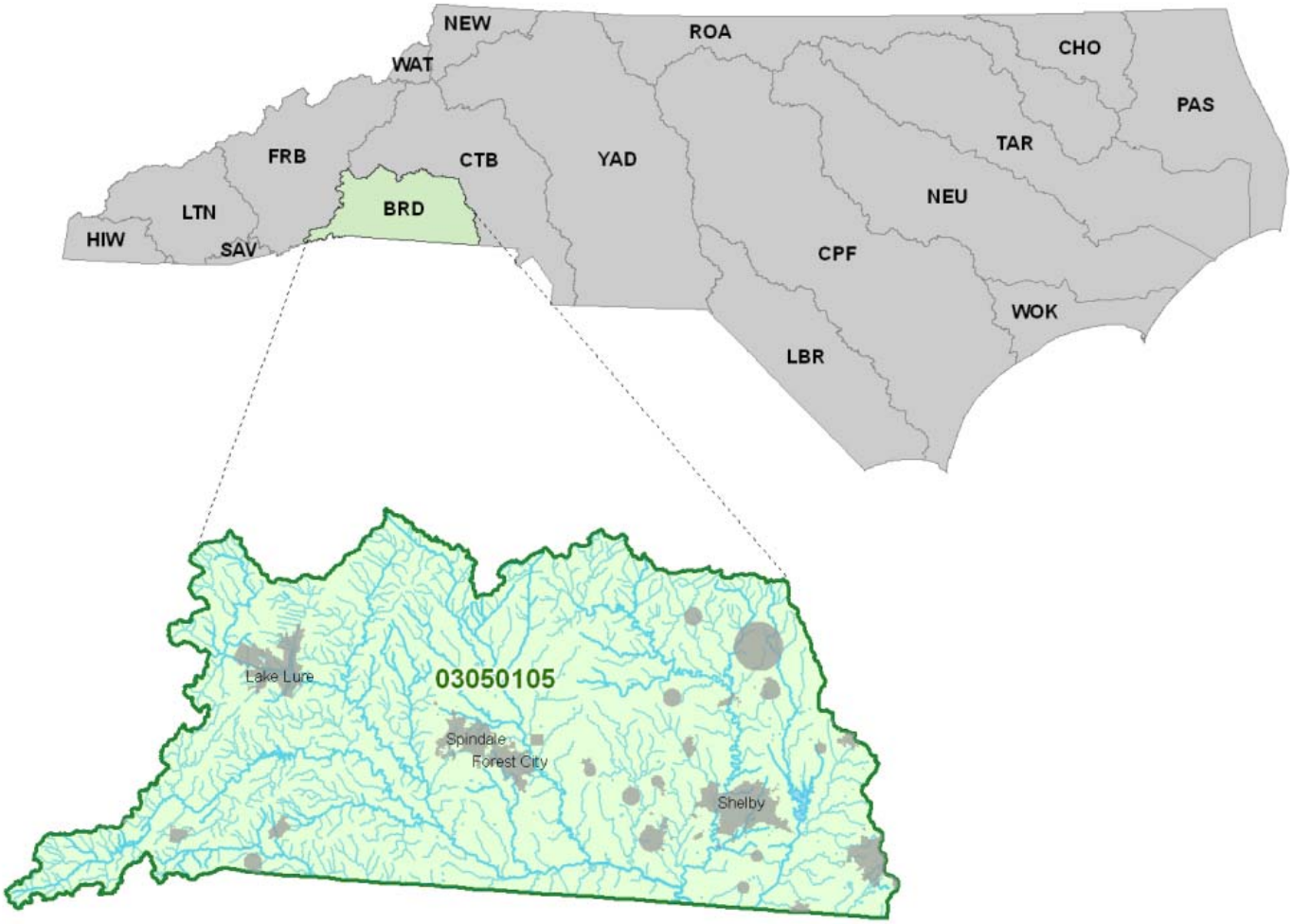


Figure 1. Geographical relationships of the Broad River basin.

BROAD RIVER HUC 03050105

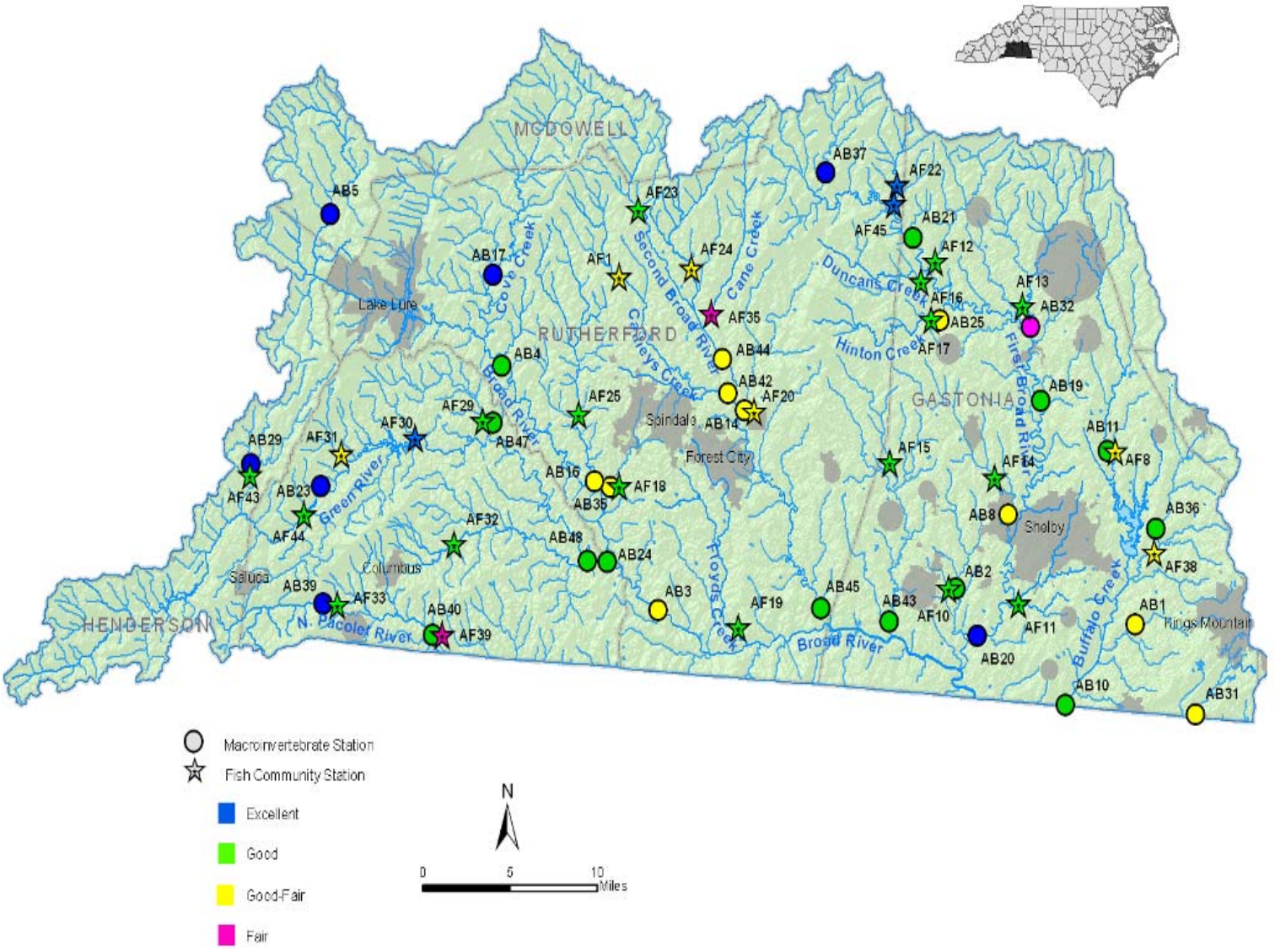


Figure 2. Sampling sites and bioclassifications in HUC 03050105 (2010).

River and Stream Assessment

The Broad River at US 221 in Rutherford County was not sampled due to high flow conditions. Site IDs ending with “B” denote benthos samples, those ending with “F” denote fish samples.

Table 1. Waterbodies monitored in HUC 03050105 in the Broad River basin for basinwide assessment, 2005 and 2010.

Site ID[1]	Waterbody	County	Location	2005	2010
AB5	Braod R	Buncombe	SR 2802	Excellent	Excellent
AB4	Broad R	Rutherford	SR 1181	Fair	Good
AB17	Cove Cr	Rutherford	SR 1381	Excellent	Excellent
AB3	Broad R	Rutherford	SR 1106	Good-Fair	Good-Fair
AB35	Mountain Cr	Rutherford	SR 1149	Good-Fair	Good-Fair
AB16	Cleghorn Cr	Rutherford	SR 1149	Fair	Good-Fair
AB29	Hungry R	Henderson	SR 1799	Good	Excellent
AB23	Green R	Polk	SR 1151	Good	Excellent
AB24	Green R	Rutherford	SR 1302	Good-Fair	Good
AB47	Walnut Cr	Polk	SR 1315	Good	Good
AB48	Whiteoak Cr	Polk	SR 1352	Good	Good
AB6	Broad R	Rutherford	US 221	Good-Fair	Not Sampled
AB44	Second Broad R	Rutherford	SR 1538	Good-Fair	Good-Fair
AB14	Catheys Cr	Rutherford	SR 1549	Good-Fair	Good-Fair
AB42	Roberson Cr	Rutherford	SR 1561	Good-Fair	Good-Fair
AB45	Second Broad R	Rutherford	SR 1973	Good-Fair	Good
AB43	Sandy Run Cr	Cleveland	SR 1195	Good	Good
AB21	First Broad R	Cleveland	SR 1530	Excellent	Good
AB37	N Fk First Broad R	Rutherford	SR 1728	Excellentq	Excellent
AB25	Hinton Cr	Cleveland	NC 226	Excellent	Good-Fair
AB19	First Broad R	Cleveland	Off SR 1809	Good	Good
AB32	Knob Cr	Cleveland	SR 1004	Good	Fair
AB20	First Broad R	Cleveland	SR 1140	Good	Excellent
AB8	Brushy Cr	Cleveland	SR 1308	Excellent	Good-Fair
AB2	Beaverdam Cr	Cleveland	NC 150	Excellent	Good
AB11	Buffalo Cr	Cleveland	SR 1908	Good	Good
AB10	Buffalo Cr	Cleveland	NC 198	Good-Fair	Good
AB36	Muddy Fk	Cleveland	SR 2012	Excellent	Good
AB1	Beason Cr	Cleveland	SR 2246	Good	Good-Fair
AB31	Kings Cr	Cleveland	SR 2286	Good	Good-Fair
AB39	N Pacolet R	Polk	SR 1179	Excellent	Excellent
AB40	N Pacolet R	Polk	SR 1501	Good	Good
AF25	Mountain Cr	SR 1178	Rutherford	Good-Fair	Good
AF18	Cleghorn Cr	SR 1149	Rutherford	Good-Fair	Good
AF43	Hungry R	off SR 1799	Henderson	---	Good
AF44	Cove Cr	off SR 1151	Polk	---	Good
AF31	Brights Cr	SR 1155	Polk	Good	Good-Fair
AF30	Britten Cr	NC 9	Polk	Excellent	Excellent
AF29	Walnut Cr	SR 1315	Polk	Excellent	Good
AF32	Whiteoak Cr	SR 1526	Polk	Good	Good
AF19	Floyds Cr	SR 1116	Rutherford	Good	Good
AF23	Second Broad R	SR 1500	Rutherford	Good	Good
AF24	Big Camp Cr	SR 1504	Rutherford	Good-Fair	Good-Fair
AF35	Cane Cr	SR 1558	Rutherford	Good-Fair	Fair
AF1	Catheys Cr	US 221	Rutherford	Good	Good-Fair
AF20	Roberson Cr	SR 1561	Rutherford	Good	Good-Fair
AF15	Sandy Run Cr	SR 1332	Cleveland	Fair	Good
AF45	Brier Cr	SR 1736	Rutherford	Excellent	Excellent
AF22	Brier Cr	SR 1733	Rutherford	---	Excellent
AF12	Wards Cr	SR 1525	Cleveland	Good	Good
AF16	Duncans Cr	NC 226	Cleveland	Good	Good
AF17	Hinton Cr	NC 226	Cleveland	Good	Good
AF13	Knob Cr	SR 1641	Cleveland	Good-Fair	Good
AF14	Brushy Cr	SR 1342	Cleveland	Good-Fair	Good
AF11	Hickory Cr	NC 18	Cleveland	Good	Good
AF10	Beaverdam Cr	NC 150	Cleveland	Good	Good
AF8	Buffalo Cr	SR 1908	Cleveland	Good (2004)	Good-Fair
AF38	Muddy Fk	SR 1001	Cleveland	Good (2000)	Good-Fair
AF33	N Pacolet R	US 176 & SR 1125	Polk	Good-Fair	Good
AF39	N Pacolet R	SR 1501	Polk	Good (1995)	Fair

SPECIAL STUDIES (2005-2010).
The following special studies were conducted in this HUC ("F" denotes a fish assessment while a "B" denotes a benthic assessment):

BAU Memo (F-20110721; Brier Creek).

BAU Memo (F-20110721; Britten Creek).

BAU Memo (F-20071003; Walnut Creek).

BAU Memo (F-20051013; North Fork First Broad River).

BAU Memo (B-20060208; North Pacolet River).

BAU Memo (B-20060208; Potts Creek).

BAU Memo (B-20051214; Buffalo Creek, Little Whiteoak Creek, Green River, Joe Creek).

GLOSSARY

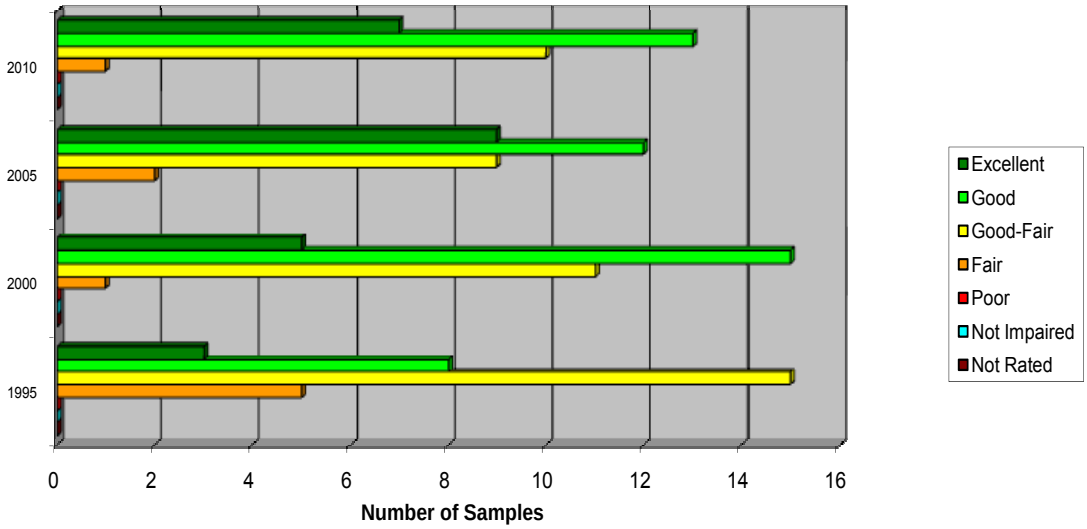
7Q10	A value which represents the lowest average flow for a seven day period that will recur on a ten year frequency. This value is applicable at any point on a stream. 7Q10 flow (in cfs) is used to allocate the discharge of toxic substances to streams.
Bioclass	Criteria have been developed to assign bioclassifications ranging from Poor to Excellent to each benthic sample based on the number of taxa present in the intolerant groups (EPT) and the Biotic Index value.
cfs	Cubic feet per second, generally the unit in which stream flow is measured.
Chl *a*	Chlorophyll *a*.
Class C Waters	Freshwaters protected for secondary recreation, fishing, and aquatic life including propagation and survival, and wildlife. All freshwaters shall be classified to protect these uses at a minimum.
Conductivity	In this report, synonymous with specific conductance and reported in the units of μmhos/cm at 25 ^{o}C. Conductivity is a measure of the resistance of a solution to electrical flow. Resistance is reduced with increasing content of ionized salts.
Division	The North Carolina Division of Water Quality.
D.O.	Dissolved Oxygen.
Ecoregion	An area of relatively homogeneous environmental conditions, usually defined by elevation, geology, and soil type. Examples include Southern Outer Piedmont, Carolina Flatwoods, Sandhills, and Slate Belt.
EPT	The insect orders (Ephemeroptera, Plecoptera, Trichoptera); as a whole, the most intolerant insects present in the benthic community.
EPT N	The abundance of Ephemeroptera, Plecoptera, Trichoptera insects present, using values of 1 for Rare, 3 for Common and 10 for Abundant.
EPT S	Taxa richness of the insect orders Ephemeroptera, Plecoptera and Trichoptera. Higher taxa richness values are associated with better water quality.
HQW	High Quality Waters. Waters which are rated as excellent based on biological and physical/chemical characteristics through Division monitoring or special studies; primary nursery areas designated by the Marine Fisheries Commission; and all Class SA waters.
IWC	Instream Waste Concentration. The percentage of a stream comprised of an effluent calculated using permitted flow of the effluent and 7Q10 of the receiving stream.

Major Discharger	Greater than or equal to one million gallons per day discharge (≥ 1 MGD).
MGD	Million Gallons per Day, generally the unit in which effluent discharge flow is measured.
Minor Discharger	Less than one million gallons per day discharge (< 1 MGD).
NPDES	National Pollutant Discharge Elimination System.
NCBI (EPT BI)	North Carolina Biotic Index, EPT Biotic Index. A summary measure of the tolerance values of organisms found in the sample, relative to their abundance. Sometimes noted as the NCBI or EPT BI.
NCIBI	North Carolina Index of Biotic Integrity (NCIBI); a summary measure of the effects of factors influencing the fish community.
NSW	Nutrient Sensitive Waters. Waters subject to growths of microscopic or macroscopic vegetation requiring limitations on nutrient inputs.
NTU	Nephelometric Turbidity Unit.
ORW	Outstanding Resource Waters. Unique and special waters of exceptional state or national recreational or ecological significance, which require special protection to maintain existing uses.
Parametric Coverage	A listing of parameters measured and reported.
SOC	A consent order between an NPDES permittee and the Environmental Management Commission that specifically modifies compliance responsibility of the permittee, requiring that specified actions be taken to resolve non-compliance with permit limits.
Total S (or S)	The number of different taxa present in a benthic macroinvertebrate sample.
UT	Unnamed tributary.
WWTP	Wastewater treatment plant.

Appendix 1. Summary of Benthic Macroinvertebrate Data.

Since 1995, the largest trend noted among the river and stream samples was an overall reduction in the number of samples rated Fair and Good-Fair and an increase in samples receiving Good and Excellent bioclassifications (Figure 3). Examples of these trends can be seen at Walnut Creek at SR 1315 and North Pacolet River at SR 1501 which have steadily improved from Fair in 1995 to Good or Excellent from 2000 to present (Table 1). In addition, sites improving from Good-Fair in 1995 to Good (2005) and then to Excellent in 2010 include the Green River at SR 1151, the Hungry River at SR 1799, and First Broad River ar SR 1140 (Table 1). These data suggest improved physico-chemical conditions in these waterbodies since 1995. However, in 2010 there were some sites that experienced large reductions in bioclassifications. Specefically, Brushy Creek at SR 1308 and Hinton Creek at NC 226 dropped from Excellent in 2005 to Good-Fair in 2010 while Knob Creek at SR 1004 dropped from Good to Fair over the same time (Table 1). These data suggest a decline in physico-chemical conditions in these waterbodies.

Figure 3. Bioclassification Trends in the Broad River Basin: 1995-2010.



Appendix 2. Benthic Macroinvertebrate Sampling Methods

Standard Qualitative (Full Scale) Method

The Biological Assessment Unit's standard qualitative (Full Scale) sampling procedure comprises 10 components: two kick-net collections, three sweeps, two rock or log washes, one sand collection, one leaf-pack collection, and visual collections from large rocks and logs.[i] Invertebrates are removed from the matrix ("picked") on-site. The purpose of these collections is to inventory the aquatic fauna and produce an indication of relative abundance for each taxon. Organisms are classified as Rare (1 - 2 specimens), Common (3 - 9 specimens), or Abundant (≥ 10 specimens).

EPT Method

Benthic macroinvertebrates can also be collected using the EPT sampling procedure. Four, rather than 10, composite qualitative samples are taken at each site: one kick, one sweep, one leaf-pack, and visual collections. Only EPT taxa are collected and identified and only EPT taxa richness is used to assign a bioclassification.

Habitat Evaluation

Habitat assessment forms have been developed by the Biological Assessment Unit to evaluate the physical habitat of mountain/piedmont and coastal streams. The habitat score, which ranges between 1 and 100, is based on the evaluation of channel modification, amount of instream habitat, type of bottom substrate, pool variety, bank stability, light penetration, and riparian zone width. Higher numbers suggest better habitat quality, but no criteria have been developed to assign impairment ratings.

Appendix 3. Benthic Macroinvertebrate Data Analysis and Critieria

Data Analysis

Bioclassifications for the Full Scale assessment method are based on EPT Richness and North Carolina Biotic Index (NCBI, sometimes just identified as BI) values. Both tolerance values for individual taxa and community biotic index values have a range of zero through 10, with higher numbers indicating more tolerant taxa and more polluted conditions respectively. NCBI scores are averaged with EPT taxa richness scores to produce a final bioclassification. Bioclassifications for the EPT sample method are based on the total number of EPT taxa present in the sample. EPT abundance and overall taxa richness can also be used to help examine between-site differences in water quality.

EPT Richness and BI values are affected by seasonal changes. DWQ criteria for assigning bioclassifications are based on summer sampling, which occurs from June through September. For samples collected outside the summer sampling period, EPT Richness is often adjusted by removing the number of winter/spring Plecoptera taxa present to give a seasonally corrected value. Adjustments for seasonality may also be performed based upon site-specific differences between summer and non-summer samples if such data are available. The BI values also are seasonally adjusted for samples outside the summer season.

No criteria are in place for small-stream samples collected from sites with a drainage area less than or equal to 3.0 square miles that are subject to anthropogenic disturbance and collected outside of the April to June seasonal window. Such sites are assigned a “Not Impaired” if they would earn a classification of either Excellent, Good, or Good-Fair using EPT criteria for larger stream sites, or a “Not Rated” otherwise.

Standard Qualitative (Full-Scale) and EPT Criteria

Criteria for bioclassifications for standard qualitative (Full-Scale) samples in piedmont and Coastal Plain ecoregions are given below in Table 5 and are based on EPT S and the NCBI. Criteria for bioclassifications for the EPT sample method are provided in Table 6 and are based on EPT taxa richness.

Tolerance values for individual species and biotic index values have a range of 0 - 10, with higher numbers indicating more tolerant species or more polluted conditions. Water quality scores (5 = Excellent, 4 = Good, 3 = Good-Fair, 2 = Fair and 1 = Poor) assigned with the biotic index numbers are averaged with EPT taxa richness scores to produce a final bioclassification. Criteria for piedmont and coastal plain streams are used for the Neuse River basin. EPT abundance and Total taxa richness calculations also are used to help examine between-site differences in water quality.

Table 2. Criteria for Standard Qualitative (Full Scale) Samples.

Score	BI Values		EPT Values	
	Piedmont	Coastal Plain (CA)	Piedmont	Coastal Plain (CA)
5	<5.14	< 5.42	>33	>29
4.6	5.14—5.18	5.47—5.46	32-33	28
4.4	5.19—5.23	5.47—5.51	30-31	27
4	5.24—5.73	5.52—6.00	26-29	22-26
3.6	5.74—5.78	6.01—6.05	24-25	21
3.4	5.79—5.83	6.06—6.10	22-23	20
3	5.84—6.43	6.11—6.67	18-21	15-19
2.6	6.44—6.48	6.68—6.72	16-17	14
2.4	6.49—6.53	6.73—6.77	14-15	13
2	6.54—7.43	6.78—7.68	10-13	8-12
1.6	7.44—7.48	7.69—7.73	8-9	7
1.4	7.49—7.53	7.74—7.79	6-7	6
1	> 7.53	>7.79	0-5	0-5

Table 3. Criteria for EPT Samples.

Score	EPT Values	EPT Values
	Piedmont	Coastal Plain (CA)
Excellent	>27	>23
Good	21-27	18-23
Good-Fair	14-20	12-17
Fair	7-13	6-11
Poor	0-6	0-5

Appendix 4. Summary of fish community assessment data.

Monitoring efforts for 2010 for the Broad River Basin can be summarized:

- Twenty-eight sites were assessed as part of the basinwide monitoring cycle or as a special study.
- All of the sites, except two, had been sampled during the previous basinwide cycle in 2004-2005.
- One of the two new sites, Cove Creek, Polk County, was sampled to determine if it qualified for reclassification to High Quality Waters. Despite having high quality instream and riparian habitats, the community rated Good and did not qualify as High Quality Waters. The other new sampling site was on Hungry River; it drained a previously unassessed watershed.
- None of the sites sampled in 2010 were on the §303 (d) impaired streams list.
- No special studies were conducted in the basin during the intervening years between 2005 and 2010.
- The most widely distributed species collected at all 28 sites was the Bluehead Chub; the Redbreast Sunfish and Striped Jumprock were collected at 27 and 26 sites, respectively. The Bluehead Chub was the most abundant species, representing 27 percent of all the fish collected.
- All streams were evaluated and rated using the North Carolina Index of Biotic Integrity (NCIBI). The NCIBI scores ranged from 38 to 54 and the NCIBI ratings ranged from Fair to Excellent; 71% of the sites rated Good or Excellent (Figures 4 and 5).

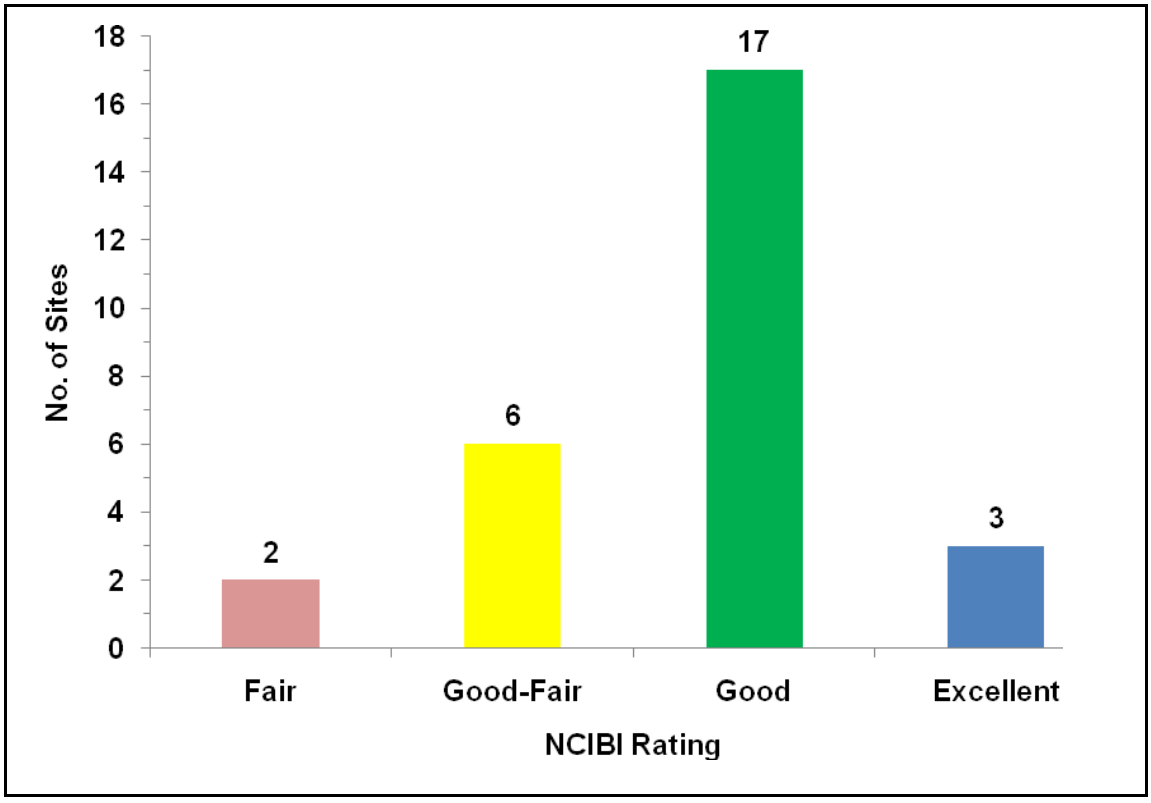


Figure 4. Distribution of the NCIBI ratings of 28 fish community basinwide sites in the Broad River basin, 2010.

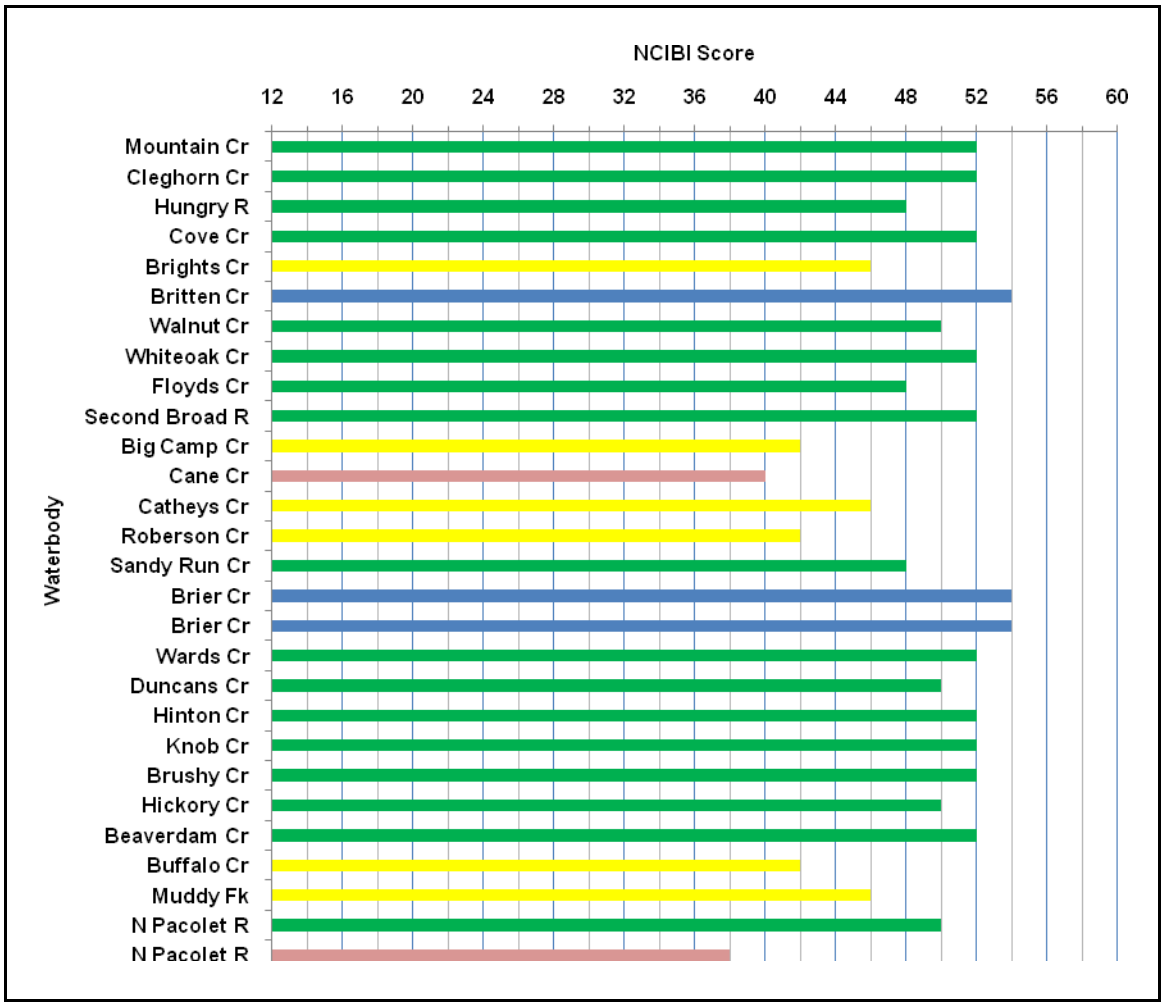


Figure 5. **NCIBI scores and ratings of 28 fish community basinwide sites in the Broad River basin, 2010. Blue = Excellent, Green = Good, Yellow = Good-Fair, and Pink = Fair sites.**

Twenty-two of the same sites had been sampled during the 2010 and 2004-2005 monitoring cycles. In 2004-2005, 68% of the sites rated Good or Excellent; in 2010, 82% of the sites rated Good or Excellent (Figure 5). By contrast, 27% of the sites rated Good-Fair in 2004-2005 and 18% in 2010. Overall, the biological integrity of the fish communities improved between 2004-2005 and 2010.

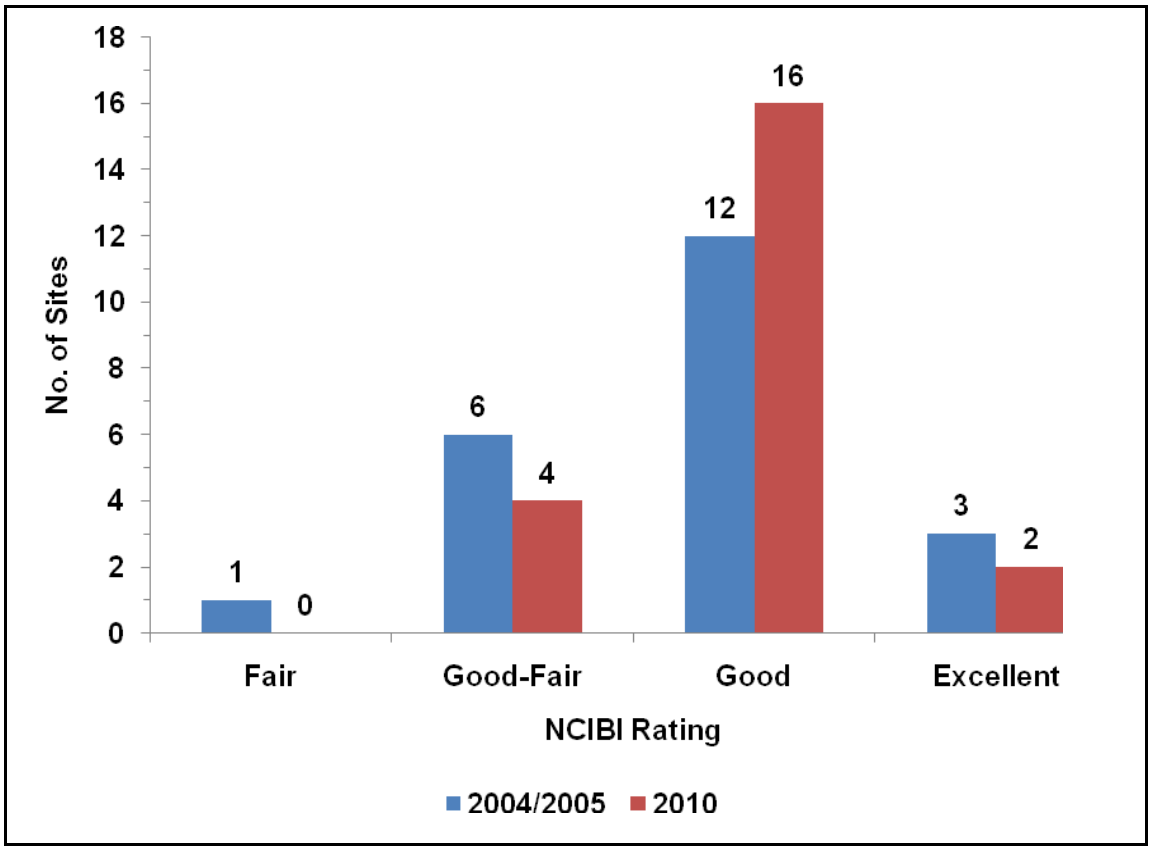


Figure 6. **NCIBI ratings of 22 repeat fish community sites in the Broad River basin, 2004-2005-2010.**

- Twenty-four sites had been sampled during the previous one (2004-2005) or two (2004-2005 and 2000) basinwide monitoring cycles (Figure 6). Between 2004-2005 and 2010, 13 sites had no appreciable change in their NCIBI ratings; 4 sites had ratings that increased one class; 1 site's rating increased two classes; and 6 sites had ratings that decreased one class (Figure 6).
- The improvements in the NCIBI scores and NCIBI ratings were attributed to perhaps more efficient operation of upstream NPDES permitted wastewater treatment plants or for reasons unknown.
- The declines in the NCIBI scores and ratings were attributed to increasing developmental pressures, nonpoint source nutrient and sediment runoff, high water events, and a reservoir downstream that prevents colonization of upstream lotic environments following prolonged droughts.

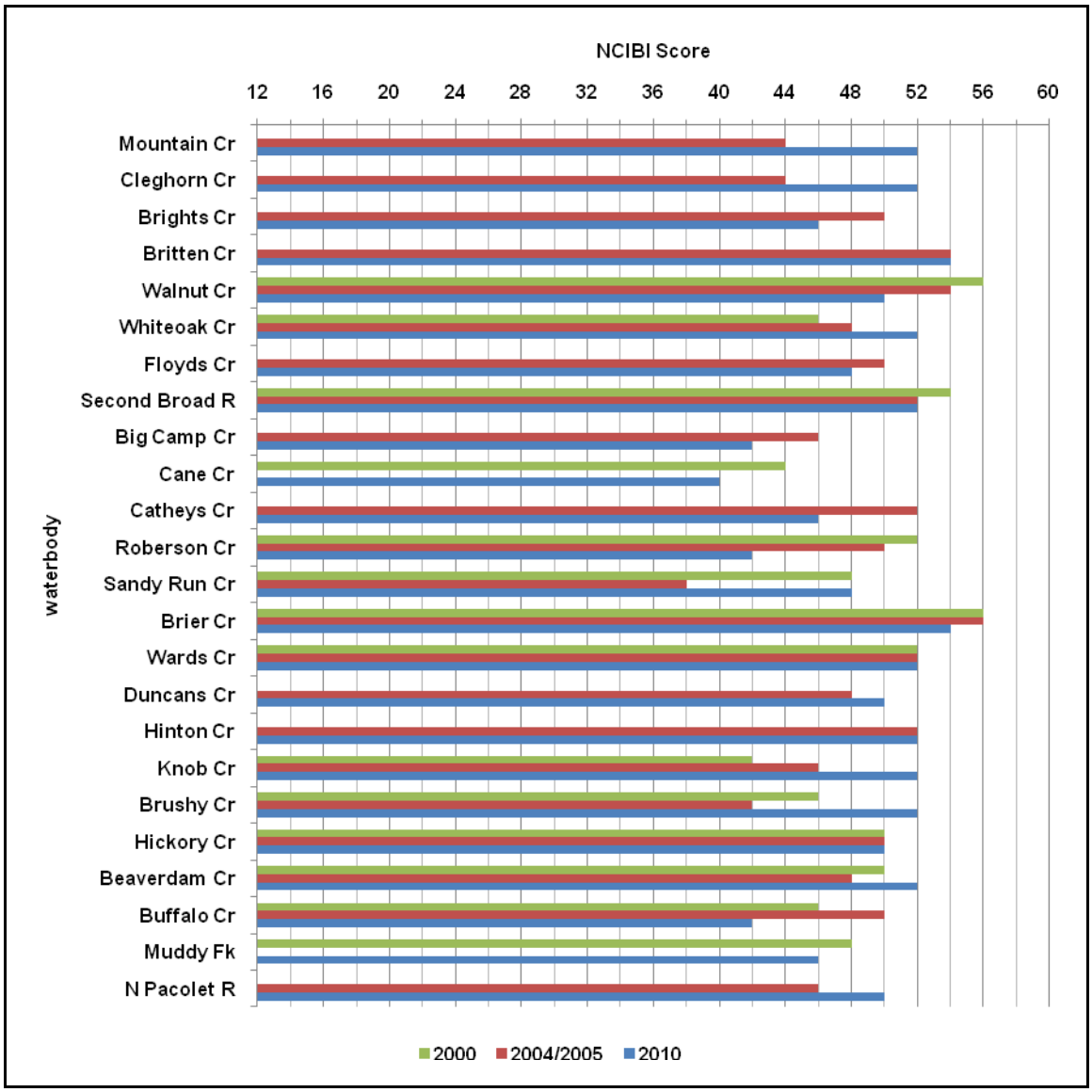


Figure 7. NCIBI scores of 24 repeat fish community sites in the Broad River basin, 2000-2010.

- Repeat/verification sampling should be conducted in 2011 to determine why the NCIBI scores and ratings declined or changed substantially at:
  - Cane Creek at SR 1558 in Rutherford County;
  - Sandy Run at SR 1332 in Cleveland County; and
  - North Pacolet River at SR 1501 in Polk County.
- Two sites/watersheds qualify as new Outstanding Resource Waters or High Quality Waters:
  - Britten Creek at NC 9 in Polk County, and
  - Brier Creek at SR 1733 and SR 1736 in Rutherford County.

Appendix 5. Fish community sampling methods and criteria.

Sampling Methods

Fish community assessments were performed adhering to all methods in the existing standard operating procedures (NCDENR 2006). At each site, a 600 ft. section of stream was selected and measured. The fish in the delineated reach were then collected using two backpack electrofishing units and two persons netting the stunned fish. A seine was also used where there were substantial riffles. After collection, all readily identifiable fish were examined for sores, lesions, fin damage, or skeletal anomalies, measured (total length to the nearest 1 mm), and then released. Those fish that were not readily identifiable were preserved and returned to the laboratory for identification, examination, and total length measurement. These fish have been deposited as voucher specimens with the North Carolina State Museum of Natural Sciences in Raleigh.

NCIBI (North Carolina Index of Biotic Integrity) Analysis, Evaluation, and Scoring Criteria

The NCIBI is a modification of the Index of Biotic Integrity initially proposed by Karr (1981) and Karr, *et al*. (1986). The IBI method was developed for assessing a stream's biological integrity by examining the structure and health of its fish community. The scores derived from this index are a measure of the ecological health of the waterbody and may not directly correlate to water quality. For example, a stream with excellent water quality, but with poor or fair fish habitat, would not be rated excellent with this index. However, in many instances, a stream which rated excellent on the NCIBI should be expected to have excellent water quality.

The Index of Biological Integrity incorporates information about species richness and composition, trophic composition, fish abundance, and fish condition. The NCIBI summarizes the effects of all factors that influence aquatic faunal communities (water quality, energy source, habitat quality, flow regime, and biotic interactions). While change within a fish community can be caused by many factors, certain aspects of the community are generally more responsive to specific influences. Species composition measurements reflect habitat quality effects. Information on trophic composition reflects the effect of biotic interactions and energy supply. Fish abundance and condition information indicate additional water quality effects. It should be noted, however, that these responses may overlap. For example, a change in fish abundance may be due to decreased energy supply or a decline in habitat quality, not necessarily a change in water quality.

The assessment of biological integrity using the North Carolina Index of Biotic Integrity (NCIBI) is provided by the cumulative assessment of 12 parameters or metrics. The values provided by the metrics are converted into scores on a 1, 3, or 5 scale. A score of 5 represents conditions which would be expected for undisturbed reference streams in the specific river basin or ecoregion, while a score of 1 indicates that the conditions deviate greatly from those expected in undisturbed streams of the region. Each metric is designed to contribute unique information to the overall assessment. The scores for all metrics are then summed to obtain the overall NCIBI score. Finally, the score (an even number between 12 and 60) is then used to determine the ecological integrity class of the stream from which the sample was collected.

In 2001 the NCIBI was revised with bioclassifications and criteria recalibrated against regional reference site data (Biological Assessment Unit Memorandum F-20010922; NCDENR 2006). To qualify as a reference site, the site had to satisfy all seven criteria in Table 4 in the order listed. Reference sites represent the least impacted streams and the overall biological condition of the fish communities that could be attained. In the Broad River basin 10 streams have been identified as reference sites (Table 5). Criteria and ratings that have been developed are applicable only to wadeable streams in the mountain and piedmont regions of the Broad River basin (Tabless 6 and 7) . The definition of mountain and piedmont is based on a map of North Carolina watersheds by Fels (1997) and Griffith *et al*. (2002). Metrics and ratings should not be applied to non-wadeable streams nor to small, wadeable Southern Appalachian type trout

streams. Characteristics of Southern Appalachian type trout streams include gradient, visual aspects of the stream and riparian zones, presence of plunge pools, overall fish faunal characteristics, specific conductance, temperature, clarity, elevation, and stream order. These streams are currently not rated. The focus continues to apply and restrict the use of the NCIBI to wadeable streams that can be sampled by a crew of four persons.

Table 4. Reference site selection hierarchy -- a watershed-based approach for streams.

Criterion	Qualification
1 -- Habitat	Total habitat score ≥ 65
2 – NPDES dischargers	No NPDES dischargers ≥ 0.01 MGD above the site or if there are small dischargers (~≤ 0.01 MGD), the dischargers are more than one mile upstream
3 – Percent urbanization	< 10% of the watershed is urban or residential areas
4 – Percent forested	≥ 70% of the watershed is forested or in natural vegetation
5 – Channel incision	At the site, the stream is not incised beyond natural conditions
6 – Riparian zone integrity	No breaks in the riparian zones or, if there are breaks, the breaks are rare
7 – Riparian zone width	Piedmont streams – width of the riparian zone along both banks is ≥ 12 m Mountain streams -- width of the riparian zone along both banks is ≥ 6m
Exception 1	If the site satisfied Criteria 1 - 6, except one of the two riparian widths was less than one unit optimal, then the site still qualified as a reference site
Exception 2	If the site satisfied Criteria 1 - 3 and 5 - 7, but the percentage of the watershed in forest or natural vegetations was ≥ 60% (rather than ≥ 70%), then the site still qualified as a reference site. [Note: in the New River Basin this last exception is ≥ 50%.]

Table 5. Regional reference sites in the Broad River basin.

Waterbody	Station	County	Level IV Ecoregion
Brier Creek	SR 1733	Rutherford	Northern Inner Piedmont
Brier Creek	SR 1736	Rutherford	Northern Inner Piedmont
Britten Creek	NC 9	Polk	Southern Inner Piedmont
Cedar Creek	SR 1371	Rutherford	Southern Inner Piedmont
Cove Creek	SR 1001	Rutherford	Southern inner Piedmont
Cove Creek	off SR 1151	Polk	Southern Crystalline Ridges & Mountains
Flat Creek	SR 2802	Buncombe	Southern Crystalline Ridges & Mountains
N Fk First Broad River	SR 1728	Rutherford	Eastern Blue Ridge Foothills
Second Broad River	SR 1500	Rutherford	Southern inner Piedmont
Wards Creek	SR 1525	Cleveland	Northern Inner Piedmont

Table 6. Revised scores and classes for evaluating the fish community of a wadeable stream using the North Carolina Index of Biotic Integrity in the Inner Piedmont, Foothills, and Eastern Mountains of the Broad, Catawba, Savannah, and Yadkin River basins.

NCIBI Scores	NCIBI Classes
54, 56, 58, or 60	Excellent
48, 50, or 52	Good
42, 44, or 46	Good-Fair
36, 38, or 40	Fair
≤ 34	Poor

Table 7. Scoring criteria for the NCIBI for wadeable streams in the mountain and piedmont ecoregions of the Broad, Catawba, Savannah, and Yadkin River basins with watershed drainage areas ranging between 2.8 and 245 mi^2.

No.	Metric		
1	**No. of species**		
	where Y is the number of species in the sample and X is the stream's drainage area in mi^2:		
	$Y \geq 9.5*Log_{10}X+1.6$		5
	$4.8*Log_{10}X+0.8 \leq Y < 9.5*Log_{10}X+1.6$		3
	$Y < 4.8*Log_{10}X+0.8$		1
2	**No. of fish**		
	Mountains	Piedmont	
	≥ 300 fish	≥ 150 fish	5
	200-299 fish	100-149 fish	3
	< 200 fish	< 100 fish	1
3	**No. of species of darters**		
	where Y is the number of species of darters in the sample and X is the stream's drainage area in mi^2.		
	$Y \geq 1.6*Log_{10}X$		5
	$0.8*Log_{10}X \leq Y < 1.6*Log_{10}X$		3
	$Y < 0.8*Log_{10}X$		1
	If the drainage area is > 70 mi^2, then ≥ 3 species = 5		
4	**No. of species of sunfish, bass, and trout**		
	≥ 3 species		5
	2 species		3
	0 or 1 species		1
5	**No. of species of suckers**		
	≥ 2 species		5
	1 species		3
	0 species		1
6	**No. of intolerant species**		
	Mountains	**Piedmont**	
	≥ 3 species	≥ 1 species	5
	1or 2 species	(no middle criteria or score)	3
	0 species	0 species	1
7	**Percentage of tolerant individuals**		
	Mountains	**Piedmont**	
	≤ 12%	≤ 25%	5
	13-25%	26-35%	3
	> 25%	> 35%	1
8	**Percentage of omnivorous and herbivorous individuals**		
	10-35%		5
	36-50%		3
	> 50%		1
	< 10%		1
9	**Percentage of insectivorous individuals**		
	60-90%		5
	45-59%		3
	< 45%		1
	> 90%		1
10	**Percentage of piscivorous individuals**		
	≥ 1.0%		5
	0.25-1.0%		3
	≤ 0.24%		1
11	**Percentage of diseased fish (DELT = diseased, fin erosion, lesions, and tumors)**		
	< 0.75%		5
	0.76-1.25%		3
	> 1.25%		1
12	**Percentage of species with multiple age groups**		
	Mountains	Piedmont	
	≥ 65% of all species have multiple age groups	≥ 55% of all species have multiple age groups	5
	45-64% all species have multiple age groups	35-54% all species have multiple age groups	3
	< 45% all species have multiple age groups	< 35% all species have multiple age groups	1

Table 8. Tolerance ratings and adult trophic guild assignments for fish in the Broad River basin. Common and scientific names follow Nelson, *et al*. (2004), except for *Scartomyzon*.

Family/Species	Common Name	Tolerance Rating	Trophic Guild of Adults
Clupeidae	**Herrings and Shads**		
Alosa aestivalis	Blueback Herring	Intermediate	Insectivore
Dorosoma cepedianum	Gizzard Shad	Intermediate	Omnivore
D. petenense	Threadfin Shad	Intermediate	Omnivore
Cyprinidae	**Carps and Minnows**		
Campostoma anomalum	Stoneroller	Intermediate	Herbivore
Carassius auratus	Goldfish	Tolerant	Omnivore
Clinostomus funduloides	Rosyside Dace	Intermediate	Insectivore
Ctenopharyngodon idella	Grass Carp	Tolerant	Herbivore
Cyprinella chloristia	Greenfin Shiner	Intermediate	Insectivore
C. galactura	Whitetail Shiner	Intermediate	Insectivore
C. labrosa	Thicklip Chub	Intolerant	Insectivore
C. nivea	Whitefin Shiner	Intermediate	Insectivore
C. pyrrhomelas	Fieryblack Shiner	Intolerant	Insectivore
C. zanema	Santee Chub	Intolerant	Insectivore
Cyprinus carpio	Common Carp	Tolerant	Omnivore
Hybognathus regius	Silvery Minnow	Intermediate	Herbivore
Hybopsis hypsinotus	Highback Chub	Intolerant	Insectivore
Luxilus coccogenis	Warpaint Shiner	Intermediate	Insectivore
Nocomis leptocephalus	Bluehead Chub	Intermediate	Omnivore
Notemigonus crysoleucas	Golden Shiner	Tolerant	Omnivore
Notropis hudsonius	Spottail Shiner	Intermediate	Omnivore
N. procne	Swallowtail Shiner	Intermediate	Insectivore
N. rubricroceus	Saffron Shiner	Intermediate	Insectivore
N. scepticus	Sandbar Shiner	Intermediate	Insectivore
N. spectrunculus	Mirror Shiner	Intermediate	Insectivore
N. sp. cf. *chlorocephalus*	Piedmont Shiner	Intermediate	Insectivore
Pimephales promelas	Fathead Minnow	Tolerant	Omnivore
Rhinichthys obtusus	Western Blacknose Dace	Intermediate	Insectivore
Semotilus atromaculatus	Creek Chub	Tolerant	Insectivore
Catostomidae	**Suckers**		
Carpiodes sp. cf. *cyprinus*	(no common name)	Intermediate	Omnivore
Catostomus commersonii	White Sucker	Tolerant	Omnivore
Hypentelium nigricans	Northern Hogsucker	Intermediate	Insectivore
Moxostoma collapsum	Notchlip Redhorse	Intermediate	Insectivore
M. duquesnei	Black Redhorse	Intermediate	Insectivore
M. pappillosum	V-Lip Redhorse	Intermediate	Insectivore
Scartomyzon rupiscartes	Striped Jumprock	Intermediate	Insectivore
S. sp. cf. *lachneri*	Brassy Jumprock	Intermediate	Insectivore
Ictaluridae	**North American Catfishes**		
Ameiurus brunneus	Snail Bullhead	Intermediate	Insectivore
A. catus	White Catfish	Tolerant	Omnivore
A. nebulosus	Brown Bullhead	Tolerant	Omnivore
A. platycephalus	Flat Bullhead	Tolerant	Insectivore
Ictalurus punctatus	Channel Catfish	Intermediate	Omnivore
Noturus insignis	Margined Madtom	Intermediate	Insectivore
Esocidae	**Pikes**		
Esox masquinongy	Muskellunge	Intermediate	Piscivore
Salmonidae	**Trouts and Salmons**		
Oncorhynchus mykiss	Rainbow Trout	Intolerant	Insectivore
Salmo trutta	Brown Trout	Intermediate	Piscivore
Salvelinus fontinalis	Brook Trout	Intolerant	Insectivore
Poeciliidae	**Livebearers**		
Gambusia holbrooki	Eastern Mosquitofish	Tolerant	Insectivore
Cottidae	**Sculpins**		
Cottus bairdii	Mottled Sculpin	Intermediate	Insectivore
Moronidae	**Temperate Basses**		
Morone americana	White Perch	Intermediate	Piscivore
M. chrysops	White Bass	Intermediate	Piscivore

Table 8 (continued).

Family/Species	Common Name	Tolerance Rating	Trophic Guild of Adults
Centrarchidae	**Sunfishes and Black Basses**		
Ambloplites rupestris	Rock Bass	Intolerant	Piscivore
Lepomis auritus	Redbreast Sunfish	Tolerant	Insectivore
L. cyanellus	Green Sunfish	Tolerant	Insectivore
L. gibbosus	Pumpkinseed	Intermediate	Insectivore
L. gulosus	Warmouth	Intermediate	Insectivore
L. macrochirus	Bluegill	Intermediate	Insectivore
L. microlophus	Redear Sunfish	Intermediate	Insectivore
Lepomis sp.	hybrid sunfish	Tolerant	Insectivore
Micropterus dolomieu	Smallmouth Bass	Intolerant	Piscivore
M. salmoides	Largemouth Bass	Intermediate	Piscivore
Pomoxis annularis	White Crappie	Intermediate	Piscivore
P. nigromaculatus	Black Crappie	Intermediate	Piscivore
Percidae	**Darters and Perches**		
Etheostoma brevispinum	Carolina Fantail Darter	Intermediate	Insectivore
E. olmstedi	Tessellated Darter	Intermediate	Insectivore
E. thalassinum	Seagreen Darter	Intolerant	Insectivore
Perca flavescens	Yellow Perch	Intermediate	Piscivore
Percina crassa	Piedmont Darter	Intolerant	Insectivore
Stizostedion vitreus	Walleye	Intermediate	Piscivore

Blackspot and Other Diseases

Blackspot and yellow grub diseases are naturally occurring, common infections of fish by an immature stage of flukes. The life cycle involves fish, snails, and piscivorous birds. Heavy, acute infections can be fatal, especially to small fish. However, fish can carry amazingly high worm burdens without any apparent ill effects (Noga 1996). The infections may often be disfiguring and render the fish aesthetically unpleasing (Figure 8).

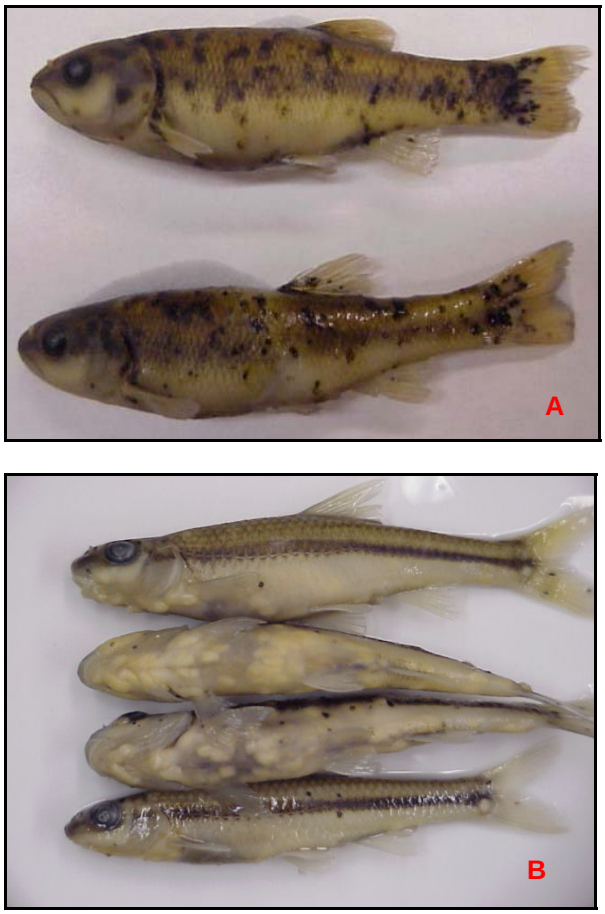


Figure 8. **Heavy infestation of blackspot disease in Creek Chub (A) and yellow grub in Bigeye Chub (B).**

Although some researchers incorporate the incidence of black spot and yellow grub into indices of biotic integrity (e.g., Steedman 1991), others, because of a lack of a consistent, inverse relationship to environmental quality, do not (e.g., Sanders *et al*. 1999). The diseases are not considered in the NCIBI because it is widespread, affecting fish in all types of streams. Because of its commonness throughout the state in so many species, regrettably, its occurrence is not consistently recorded at all sites. Other diseases observed in 2010 included scoliosus in one individual of Greenfin Shiner and incidences of “popeye” or exopthalmos in Rosyside Dace, Sandbar Shiner, Spottail Shiner, and Highback Chub caused by bacterial, viral, and nematode infections (Figure 9). Overall, the incidence of diseases in fish in the Broad River Basin was very low.

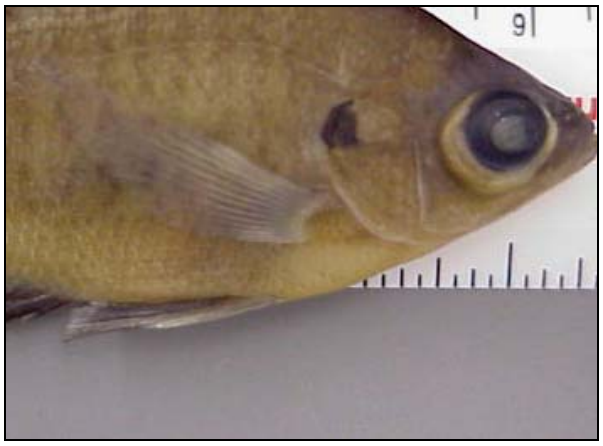


Figure 9. Popeye caused by nematode infection in Bluegill.

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Broad Basin Macroinvertebrate Template Reports

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
BROAD R	**SR 2802**	**AB5**	**06/29/10**	**Excellent**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
BUNCOMBE	1	03050105	35.495278	-82.273611	9-(1)	Southern Crystalline Ridges and Mountains

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
C;Tr	34	1940	10	0.5

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

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

Water Quality Parameters

Temperature (°C)	22.8
Dissolved Oxygen (mg/L)	7.9
Specific Conductance (µS/cm)	32
pH (s.u.)	6.2
Water Clarity	clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	17
Bottom Substrate (15)	12
Pool Variety (10)	9
Riffle Habitat (16)	15
Bank Erosion (7)	7
Bank Vegetation (7)	6
Light Penetration (10)	2
Left Riparian Score (5)	3
Right Riparian Score (5)	3
Total Habitat Score (100)	79

Site Photograph

Substrate mix of boulder, cobble, gravel, sand, silt

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
06/29/10	11002	126	58	3.23	2.52	Excellent
07/11/05	9663	77	43	2.71	2.20	Excellent
07/10/00	8145	99	49	3.79	2.91	Excellent
07/10/95	6830	82	43	3.21	2.44	Excellent

Data Analysis

The site is about 8 kilometers northwest of Lake Lure, and about 12 stream-kilometers upstream of the reservoir. The catchment is primarily forest with very little agriculture.

The BAU have benthic data for four sampling events, beginning in 1995. All benthic sampling at the site was conducted using Full Scale methods. EPT Richness was greater in 2010 than for the prior high value (58 versus 49 taxa in 2000). The NCBI value for 2010 was near the middle of the range for all prior sampling events. Based up the benthic community, there is no indication of water quality problems at the site.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
BROAD R	**SR 1181**	**AB4**	**07/02/10**	**Good**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
RUTHERFORD	2	03050105	35.394167	-82.096111	9-(22)b	Southern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
C	190	820	26	0.8

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

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

Water Quality Parameters

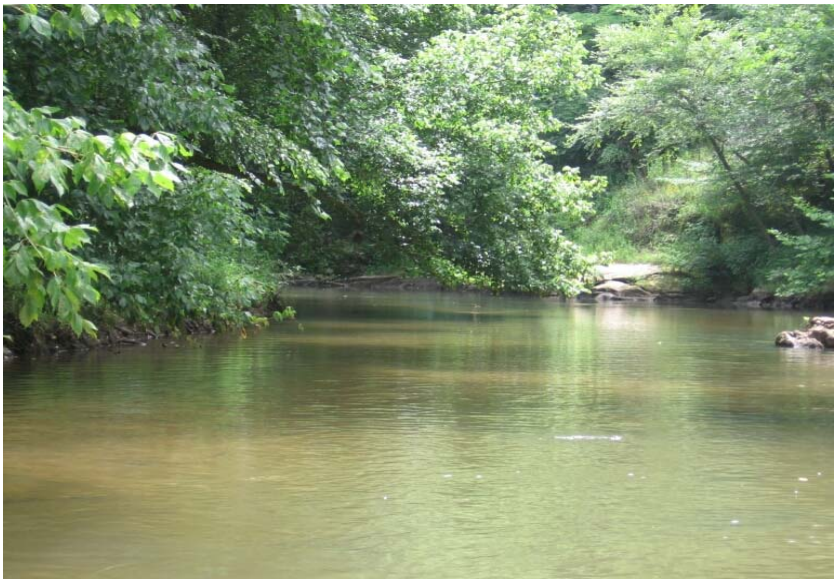
Temperature (°C)	23.8
Dissolved Oxygen (mg/L)	9.8
Specific Conductance (µS/cm)	41
pH (s.u.)	7.2

Water Clarity: slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	7
Bottom Substrate (15)	3
Pool Variety (10)	9
Riffle Habitat (16)	4
Bank Erosion (7)	7
Bank Vegetation (7)	7
Light Penetration (10)	2
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	53

Site Photograph



Substrate: sand

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
07/02/10	11000	91	42	4.19	3.68	Good
09/21/05	9751	60	19	5.44	4.96	Fair
07/12/00	8151	81	31	4.83	3.51	Good
07/12/95	6841	57	28	4.82	4.17	Good-Fair

Data Analysis

The site is about 13 kilometers west of Rutherfordton, about 13 stream-kilometers downstream of the reservoir of Lake Lure, and within a 303(d)-listed segment (AU 9-(22)b) due to the classification of Fair received following benthic sampling at this site in 2005. The catchment is primarily forest, with some development (Chimney Rock, Lake Lure).

The BAU have benthic data for four sampling events beginning in 1995, all using Full Scale collection methods. EPT Richness in 2010 is much greater than for the prior high in 2000 (42 versus 31 taxa) and more than double that collected in 2005 (19 taxa). Also, the NCBI value is significantly lower than for any prior collection event. It was noted in the prior basinwide report that only one stonefly taxon was collected in 2005 while four were collected during each of the two prior sampling events in 1995 and 2000. Five stonefly taxa were collected in 2010.

The late season collection in 2005 likely contributed to both the depressed EPT Richness and high NCBI value. Compared to results from 1995 and 2000, where seasonal effects should be nearly non-existent, the combination of the significant increase in EPT Richness and decrease in NCBI value in 2010 is highly suggestive of an improvement in water quality since those two earlier sampling events.

As in 2000, a large mussel bed was noted in the reach sampled in 2010. No such bed was found by the field crew sampling in 2005.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
COVE CR	**off SR 1381**	**AB17**	**07/01/10**	**Excellent**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
RUTHERFORD	1	03050105	35.456944	-82.106944	9-23-(9)	Southern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
C	43	880	18	0.3

	Forested/Wetland	Urban	Agriculture	Road	Other (describe)
Visible Landuse (%)	10	0	80	10	0

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

Water Quality Parameters

Temperature (°C)	24.1
Dissolved Oxygen (mg/L)	8.8
Specific Conductance (µS/cm)	41
pH (s.u.)	6.7

Water Clarity	clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	19
Bottom Substrate (15)	10
Pool Variety (10)	6
Riffle Habitat (16)	16
Bank Erosion (7)	5
Bank Vegetation (7)	4
Light Penetration (10)	5
Left Riparian Score (5)	1
Right Riparian Score (5)	1
Total Habitat Score (100)	72

Site Photograph

Substrate cobble dominant, otherwise mix of gravel, sand, boulder

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
07/01/10	11001	---	49	---	3.08	Excellent
09/21/05	9750	---	37	---	3.98	Excellent
07/12/00	8152	---	40	---	3.15	Excellent
07/10/95	6831	---	37	---	2.99	Excellent

Data Analysis

The site is 17 kilometers northwest of downtown Rutherfordton, and about 8 stream-kilometers from the confluence with Broad River. The catchment is primarily forested, with some grassland and agriculture.

The BAU have data from four sampling events for the site, beginning in 1995. Each collection has been made using EPT methods. EPT Richness was significantly higher in 2010 than for any previous sampling event (49 taxa versus 40 in 2000), while the EPT BI was within the range of prior values.

The substrate and hydrological characteristics seen in 2010 did not reflect those noted in the prior basinwide report for the 2005 collection (which described the site as having about 70% sandy substrate, pools filling with sediment, and infrequent riffles). Substrate characteristics were very similar for the 2010 and 2000 collections.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
BROAD R	**SR 1106**	**AB3**	**08/24/10**	**Good-Fair**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
RUTHERFORD	2	03050105	35.227778	-81.930833	9-(25.5)	Southern Outer Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
WS-IV	539	720	40	0.6

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

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
Rutherfordton WWTP	NC0025909	3

Water Quality Parameters

Temperature (°C)	26.4
Dissolved Oxygen (mg/L)	7.5
Specific Conductance (µS/cm)	45
pH (s.u.)	6.7
Water Clarity	slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	14
Bottom Substrate (15)	3
Pool Variety (10)	4
Riffle Habitat (16)	3
Bank Erosion (7)	5
Bank Vegetation (7)	7
Light Penetration (10)	2
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	52

Site Photograph

Substrate sand dominant, otherwise mix of bedrock, gravel, cobble, boulder

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/24/10	10996	80	31	4.98	4.38	Good-Fair
09/20/05	9747	48	19	4.83	4.23	Good-Fair
07/11/00	8156	71	24	5.46	4.69	Good-Fair
07/12/95	6844	52	23	4.85	3.85	Good-Fair

Data Analysis

The site is about 13 kilometers southwest of midtown Forest City. The catchment is primarily forest, especially in the higher elevations, while the remainder is development (Chimney Rock, Lake Lure, Rutherfordton and portions of Ruth, Spindale, Saluda, and Columbus), and pasture and cropland.

The BAU have benthic data for four sampling events at the site, with Full Scale collection methods used each time. The greatest number of EPT taxa (31) were collected in 2010, significantly greater than the prior high of 24 in 2000. The NCBI value for 2010 was within the range for the prior sampling events. Except for the jump in EPT Richness for 2010, indications are that water quality is stable at the site.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
MOUNTAIN CR	**SR 1149**	**AB35**	**06/30/10**	**Good**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
RUTHERFORD	2	03050105	35.316389	-81.998611	9-25-(3.5)	Southern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
WS-IV	47	750	10	0.3

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

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

Water Quality Parameters

Temperature (°C)	21.8
Dissolved Oxygen (mg/L)	7.8
Specific Conductance (µS/cm)	56
pH (s.u.)	6.1

Water Clarity: slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	7
Bottom Substrate (15)	3
Pool Variety (10)	6
Riffle Habitat (16)	3
Bank Erosion (7)	5
Bank Vegetation (7)	6
Light Penetration (10)	9
Left Riparian Score (5)	4
Right Riparian Score (5)	5
Total Habitat Score (100)	53

Site Photograph

Substrate: sand

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
06/30/10	10998	---	25	---	3.71	Good-Fair
09/21/05	9752	---	19	---	4.04	Good-Fair
08/17/00	8165	53	19	4.91	4.11	Good-Fair
07/12/95	6842	---	28	---	3.85	Good

Data Analysis

The site is 6.5 kilometers southwest of downtown Rutherfordton and about 700 stream-meters from the confluence with Broad River. The catchment is a mixture of forest, grassland, and pasture and cropland.

The BAU have benthic data from four sampling events at the site beginning in 1995. EPT sampling methods were used in 1995, 2005, and 2010, while Full Scale methods were used in 2000. EPT richness for 2010 is within the range for the prior sampling events, and significantly greater than for 2005. The EPTBI value for 2010 is slightly lower than recorded for prior samples.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
CLEGHORN CR	**SR 1149**	**AB16**	**06/30/10**	**Excellent**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
RUTHERFORD	2	03050105	35.312500	-81.982222	9-26-(0.5)b	Southern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
C	14	750	8	0.3

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

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
Rutherfordton WWTP	NC0025909	3

Water Quality Parameters

Temperature (°C)	21.4
Dissolved Oxygen (mg/L)	7.8
Specific Conductance (µS/cm)	85
pH (s.u.)	6.9

Water Clarity: slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	8
Bottom Substrate (15)	5
Pool Variety (10)	10
Riffle Habitat (16)	14
Bank Erosion (7)	5
Bank Vegetation (7)	6
Light Penetration (10)	9
Left Riparian Score (5)	2
Right Riparian Score (5)	3
Total Habitat Score (100)	66

Site Photograph

Substrate: mostly sand, some gravel, silt, and cobble also present

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
06/30/10	10997	77	30	5.01	4.06	Good-Fair
09/21/05	9753	55	21	6.02	4.92	Fair
07/13/00	8162	84	24	6.11	5.31	Good-Fair
07/12/95	6843	49	17	5.25	5.07	Fair

Data Analysis

The site is six kilometers SSW of downtown Rutherfordton, and about 2.6 stream-kilometers upstream of Broad River. It is also near bottom of one 303(d)-listed segment (9-26-(0.5)b), and just above a second listed segment (9-26-(0.75) with a stream classification of WS-IV). Both segments were listed due to the classification of Fair received following benthic basinwide sampling in 2005. A large portion of the catchment is developed (Rutherfordton and portions of Ruth and Spindale), with the remainder a mix of forest, cropland and pasture, and grassland.

The BAU have data for four benthic sampling events starting in 1995. All benthic sampling was conducted using Full Scale methods. EPT Richness was significantly higher in 2010 than in prior years. The decline in caddisfly taxa noted in the prior basinwide report for the 2005 collection was reversed in 2010; Trichoptera richness was 6, 11, 6, and 14 for 1995, 2000, 2005, and 2010 respectively. The NCBI value was also lower than for all prior years. Considering both the richness and biotic index metrics, this may indicate an improvement in water quality in 2010.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
HUNGRY R	**OFF SR 1799**	**AB29**	**08/25/10**	**Excellent**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
HENDERSON	3	03050105	35.318510	-82.347610	9-29-30	Southern Crystalline Ridges and Mountains

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
C;Tr	18	1820	8	0.3

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

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

Water Quality Parameters

Temperature (°C)	19.3
Dissolved Oxygen (mg/L)	8.3
Specific Conductance (µS/cm)	58
pH (s.u.)	6.4

Water Clarity	clear

Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	18
Bottom Substrate (15)	13
Pool Variety (10)	10
Riffle Habitat (16)	16
Bank Erosion (7)	5
Bank Vegetation (7)	4
Light Penetration (10)	4
Left Riparian Score (5)	4
Right Riparian Score (5)	0
Total Habitat Score (100)	78

Site Photograph

Substrate mix of cobble, boulder, gravel, sand, and silt

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/25/10	11102	---	45	---	2.78	Excellent
09/22/05	9755	---	31	---	2.62	Good
09/12/00	8307	---	34	---	2.70	Good
07/10/00	8143	---	34	---	2.44	Good
07/10/95	6833	---	25	---	2.46	Good-Fair

Data Analysis

The site is about 10 kilometers east of Hendersonville, about 5 stream-kilometers from the confluence with Green River, and directly below the mouth of Tumblebug Creek. The catchment is primarily forest, with some small areas of development and some agriculture.

The BAU have benthic data for five sampling events beginning in 1995 (the second 2000 event in September was for method QA of the July sample). All samples were collected using EPT methods.

EPT Richness was significantly higher in 2010 than for any previous sampling event. Currently, water quality problems are not indicated by the benthic community. However, during the 2010 sampling effort, a relative to a nearby property owner and the property owner himself complained of sediments coming from upstream on Tumblebug Creek. A brief investigation of the creek by the BAU field crew showed extensive sedimentation in depositional areas. Also noted was a silt plume at the mouth of the creek. Sources upstream on Tumblebug Creek may be responsible for the much of the silt present at the basinwide site on Hungry River. Asheville Regional Office has been notified of the complaint by the property owner and of the observations of the BAU crew.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
GREEN R	**SR 1151**	**AB23**	**07/01/10**	**Excellent**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
POLK	3	03050105	35.305556	-82.275556	9-29-(33)	Southern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
C	105	960	30	0.5

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

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

Water Quality Parameters

Temperature (°C)	22.5
Dissolved Oxygen (mg/L)	11.3
Specific Conductance (µS/cm)	40
pH (s.u.)	6.1

Water Clarity	slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	18
Bottom Substrate (15)	10
Pool Variety (10)	4
Riffle Habitat (16)	14
Bank Erosion (7)	7
Bank Vegetation (7)	7
Light Penetration (10)	2
Left Riparian Score (5)	4
Right Riparian Score (5)	3
Total Habitat Score (100)	73

Site Photograph

Substrate	mix of boulder, cobble, gravel, and sand

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
07/01/10	11005	109	54	3.84	3.27	Excellent
09/22/05	9754	89	37	4.42	3.17	Good
07/11/00	8149	71	29	4.39	3.42	Good-Fair
07/10/95	6832	54	25	4.29	3.69	Good-Fair

Data Analysis

The site is about 11 kilometers NNW of Tryon. It is influenced by scheduled flow releases from Duke Energy's Tuxedo hydroelectric facility (Lake Summit), about 20 stream-kilometers upstream. The catchment is mostly forest, with some development (communities north and west of Lake Summit and a portion of Saluda) and very little agriculture. The section of the river including this benthic site is used for recreation (boating and tubing) by organized groups (including commercial) in the summer, and should be considered for Class B classification.

The BAU have benthic data from four sampling events beginning in 1995. Full Scale sampling methods were used in each instance. There has been an increase in the number of EPT taxa collected over successive sampling events. The difference between EPT richness in 2005 and 2010 is especially significant, with an increase of 17 such taxa collected in 2010 over 2005. The NCBI value for 2010 was lower than for any prior year. Between the two metrics, improved water quality is indicated since benthic sampling began in 1995.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
GREEN R	SR 1302	AB24	06/29/10	Good

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
POLK	2	03050105	35.260278	-81.984167	9-29-(47)	Southern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
WS-IV	243	720	30	0.5

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

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

Water Quality Parameters

Temperature (°C)	26.0
Dissolved Oxygen (mg/L)	7.5
Specific Conductance (µS/cm)	41
pH (s.u.)	6.1

Water Clarity	slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	17
Bottom Substrate (15)	12
Pool Variety (10)	5
Riffle Habitat (16)	15
Bank Erosion (7)	7
Bank Vegetation (7)	7
Light Penetration (10)	2
Left Riparian Score (5)	3
Right Riparian Score (5)	4
Total Habitat Score (100)	77

Site Photograph

Substrate mix of boulder, cobble, gravel, sand, and small amount of silt

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
06/29/10	10994	53	29	4.02	3.82	Good
09/20/05	9748	58	23	4.72	4.04	Good-Fair
07/12/00	8153	70	29	4.50	3.71	Good-Fair
07/11/95	6835	52	27	4.51	4.16	Good-Fair
07/26/89	5015	83	35	4.71	4.06	Good
07/21/87	4165	74	33	4.88	4.25	Good

Data Analysis

The site is located about 14 kilometers southwest of midtown Forest City and about 1.4 stream-kilometers from the confluence with Broad River. The catchment is mostly forested, particularly in the upper two-thirds, and otherwise a mixture of development (portions of Saluda and Columbus), pasture and cropland, and grassland.

The site has been collected six times since 1987, with Full Scale collection methods used each time. A significantly lower NCBI value was recorded for 2010 (4.02) than for any prior sampling event (the previous low value was 4.50 in 2000 as determined using the latest tolerance values). EPT richness for 2010 is in the middle of the range for all sampling events at the site. Overall there does not appear to be a trend in water quality as reflected by the benthos.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
WALNUT CR	**SR 1315**	**AB47**	**06/30/10**	**Good**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
POLK	2	03050105	35.354167	-82.103333	9-29-44	Southern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
C	17	800	9	0.3

	Forested/Wetland	Urban	Agriculture	Road	Other (describe)
Visible Landuse (%)	30	0	70	0	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)	35
pH (s.u.)	6.8

Water Clarity	slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	18
Bottom Substrate (15)	13
Pool Variety (10)	9
Riffle Habitat (16)	15
Bank Erosion (7)	4
Bank Vegetation (7)	4
Light Penetration (10)	7
Left Riparian Score (5)	3
Right Riparian Score (5)	2
Total Habitat Score (100)	79

Site Photograph

Substrate even mix of boulder, cobble, sand, with some gravel

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
06/30/10	10999	---	29	---	2.95	Good
09/21/05	9703	---	33	---	3.50	Good
07/11/00	8150	---	38	---	3.23	Excellent
07/11/95	6834	---	14	---	4.13	Fair

Data Analysis

The site is 13 kilometers west of downtown Rutherfordton, and about 1.3 stream-kilometers from the confluence with Green River. The catchment is a mixture of forest, pasture and cropland, and grassland.

The BAU have benthic data for four sampling events beginning in 1995. EPT collection methods were used in each instance. EPT Richness has shown a decline in each successive sampling event starting with 2000. This is primarily driven by differences in the number of Trichoptera taxa collected, though within that insect order there are generally no apparent trends. The low EPT BI value in 2010 compared to prior years is indicative of better water quality in spite of declines in EPT Richness since 2000.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
WHITEOAK CR	**SR 1352**	**AB48**	**06/30/10**	**Excellent**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
POLK	2	03050105	35.260556	-82.003889	9-29-46	Southern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
C	52	750	13	0.3

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

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

Water Quality Parameters

Temperature (°C)	23.4
Dissolved Oxygen (mg/L)	7.1
Specific Conductance (µS/cm)	53
pH (s.u.)	6.5

Water Clarity	slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	13
Bottom Substrate (15)	5
Pool Variety (10)	6
Riffle Habitat (16)	9
Bank Erosion (7)	6
Bank Vegetation (7)	5
Light Penetration (10)	7
Left Riparian Score (5)	5
Right Riparian Score (5)	3
Total Habitat Score (100)	64

Site Photograph

Substrate sand dominant, with mix of gravel, silt, and cobble

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
06/30/10	10995	---	32	---	3.79	Good
09/20/05	9749	---	28	---	3.93	Good
07/11/00	8154	95	40	4.58	3.76	Good
07/11/95	6836	63	36	4.51	4.06	Good
05/15/95	6802	86	40	4.55	3.05	Good
10/29/86	3929	---	24	---	4.03	Good-Fair

Data Analysis

The site is about 15 kilometers southwest of midtown Forest City, and about 650 stream-meters from the confluence with Green River. The catchment is a mixture of forest, development (including a portion of Columbus), cropland, and pasture.

The BAU have data for six benthic sampling events from 1986, three using EPT methods and three Full Scale. Due to different sampling methods and different collection times during the year it is difficult to make any assessment of trends in water quality. EPT Richness differs by four taxa between the two most recent sampling events in 2005 and 2010 (both of which were collected using EPT methods), but the increase in 2010 over 2005 may be due, in part, to season (late June collection versus mid-September).

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
SECOND BROAD R	**SR 1538**	**AB44**	**06/28/10**	**Good-Fair**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
RUTHERFORD	2	03050105	35.404167	-81.871944	9-41-(10.5)	Southern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
WS-IV	87	840	14	0.3

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

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

Water Quality Parameters

Temperature (°C)	25.5
Dissolved Oxygen (mg/L)	7.2
Specific Conductance (µS/cm)	64
pH (s.u.)	6.0

Water Clarity	slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	6
Bottom Substrate (15)	3
Pool Variety (10)	2
Riffle Habitat (16)	2
Bank Erosion (7)	5
Bank Vegetation (7)	6
Light Penetration (10)	9
Left Riparian Score (5)	4
Right Riparian Score (5)	4
Total Habitat Score (100)	46

Site Photograph

Substrate sand

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
06/28/10	10991	77	23	4.81	3.75	Good-Fair
09/19/05	9744	66	26	5.09	4.25	Good-Fair
08/16/00	8164	64	26	4.61	3.79	Good-Fair
07/13/95	6848	51	26	4.43	3.74	Good-Fair
06/28/94	6563	68	33	4.29	3.83	Good

Data Analysis

The site is located about 8 kilometers north of midtown Forest City. The lower portion of the catchment is a mixture of forest, pasture and cropland, and grassland while the upper portion is primarily forest.

The site has been sampled five times since 1994, using Full Scale collection methods each time. EPT Richness was consistent for the sampling events in 1995, 2000, and 2005, but 2010 showed the lowest EPT Richness for all sampling events. The BI value for 2010 was near the high end of the range for all sampling events. In combination, the values of the two metrics for 2010 may indicate slightly worse benthic conditions compared to prior years.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
CATHEYS CR	**SR 1549**	**AB14**	**06/28/10**	**Good**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
RUTHERFORD	2	03050105	35.380833	-81.865833	9-41-13-(6)b	Southern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
C	44	830	11	0.2

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

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
Spindale WWTP	NC0020664	6

Water Quality Parameters

Temperature (°C)	23.1
Dissolved Oxygen (mg/L)	7.1
Specific Conductance (µS/cm)	77
pH (s.u.)	6.3

Water Clarity	slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	6
Bottom Substrate (15)	3
Pool Variety (10)	2
Riffle Habitat (16)	2
Bank Erosion (7)	5
Bank Vegetation (7)	6
Light Penetration (10)	9
Left Riparian Score (5)	5
Right Riparian Score (5)	4
Total Habitat Score (100)	46

Site Photograph

Substrate sand

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
06/28/10	10990	---	21	---	4.01	Good-Fair
06/12/03	9157	48	20	5.17	4.34	Good-Fair
08/16/00	8163	---	18	---	4.37	Fair
07/13/95	6847	---	18	---	3.99	Fair
06/27/94	6564	50	18	5.28	3.67	Good-Fair
03/23/88	4302	---	15	---	3.95	Fair

Data Analysis

The site is located about 5 kilometers north of midtown Forest City, about 900 stream-meters upstream of the confluence with Second Broad River, and within a 303(d)-listed segment due to a classification of Fair following a fish community assessment in 2004. The catchment includes a mixture of forest, cropland and pasture, grassland, and development (portions of Spindale and Ruth).

The sampling event in 2010 resulted in the highest number of EPT taxa collected, even more than for 1994 and 2003 when more intensive Full Scale sampling methods were used, and may indicate better biological conditions in 2010 than in prior years. However, the EPT BI is near the middle of the range of values among all sampling events, so nothing conclusive can be said about water quality trends at the site.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
ROBERSON CR	**SR 1561**	**AB42**	**06/28/10**	**Good**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
RUTHERFORD	2	03050105	35.368889	-81.848611	9-41-14	Southern Outer Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
WS-V	26	820	6	0.3

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

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

Water Quality Parameters

Temperature (°C)	25.3
Dissolved Oxygen (mg/L)	6.3
Specific Conductance (µS/cm)	47
pH (s.u.)	6.1

Water Clarity: slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	16
Bottom Substrate (15)	6
Pool Variety (10)	6
Riffle Habitat (16)	10
Bank Erosion (7)	5
Bank Vegetation (7)	5
Light Penetration (10)	10
Left Riparian Score (5)	5
Right Riparian Score (5)	4
Total Habitat Score (100)	72

Site Photograph

Substrate: mostly gravel and sand, some silt

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
06/28/10	10989	---	25	---	3.82	Good-Fair
09/19/05	9743	---	24	---	4.14	Good-Fair
07/13/00	8155	---	21	---	4.35	Good-Fair
07/13/95	6846	---	26	---	4.11	Good-Fair

Data Analysis

The site is located about 700 stream-meters upstream of the confluence with Second Broad River and just outside of the town of Bostic. The catchment includes a mix of forest, pasture and cropland, and grassland.

The BAU have data for four sampling events at the site. EPT collection methods were used each time. EPT Richness has been fairly stable for each collection. The 2010 EPTBI value is lower than for all prior years, and may indicate slightly better biological conditions over the prior sampling dates.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
SECOND BROAD R	SR 1973	AB45	06/29/10	Good

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
RUTHERFORD	2	03050105	35.233056	-81.766667	9-41-(24.7)	Southern Outer Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
WS-IV	220	690	17	0.5

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

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
Spindale WWTP	NC0020664	6
Forest City WWTP	NC0025984	4.95

Water Quality Parameters

Temperature (°C)	25.4
Dissolved Oxygen (mg/L)	7.2
Specific Conductance (µS/cm)	72
pH (s.u.)	6.3

Water Clarity: slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	17
Bottom Substrate (15)	12
Pool Variety (10)	9
Riffle Habitat (16)	15
Bank Erosion (7)	6
Bank Vegetation (7)	5
Light Penetration (10)	2
Left Riparian Score (5)	5
Right Riparian Score (5)	4
Total Habitat Score (100)	80

Site Photograph

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

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
06/29/10	10993	89	36	5.05	4.37	Good
09/19/05	9745	62	26	5.26	4.27	Good-Fair
07/19/00	8192	83	29	5.82	4.68	Good-Fair
07/13/95	6845	42	20	5.57	4.73	Good-Fair
07/08/91	5649	59	25	5.07	4.35	Good-Fair
07/25/89	5011	60	17	6.24	5.37	Fair
07/21/87	4167	65	25	5.67	4.52	Good-Fair
09/04/85	3645	44	15	6.07	4.92	Fair
08/11/83	3115	26	9	7.82	4.77	Poor

Data Analysis

The site is 14 kilometers southeast of midtown Forest City and about 1.9 stream-kilometers from the confluence with Broad River. Sampling was conducted directly upstream of the Cliffside Sanitary District WWTP outfall. The catchment includes a mixture of forest (primarily at the headwaters), pasture and cropland, and development (Bostic and portions of Ruth, Spindale, and Forest City).

The site has been sampled for benthos nine time since 1983, each time using Full Scale collection methods. More EPT taxa were collected during the 2010 sampling event than for any prior event (the previous high was 29 in 2000). The lowest NCBI value was also recorded for 2010, very slightly lower than that recorded in 1991. Though the sample in 2010 was collected a little earlier in the year than for previous summer sampling at the site, spring taxa are not the reason for high EPT richness. It appears that there has been an improvement in biological condition at the site since 1983 and 1985; with those two data points removed there is still a suggestion of a trend towards better water quality over time as reflected by NCBI values and more particularly by upward-trending EPT richness. A marked decrease in specific conductance as measured during the sampling events in 1995, 2000, and 2005 against 2010 (210, 368, 226, and 72 µS/cm respectively) supports the biological evidence for better water quality in 2010 over prior years.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
SANDY RUN CR	**SR 1195**	**AB43**	**06/30/10**	**Good**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
CLEVELAND	4	03050105	35.225556	-81.696944	9-46-(3.5)	Southern Outer Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
WS-IV	65	695	16	0.2

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

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

Water Quality Parameters

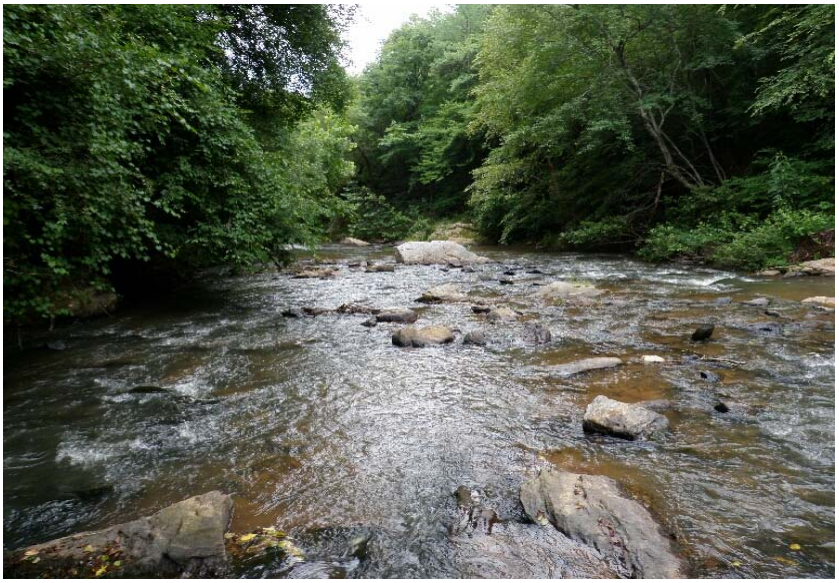
Temperature (°C)	25.0
Dissolved Oxygen (mg/L)	---
Specific Conductance (µS/cm)	59
pH (s.u.)	6.2

Water Clarity	clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	20
Bottom Substrate (15)	15
Pool Variety (10)	10
Riffle Habitat (16)	16
Bank Erosion (7)	5
Bank Vegetation (7)	7
Light Penetration (10)	5
Left Riparian Score (5)	4
Right Riparian Score (5)	4
Total Habitat Score (100)	91

Site Photograph



Substrate mix of boulder, cobble, silt, with some bedrock, gravel, sand

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
06/30/10	10947	83	35	4.83	4.16	Good
07/12/05	9687	79	37	4.37	3.57	Good
07/19/00	8194	80	38	4.66	3.79	Good
07/11/95	6860	61	28	4.99	4.10	Good-Fair

Data Analysis

The site is 16 kilometers WSW of Shelby, and about three stream-kilometers from the confluence with Broad River. The catchment above the site is mostly agriculture, with forest along stream corridors.

The BAU have benthic data from four sampling events beginning in 1995. All collections were made using Full Scale methods. Since the Good-Fair received in 1995, the site has received a bioclassification each time. However, EPT Richness has slipped a little since 2000 and the NCBI is at it's highest level since 2000.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
FIRST BROAD R	**SR 1530**	**AB21**	**07/01/10**	**Excellent**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
CLEVELAND	4	03050105	35.493056	-81.682222	9-50-(1)	Northern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
WS-V;Tr	60	960	15	---

	Forested/Wetland	Urban	Agriculture	Road	Other (describe)
Visible Landuse (%)	50	25	25	0	0

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

Water Quality Parameters

Temperature (°C)	22.8
Dissolved Oxygen (mg/L)	---
Specific Conductance (µS/cm)	40
pH (s.u.)	6.3

Water Clarity: slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	3
Instream Habitat (20)	14
Bottom Substrate (15)	8
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)	5
Total Habitat Score (100)	71

Site Photograph

Substrate: mostly sand and cobble, with bedrock, boulder, gravel, and silt

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
07/01/10	10987	92	38	3.95	3.41	Good
09/19/05	9696	118	54	4.65	3.61	Excellent
07/17/00	8184	112	47	4.43	3.49	Good
07/10/95	6855	92	39	4.09	3.38	Good
10/28/93	6416	---	35	---	3.52	Good
07/24/89	5008	92	37	4.37	3.80	Good
07/27/88	4651	96	42	4.48	3.64	Good
07/22/86	3854	91	37	4.83	3.78	Good

Data Analysis

The site is 24 kilometers northeast of midtown Forest City, about 80 stream-kilometers from the confluence with Broad River, and at the downstream end of a stream segment on the state's 303(d) list due to a standard violation for low pH. The catchment above the site is mostly forested with some agriculture.

The BAU have benthic data for eight sampling events since 1986 at the site. Full Scale sampling methods have been used each time except for 1993 when EPT methods were used. The NCBI value for 2010 is the lowest for all Full Scale sampling events at the site, an indication that water quality is better than in prior years. However, EPT Richness for 2010 is near the low end of the range of values for Full-Scale samples. It is therefore difficult to assess any overall trend in water quality at the site. Though flows were higher for the basin during the summer in 2005 than for 2000 or 2010, the collection in 2005 was two months later in the season so flows at the time of collection were comparable for those three most recent sampling events at the site. The spike in EPT Richness in 2005, which is exhibited in several other sites in the Broad basin, is puzzling.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
N FK FIRST BROAD R	**SR 1728**	**AB37**	**07/01/10**	**Excellent**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
RUTHERFORD	4	03050105	35.536389	-81.772222	9-50-4	Eastern Blue Ridge Foothills

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
C;Tr,ORW	12	1180	11	0.2

	Forested/Wetland	Urban	Agriculture	Road	Other (describe)
Visible Landuse (%)	75	25	0	0	0

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)	---
Specific Conductance (µS/cm)	33
pH (s.u.)	6.1

Water Clarity	slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	19
Bottom Substrate (15)	15
Pool Variety (10)	6
Riffle Habitat (16)	16
Bank Erosion (7)	5
Bank Vegetation (7)	5
Light Penetration (10)	7
Left Riparian Score (5)	2
Right Riparian Score (5)	5
Total Habitat Score (100)	85

Site Photograph

Substrate mostly cobble, remainder a mix of boulder, gravel, sand, silt

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
07/01/10	10986	---	42	---	2.64	Excellent
07/13/05	9690	---	49	---	2.49	Excellent
07/17/00	8183	---	36	---	2.83	Excellent
07/10/95	6852	84	40	3.47	2.97	Excellent
07/24/89	5007	35	35	3.15	3.15	Good

Data Analysis

The site is 24 kilometers NNE of midtown Forest City and 2.4 stream-kilometers from the confluence with First Broad River. The catchment above the site is heavily forested, with pockets of agriculture, grassland, and shrubland.

The BAU have data for five sampling events since 1989. Full Scale collection methods were used in 1989 and 1995, and EPT methods in 2000, 2005, 2010. As with several other sites in the basin, there was a spike in the number of EPT collected in 2005. This may be linked to higher flows exhibited in late June and July for the basin for that year, though not all sites showed the same response. In general, EPTBI values have been showing a downward trend over all sampling events at the site.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
HINTON CR	**NC 226**	**AB25**	**07/01/10**	**Good-Fair**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
CLEVELAND	4	03050105	35.436389	-81.652500	9-50-15	Northern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
C	19	870	5	0.2

	Forested/Wetland	Urban	Agriculture	Road	Other (describe)
Visible Landuse (%)	100	0	0	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)	---
Specific Conductance (µS/cm)	39
pH (s.u.)	5.8
Water Clarity	---

Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	13
Bottom Substrate (15)	8
Pool Variety (10)	4
Riffle Habitat (16)	7
Bank Erosion (7)	6
Bank Vegetation (7)	7
Light Penetration (10)	10
Left Riparian Score (5)	3
Right Riparian Score (5)	4
Total Habitat Score (100)	66

Site Photograph

Substrate mostly gravel and sand, some boulder and cobble

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
07/01/10	10870	---	25	---	3.93	Good-Fair
07/13/05	9689	---	40	---	3.14	Excellent
07/17/00	8186	---	26	---	3.80	Good-Fair
07/10/95	6853	---	22	---	3.42	Good-Fair

Data Analysis

The site is 19 kilometers NNW of Shelby off of NC 226 and two stream-kilometers from the confluence with First Broad River. Forest is the most highly represented land cover in the catchment above the site, with a moderate amount of agriculture also present.

The site has been sampled using EPT methods on four occasions back to 1995. All have resulted in classifications of Good-Fair except for 2005, when a greater number of EPT taxa than usual were collected from the site. The reason for the marked spike in the number of EPT taxa collected in 2005 is not clear, though it may be related to higher July flows in the basin in 2005 (due to tropical depressions Cindy and Dennis) over other years.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
FIRST BROAD R	**SR 1809**	**AB19**	**06/29/10**	**Good**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
CLEVELAND	4	03050105	35.382271	-81.548899	9-50-(19.5)	Southern Outer Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
WS-IV	122	780	25	0.4

	Forested/Wetland	Urban	Agriculture	Road	Other (describe)
Visible Landuse (%)	75	25	0	0	0

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

Water Quality Parameters

Temperature (°C)	27.5
Dissolved Oxygen (mg/L)	---
Specific Conductance (µS/cm)	52
pH (s.u.)	7.2

Water Clarity	turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	16
Bottom Substrate (15)	10
Pool Variety (10)	9
Riffle Habitat (16)	12
Bank Erosion (7)	6
Bank Vegetation (7)	6
Light Penetration (10)	5
Left Riparian Score (5)	2
Right Riparian Score (5)	4
Total Habitat Score (100)	75

Site Photograph

Substrate mix of gravel, cobble, bedrock, and sand with some boulder, silt

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
06/29/10	10962	86	38	4.55	3.99	Good
09/20/05	9698	111	38	4.85	3.90	Good
07/18/00	8188	83	32	4.54	3.75	Good
07/11/95	6857	74	31	4.76	3.94	Good

Data Analysis

The site is 10 kilometers north of Shelby and 42 stream-kilometers from the confluence with Broad River. Land cover is primarily forest in the upper portion of the catchment, and mostly agriculture closer to the site.

Full Scale sampling methods were used during each sampling event in 1995, 2000, 2005, and 2010. NCBI values have not varied greatly between sampling events. The number of EPT taxa collected in both 2005 and 2010 is significantly higher than for both 1995 and 2000, suggesting an improvement in water quality between 2000 and the two most recent sampling events.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
KNOB CR	**SR 1004**	**AB32**	**07/01/10**	**Good-Fair**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
CLEVELAND	4	03050105	35.433611	-81.560278	9-50-19-(4)	Southern Outer Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
WS-IV;CA	35	820	10	0.2

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

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

Water Quality Parameters

Temperature (°C)	23.5
Dissolved Oxygen (mg/L)	---
Specific Conductance (µS/cm)	48
pH (s.u.)	6.4

Water Clarity	clear

Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	11
Bottom Substrate (15)	3
Pool Variety (10)	0
Riffle Habitat (16)	3
Bank Erosion (7)	7
Bank Vegetation (7)	2
Light Penetration (10)	7
Left Riparian Score (5)	5
Right Riparian Score (5)	1
Total Habitat Score (100)	43

Site Photograph

Substrate nearly all sand, with some silt

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
07/01/10	10988	---	15	---	3.75	Fair
09/20/05	9697	---	25	---	4.26	Good
07/17/00	8187	---	30	---	3.88	Good
07/11/95	6856	75	31	4.49	3.85	Good

Data Analysis

The site is 16 kilometers north of downtown Shelby, and approximately 600 stream-meters from the confluence with First Broad River. Land cover in the catchment above the site is a mix of agriculture and forest.

The BAU have data from four sampling events since 1995. Full Scale sampling methods were used in 1995, and EPT each time since. The site was erroneously evaluated using Piedmont criteria in 2005; using Mountain criteria it would have received a Good-Fair. The number of EPT collected at the site slipped a little between 2000 and 2005, with a much greater reduction between 2005 and 2010. However, the EPTBI value for 2010 is lower than for any other collection. Loss of colonizable macroinvertebrate habitat at the site due to sedimentation could account, in part, for the results.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
FIRST BROAD R	**SR 1140**	**AB20**	**06/30/10**	**Excellent**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
CLEVELAND	4	03050105	35.217500	-81.608056	9-50-(28)	Southern Outer Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
C	295	640	25	0.3

	Forested/Wetland	Urban	Agriculture	Road	Other (describe)
Visible Landuse (%)	75	0	0	0	25 (power lines right of way)

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
PPG Industries Fiber Glass Products Inc, Shelby facility	NC0004685	1.3
City of Shelby, First Broad River WWTP	NC0024538	6

Water Quality Parameters

Temperature (°C)	27.2
Dissolved Oxygen (mg/L)	---
Specific Conductance (µS/cm)	---
pH (s.u.)	6.4

Water Clarity	slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	3
Instream Habitat (20)	11
Bottom Substrate (15)	3
Pool Variety (10)	4
Riffle Habitat (16)	7
Bank Erosion (7)	5
Bank Vegetation (7)	5
Light Penetration (10)	1
Left Riparian Score (5)	3
Right Riparian Score (5)	3
Total Habitat Score (100)	45

Site Photograph

Substrate sand dominant, some gravel and silt

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
06/30/10	10871	84	30	5.09	4.29	Excellent
09/20/05	9699	82	30	5.63	4.29	Good
07/20/00	8198	70	23	5.51	4.27	Good
07/12/95	6864	51	19	5.48	4.78	Good-Fair
07/25/89	5013	73	23	5.77	4.59	Good
07/21/87	4168	69	26	5.76	4.24	Good
09/05/85	3648	44	12	6.77	5.47	Fair
08/11/83	3117	57	21	6.04	4.76	Good-Fair

Data Analysis

The site is located about 10 kilometers southwest of downtown Shelby and 5 stream-kilometers from the confluence with Broad River. Catchment landcover is primarily forest in the upper portion and agriculture in the middle and lower portions, and with development associated with the city of Shelby.

The BAU have benthic data for eight sampling events starting in 1983. Full Scale collection methods were used each time. The bioclassification of Excellent in 2010, the first for the site, is due to the lowest NCBI score recorded and the highest EPT Richness (equaling that attained in 2005) for this location. The classification of Excellent in especially significant considering the poor habitat at the site.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
BRUSHY CR	**SR 1308**	**AB8**	**07/01/10**	**Good-Fair**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
CLEVELAND	4	03050105	35.302778	-81.578889	9-50-29	Southern Outer Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
C	27	740	10	0.1

	Forested/Wetland	Urban	Agriculture	Road	Other (describe)
Visible Landuse (%)	75	25	0	0	0

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
PPG Industries Fiber Glass Products Inc--Shelby Facility	NC0004685	1.3

Water Quality Parameters

Temperature (°C)	23.4
Dissolved Oxygen (mg/L)	---
Specific Conductance (µS/cm)	111
pH (s.u.)	6.2

Water Clarity	clear

Habitat Assessment Scores (max)

Channel Modification (5)	3
Instream Habitat (20)	11
Bottom Substrate (15)	3
Pool Variety (10)	0
Riffle Habitat (16)	7
Bank Erosion (7)	3
Bank Vegetation (7)	7
Light Penetration (10)	10
Left Riparian Score (5)	5
Right Riparian Score (5)	3
Total Habitat Score (100)	52

Site Photograph

Substrate mostly sand with some gravel and silt

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
07/01/10	10867	---	15	---	4.86	Good-Fair
09/21/05	9701	---	31	---	4.72	Excellent
07/20/00	8196	62	24	5.16	4.14	Good

Data Analysis

The site is within the city of Shelby and four stream-kilometers from the confluence with First Broad River. The stream originates near Polkville. Landcover is mostly a mix of agriculture and forest with some development.

The site was collected using EPT methods in 2010 and 2005, and Full Scale in 2000. Far fewer EPT were collected in 2010 than in 2005, indicative of a much more highly stressed community in 2010 over 2005; however, EPT BI values were similar between the two most recent sampling events. Though stream flows were higher during the summer of 2005 than 2010 in the basin, flows at the time of the 2005 and 2010 sampling events (mid-September and early July respectively) were similar. PPG Industries Fiber Glass Products Incorporated operates a permitted discharger (permit NC0004685) with two outfalls, one of which is upstream of this benthic site and used for elimination of process and domestic wastewater. There have been a number of NOVs generated for the facility between 2005 and July 2010 at the outfall to Brushy Creek: six for exceeding the limit on oil and grease (three in 2006 and three in 2008); one for pH in 2006; two for ammonia in January and February 2010; one for BOD in July 2010. Prior to 2005 there were only two NOVs for the facility at the Brushy Creek outfall.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
BEAVERDAM CR	**NC 150**	**AB2**	**06/30/10**	**Good**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
CLEVELAND	4	03050105	35.250278	-81.630278	9-50-32	Southern Outer Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
C	17	720	6	0.2

	Forested/Wetland	Urban	Agriculture	Road	Other (describe)
Visible Landuse (%)	25	25	50	0	0

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
PPG Industries Fiber Glass Products Inc, Shelby facility	NC0004685	1.3

Water Quality Parameters

Temperature (°C)	24.8
Dissolved Oxygen (mg/L)	---
Specific Conductance (µS/cm)	74
pH (s.u.)	6.4

Water Clarity	clear

Habitat Assessment Scores (max)

Channel Modification (5)	3
Instream Habitat (20)	13
Bottom Substrate (15)	3
Pool Variety (10)	4
Riffle Habitat (16)	12
Bank Erosion (7)	4
Bank Vegetation (7)	6
Light Penetration (10)	7
Left Riparian Score (5)	2
Right Riparian Score (5)	4
Total Habitat Score (100)	58

Site Photograph

Substrate dominated by sand, some silt and cobble

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
06/30/10	10985	93	26	5.04	4.81	Good
07/12/05	9688	85	35	4.91	3.88	Excellent
07/19/00	8195	68	24	5.68	4.93	Good
07/11/95	6859	57	20	5.74	4.92	Good-Fair

Data Analysis

The site is nine kilometers southwest of downtown Shebly and six stream-kilometers from the confluence with First Broad River. Land cover is primarily agriculture, with forests along stream corridors, and some development associated mostly with Shelby, Boiling Springs and along US 74.

The BAU have data from four sampling events in 1995, 2000, 2005, and 2010. Full-scale sampling methods were used each time. There was a sharp increase in the number of EPT taxa collected between 2000 and 2005, with a sharp decrease between 2005 and 2010; this is one of eight basinwide sites in the Broad River basin exhibiting that pattern in EPT Richness values. NCBI values were similar in 1995 and 2000, then dropped markedly for 2005 and 2010. PPG Industries Fiber Glass Products Incorporated is a permitted discharger with one of its two outfalls upstream of the benthic site on Beaverdam Creek; this outfall is used for elimination of stormwater and non-contact cooling water.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
BUFFALO CR	**SR 1908**	**AB11**	**06/29/10**	**Good**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
CLEVELAND	5	03050105	35.349167	-81.480278	9-53-(1)	Southern Outer Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
WS-III	44	780	12	0.3

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

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

Water Quality Parameters

Temperature (°C)	21.3
Dissolved Oxygen (mg/L)	---
Specific Conductance (µS/cm)	69
pH (s.u.)	6.1
Water Clarity	milky

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	12
Bottom Substrate (15)	3
Pool Variety (10)	10
Riffle Habitat (16)	7
Bank Erosion (7)	5
Bank Vegetation (7)	5
Light Penetration (10)	7
Left Riparian Score (5)	4
Right Riparian Score (5)	4
Total Habitat Score (100)	62

Site Photograph

Substrate mostly sand and bedrock, some boulder and silt

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
06/29/10	10961	---	25	---	4.37	Good
09/19/05	9694	---	27	---	4.35	Good
07/18/00	8189	79	35	4.83	4.15	Excellent
07/11/95	6858	67	29	4.94	4.51	Good

Data Analysis

The site is about 8.5 kilometers northeast of downtown Shelby and approximately five stream-kilometers upstream of Kings Mountain Reservoir. Land cover is a mix of agriculture and forest.

The BAU have data for four sampling events beginning in 1995. Full Scale collection methods were used in 1995 and 2000, and EPT methods in 2005 and 2010. EPT Richness was similar for 2005 and 2010. EPT BI values, which can be compared for all years in spite of the two different collection methods used, are fairly similar across all sampling events. No significant changes in water quality are suggested since 1995 at the site.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
BUFFALO CR	**NC 198**	**AB10**	**06/30/10**	**Good**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
CLEVELAND	5	03050105	35.171111	-81.517222	9-53-(5)	Southern Outer Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
C	160	600	20	0.2

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

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
City of Kings Mountain, Pilot Creek WWTP	NC0020737	6
CNA Holdings Inc., Ticona Facility	NC0004952	0.8

Water Quality Parameters

Temperature (°C)	24.7
Dissolved Oxygen (mg/L)	---
Specific Conductance (µS/cm)	143
pH (s.u.)	6.5

Water Clarity: slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	3
Instream Habitat (20)	11
Bottom Substrate (15)	3
Pool Variety (10)	0
Riffle Habitat (16)	12
Bank Erosion (7)	6
Bank Vegetation (7)	6
Light Penetration (10)	5
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	56

Site Photograph

Substrate: sand dominant, some gravel and silt

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
06/30/10	10963	---	21	---	4.70	Good
09/20/05	9700	---	21	---	4.83	Good-Fair
07/20/00	8199	75	27	5.23	4.41	Good
07/12/95	6862	56	24	5.16	4.66	Good
07/27/88	4647	80	14	6.65	5.75	Fair
08/06/84	3287	55	18	6.18	5.32	Good-Fair
11/14/83	3123	59	15	6.97	5.45	Fair

Data Analysis

The site is 13 kilometers south of downtown Shelby and at the South Carolina border. Land cover is a mix of agriculture, forest, and development mostly associated with the cities of Kings Mountain, Shelby, and Cherryville.

The BAU have data for seven sampling events since 1983, with Full Scale methods used for the first five events and EPT for the most recent two. The site was erroneously evaluated using Mountain rather than Piedmont criteria in 2005, thus the difference in bioclassification in spite of equal EPT Richness for both 2005 and 2010. EPTBI values between 1995 and 2010 suggest little change in water quality over that time period, but do indicate improvement compared to 1983 through 1988.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
MUDDY FK	**SR 2012**	**AB36**	**06/29/10**	**Good**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
CLEVELAND	5	03050105	35.295833	-81.429167	9-53-6	Southern Outer Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
C	22	720	7	0.2

	Forested/Wetland	Urban	Agriculture	Road	Other (describe)
Visible Landuse (%)	50	25	25	0	0

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

Water Quality Parameters

Temperature (°C)	23.6
Dissolved Oxygen (mg/L)	---
Specific Conductance (µS/cm)	72
pH (s.u.)	6.8

Water Clarity	clear

Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	10
Bottom Substrate (15)	3
Pool Variety (10)	6
Riffle Habitat (16)	10
Bank Erosion (7)	5
Bank Vegetation (7)	3
Light Penetration (10)	7
Left Riparian Score (5)	3
Right Riparian Score (5)	3
Total Habitat Score (100)	54

Site Photograph

Substrate sand, gravel, and silt

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
06/29/10	10960	76	22	5.35	4.65	Good
07/12/05	9686	87	35	5.25	4.57	Excellent
07/18/00	8190	73	25	5.46	4.76	Good
07/13/95	6865	74	23	5.56	5.03	Good
09/13/90	5462	74	17	5.80	5.21	Good-Fair
11/14/83	3187	75	18	6.06	4.43	Good-Fair

Data Analysis

The site is located 10 kilometers east of Shelby and about 7.5 stream-kilometers from the confluence with Buffalo Creek. Land cover is mostly a mix of forest and agriculture, with a little development associated with Cherryville at the headwaters.

The BAU have data for six sampling events beginning in 1983. Full Scale collection methods were used each time. NCBI values have been trending downward since 1983, and indication of improving water quality over that time. EPT richness trended upward to a spike in the number of EPT collected in 2005. However, there was a marked drop in the number of EPT taxa collected between 2005 and 2010. Higher water flow in 2005 over other sampling events may be in part responsible for the spike in the number of EPT taxa collected in 2005.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
BEASON CR	**SR 2246**	**AB1**	**06/28/10**	**Good-Fair**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
CLEVELAND	5	03050105	35.229167	-81.447778	9-53-8	Southern Outer Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
C	10	680	5	0.1

	Forested/Wetland	Urban	Agriculture	Road	Other (describe)
Visible Landuse (%)	25	25	50	0	0

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

Water Quality Parameters

Temperature (°C)	27.4
Dissolved Oxygen (mg/L)	6.9
Specific Conductance (µS/cm)	83
pH (s.u.)	---

Water Clarity	clear

Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	13
Bottom Substrate (15)	8
Pool Variety (10)	6
Riffle Habitat (16)	16
Bank Erosion (7)	2
Bank Vegetation (7)	6
Light Penetration (10)	4
Left Riparian Score (5)	1
Right Riparian Score (5)	4
Total Habitat Score (100)	64

Site Photograph

Substrate mix of gravel, sand, and cobble, with some silt

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
06/28/10	10959	---	18	---	4.85	Good-Fair
07/12/05	9685	---	23	---	4.34	Good
07/18/00	8191	---	15	---	5.17	Good-Fair
07/12/95	6863	59	18	5.43	5.09	Good-Fair
06/10/87	4093	69	17	6.01	5.10	Good-Fair

Data Analysis

The site is nine kilometers west of downtown Kings Mountain and about five stream-kilometers from the confluence with Buffalo Creek. Land cover is mix of forest and agriculture in the lower portion of the small catchment above the site, and development associated with Kings Mountain in the upper portion.

The BAU have data from five sampling events beginning in 1987. Full Scale methods were used in 1987 and 1995, and EPT methods in 2000, 2005, and 2010. Stream flows were higher in the Broad River basin during late June and July in 2005 than for either 2000 or 2010, which is likely responsible, in part, for the peak in EPT Richness and the lower EPT BI value for that year (though this pattern does not hold for all streams in the basin; it is not clear why some communities responded in this manner to higher flows while others did not). Discounting 2005, it appears that water quality is stable or possibly improving slightly since 1987.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
KINGS CR	**SR 2286**	**AB31**	**06/28/10**	**Good-Fair**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
CLEVELAND	5	03050105	35.167778	-81.385556	9-54	Kings Mountain

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
C	12	720	5	0.1

	Forested/Wetland	Urban	Agriculture	Road	Other (describe)
Visible Landuse (%)	50	25	25	0	0

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

Water Quality Parameters

Temperature (°C)	25.1
Dissolved Oxygen (mg/L)	7.4
Specific Conductance (µS/cm)	498
pH (s.u.)	---

Water Clarity	clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	16
Bottom Substrate (15)	11
Pool Variety (10)	6
Riffle Habitat (16)	16
Bank Erosion (7)	5
Bank Vegetation (7)	5
Light Penetration (10)	10
Left Riparian Score (5)	4
Right Riparian Score (5)	4
Total Habitat Score (100)	82

Site Photograph

Substrate mostly silt and cobble, also sand and gravel

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
06/28/10	10957	---	20	---	5.42	Good-Fair
09/19/05	9763	---	22	---	5.17	Good
07/21/00	8201	73	25	5.55	4.54	Good
07/13/95	6866	57	19	6.18	5.55	Good-Fair

Data Analysis

The site is located nine kilometers SSW of downtown Kings Mountain, in the far southeastern part of the North Carolina portion of the Broad River basin, and about one-half kilometer upstream of the South Carolina state line. The small catchment above the site is mostly forest, with some agriculture and development associated with Kings Mountain. Interstate 85 passes through the upper portion of the catchment. A beaver dam was present upstream of the reach when it was sampled in 2010.

With a measurement of 498 µS/cm, this site on Kings Creek had the highest specific conductance of all sites measured in the Broad Basin for 2010. The next highest measurement was 143 µS/cm on Buffalo Creek at NC 198. The 2010 measurement also exceeded measurements taken in 2005, 2000, and 1995 at the site (with values of 54, 482, and 225 µS/cm respectively).

The BAU have data from four sampling events from the site. Full Scale collection methods were used in 1995 and 2000, and EPT methods in 2005 and 2010. With two fewer EPT taxa collected in 2010 than 2005, the bioclassification slipped from Good to Good-Fair between the two years. Considering the amount of silt present and the very high specific conductance, a bioclassification of Good-Fair for the site is better than might be expected.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
N PACOLET R	**SR 1179**	**AB39**	**07/01/10**	**Excellent**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
POLK	6	03050105	35.224167	-82.270556	9-55-1-(1)	Southern Crystalline Ridges and Mountains

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
C;Tr	37	980	12	0.3

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

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)	11.3
Specific Conductance (µS/cm)	40
pH (s.u.)	6.0

Water Clarity	slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	19
Bottom Substrate (15)	12
Pool Variety (10)	6
Riffle Habitat (16)	15
Bank Erosion (7)	7
Bank Vegetation (7)	4
Light Penetration (10)	2
Left Riparian Score (5)	1
Right Riparian Score (5)	1
Total Habitat Score (100)	71

Site Photograph

Substrate mostly boulder and cobble, some gravel and sand

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
07/01/10	11006	100	47	3.18	2.59	Excellent
07/14/05	9693	108	52	3.22	2.61	Excellent
07/11/00	8148	83	37	4.01	3.18	Good
07/11/95	6840	68	31	4.12	3.36	Good

Data Analysis

The site is about three kilometers northwest of midtown Tryon. The catchment is mostly forest, with some development (a portion of Saluda and along US 176) and small pockets of agriculture.

The BAU have data for four benthic sampling events beginning in 1995. All collections were made using Full Scale methods. Slightly fewer EPT taxa were collected in 2010 than during the prior sampling effort in 2005; the NCBI value was similar for both efforts. Values for both metrics were better in 2005 and 2010 than they were for the prior sampling efforts in 1995 and 2000, suggesting a long-term trend in improving biological conditions over 15 years.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
N PACOLET R	**SR 1501**	**AB40**	**06/30/10**	**Good**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
POLK	6	03050105	35.205000	-82.158889	9-55-1-(10)	Southern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
C	49	850	12	0.6

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

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
Grover Industries Inc., Tryon Plant WWTP	NC0004391	0.45
Town of Tryon WWTP	NC0021601	1.5

Water Quality Parameters

Temperature (°C)	23.7
Dissolved Oxygen (mg/L)	7.8
Specific Conductance (µS/cm)	59
pH (s.u.)	6.7

Water Clarity	slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	12
Bottom Substrate (15)	5
Pool Variety (10)	6
Riffle Habitat (16)	4
Bank Erosion (7)	4
Bank Vegetation (7)	5
Light Penetration (10)	7
Left Riparian Score (5)	3
Right Riparian Score (5)	2
Total Habitat Score (100)	53

Site Photograph

Substrate mostly sand, some gravel, silt, and cobble

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
06/30/10	11004	82	31	4.64	3.96	Good
09/21/05	9702	93	35	5.40	4.01	Good
07/11/00	8147	97	33	5.51	4.38	Good-Fair
07/11/95	6838	51	18	5.15	4.84	Fair

Data Analysis

The site is seven kilometers east of Tryon, and about two stream-kilometers upstream of the South Carolina border. The catchment is primarily forest, with some development (Tryon and portions of Saluda and Columbus), pasture, and cropland.

The BAU have benthic data from four sampling events beginning in 1995. Full Scale collection methods were used each time. Almost certainly, water quality improved from 1995 to 2000 as evidenced by the large increase in EPT Richness. However, since 2000 no trend is apparent. Fewer EPT taxa were collected in 2010 than during the two prior sampling efforts, but the NCBI value for 2010 was significantly lower than for 2000 and 2005.

Broad Basin Fish Community Assessment Template Reports

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
MOUNTAIN CR	**SR 1178**	**06/09/10**	**AF25**	**Good**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
RUTHERFORD	2	03050105	35.3625	-82.01694444	9-25-(3.5)	Southern Inner Piedmont

Stream Classification	Drainage Area (mi^2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
WS-IV	28.7	790	8	0.4	No

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	50	0	0	50 (sand dipping op. & shooting range)

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)	10.0
Specific Conductance (µS/cm)	54
pH (s.u.)	6.2

Water Clarity	Turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	12
Bottom Substrate (15)	4
Pool Variety (10)	6
Riffle Habitat (16)	2
Erosion (7)	5
Bank Vegetation (7)	6
Light Penetration (10)	10
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	**60**

Site Photograph

Substrate Sand, gravel

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
06/09/10	2010-39	19	52	Good
06/21/05	2005-75	16	44	Good-Fair

Most Abundant Species, 2010 Bluehead Chub (37%)

Exotic Species None

Species Change Since Last Cycle

Gains -- Greenfin Shiner, Santee Chub, Spottail Shiner, Sandbar Shiner, Piedmont Darter. **Losses --** Green Sunfish, Largemouth Bass. All species gained or lost were represented by 1-3 fish/species.

Data Analysis

Watershed -- drains west central Rutherford County; no NPDES permitted dischargers or municipalities in the watershed; tributary to the Broad River. **Habitats** -- same as in 2005; no rocks, entrenched with eroding left bank; riffles composed of snags and sticks in the current. **Water Quality** -- typical for a Piedmont stream, specific conductance was 48 and 54 µS/cm in 2005 and 2010. **2010** -- more than twice as many fish collected in 2010 than in 2005, a more balanced trophic structure, and with more species with more age classes present; all indicative of an improvement in biological integrity and water quality. **2005 & 2010** -- 21 species known from the site, including 5 intolerant species, 4 species of darters, and 3 species of suckers; dominant species is the Bluehead Chub. **Recommendation** -- continue basinwide monitoring of this site in 2015 to determine if improvement in the biological integrity of the fish community and water quality of the stream are permanent or temporary.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
CLEGHORN CR	**SR 1149**	**06/09/10**	**AF18**	**Good**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
RUTHERFORD	2	03050105	35.3125	-81.98194444	9-26b	Southern Inner Piedmont

Stream Classification	Drainage Area (mi^2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	13.6	750	10	0.4	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)
Rutherfordton WWTP	NC0025909	3

Water Quality Parameters

Temperature (°C)	20.0
Dissolved Oxygen (mg/L)	9.2
Specific Conductance (µS/cm)	58
pH (s.u.)	6.2

Water Clarity	Turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	11
Bottom Substrate (15)	3
Pool Variety (10)	6
Riffle Habitat (16)	3
Erosion (7)	2
Bank Vegetation (7)	7
Light Penetration (10)	10
Left Riparian Score (5)	4
Right Riparian Score (5)	5
Total Habitat Score (100)	**56**

Site Photograph

Substrate Cobble, gravel, sand

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
06/09/10	2010-40	19	52	Good
06/08/05	2005-67	15	44	Good-Fair

Most Abundant Species, 2010 Bluehead Chub (27%), Greenfin Shiner (24%)

Exotic Species Green Sunfish (n=7)

Species Change Since Last Cycle

Gains -- Spottail Shiner, Northern Hog Sucker, Notchlip Redhorse, Brassy Jumprock, Bluegill, Tessellated Darter, Piedmont Darter. **Losses** -- Highback Chub, White Sucker, Margined Madtom. All species gained or lost were represented by 1-3 fish/species, except for Bluegill (n=6).

Data Analysis

Watershed -- drains the southwestern portion of Rutherford County including the towns of Rutherfordton and Spindale; one NPDES permitted discharger in the watershed; tributary to the Broad River; Ecosystem Enhancement Program stream restoration project is in progress between the site and the confluence with the river (A. Leslie, EEP, pers. com. 12/ 2010). **Habitats** -- roots, snags, riffles comprised of sticks in the current, an entrenched channel filled with sediment. **Water Quality** -- specific conductance typical for a Piedmont stream, ranging from 58 to 73 µS/cm. **2010** -- only site where 4 species of darter and 4 species of suckers were collected and a more balanced trophic structure than in 2005, all indicative of an improvements in biological integrity of the fish community and water quality of the stream, perhaps due to the more efficient operation of the upstream WWTP especially as related to the total residual chlorine in its discharge; facility underwent some upgrades to the aeration basin since 2005 and flow has decreased due to collection system repairs (D. Price, DWQ-ARO, pers. com 01/21/2011). **2005 & 2010** -- 22 species known from the site, including 5 species of suckers and 4 species each of darters and intolerant species; dominant species is the Bluehead Chub. R**ecommendation** -- continue basinwide monitoring of this site in 2015 to determine if improvements in the fish community and water quality of the stream are permanent or were just temporary.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
HUNGRY R	**off SR 1799**	**06/07/10**	**AF43**	**Good**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
HENDERSON	3	03050105	35.317159	-82.3479287	9-29-30	Southern Crystaline Ridges & Mtns.

Stream Classification	Drainage Area (mi^2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C;Tr	17.6	1400	10	0.5	No

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	85	0	0	15 (road)

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

Water Quality Parameters

Temperature (°C)	17.9
Dissolved Oxygen (mg/L)	8.3
Specific Conductance (µS/cm)	47
pH (s.u.)	6.6

Water Clarity	Clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	18
Bottom Substrate (15)	13
Pool Variety (10)	8
Riffle Habitat (16)	16
Erosion (7)	6
Bank Vegetation (7)	6
Light Penetration (10)	7
Left Riparian Score (5)	5
Right Riparian Score (5)	4
Total Habitat Score (100)	**88**

Site Photograph

Substrate Cobble, boulder, bedrock, gravel, sand

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
06/07/10	2010-31	12	48	Good

Most Abundant Species Mottled Sculpin (41%, 202/498)

Exotic Species Saffron Shiner (n=86), Rainbow Trout (n=1), Brown Trout (n=1), Mottled Sculpin (n=202)

Species Change Since Last Cycle **N/A**

Data Analysis

This is the first fish community sample collected at this site. **Watershed** -- drains southeastern Henderson County; no NPDES dischargers or municipalities in the watershed; impounded ~ 1.7 miles downstream by Big Hungry River Dam; tributary to the Green River; site extends 600 ft. downstream from the mouth of Tumblebug Creek. **Water Quality** -- specific conductance slightly elevated for a Mountain stream. **Habitats** -- long riffles and runs, pool at the confluence of the creek and the river. **2010** -- total species diversity, diversity of darters, and diversity of intolerant species was lower than expected compared to what is observed at regional reference sites; only one intolerant species collected and no species of darters; exotic species constituted more than one-half (290/498) of all the fish collected and one-third of the total species diversity, most number of exotic fish of any site in 2010; all trout collected were wild; a low diversity fauna whose fishery is managed as Hatchery Supported Trout Waters by the NC Wildlife Resources Commission. **Recommendation** -- continue monitoring this new basinwide site in 2015 to document future landuse changes in the watershed.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
COVE CR	off SR 1151	06/07/10	AF44	Good

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
POLK	3	03050105	35.2853735	-82.2922658	9-29-34	Southern Crystaline Ridges & Mtns.

Stream Classification	Drainage Area (mi^2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C;Tr	8.4	1000	7	0.4	Yes

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	90	0	10	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)	8.5
Specific Conductance (µS/cm)	46
pH (s.u.)	6.4

Water Clarity	Slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	16
Bottom Substrate (15)	10
Pool Variety (10)	8
Riffle Habitat (16)	16
Erosion (7)	6
Bank Vegetation (7)	6
Light Penetration (10)	9
Left Riparian Score (5)	5
Right Riparian Score (5)	4
Total Habitat Score (100)	**85**

Site Photograph

Substrate Cobble, gravel, bedrock, boulders, sand

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
06/07/10	2010-32	20	52	Good

Most Abundant Species Central Stoneroller (16%) and Piedmont Shiner (15%)

Exotic Species Mirror Shiner (n=19), Mottled Sculpin (n=19)

Species Change Since Last Cycle **N/A**

Data Analysis

This is the first fish community sample collected at this site. **Watershed** -- drains southwestern Polk County; headwaters are in the Town of Saluda; watershed bisected by the I-26 corridor; no NPDES permitted dischargers in the watershed; tributary to the Green River, site is ~ 50 ft. upstream of the creek's confluence with the river; part of the Green River Gamelands. **Water Quality** -- specific conductance slightly elevated for a Mountain stream. **Habitats** -- high quality instream and riparian habitats; long and short riffles, runs, roots, silty pools; qualified as a new fish community regional reference site. **2010** -- 4 species of darters present, but only 1 species of sunfish (Redbreast Sunfish), bass, trout collected and no piscivores; otherwise, site would have rated Excellent and would have qualified as High Quality Waters; fishery is managed as Wild Trout Waters by the NC Wildlife Resources Commission; one 225 mm TL stocked Brook Trout collected. **Recommendation** -- site is not suitable as a long-term basinwide site because access to the site is dependent upon flows in the Green River which must be forded to reach the site.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
BRIGHTS CR	**SR 1155**	**06/08/10**	**AF31**	**Good-Fair**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
POLK	3	03050105	35.32833333	-82.25583333	9-29-38-1	Southern Inner Piedmont

Stream Classification	Drainage Area (mi^2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C;Tr	5.9	960	8	0.4	No

	Forested/Wetland	Rural Residential	Agriculture	Other (describe)
Visible Landuse (%)	90	10	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)	9.1
Specific Conductance (µS/cm)	37
pH (s.u.)	6.2

Water Clarity	Clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	17
Bottom Substrate (15)	12
Pool Variety (10)	9
Riffle Habitat (16)	15
Erosion (7)	6
Bank Vegetation (7)	7
Light Penetration (10)	9
Left Riparian Score (5)	3
Right Riparian Score (5)	5
Total Habitat Score (100)	**88**

Site Photograph

Substrate Cobble, boulder, bedrock shelves

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
06/08/10	2010-33	14	46	Good-Fair
06/23/05	2005-82	15	50	Good

Most Abundant Species, 2010 Bluehead Chub (44%)

Exotic Species None

Species Change Since Last Cycle

Gains -- Spottail Shiner, Largemouth Bass. **Lost** -- Fieryblack Shiner, Brown Trout, Tessellated Darter. All species gained or lost were represented by 1 fish/species, except Fieryblack Shiner (n=64).

Data Analysis

Watershed -- drains northwest Polk County, including the 4,500 acre Bright's Creek Golf Club residential development which is permitted to spray its treated wastewater effluent on the golf course; borders the Southern Crystalline Mountains and Ridges ecoregion; tributary to the Green River/Lake Adger. **Habitats** -- same as in 2005, but with less silt atop the rocks; boulder riffles, runs, plunge pools, bedrock shelves, overgrown pasture on the left, forested bluff on the right. **Water Quality** -- typical for a Mountain stream, specific conductance was 33 and 37 µS/cm in 2005 and 2010. **2010** -- intolerant Fieryblack Shiner and trout absent; 1 of 3 sites where only 1 intolerant species (Seagreen Darter) was collected; the greatest percentage of omnivores+herbivores (66%, Central Stoneroller and Bluehead Chub) of any site ever in the basin with a less balanced trophic structure than in 2005, all indicative of increased nonpoint nutrient enrichment and a overall decline in biological integrity of the fish community and water quality of the stream. **2005 & 2010** -- 17 species known from the site, including 2 species each of suckers, darters, and intolerant species; dominant species is the Bluehead Chub. **Recommendation** -- continue basinwide monitoring of this site in 2015 to document impacts from sediment runoff as the development is built out and from the land application of the treated effluent. Because a reproducing population of trout was not documented in 2010 or 2005, this site should also be reassessed to determine if the Trout waters supplemental classification is still warranted or if more strict mitigation and restoration measures are needed.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
BRITTEN CR	**NC 9**	**06/08/10**	**AF30**	**Excellent**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
POLK	2	03050105	35.34166667	-82.18194444	9-29-43	Southern Inner Piedmont

Stream Classification	Drainage Area (mi^2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	6.8	840	9	0.4	Yes

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	75	0	25	0

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

Water Quality Parameters

Temperature (°C)	19.4
Dissolved Oxygen (mg/L)	8.5
Specific Conductance (µS/cm)	37
pH (s.u.)	6.1

Water Clarity	Clear, easily silted

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	19
Bottom Substrate (15)	13
Pool Variety (10)	10
Riffle Habitat (16)	16
Erosion (7)	7
Bank Vegetation (7)	7
Light Penetration (10)	9
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	**96**

Site Photograph

Substrate Cobble, boulder, bedrock

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
06/08/10	2010-34	21	54	Excellent
06/23/05	2005-81	15	54	Excellent

Most Abundant Species, 2010 Fieryblack Shiner (22%)

Exotic Species None; no species known from the site.

Species Change Since Last Cycle

Gains -- Rosyside Dace, Greenfin Shiner, Whitefin Shiner, Santee Chub, V-lip Redhorse, Snail Bullhead, Warmouth. **Lost** --Golden Shiner. All species gained or lost were represented by 1-3 fish/species, except for Greenfin Shiner (n=5).

Data Analysis

Watershed -- drains northwestern Polk County; one NPDES permitted discharger in the watershed (Pavilion International, NC0085294, Qw = 0.0059 MGD, located ~ 4 miles upstream); tributary to the Green River, site is ~ 400 yards upstream of the creek's confluence with the river. **Habitats** -- consistently very high quality instream and riparian habitats; plunge pools, chutes, riffles, soft bottom pool at the beginning of the reach. **Water Quality** -- specific conductance low for a Piedmont stream (35 and 37 µS/cm). **2010** -- diverse community with Excellent biological integrity and water quality; greatest species diversity of any fish community site in the basin. **2005 & 2010** -- 22 species known from the site, including 4 intolerant species and 3 species each of suckers and darters; dominant species is the intolerant Fieryblack Shiner. **Recommendation** -- if petitioned, Britten Creek should be reclassified to Class C, High Quality Waters based upon its Excellent fish community ratings, its intact and indigenous fish community, its high quality instream and riparian habitats, and its status as a fish community regional reference site; continue monitoring this site in 2015.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
WALNUT CR	**SR 1315**	**06/09/10**	**AF29**	**Good**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
POLK	2	03050105	35.35388889	-82.10333333	9-29-44	Southern Inner Piedmont

Stream Classification	Drainage Area (mi^2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	16.9	790	8	0.4	No

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

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

Water Quality Parameters

Temperature (°C)	18.3
Dissolved Oxygen (mg/L)	10.5
Specific Conductance (µS/cm)	35
pH (s.u.)	6.0

Water Clarity	Turbid, easily silted

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	14
Bottom Substrate (15)	6
Pool Variety (10)	4
Riffle Habitat (16)	6
Erosion (7)	7
Bank Vegetation (7)	6
Light Penetration (10)	8
Left Riparian Score (5)	5
Right Riparian Score (5)	3
Total Habitat Score (100)	**64**

Site Photograph

Substrate Cobble, gravel, sand

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
06/09/10	2010-38	19	50	Good
06/23/05	2005-80	23	54	Excellent
05/12/00	2000-32	22	56	Excellent

Most Abundant Species, 2010 Bluehead Chub (22%)

Exotic Species None

Species Change Since Last Cycle

Gains -- first collection for Greenfin Shiner; Santee Chub. **Lost** -- Thicklip Chub, Notchlip Redhorse, Brassy Jumprock, Green Sunfish, Bluegill, Carolina Fantail Darter. All species gained or lost were represented by 1-3 fish/species, except for Greenfin Shiner (n=7).

Data Analysis

Watershed -- drains the extreme northeast corner of Polk County; no municipalities or NPDES dischargers in the watershed; tributary to the Green River; site is ~ 1 mile above the creek's confluence with the river. **Habitats** -- same as in 2000 and 2005; diverse habitats with the lower one-third of the reach having a cobble and boulder substrate with riffles and a swift current; the upper two-thirds is shallower and slower moving with a sandy substrate. **Water Quality** -- consistently low specific conductance, ranging from 33-35 µS/cm. **2010** -- ~ 50% fewer fish collected in 2010 than in 2005; 1 of 2 sites where the percentage of tolerant fish (26%) was greater than at any other site in the basin; increase in percentage of tolerant fish and slight declines in the various diversity metrics and rating may be early signs of a decline in biological integrity and water quality. **2000-2010** -- the most diverse community in the basin with 26 species known from the site, including 6 intolerant species, 5 species of suckers, and 4 species of darters; dominant species is the Bluehead Chub. **Recommendation** -- continue basinwide monitoring in 2015 to determine if the declines in the biological integrity of the fish community and water quality of the stream were temporary or permanent.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
WHITEOAK CR	**SR 1526**	**06/08/10**	**AF32**	**Good**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
POLK	2	03050105	35.26888889	-82.13972222	9-29-46	Southern Inner Piedmont

Stream Classification	Drainage Area (mi^2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	11.3	880	7	0.4	No

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	40	0	35	25 (dirt bike track)

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)	9.1
Specific Conductance (µS/cm)	57
pH (s.u.)	6.5

Water Clarity	Clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	12
Bottom Substrate (15)	3
Pool Variety (10)	8
Riffle Habitat (16)	1
Erosion (7)	3
Bank Vegetation (7)	5
Light Penetration (10)	5
Left Riparian Score (5)	1
Right Riparian Score (5)	2
Total Habitat Score (100)	**45**

Site Photograph

Substrate Sand

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
06/08/10	2010-35	17	52	Good
06/23/05	2005-79	14	48	Good
05/12/00	2000-31	13	46	Good-Fair

Most Abundant Species, 2010 Bluehead Chub (34%)

Exotic Species None; no species known from the site.

Species Change Since Last Cycle

Gains -- first collection for Greenfin Shiner, Flat Bullhead, and Largemouth Bass. **Lost** -- *Lepomis* sp. hybrid. All species gained or lost were represented by 1-4 fish/species, except Greenfin Shiner (n=9).

Data Analysis

Watershed -- drains central Polk County, including the Town of Columbus; one NPDES permitted discharger in the watershed (Town of Columbus' WWTP, NC0021369, Q_w = 0.8 MGD, located ~ 3 miles upstream); tributary to the Green River. **Habitats** -- sandy runs, side snags, less canopy cover than in 2005, riffles comprised of a few sticks in the current; riparian zones, especially on the left, drastically altered by bulldozing activity. **Water Quality** -- despite upstream source inputs, specific conductance has been relatively stable at ~ 58 µS/cm; at the upstream WWTP some operational enhancements have been made and flow has decreased due to addressing several collection system issues (D. Price, DWQ-ARO, pers. com. 01/21/2011). **2010** -- recent riparian alterations, but community continued to rate Good, although the incidence of disease (popeye in Sandbar Shiner and Highback Chub) was high (1.3%). **2000-2010** -- 17 species known from the site, including 3 species of suckers and 2 species each of darters and intolerant species; dominant species is the Bluehead Chub; slight but steady increase in the biological integrity of the community since 2000. **Recommendation** -- encourage property owner to restore and re-vegetate riparian zones to reduce sediment inputs to the stream and for future protection of the stream and its fish community; continue basinwide monitoring of this site in 2015.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
FLOYDS CR	**SR 1116**	**06/10/10**	**AF19**	**Good**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
RUTHERFORD	2	03050105	35.21833333	-81.85	9-37	Southern Outer Piedmont

Stream Classification	Drainage Area (mi^2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	27	580	9	0.4	No

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

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)	7.8
Specific Conductance (µS/cm)	48
pH (s.u.)	6.0

Water Clarity	Slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	12
Bottom Substrate (15)	3
Pool Variety (10)	8
Riffle Habitat (16)	3
Erosion (7)	2
Bank Vegetation (7)	7
Light Penetration (10)	8
Left Riparian Score (5)	5
Right Riparian Score (5)	4
Total Habitat Score (100)	**57**

Site Photograph

Substrate Sand, gravel

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
06/10/10	2010-41	17	48	Good
06/08/05	2005-68	20	50	Good

Most Abundant Species, 2010 Greenfin Shiner (30%)

Exotic Species Green Sunfish (n=2)

Species Change Since Last Cycle

Gains -- White Sucker, Bluegill. **Lost** -- Rosyside Dace, Golden Shiner, Creek Chub, Carolina Fantail Darter, Piedmont Darter. All species gained or lost were represented by 1 fish/species, except for the intolerant Piedmont Darter (n=6).

Data Analysis

Watershed -- drains southern Rutherford County including the towns of Spindale and Forest City and the US 74 corridor; no NPDES dischargers in the watershed; tributary to the Broad River, site is ~ 1.8 miles above the confluence with the river. **Habitats** -- large bank blow-outs, especially on the right bank at the end of the reach; coarse woody debris snags creating chutes below the deadfalls, shallow runs. **Water Quality** -- specific conductance typical for a Piedmont stream, ranging from 44 to 48 µS/cm. **2010** -- incidence of disease was elevated, compared to that at a reference site, at 1.9% (popeye in Sandbar Shiner). **2005 & 2010** -- 22 species known from the site, including 4 species each of suckers, darters, and intolerant species; dominant species is the Greenfin Shiner and Bluehead Chub; no appreciable change in the biological integrity of the fish community or water quality of the stream. **Recommendation** -- continue basinwide monitoring of this site in 2015.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
SECOND BROAD R	**SR 1500**	**06/11/10**	**AF23**	**Good**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
RUTHERFORD	2	03050105	35.51759	-81.972016	9-41-(0.5)	Southern Inner Piedmont

Stream Classification	Drainage Area (mi^2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
WS-V	20	975	10	0.4	Yes

	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)	19.6
Dissolved Oxygen (mg/L)	8.7
Specific Conductance (µS/cm)	57
pH (s.u.)	6.4

Water Clarity	Clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	18
Bottom Substrate (15)	11
Pool Variety (10)	4
Riffle Habitat (16)	16
Erosion (7)	7
Bank Vegetation (7)	6
Light Penetration (10)	10
Left Riparian Score (5)	4
Right Riparian Score (5)	5
Total Habitat Score (100)	**86**

Site Photograph

Substrate Cobble, gravel, sand

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
06/11/10	2010-45	16	52	Good
06/21/05	2005-73	18	52	Good
05/11/00	2000-29	18	54	Excellent

Most Abundant Species, 2010 Bluehead Chub (42%)

Exotic Species Smallmouth Bass (n=1)

Species Change Since Last Cycle

Gains -- Smallmouth Bass. **Lost** -- Notchlip Redhorse, Green Sunfish, Redear Sunfish. All species gained or lost were represented by 1 fish/species.

Data Analysis

Watershed -- drains southern McDowell, including the US 221 corridor and a smaller portion of northern Rutherford counties; no NPDES permitted dischargers or municipalities in the watershed. **Habitats** -- consistently high quality instream and riparian habitats; no change since 2000; cobble riffles, silty-sandy pools, boulder pools near the upper end of the sampling reach. **Water Quality** -- specific conductance typical for a Piedmont stream, stable, and ranging from 51 to 57 µS/cm; since 1999 there have been only four exceedances of the turbidity standard at the ambient monitoring site at Logan. **2010** -- slight change in the trophic metrics (percentages of omnivores+herbivores and insectivores), indicating a possible slight increase in nonpoint nutrient enrichment. **2000-2010** -- 20 species are known from the site including 4 intolerant species, 3 species of suckers, and the Carolina Fantail Darter which is the only species of darter that has ever been collected at this site; other darter species (e.g., Seagreen Darter, Tessellated Darter, and Piedmont Darter) along with the Northern Hog Sucker are not known from this part of the watershed, so the low darter diversity may be natural; dominant species are the Bluehead Chub and Carolina Fantail Darter. Although the number of fish collected has declined two-fold over the 10 year period, there have been no substantial changes in the metrics; water quality of the stream and biological integrity of the fish community remains a very high Good. **Recommendation** -- continue basinwide monitoring of this regional reference site in 2015.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
BIG CAMP CR	**SR 1504**	**06/11/10**	**AF24**	**Good-Fair**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
RUTHERFORD	2	03050105	35.46666667	-81.90555556	9-41-11-(2.5)	Southern Inner Piedmont

Stream Classification	Drainage Area (mi^2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	12.2	895	6	0.3	No

	Forested/Wetland	Rural Residential	Agriculture	Other (describe)
Visible Landuse (%)	50	25	25	0

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

Water Quality Parameters

Temperature (°C)	19.5
Dissolved Oxygen (mg/L)	8.9
Specific Conductance (µS/cm)	46
pH (s.u.)	6.2

Water Clarity	Clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	14
Bottom Substrate (15)	4
Pool Variety (10)	4
Riffle Habitat (16)	10
Erosion (7)	3
Bank Vegetation (7)	7
Light Penetration (10)	10
Left Riparian Score (5)	5
Right Riparian Score (5)	3
Total Habitat Score (100)	**65**

Site Photograph

Substrate Sand, gravel

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
06/11/10	2010-46	10	42	Good-Fair
06/21/05	2005-74	10	46	Good-Fair

Most Abundant Species, 2010 Piedmont Shiner (47%)

Exotic Species None; no species known from the site.

Species Change Since Last Cycle **Gains** -- Santee Chub (n=2). **Lost** -- White Sucker (n=3).

Data Analysis

Watershed -- drains rural northern Rutherford County; no NPDES dischargers or municipalities in the watershed; tributary to the Second Broad River; site is straddles the Southern Inner Piedmont and the Eastern Blue Ridge Foothills. **Water Quality** -- typical for a Piedmont stream, specific conductance was 43 and 46 µS/cm in 2005 and 2010; the water became very turbid when walking in the channel. **Habitats** -- same as in 2005; gravel riffles, undercuts, roots, shallow pools, eroded banks. **2010** -- fewest species collected from any site, but also the lowest percentage of tolerant fish (1%); the number of fish collected in 2010 was almost the same as in 2005 (453 vs. 441, respectively). **2005 & 2010** -- only 11 species known from this site, including 2 species each of suckers and intolerant species and 1 species of darter; dominant species is the Piedmont Shiner; no substantial change in the biological integrity of the fish community or water quality of this headwater stream. **Recommendation** -- although the watershed is rural, the source of the excessive turbidity should be investigated; continue basinwide monitoring of this site in 2015.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
CANE CR	**SR 1558**	**06/10/10**	**AF35**	**Fair**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
RUTHERFORD	2	03050105	35.43583333	-81.88472222	9-41-12-(5.5)	Southern Inner Piedmont

Stream Classification	Drainage Area (mi^2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
WS-IV	24.6	870	7	0.4	No

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

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

Water Quality Parameters (2010)

Temperature (°C)	21.2
Dissolved Oxygen (mg/L)	8.0
Specific Conductance (µS/cm)	62
pH (s.u.)	6.1

Water Clarity	Slightly turbid

Habitat Assessment Scores (max) (2010)

Channel Modification (5)	5
Instream Habitat (20)	11
Bottom Substrate (15)	3
Pool Variety (10)	9
Riffle Habitat (16)	3
Erosion (7)	2
Bank Vegetation (7)	7
Light Penetration (10)	10
Left Riparian Score (5)	4
Right Riparian Score (5)	4
Total Habitat Score (100)	**58**

Site Photograph

Substrate Sand

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
07/06/11	2011-59	12	44	Good-Fair
06/10/10	2010-43	14	40	Fair
05/10/00	2000-28	13	44	Good-Fair

Most Abundant Species, 2010 Bluehead Chub (44%)

Exotic Species None; no species known from the site.

Species Change Since Last Cycle (2010 vs. 2010)

Gains -- Greenfin Shiner, Fieryblack Shiner, Eastern Mosquitofish. **Lost** -- Highback Chub, Flat Bullhead. All species gained or lost were represented by 1-4 fish/species.

Data Analysis

Watershed -- drains northern Rutherford and southeastern McDowell counties, paralleling and east of the US 64 corridor; no NPDES dischargers or municipalities in the watershed; tributary to the Second Broad River. **Habitats** -- entrenched with eroding banks and blow-outs; pasture on the lower right quadrant, other quadrants with fallow fields. **Water Quality** -- specific conductance typical for a Piedmont stream, was 61 µS/cm in 2000 and 62 µS/cm in 2010. **2010** -- total species diversity lower than expected as compared to a reference site; abundance of omnivores+herbivores indicating some nonpoint nutrient enrichment; lowest percentage of species with multiple age groups of any site (29%), indicative of loss of age classes perhaps due to high-water events during winter 2010 or lingering effects from the 2007-2009 drought; 9 of 14 species were represented by only 1 or 2 fish/species. **2000 & 2010** -- 16 species known from the site, including 3 intolerant species, 2 species of suckers, and 1 species of darter; dominant species are Bluehead Chub and Piedmont Shiner; site was not sampled in 2005 because of excessive turbidity on two occasions. **Recommendation** -- site should be re-sampled in 2011 to verify if slight rating decline is the beginning of a downward trend and site should continue as a basinwide monitoring site in 2015. **Note**: this site was resampled in 2011 and was rated Good-Fair; Bluehead Chub and Piedmont Shiner were the dominant species; community had recovered from previous flow-related impacts as evident by the presence of more species with multiple ages and size classes.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
CATHEYS CR	US 221	06/10/10	AF1	Good-Fair

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
RUTHERFORD	2	03050105	35.45888889	-81.97888889	9-41-13-(0.5)	Southern Inner Piedmont

Stream Classification	Drainage Area (mi^2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
WS-V	13.3	930	8	0.4	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)	22.6
Dissolved Oxygen (mg/L)	7.9
Specific Conductance (µS/cm)	57
pH (s.u.)	6.4

Water Clarity	Very slightly turbid

Habitat Assessment Scores (max)

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

Site Photograph

Substrate Gravel

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
06/10/10	2010-42	12	46	Good-Fair
03/23/04	2004-07	13	52	Good

Most Abundant Species, 2010 Piedmont Shiner (30%)

Exotic Species None; no species known from the site.

Species Change Since Last Cycle

Gains -- Sandbar Shiner, Creek Chub. **Lost** -- Rosyside Dace, White Sucker, Bluegill. All species gained or lost were represented by 1 or 2 fish/species, except for Rosyside Dace (n=14) and Creek Chub (n=6).

Data Analysis

Watershed -- drains northern Rutherford County, west of the US 221 corridor; no NPDES permitted dischargers or municipalities in the watershed; tributary to the Second Broad River. **Habitats** -- good riparian zones with bluff on the left bank, sediment problems (became very turbid when walking in the channel), snags, gravel riffles, deadfalls. **Water Quality** -- typical for a Piedmont stream, was 52 and 57 µS/cm in 2004 and 2010. **2010** -- high flows in winter 2010 may have contributed to a 2.2-fold decrease in the number of fish collected in 2010 contrasted to 2005 (265 vs. 589, respectively) and some diversity metrics were lower than expected compared to a reference site. **2004 & 2010** -- 15 species known from the site, including 3 intolerant species, 2 species of suckers, and 1 species of darter; dominant species is the Piedmont Shiner; Fantail Darter is the only species of darter that has been collected at this site, other darter species (i.e., Seagreen Darter, Tessellated Darter, and Piedmont Darter) along with the Northern Hog Sucker are not known from this part of the watershed, so the low darter diversity may be natural. **Recommendation** -- continue basinwide monitoring of this site in 2015 to determine if the decline in the biological integrity of the fish community and water quality of the stream are permanent or just temporary.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
ROBERSON CR	**SR 1561**	**06/10/10**	**AF20**	**Good-Fair**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
RUTHERFORD	2	03050105	35.36861111	-81.84777778	9-41-14	Southern Outer Piedmont

Stream Classification	Drainage Area (mi^2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
WS-V	26	810	10	0.4	No

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	80	0	10	10 (sand dipping operation)

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

Water Quality Parameters

Temperature (°C)	22.1
Dissolved Oxygen (mg/L)	8.3
Specific Conductance (µS/cm)	47
pH (s.u.)	6.1

Water Clarity	Slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	16
Bottom Substrate (15)	4
Pool Variety (10)	4
Riffle Habitat (16)	10
Erosion (7)	2
Bank Vegetation (7)	7
Light Penetration (10)	9
Left Riparian Score (5)	2
Right Riparian Score (5)	5
Total Habitat Score (100)	**64**

Site Photograph

Substrate Gravel, sand

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
06/10/10	2010-44	14	42	Good-Fair
06/09/05	2005-69	17	50	Good
05/10/00	2000-26	20	52	Good

Most Abundant Species Piedmont Shiner (40%)

Exotic Species Green Sunfish (n=2)

Species Change Since Last Cycle

Gains -- Flat Bullhead. **Lost** -- White Sucker, Striped Jumprock, Bluegill, Largemouth Bass. All species gained or lost were represented by 1 or 2 fish/species.

Data Analysis

Watershed -- drains east central Rutherford County; no NPDES permitted dischargers or municipalities in the watershed; tributary to the Second Broad River. **Habitats** -- sand auguring/dipping operation on the left downstream bank and in the channel; runs, sides snags, root mats, sand and gravel riffles and runs. **Water Quality** -- specific conductance typical for a Piedmont stream, stable, and ranging from 42-47 µS/cm. **2010** -- total species diversity and other diversity metrics were all lower than expected; 1 of only 2 sites where suckers were absent. **2000-2010** -- 21 species are known from the site including 3 species each of sucker and intolerant species, but only 1 species of darter; dominant species are the Bluehead Chub (2000 and 2005) and Piedmont Shiner (2010); number of species continues to decline as does the biological integrity of the fish community. **Recommendation** -- because there are no municipalities or dischargers in the watershed, causes for the decline in the biological integrity of the fish community and water quality of the stream may be from nonpoint source runoff and localized habitat modifications; continue basinwide monitoring of this site in 2015.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
SANDY RUN CR	SR 1332	06/22/10	AF15	Good

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
CLEVELAND	4	03050105	35.33638889	-81.7	9-46-(1)	Southern Outer Piedmont

Stream Classification	Drainage Area (mi^2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	11.2	800	12	0.4	No

	Forested/Wetland	Rural Residential	Agriculture	Other (describe)
Visible Landuse (%)	5	5	90	0

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

Water Quality Parameters (2010)

Temperature (°C)	23.8
Dissolved Oxygen (mg/L)	6.8
Specific Conductance (µS/cm)	40
pH (s.u.)	5.8

Water Clarity	Turbid, became very turbid

Habitat Assessment Scores (max) (2010)

Channel Modification (5)	5
Instream Habitat (20)	12
Bottom Substrate (15)	2
Pool Variety (10)	4
Riffle Habitat (16)	2
Erosion (7)	3
Bank Vegetation (7)	6
Light Penetration (10)	8
Left Riparian Score (5)	3
Right Riparian Score (5)	5
Total Habitat Score (100)	**50**

Site Photograph

Substrate Sand, gravel, clay

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
07/07/11	2011-62 (above the bridge)	11	52	Good
07/07/11	2011-61 (below the bridge)	10	52	Good
06/22/10	2010-56 (below the bridge)	11	48	Good
06/07/05	2005-61 (above the bridge)	8	38	Fair
05/10/00	2000-25 (above the bridge)	15	48	Good

Most Abundant Species, 2010 Tessellated Darter (26%)

Exotic Species None; no species known from the site.

Species Change Since Last Cycle (2010 vs. 2005) **Gains** -- Sandbar Shiner (n=43), Bluegill (n=1), Seagreen Darter (n=6). **Lost** -- none.

Data Analysis

Watershed -- drains western Cleveland and eastern Rutherford counties; no NPDES dischargers or municipalities in the watershed; tributary to the Broad River. **Habitats** -- three cattle fences across the stream upstream of the bridge prevented access to the historical sampling reach; the 2010 reach was downstream of the bridge where there were poor riparian and riffle habitats, bedrock shelves, runs and snags, silty edges and sediment in the main channel; total habitat score in the reach above the bridge was 35 in 2005. **Water Quality** -- specific conductance typical for a Piedmont stream, relatively low, and stable ranging from 36-40 µS/cm despite nonpoint source runoff and sediment issues. **2010** -- only 1 of 2 sites where the percentage of tolerant fish was the greatest (26%); improvements noted in the diversity of darters and sunfish and in the trophic metrics. **2000-2010** -- 15 species known from the site, including 3 species each of darters and intolerant species and 2 species of suckers; dominant species are Bluehead Chub (2000 and 2005) and Tessellated Darter (2010); Carolina Fantail Darter and intolerant Fieryblack Shiner have not been collected since 2000. **Recommendation** -- the reach above the exclusion fencing should be reassessed in 2011 to verify if the rating documented downstream was due to habitat differences or overall improvement in the water quality of the entire stream; continue basinwide monitoring of this site in 2015. **Note**: a site above and below the bridge were sampled in 2011, both rated Good despite degraded riparian zones and livestock having access to the stream.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
BRIER CR	**SR 1733**	**06/24/10**	**AF22**	**Excellent**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
RUTHERFORD	4	03050105	35.52944444	-81.69944444	9-50-8	Northern Inner Piedmont

Stream Classification	Drainage Area (mi^2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C;Tr	8.9	1030	7	0.4	Yes

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	75	0	25	0

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)	8.1
Specific Conductance (µS/cm)	30
pH (s.u.)	5.7

Water Clarity	Clear, easily silted

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	18
Bottom Substrate (15)	12
Pool Variety (10)	10
Riffle Habitat (16)	16
Erosion (7)	6
Bank Vegetation (7)	7
Light Penetration (10)	10
Left Riparian Score (5)	3
Right Riparian Score (5)	5
Total Habitat Score (100)	**92**

Site Photograph

Substrate Cobble, boulder, gravel

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
06/24/10	2010-62	11	54	Excellent
06/20/05	2005-71	14	56	Excellent
09/28/98	98-74	15	56	Excellent

Most Abundant Species Bluehead Chub (34%) **Exotic Species** Smallmouth Bass (n=5)

Species Change Since Last Cycle **Gains** -- none. **Lost** -- Creek Chub (n=2), Rainbow Trout (n=3), Tessellated Darter (n=1).

Data Analysis

Watershed --drains northeastern Rutherford and northwestern Cleveland counties; no NPDES dischargers or municipalities in the watershed; headwaters are in the South Mountain/Rollins Tract NCWRC gamelands and managed as Wild Trout Waters; tributary to the First Broad River. **Habitats** -- consistently high quality instream and riparian habitats; road along the left bank with natural rip/rap on that bank at the bend in the creek; riffles, runs, and plunges, pool at the end of the reach. **Water Quality** -- lowest specific conductance of any fish community basin site in 2010, has ranged from 29-31 µS/cm since 1998. **1998-2010** -- 15 species known from the site, including 6 intolerant species, 3 species of darters, but just 1 species of sucker (White Sucker represented only by young-of-year in 2010); dominant species are Piedmont Shiner (1998) and Bluehead Chub (2005 and 2010). Although the site has consistently rated Excellent, the total number of fish, total species, and number and percent abundance of Piedmont Shiner and Margined Madtom have been steadily declining, while the percent abundance of the Bluehead Chub has been increasing, and the intolerant Santee Chub has not been collected since 1998; all indicating a slight decline in the biological integrity of the fish community and water quality of the stream. **Recommendation** -- to prevent further decline in the fish community, if petitioned, Brier Creek should be promptly reclassified to Class C, Tr, High Quality Waters or Outstanding Resource Waters based upon the consistent Excellent fish community ratings, the high quality instream and riparian habitats, and because it is a fish community regional reference site.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
BRIER CR	**SR 1736**	**06/24/10**	**AF45**	**Excellent**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
RUTHERFORD	4	03050105	35.5162042	-81.701783	9-50-8	Northern Inner Piedmont

Stream Classification	Drainage Area (mi^2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C;Tr	13.6	980	8	0.4	Yes

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

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)	7.9
Specific Conductance (µS/cm)	32
pH (s.u.)	5.9

Water Clarity	Clear, easily silted

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	18
Bottom Substrate (15)	10
Pool Variety (10)	8
Riffle Habitat (16)	10
Erosion (7)	7
Bank Vegetation (7)	7
Light Penetration (10)	9
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	**84**

Site Photograph

Substrate Bedrock, cobble, sand, silt

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
06/24/10	2010-61	13	54	Excellent

Most Abundant Species Fieryblack Shiner (22%)

Exotic Species Smallmouth Bass (n=4)

Species Change Since Last Cycle **N/A**

Data Analysis

This is the first fish community sample collected at this site; it was assessed to support reclassification of the entire Brier Creek watershed to C; Tr, High Quality Waters or Outstanding Resource Waters which it so qualifies. **Watershed** -- drains northeastern Rutherford and northwestern Cleveland counties; no NPDES dischargers or municipalities in the watershed; headwaters are in the South Mountain/Rollins Tract North Carolina Wildlife Resources Commission gamelands and fishery is managed as Wild Trout Waters; tributary to the First Broad River. **Water Quality** -- low specific conductance for a Piedmont stream. **Habitats** -- high quality instream and riparian habitats; *Rhododendron* bluff on the right; bedrock shelves and pools; qualified as a new fish community regional reference site. **2010** -- biological integrity of the fish community and water quality of the stream were Excellent.
Recommendation -- if petitioned, the entire Brier Creek watershed should be promptly reclassified to Class C, Tr, High Quality Waters or Outstanding Resource Waters based upon the Excellent fish community ratings (including those from the site at SR 1733), the high quality instream and riparian habitats, it is a fish community regional reference site, the presence of a Special Concern species of crayfish (Broad River Spiny Crayfish) and a Significantly Rare crayfish (Broad River Stream Crayfish) in the watershed; the trout fishery in the upper watershed is managed as Wild Trout waters, and a portion of the watershed is a Natural Heritage Program Significant Natural Heritage Area.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
WARDS CR	**SR 1525**	**06/23/10**	**AF12**	**Good**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
CLEVELAND	4	03050105	35.47694444	-81.65861111	9-50-12	Northern Inner Piedmont

Stream Classification	Drainage Area (mi^2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	17.5	860	7	0.4	Yes

	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)	22.6
Dissolved Oxygen (mg/L)	9.1
Specific Conductance (µS/cm)	44
pH (s.u.)	6.2
Water Clarity	Very slightly turbid, easily silted

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	16
Bottom Substrate (15)	8
Pool Variety (10)	6
Riffle Habitat (16)	7
Erosion (7)	7
Bank Vegetation (7)	7
Light Penetration (10)	9
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	**75**

Site Photograph

Substrate Sand, gravel, clay, bedrock, boulders

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
06/23/10	2010-59	14	52	Good
06/07/05	2005-64	17	52	Good
05/09/00	2000-23	16	52	Good

Most Abundant Species, 2010 Highback Chub (23%) and Bluehead Chub (21%)

Exotic Species None; no species known from the site.

Species Change Since Last Cycle **Gains** -- none. **Lost** -- Central Stoneroller (n=1), Greenfin Shiner (n=1), Notchlip Redhorse (n=3).

Data Analysis

Watershed -- drains the rural northwestern corner of Cleveland County; no NPDES permitted dischargers or municipalities in the watershed; tributary to the First Broad River. **Habitats** -- a few plunge riffles, very silty and sandy runs, good cobble riffles, undercuts, root mats, some bank erosion, but not as bad as at other sites in the basin. **Water Quality** -- although there are no municipalities within the watershed, the conductivity has gradually and slightly increased since 2000 from 24 to 39 to 44 µS/cm and reasons for the increase are unknown; water easily silted. **2010** -- greatest percentage of species with multiple age class/groups (86%) of any site. **2000-2010 --** 18 species known from the site, including 5 intolerant species, 3 species each of suckers and darters, but only 1 species of sunfish (Redbreast Sunfish), bass, and trout; dominant species are Bluehead Chub (2000 and 2005) and intolerant Highback Chub (2010); intolerant Santee Chub has not been collected since 2000. A regional reference site that has consistently rated Good; it would have consistently rated Excellent, but for the naturally low diversity of sunfish. **Recommendation** -- continue basinwide monitoring of this site in 2015.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
DUNCANS CR	**NC 226**	**06/23/10**	**AF16**	**Good**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
CLEVELAND	4	03050105	35.46305556	-81.6725	9-50-13	Northern Inner Piedmont

Stream Classification	Drainage Area (mi^2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	19.7	870	6	0.4	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)	20.6
Dissolved Oxygen (mg/L)	9.1
Specific Conductance (µS/cm)	35
pH (s.u.)	5.8

Water Clarity	Clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	14
Bottom Substrate (15)	2
Pool Variety (10)	6
Riffle Habitat (16)	5
Erosion (7)	1
Bank Vegetation (7)	6
Light Penetration (10)	7
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	**56**

Site Photograph

Substrate sand, gravel, clay bank on the left bank

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
06/23/10	2010-58	15	50	Good
06/08/05	2005-66	16	48	Good

Most Abundant Species, 2010 Bluehead Chub (28%)

Exotic Species None; no species known from the site.

Species Change Since Last Cycle **Gains** -- none. **Lost** -- Flat Bullhead (n=1).

Data Analysis

Watershed -- drains rural northeastern Rutherford and northwestern Cleveland counties; no NPDES permitted dischargers or municipalities in the watershed; tributary to the First Broad River. **Habitats** -- same as in 2005; both banks with severe erosion, deeply entrenched, snags and large deadfalls. **Water Quality** -- specific conductance low for a Piedmont stream, ranging from 33 to 35 µS/cm in 2005 and 2010. **2010** -- the number of fish collected in 2010 was ~1.5 times greater than in 2005 (226 *vs.* 150, respectively), in June 2005 there was evidence of flood debris and other high water impacts from the September 2004 hurricane-induced flooding which may have reduced the size of the fish population. **2005 & 2010** -- 16 species are known from the site, including 5 intolerant species, 3 species of darters, but only 1 species each of sucker (Striped Jumprock) and sunfish (Redbreast Sunfish), bass, and trout; dominant species is the Bluehead Chub; no change in the biological integrity of the fish community or water quality of the stream.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
HINTON CR	**NC 226**	**06/23/10**	**AF17**	**Good**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
CLEVELAND	4	03050105	35.43666667	-81.6525	9-50-15	Northern Inner Piedmont

Stream Classification	Drainage Area (mi^2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	18.7	850	5	0.4	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)	20.5
Dissolved Oxygen (mg/L)	8.5
Specific Conductance (µS/cm)	36
pH (s.u.)	5.6

Water Clarity	Clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	15
Bottom Substrate (15)	6
Pool Variety (10)	6
Riffle Habitat (16)	10
Erosion (7)	5
Bank Vegetation (7)	6
Light Penetration (10)	10
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	**73**

Site Photograph

Substrate Sand, gravel, cobble

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
06/23/10	2010-57	14	52	Good
06/08/05	2005-65	16	52	Good

Most Abundant Species, 2010 Bluehead Chub (25%)

Exotic Species Green Sunfish (n=4)

Species Change Since Last Cycle

Gains -- Green Sunfish. **Lost** -- Thicklip Chub, White Sucker, Flat Bullhead, *Lepomis* sp. hybrid. All species gained or lost were represented by 1 or 2 fish/species, except Green Sunfish (n=4).

Data Analysis

Watershed -- drains rural northeastern Rutherford and northwestern Cleveland counties; no NPDES permitted dischargers or municipalities in the watershed; tributary to the First Broad River. **Habitats** -- gravel and cobble riffles, sandy runs, deadfalls, side snags and undercuts. **Water Quality** -- low specific conductance for a Piedmont stream, ranging from 32 to 36 µS/cm. **2010** -- the number of fish collected in 2010 was ~1.2 times greater than in 2005 (305 *vs.* 256, respectively), in June 2005 there was evidence of flood debris and other high water impacts from the September 2004 hurricane-induced flooding which may have reduced the size of the fish population. **2005 & 2010** -- 17 species are known from the site, including4 intolerant species, 3 species of darters, and 2 species of suckers; dominant species is the Bluehead Chub; no change in the biological integrity of the fish community or water quality of the stream. **Recommendation** -- continue basinwide monitoring of this site in 2015.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
KNOB CR	**SR 1641**	**06/23/10**	**AF13**	**Good**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
CLEVELAND	4	03050105	35.44805556	-81.56944444	9-50-19-(2.5)	Southern Outer Piedmont

Stream Classification	Drainage Area (mi^2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	33.3	810	9	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)	23.5
Dissolved Oxygen (mg/L)	8.8
Specific Conductance (µS/cm)	45
pH (s.u.)	6.3

Water Clarity	Clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	11
Bottom Substrate (15)	3
Pool Variety (10)	6
Riffle Habitat (16)	3
Erosion (7)	6
Bank Vegetation (7)	7
Light Penetration (10)	7
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	**58**

Site Photograph

Substrate Sand

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
06/23/10	2010-60	17	52	Good
06/07/05	2005-63	15	46	Good-Fair
05/09/00	2000-22	13	42	Good-Fair

Most Abundant Species, 2010 Piedmont Shiner (17%)

Exotic Species None; no species known from the site.

Species Change Since Last Cycle

Gains -- first collection for Thinlip Chub, Northern Hog Sucker, and Flat Bullhead. **Lost** -- Bluegill. All species gained or lost were represented by 1-3 fish/species.

Data Analysis

Watershed -- drains north-central Cleveland County; no NPDES permitted dischargers or municipalities in the watershed; a tributary to the First Broad River. **Habitats** -- same as in 2005; swift flow with deep plunges downstream from large deadfalls, sandy runs, undercut banks which had re-vegetated from the September 2004 floods. **Water Quality** -- specific conductance typical for a Piedmont stream, stable, and ranging from 41-45 µS/cm. **2010** -- total number of species and fish collected in 2010 were greater than in 2005 (17 *vs.* 15 and 236 *vs.* 138, respectively). **2000-2010** -- 18 species are known from the site, including 4 intolerant species and 3 species each of suckers and darters; dominant species is the Bluehead Chub (2000-2010) and Piedmont Shiner (2010); total number of species collected and the percentage of insectivores has been steadily increasing; percentage of omnivores+herbivores (primarily Bluehead Chub) has been steadily decreasing; resulting in an increase in the NCIBI scores and ratings since 2000, suggesting overall improvements in the biological integrity of the fish community and water quality of the stream and recovery from the 2004 floods. **Recommendation** -- continue basinwide monitoring of this site in 2015.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
BRUSHY CR	**SR 1342**	**06/22/10**	**AF14**	**Good**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
CLEVELAND	4	03050105	35.32777778	-81.59388889	9-50-29	Southern Outer Piedmont

Stream Classification	Drainage Area (mi^2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	20	770	6	0.4	No

	Forested/Wetland	Rural Residential	Agriculture	Other (describe)
Visible Landuse (%)	25	25	50	0

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
PPG Industries Fiber Glass Products, Inc., Shelby Facility	NC0004685	1.3

Water Quality Parameters

Temperature (°C)	24.4
Dissolved Oxygen (mg/L)	7.5
Specific Conductance (µS/cm)	99
pH (s.u.)	5.8

Water Clarity	Clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	11
Bottom Substrate (15)	4
Pool Variety (10)	4
Riffle Habitat (16)	4
Erosion (7)	4
Bank Vegetation (7)	7
Light Penetration (10)	5
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	**54**

Site Photograph

Substrate Sand, gravel, clay

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
06/22/10	2010-55	20	52	Good
06/07/05	2005-62	18	42	Good-Fair
05/09/00	2000-24	16	46	Good-Fair

Most Abundant Species, 2010 Bluehead Chub (32%)

Exotic Species None; no species known from the site.

Species Change Since Last Cycle

Gains -- first collection for Thicklip Chub, Notchlip Redhorse, Margined Madtom, and Carolina Fantail Darter.
Lost -- Snail Bullhead, Bluegill. All species gained or lost were represented by 1-3 fish/species.

Data Analysis

Watershed -- drains west-central Cleveland County; one NPDES permitted discharger in the watershed, Ramseur Washerette (NC0030481, located ~ 3.8 miles upstream on Little Creek, a tributary to Brushy Creek) ceased discharging; tributary to the First Broad River. **Habitats** -- re-vegetated banks, numerous snags, widths variable with channels, overhanging grass vegetation, shallow pools and infrequent riffles. **Water Quality --** second highest specific conductance of any fish community basin site in 2010, indicative of discharger located ~ 2 miles upstream; has ranged from 76 µS/cm in 2005 to 120 µS/cm in 2000; PPG facility has a pro-active approach to operation of the WWTP and does not have an established chronic non-compliance record (M. Parker, DWQ-MRO, pers. com. 01/21/2011). **2010 --** 4 species of suckers present; increases in the sucker, darter, and trophic metrics. **2000-2010** -- 23 species are known from the site, including 4 species each of suckers and intolerant species and 3 species of darters; dominant species is the Bluehead Chub, although its dominance has been gradually decreasing from 61% in 2000 to 32% in 2010; total number of species, species of darters, and fish collected and the percentage of insectivores has been steadily increasing; percentage of omnivores+herbivores (primarily Bluehead Chub) has been steadily decreasing; perhaps due to more efficient operation of the upstream WWTP; overall result has been an increase in the NCIBI score and rating, indicative of improvements in biological integrity of the fish community and water quality of the stream. **Recommendation** -- continue basinwide monitoring of the site in 2015.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
HICKORY CR	**NC 18**	**06/21/10**	**AF11**	**Good**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
CLEVELAND	4	03050105	35.24111111	-81.56638889	9-50-30	Southern Outer Piedmont

Stream Classification	Drainage Area (mi^2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	18.6	670	5	0.3	No

	Forested/Wetland	Rural Residential	Agriculture	Other (describe)
Visible Landuse (%)	60	15	0	25 (commercial)

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)	8.0
Specific Conductance (µS/cm)	110
pH (s.u.)	6.5

Water Clarity	Clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	12
Bottom Substrate (15)	4
Pool Variety (10)	4
Riffle Habitat (16)	5
Erosion (7)	3
Bank Vegetation (7)	7
Light Penetration (10)	7
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	**57**

Site Photograph

Substrate Sand, gravel, clay

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
06/21/10	2010-51	17	50	Good
06/06/05	2005-59	18	50	Good
05/08/00	2000-19	18	50	Good

Most Abundant Species, 2010 Bluehead Chub (34%)

Exotic Species Green Sunfish (n=2)

Species Change Since Last Cycle

Gains -- first collection for Thicklip Chub; Santee Chub, Creek Chub, Seagreen Darter. **Lost** -- White Sucker, Northern Hog Sucker, Striped Jumprock, Margined Madtom, Warmouth. All species gained or lost were represented by 1-5 fish/species, except Santee Chub (n=10) and Thicklip Chub (n=6).

Data Analysis

Watershed -- drains the eastern portion of the Town of Shelby in south-central Cleveland County; no NPDES permitted dischargers in the watershed; tributary to the First Broad River, site is ~ 0.8 miles above creek's confluence with the river. **Habitats** -- same as in 2005; sandy runs, snags, gravel riffles, some boulder out-crops, entrenched. **Water Quality** -- greatest specific conductance of any fish community basin site in 2010, indicative of urban stormwater runoff. **2010** -- only 1 of 2 sites where juvenile or adult suckers were not collected (only young-of-year of White Sucker and Northern Hog Sucker were present, but not counted in the analyses). **2000-2010** -- 24 species are known from the site, including 5 species each of sunfish and intolerant species and 3 species each of suckers and darters; dominant species is the Bluehead Chub; despite the creek draining an increasingly urbanized watershed, the biological integrity of the fish community and water quality of the stream have been stable since 2000. **Recommendation** -- continue basinwide monitoring of this site in 2015 to document long-term changes in the fish community in an increasingly urbanized watershed.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
BEAVERDAM CR	**NC 150**	**06/21/10**	**AF10**	**Good**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
CLEVELAND	4	03050105	35.25	-81.63083333	9-50-32	Southern Outer Piedmont

Stream Classification	Drainage Area (mi^2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	16.9	690	7	0.3	No

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	75	0	0	25 (utility substation)

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

Water Quality Parameters

Temperature (°C)	26.9
Dissolved Oxygen (mg/L)	7.3
Specific Conductance (µS/cm)	73
pH (s.u.)	6.0

Water Clarity	Clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	14
Bottom Substrate (15)	4
Pool Variety (10)	4
Riffle Habitat (16)	5
Erosion (7)	3
Bank Vegetation (7)	7
Light Penetration (10)	7
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	**59**

Site Photograph

Substrate Sand, gravel, clay

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
06/21/10	2010-52	15	52	Good
06/06/05	2005-60	17	48	Good
05/08/00	2000-20	18	50	Good
06/20/95	95-63	18	48	Good

Most Abundant Species, 2010 Bluehead Chub (28%) and Greenfin Shiner (26%)

Exotic Species None

Species Change Since Last Cycle

Gains -- Central Stoneroller. **Lost** -- Fathead Minnow, Flat Bullhead, Largemouth Bass. All species gained or lost were represented by 1 or 2 fish/species.

Data Analysis

Watershed -- drains southwestern Cleveland County, including the northeast portion of the Town of Boiling Springs; one NPDES discharger in the watershed (NC0004685, PPG Industries, stormwater and non-contact cooling water to an unnamed tributary in the creek's headwaters, > 5.5 miles upstream); two dischargers have ceased (NC0042293 and NC0005061); since 2000, four facilities have ceased discharging (total Qw = 0.0575 MGD); tributary to the First Broad River. **Habitats** -- same as in 2005; gravel riffles, grasses hanging in the stream, shallow runs and pools, side snags. **Water Quality** -- specific conductance was 188 µS/cm in 1995, since then it has ranged from 63 µS/cm in 2000 to 73 µS/cm in 2010. **2010** -- improvements in the trophic metrics were largely responsible for the slight increase in the NCIBI score, but not the rating. **1995-2010** -- a diverse and abundant community, 23 species are known from the site, including 5 intolerant species, 4 species of suckers, and 3 species of darters; dominant species is the Bluehead Chub; although the biological integrity of the fish community has consistently rated Good, three intolerant and endemic species (Santee Chub, Thicklip Chub, and Fieryblack Shiner) have not been collected since 2000 or 2005. **Recommendation** -- continue basinwide monitoring of this site in 2015 to document suburbanization of the watershed and to determine if recolonization of the stream by the three intolerant and endemic species occurs.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
BUFFALO CR	**SR 1908**	**06/22/10**	**AF8**	**Good-Fair**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
CLEVELAND	5	03050105	35.34861111	-81.48027778	9-53-(1)	Southern Outer Piedmont

Stream Classification	Drainage Area (mi^2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
WS-III	43.3	770	11	0.5	No

	Forested/Wetland	Rural Residential	Agriculture	Other (describe)
Visible Landuse (%)	25	25	25	25 (church w/lawn)

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

Water Quality Parameters

Temperature (°C)	22.5
Dissolved Oxygen (mg/L)	7.6
Specific Conductance (µS/cm)	61
pH (s.u.)	5.8
Water Clarity	Slightly turbid, became very turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	12
Bottom Substrate (15)	3
Pool Variety (10)	10
Riffle Habitat (16)	3
Erosion (7)	2
Bank Vegetation (7)	7
Light Penetration (10)	7
Left Riparian Score (5)	4
Right Riparian Score (5)	5
Total Habitat Score (100)	**58**

Site Photograph

Substrate Sand, bedrock, silt

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
06/22/10	2010-54	10	42	Good-Fair
07/14/04	2004-120	14	50	Good
5/9/00 (at SR 1906)	2000-21	14	46	Good-Fair

Most Abundant Species, 2010 Greenfin Shiner (42%)

Exotic Species None

Species Change Since Last Cycle

Gains -- Highback Chub. **Lost** -- Common Carp, Golden Shiner, Flat Bullhead, Warmouth, Redear Sunfish. All species gained or lost were represented by 1-3 fish/species.

Data Analysis

Watershed -- drains northeastern Cleveland, southwestern Lincoln, and northwestern Gaston counties; no NPDES dischargers or municipalities in the watershed; site is ~ 3 miles upstream of Kings Mountain Reservoir (Moss Lake). **Habitats** -- same as in 2004; deep pools and blow-outs along both banks, eroded banks, snags present but with no fish, upper end of the reach was very shallow with no instream habitats. **Water Quality** -- specific conductance typical for a Piedmont stream, ranging from 58 to 61 µS/cm; became very turbid when walking in the stream. **2010** -- 1 of 2 sites where only 10 species were collected; fewest fish collected at any site in 2010 and the second fewest of any site in the basin ever; number of fish collected declined by 2.5 fold since 2004 (from 181 to 73), 1 of 3 sites where darters were absent; all these declines led to a decrease in the NCIBI score and rating. **2000-2010** -- 15 species are known from the site, including 2 species each of suckers and intolerant species, but no species of darters; dominant species is the Bluehead Chub (2000) and Greenfin Shiner (2004 and 2010); recolonization avenues from downstream lotic sources following prolonged droughts are hampered by Kings Mountain Reservoir and will be reflective in the lower than expected metric scores and biological integrity ratings as compared to a reference site. **Recommendation** -- continue monitoring of this basinwide site in 2015.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
MUDDY FK	**SR 1001**	**06/22/10**	**AF38**	**Good-Fair**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
CLEVELAND	5	03050105	35.27944444	-81.43027778	9-53-6	Southern Outer Piedmont

Stream Classification	Drainage Area (mi^2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	31.3	690	11	0.3	No

	Forested/Wetland	Rural Residential	Agriculture	Other (describe)
Visible Landuse (%)	25	35	40	0

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

Water Quality Parameters

Temperature (°C)	21.3
Dissolved Oxygen (mg/L)	7.5
Specific Conductance (µS/cm)	57
pH (s.u.)	6.3

Water Clarity	Clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	12
Bottom Substrate (15)	3
Pool Variety (10)	4
Riffle Habitat (16)	2
Erosion (7)	2
Bank Vegetation (7)	5
Light Penetration (10)	5
Left Riparian Score (5)	1
Right Riparian Score (5)	5
Total Habitat Score (100)	**44**

Site Photograph

Substrate Sand, some bedrock outcrops across the stream

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
06/22/10	2010-53	15	46	Good-Fair
05/08/00	2000-18	16	48	Good

Most Abundant Species, 2010 Bluehead Chub (27%) and Greenfin Shiner (22%)

Exotic Species None; no species known from the site.

Species Change Since Last Cycle **Gains** -- Margined Madtom (n=10). **Lost** -- Bluegill (n=1), Seagreen Darter (n=2).

Data Analysis

Watershed -- drains eastern Cleveland and western Gaston counties, including the Town of Cherryville; no NPDES dischargers in the watershed; tributary to Buffalo Creek downstream of Kings Mountain Reservoir. **Habitats** -- same as in 2000; very shallow and wide sandy runs, eroded banks, infrequent riffles made by sticks with the current, sediment impacts with a sand dipping operation at ATV access at end of the reach on the left bank. **Water Quality** -- specific conductance typical for a Piedmont stream, ranging from 57 to 60 µS/cm. **2010** -- an abundant fish community, ~ 85% of all the fish collected were Bluehead Chub, Greenfin Shiner, Redbreast Sunfish, and Sandbar Shiner; only 1 species of sunfish (Redbreast Sunfish) and intolerants (Highback Chub) present; decreases in diversity metrics were offset by improvements in the trophic metrics, such that there was only a slight decrease in the NCIBI score and rating between 2010 and 2000. **2000 & 2010** -- an abundant fish community consisting of 17 species, including 3 species of suckers and 2 species each of darters and intolerant species; dominant species is the Bluehead Chub; the biological integrity of the fish community and water quality of the stream have not changed appreciably since 2000. **Recommendation** -- continue basinwide monitoring at this site in 2015; efforts are needed to re-vegetate the riparian zone along the left bank to reduce sediments inputs to the stream.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
N PACOLET R	**US 176 & SR 1125**	**06/09/10**	**AF33**	**Good**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
POLK	6	03050105	35.22333333	-82.25611111	9-55-1-(1)	Southern Inner Piedmont

Stream Classification	Drainage Area (mi^2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C;Tr	17.7	940	13	0.5	No

	Forested/Wetland	Rural Residential	Agriculture	Other (describe)
Visible Landuse (%)	25	75	0	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)	10.6
Specific Conductance (µS/cm)	39
pH (s.u.)	6.1

Water Clarity	Slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	18
Bottom Substrate (15)	12
Pool Variety (10)	9
Riffle Habitat (16)	16
Erosion (7)	6
Bank Vegetation (7)	5
Light Penetration (10)	7
Left Riparian Score (5)	3
Right Riparian Score (5)	1
Total Habitat Score (100)	**82**

Site Photograph

Substrate Cobble, bedrock shelves, gravel, sand

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
06/09/10	2010-37	15	50	Good
06/24/05	2005-83	15	46	Good-Fair

Most Abundant Species, 2010 Bluehead Chub (42%)

Exotic Species Rainbow Trout (n=4)

Species Change Since Last Cycle **Gains** -- Bluegill (n=2). **Lost** -- Brown Trout (n=1)

Data Analysis

Watershed -- drains the southwest corner of Polk County west of the Town of Tryon and including the Town of Saluda and the extreme southeastern corner of Henderson County; borders the Southern Crystalline Mountains and Ridges ecoregion; one NPDES permitted discharger in the watershed (Town of Saluda's WWTP, NC0028975, located ~ 7.5 miles upstream, Q_w = 0.1 MGD to Joel's Creek, a tributary to the river). **Habitats** -- same as in 2005; plunges, bedrock and cobble riffles, residential lawns along both banks to the edge of the stream with a narrow riparian buffer along the banks closest to the bridge. **Water Quality** -- low specific conductance for a Piedmont stream, ranging from 31 to 39 µS/cm. **2010** -- an extremely and overly productive site for a stream of its size, the most fish collected of any site ever in the basin (n=1,144), fish were also abundant in 2005 (n=962); ~ 75% of all the fish collected were Bluehead Chub, Fieryblack Shiner, and Striped Jumprock; changes in the percent abundance of Bluehead Chub (decrease) and Fieryblack Shiner (increase) were responsible for the slight improvement in NCIBI score and rating between 2005 and 2010; Hatchery Supported Trout Waters, but all Rainbow Trout collected were wild. **2005 & 2010** -- 16 species are known from the site, including 4 intolerant species, 2 species of suckers, and 1 species of darter; dominant species is the Bluehead Chub; overall biological integrity of the fish community and water quality of the stream have not substantially changed. **Recommendation** -- continue basinwide monitoring of this site in 2015; riparian buffers and restoration are needed in the watershed along US 176 to reduce nutrient inputs and overall productivity of the stream.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
N PACOLET R	**SR 1501**	**06/08/10**	**AF39**	**Fair**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
POLK	6	03050105	35.205	-82.15833333	9-55-1-(10)	Southern Inner Piedmont

Stream Classification	Drainage Area (mi^2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	49.3	795	15	0.7	No

	Forested/Wetland	Rural Residential	Agriculture	Other (describe)
Visible Landuse (%)	25	25	50 (turf farm)	0

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
Tryon WWTP	NC0021601	1.5

Water Quality Parameters (2010)

Temperature (°C)	21.5
Dissolved Oxygen (mg/L)	8.9
Specific Conductance (µS/cm)	55
pH (s.u.)	6.1

Water Clarity	Very slightly turbid

Habitat Assessment Scores (max) (2010)

Channel Modification (5)	5
Instream Habitat (20)	13
Bottom Substrate (15)	4
Pool Variety (10)	4
Riffle Habitat (16)	3
Erosion (7)	3
Bank Vegetation (7)	6
Light Penetration (10)	8
Left Riparian Score (5)	5
Right Riparian Score (5)	2
Total Habitat Score (100)	**53**

Site Photograph

Substrate Sand

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
07/06/11	2011-60	16	52	Good
06/08/10	2010-36	15	38	Fair
06/19/95	95-62	12	48	Good

Most Abundant Species, 2010 Greenfin Shiner (58%)

Exotic Species None; no species known from the site.

Species Change Since Last Cycle (2010 vs. 1995)

Gains -- Rosyside Dace, Highback Chub, Notchlip Redhorse, Brassy Jumprock, Margined Madtom, Flat Bullhead. **Lost** -- Bluegill, Largemouth Bass, Seagreen Darter. All species gained or lost were represented by 1-3 fish/species, except Highback Chub and Margined Madtom (n=8 each) and Flat Bullhead (n=6).

Data Analysis

Site has not been sampled in 15 years. **Watershed** -- drains the southwest corner of Polk County, including the Town of Tryon and northern Greenville County, SC; eight NPDES permitted dischargers in the watershed with a total discharge to the river of 2.574 MGD. **Habitats** -- swift runs, no cobble riffles, side snags and rip/rap crevices, eroding right bank; channel deeply entrenched; 10,000 ft. of streambank stabilization and stream restoration have been approved between Tryon and the state line (L. Wiggs, DWQ-ARO, pers. com. 01/21/2011). **Water Quality** -- specific conductance was 96 µS/cm in 1995 and 55 µS/cm in 2010. **2010** -- total species diversity, diversity of darters and sunfish were lower than expected for a stream of its size and as compared to a reference site; 1 of only 3 sites where darters were absent, but 4 species of suckers were present; very skewed trophic structure; Bluehead Chub decreased from 41% to 6% and Greenfin Shiner increased from 4% to 58% of the total fauna between 1995 and 2010. **1995 & 2010** -- 18 species are known from the site, including 4 species each of suckers and intolerant species and 1 species of darters (represented by only 1 fish in 1995); dominant species are the Bluehead Chub (1995) and Greenfin Shiner (2010). **Recommendation** -- site should be re-sampled in 2011 to verify if declines in the biological integrity of the fish community and water quality of the stream are accurate; continue basinwide monitoring of this site in 2015 under lower flow conditions. **Note**: this site was re-sampled in 2011 under lower flow conditions and was rated Good; Greenfin Shiner was the dominant species; and the intolerant Seagreen Darter was again present.