BASINWIDE ASSESSMENT REPORT

CATAWBA 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 re-assessed every five years. The Catawba River basin has been sampled by the Environmental Sciences Section (ESS) four times for basinwide monitoring: 1992, 1997, 2002, and 2007.

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 Catawba River basin include benthic macroinvertebrates and fish community for the period 2002 - 2007. Details of biological sampling methods (including habitat evaluation) and rating criteria can be found in the appendices of this report. Technical terms are defined in the Glossary.

The document is structured with physical, geographical, and biological data discussions presented by 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 Catawba River basin (along with the Broad River basin) forms the headwaters of the Santee-Cooper River system, which flows through South Carolina to the Atlantic Ocean (Figure 1). The basin is the eighth largest river basin in the state covering 3,279 square miles in the south central portion of western North Carolina. The Catawba River has its source on the eastern slopes of the Blue Ridge Mountains near the Town of Old Fort in McDowell County, and flows eastward, then southward, to the state line near Charlotte. The basin encompasses all or part of 12 counties: Alexander, Avery, Burke, Caldwell, Catawba, Gaston, Iredell, Lincoln, McDowell, Mecklenburg, Union, and Watauga.

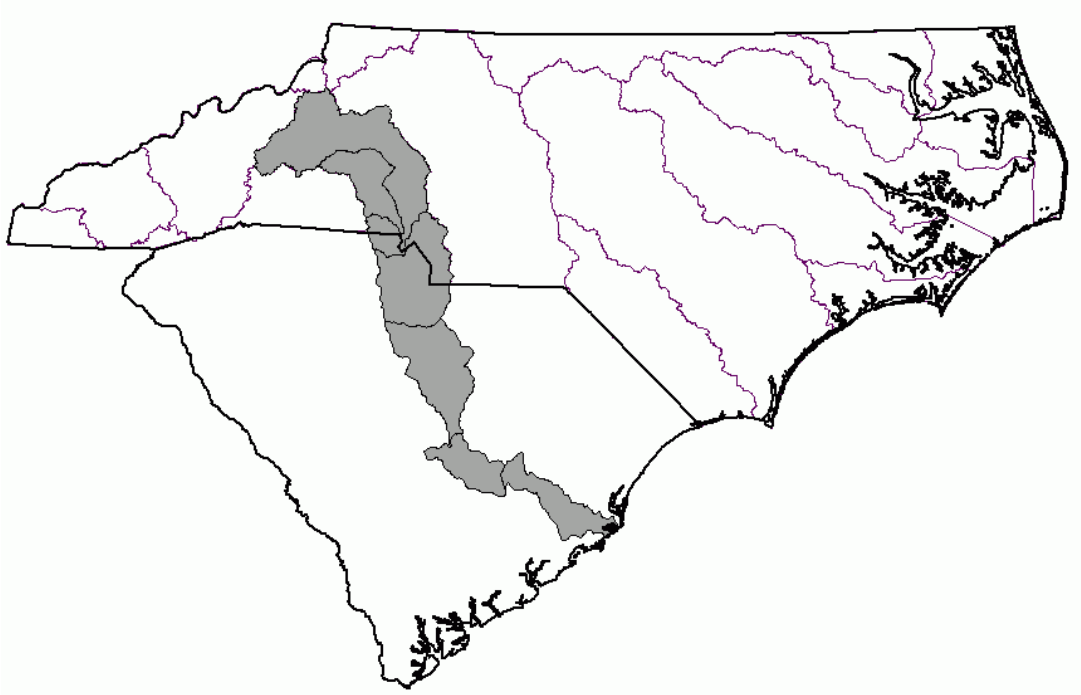

Figure 1. The Catawba River Basin

HUC (03050101) includes Subbasins 30, 31, 32, 33, and 37 and spans Avery, Burke, McDowell, Caldwell, Alexander, Catawba, Iredell, Gaston, Lincoln, and Mecklenburg counties. This is a large and physiographically diverse area and contains the Level-IV ecoregions of Southern Metasedimentary Ridges and Mountains, Southern Crystalline Ridges and Mountains, Northern Inner Piedmont, Eastern Blue Ridge Foothills, and Southern Outer Piedmont (Figure 2). Much of the upper portion of this HUC is contained within the Pisgah National Forest and, therefore, protected from most land-disturbing activities. However, in areas of lower relief and outside of protected natural areas that are typically found in the middle and lower portions of this HUC, influences from agriculture and urbanization occur in large concentration. Generally, streams in subbasins 30, 31, and 32 are of moderate to high gradient and have heterogeneous substrates. Streams found in subbasins 33 and 37 are lower in gradient and while rocks and gravel are often present, these streams typically have larger proportions of sand and silt substrates than streams found elsewhere in the HUC. The cities of Marion, Morganton, and Lenoir are the primary urban centers.

The next HUC (03050102) found in the Catawba River basin includes Subbasins 35 and 36 and NCDWQ collects long-term benthic macroinvertebrate samples in Burke, Catawba, Lincoln, and Gaston counties. There are two Level-IV ecoregions in this watershed and include the Southern Outer Piedmont and Northern Inner Piedmont (Figure 2). In general, land use is a mix of forest,

agriculture, pasture, and areas of urbanization. Specifically, urban areas here include Gastonia, Lincolnton, and Hickory. Streams in this HUC are typically low to moderate in gradient, and tend to be largely sandy although Jacob Fork has a much higher percentage of rock and gravel than most other streams in this HUC.

The last and furthermost downstream HUC (03050103) in this river basin includes Subbasins 34 and 38 and NCDWQ maintains long-term benthological sample points in Mecklenburg and Union counties. This HUC also contains the Southern Outer Piedmont and Carolina Slate Belt Level-IV ecoregions. The City of Charlotte and associated suburban areas are contained within the boundaries of this HUC. Outside of these substantial urban areas, agriculture is the predominate land use. In general, streams near Charlotte and within the Southern Outer Piedmont tend to be sandy with some rock substrates present and are moderate in gradient. In contrast, streams located in Union County (and within the Carolina Slate Belt) are characterized by much higher levels of rock substrates and much lower summer flows.

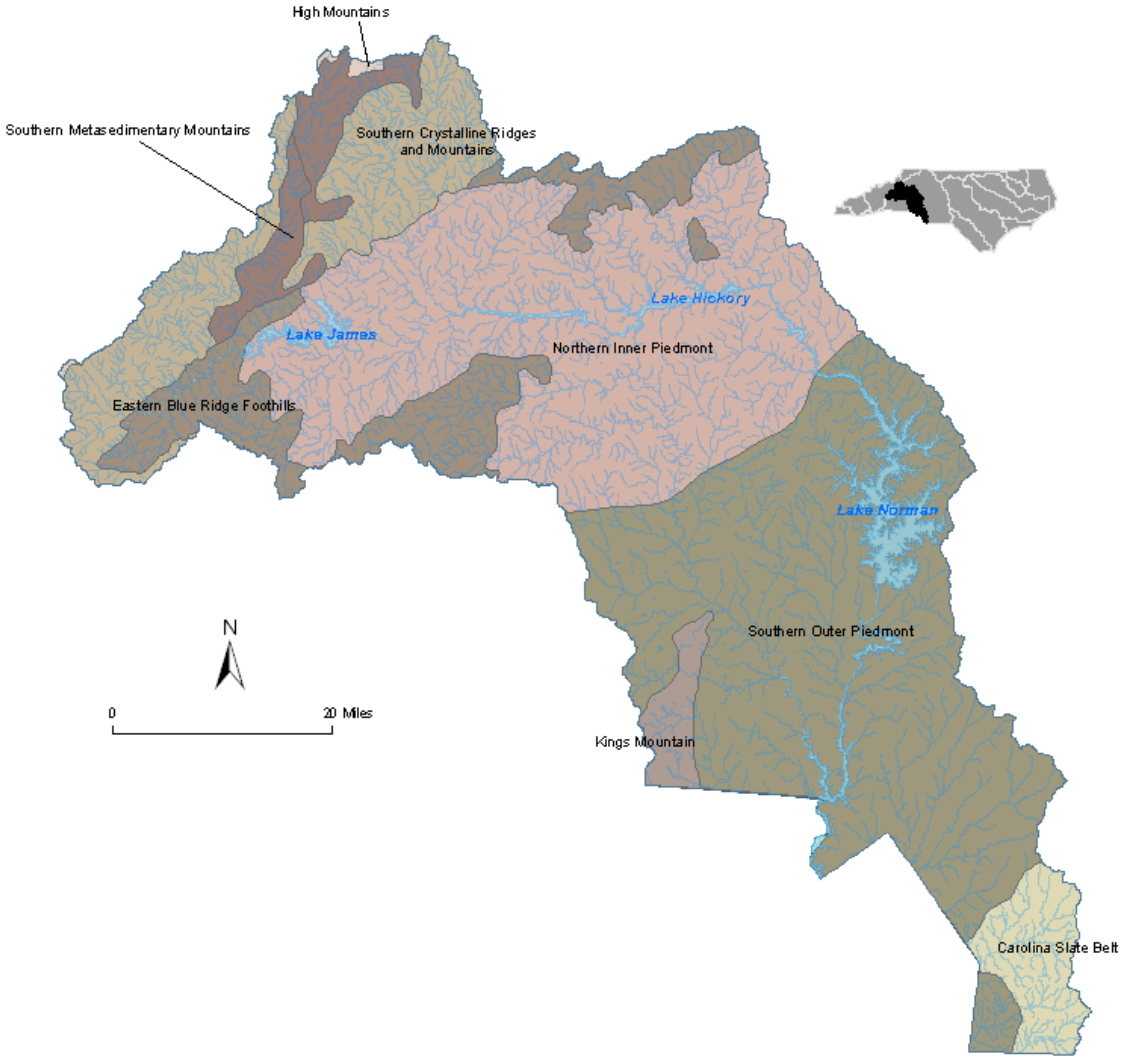

Figure 2. **Level-IV Ecoregions of the Catawba River Basin**

CATAWBA RIVER HUC 03050101 – CATAWBA RIVER HEADWATERS

Description

HUC 03050101, with an area of 2200 square miles, is the largest eight-digit HUC in the Catawba River basin. It includes Catawba River subbasins 30 through 33, the northwest portion of subbasin 34, and subbasin 37. Ten counties are included in HUC 03050101 in whole or in part: Avery, Caldwell, McDowell, Burke, Alexander, Catawba, Iredell, Lincoln, Gaston, and Mecklenburg. The HUC includes Catawba River, its headwaters originating east of the Tennessee Valley Divide, and all tributaries downstream to above the mouth of South Fork Catawba River. Below the mouth of South Fork Catawba River the tributaries to the east of Catawba River downstream to the South Carolina border are included. Catawba and Crowders

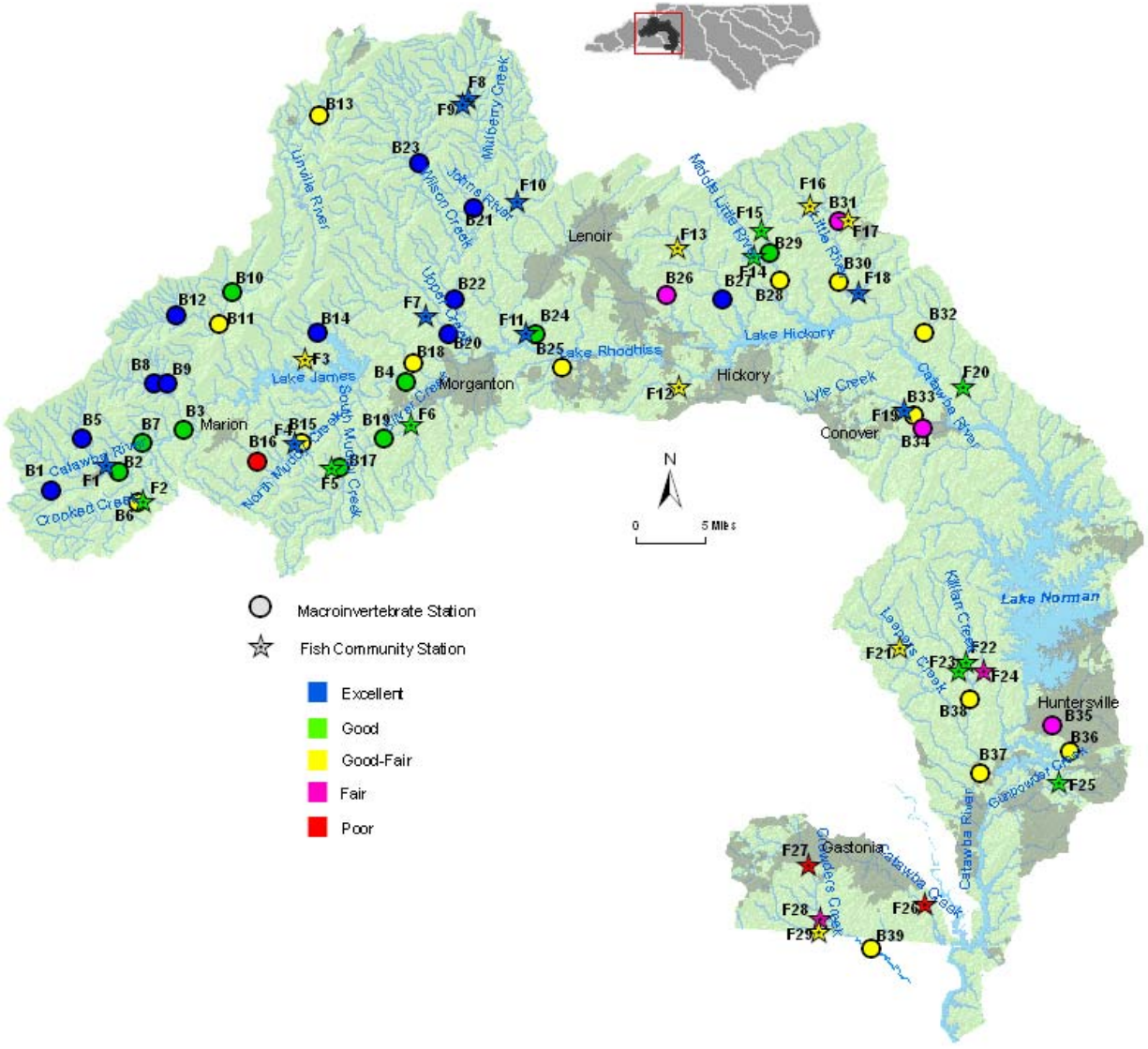

Figure CTB01. Sampling sites in HUC 03050101 in the Catawba River basin. Monitoring sites are listed in Table CTB01.2.

Creek watersheds in southern Gaston County, which drain into South Carolina, are also within the HUC. The area within the HUC is mostly forest (greater in the upper portion of the watershed above Lake Hickory), with significant areas of agriculture and urbanization. The largest urban areas include Morganton, Lenoir, the north portion of Hickory, Huntersville, Gastonia, and outlying areas north and west of Charlotte. Major active dischargers are listed in Table CTB01.

Table CTB01.1. Major active NPDES dischargers in HUC 03050101 in the Catawba River basin as of December 2007.

Permit	Facility	County	Receiving Waterbody	Permitted Flow (MGD)
NC0026573	City of Morganton, Catawba River Pollution Control Facility	Burke	Catawba River	13
NC0041696	Town of Valdese, Lake Rhodhiss WWTP	Burke	Catawba River	10.5
NC0025135	Huffman Finishing Inc, Huffman Finishing	Caldwell	Catawba River	0.25
NC0020401	City of Hickory, Northeast WWTP	Catawba	Catawba River	6
NC0004987	Duke Energy Carolinas LLC, Marshall Steam Station	Catawba	Catawba River	0
NC0024392	Duke Energy Carolinas LLC, McGuire Nuclear Power Plant	Mecklenburg	Catawba River	
NC0004961	Duke Energy Carolinas LLC, Riverbend Steam Station	Gaston	Catawba River	0
NC0021156	City of Mount Holly WWTP	Gaston	Catawba River	4
NC0004375	Clariant Corporation, Mount Holly East (MHE) Facility	Mecklenburg	Catawba River	3.9
NC0004979	Duke Energy Carolinas LLC, Plant Allen Steam Station	Gaston	Catawba River	10
NC0021181	City of Belmont WWTP	Gaston	Catawba River	5
NC0004979	Duke Energy Carolinas LLC, Plant Allen Steam Station	Gaston	Catawba River	10
NC0021229	Town of Old Fort WWTP	McDowell	Curtis Creek	1.2
NC0006564	Baxter Healthcare Corporation	McDowell	North Fork Catawba River	1.2
NC0004243	Coats American Inc--Sevier Plant	McDowell	North Fork Catawba River	2
NC0031879	City of Marion, Corpening Creek WWTP	McDowell	Youngs Fork	3
NC0023981	City of Lenoir, Lower Creek WWTP	Caldwell	Lower Creek	6
NC0023736	City of Lenoir, Gunpowder Creek WWTP	Caldwell	Gunpowder Creek	2
NC0034860	Schneider Mills Inc WWTP	Alexander	Muddy Fork	0.78
NC0024252	City of Conover, Northeast WWTP	Catawba	Lyle Creek	1.5
NC0036277	Charlotte Mecklenburg Utility Dept, McDowell Creek WWTP	Mecklenburg	McDowell Creek	12
NC0074268	City of Gastonia, Crowders Creek WWTP	Gaston	Crowders Creek	6
NC0005177	FMC Corporation, Lithium Division Plant	Gaston	Abernethy Creek	0.615
NC0085359	Union County Public Works, Twelve Mile Creek WWTP	Union	Twelvemile Creek	6

Several mountain and piedmont ecoregions are present in the HUC: Southern Crystalline Ridges and Mountains, Southern Metasedimentary Mountains, and High Mountains ecoregions are represented in the extreme upper part of the HUC; portions of the Eastern Blue Ridge Foothills are present at lower elevations in the upper portion of the HUC; Northern Inner Piedmont comprises about one-third of the area around the middle part of the HUC; approximately the lower quarter is Southern Outer Piedmont; and Kings Mountain, through which the upper portion

of Crowders Creek and South Crowders Creek flow in southeast Gaston County[1] (Griffith *et al.* 2002). Streams in the higher elevations of the HUC are high-gradient with bedrock and boulder substrates. Foothill streams have moderate gradient; in addition to the bedrock and boulder substrates of the high-elevation streams cobble and gravel become more prevalent. Piedmont streams in the HUC are characterized by having low to moderate gradient and substrates mostly of cobble, gravel, and sand.

The North Carolina Natural Heritage Program (NCNHP) has Significant Natural Area (SNA) inventories for six counties in the HUC. The listed areas within the HUC for those counties include:

- **Avery County**[2]
    - **Flat Rock Mountain**, located along the Blue Ridge Parkway and owned by the National Park Service, is home to several Significantly Rare plant species, including: pinebarren deathcamas, tufted bulrush, homalia moss, and paradox campylopus moss. Ecological communities present at the site include High Elevation Granitic Dome and High Elevation Red Oak Forest. Bare granitic rock and shallow soils are characteristic for the area.
    - **Grandfather Mountain** is one of the most important sites for biological diversity in North Carolina. Nineteen animal and 41 plant species found within the area are considered rare. Boulders, cliffs, and crags form much of the landscape.
    - **Anthony Creek Swamp-Forest Bog Complex** is a natural representative of the Swamp Forest-Bog Complex ecological community. Several uncommon plant species are found in the area.
    - **Linville River Swamp-Forest Bog Complex** is another natural representative of the Swamp Forest-Bog Complex.
    - **Lost Cove Cliffs** includes Big Lost Cove and Little Lost Cove Cliffs in Pisgah National Forest. Peregrine falcon nest in the area. The area has not been logged within the past 60 years, allowing for the growth of a mature forest. The area is protected as a Wilderness Study Area by the U.S. Forest Service.
    - **Lost Cove Creek Forests** includes a good representative of a Montane Alluvial Forest along the low-gradient and meandering Lost Cove Creek above its confluence with Wilson Creek.
    - **Wilson Creek Slopes** contains representatives of six different ecological communities. Topography includes a range from floodplains to steep slopes.
    - **Wilson Creek Aquatic Habitat** includes the entire length of Wilson Creek, from its headwaters in Grandfather Mountain SNA to the confluence with Johns River in Caldwell County. Wilson Creek received the designation of National Wild and Scenic River in 2000.
- **McDowell County**[3]
    - **Beartree Ridge** is situated next to the Blue Ridge Parkway at the Yancey County line. Chestnut Oak Forest, Pine-Oak/Heath, Montane Acidic Cliff, and Carolina Hemlock Bluff are the natural communities represented in the 107-acre area.
    - **Catawba River Dolomite Area** in the far northern part of the county includes the Montane Calcareous subtype of the Basic Mesic Forest, a community known in only one other location in the state. Chinkapin oak, black walnut, white ash, and sugar maple are typical for the subtype.

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[1] Griffith, G.E., Omernik, J.M., Comstock, J.A. Schafale, M.P., McNab, W.H., Lenat, D.R., MacPherson, T.F., Glover, J.B. and Shelburne, V.B. 2002. Ecoregions of North Carolina and South Carolina. (color poster with map, descriptive text, summary tables and photographs): Reston, VA, U.S. Geological Survey (map scale 1:1,500,000).

[2] Anonymous. 2006. *Executive Summary: An Inventory of the Significant Natural Areas of Avery County, North Carolina*. North Carolina Natural Heritage Program.

[3] Anonymous. 2005. *Executive Summary: An Inventory of the Significant Natural Areas of McDowell County, North Carolina*. North Carolina Natural Heritage Program.

- **Edmondson Mountain**, southwest of Old Fort, includes several low-mountain ecological community types: Montane Oak-Hickory Forest, Acidic Cove Forest, Chestnut Oak Forest, and Pine-Oak/Heath.
- **Laurel Ridges**, situated along the Blue Ridge Parkway, includes High Elevation Red Oak Forest and Pine-Oak/Heath communities.
- **Linville Caverns** is the only known site for the Linville Caverns spider. This is the other known location for the Montane Calcareous subtype of the Basic Mesic Forest.
- **Linville Mountain Natural Area** includes old-growth representatives of the Rich Cove Forest and Chestnut Oak Forest communities.
- **Mackey Mountain** is located in Pisgah National Forest NNE of Old Fort. Large tracts of Chestnut Oak Forest and Acidic Cove Forest ecological communities are present within the 1850-acre area.
- **Newberry Creek Gorge** is a 41-acre area NNW of Old Fort containing several Significantly Rare mosses: sword moss, lime homalia, Himalayan ribbed-weissa, copper moss, Agoyan cataract moss, and cirriphyllum moss.
- **North Fork Catawba River Aquatic Habitat** includes the stream from its source in Avery County near the Tennessee Valley Divide down to the mouth of Armstrong Creek in McDowell County. *Ephemerella berneri*, a Significantly Rare mayfly, has been recorded from the stream reach; the BAU has only 17 records from benthic sites across the state for the species.
- **Pinnacle Mountain/Mill Creek** is home to northern flying squirrels and timber rattlesnakes. Rare plants found in the area include Gray's lily, purple-fringed orchid, Appalachian fir clubmoss, and ash-leaved golden-banner.
- **The Loop-Gillespie Gap** includes Rich Cove Forest, Montane Oak-Hickory Forest, Acidic Cove Forest, Chestnut Oak Forest, and uncommon Montane White Oak Forest.
- **Woods Mountain/Singecat Ridge** is significant for being one locality for the federally-endangered mountain golden-heather. The shrub is only known from seven populations in Burke and McDowell Counties.
- **Bobs Creek Pocket Wilderness** hosts several rare plant species including roundleaf serviceberry, yellow honeysuckle, sweet white trillium, Appalachian golden-banner, and sweet pinesap. Acidic Cove Forest, Dry-Mesic Oak-Hickory Forest, and Chestnut Oak Forest are among the communities represented in the area.
- **Brackettown Seepage Bog** contains several rare plants: large-leaved grass-of-Parnassus, Appalachian golden-banner, and Cuthbert's turtlehead.
- **Brackettown Valley Bog** is a 0.7-acre site representing the rare Swamp Forest-Bog Complex and includes two rare plant species: small spreading pogonia and Pringle's autumn coralroot.
- **Muddy Creek Bog and Slopes** includes another representative of the Swamp Forest-Bog Complex. Large-leaved grass-of-Parnassus, Alabama grape-fern, and American barberry are among the rare plants present in the area.
- **Hickorynut Mountain** straddles the divide between the Catawba and Broad Basins. The 7800-acre area is the largest Significant Natural Area in McDowell County; 1500 of those acres are in this HUC.

- **Burke County**[4]
  - **Upper Creek Aquatic Habitat** is Upper Creek from the mouth of Timbered Branch to its confluence with Irish Creek and including the lower 3.6 stream-miles of Steels Creek. NCNHP notes three Significantly Rare species of dragonflies present in the area: *Ophiogomphus howei, Ophiogomphus edmundo*,

[4] Anonymous. 2002. *Executive Summary: An Inventory of the Significant Natural Areas of Burke County, North Carolina*. North Carolina Natural Heritage Program.

and *Macromia margarita*. The BAU has a record from Steels Creek for another Significantly Rare species: the mayfly *Ephemerella berneri*.

- **Johns River/Mulberry Creek Aquatic Habitat** is Johns River from its confluence with Catawba River in Burke County upstream to the mouth of Thunderhole Creek in Caldwell County. The area also includes Mulberry Creek from its confluence with Johns River upstream to the mouth of the upper Little Mulberry Creek (DWQ stream index number 11-38-32-17) and Thunderhole Creek from its confluence upstream to the mouth of Curtis Creek. The BAU has records of several Significantly Rare species from sites within the area: *Ephemerella berneri, Serratella serrata, Bolotoperla rossi, Ceraclea mentiea,* and *C. slossonae*.
- **Island Creek Heath Bluff** is significant for its population of dwarf-flowered heartleaf, which is listed at both state and federal levels as threatened.
- **Vulcan-Rhodhiss Slopes** includes representatives of Piedmont/Low Mountain Alluvial Forest and Mesic Mixed Hardwood Forest communities.
- **Linville Gorge** contains Canada Hemlock Forest and Carolina Hemlock Bluff communities in a large old-growth forest. The site is a National Wilderness Area. Rare plants within the area include mountain golden-heather and Heller's blazing star. Red crossbill, peregrine falcon, and Allegheny woodrat are found here.
- **Linville River Aquatic Habitat** is Linville River from Lake James upstream to the mouth of an unnamed tributary five stream-miles downstream of Linville Falls. The brook floater (*Alasmidonta varicosa*), a mussel listed as endangered by the state and as a species of concern federally, has been found here. A Significantly Rare mayfly, *Ephemerella berneri*, has been collected by the BAU from a site at the downstream end of the area.
- **Linville Falls** has representatives of Canada Hemlock Forest and Carolina Hemlock Bluff communities. Rare plant species in the area include: purple fringeless orchid, the liverwort *Plagiochila caduciloba*, and undulate dicranum moss. The red crossbill also inhabits the area.
- **Duggers Creek Forests** includes much of Duggers Creek (a tributary to Linville River) and adjacent areas within the watershed. Part of the adjacent Gulf Branch watershed is also included in the SNA.
- **Jonas Ridge Bog** includes a Southern Appalachian Bog community.
- **Cranberry Knob Bogs and Swamp Forest** also includes examples of the Southern Appalachian Bog community along with a Swamp-Forest Bog Complex.
- **Brown Mountain Greenstone Forests** is home to the Significantly Rare timber rattlesnake. Pine-Oak/Heath, Acidic Cove Forest, Chestnut Oak Forest, and Montane Oak-Hickory Forest communities are represented in the area.
- **Upper Creek Falls Forest** is an 110-acre site near the headwaters of Upper Creek. The area contains Chestnut Oak Forest, Acidic Cove Forest, and Rocky Bar and Shore communities.
- 140 of the 710 acres in the **Yellow Mountain/Ironmonger Mountain** SNA are within this HUC. Montane Oak-Hickory Forest, Chestnut Oak Forest, and Pine-Oak/Heath communities are found in the area, as well as the rare Alabama grapefern.
- Most of **Smith Mountain** SNA is contained with this HUC (approximately 800 of 1400 acres). Chestnut Oak Forest and Pine-Oak/Heath communities are found within the area, along with the timber rattlesnake.
- **Clear Creek Watershed Natural Area** is a 2150-acre band of forest on the northwest side of the divide between this HUC and the South Fork Catawba River HUC. The area includes headwaters of Shoal Creek, Clear Creek, and Double Branch. Low-Elevation Rocky Summit and Carolina Hemlock Bluff communities, along with old-growth Rich Cove Forest and Chestnut Oak Forest communities, are contained within the area.

- **Deaf School Watershed** is a 270-acre SNA just northeast of Clear Creek Watershed Natural Area at the headwaters of Bailey Fork. A Low-Elevation Rocky Summit community is represented here.
- About 120 of 480 acres of **Broughton Hospital/Keller Knob** is in this HUC. Chestnut Oak Forest and Montane Oak-Hickory Forest communities are present within the area.
- **Shoal Creek Watershed** captures about 210 acres of the watershed downstream of the Clear Creek Watershed Natural Area. Chestnut Oak Forest, Montane Oak-Hickory Forest, Acidic Cove Forest, Spray Cliff, Montane Mafic Cliff, and Low-Elevation Rocky Summit communities are all represented in the area.
- **Brindletown Forests** includes the headwaters of Hall Creek and a lower portion of Lane Branch. Chestnut Oak Forest, Montane Oak-Hickory Forest, Rich Cove Forest, and Low-Elevation Rocky Summit communities all have representatives within the area.
- **Burkemont Mountain** is a 130-acre headwater area to an unnamed tributary to Bailey Fork. Ecological communities in the area include Chestnut Oak Forest, Montaine Oak-Hickory Forest, and Rich Cove Forest.
- **Hall Knob** includes representatives of Chestnut Oak Forest and Montane Oak-Hickory Forest communities.

- **Iredell County**[5]
  - **Lake Norman State Park Natural Areas** comprises several small non-conterminous sites around the lake. Dry-Mesic Oak-Hickory Forest, Piedmont Low Mountain Alluvial Forest, and Piedmont Monadnock Forest are communities included at the sites.
- **Lincoln County**[6]
  - **Beth Haven Church Road Forests** is a 1000-acre tract in the eastern half of Lincoln County. Ecological communities present within the area include Dry-Mesic Oak-Hickory Forest and Piedmont/Low Mountain Alluvial Forest.
  - **Cloninger Lane Woods** includes a Dry-Mesic Hickory Forest on a ridge next to Leepers Creek that has been subject to timbering in some areas.
  - **Leepers Creek Heartleaf Site** is a 28-acre site around the confluence of Lick Run with Leepers Creek. A population of dwarf-flowered heartleaf is present at the site; found only in the upper Piedmont of North Carolina and South Carolina, the perennial herb is listed as Threatened at both state and federal levels.
  - **Leepers Creek Monadnock and Wetland** exhibits examples of Piedmont Monadnock Forest, Mesic Mixed Hardwood Forest, and Piedmont/Low Mountain Alluvial Forest communities.
  - **Lick Run Slopes**, ENE of Lincolnton, represents the Dry-Mesic Oak-Hickory Forest community.
  - **Little Egypt Woods** includes a high-quality Dry-Mesic Oak-Hickory Forest community. Spiked crested coralroot, a Significantly Rare orchid, is found here.
  - **Mountain Island Lake Forest** covers extreme southeast Lincoln and northeast Gaston Counties, and a small portion of western Mecklenburg County on both the east and west sides of Catawba River.
  - **Reese Mountain** provides another example of the Piedmont Monadnock Forest community at this rocky and xeric site.
  - **Wingate Creek Slopes** is a 95-acre site with a Basic Mesic Forest community type.
- **Gaston County**[7]

[5] Anonymous. 1996. *Executive Summary: An Inventory of the Significant Natural Areas of Iredell County, North Carolina*. North Carolina Natural Heritage Program.
[6] Anonymous. 2002. *Executive Summary: An Inventory of the Significant Natural Areas of Lincoln County, North Carolina*. North Carolina Natural Heritage Program.

- **Crowders Mountain State Park and Vicinity** is two disjunct areas: one is a 2740-acre area in southwest Gaston County and crossing into southeast Cleveland County (of which only 860 acres are in this HUC); the other is a 735-acre area in wholly in southwest Gaston County. The Significant Natural Area hosts several plants rare in the state: bear oak, dwarf juniper, Bradley's spleenwort, Allegheny Mountain goldenbanner, and Schwerin's false indigo. A high-quality Low Elevation Rocky Summit ecological community is represented in the area.
- **Stagecoach Road Granitic Outcrop** is a 9-acre site with a Granitic Flatrock community surrounded by a hickory-dominant forest. Exposed granite and mats of vegetation are typical for the community.
- **North Stanley Creek Basic Forest** in northeast Gaston County supports both Basic Mesic Forest and Piedmont Alluvial Forest communities along with a population of bigleaf magnolia.
- **South Crowders Creek Mesic Forest** is a 68-acre site adjacent to an unnamed tributary to South Crowders Creek in southeast Gaston County. The area includes a Mesic Mixed Hardwood Forest community.
- **Twin Brooks/Stanley Basic Forest** is adjacent to South Stanley Creek in northwest Gaston County. High-quality Basic Mesic Forest and Basic Oak-Hickory Forest communities are included in the area. Georgia aster, which is rare in the state, grows here.

Overview of Water Quality

The following stream segments within HUC 03050101 are on the final 303(d) impaired waters list for 2006:

Waterbody / *Description*	Assessment Unit	Class	Reason for Listing
● Catawba River (Rhodhiss Lake) *From Johns River to Rhodhiss Dam*	11-(37)	WS-IV	Standard violation: High pH
● North Fork Catawba River *From Stillhouse Branch to Armstrong Creek*	11-24-(2.5)b	B;Tr	Impaired biological integrity
● Youngs Fork (Coperning Creek) *From source to Marion WWTP*	11-32-1-4a	C	Impaired biological integrity
● Youngs Fork (Coperning Creek) *From Marion WWTP to North Muddy Creek*	11-32-1-4b	C	Impaired biological integrity
● Jacktown Creek *From source to Youngs Fork*	11-32-1-4-1	C	Impaired biological integrity
● Irish Creek *From Roses Creek to Warrior Fork*	11-35-3-(2)b	WS-II	Impaired biological integrity
● Hunting Creek *From a point 1.0 mile upstream of Burke County SR 1940 to a point 0.4 mile downstream of Pee Dee Branch*	11-36-(0.7)	WS-IV	Impaired biological integrity
● Harper Creek *From source to Wilson Creek*	11-38-34-14	C;Tr,	Historical listing decision: Sediment
● Lower Creek *From source to Zack's Fork*	11-39-(0.5)a	C	Impaired biological integrity
● Lower Creek *From a point 0.7 mile downstream of Bristol Creek to Rhodhiss Lake, Catawba River*	11-39-(9)	WS-IV	Impaired biological integrity Standard violation: Turbidity
● Zacks Fork Creek *From source to Lower Creek*	11-39-1	C	Impaired biological integrity
● Spainhour Creek *From source to Lower Creek*	11-39-3	C	Impaired biological integrity

[7] Anonymous. 2000. *Executive Summary: An Inventory of the Significant Natural Areas of Gaston County, North Carolina*. North Carolina Natural Heritage Program.

● Greasy Creek *From source to Lower Creek*	11-39-4	C	Impaired biological integrity
● Bristol Creek *From source to Lower Creek*	11-39-8	WS-IV	Impaired biological integrity
● McGalliard Creek *From a point 0.6 mile upstream of mouth to Rhodhiss Lake, Catawba River*	11-44-(3)	WS-IV	Impaired biological integrity
● Horseford Creek *From Frye Creek to a point 0.7 mile upstream of mouth*	11-54-(0.5)	WS-IV	Impaired biological integrity
● Lower Little River *From source to a point 0.5 mile upstream of mouth of Stirewalt Creek*	11-69-(0.5)	C	Impaired biological integrity
● McDowell Creek *From source to U.S. Hwy. 21*	11-115-(1)	C	Impaired biological integrity
● McDowell Creek *From U.S. Hwy. 21 to SR 2136 Mecklenburg Co*	11-115-(1.5)a	WS-IV	Impaired biological integrity
● McDowell Creek *From SR 2136 Mecklenburg Co to a point 0.7 mile upstream of mouth*	11-115-(1.5)b	WS-IV	Impaired biological integrity
● McDowell Creek *From a point 0.7 mile upstream of mouth to Mountain Island Lake, Catawba River*	11-115-(5)	WS-IV	Impaired biological integrity
● Killian Creek *From Anderson Creek to a point 1.2 miles upstream of mouth*	11-119-2-(0.5)b	C	Impaired biological integrity
● Catawba Creek *From source to SR 2446, Gaston*	11-130a	C	Impaired biological integrity
● Catawba Creek *From SR 2446, Gaston to SR 2439, Gaston*	11-130b	C	Impaired biological integrity
● Catawba Creek *From SR 2439 to Lake Wylie*	11-130c	C	Impaired biological integrity
● Crowders Creek *From source to SR 1118*	11-135a	C	Impaired biological integrity
● Crowders Creek *From SR 1122 to SR 1131*	11-135c	C	Impaired biological integrity
● Crowders Creek *From SR 1131 to SR 1108*	11-135d	C	Impaired biological integrity
● Crowders Creek *From SR 1108 To NC 321*	11-135e	C	Impaired biological integrity Standard violation: Fecal Coliform
● Crowders Creek *From NC 321 to SR 2424*	11-135f	C	Impaired biological integrity Standard violation: Fecal Coliform
● Crowders Creek *From SR 2424 to North Carolina-South Carolina State Line*	11-135g	C	Standard violation: Fecal Coliform Impaired biological integrity
● McGill Creek *From source to Crowders Creek*	11-135-2	C	Impaired biological integrity
● Abernethy Creek *From First Creek to Crowders Creek*	11-135-4b	C	Impaired biological integrity

Three fish kills were investigated between 2003 and 2007: 1) July 2004 at Lake Norman with an estimated mortality of 2500 individuals; 2) February 2006 on Hunting Creek near Morganton with an estimated 1000 fish killed; 3) November 2006 on Paw Creek in Charlotte with an estimate of 180 fish killed. See Appendix F-8 for more details.

Sixty-eight basinwide collections were made in 2004 (five fish collections) and 2007 in the HUC (Table CTB01.2. Twenty-three sites were sampled for fish only, 33 for macroinvertebrates only, and six were sampled for both macroinvertebrates and fish. For fish sites nine rated as Excellent, nine rated as Good, seven as Good-Fair, two as Fair, and two as Poor. For benthic sites 11 rated as Excellent, nine as Good, 14 as Good-Fair, four as Fair, and one as Poor. Of the shared

Table CTB01.2. Waterbodies monitored in HUC 03050101 in the Catawba River basin for basinwide assessment, 2002 and 2007.

Map#[1]	Waterbody	County	Location	2002	2007
B-1	Catawba R	McDowell	SR 1274	Good-Fair	Excellent
B-2	Catawba R	McDowell	SR 1234	Good	Good
B-3	Catawba R	McDowell	SR 1221	Good-Fair	Good
B-4	Catawba R	Burke	SR 1147	Good	Good
B-5	Curtis Cr	McDowell	SR 1227	Good	Excellent
B-6	Crooked Cr	McDowell	SR 1135	Good	Good-Fair
B-7	Mackey Cr	McDowell	US 70	Good	Good
B-8	Buck Cr	McDowell	NC 80	Good	Excellent
B-9	L Buck Cr	McDowell	SR 1436	Good	Excellent
B-10	N Fk Catawba R	McDowell	SR 1573	Good	Good
B-11	N Fk Catawba R	McDowell	SR 1560	Fair	Good-Fair
B-12	Armstrong Cr	McDowell	Armstrong Creek Rd	Excellent	Excellent
B-13	Linville R	Avery	US 221	Good	Good-Fair
B-14	Linville R	Burke	NC 126	Excellent	Excellent
B-15	N Muddy Cr	McDowell	SR 1760	Good-Fair	Good-Fair
B-16	Corpening Cr	McDowell	SR 1819	Fair	Poor
B-17	S Muddy Cr	McDowell	SR 1764	Good-Fair	Good
B-18	Canoe Cr	Burke	SR 1250	Good	Good-Fair
B-19	Silver Cr	Burke	SR 1127	Good-Fair	Good
B-20	Warrior Fk	Burke	SR 1440	Good	Excellent
B-21	Johns R	Caldwell	SR 1356	Excellent	Excellent
B-22	Johns R	Burke	SR 1438	Good	Excellent
B-23	Wilson Cr	Caldwell	off SR 1328	Excellent	Excellent
B-24	Smoky Cr	Burke	SR 1515	Good-Fair	Good
B-25	McGalliard Cr	Burke	SR 1538	Fair	Good-Fair
B-26	Gunpowder Cr	Caldwell	SR 1718	Good-Fair	Fair
B-27	Upper Little R	Caldwell	SR 1740	Good	Excellent
B-28	Middle Little R	Alexander	SR 1153	Fair	Good-Fair
B-29	Duck Cr	Alexander	NC 127	Good	Good
B-30	Lower Little R	Alexander	SR 1131	Good-Fair	Good-Fair
B-31	Muddy Fk	Alexander	SR 1313	Fair	Fair
B-32	Elk Shoal Cr	Alexander	SR 1605	Good-Fair	Good-Fair
B-33	Lyle Cr	Catawba	US 64-70	Good-Fair	Good-Fair
B-34	McLin Cr	Catawba	SR 1722	Good-Fair	Fair
B-35	McDowell Cr	Mecklenburg	SR 2128	Fair	Fair
B-36	Gar Cr	Mecklenburg	SR 2074	---	Good-Fair
B-37	Dutchmans Cr	Gaston	SR 1918	Good-Fair	Good-Fair
B-38	Killian Cr	Lincoln	SR 1511	Not Rated	Good-Fair
B-39	Crowders Cr	Gaston	SC 564	Fair	Good-Fair
F-1	Curtis Cr	McDowell	US 70	Excellent	Excellent
F-2	Crooked Cr	McDowell	SR 1135	Excellent	Good
F-3	Paddy Cr	Burke	NC 126	Good-Fair	Good-Fair
F-4	N Muddy Cr	McDowell	SR 1760	Good	Excellent
F-5	S Muddy Cr	McDowell	SR 1764	Good	Good
F-6	Silver Cr	Burke	SR 1149	Excellent	Good
F-7	Irish Cr	Burke	SR 1439	Fair (2003)	Excellent
F-8	Johns R	Caldwell	off SR 1367	---	Excellent
F-9	Gragg Pr	Caldwell	SR 1367	Excellent (1999)	Excellent
F-10	Mulberry Cr	Caldwell	NC 90	Excellent (1999)	Excellent
F-11	Smoky Cr	Burke	SR 1515	Excellent	Excellent
F-12	Drowning Cr	Burke	SR 1647	---	Good-Fair

[1]B = benthic macroinvertebrate monitoring sites; F = fish community monitoring sites.

Table CAT01.2 Continued.

Map#[1]	Waterbody	County	Location	2002	2007
F-13	Upper Little R	Caldwell	SR 1712	---	Good-Fair
F-14	Middle Little R	Alexander	SR 1002	Excellent	Good
F-15	Duck Cr	Alexander	NC 90	Good	Good
F-16	Lambert Fk	Alexander	SR 1317	---	Good-Fair
F-17	Muddy Fk	Alexander	SR 1313	---	Good-Fair (2004)
F-18	Glade Cr	Alexander	SR 1610	---	Excellent
F-19	Lyle Cr	Catawba	US 70	Good (1997)	Excellent (2004)
F-20	Buffalo Shoals Cr	Iredell	SR 1503	Excellent (1997)	Good
F-21	Leepers Cr	Lincoln	NC 73	Good	Good-Fair
F-22	Killian Cr	Lincoln	NC 73	Good-Fair	Good
F-23	Anderson Cr	Lincoln	SR 1383	Good	Good
F-24	Forney Cr	Lincoln	SR 1386	---	Fair
F-25	Long Cr	Mecklenburg	SR 2042	---	Good (2004)
F-26	Catawba Cr	Gaston	SR 2435	Fair	Poor
F-27	Crowders Cr	Gaston	SR 1131	---	Poor (2004)
F-28	Crowders Cr	Gaston	SR 1108	Fair	Fair
F-29	S Crowders Cr	Gaston	SR 1109	---	Good-Fair (2004)

[1]B = benthic macroinvertebrate monitoring sites; F = fish community monitoring sites.

fish/benthic sites the resulting bioclassifications were either the same or differed by one class at four sites. However, two sites resulted in classifications that differed by two classes: North Muddy Creek at SR 1760 in McDowell County received classifications of Good-Fair and Excellent following benthic and fish sampling respectively in 2007; Lyle Creek at US 64/70 received classifications of Good-Fair and Excellent following benthic sampling in 2007 and fish sampling in 2004.

Most fish and benthic sites on the mainstem of or tributaries to Catawba River upstream of Lake James reservoir received classifications of Good or Excellent following basinwide sampling in 2007, with sites closer to the headwaters receiving a classification of Excellent (benthic sites Catawba River at SR 1274, Curtis Creek at SR 1227, Buck Creek at NC 80, Little Buck Creek at SR 1436, and the fish site at Curtis Creek at US 70 all in McDowell County) and lower sites receiving Good (benthic sites Catawba River at SR 1234 and SR 1221, Mackey Creek at US 70, and fish result from the shared site Crooked Creek at SR 1135 all in McDowell County). The single exception is the benthic result from the shared site on Crooked Creek at SR 1135 in McDowell County which received a classification of Good-Fair; however, the site missed a classification of Good by the collection of a single additional EPT taxon. Also, most sites in the area either retained or improved on the classification received during the previous basinwide cycle, though both fish and benthic results in 2007 from the shared site on Crooked Creek at SR 1135 in McDowell County fell a category from 2002 results, from Excellent to Good for fish and Good to Good-Fair for benthos.

Classifications of fish and benthic sites on tributaries to Lake James reservoir following basinwide sampling in 2007 ranged from Good-Fair (lower benthic site on North Fork Catawba River at SR 1560 in McDowell County, fish site on Paddy Creek at NC 126 in Burke County, upper benthic site on Linville River at US 221 in Avery County) through Good (upper benthic site on North Fork Catawba River at SR 1573 in McDowell County) to Excellent (benthic site on Armstrong Creek off Armstrong Creek Road in McDowell County and the upper benthic site on Linville River at NC 126 in Burke County). Most sites in the area in 2007 retained the classification received in 2002. Exceptions were an increase in classification from Fair to Good-Fair for the lower benthic site on North Fork Catawba River at SR 1560 in McDowell County (an additional sample collected in 2003 from the site resulted in a classification of Good), and a decrease in classification from Good to Good-Fair for the upper benthic site on Linville River at US 221 in Avery County.

Streams in the Muddy Creek and Silver Creek catchments drain from the south into Catawba River between Lake James and Lake Rhodhiss reservoirs. Bioclassifications of basinwide sites in the area after sampling in 2007 ranged from Poor (benthic site on Corpening Creek [Youngs Fork] at SR 1819 in McDowell County), through Good-Fair (benthic result from shared site on North Muddy Creek at SR 1760 in McDowell County) and Good (benthic site on Silver Creek at SR 1127 in Burke County, fish site on Silver Creek at SR 1149 in Burke County, and results from both fish and benthos on the shared site on South Muddy Creek at SR 1764 in McDowell County) to Excellent (fish result from shared site on North Muddy Creek at SR 1760 in McDowell County). Most of the results in the two catchments after basinwide sampling in 2007 were either better than or remained the same as 2002 results. Exceptions were the benthic site on Corpening Creek (Youngs Fork) at SR 1819 in McDowell County, which fell a classification from Fair in 2002 to Poor in 2007, and the fish site on Silver Creek at SR 1149 in Burke County, which fell from Excellent in 2002 to Good in 2007. Reduced macroinvertebrate habitat due to lower than normal water levels at the Corpening Creek site is in part responsible for the decrease in bioclassification to Poor in 2007, though worsening water quality is also implicated by the benthic results. Low flows and the possibility of sediment inputs to the stream are implicated in the reduced classification of the fish site on Silver Creek to Good in 2007. There is a suggestion of worsening water quality in the results from benthic sampling at the shared fish/benthos site on North Muddy Creek at SR 1760 in McDowell County over the past three sampling events since 1997; however, fish results do not show such recent degradation, as illustrated by the increase in bioclassification from Good in 1997 and 2002 to Excellent in 2007.

Four basinwide sites in central Burke County are tributaries to, or on the mainstem of, Catawba River between Lake James and Lake Rhodhiss reservoirs. The benthic site on Catawba River at SR 1147 maintained its classification of Good from 2002 to 2007; water quality as reflected by the benthic community appears to be stable through four sampling events from 1988. The benthic site on Canoe Creek at SR 1250 slipped one classification, from Good in 2002 to Good-Fair in 2007, though the addition of a single EPT taxon would have brought the 2007 classification into Good. The benthic site on Warrior Fork at SR 1440 improved its classification from Good in 2002 to Excellent in 2007 (the same classification received in 1997). There was a remarkable improvement in the fish community in Irish Creek at SR 1439 exhibited by a jump in bioclassification from Fair in both 2002 and 2003 to Excellent in 2007; the reason for the improvement is unknown.

Six basinwide sites are present in the Johns River watershed, three fish (Johns River off SR 1367 in Caldwell County, Gragg Prong at SR 1367 in Caldwell County, and Mulberry Creek at NC 90 in Caldwell County) and three benthic (Wilson Creek off SR 1328 in Caldwell County and Johns River at SR 1356 in Caldwell County and at SR 1438 in Burke County). All six sites received bioclassifications of Excellent following basinwide sampling in 2007, and with one exception have received classifications of Excellent during every prior sampling event as well. The exception is the benthic sampling event on Johns River at SR 1438 in Burke County in August 2002, when the site missed a classification of Excellent by the collection of an additional EPT taxon. Much of the Johns River watershed receives protection from the presence of Pisgah National Forest.

Six basinwide sites are present in eastern Burke and Caldwell Counties, one of which is a shared fish/benthic site. The shared site on Smoky Creek at SR 1515 in Burke County has received bioclassifications of Excellent in 2002 and 2007 following fish sampling; benthic sampling produced a classification of Good-Fair in 2002 followed by Good in 2007 after the collection of an additional two EPT taxa in the latter year. Two other benthic sites improved by a single classification between sampling events in 2002 and 2007: McGalliard Creek at SR 1538 in Burke County improved from Fair to Good-Fair (an additional sample collected in 2003 also produced a classification of Fair); Upper Little River at SR 1740 in Caldwell County improved from Good to Excellent. The remaining benthic site in the area, Gunpowder Creek at SR 1718 in Caldwell County, fell in classification from Good-Fair in 2002 to Fair in 2007. The fish sites on Drowning Creek at SR 1647 in Burke County and Upper Little River at SR 1712 in Caldwell County were both sampled for the first time in 2007; both sites received bioclassifications of Good-Fair.

Four basinwide sites, two fish and two benthic, are within the Middle Little River catchment; Middle Little River is a tributary of Catawba River at Lake Hickory reservoir. The upper three sites all received bioclassifications of Good after sampling in 2007 (the benthic site on Duck Creek at NC 127 in Alexander County and the fish sites Duck Creek at NC 90 in Alexander County and Middle Little River at SR 1002 in Alexander County). The fish site on Middle Little River at SR 1002 fell from the 2002 classification of Excellent, returning to the Good it received in 1997. The benthic site on Middle Little River at SR 1153 in Alexander County, the lowermost site in the catchment, received a classification of Good-Fair in 2007 and 2003, up from the classification of Fair that it received in 2002; the benthic community at the site is more likely limited by lack of habitat for colonization than by water-borne pollutants.

There are four basinwide sites in the Lower Little River catchment in central Alexander County; one of the sites is a shared fish/benthic site. The fish site on Glade Creek at SR 1610 stands out from the other sites by the classification of Excellent it received in 2007; the site had not previously been sampled. The fish site on Lambert Fork at SR 1317 was sampled for the first time in 2007; the site received a classification of Good-Fair. The shared fish/benthic site on Muddy Fork at SR 1313 received a classification of Fair in 2007 for benthos with the number of EPT taxa collected taking a precipitous decline to eight taxa in 2007, down from 18 in 2003; the site was sampled for the first time in 2004 for fish and received a classification of Good-Fair. The benthic site on Lower Little River at SR 1131 received the same classification of Good-Fair in both 2007 and the prior sampling event in 2002.

The next three downriver catchments are Elk Shoal Creek (East Side), Lyle Creek, and Buffalo Shoals Creek. The benthic site on Elk Shoal Creek at SR 1605 in Alexander County has retained the same classification of Good-Fair after each 5-year sampling event since 1992; reduced habitat for macroinvertebrate colonization is implicated for low EPT richness at the site. Similarly for the shared fish/benthic site on Lyle Creek at US 64/70 in Catawba County, results from benthic sampling have produced a classification of Good-Fair after each 5-year sampling event since 1992; both reduced macroinvertebrate habitat and water-quality problems are implicated for limiting the benthic community. Fish results from the shared site on Lyle Creek improved to Excellent in 2004 from Good after two prior sampling events in 1993 and 1997. The benthic site on McLin Creek at SR 1722 in Catawba County dropped from the bioclassification of Good-Fair following basinwide sampling in 1997 and 2002 to Fair in 2007; both reduced habitat and water-borne stressors are implicated for impacts to the macroinvertebrate community. The fish site on Buffalo Shoals Creek at SR 1503 in Iredell County received a classification of Good in 2007; the site received an Excellent after the prior sampling event in 1997. The differences in the fish community between 1997 and 2007 at the Buffalo Shoals Creek site may be due to a combination of low flows in 2007 and the downstream reservoir, which inhibits recolonization.

Nine basinwide sites are in catchments that flow into the Catawba River at or directly below Mountain Island Lake. Three of the catchments drain from the east side of the river (McDowell Creek, Gar Creek, and Long Creek each with one basinwide site each), the other drains from the west (Dutchmans Creek with the remaining six sites). The benthic site on McDowell Creek at SR 2128 in Mecklenburg County has received a classification of Fair after sampling events in 2002 and 2007; the site received a rating of Good-Fair in 1990 and had more than double the number of EPT taxa collected than during the most recent sampling events at the site (17 in 1990, eight in both 2002 and 2007). The benthic site on Gar Creek at SR 2074 in Mecklenburg County slipped a classification level after sampling in 2007, from Good in 1992, 1994, and 1997 to Good-Fair in 2007. A basinwide fish site was established on Long Creek at SR 2042 in Mecklenburg County and sampled in 2004; the site received a classification of Good. Results of the most recent basinwide sampling in the Dutchmans Creek catchment ranged from Fair (fish site on Forney Creek at SR 1386 in Lincoln County) through Good-Fair (fish site on Leepers Creek at NC 73 in Lincoln County and benthic sites on Killian Creek at SR 1511 in Lincoln County and Dutchmans Creek at SR 1918 in Gaston County) to Good (fish sites on Killian Creek at NC 73 in Lincoln County and Anderson Creek at SR 1383 in Lincoln County). Between sampling events the fish

site on Leepers Creek has declined in classification from Excellent in 1993 to Good in 1997 and to the Good-Fair it received in 2007; within the fish community the changes are mostly due to the loss of intolerant species of darters.

Waters from the Catawba Creek and Crowders Creek catchments are received by Lake Wylie. The fish site on Catawba Creek at SR 2435 in Gaston County has declined in classification from Good-Fair in 1997 through Fair in 2002 to Poor in 2007; the stream drains a portion of the city of Gastonia. The upper fish site on Crowders Creek at SR 1131 in Gaston County received a classification of Poor after its first sampling event in 2004; the site is bordered by a golf course and has no riparian zone or canopy. The downstream fish site on Crowders Creek at SR 1108 in Gaston County has received classifications of Fair after each sampling event in 1997, 2002, and 2007. The lowermost basinwide site on Crowders Creek is the benthic site at SC 564 in York County, SC; in 2007 the site received a bioclassification of Good-Fair. The site on South Fork Crowders Creek at SR 1109 in Gaston County received a Good-Fair after it was sampled for the first time for fish in 2004.

Two sites in the HUC changed by more than one bioclassification level: the benthic site on Catawba River at SR 1274 in McDowell County improved from Good-Fair in 2002 to Excellent in 2007; and the fish site on Irish Creek at SR 1439 in Burke County improved from Fair in 2003 to Excellent in 2007. For the remaining sites that changed classification between sampling events the increases exceeded the decreases by five instances.

Four of the basinwide sites sampled in 2007 were classified as Fair and are not located on stream segments on the final 303(d) impaired waters list for 2006: 1) the benthic site on Gunpowder Creek at SR 1718 in Caldwell County, AU number 11-55-(1.5); 2) the benthic site on Muddy Fork at SR 1313 in Alexander County, AU number 11-69-4 (the site was sampled for fish for the first time in 2004 and received a classification of Good-Fair); 3) the benthic site on McLin Creek at SR 1722 in Catawba County, AU number 11-76-5-(3); 4) the fish site on Forney Creek at SR 1386 in Lincoln County, AU number 11-119-2-3.

River and Stream Assessment

Catawba River at NC 181 in Burke County was not sampled for macroinvertebrates due to poor timing with regard to upstream releases from Lake James reservoir; flows were too high both times the site was visited with a field crew and also too turbid during the second visit.

Due to the small size of the site on Mackey Creek at SR 1453 in McDowell County, the benthic basinwide site was moved downstream to the road crossing at US 70. Both sites had been sampled during the 2002 basinwide cycle.

The benthic site on Lower Creek at SR 1501 in Burke County was too deep for wading directly upstream and downstream of the road crossing (possibly due to dredging since the last basinwide visit). The site had been sampled upstream of the road crossing previously; upstream of the deep pooled section a riffle could be seen, but steep vertical banks and signs marked “no trespassing” made the riffle inaccessible.

Site specific summaries of the 39 benthic macroinvertebrate and 29 fish community basinwide sampling events may be found at this link: **03050101**.

Special Studies

Killian Creek

The benthic basinwide site at SR 1511 in Lincoln County was selected as part of a study of the effects of the low rainfall years between 1999 and 2002 on streams in Catawba, Neuse and Cape Fear basins (BAU memorandum B-20040823). Sampling events at the site on Killian Creek in August 1997, August 2002, and February 2003 were considered in the study; EPT richness for

those events were 24, 12, and 15 and resultant bioclassifications were reported as Good, Fair, and Good-Fair respectively. However, because the February 2003 sample was part of the drought recovery study, the classification for the sample should be Not Rated.

Wilson Creek
In April 2003 a sample was collected from the basinwide site established in 2002 off SR 1328 in Caldwell County to observe differences in the benthic community between spring and summer seasons. The site received the same bioclassification of Excellent as it did in the 2002 and 2007 basinwide sampling events. A memorandum was not prepared to report the results of the spring sample.

Leepers Creek, 2003
The benthic sample from SR 1354 in Lincoln County in June 2003 may have been collected for the drought study cited above for Killian Creek, though the results were not included in the report. The EPT sample resulted in 24 EPT taxa and a bioclassification of Good.

Follow-up Benthic Sampling of Potential 303(d)-listed Streams
Four of the basinwide sites in the HUC received bioclassifications of Fair following benthic sampling for the previous basin cycle in 2002: North Fork Catawba River at SR 1560 in McDowell County; McGalliard Creek at SR 1538 in Burke County; Middle Little River at SR 1153 in Alexander County; and Muddy Fork at SR 1313 in Alexander County. Of the four, only the site on McGalliard Creek retained the classification of Fair after a second round of sampling in August 2003 (BAU memorandum B-20030919); the other three sites improved to either Good-Fair or Good.

Greasy and Lower Creeks
Following a TMDL study in 2002 that included Greasy and Lower Creeks (BAU memorandum B-20030319), additional benthic sampling was done in 2004 at three sites on those two creeks to help assess the possible effects of drought on the results (DWQ Watershed Assessment Team Technical Brief, 21 December 2004). The site on Lower Creek and the upper site on Greasy Creek both showed significant improvements in the benthic community between the 2002 and 2004 sampling events, suggesting the possibility of drought effects. The lower site on Greasy Creek did not show such improvement; low habitat quality and possible water-quality impacts are implicated for the low resilience of the benthic community at the site.

UT Double Branch
The site off SR 1964 in Burke County was collected as a Wadeable Streams Assessment sample in August 2004; a second comparative sample was collected using EPA methods at the same time. The small drainage area at the site precluded the assignment of a formal bioclassification using North Carolina criteria; therefore the site is described as Not Impaired. The results for this sampling event have not been presented in a prior report.

Small Streams Study
As part of the process to gather data for the development of criteria for the assessment of stream-sites draining catchments of less than 3 square miles, the following sites within the Catawba Headwaters were sampled (several sites were sampled more than once):

Waterbody	Location	County	Index No.
Singecat Br	NC 80	McDowell	11-19-2
Reedy Br	NC 80	McDowell	11-19-8
Laurel Br	US 221	McDowell	11-24-3
Pepper Cr	SR 1586	McDowell	11-24-10
Bee Rock Cr	SR 1443	McDowell	11-24-14-2
Cow Cr	SR 1443	McDowell	11-24-14-3
Roses Cr	SR 1443	McDowell	11-24-14-6
Buchanan Cr	NC 226	McDowell	11-24-14-10-1

Bartlett Cr	NC 226	McDowell	11-24-14-10-3-1
UT Lower Little R	SR 1307	Alexander	
Lambert Fk	SR 1305	Alexander	11-69-3
Poplar Cr	SR 1305	Alexander	11-69-3-1

Final small-stream criteria are pending.

Leepers Creek, 2006
A sample was collected at SR 1354 in Lincoln County in May 2006 as a reference for a TMDL study in the adjacent Yadkin River basin. The site received a bioclassification of Good.

Abernethy Creek
At the request of the Mooresville Regional Office, a site on Abernethy Creek upstream of US 29/74 was collected in June 2007 for benthic invertebrates (BAU memorandum B-20070727). The site is the most downstream of six sites in the Abernethy Creek catchment that have been sampled for benthos, and is downstream of the former Bessemer City WWTP outfall. The prior sampling event at the site in 1989 resulted in a bioclassification of Poor. The resultant classification of Good-Fair for the 2007 sampling event is an indication of better water quality at the site.

Special Requests for Catawba River subbasin 32
Three stream sites in the subbasin were sampled for benthic invertebrates in June 2007 at the request of Mooresville Regional Office (BAU memorandum B-20071005a). The purpose for the request was to obtain baseline data for the previously unsampled streams. The results from sampling the sites on Buffalo Shoals Creek, Snow Creek, and Falling Creek showed a trend of increasing impairment with greater proportions of urbanization; resultant bioclassifications were Good, Good-Fair, and Fair respectively.

Special Requests for Catawba River subbasins 30 and 31
Two stream sites in subbasin 30 and one stream site in subbasin 31 were sampled in June 2007 for benthic invertebrates at the request of Asheville Regional Office (BAU memorandum B-20071005b). Left Prong Catawba River off SR 1274 in McDowell County was requested to help assess the impacts from the construction of two large developments upstream. Mulberry Creek at SR 1310 in Caldwell County was sampled to supplement historical benthic data from the site, which was last sampled in 1989. Muddy Creek at US 70 in Burke County was requested to assess water quality near the confluence of the stream with Catawba River; Muddy Creek has been subjected to many stream-improvement projects. Bioclassifications resulting from sampling of the sites in 2007 were Excellent for the sites on Left Prong Catawba River and Mulberry Creek, and Good-Fair for the site on Muddy Creek.

HQW/ORW Reclassification Study
The following stream sites were specifically sampled for benthic invertebrates in October 2007 (except the site on Dales Creek, which was sampled in June 2007) following a request by Asheville Regional Office to assist with an effort to reclassify the streams as either High-Quality Waters or Outstanding Resource Waters (BAU memorandum B-20080205):

Waterbody	Location	County	Index No.
N Fk Catawba R	Linville Caverns	McDowell	11-24-(1)
Honeycutt Cr	SR 1568	McDowell	11-24-8
Pepper Cr	US 221	McDowell	11-24-10
Bailey Cr	SR 1552	McDowell	11-26
Dales Cr	Lake James Rd	McDowell	11-27
UT Lake James	SR 1552	McDowell	
White Cr	NC 126	Burke	11-30
Johns R	off SR 1367	Caldwell	11-38-(1)
Thunderhole Cr	SR 1367	Caldwell	11-38-5
Anthony Cr	SR 1362	Caldwell	11-38-10-3
Sally Cr	off SR 1356	Caldwell	11-38-29-1
Franklin Br	off NC 90	Caldwell	11-38-31
L Mulberry Cr	SR 1368	Caldwell	11-38-32-17
L Mulberry Cr	NC 90	Caldwell	11-38-32-18
Parks Cr	SR 1424	Burke	11-38-35

The following benthic sites were sampled previously either for basinwide sampling or for other special studies and were also included in the reclassification study:

Waterbody	Location	County	Index No.
Catawba R	SR 1274	McDowell	11-(1)
L Pr Catawba R	off SR 1274	McDowell	11-6
Crooked Cr	SR 1135	McDowell	11-12
Silver Cr	SR 1127	Burke	11-34-(0.5)
Johns R	SR 1356	Caldwell	11-38-(28)
Mulberry Cr	SR 1310	Caldwell	11-38-32-(15)

As a result of bioclassifications of Excellent after benthic sampling at the following sites, the stream segment including each site and in many cases the upstream tributaries qualified for HQW or ORW status:

Waterbody	Location	County	Index No.
Catawba R	SR 1274	McDowell	11-(1)
L Pr Catawba R	off SR 1274	McDowell	11-6
Dales Cr	Lake James Rd	McDowell	11-27
Johns R	off SR 1367	Caldwell	11-38-(1)
Johns R	SR 1356	Caldwell	11-38-(28)
Sally Cr	off SR 1356	Caldwell	11-38-29-1
Mulberry Cr	SR 1310	Caldwell	11-38-32-(15)

Overlap Sampling
Three basinwide sites were selected for additional benthic sampling to help assess the repeatability of BAU collection and assessment methods (BAU memorandum B-20080124): Linville River at NC 126 in Burke County; Canoe Creek at SR 1250 in Burke County; and Catawba River at SR 1274 in McDowell County. The site on Linville River produced bioclassifications of Good and Excellent, though both bioclassifications were near the borderline and the metrics were similar.

Three weeks separated the first and second sampling events at the sites on Canoe Creek and Catawba River; in both cases the second sampling event produced the next lower bioclassification and community metrics between sampling events were dissimilar. The increasing effects from drought are implicated; streamflow at both sites were markedly lower during the second sampling event, reducing macroinvertebrate habitat.

Follow-up Fish Community Sampling of Potential 303(d)-listed Streams
Four fish sites in the HUC that received bioclassifications of Fair following basinwide sampling in 2002 were sampled again in 2003 (BAU memorandum F-20030925). The site on Lower Little River at SR 1318 in Alexander County improved its bioclassification to Good-Fair after sampling in 2003. Two sites retained the bioclassification of Fair: Irish Creek at SR 1439 in Burke County, and Hunting Creek at SR 1512 in Burke County. The site on McGalliard Creek at SR 1538 in Burke County received a classification of Poor after fish sampling in 2003.

Little River
A site on Little River off SR 1900 in Burke County was sampled for fish as part of the Environmental Sciences Section's Probabilistic Random Ambient Monitoring Program. The site received a bioclassification of Good after sampling in March 2007. The report on the results of all probabilistic monitoring of fish communities across the state is pending.

CATAWBA RIVER HUC 03050102 – SOUTH FORK CATAWBA

Description

The South Fork Catawba River HUC 03050102 contains two subbasins and four adjacent level IV ecoregions (Griffith *et al* 2002). Subbasin 030835 embodies the majority of the HUC including the headwater watersheds of Henry and Jacob Forks, which lie in the Eastern Blue Ridge Foothills ecoregion. The South Fork Catawba River originates at the confluence of these upper catchments in the western part of Catawba County, just below the town of Hickory (Figure CTB02). The other major tributaries in this subbasin include Potts, Howards, Clark, Indian, Beaverdam, and Hoyle Creeks, which occur in the Northern Inner and Southern Outer Piedmont ecoregions. Subbasin 030836 is located entirely within Gaston County in the southernmost part of the HUC, and includes the Long Creek and Duharts Creek watersheds, and the western arm of Lake Wylie. Notwithstanding a small portion of the Kings Mountain level IV ecoregion that protrudes into the lower part of the HUC, the majority of subbasin 030836 lies within the Southern Outer Piedmont ecoregion.

The headwater portions of the Henry Fork and Jacob Fork watersheds have been supplementally classified to Outstanding Resource Waters. South Mountain State Park embodies the upstream portions of these forested streams.

Land use in this HUC is largely forest, but there is also a considerable amount of land in pasture, mostly within subbasin 35. The major municipal areas that lie within this HUC include Hickory, Newton, Lincolnton, Gastonia, and Belmont. There are 11 major NPDES facilities operating in this HUC, with a total discharge of nearly 60 MGD. The largest of these dischargers are municipal WWTPs that serve Hickory (9 MGD to Henry Fork), Newton (7.5 MGD to Clarks Creek), Lincolnton (6 MGD to the South Fork Catawba River), Gastonia (16 MGD to Long Creek), and Cramerton (4 MGD to the South Fork Catawba River). There are also about 20 other minor NPDES dischargers in this HUC with discharges of less than 1 MGD.

Overview of Water Quality

Fourteen benthic macroinvertebrate and fish community samples were collected from twelve South Fork Catawba River tributaries during the 2007 basinwide assessment cycle (Table CTB02). Bioclassifications and instream and riparian habitats were of high quality (Excellent or Good) in the upper reaches of Henry and Jacob Forks, which are largely forested. The Henry Fork site is the only fish community regional reference site in this 8 digit HUC. Moving downstream through the HUC, urban and agricultural land uses become evident among bioclassifications and habitat scores. The largely agricultural Pott Creek watershed appeared to suffer from hurricane flow scouring at the fish community site, and declined by two bioclassifications to Fair. However, the adjacent Howards Creek catchment received ratings of Good for both benthic macroinvertebrates and fish. The only Poor bioclassification in the HUC was incurred by the Clark Creek fish community site, located about 1.5 miles below the Newton WWTP. In addition to high conductivity water, an indication of nutrient enrichment, cattle access and urban debris are also impacting this watershed. Further downstream towards the South Fork Catawba River and the City of Lincolnton, the Clark Creek benthic macroinvertebrate site received its second consecutive Fair rating.

The Indian Creek watershed in western Lincoln County has been sampled at the same location for benthic macroinvertebrates and fish during three basinwide cycles. Although the fish community has earned three consecutive bioclassifications of Fair because of consistently low diversities and limited avenues for recolonization (due to an impoundment), the benthos rating has maintained a bioclassification of Good at this site. Just one catchment away, the total number of fish species in Beaverdam Creek increased by five during its second sample, and the site improved by one rating to Excellent. However, the Hoyle Creek watershed continues to decline in rating based on its fish community, presumably because of flow extremes. Long Creek

also shares a benthic and fish community station, and is the only site located in subbasin 36. Although not sampled in the last cycle due to low flows, this watershed has received three consecutive Good-Fair benthic macroinvertebrate ratings, and a first fish community bioclassification of Excellent.

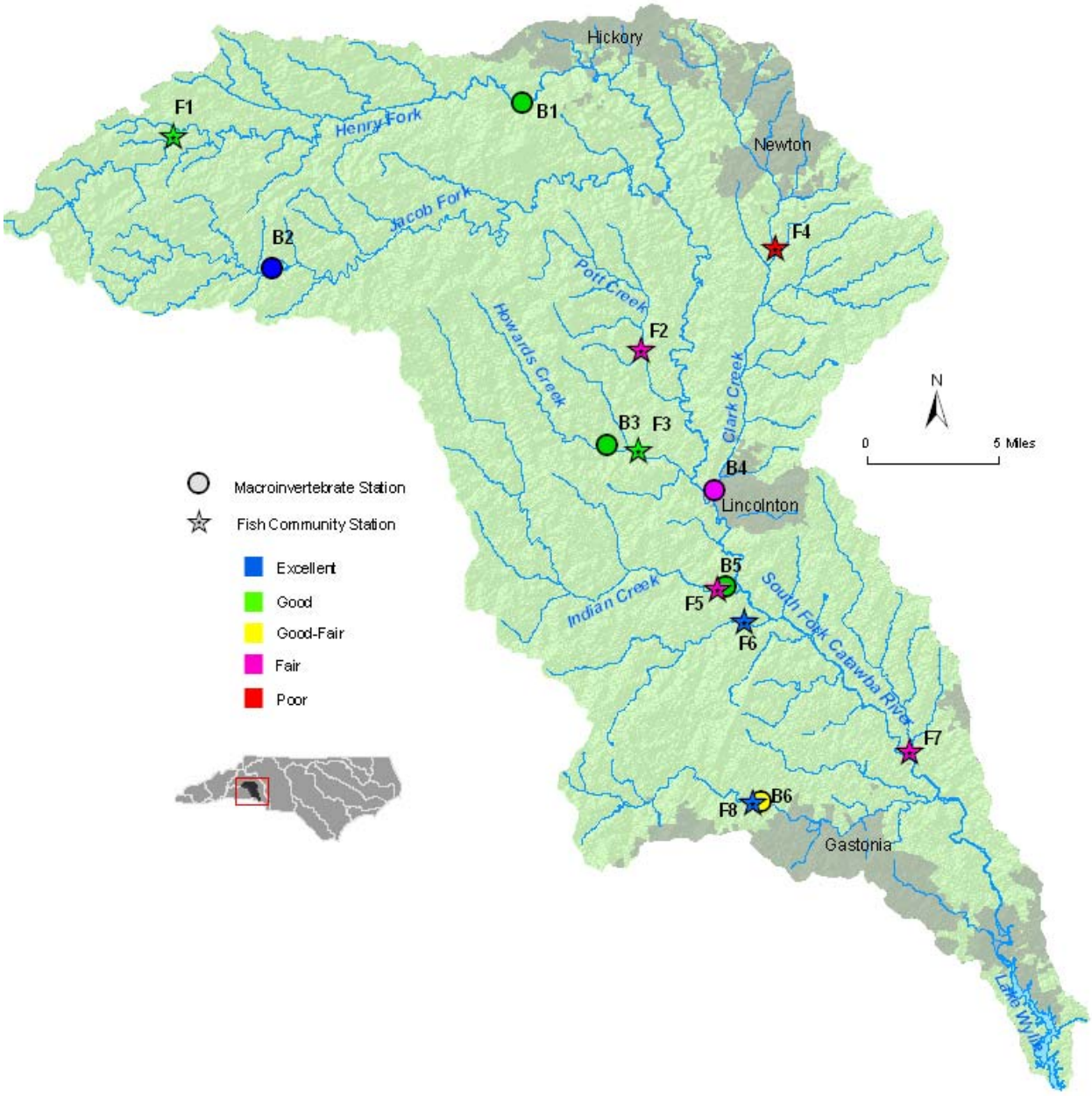


Figure CTB02. Sampling sites in South Fork Catawba River HUC 03050102 in the Catawba River Basin.

Table CTB02. Waterbodies monitored in HUC 03050102 in the Catawba River Basin for basinwide assessment, 2002 and 2007.

Map #[1]	Waterbody	County	Location	2002	2007
B-1	Henry Fk	Catawba	SR 1124	Good	Good (2006)
B-2	Jacob Fk	Burke	SR 1924	Good	Excellent (2006)
B-3	Howards Cr	Lincoln	SR 1200	Good-Fair	Good (2006)
B-4	Clark Cr	Lincoln	SR 1008	Fair	Fair
B-5	Indian Cr	Lincoln	SR 1252	Not Rated	Good (2006)
B-6	Long Cr	Gaston	SR 1456	---	Good-Fair
F-1	Henry Fk	Burke	SR 1922	---	Good
F-2	Pott Cr	Lincoln	SR 1217	Good	Fair (2006)
F-3	Howards Cr	Lincoln	SR 1185	---	Good
F-4	Clark Cr	Catawba	SR 2012	---	Poor (2004)
F-5	Indian Cr	Lincoln	SR 1252	Fair	Fair (2006)
F-6	Beaverdam Cr	Gaston	SR 1609	Good	Excellent (2006)
F-7	Hoyle Cr	Gaston	SR 1836	Good-Fair	Fair (2006)
F-8	Long Cr	Gaston	SR 1456	---	Excellent (2004)

[1]B = benthic macroinvertebrate monitoring sites; F = fish community monitoring sites.

River and Stream Assessment

Specific site summaries of the 14 benthic macroinvertebrate and fish community samples may be found at this link: **03050102.** No benthic macroinvertebrate samples were collected from the South Fork Catawba River at NC 10 or at NC 7; despite having low flows, those basinwide sites were too turbid to sample.

Special Studies

Jacob Fork at NC 127, Catawba County

A benthic macroinvertebrate sample for Jacob Fork was requested by the DWQ Planning Section and the Mooresville Regional Office because there were no existing benthic data in its lower reaches (Biological Assessment Unit Memorandum B-20070727). The site was relocated from the requested station at SR 1008 due to a sand dipping operation at that location. The site characteristics included a natural, but fairly straight channel with frequent riffles and pools of various sizes, and a good variety of substrates and instream habitats. The total habitat score was 73. Previous benthic samples in the upstream reaches of this watershed, including three sites within the South Mountains State Park, have been rated Excellent (n=5) or Good (n=1). The 2007 site at NC 127 was also rated Good.

Long Creek at NC 275, Gaston County

The DWQ Mooresville Regional Office requested that the Long Creek watershed be sampled for benthic macroinvertebrates to gauge the impacts of new development and a recently completed ag-based restoration project in the watershed (Biological Assessment Unit Memorandum B-20070727). This site was sampled annually using full-scale methods for the years 1991 through 1995 as part of a study to assess the results of BMPs initiated for the watershed. From 1991 through 1993, the site was rated Good-Fair. In the years 1994 and 1995 the bioclassification improved to Good, and in this latest survey, the site returned to Good-Fair. EPT richness was lower in 2007 than in 1995, yet still higher than the 1991 through 1994 samples.

TMDL sampling of the South Fork Catawba River 8-digit HUC 03050102

A total of 18 sites (14 benthos and 4 fish community) were sampled in 2006 to assist the TMDL/Modeling Unit with the development of modeling targets for impaired waters in the South

Fork Catawba River 8-digit HUC (Biological Assessment Unit Memorandum B-F-20061207). Biological assessments of the current basinwide stations included in this study (4 benthos and 4 fish community) can also be located above as site templates. The general trend of habitat assessments and bioclassifications for these watersheds includes higher scores in the headwater reaches of the HUC, especially in the Henry and Jacob Fork watersheds, followed by more moderate habitat scores and Good to Fair ratings in the lower segments of the HUC.

CATAWBA RIVER HUC 03050103 – CATAWBA RIVER

Description

The Catawba River 8 digit HUC 03050103 contains the Catawba River subbasins 34 and 38 (Figure CTB03). Streams of this small HUC are located mainly within Mecklenburg and Union Counties and drain the southern and southwestern portion of Charlotte then flow south into South Carolina.

Subbasin 34 is entirely within the Southern Outer Piedmont ecoregion and contains the Sugar Creek watershed, a portion of Lake Wylie, and much of the city of Charlotte's metropolitan area. Land use is mainly urban. Irwin Creek and Little Sugar Creek, tributaries of Sugar Creek, are on the state's 303(d) impaired streams list due to impaired biological integrity and standard Fecal Coliform violations.

Subbasin 38 includes portions of the Southern Outer Piedmont and the Carolina Slate Belt. Twelvemile and Waxhaw Creeks are the only basinwide sites in this HUC that are located in the Carolina Slate Belt ecoregion. These streams tend to have very low flows during the summer and may stop flowing during drought periods. Land use is mainly forest and cultivated agriculture. Sixmile Creek, a tributary to the Catawba River, is on the state's 303(d) impaired streams list due to impaired biological integrity.

There are over 45 major and minor dischargers in this HUC of which several have permitted flows > 1 MGD. The facilities that have permitted flows > 1 MGD mainly discharge to the Catawba River and Irwin, Little Sugar, Sugar, and Twelvemile Creeks.

Overview of Water Quality

Poor habitat, large WWTP discharges, nonpoint source and urban runoff are major sources of water quality degradation in this HUC. Many of the streams in this HUC have moderate to severe bank erosion, and are suffering from lower than normal flows. During benthos sampling most of the streams were slightly turbid. Table CTB03 presents the waterbodies monitored in HUC 03050103 for benthos and fish basinwide assessment in 2007. Figure XX presents the sites monitored for benthos and fish in 2007, depicting the bioclassification calculated for each location.

Two sites were sampled for benthic macroinvertebrates in this HUC in 2007. All the streams sampled for benthos were classified using Piedmont criteria. Both sites (Little Sugar Creek at NC 51 and Sugar Creek at SR 1156) showed improved bioclassifications compared with 2002 sampling. Both sites improved to Fair.

Seven sites were sampled to evaluate fish populations. Two sites (Little Sugar Creek at NC 51 and Waxhaw Creek at SR 1103) showed degraded classification compared to 2002. Little Sugar Creek dropped from Good-Fair to Fair and Waxhaw Creek dropped from Excellent to Good. Five additional fish sites were added as basinwide sites: Irwin Creek off US 21, McAlpine Creek at NC 51, McMullen Creek off NC 51, East Fork Twelvemile Creek at SR 1008 and West Fork Twelvemile Creek at SR 1321.

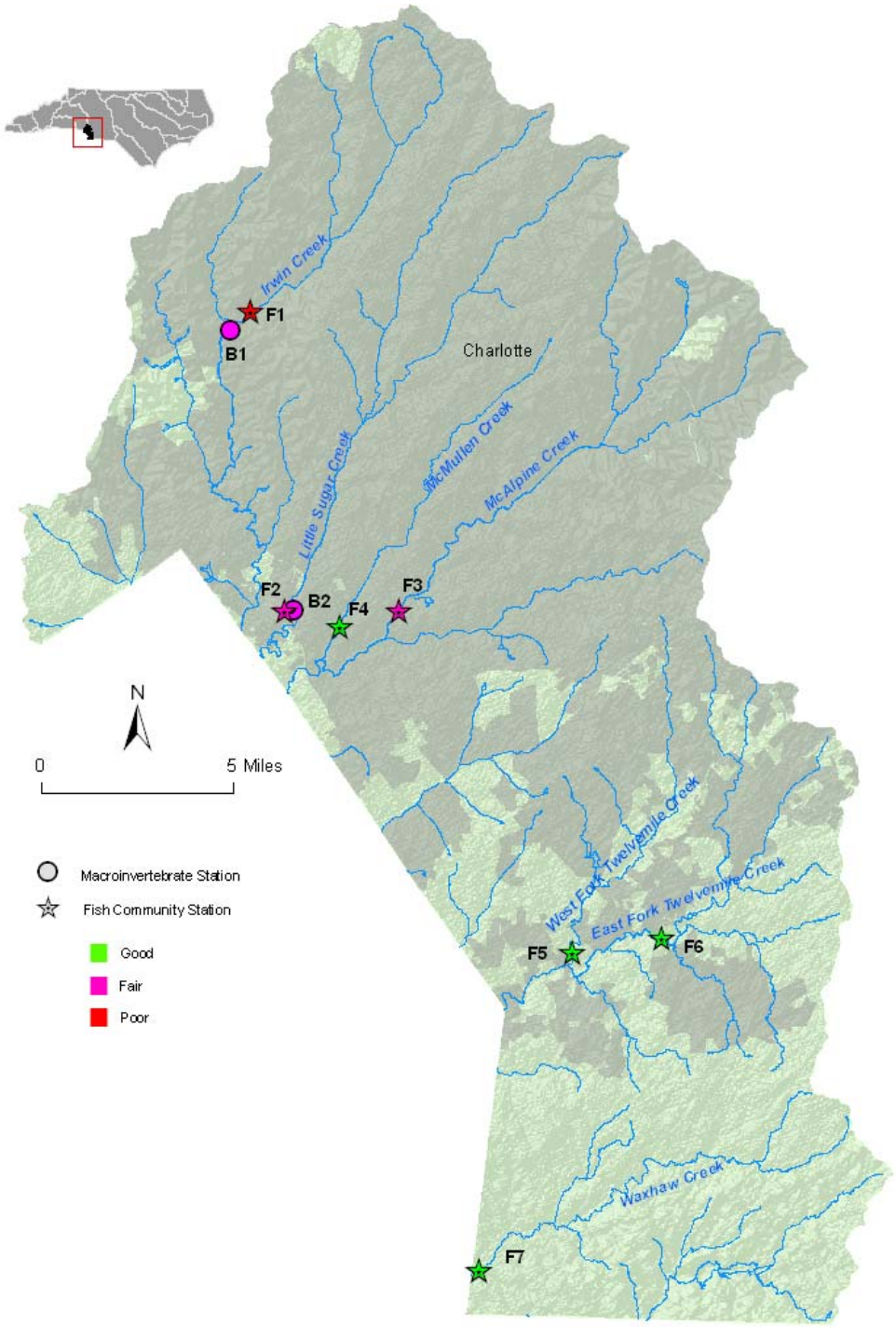


Figure CTB03. Sampling sites in HUC 03050103 in the Catawba River basin. Monitoring sites are listed in Table CTB03.

Table CTB03. Waterbodies monitored in HUC 03050103 in the Catawba River Basin for basinwide assessment, 2002 and 2007.

Map #[1]	Waterbody	County	Location	2002	2007
B-1	Sugar Cr	Mecklenburg	SR 1156	Poor	Fair
B-2	Little Sugar Cr	Mecklenburg	NC 51	Poor	Fair
F-1	Irwin Cr	Mecklenburg	Off US 521	---	Poor (2004)
F-2	Little Sugar Cr	Mecklenburg	NC 51	---	Fair
F-3	McAlpine Cr	Mecklenburg	NC 51	---	Fair (2004)
F-4	McMullen Cr	Mecklenburg	Off NC 51	---	Good
F-5	W Fk Twelvemile Cr	Union	SR 1321	---	Good
F-6	E Fk Twelvemile Cr	Union	SR 1008	---	Good
F-7	Waxhaw Cr	Union	SR 1103	---	Good

[1]B = benthic macroinvertebrate monitoring sites; F = fish community monitoring sites.

River and Stream Assessment

In 2002, Little Sugar Creek and Waxhaw Creek were not sampled for fish and Waxhaw Creek and McAlpine Creek were not sampled for macroinvertebrates due to low flows in 2002 and 2007. Sugar Creek at SC 160 was not sampled due to high flows. Four new fish basinwide sites were added in 2007. Two fish kills occurred in this subbasin during 2007; one in Stewarts Creek and one in Little Sugar Creek. Site specific summaries for the 9 benthic macroinvertebrate and fish community samples can be found at this link: **03050103.**

GLOSSARY

$7Q_{10}$	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. $7Q_{10}$ flow (in cfs) is used to allocate the discharge of toxic substances to streams.
Bioclass or Bioclassification	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, 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, vegetation, and soil type. Examples include Mountains, Piedmont, Coastal Plain, Sand Hills, and Carolina 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 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.
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).

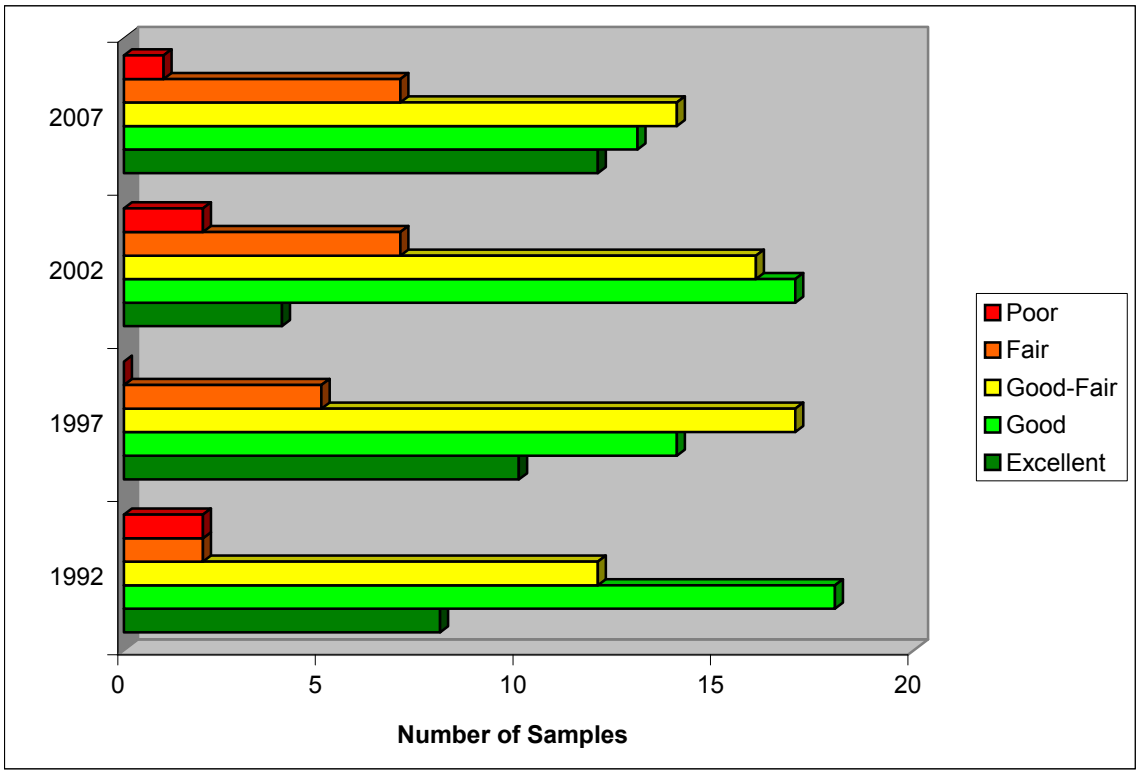
NPDES	National Pollutant Discharge Elimination System.
NCBI (EPT BI)	North Carolina Biotic Index, EPT Biotic Index. A summary measure of the tolerance values of organisms found in the sample, relative to their abundance. Sometimes noted as the NCBI or EPT BI.
NCIBI	North Carolina Index of Biotic Integrity (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.
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.
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 are 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 B-1. Summary of benthic macroinvertebrate data, sampling methods and criteria.

Overall Catawba River Basin Summary:

For 2007, 47 long-term benthic macroinvertebrate samples were sampled in the Catawba River Basin as part of the Basinwide Assessment program. Graphical representations of bioclassification trends from 2007-1992 among these long-term basinwide benthos sites for the entire Catawba River basin (Figure B-1.1 as well as for each of the HUCS (Figures B-1.2, B-1.8, B-1.11) and subbasins (Figures B-1.3, B-1.4, B-1.5, B-1.6, B-1.7, B-1.9) can be found below. As can be seen from this data, the 2007 benthic macroinvertebrate community bioclassifications have generally improved from previous levels. In some of these instances, the improvement may be attributable to drought and this trend was most pronounced in areas of the basin where point source dischargers were rare and where the largest potential source of stress to aquatic invertebrate communities were due to nonpoint sources. In general, during droughts, invertebrate communities below large point source dischargers tend to become less diverse and more pollution tolerant in composition as effluent is concentrated as a result of lowered precipitation and groundwater inputs. Conversely, during drought conditions, less runoff from nonpoint sources is introduced from land into waterbodies and this typically results in the development of a more diverse, and less pollution tolerant invertebrate community.

Figure B-1.1. Catawba River Basin Bioclassification Trends: (2007-1992).



HUC 03050101 (Catawba River Headwaters) Summary

The bioclassification trends for all of HUC 03050101 from 2007-1992 can be seen below (Figure B-1.2). Much of this HUC is comprised of a mix of forest and agriculture with limited impacts associated with large point source dischargers. As a result, many sites improved in bioclassification from earlier samples. The one notable exception was Corpening Creek, which received a Poor bioclassification in 2007 for the first time. In 2007, several sites received an Excellent bioclassification for the first time in their respective sampling histories and included the following streams: Catawba River (SR 1274), Curtis Creek (SR 1227) and Upper Little River (SR 1740). Sites that improved from Good-Fair in 1992, 1997, and 2002 to Good in 2007 included South Muddy Creek (SR 1764) and Silver Creek (SR 1149/SR 1127).

Figure B-1.2. **Catawba River Basin HUC 03050101 (Subbasins 30, 31, 32, 33, & 37): Bioclassification Trends (2007-1992)**

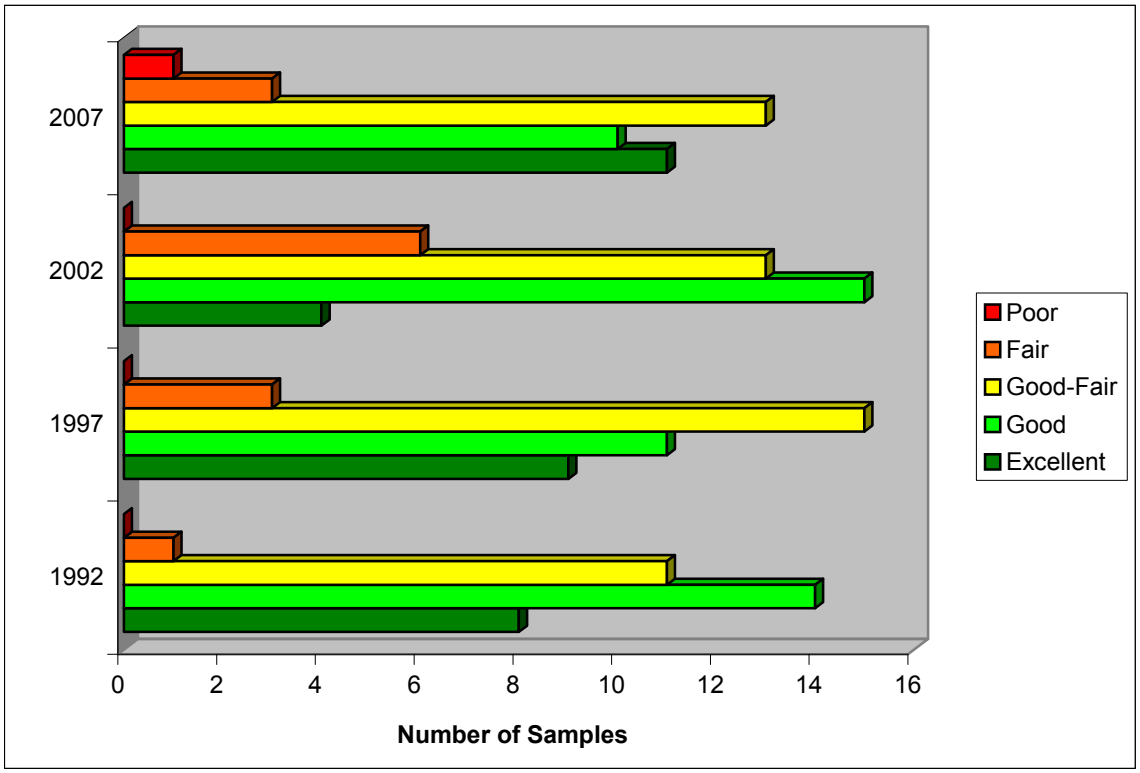


Figure B-1.3. Catawba River Subbasin 30 (HUC 03050101): Bioclassification Trends (2007-1992)

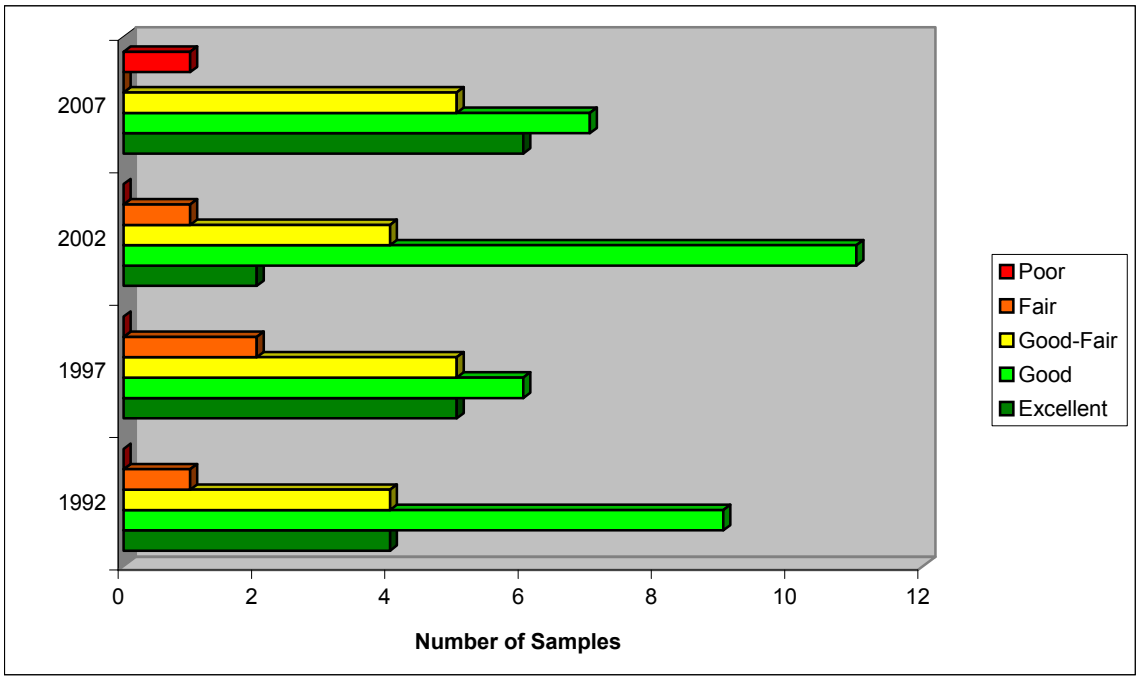


Figure B-1.4. Catawba River Subbasin 31 (HUC 04050101): Bioclassification Trends (2007-1992)

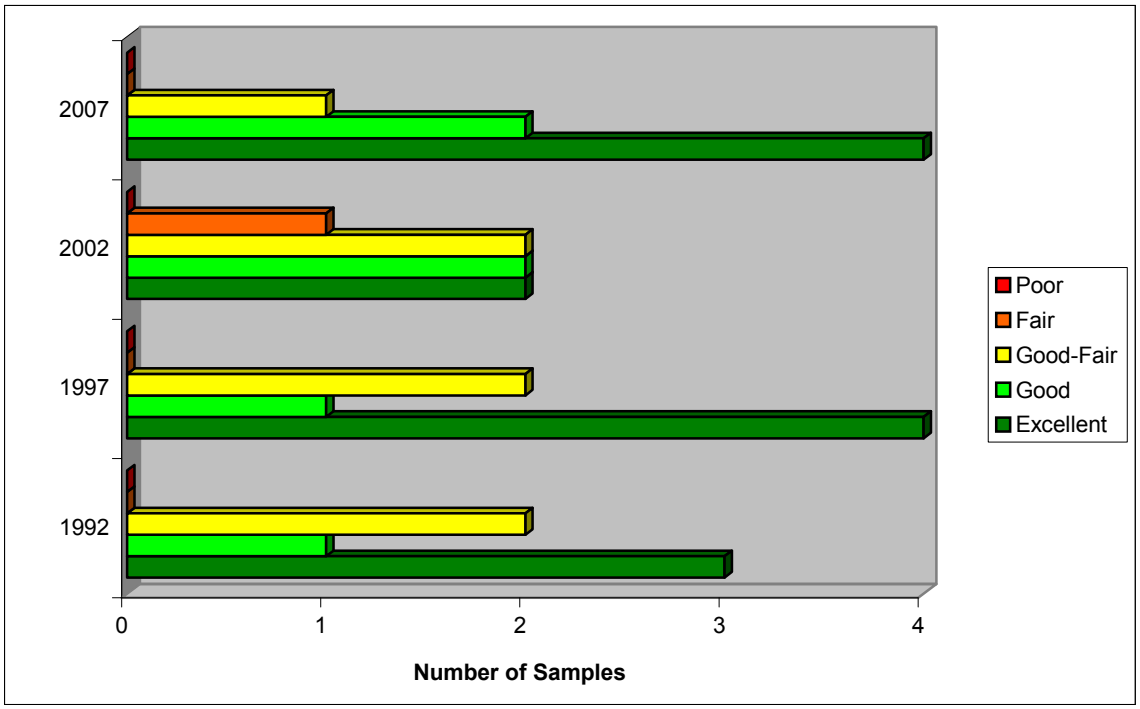


Figure B-1.5. Catawba River Subbasin 32 (HUC 03050101): Bioclassification Trends (2007-1992)

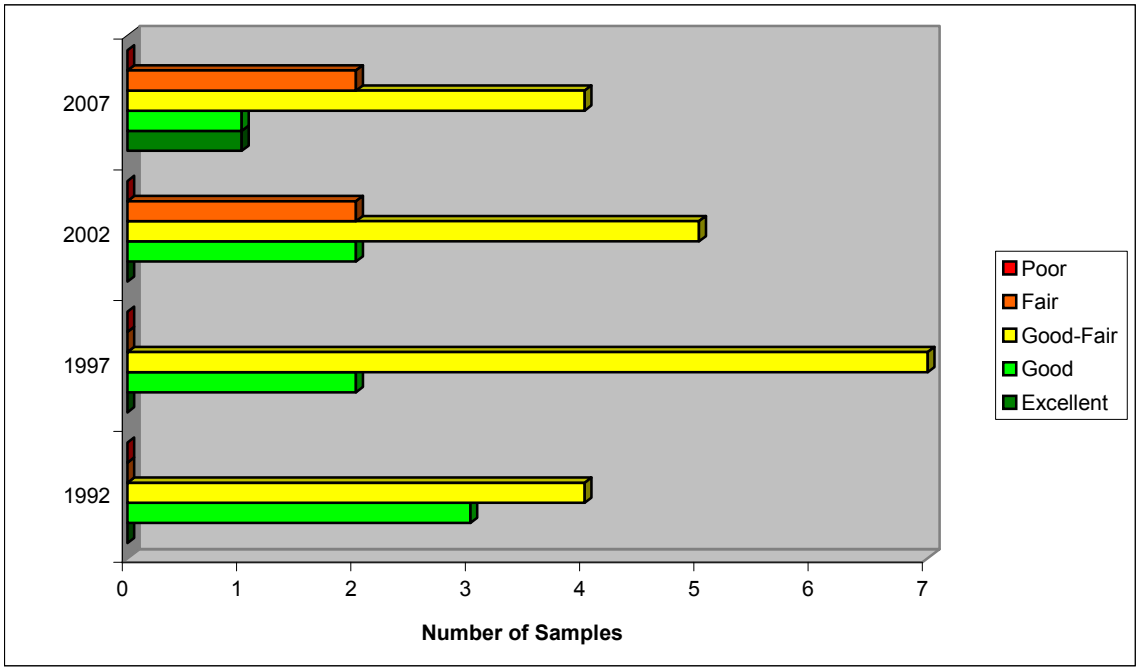


Figure B-1.6. Catawba River Subbasin 33 (HUC 03050101): Bioclassification Trends (2007-1992)

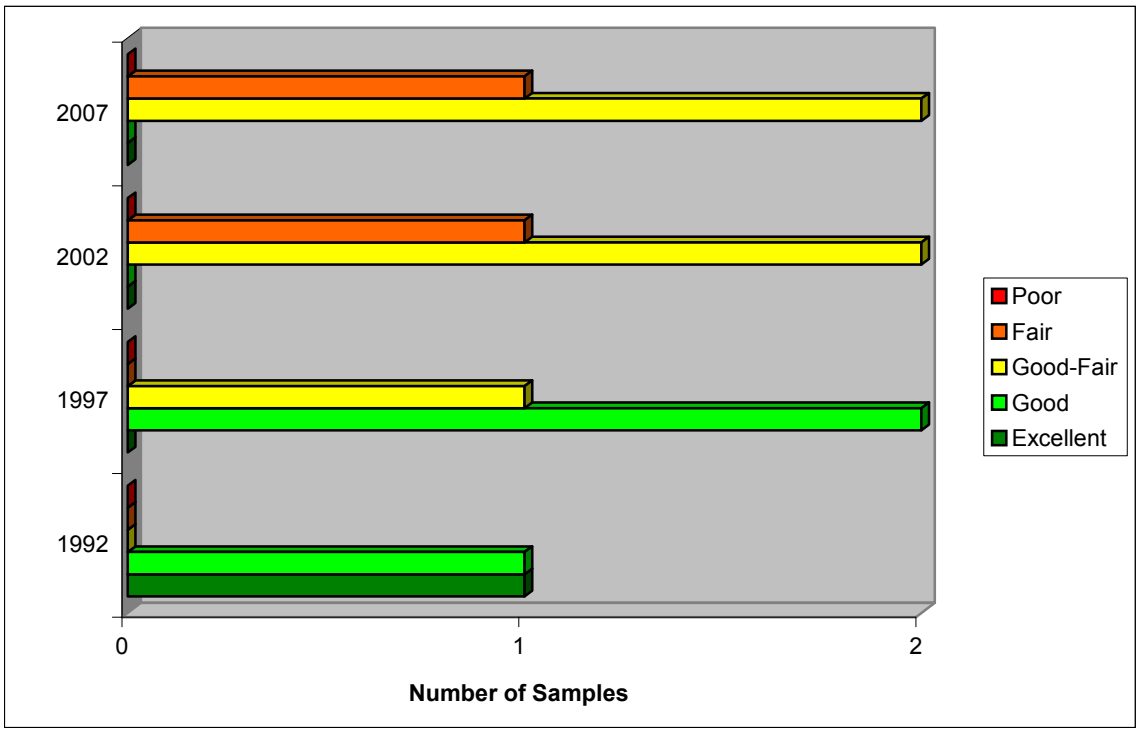
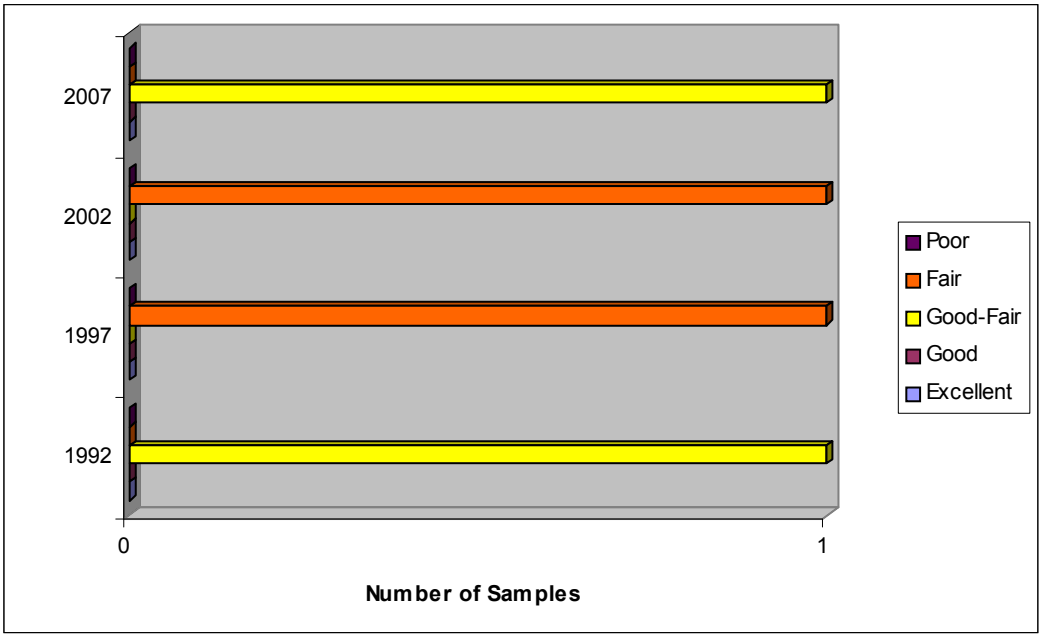


Figure B-1.7. Catawba River Subbasin 37 (HUC 03050101): Bioclassification Trends (1992-2007)



HUC 03050102 (South Fork Catawba River) Summary

The bioclassification trends for all of HUC 03050102 from 2007-1992 can bee seen below in Figure B-1.8. Several portions of this HUC are comprised mostly of a mix of forest and agriculture with limited impacts associated with large point sources. Streams in these areas of the HUC improved from samples taken from most samples in previous years and included Jacob Fork (SR 1924), Howards Creek (SR 1200), and Indian Creek (SR 1177).

Figure B-1.8. Catawba River Basin HUC 03050102 (Subbasins 35 & 36): Bioclassification Trends (2007-1992)

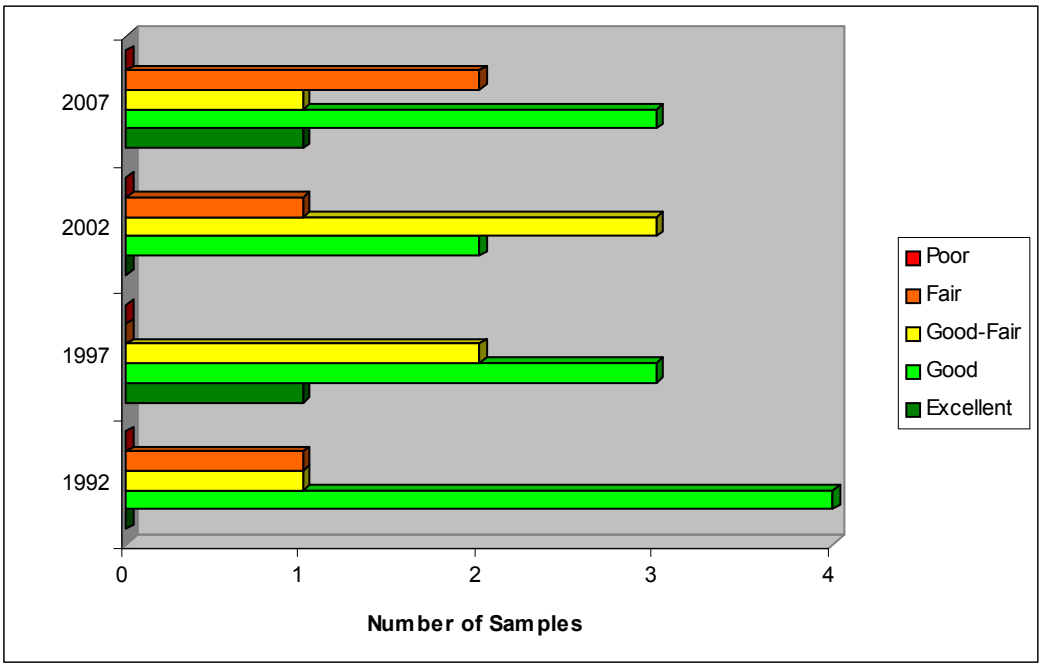


Figure B-1.9. Catawba River Subbasin 35 (HUC 03050102): Bioclassification Trends (2007-1992)

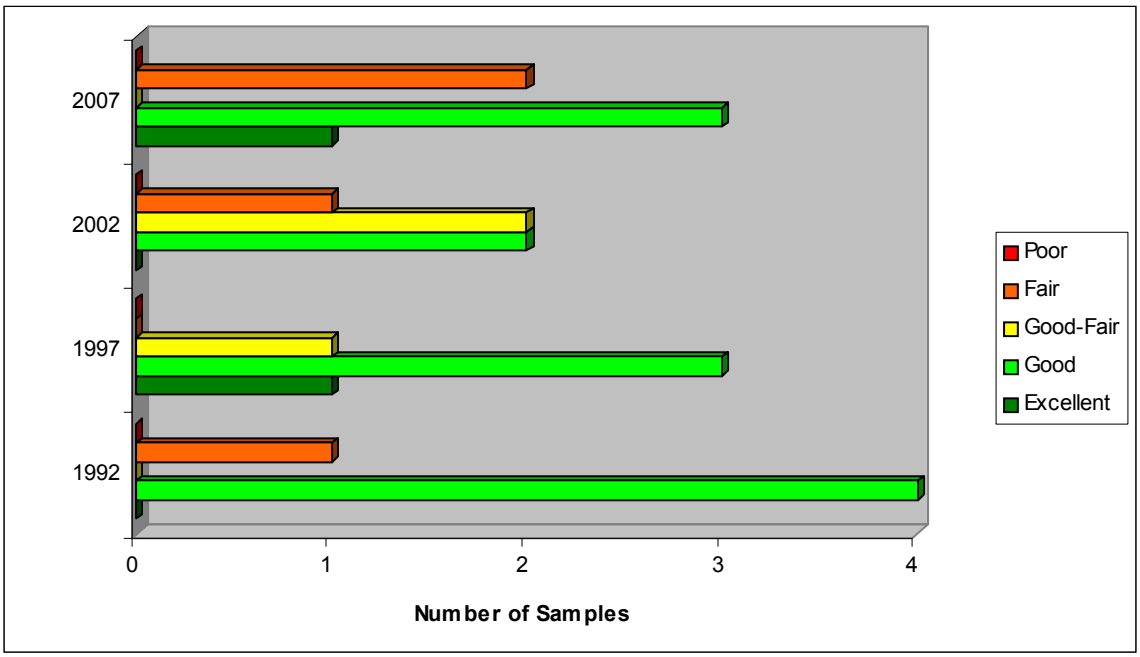
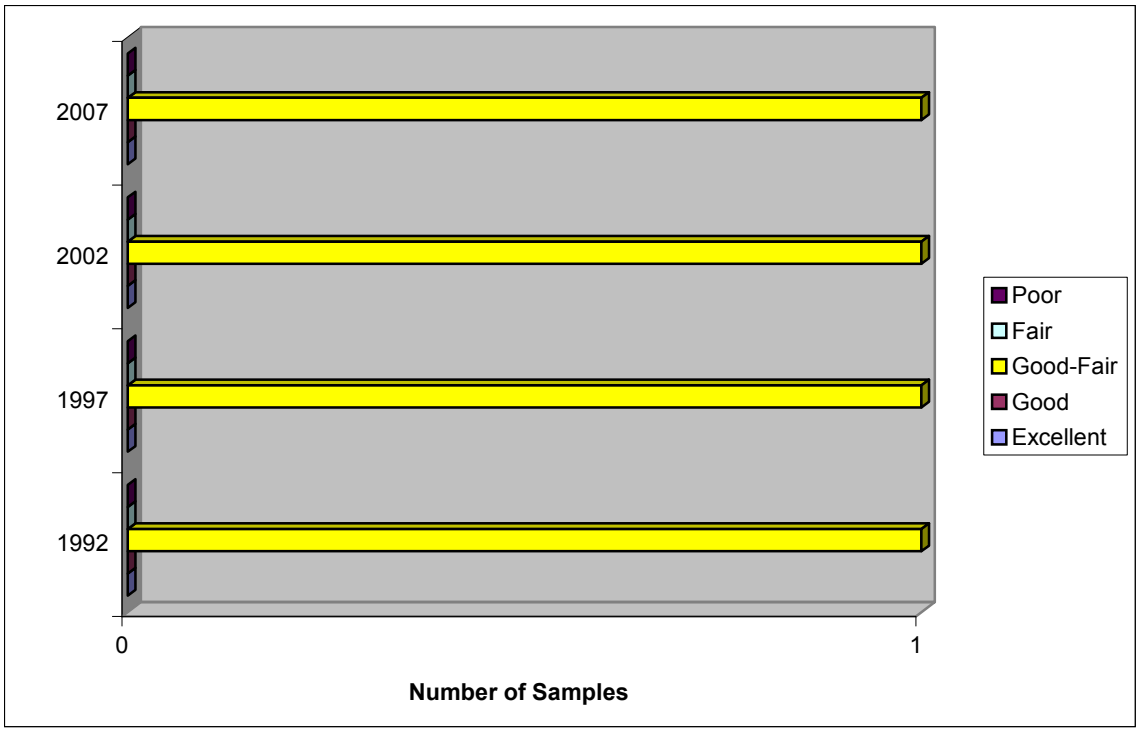


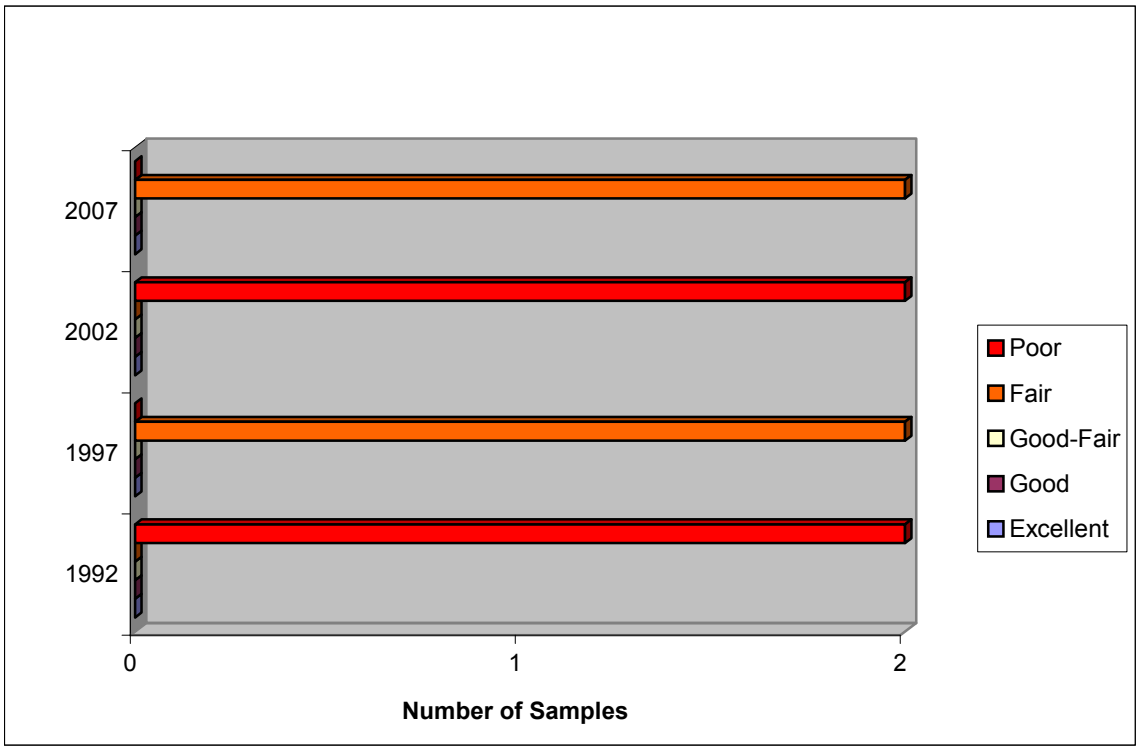
Figure B-1.10. Catawba River Subbasin 36 (HUC 03050102): Bioclassification Trends (2007-1992)



HUC 03050103 (Catawba River) Summary

The bioclassification trends for all of HUC 03050103 from 2007-1992 can bee seen below in Figure B-1.11. The Charlotte metropolitan area dominates much of this HUC and many streams here host large NPDES dischargers. Two examples include Sugar Creek (SR 1156) and Little Sugar Creek (NC 51) both of which have large NPDES dischargers located upstream. Surprisingly, both of these sites improved slightly from Poor in 2002 to Fair in 2007. This suggests that non-point impacts associated with urban sources of runoff may be as important as the NPDES dischargers in affecting their water quality. Although this HUC also includes subbasin 38, there have been no benthic macroinvertebrate samples collected in this area since 1992. This paucity of benthic macroinvertebrate collections here is a result of chronic low summer flows and is largely due to Carolina Slate Belt geology found here.

Figure B-1.11. **Catawba River Basin HUC 03050103 (Subbasin 34): Bioclassification Trends (2007-1992)**



Numerous rare invertebrate taxa were collected in the Catawba River basin in 2007 (Table 1).

Table 1. Rare invertebrate taxa: Catawba River Basin, 2002-2007.

Taxon	Total Number of DWQ Collections	Collection Location(s)	First Time Collected in Catawba Basin?
Mayfly**: *Baetopus trishae***	**3**	Jacob Fork (SR 1924, *Burke*)	Yes
Stonefly**: *Isogenoides hansoni***	**51**	Thunderhole Creek (SR 1367, *Caldwell*)	Yes
Stonefly**: *Acroneuria evoluta***	**23**	Upper Little River (SR 1740, *Caldwell*), Roses Creek (SR 1443, *McDowell*)	No
Stonefly**: *Acroneuria perplexa***	**4**	Johns River (SR 1367, *Caldwell*), Reedy Branch (NC 80, *McDowell*)	No
Stonefly**: *Pteronarcys biloba***	**34**	Crooked Creek (SR 1135, *McDowell*), Thunderhole Creek (SR 1367, *Caldwell*)	Yes
Stonefly**: *Pteronarcys comstocki***	**4**	Johns River (SR 1356, *Caldwell*), Mulberry Creek (SR 1310, *Caldwell*)	Yes
Caddisfly**: *Mystacides fimbriatus***	**4**	Upper Little River (SR 1740, *Caldwell*), Wilson Creek (SR 1328, *Caldwell*)	Yes
Caddisfly**: *Ceraclea slossonae***	**8**	Johns River (SR 1438, *Burke*)	Yes
Caddisfly**: *Neophylax fuscus***	**42**	Mulberry Creek (SR 1310, *Caldwell*), Johns River (SR 1438, *Burke*), Johns River (SR 1356, *Caldwell*), Linville River (NC 126, *Burke*)	No
Caddisfly**: *Ochrotrichia sp***	**23**	Upper Lower Little River (SR 1740, *Caldwell*), Walker Branch (NC 49, *Mecklenburg*), Linville River (NC 126, *Burke*)	No
Caddisfly**: *Brachycentrus lateralis***	**51**	Wilson Creek (SR 1335, *Caldwell*), Upper Creek (SR 1407, *Burke*), Upper Creek (NC 181, *Burke*), Steels Creek (NC 181, *Burke*), Johns River (SR 1438, *Burke*), Johns River (SR 1356, *Caldwell*))	
Caddisfly**: *Oecetis avara***	**30**	Linville River (NC 126, *Burke*), Johns River (SR 1438, *Burke*), Warrior Fork (SR 1440, *Burke*), Wilson Creek (SR 1328, *Caldwell*)	No

SAMPLING METHODS

Standard Qualitative (Full Scale) Method

Benthic macroinvertebrates can be collected from wadeable, freshwater, flowing waters using three sampling procedures. The Biological Assessment Unit's standard qualitative (Full Scale) sampling procedure includes 10 composite samples: two kick-net samples, three bank sweeps, two rock or log washes, one sand sample, one leafpack sample, and visual collections from large rocks and logs (NCDENR 2003). The samples are 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: 1 kick, 1 sweep, 1 leafpack and visual collections (NCDENR 2006). Only EPT taxa are collected and identified and only EPT criteria are used to assign a bioclassification.

Habitat Evaluation

An assessment form has been developed by the Biological Assessment Unit to better evaluate the physical habitat of a stream. The habitat score, which ranges between 1 and 100, is based on the evaluation of channel modification, amount of instream habitat, and 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.

Data Analysis

Criteria for bioclassifications for standard qualitative samples in piedmont ecoregions are given below and are based on EPT S and the NCBI.

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.

EPT S and BI values can be affected by seasonal changes. DWQ criteria for assigning bioclassification are based on summer sampling: June - September. For samples collected outside summer, EPT S can be adjusted by subtracting out winter/spring Plecoptera or other adjustment based on resampling of summer site. The BI values also are seasonally adjusted for samples outside the summer season.

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

	BI Values		EPT Values	
Score	**Mountain**	**Piedmont**	**Mountain**	**Piedmont**
5	<4.00	<5.14	> 43	>33
4.6	4.00—4.04	5.14—5.18	42-43	32-33
4.4	4.05—4.09	5.19—5.23	40-41	30-31
4	4.10—4.83	5.24—5.73	34-39	26-29
3.6	4.84—4.88	5.74—5.78	32-33	24-25
3.4	4.89—4.93	5.79—5.83	30-31	22-23
3	4.94—5.69	5.84—6.43	24-29	18-21
2.6	5.70—5.74	6.44—6.48	22-23	16-17
2.4	5.75—5.79	6.49—6.53	20-21	14-15
2	5.80—6.95	6.54—7.43	14-19	10-13
1.6	6.96—7.0	7.44—7.48	12-13	8-9
1.4	7.01-7.05	7.49—7.53	10-11	6-7
1	>7.05	> 7.53	0-9	0-5

Table 3. EPT Criteria for EPT samples.

	EPT Values	
Score	**Mountain**	**Piedmont**
Excellent	>35	>27
Good	28-35	21-27
Good-Fair	19-27	14-20
Fair	11-18	7-13
Poor	0-10	0-6

Table 4. Benthic macroinvertebrate data collected from Catawba River Basin, 2002-2007. Basinwide sites sampled in 2007 are in bold font.

HUC/Waterbody	Location	County	Index No.	Date	ST	EPT	NCBI	EPT BI	BioClass
HUC 03050101									
Catawba R	SR 1274	McDowell	11-(1)	8/3/2007	29	29	2.9	2.9	Good
				7/12/2007	42	42	2.6	2.6	Excellent
				8/8/2002	26	26	2.7	2.7	Good-Fair
L Pr Catawba R	OFF SR 1274	McDowell	11-6	6/21/2007	44	44	2.5	2.5	Excellent
Catawba R	SR 1234	McDowell	11-(8)	7/10/2007	104	38	4.7	3.5	Good
				8/8/2002	89	36	4.7	3.5	Good
Catawba R	SR 1221	McDowell	11-(8)	7/12/2007	93	35	5.1	3.8	Good
				8/7/2002	73	27	5.3	4.1	Good-Fair
Curtis Cr	SR 1227	McDowell	11-10-(6)	7/12/2007	40	40	2.7	2.7	Excellent
				8/8/2002	30	30	3.3	3.3	Good
Crooked Cr	SR 1135	McDowell	11-12	7/12/2007	27	27	3.2	3.2	Good-Fair
				8/7/2002	74	32	4.4	3.6	Good
Mackey Cr	BE US 70	McDowell	11-15-(3.5)	8/6/2002	67	30	4.2	3.6	Good
Mackey Cr	SR 1453	McDowell	11-15-(3.5)	8/8/2002	23	23	3.3	3.3	Not Impaired
Mackey Cr	US 70	McDowell	11-15-(3.5)	7/12/2007	33	33	3.1	3.1	Good
Singe Cat Br	NC 80	McDowell	11-19-2	6/22/2005	49	32	1.9	1.5	Not Impaired
				4/21/2005	68	33	2.1	1.1	Not Impaired
Reedy Br	NC 80	McDowell	11-19-8	5/22/2006	55	39	2.5	2	Not Impaired
				6/22/2005	63	32	2.6	1.7	Not Impaired
				4/21/2005	57	36	2.1	1.6	Not Impaired
Buck Cr	NC 80	McDowell	11-19-(14)	7/11/2007	45	45	2.8	2.8	Excellent
				8/5/2002	31	31	3	3	Good
L Buck Cr	SR 1436	McDowell	11-19-11	7/11/2007	49	49	2.5	2.5	Excellent
				8/6/2002	35	35	2.7	2.7	Good
N Fk Catawba R	Linville Caverns	McDowell	11-24-(1)	10/22/2007	29	29	2.1	2.1	Good
N Fk Catawba R	SR 1573	McDowell	11-24-(1)	7/11/2007	31	31	4.2	4.2	Good
				8/6/2002	29	29	3.8	3.8	Good
N Fk Catawba R	SR 1560	McDowell	11-24-(1)	7/11/2007	21	21	4.1	4.1	Good-Fair
				8/27/2003	78	33	4.2	3.7	Good
				8/6/2002	74	23	5.9	4.9	Fair
Laurel Br	US 221	McDowell	11-24-3	4/19/2005	51	28	2.5	1.4	Not Impaired
Honeycutt Cr	SR 1568	McDowell	11-24-8	10/22/2007	27	27	2.7	2.7	Good-Fair
Pepper Cr	SR 1586	McDowell	11-24-10	4/19/2005	58	32	2.2	1.4	Not Impaired
Pepper Cr	US 221	McDowell	11-24-10	10/22/2007	22	22	3.4	3.4	Good-Fair
Armstrong Cr	Armstrong Cr Rd	McDowell	11-24-14-(1.5)	7/11/2007	44	44	2.5	2.5	Excellent
				8/6/2002	38	38	2.8	2.8	Excellent
Cow Cr	SR 1443	McDowell	11-24-14-3	4/20/2005	66	37	2.3	1.3	Not Impaired
Roses Cr	SR 1443	McDowell	11-24-14-6	6/21/2005	52	30	2.3	1.8	Not Impaired
				4/20/2005	64	41	2.7	1.7	Not Impaired
Buchanan Cr	NC 226	McDowell	11-24-14-10-1	4/20/2005	69	35	2.4	1.6	Not Impaired
Bartlett Cr	NC 226	McDowell	11-24-14-10-3-1	6/22/2005	50	23	2.1	1	Not Impaired
				4/20/2005	61	28	1.9	0.8	Not Impaired
Bee Rock Cr	SR 1443	McDowell	11-24-24-2	5/22/2006	67	40	2.6	2.1	Not Impaired
				6/21/2005	67	41	2.3	1.6	Not Impaired
				4/20/2005	59	36	2.1	1.3	Not Impaired
Bailey Cr	SR 1552	McDowell	11-26	10/22/2007	29	29	2.4	2.4	Good-Fair
Linville R	NC 126	Burke	11-29-(1)	7/10/2007	95	45	4	3.4	Excellent
				7/9/2007	91	40	4.3	3.5	Good
				8/23/2002	91	48	4.2	3.4	Excellent

Table 4 (continued).

HUC/Waterbody	Location	County	Index No.	Date	ST	EPT	NCBI	EPT BI	BioClass
HUC 03050101									
				8/7/2002	90	47	3.9	3.2	Excellent
Anthony Cr	SR 1362	Caldwell	11-29-6	10/23/2007	33	33	2.4	2.4	Good
Linville R	US 221	Avery	11-29-(23)	7/10/2007	101	29	5.8	4.2	Good-Fair
				8/6/2002	28	28	3.9	3.9	Good
White Cr	NC 126	Burke	11-30	10/23/2007	14	14	3.7	3.7	Fair
Catawba R	SR 1147	Burke	11-(31)	7/10/2007	88	33	4.5	3.2	Good
				8/8/2002	60	21	4	2.9	Good
N Muddy Cr	SR 1760	McDowell	11-32-1-(0.5)	7/9/2007	78	25	5.3	4.3	Good-Fair
				8/5/2002	79	32	5.5	4.5	Good-Fair
Corpening Cr	SR 1819	McDowell	11-32-1-4	7/9/2007	7	7	5.9	5.9	Poor
				8/7/2002	65	21	5.7	4.6	Fair
S Muddy Cr	SR 1764	McDowell	11-32-2-(8.5)	7/9/2007	32	32	3.9	3.9	Good
				8/5/2002	23	23	4.2	4.2	Good-Fair
Muddy Cr	US 70	Burke	11-32-6	6/20/2007	77	25	5.2	4.7	Good-Fair
Canoe Cr	SR 1250	Burke	11-33-(2)	8/2/2007	18	18	4.9	4.9	Fair
				7/10/2007	27	27	4.1	4.1	Good-Fair
				8/21/2002	28	28	3.5	3.5	Good
UT Lake James	SR 1552	McDowell	11-(31)	10/22/2007	23	23	2.5	2.5	Good
Catawba R	NC 181	Burke	11-(31)	8/22/2002	46	21	4.4	3.5	Good-Fair
Dales Cr	SR 1552	McDowell	11-27	6/21/2007	47	47	2.5	2.5	Excellent
Silver Cr	SR 1127	Burke	11-34-(0.5)	8/3/2007	31	31	4.1	4.1	Good
				8/21/2002	25	25	3.7	3.7	Good-Fair
UT Double Br	OFF SR 1964	Burke	11-34-6-4	8/5/2004	47	21	2.9	2.2	Not Impaired
Warrior Fk	SR 1440	Burke	11-35-(1)	8/2/2007	39	39	4.1	4.1	Excellent
				8/21/2002	34	34	3.3	3.3	Good
Johns R	off SR 1367	Caldwell	11-38-(9)	10/23/2007	39	39	2.4	2.4	Excellent
Johns R	SR 1356	Caldwell	11-38-(9)	7/13/2007	45	45	2.8	2.8	Excellent
				8/22/2002	43	43	3.3	3.3	Excellent
Johns R	SR 1438	Burke	11-38-(28)	8/1/2007	39	39	2.9	2.9	Excellent
				8/22/2002	35	35	3.4	3.4	Good
Thunderhole Br	SR 1367	Caldwell	11-38-5	10/23/2007	38	38	2.9	2.9	Good
Sally Cr	off SR 1356	Caldwell	11-38-29-1	10/23/2007	48	48	2.6	2.6	Excellent
Franklin Br	off NC 90	Caldwell	11-38-31	10/23/2007	23	23	4	4	Good-Fair
Mulberry Cr	SR 1310	Caldwell	11-38-32-(15)	6/20/2007	38	38	3.2	3.2	Excellent
L Mulberry Cr	NC 90	Caldwell	11-38-32-17	10/24/2007	18	18	3.7	3.7	Not Rated
L Mulberry Cr	SR 1368	Caldwell	11-38-32-18	10/24/2007	35	35	3.9	3.9	Good
Wilson Cr	OFF SR 1328	Caldwell	11-38-34	8/1/2007	119	52	3.8	2.9	Excellent
				4/1/2003	105	62	2.9	2.3	Excellent
				8/22/2002	85	45	3.3	2.4	Excellent
Parks Cr	SR 1424	Burke	11-38-35	10/24/2007	17	17	4.2	4.2	Fair
Greasy Cr	NC 18	Caldwell	11-39-4	7/7/2004	13	13	4.1	4.1	Fair
Greasy Cr	SR 1305	Caldwell	11-39-4	7/7/2004	19	19	3.7	3.7	Good-Fair
Lower Cr	NC 90	Caldwell	11-39-(6.5)	7/7/2004	19	19	5.5	5.5	Good-Fair
Lower Cr	SR 1501	Burke	11-39-(6.5)	9/11/2002	55	14	6.1	4.9	Fair
Smoky Cr	SR 1515	Burke	11-41-1	8/2/2007	28	28	3.5	3.5	Good
				8/21/2002	26	26	3.5	3.5	Good-Fair
McGalliard Cr	SR 1538	Burke	11-44-(0.5)	8/2/2007	22	22	5	5	Good-Fair
				8/27/2003	18	18	4.2	4.2	Fair
				8/21/2002	16	16	5	5	Fair
Gunpowder Cr	SR 1718	Caldwell	11-55-(1.5)	8/1/2007	14	14	4.8	4.8	Fair
				8/21/2002	23	23	4.7	4.7	Good-Fair

Table 4 (continued).

HUC/Waterbody	Location	County	Index No.	Date	ST	EPT	NCBI	EPT BI	BioClass
HUC 03050101									
Upper Little R	SR 1740	Caldwell	11-58-(5.5)	7/31/2007	111	50	4.6	3.7	Excellent
				8/20/2002	83	33	4.9	3.9	Good
Falling Cr	SR 1402	Catawba	11-60	6/20/2007	46	10	6.1	5.7	Fair
Snow Cr	SR 1507	Catawba	11-61	6/19/2007	65	16	5.4	4.4	Good-Fair
Middle Little R	SR 1153	Alexander	11-62	7/31/2007	24	24	3.8	3.8	Good-Fair
				8/27/2003	26	26	3.1	3.1	Good-Fair
				8/20/2002	18	18	3.7	3.7	Fair
Duck Cr	NC 127	Alexander	11-62-2-(4)	7/31/2007	33	33	3.3	3.3	Good
				8/20/2002	33	33	3.7	3.7	Good
UT Lower Little R	SR 1307	Alexander	11-69	4/18/2005	68	37	2.9	2.3	Not Impaired
Lower Little R	SR 1131	Alexander	11-69	7/31/2007	89	32	5	4.1	Good-Fair
				8/20/2002	61	28	4.8	3.9	Good-Fair
Lambert Fk	SR 1305	Alexander	11-69-3	4/18/2005	65	29	3.4	2.4	Not Impaired
Poplar Cr	SR 1305	Alexander	11-69-3-1	4/18/2005	84	40	2.9	2.1	Not Impaired
Muddy Fk	SR 1313	Alexander	11-69-4	7/30/2007	8	8	5.3	5.3	Fair
		Alexander		8/27/2003	18	18	5.3	5.3	Good-Fair
		Alexander		8/19/2002	12	12	6	6	Fair
Elk Shoal Cr	SR 1605	Alexander	11-73-(0.5)	7/30/2007	18	18	4.6	4.6	Good-Fair
				8/20/2002	16	16	5	5	Good-Fair
Lyle Cr	US 64-70	Catawba	11-76-3.5	7/30/2007	22	22	4.4	4.4	Good-Fair
				8/19/2002	22	22	4.6	4.6	Good-Fair
McLin Cr	SR 1722	Catawba	11-76-5-(0.7)	7/30/2007	18	18	5.2	5.2	Fair
				8/19/2002	23	23	5.1	5.1	Good-Fair
Buffalo Shoals Cr	SR 1333	Iredell	11-78-(3)	6/19/2007	101	38	4.5	4.1	Good
McDowell Cr	SR 2128	Mecklenburg	11-115-(1)	7/17/2007	59	8	6.6	6	Fair
				8/20/2002	48	8	6.6	5.7	Fair
Gar Cr	SR 2074	Mecklenburg	11-116-(1)	7/11/2007	16	16	5.6	5.6	Good-Fair
Dutchmans Cr	SR 1918	Gaston	11-119-(0.5)	7/10/2007	18	18	5.2	5.2	Good-Fair
				8/21/2002	19	19	5	5	Good-Fair
Leepers Cr	SR 1354	Lincoln	11-119-1-(1)	5/8/2006	97	34	5.3	4.4	Good
				6/6/2003	24	24	4.5	4.5	Good
Killian Cr	SR 1511	Lincoln	11-119-2-(0.5)	7/17/2007	19	19	5.3	5.3	Good-Fair
Killian Cr	SR 1511	Lincoln		2/3/2003	15	15	4.5	4.5	Good-Fair
Killian Cr	SR 1511	Lincoln		8/20/2002	12	12	5	5	Not Rated
Crowders Cr	SC 564	Gaston	11-135	7/10/2007	51	19	5.8	5.3	Good-Fair
				5/20/2002	57	14	6.3	5.9	Fair
Abernethy Cr	Nr Valley Ct	Gaston	11-135-4	6/18/2007	74	17	5.9	5.3	Good-Fair
HUC 03050102									
Sugar Cr	SC 160	York, SC	11-137	8/19/2002	34	7	6.4	6.1	Fair
Sugar Cr	SR 1156	Mecklenburg	11-137-1	7/11/2007	8	8	6.6	6.6	Fair
				8/20/2002	5	5	7	7	Poor
L Sugar Cr	NC 51	Mecklenburg	11-137-8	7/11/2007	8	8	6.4	6.4	Fair
				8/19/2002	6	6	6.7	6.7	Poor
McAlpine Cr	NC 51	Mecklenburg	11-137-9	8/19/2002	43	7	6.9	5.8	Fair
HUC 03050103									
Beaverdam Cr	SR 1609	Gaston	11-129-9-(0.7)	5/5/2006	106	42	5.5	4.2	Good
Clark Cr	SR 1008	Lincoln	11-129-5-(9.5)	7/9/2007	49	12	6.2	5.8	Fair
				8/21/2002	47	9	6.2	5.1	Fair
Garrison Cr	NC 18	Burke	11-129-1-13-1	5/22/2006	0	0		1.4	Not Impaired

Table 4 (continued).

HUC/Waterbody	Location	County	Index No.	Date	ST	EPT	NCBI	EPT BI	BioClass
HUC 03050103									
				4/19/2005	72	41	2.7	2.2	Not Impaired
Henry Fk	SR 1854	Burke	11-129-1-(1)	5/1/2006	110	49	4.6	3.6	Good
				4/1/2003	34	34	2.4	2.4	Good-Fair
Henry Fk	SR 1803	Burke	11-129-1-(1)	5/1/2006	111	49	4.3	3.4	Good
Henry Fk	SR 1916	Burke	11-129-1-(2)	5/2/2006	138	62	3.9	2.8	Excellent
Henry Fk	SR 1922	Burke	11-129-1-(2)	5/2/2006	133	65	3.9	2.8	Excellent
Henry Fk	SR 1124	Catawba	11-129-1-(12.5)	5/1/2006	126	61	4.1	3	Good
				8/22/2002	94	38	4.8	3.3	Good
Jacob Fk	NC 127	Catawba	11-129-2-(1)	6/18/2007	111	43	4.7	3.8	Good
Jacob Fk	SR 1924	Burke	11-129-2-(1)	5/2/2006	136	60	3.9	2.3	Excellent
				8/22/2002	35	35	3.3	3.3	Good
Pott Cr	SR 1217	Lincoln	11-129-3	5/3/2006	92	31	5.7	5	Good
Howards Cr	SR 1200	Lincoln	11-129-4	5/3/2006	121	40	5.6	4.6	Good
				8/21/2002	17	17	4.5	4.5	Good-Fair
Indian Cr	SR 1177	Lincoln	11-129-8-(5)	5/3/2006	79	19	6.5	5.1	Fair
				9/16/2003	17	17	5	5	Good-Fair
				2/3/2003	12	12	4.9	4.9	Not Rated
				8/21/2002	13	13	4.8	4.8	Not Rated
Indian Cr	SR 1252	Lincoln	11-129-8-(5)	5/3/2006	81	26	5.5	4.8	Good
Hoyle Cr	SR 1836	Gaston	11-129-15-(4)	5/4/2006	91	33	5.1	4.1	Good
Mauney Cr	SR 1831	Gaston	11-129-15-5	5/4/2006	49	6	7.4	6.2	Poor
Long Cr	NC 274	Gaston	11-129-16-(4)	6/18/2007	86	20	6.1	5.2	Good-Fair
Long Cr	SR 1456	Gaston	11-129-16-(4)	7/10/2007	74	23	6.1	5.5	Good-Fair
Dallas Br	SR 2275	Gaston	11-129-16-7	5/4/2006	34	0	7.4	0	Not Rated

Appendix F-1. Fish community sampling methods and criteria.

Sampling Methods

At each sample site, a 600 ft. section of stream was selected and measured. Fish within the delineated stretch of stream were then collected using two backpack electrofishing units and usually, two persons netting the stunned fish. A seine was also used where there were substantial riffles. During the 2007 basinwide assessment BAU staff were assisted by staff from the NC Wildlife Resources Commission, Duke Power Company, DENR's Ecosystem Enhancement Program, U. S. Forest Service, and a summer intern from North Carolina State University. After collection, all readily identifiable fish were examined for sores, lesions, fin damage, and 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. All young-of-year were excluded from the analyses.

NCIBI Analysis

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.

The NCIBI has been revised (NCDENR 2006). Currently, the focus of using and applying the NCIBI has been restricted to wadeable streams that can be sampled by a crew of four persons. In 2001, the bioclassifications and criteria were recalibrated against regional reference site data (Biological Assessment Unit Memorandum F-20010922) (Tables 1 – 5). To qualify as a reference site, the site had to satisfy all seven criteria in the order listed in Table 1. Reference sites represented the least impacted or the most minimally impacted streams and the overall biological conditions of the fish communities that could be attained (Table 2).

Table 1. 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	Mountain streams -- width of the riparian zone along both banks is ≥ 6m Piedmont streams – width of the riparian zone along both banks is ≥ 12 m
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 2. Regional fish community reference sites in the Catawba River basin.

HUC/Waterbody	Station	County	Level IV Ecoregion
03050101 Catawba River Headwaters			
Mill Cr	SR 1400	McDowell	Southern Crystalline Ridges and Mountains
Curtis Cr	US 70	McDowell	Eastern Blue Ridge Foothills
Crooked Cr	SR 1135	McDowell	Eastern Blue Ridge Foothills
Mackey Cr	US 70	McDowell	Eastern Blue Ridge Foothills
Armstrong Cr	SR 1456	McDowell	Southern Crystalline Ridges and Mountains
Canoe Cr	SR 1250	Burke	Northern Inner Piedmont
Upper Cr	SR 1439	Burke	Northern Inner Piedmont
Johns R	off SR 1367	Caldwell	Southern Crystalline Ridges and Mountains
Gragg Pr	SR 1367	Caldwell	Southern Crystalline Ridges and Mountains
Mulberry Cr	NC 90	Caldwell	Northern Inner Piedmont
Smoky Cr	SR 1515	Burke	Northern Inner Piedmont
Middle Little R	SR 1002	Alexander	Northern Inner Piedmont
03050102 South Fork Catawba River			
Henry Fk	SR 1922	Burke	Eastern Blue Ridge Foothills
Henry Fk	SR 1916	Burke	Eastern Blue Ridge Foothills
03050103 Catawba River			
Waxhaw Cr	SR 1103	Union	Southern Outer Piedmont

Table 3. 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		Score
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, 2 species = 3, and 0 or 1 species = 1		
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 + 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 4. Tolerance ratings and adult trophic guild assignments for fish in the Catawba River basin. Species collected in 2004 - 2007 are highlighted in blue. Common and scientific names follow Nelson, *et al*. (2004), except for *Scartomyzon*.

Family/ Species	Common Name	Tolerance Rating	Trophic Guild of Adults
Lepisosteidae	**Gars**		
Lepisosteus osseus	Longnose Gar	Tolerant	Piscivore
Amiidae	**Bowfins**		
Amia calva	Bowfin	Tolerant	Piscivore
Anguillidae	**Freshwater Eels**		
Anguilla rostrata	American Eel	Intermediate	Piscivore
Clupeidae	**Herrings and Shads**		
Alosa aestivalis	Blueback Herring	Intermediate	Insectivore
Alosa pseudoharengus	Alewife	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	Eastern Silvery Minnow	Intermediate	Herbivore
Hybopsis hypsinotus	Highback Chub	Intolerant	Insectivore
Luxilus coccogenis	Warpaint Shiner	Intermediate	Insectivore
Nocomis leptocephalus	Bluehead Chub	Intermediate	Omnivore
N. micropogon	River Chub	Intermediate	Omnivore
Notemigonus crysoleucas	Golden Shiner	Tolerant	Omnivore
Notropis alborus	Whitemouth Shiner	Intermediate	Insectivore
N. altipinnis	Highfin Shiner	Intermediate	Insectivore
N. chiliticus	Redlip Shiner	Intermediate	Insectivore
N. chlorocephalus	Greenhead Shiner	Intermediate	Insectivore
N. cummingsae	Dusky Shiner	Intermediate	Insectivore
N. hudsonius	Spottail Shiner	Intermediate	Omnivore
N. leuciodus	Tennessee Shiner	Intermediate	Insectivore
N. petersoni	Coastal Shiner	Intermediate	Insectivore
N. procne	Swallowtail Shiner	Intermediate	Insectivore
N. rubricroceus	Saffron Shiner	Intermediate	Insectivore
N. scepticus	Sandbar Shiner	Intermediate	Insectivore
N. spectrunculus	Mirror Shiner	Intermediate	Insectivore
Phoxinus oreas	Mountain Redbelly Dace	Intermediate	Herbivore
Pimephales promelas	Fathead Minnow	Tolerant	Omnivore
Rhinichthys cataractae	Longnose Dace	Intermediate	Insectivore
R. obtusus	Western Blacknose Dace	Intermediate	Insectivore
Semotilus atromaculatus	Creek Chub	Tolerant	Insectivore
Catostomidae	**Suckers**		
Carpiodes sp. cf. *cyprinus*	(no common name)	Intermediate	Omnivore
C. sp. cf. *velifer*	(no common name)	Intermediate	Omnivore
Catostomus commersonii	White Sucker	Tolerant	Omnivore
Erimyzon oblongus	Creek Chubsucker	Intermediate	Omnivore
Hypentelium nigricans	Northern Hog Sucker	Intermediate	Insectivore
Ictiobus bubalus	Smallmouth Buffalo	Intermediate	Omnivore
I. cyprinellus	Bigmouth Buffalo	Intermediate	Insectivore
Moxostoma collapsum	Notchlip Redhorse	Intermediate	Insectivore
M. macrolepidotum	Shorthead Redhorse	Intermediate	Insectivore
M. pappillosum	V-Lip Redhorse	Intermediate	Insectivore
Scartomyzon rupiscartes	Striped Jumprock	Intermediate	Insectivore
S. sp. cf. *lachneri*	"Brassy" Jumprock	Intermediate	Insectivore

Table 4 (continued).

Family/ Species	Common Name	Tolerance Rating	Trophic Guild of Adults
Ictaluridae	**North American Catfishes**		
Ameiurus brunneus	Snail Bullhead	Intermediate	Insectivore
A. catus	White Catfish	Tolerant	Omnivore
A. melas	Black Bullhead	Tolerant	Insectivore
A. nebulosus	Brown Bullhead	Tolerant	Omnivore
A. platycephalus	Flat Bullhead	Tolerant	Insectivore
Ictalurus furcatus	Blue Catfish	Intermediate	Piscivore
I. punctatus	Channel Catfish	Intermediate	Omnivore
Noturus insignis	Margined Madtom	Intermediate	Insectivore
Pylodictis olivaris	Flathead Catfish	Intermediate	Piscivore
Esocidae	**Pikes**		
Esox americanus americanus	Redfin Pickerel	Intermediate	Piscivore
Salmonidae	**Trouts and Salmons**		
Oncorhynchus mykiss	Rainbow Trout	Intolerant	Insectivore
Salmo trutta	Brown Trout	Intermediate	Piscivore
Salvelinus fontinalis	Brook Trout	Intolerant	Insectivore
Aphredoderidae	**Pirate Perches**		
Aphredoderus sayanus	Pirate Perch	Intermediate	Insectivore
Fundulidae	**Topminnows**		
Fundulus rathbuni	Speckled Killifish	Intermediate	Insectivore
Poeciliidae	**Livebearers**		
Gambusia holbrooki	Eastern Mosquitofish	Tolerant	Insectivore
Moronidae	**Temperate Basses**		
Morone americana	White Perch	Intermediate	Piscivore
M. chrysops	White Bass	Intermediate	Piscivore
M. saxatilis	Striped Bass	Intermediate	Piscivore
Centrarchidae	**Sunfishes**		
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. macochirus	Bluegill	Intermediate	Insectivore
L. marginatus	Dollar Sunfish	Intermediate	Insectivore
L. microlophus	Redear Sunfish	Intermediate	Insectivore
Lepomis sp.	Hybrid Sunfish	Tolerant	Insectivore
Micropterus coosae	Redeye Bass	Intermediate	Piscivore
M. dolomieu	Smallmouth Bass	Intolerant	Piscivore
M. punctulatus	Spotted Bass	Intermediate	Piscivore
M. salmoides	Largemouth Bass	Intermediate	Piscivore
Pomoxis annularis	White Crappie	Intermediate	Piscivore
P. nigromaculatus	Black Crappie	Intermediate	Piscivore
Percidae	**Perches**		
Etheostoma collis	Carolina Darter	Intermediate	Insectivore
E. flabellare	Fantail Darter	Intermediate	Insectivore
E. fusiforme	Swamp 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
Sander canadensis	Sauger	Intermediate	Piscivore
S. vitreus	Walleye	Intermediate	Piscivore

Table 5. 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

Criteria and ratings are applicable only to wadeable streams in the Catawba River basin. The metrics are the same as those for the Broad, Savannah, and Yadkin River basins (Tables 3 and 5). Metrics and ratings should not be applied to non-wadeable streams nor to small, wadeable Southern Appalachian type trout streams in each of these basins. General characteristics of Southern Appalachian type trout streams include high gradient, certain visual aspects of the stream and riparian zones (e.g., *Rhododendron*-, *Leucothoe*-, and *Tsuga*-lined), presence of boulder and rock outcrop plunge pools, overall faunal characteristics (naturally low fish diversity), low specific conductance (often less than 25µS/cm), temperature (often less than 20˚C), clarity (gin-clear), elevation (which will vary from basin to basin and within a basin), and stream order (1st – 3rd). These streams are currently not rated.

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 1).

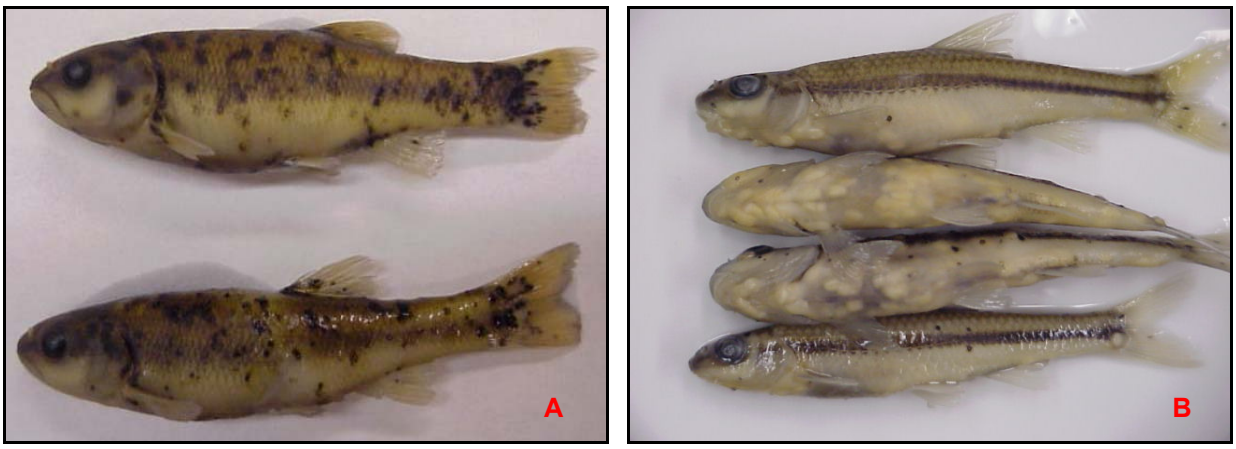


Figure 1. Heavy infestation of blackspot disease in creek chub (A) and yellow grub in bigeye chub (B).

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.

Appendix F-2. A summary of fish community assessment data.

Monitoring efforts from 2003 to 2007 can be summarized as:

- From 2003 to 2007, 51 samples were collected as part of the basinwide monitoring cycle or as special studies. Some of the samples served dual purposes (i.e., as special study and as basinwide samples).
- Forty-four sites were considered to be basinwide sites and covered the period 2004 – 2007.
- Ten of the 44 basinwide sites had not been previously sampled. Some of these sites were in rural watersheds where there were no NPDES dischargers and were selected as potential candidates for fish community regional reference sites (i.e. Johns River, Drowning Creek, Glade Creek, Lambert Fork, Upper Little River, Anderson Creek, Howards Creek, East Fork Twelvemile Creek, and West Fork Twelvemile Creek). Only the Johns River possessed exceptionally high quality instream, riparian, and watershed characteristics to qualify as a new fish community regional reference site (Appendices F-1 and F-6).
- The remaining sites had been sampled during the last basinwide cycle in 2002, during the first basinwide cycle in 1997, or as part of special studies conducted in 1999 and 2004 (Appendix F-3).
- All sites scheduled to be sampled in 2007 were sampled.
- Eleven streams sampled from 2003 to 2007 were on the impaired waters list (NCDENR 2007):
    - Hunting Creek from a point 1.0 mile upstream of Burke County SR 1940 to a point 0.4 mile downstream of Pee Dee Branch;
    - Irish Creek from Roses Creek to Warrior Fork;
    - McGalliard Creek from a point 0.6 mile upstream of mouth to Rhodhiss Lake, Catawba River;
    - Lower Little River from source to a point 0.5 mile upstream of mouth of Stirewalt Creek
    - Irwin Creek from source to Sugar Creek;
    - Little Sugar Creek from source to North Carolina-South Carolina state line;
    - McAlpine Creek from source to North Carolina-South Carolina state line;
    - Clark Creek from Miller Branch to 0.9 mile upstream of Walker Creek;
    - Indian Creek from a point 0.3 mile upstream of Lincoln County SR 1169 to South Fork Catawba River;
    - Catawba Creek from source to Lake Wylie; and
    - Crowders Creek from source to North Carolina-South Carolina state line.
- From 2003 to 2007, 20 sites were sampled as part of special studies (Appendix F-3):
    - in 2003, four sites (Hunting, Irish, and McGalliard creeks and the Lower Little River) were sampled for verification of 2002 basinwide results;
    - in 2004, eight sites (Muddy Fork, Irwin, Long (Mecklenburg County), McAlpine, Clark, Long (Gaston County), Crowders (at SR 1131), and South Crowders creeks) were sampled as part of a larger study on the impact of urbanization on aquatic communities in the Piedmont of North Carolina;
    - in 2006, four sites (Beaverdam, Hoyle, Indian, and Pott creeks) were sampled as part of the development of a biological Total Maximum Daily Load model; and
    - in 2007, four sites (Freemason, Little Sugar, and McMullen creeks and the Little River) were sampled as part of a state-wide probabilistic monitoring study.
- The drainage areas of the assessed watersheds in 2004 - 2007 ranged from 6.7 to 69.2 square miles (Appendix F-4).
- The most widely distributed species were the Redbreast Sunfish and Bluehead Chub (Appendix F-5). The most abundant species were the Bluehead Chub, Redbreast Sunfish, and Tessellated Darter.
- All samples were evaluated and rated using the North Carolina Index of Biotic Integrity (NCIBI) (Appendices F-1, F-3, and F-4). The NCIBI scores ranged from 30 to 60 and the NCIBI ratings ranged from Poor to Excellent (Figures 1 and 2); 33 of the 44 sites were rated Good-Fair or better. The Johns River, a new regional fish community reference site, rated Excellent.

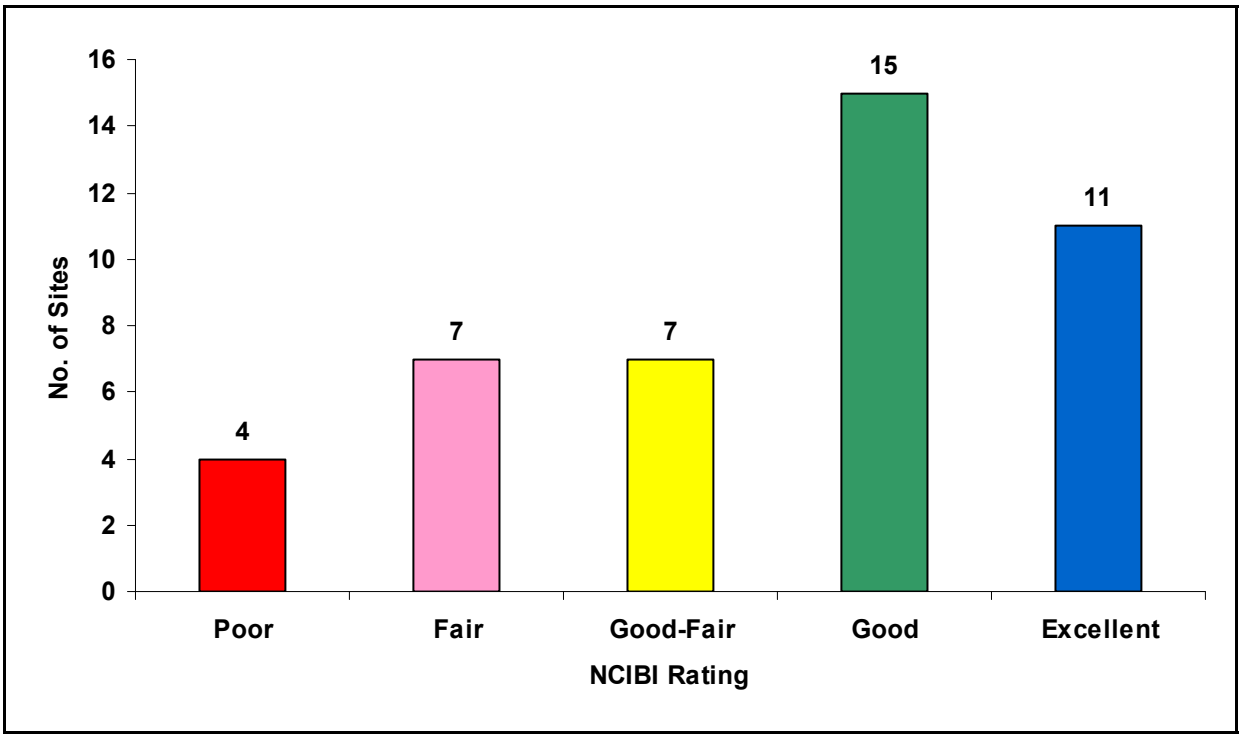


Figure 1. Distribution of the ratings of 44 fish community sites in the Catawba River basin, 2004 - 2007.

- Four sites and their watersheds may qualify as new High Quality Waters, if so petitioned. These sites are Gragg Prong and Curtis, Mulberry, and Smoky creeks.
- Sites rated Excellent or Good were generally found in the upper part of the basin (Catawba River Headwaters HUC) (Figure 2).
- Sites rated Fair or Poor were found in areas receiving nonpoint source runoff from urban/suburban or agricultural areas or below wastewater treatment plants in Lincoln, Gaston, and Mecklenburg counties.
- Twenty-five of the 44 sites had been sampled more than once, either in the previous two basinwide monitoring cycles or as special studies (Figure 3). Of these 25 sites, 13 sites had no appreciable change in their score or NCIBI rating; 3 sites had scores or ratings that increased; and 9 sites had scores or ratings that decreased over the 10 year period. The improvements in scores and ratings were most pronounced at Irish, North Muddy, and Lyle creeks. The latter two sites are more than six miles below permitted wastewater treatment plants which may be benefiting the fish community by providing more stable and permanent flows during periods of low flows and prolonged droughts. The cause for the improvement at Irish Creek was unknown. The most pronounced declines were noted at the Middle Little River and at Silver, Leepers, Catawba, Pott, and Waxhaw creeks. Except for Catawba Creek which drains an urban area, the declines at the other more rural sites may be related to the effects from low flows or nonpoint source runoff.
- The instream and riparian habitat assessment scores at the 44 sites ranged from 24 to 95 (Appendix F-6). Fish communities rated Excellent or Good were found where the habitats were of moderate to high quality; communities rated Good-Fair, Fair, or Poor were found where the habitats were of lower quality.
- No dissolved oxygen concentrations were less than the water quality standard of 5 mg/L.
- Specific conductance ranged from 16 µS/cm at Paddy Creek to 347 µS/cm at McMullen Creek. Elevated readings were associated with dischargers from upstream wastewater treatment plants or from nonpoint sources in urban areas. Conductivity was generally much lower in streams draining more forested watersheds in the headwaters part of the basin in the Upper Catawba

River HUC and greater in streams draining more agricultural and developed watersheds in Gaston and Mecklenburg counties.

- The pH was less than 6.0 s.u. at five sites, all located in the upper part of the basin.

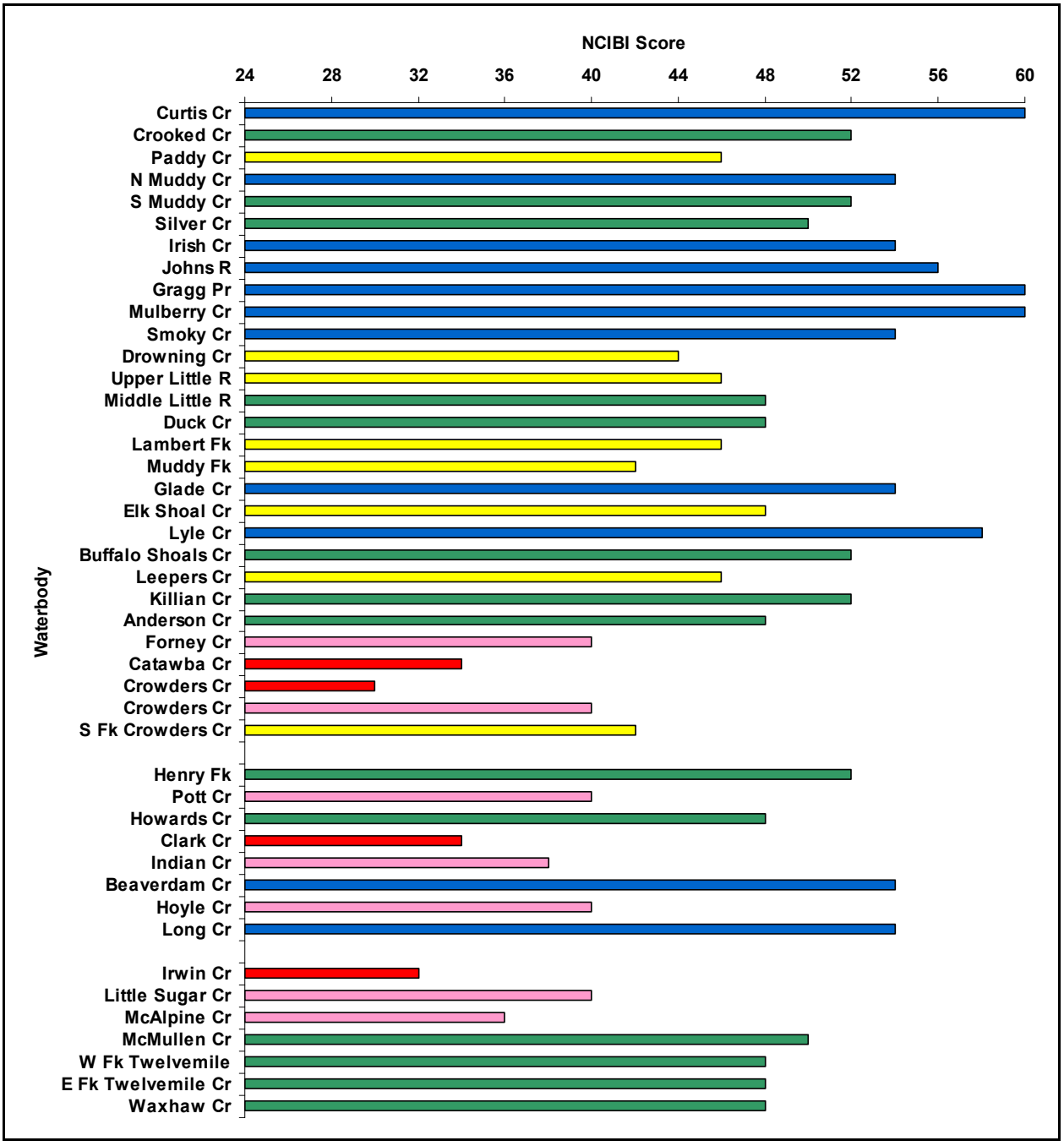


Figure 2. **NCIBI scores and ratings of 44 fish community basinwide sites in the Catawba River basin, 2004 - 2007. Blue = Excellent, Green = Good, Yellow = Good-Fair, Rose = Fair, and Red = Poor sites**

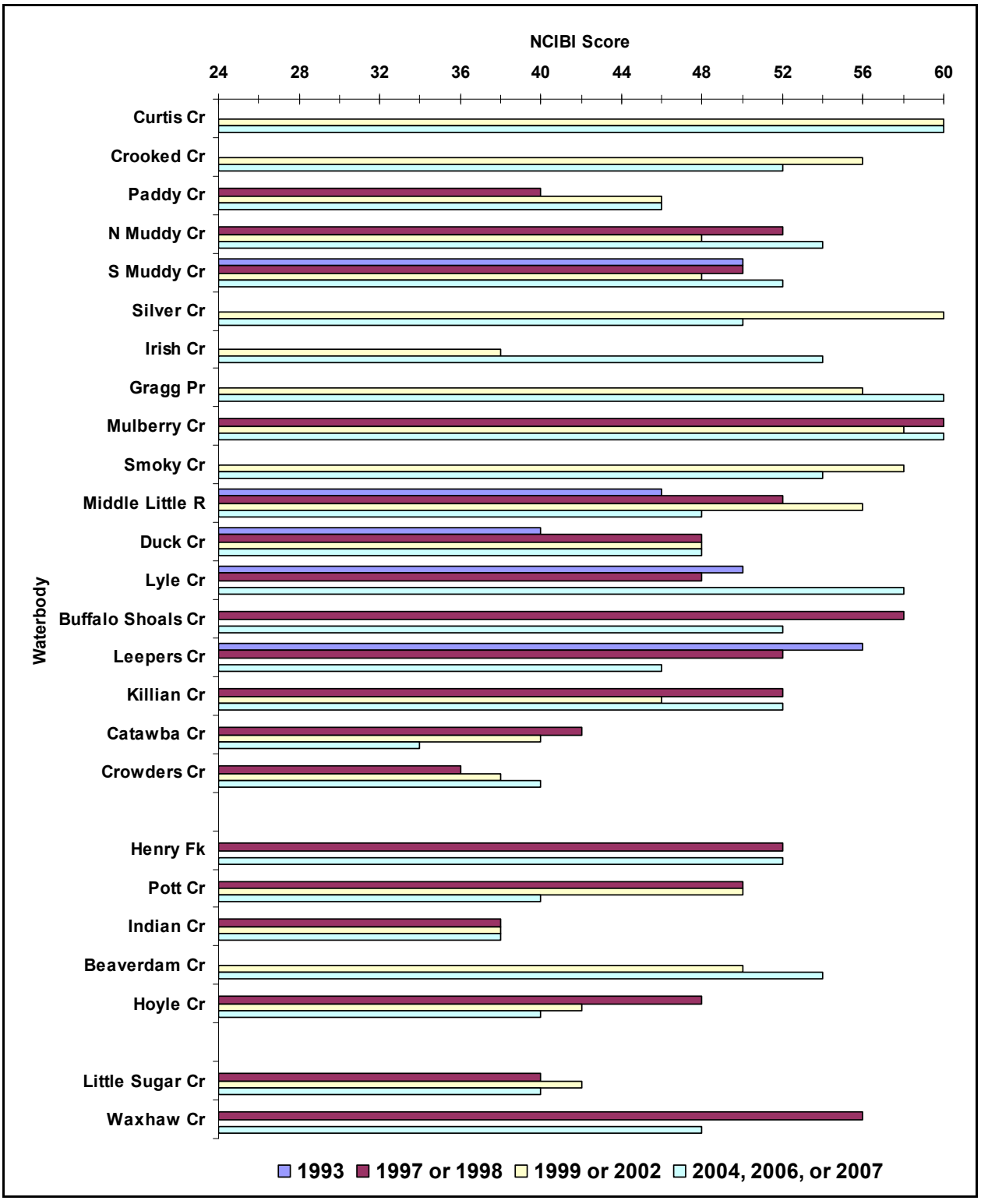


Figure 3. **NCIBI scores and ratings of 25 repeat fish community sites in the Catawba River basin, 1993 - 2007.**

Appendix F-3. Fish community data collected from the Catawba River basin, 1993 – 2007. Basinwide sites sampled in 2004 - 2007 are in bold font.

HUC/Waterbody	Station	County	Index No.	Date	NCIBI Score	NCIBI Rating
03050101 Catawba River Headwaters						
Catawba R	SR 1110	McDowell	11-1	04/29/02	46	Good-Fair
				05/07/97	50	Good
Mill Cr	SR 1400	McDowell	11-7-(0.5)	06/08/99	58	Excellent
Curtis Cr	US 70	McDowell	11-10	05/24/07	60	Excellent
				04/30/02	60	Excellent
Crooked Cr	SR 1135	McDowell	11-12	05/24/07	52	Good
				04/30/02	56	Excellent
Mackey Cr	US 70	McDowell	11-15-(3.5)	03/25/98	48	Good
Mackey Cr	US 70	McDowell	11-15-(3.5)	03/25/98	18	Poor
				04/29/02	50	Good
Armstrong Cr	SR 1456	McDowell	11-24-14-(1)	09/23/99	54	Excellent
				06/22/99	56	Excellent
				04/15/99	54	Excellent
				05/07/97	56	Excellent
Paddy Cr	NC 126	Burke	11-28	05/23/07	46	Good-Fair
				05/01/02	46	Good-Fair
				05/05/97	40	Fair
N Muddy Cr	SR 1760	McDowell	11-32-1	05/23/07	54	Excellent
				04/30/02	48	Good
				05/07/97	52	Good
Corpening Cr	SR 1794	McDowell	11-32-1-4	09/23/02	40	Fair
S Muddy Cr	SR 1764	McDowell	11-32-2	05/23/07	52	Good
				05/01/02	48	Good
				07/02/97	50	Good
				06/28/93	50	Good
Canoe Cr	SR 1250	Burke	11-33-(2)	05/02/02	50	Good
				05/05/97	54	Excellent
				05/10/93	46	Good-Fair
Silver Cr	SR 1149	Burke	11-34-(0.5)	05/22/07	50	Good
				05/01/02	60	Excellent
Upper Cr	SR 1439	Burke	11-35-2-(13)	09/22/99	56	Excellent
				06/21/99	54	Excellent
				04/16/99	56	Excellent
				07/01/97	54	Excellent
Irish Cr	SR 1439	Burke	11-35-3-(2)	05/22/07	54	Excellent
				07/30/03	40	Fair
				05/02/02	38	Fair
Hunting Cr	SR 1512	Burke	11-36-(0.3)	08/26/03	40	Fair
				05/01/02	38	Fair
Johns R	off SR 1367	Caldwell	11-38-(1)	05/22/07	56	Excellent
Gragg Pr	SR 1367	Caldwell	11-38-10	05/22/07	60	Excellent
				05/25/99	56	Excellent
				10/01/98	56	Excellent
Mulberry Cr	NC 90	Caldwell	11-38-32-(15)	05/21/07	60	Excellent
				09/22/99	60	Excellent
				06/21/99	58	Excellent
				04/16/99	56	Excellent
				05/08/97	60	Excellent
Lower Cr	SR 1142	Caldwell	11-39-(6.5)	05/10/93	44	Good-Fair
Lower Cr	SR 1501	Burke	11-39-(6.5)	05/02/02	42	Good-Fair
				10/24/97	44	Good-Fair
Smoky Cr	SR 1515	Burke	11-41-(1)	05/21/07	54	Excellent
				05/03/02	58	Excellent
				05/10/93	---	Not Rated
McGalliard Cr	SR 1538	Burke	11-44-(0.5)	07/30/03	24	Poor
				05/03/02	40	Fair
				05/06/97	48	Good
				05/10/93	38	Fair
Freemason Cr	SR 1123	Caldwell	11-47-1	03/28/07	52	Good
Drowning Cr	SR 1647	Burke	11-52-(1)	05/21/07	44	Good-Fair
Upper Little R	SR 1712	Caldwell	11-58	04/27/07	46	Good-Fair
Upper Little R	SR 1786	Caldwell	11-58-(5.5)	05/24/02	42	Good-Fair

Appendix F-3 (continued).

HUC/Waterbody	Station	County	Index No.	Date	NCIBI Score	NCIBI Rating
Middle Little R	SR 1002	Alexander	11-62	04/27/07	48	Good
				05/23/02	56	Excellent
				05/08/97	52	Good
				05/11/93	46	Good-Fair
Duck Cr	NC 90	Alexander	11-62-2-(1)	04/26/07	48	Good
				05/23/02	48	Good
				05/08/97	48	Good
				05/11/93	40	Fair
Lower Little R	SR 1318	Alexander	11-69-(0.5)	07/30/03	46	Good-Fair
				05/23/02	38	Fair
				05/09/97	48	Good
				05/11/93	28	Poor
Lambert Fk	SR 1317	Alexander	11-69-3	04/26/07	46	Good-Fair
Muddy Fk	SR 1313	Alexander	11-69-4	06/21/04	42	Good-Fair
Glade Cr	SR 1610	Alexander	11-69-7-(0.7)	04/26/07	54	Excellent
Elk Shoal Cr	SR 1605	Alexander	11-73-(0.5)	05/23/02	48	Good
				05/09/97	54	Excellent
				05/11/93	48	Good
Lyle Cr	US 70	Catawba	11-76-(3.5)	07/14/04	58	Excellent
				07/01/97	48	Good
				05/11/93	50	Good
Buffalo Shoals Cr	SR 1503	Iredell	11-78-(0.5)	04/26/07	52	Good
				06/04/97	58	Excellent
McDowell Cr	SR 2136	Mecklenburg	11-115-(1.5)	05/20/02	22	Poor
				06/12/97	40	Fair
Dutchmans Cr	SR 1918	Gaston	11-119-(0.5)	06/30/93	50	Good
Leepers Cr	NC 73	Lincoln	11-119-1-(1)	04/25/07	46	Good-Fair
				05/20/97	52	Good
				06/29/93	56	Excellent
Killian Cr	NC 73	Lincoln	11-119-2-(0.5)	04/25/07	52	Good
				05/21/02	46	Good-Fair
				05/20/97	52	Good
Killian Cr	SR 1511	Lincoln	11-119-2-(0.5)	06/29/93	56	Excellent
Anderson Cr	SR 1383	Lincoln	11-119-2-2	04/25/07	48	Good
Forney Cr	SR 1386	Lincoln	11-119-2-3	04/25/07	40	Fair
Long Cr	SR 2042	Mecklenburg	11-120-(0.5)	07/15/04	48	Good
Catawba Cr	SR 2435	Gaston	11-130	04/24/07	34	Poor
				05/22/02	40	Fair
				05/19/97	42	Good-Fair
Crowders Cr	SR 1131	Gaston	11-135	06/22/04	30	Poor
Crowders Cr	SR 1108	Gaston	11-135	04/24/07	40	Fair
				05/22/02	38	Fair
				05/19/97	36	Fair
S Fk Crowders Cr	SR 1109	Gaston	11-135-10-1	06/22/04	42	Good-Fair
03050102 South Fork Catawba River						
Henry Fk	SR 1922	Burke	11-129-1-(2)	05/23/07	52	Good
				09/28/98	52	Good
Henry Fk	SR 1916	Burke	11-129-1-(2)	05/06/97	46	Good-Fair
Jacob Fk	SR 1924	Burke	11-129-2-(4)	05/03/99	54	Excellent
				09/28/98	52	Good
				05/06/97	56	Excellent
Little R	off SR 1900	Burke	11-129-2-5	03/28/07	50	Good
Pott Cr	SR 1217	Lincoln	11-129-3-(0.7)	05/31/06	40	Fair
				05/21/02	50	Good
				05/21/97	50	Good
Howards Cr	SR 1185	Lincoln	11-129-4	04/24/07	48	Good
Clark Cr	SR 2012	Catawba	11-129-5-(0.3)	07/14/04	34	Poor
Maiden Cr	off SR 1892	Catawba	11-129-5-7-2-(1)	03/18/93	30	Poor
Maiden Cr	SR 1858	Catawba	11-129-5-7-2-(1)	03/18/93	42	Good-Fair
Indian Cr	SR 1252	Lincoln	11-129-8-(6.5)	06/01/06	38	Fair
				05/21/02	38	Fair
				07/01/97	38	Fair
Beaverdam Cr	SR 1609	Gaston	11-129-9-(0.7)	05/31/06	54	Excellent
				05/21/02	50	Good

Appendix F-3 (continued).

HUC/Waterbody	Station	County	Index No.	Date	NCIBI Score	NCIBI Rating
Hoyle Cr	SR 1836	Gaston	11-129-15-(6)	05/31/06	40	Fair
				05/22/02	42	Good-Fair
				06/12/97	48	Good
Long Cr	SR 1456	Gaston	11-129-16-(4)	07/15/04	54	Excellent
Long Cr	US 321	Gaston	11-129-16-(4)	05/22/02	46	Good-Fair
				05/20/97	40	Fair
				06/30/93	30	Poor
03050103 Catawba River						
Irwin Cr	off US 521	Mecklenburg	11-137-1	07/15/04	32	Poor
Sugar Cr	SR 1156	Mecklenburg	11-137-1	04/15/99	28	Poor
				06/30/97	32	Poor
				06/30/93	18	Poor
Little Sugar Cr	SR 3815	Mecklenburg	11-137-8	03/27/07	40	Fair
Little Sugar Cr	NC 51	Mecklenburg	11-137-8	04/24/07	40	Fair
				04/15/99	42	Good-Fair
				06/30/97	40	Fair
McAlpine Cr	NC 51	Mecklenburg	11-137-9	07/16/04	36	Fair
McMullen Cr	off NC 51	Mecklenburg	11-137-9-5	03/27/07	50	Good
Twelvemile Cr	NC 16	Union	11-138	05/20/02	42	Fair
				06/11/97	48	Good
W Fk Twelvemile Cr	SR 1321	Union	11-138-1	04/23/07	48	Good
E Fk Twelvemile Cr	SR 1008	Union	11-138-2	04/23/07	48	Good
Sixmile Cr	SR 1312	Union	11-138-3	05/20/02	38	Fair
				06/11/97	40	Fair
Waxhaw Cr	SR 1103	Union	11-139	04/23/07	48	Good
				06/11/97	56	Excellent

Appendix F-4. Fish community metric values from 44 wadeable streams in the Catawba River basinwide monitoring program, 2004 – 2007.[1]

HUC Waterbody	Location	County	d. a. (mi^2)	Date	No. Species	No. Fish	No. Sp. Darters	No. Sp. SBT	No. Sp. Suckers	No. Intol. Sp.	% Tolerant	% Omni. +Herb.	% Insect.	% Pisc.	% DELT	% MA
03050101 Catawba River Headwaters																
Curtis Cr	US 70	McDowell	16.7	05/24/07	20	746	3	5	3	4	10	35	63	2.28	0.00	70
Crooked Cr	SR 1135	McDowell	28.1	05/24/07	19	466	3	2	3	1	5	29	71	0.21	0.00	84
Paddy Cr	NC 126	Burke	6.7	05/23/07	12	349	1	3	1	1	6	57	41	2.58	0.00	75
S Muddy Cr	SR 1764	McDowell	33.5	05/23/07	16	224	3	2	3	1	5	18	82	0.00	0.00	69
N Muddy Cr	SR 1760	McDowell	45.7	05/23/07	23	225	3	4	4	1	14	39	61	0.00	0.00	74
Silver Cr	SR 1149	Burke	26.1	05/22/07	13	152	3	1	2	1	15	32	68	0.00	0.00	69
Irish Cr	SR 1439	Burke	33.9	05/22/07	21	194	4	5	3	3	4	26	70	3.61	0.00	62
Johns R	off SR 1367	Caldwell	18.4	05/22/07	17	793	2	4	3	3	4	50	49	1.39	0.00	76
Gragg Prong	SR 1367	Caldwell	14.9	05/22/07	17	1080	3	4	2	4	1	34	63	2.87	0.00	82
Mulberry Cr	NC 90	Caldwell	32.0	05/21/07	22	421	3	3	3	4	7	33	65	1.90	0.00	68
Smoky Cr	SR 1515	Burke	7.6	05/21/07	17	316	2	3	4	1	10	42	58	0.32	0.00	71
Drowning Cr	SR 1647	Burke	15.0	05/21/07	12	392	1	3	2	0	17	51	48	0.26	0.00	58
Upper Little R	SR 1712	Caldwell	11.3	04/27/07	10	643	2	1	2	0	12	20	80	0.00	0.00	90
Middle Little R	SR 1002	Alexander	16.3	04/27/07	12	295	2	1	1	2	12	23	77	0.00	0.34	83
Duck Cr	NC 90	Alexander	14.6	04/26/07	11	387	1	1	2	1	21	22	78	0.00	0.00	82
Lambert Fk	SR 1317	Alexander	10.3	04/26/07	9	267	1	0	1	1	13	25	75	0.00	0.00	89
Muddy Fk	SR 1313	Alexander	12.6	06/21/04	11	336	0	2	1	1	18	42	58	0.00	0.00	55
Glade Cr	SR 1610	Alexander	12.7	04/26/07	14	315	2	2	2	2	11	16	84	0.00	0.32	64
Lyle Cr	US 70	Catawba	43.2	07/14/04	19	288	3	5	4	1	9	37	61	1.74	0.69	63
Buffalo Shoals Cr	SR 1503	Iredell	13.8	04/26/07	13	416	2	3	3	0	19	24	76	0.24	0.00	85
Leepers Cr	NC 73	Lincoln	28.2	04/25/07	17	147	2	2	3	0	14	28	72	0.00	0.68	59
Killian Cr	NC 73	Lincoln	12.1	04/25/07	14	311	2	3	2	0	24	17	83	0.00	0.32	64
Anderson Cr	SR 1383	Lincoln	21.5	04/25/07	15	268	2	3	1	0	10	22	78	0.00	0.00	80
Forney Cr	SR 1386	Lincoln	7.8	04/25/07	11	252	2	4	0	0	18	3	97	0.00	0.00	64
Long Cr	SR 2042	Mecklenburg	16.4	07/15/04	17	176	1	4	1	0	30	27	70	2.27	0.00	47
Catawba Cr	SR 2435	Gaston	23.4	04/24/07	10	117	1	2	1	0	8	39	61	0.00	1.71	80
Crowders Cr	SR 1131	Gaston	23.5	06/22/04	9	142	0	4	1	0	83	4	94	2.11	0.00	22
Crowders Cr	SR 1108	Gaston	40.7	04/24/07	12	96	2	3	1	1	17	42	58	0.00	0.00	50
S Fk Crowders Cr	SR 1109	Gaston	27.6	06/22/04	13	120	1	4	1	0	18	32	68	0.83	0.00	54
03050102 South Fork Catawba River																
Henry Fk	SR 1922	Burke	19.1	05/23/07	13	463	2	3	2	4	2	49	47	4.32	0.00	77
Pott Cr	SR 1217	Lincoln	21.0	05/31/06	13	73	2	2	2	2	16	40	60	0.00	0.00	31
Howards Cr	SR 1185	Lincoln	17.1	04/24/07	20	169	3	6	2	2	31	41	59	0.00	0.00	50
Clark Cr	SR 2012	Catawba	30.8	07/14/04	9	75	1	3	1	0	47	35	64	1.33	1.33	44
Indian Cr	SR 1252	Lincoln	69.2	06/01/06	14	111	0	3	2	0	49	27	73	0.00	0.00	43
Beaverdam Cr	SR 1609	Gaston	23.0	05/31/06	18	148	3	6	3	2	33	19	80	1.35	0.00	50
Hoyle Cr	SR 1836	Gaston	27.5	05/31/06	15	218	1	6	2	0	17	56	43	0.92	0.00	60
Long Cr	SR 1456	Gaston	31.1	07/15/04	17	287	2	5	2	2	34	18	81	1.39	0.00	53

Appendix F-4 (continued).

HUC Waterbody	Location	County	d. a. (mi^2)	Date	No. Species	No. Fish	No. Sp. Darters	No. Sp. SBT	No. Sp. Suckers	No. Intol. Sp.	% Tolerant	% Omni. +Herb.	% Insect.	% Pisc.	% DELT	% MA
03050103 Catawba River																
Irwin Cr	off US 521	Mecklenburg	30.7	07/15/04	8	392	0	4	0	0	62	7	92	1.02	0.00	50
Little Sugar Cr	NC 51	Mecklenburg	49.2	04/24/07	14	510	1	4	1	0	60	11	89	0.00	0.20	57
McAlpine Cr	NC 51	Mecklenburg	52.6	07/16/04	13	346	1	4	1	0	64	3	95	1.16	0.29	77
McMullen Cr	off NC 51	Mecklenburg	13.9	03/27/07	14	248	1	4	2	0	32	34	65	0.81	0.40	71
W Fk Twelvemile Cr	SR 1321	Union	22.3	04/23/07	18	432	2	4	2	0	22	14	86	0.00	0.00	50
E Fk Twelvemile Cr	SR 1008	Union	33.7	04/23/07	14	189	2	4	2	0	11	28	72	0.00	0.00	64
Waxhaw Cr	SR 1103	Union	35.0	04/23/07	14	134	2	3	2	0	28	21	75	3.73	0.00	64

[1]Abbreviations are d. a. = drainage area, No. = number, Sp. = species, SBT = sunfish, bass, and trout, Intol. = intolerants, Omni. + Herb. = omnivores+herbivores, Insect. = insectivores, Pisc. = piscivores, DELT = disease, erosion, lesions, and tumors, and MA = species with multiple age groups.

Appendix F-5. Fish distributional records for the Catawba River basin.

Based upon Menhinick (1991), NC DWQ's data, and data from other researchers, approximately 95 species have been collected from the Catawba River Basin (Table 4 in Appendix F-1). The known species assemblage now includes 34 species of minnows, 12 species of suckers, 9 species of catfish, 14 species of sunfish and bass, and 9 species of darters. A few new county distributional records were also recorded in 2007 from DWQ's fish community monitoring efforts (Table 1).

Table 1. New distributional records for the Catawba River basin.

Family/Species	Common Name	County
Cyprinidae	**Carps and Minnows**	
Cyprinella pyrrhomelas	Fieryblack Shiner	Alexander
Notropis petersoni	Coastal Shiner	Union
Pimephales promelas	Fathead Minnow	Alexander
Phoxinus oreas	Mountain Redbelly Dace	Caldwell
Centrarchidae	**Sunfishes**	
Lepomis cyanellus	Green Sunfish	McDowell

At least 34 of the 95 species (36 percent of the total basin fauna) are nonindigenous (exotic) and were introduced either as sportfish, forage fish, baitfish, or for reasons unknown (Table 2). In 2004 – 2007, 10 of the 52 species collected were nonindigenous species. Of the 44 streams sampled in 2004-2007, only 11did not have any nonindigenous species present (Middle Little and Upper Little rivers, Lambert and Muddy forks, and South Muddy, Smoky, Drowning, Long (Mecklenburg County), Crowders (at SR 1131), South Fork Crowders, and Waxhaw creeks.

Table 2. Nonindigenous species in the Catawba River basin. Species collected in 2004 – 2007 are highlighted in blue.

Family/Species	Common Name	Family/Species	Common Name
Clupeidae	**Herrings**	**Salmonidae**	**Trouts and Salmons**
Alosa aestivalis	Blueback Herring	*Oncorhynchus mykiss*	Rainbow Trout
Alosa pseudoharengus	Alewife	*Salmo trutta*	Brown Trout
Dorosoma petenense	Threadfin Shad	**Moronidae**	**Temperate Basses**
Cyprinidae	**Carps and Minnows**	*Morone americana*	White Perch
Carassius auratus	Goldfish	*M. chrysops*	White Bass
Ctenopharyngodon idella	Grass Carp	*M. saxatilis*	Striped Bass
Cyprinus carpio	Common Carp	**Centrarchidae**	**Sunfishes**
Nocomis micropogon	River Chub	*Ambloplites rupestris*	Rock Bass
Notropis alborus	Whitemouth Shiner	*Lepomis cyanellus*	Green Sunfish
N. chiliticus	Redlip Shiner	*L. microlophus*	Redear Sunfish
N. leuciodus	Tennessee Shiner	*Micropterus coosae*	Redeye Bass
N. rubricroceus	Saffron Shiner	*M. dolomieu*	Smallmouth Bass
Phoxinus oreas	Mountain Redbelly Dace	*M. punctulatus*	Spotted Bass
Pimephales promelas	Fathead Minnow	*Pomoxis annularis*	White Crappie
Catostomidae	**Suckers**	**Percidae**	**Perches**
Ictiobus bubalus	Smallmouth Buffalo	*Perca flavescens*	Yellow Perch
I. cyprinellus	Bigmouth Buffalo	*Sander canadensis*	Sauger
Ictaluridae	**North American Catfishes**	*S. vitreus*	Walleye
Ameiurus melas	Black Bullhead		
Ictalurus furcatus	Blue Catfish		
I. punctatus	Channel Catfish		
Pylodictis olivaris	Flathead Catfish		

Special protection status has been given to 2 of the 95 species by the U. S. Department of the Interior, the NC Wildlife Resources Commission, or the NC Natural Heritage Program under the NC State Endangered Species Act (G.S. 113-331 to 113-337) (LeGrand *et al*. 2006; Menhinick and Braswell 1997) (Table 3). During the assessment period, the Carolina Darter was collected in West Fork Twelvemile, East Fork Twelvemile, and Waxhaw creeks. *Carpiodes* sp. cf. *velifer* is a big river fish and would not be encountered in the wadeable stream fish community assessment program.

Table 3. Species of fish listed as endangered, threatened, of special concern, or significantly rare in the Catawba River basin.

Species	Common Name	Status	State Rank
Carpiodes sp. cf. *velifer*	No common name	Special Concern	S1
Etheostoma collis pop. 1	Carolina Darter	Special Concern	S3

[1]S1 = Critically imperiled in North Carolina because of extreme rarity or because of some factor (s) making it especially vulnerable to extirpation from North Carolina. S3 = rare or uncommon in North Carolina (LeGrand *et al*. 2006).

In 2004 – 2007, 52 of the 95 species were collected. Species not collected included those with preferences for larger rivers or reservoirs (e.g. some of the larger species of suckers and catfish) and some of the more uncommon upper basin species such as the Saffron Shiner and Longnose Dace. The most widely distributed species were the Redbreast Sunfish and Bluehead Chub; these two species were collected at 43 and 41 of the 44 sites, respectively. Species less widely distributed and collected at only 1 or 2 sites included Santee Chub, Eastern Silvery Minnow, Coastal Shiner, Mountain Redbelly Dace, Fathead Minnow, Western Blacknose Dace, Shorthead Redhorse, Black Bullhead, Chain Pickerel, Rock Bass, and Black Crappie. The most abundant species were the Bluehead Chub, Redbreast Sunfish, and Tessellated Darter; these three species constituted 36 percent of all the fish collected. By contrast, some of the rarer species (less than five specimens collected) included the Santee Chub, Mountain Redbelly Dace, Fathead Minnow, Western Blacknose Dace, Shorthead Redhorse, White Catfish, Black Bullhead, and Black Crappie.

Appendix F-6. Habitat evaluations and stream and riparian habitats at 44 fish community monitoring sites in the Catawba River basin, 2004 - 2007.

Habitat Assessments

A method and scoring system has been developed to evaluate the physical habitats of a stream (NCDENR 2006). The narrative descriptions of eight habitat characteristics, including channel modification, amount of instream habitat, type of bottom substrate, pool variety, riffle frequency, bank stability, light penetration, and riparian zone width, are converted into numerical scores. The total habitat score ranges between 1 and 100. Higher numbers suggest better habitat quality, but criteria have not been developed to assign ratings. Scores greater than 65 generally represent moderate to high quality habitat sites, whereas scores less than 65 generally represent low to poor quality habitat sites (DWQ unpublished data).

Of the 44 sites sampled in 2004 – 2007, one-half of the streams had overall moderate to high quality habitats (score ≥ 65). The other one-half of the streams, mostly in the Southern Outer Piedmont, had overall low to poor quality habitats (score < 65) (Figure 1 and Tables 1 and 2). Habitat scores ranged from 24 at Crowders Creek (at SR 1131) to 95 at Gragg Prong (Tables 1 – 3).

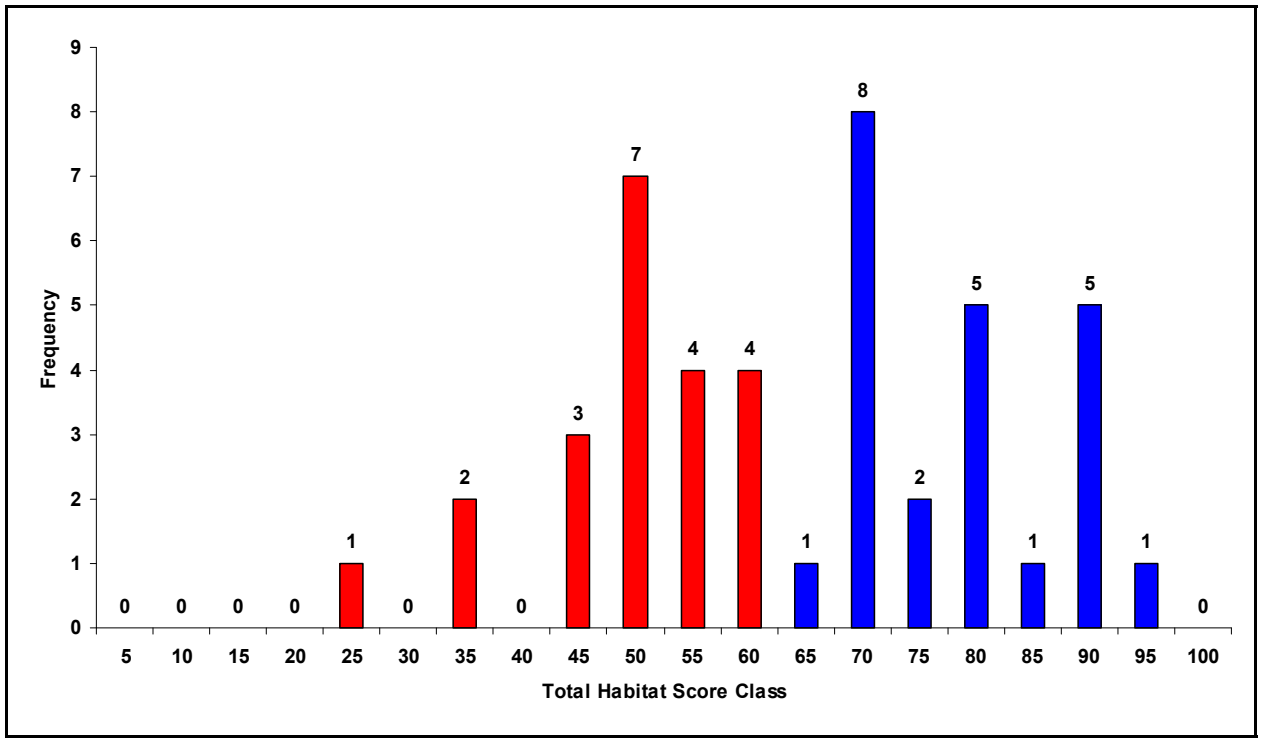


Figure 1. Distribution of the total habitat scores at 44 fish community sites in the Catawba River basin, 2004 - 2007. High to moderate quality scores are shown in blue and low to poor quality habitat sites are shown in red.

Table 1. Habitat evaluations at 44 basinwide fish community sites in the Catawba River basin, 2004 - 2007. Red bold denotes less than optimal habitat conditions.

HUC	Waterbody	Location	County	Channel	Instream Habitat	Substrate	Pools	Riffles	Bank Stability-L	Bank Stability-R	Shade	Riparian Zone-L	Riparian Zone-R	Total Score
03050101 Catawba River Headwaters														
	Curtis Cr	US 70	McDowell	5	18	12	9	14	6	6	8	5	5	88
	Crooked Cr	SR 1135	McDowell	5	16	**7**	6	15	5	6	10	5	5	80
	Paddy Cr	NC 126	Burke	5	18	15	9	16	5	6	9	**0**	3	86
	S Muddy Cr	SR 1764	McDowell	4	14	**4**	**4**	12	6	6	10	3	3	66
	N Muddy Cr	SR 1760	McDowell	5	16	**5**	6	14	7	7	9	5	5	79
	Silver Cr	SR 1149	Burke	5	11	**3**	**4**	**2**	**3**	**3**	10	5	5	51
	Irish Cr	SR 1439	Burke	5	12	**3**	6	**1**	5	5	7	3	3	50
	Johns R	off SR 1367	Caldwell	5	19	15	8	15	7	7	**5**	4	5	90
	Gragg Prong	SR 1367	Caldwell	5	19	15	10	16	7	7	6	5	5	95
	Mulberry Cr	NC 90	Caldwell	5	16	**7**	6	10	5	5	8	4	3	69
	Smoky Cr	SR 1515	Burke	5	16	8	7	9	7	6	9	5	5	77
	Drowning Cr	SR 1647	Burke	5	14	**3**	10	**3**	7	5	10	5	4	66
	Upper Little R	SR 1712	Caldwell	5	16	**4**	**4**	11	**3**	5	9	5	5	67
	Middle Little R	SR 1002	Alexander	5	18	8	8	12	6	6	10	5	5	83
	Duck Cr	NC 90	Alexander	5	16	9	8	12	6	4	10	5	2	77
	Lambert Fk	SR 1317	Alexander	5	16	**6**	**2**	12	4	4	10	5	5	69
	Muddy Fk	SR 1313	Alexander	5	**9**	**3**	**4**	**1**	**2**	**2**	**5**	**1**	**1**	33
	Glade Cr	NC 16/SR 1610	Alexander	5	16	**6**	10	11	6	6	9	5	5	79
	Lyle Cr	US 70	Catawba	5	10	**4**	6	**4**	**2**	**2**	**5**	5	3	46
	Buffalo Shoals Cr	SR 1503	Iredell	5	16	10	10	15	7	7	10	5	5	90
	Leepers Cr	NC 73	Lincoln	5	16	**4**	8	**4**	**3**	5	**2**	5	5	57
	Killian Cr	NC 73	Lincoln	5	15	**3**	**5**	**2**	5	5	9	4	4	57
	Anderson Cr	SR 1383	Lincoln	5	14	**3**	6	**5**	5	5	10	**1**	5	59
	Forney Cr	SR 1386	Lincoln	5	13	**3**	**4**	**2**	**3**	**3**	7	5	5	50
	Long Cr	SR 2042	Mecklenburg	5	**9**	**3**	**4**	**1**	**2**	**2**	10	5	3	44
	Catawba Cr	SR 2435	Gaston	5	**9**	**3**	6	**1**	**2**	**2**	8	5	**0**	41
	Crowders Cr	SR 1131	Gaston	3	**6**	**3**	6	**0**	**2**	**2**	**0**	**1**	**1**	24
	Crowders Cr	SR 1108	Gaston	5	14	**3**	6	**3**	4	4	9	5	5	58
	S Fk Crowders Cr	SR 1109	Gaston	5	12	**3**	9	**1**	2	2	10	**2**	**2**	48
03050102 South Fork Catawba River														
	Henry Fk	SR 1922	Burke	5	18	12	8	15	7	7	10	5	3	90
	Pott Cr	SR 1217	Lincoln	5	13	**3**	9	**2**	**3**	**3**	7	5	5	55
	Howards Cr	SR 1185	Lincoln	4	14	**4**	6	**7**	4	4	8	**0**	**1**	52
	Clark Cr	SR 2012	Catawba	5	14	**3**	6	**1**	**2**	**2**	9	**2**	**2**	47
	Indian Cr	SR 1252	Lincoln	5	16	**3**	9	10	6	4	9	5	5	72
	Beaverdam Cr	SR 1609	Gaston	5	16	**3**	9	**7**	7	7	8	5	5	72
	Hoyle Cr	SR 1836	Gaston	5	12	**3**	8	**1**	**3**	**3**	9	3	3	50
	Long Cr	SR 1456	Gaston	5	12	**3**	7	**3**	**3**	**3**	10	4	5	55

Table 1 (continued).

HUC	Waterbody	Location	County	Channel	Instream Habitat	Substrate	Pools	Riffles	Bank Stability-L	Bank Stability-R	Shade	Riparian Zone-L	Riparian Zone-R	Total Score
03050103 Catawba River														
	Irwin Cr	off US 521	Mecklenburg	4	15	**6**	**4**	12	5	5	7	5	5	68
	Little Sugar Cr	NC 51	Mecklenburg	3	**9**	**3**	6	**3**	**2**	**2**	**2**	**2**	3	35
	McAlpine Cr	NC 51	Mecklenburg	4	**9**	**3**	6	**1**	**1**	**1**	8	5	4	42
	McMullen Cr	off NC 51	Mecklenburg	4	11	**3**	6	**0**	**3**	**3**	10	4	5	49
	W Fk Twelvemile Cr	SR 1321	Union	4	16	10	6	**7**	4	6	6	4	4	67
	E Fk Twelvemile Cr	SR 1005	Union	5	16	**3**	10	**7**	**3**	**3**	9	5	5	66
	Waxhaw Cr	SR 1103	Union	5	16	**3**	10	**1**	4	4	9	5	5	62
Maximum possible scores				**5**	**20**	**15**	**10**	**16**	**7**	**7**	**10**	**5**	**5**	**100**

Table 2. Rankings of 44 waterbodies in Catawba River basin according to the total habitat scores, 2004 - 2007.

HUC	Waterbody	Location	County	Ecoregion	Score
High to Moderate Quality Habitats					
03050101	Gragg Prong	SR 1367	Caldwell	Southern Crystalline Ridges and Mountains	95
03050101	Buffalo Shoals Cr	SR 1503	Iredell	Northern Inner Piedmont	90
03050102	Henry Fk	SR 1922	Burke	Eastern Blue Ridge Foothills	90
03050101	Johns R	off SR 1367	Caldwell	Southern Crystalline Ridges and Mountains	90
03050101	Curtis Cr	US 70	McDowell	Eastern Blue Ridge Foothills	88
03050101	Paddy Cr	NC 126	Burke	Northern Inner Piedmont	86
03050101	Middle Little R	SR 1002	Alexander	Northern Inner Piedmont	83
03050101	Crooked Cr	SR 1135	McDowell	Eastern Blue Ridge Foothills	80
03050101	Glade Cr	NC 16/SR 1610	Alexander	Northern Inner Piedmont	79
03050101	N Muddy Cr	SR 1760	McDowell	Northern Inner Piedmont	79
03050101	Duck Cr	NC 90	Alexander	Northern Inner Piedmont	77
03050101	Smoky Cr	SR 1515	Burke	Northern Inner Piedmont	77
03050102	Beaverdam Cr	SR 1609	Gaston	Southern Inner Piedmont	72
03050102	Indian Cr	SR 1252	Lincoln	Southern Inner Piedmont	72
03050101	Lambert Fk	SR 1317	Alexander	Northern Inner Piedmont	69
03050101	Mulberry Cr	NC 90	Caldwell	Northern Inner Piedmont	69
03050103	Irwin Cr	off US 521	Mecklenburg	Southern Outer Piedmont	68
03050101	Upper Little R	SR 1712	Caldwell	Northern Inner Piedmont	67
03050103	W Fk Twelvemile Cr	SR 1321	Union	Carolina Slate Belt	67
03050101	Drowning Cr	SR 1647	Burke	Northern Inner Piedmont	66
03050103	E Fk Twelvemile Cr	SR 1005	Union	Carolina Slate Belt	66
03050101	S Muddy Cr	SR 1764	McDowell	Northern Inner Piedmont	66
Low to Poor Quality Habitats					
03050103	Waxhaw Cr	SR 1103	Union	Southern Outer Piedmont	62
03050101	Anderson Cr	SR 1383	Lincoln	Southern Outer Piedmont	59
03050101	Crowders Cr	SR 1108	Gaston	Southern Outer Piedmont	58
03050101	Killian Cr	NC 73	Lincoln	Southern Outer Piedmont	57
03050101	Leepers Cr	NC 73	Lincoln	Southern Outer Piedmont	57
03050102	Long Cr	SR 1456	Gaston	Southern Inner Piedmont	55
03050102	Pott Cr	SR 1217	Lincoln	Northern Inner Piedmont	55
03050102	Howards Cr	SR 1185	Lincoln	Southern Inner Piedmont	52
03050101	Silver Cr	SR 1149	Burke	Northern Inner Piedmont	51
03050101	Forney Cr	SR 1386	Lincoln	Southern Outer Piedmont	50
03050102	Hoyle Cr	SR 1836	Gaston	Southern Inner Piedmont	50
03050101	Irish Cr	SR 1439	Burke	Northern Inner Piedmont	50
03050103	McMullen Cr	off NC 51	Mecklenburg	Southern Outer Piedmont	49
03050101	S Fk Crowders Cr	SR 1109	Gaston	Southern Outer Piedmont	48
03050102	Clark Cr	SR 2012	Catawba	Northern Inner Piedmont	47
03050101	Lyle Cr	US 70	Catawba	Northern Inner Piedmont	46
03050101	Long Cr	SR 2042	Mecklenburg	Southern Outer Piedmont	44
03050103	McAlpine Cr	NC 51	Mecklenburg	Southern Outer Piedmont	42
03050101	Catawba Cr	SR 2435	Gaston	Southern Outer Piedmont	41
03050103	Little Sugar Cr	NC 51	Mecklenburg	Southern Outer Piedmont	35
03050101	Muddy Fk	SR 1313	Alexander	Northern Inner Piedmont	33
03050101	Crowders Cr	SR 1131	Gaston	Southern Outer Piedmont	24

Major differences between the high to moderate and the low to poor quality habitat types were in the instream habitats, substrates, riffles, and bank stabilities (Table 2). Differences were not as pronounced in the degree of channel modification, abundance of pools, extent of canopy cover, or width of riparian zones. Extremely low scores were attributable to poor landuse practices, chronic erosion of the easily eroded soils, and nonpoint source sedimentation within the respective watersheds.

Characteristics of moderate to high quality habitat streams are (Figure 2):

- instream habitats composed of rocks, sticks, leafpacks, snags, logs, undercut banks and root mats;
- a substrate of cobble and gravel with low embeddedness;
- frequent pools and riffles of varying depths and widths; and
- stable banks with a good tree canopy and a medium to wide riparian zone with no or rare breaks.

Table 3. Mean habitat scores for 44 fish community sites in the Catawba River basin, 2004 – 2007.

Habitat characteristics	Low - Poor Quality Habitat	Moderate - High Quality Habitat	Maximum score
Instream habitat	11.8	16.4	20
Substrate	3.1	7.8	15
Riffles	2.1	11.6	16
Bank stability (right and left)	6.0	11.4	14

Figure 2. High quality instream habitats at the Johns River off SR 1367, Caldwell County (left) and wide riparian zones with a good tree canopy at the Middle Little River at SR 1002, Alexander County (right).

Characteristics of low to poor quality habitat streams are (Figure 3):

- a substrate of primarily sand with instream bar development;
- an absence of riffles; if present, they are infrequent and usually caused by embedded, coarse woody debris; and
- a deeply entrenched channel with easily erodible and unstable, vertical, sparsely vegetated banks.

Figure 3. Narrow riparian zones and a lack of canopy at Crowders Creek at SR 1131, Gaston County (left) and deeply entrenched and eroding banks at Catawba Creek at SR 2435, Gaston County (right).

Habitat and NCIBI Relationships

Fish communities rated Excellent were found where the habitats were of moderate to high quality (Tables 1 and 4), with the exceptions of Irish, Lyle, and Long creeks; about one-half of the communities rated

Good also had habitats of moderate to high quality. Communities rated Good-Fair, Fair, or Poor, where there were moderate to high quality habitats, were generally streams affected by low flow (Upper Little River and Lambert Fork), low flow and recolonization barriers (Indian Creek), localized poor landuse (Paddy Creek), or were located in or downstream of urbanized areas where good buffers and instream habitats remained (Drowning and Irwin creeks). Twelve of the 22 sites with low to poor quality habitats were rated Good-Fair, Fair, or Poor. Many of these sandy bottom sites were affected by nonpoint source erosion, urban/suburban development, or WWTP discharges.

Table 4. NCIBI ratings and habitat quality for 44 streams of the Catawba River basin, 2004 - 2007.[1]

NCIBI Rating	Waterbodies with Low to Poor Quality Habitat (Score < 65)	Waterbodies with Moderate to High Quality Habitat (Score ≥ 65)
Excellent	Irish Cr, Lyle Cr, Long Cr (Gaston Co.)	Curtis Cr, N Muddy Cr, Johns R, Gragg Pr, Mulberry Cr, Smoky Cr, Glade Cr, Beaverdam Cr
Good	Silver Cr, Killian Cr, Anderson Cr, Long Cr (Mecklenburg), Howards Cr, McMullen Cr, Waxhaw Cr	Crooked Cr, S Muddy Cr, Middle Little R, Duck Cr, Buffalo Shoals Cr, Henry Fk, W Fk Twelvemile Cr, E Fk Twelvemile Cr
Good-Fair	Muddy Fk, Leepers Cr, S Fk Crowders Cr	Paddy Cr, Drowning Cr, Upper Little R, Lambert Fk
Fair	Forney Cr, Crowders Cr (SR 1108), Pott Cr, Hoyle Cr, L Sugar Cr, McAlpine Cr	Indian Cr
Poor	Catawba Cr, Crowders Cr (SR 1131), Clark Cr	Irwin Cr

[1]Blue denotes streams with moderate to high quality habitats and fish communities rated Good or Excellent. Red denotes streams with low to poor quality habitats and fish communities rated Fair or Poor.

The remaining 10 sites with low to poor quality habitats were rated Good or Excellent. Explanations for these inconsistencies are:

- In 2002 and 2003 the habitats at Irish Creek were scored a 38 and 36 and the community was rated Fair. In 2007 greater habitat scores were given for bank stability, shade, and width of riparian zones than given in 1997. The reason for the dramatic improvement in the fish community rating was not known.
- In 1997 the habitats at Lyle Creek were scored a 73 and the community was rated Good. In 2007 the habitat scores were 27 points lower due to a loss of riffles, some canopy cover, and instream habitats, but the community rated Excellent. Upstream WWTP discharge may enhance the community by proving more stable flows during prolonged droughts.
- At Long Creek (Gaston County), the Excellent fish community benefited from the good canopy cover afforded by the wide riparian zones and possibly from the aeration provided by the upstream natural bedrock shelves and falls. The upper two-thirds of the watershed has also benefited from the implementation of nonpoint source controls during the late 1990s and early 2000s.
- In 2002 the habitats at Silver Creek were scored a 48 and the community was rated Excellent; in 2007 the habitat was scored a 51 and the community rated Good. The decline in the rating was attributed to low flow conditions and nonpoint sources of deposited sediment. There are no permitted dischargers upstream and the watershed drains the northwest slopes of the South Mountains.
- The habitat scores at Killian Creek have ranged from 40 to 57 and, similar to the fish community rating, may be dependent upon flows.
- At Anderson Creek, the habitat quality suffered primarily from the low flows, sandy substrates, and the one narrow riparian zone.
- Long Creek (Mecklenburg County) and McMullen Creek had habitat scores less than 50 and specific conductance readings of 173 and 347 µS/cm, respectively even though there are no known permitted dischargers upstream at either site (Appendix F-8). Habitat characteristics that may be preventing the fish communities from deteriorating include a natural channel, infrequent pools, and wide, forested riparian zones providing good shading to the stream. Based upon the stream's developed watershed and water quality characteristics, the community was expected to rate at most Good-Fair.
- At Howards Creek the fish community was subjected to frequent breaks in the riparian zones and livestock access which contributed sediment and nutrients to the stream. Although the

community was sampled for the first time in 2007 the Good rating may be in jeopardy if the habitat degradation persists.

- In 1997 the habitats at Waxhaw Creek were scored a 74 and the fish community was rated Excellent. The slight decrease in scores between the two years was attributed to a slightly sandier substrate and a loss of small gravely riffles.

Since 1997, 132 rateable fish community samples with associated habitat evaluations have been collected throughout the basin. Disregarding the confounding and multiple effects from flows (especially in Carolina Slate Belt type streams), hydrologic modifications and alterations, lingering impacts from droughts or high flow events, and WWTP discharges, communities rated Excellent or Good were found where high quality instream and riparian habitats existed as contrasted to communities rated Good-Fair to Poor (Figure 7). Median habitat scores for Excellent and Good sites were 79 and 66, respectively; Good-Fair, Fair, and Poor sites had median habitat scores of 59, 53, and 52, respectively.

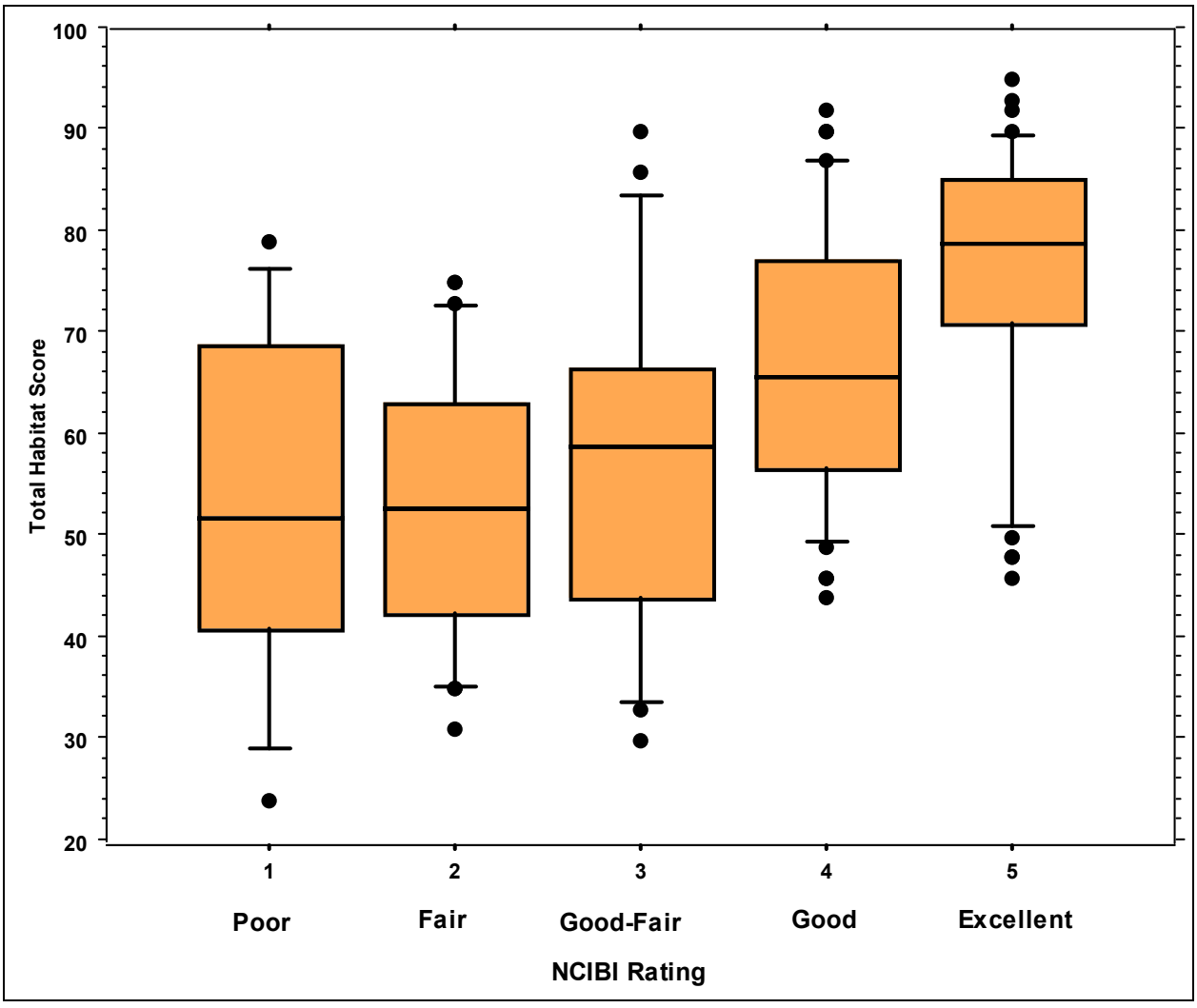


Figure 7. Relationships between total habitat scores and NCIBI ratings in the Catawba River basin, 1997 - 2007.

Appendix F-7. Water quality at 44 fish community sites in the Catawba River basin, 2004 - 2007.

In 2004 - 2007 water quality data (temperature, specific conductance, dissolved oxygen, and pH) were collected at every site during fish community assessments (Table 1). [Note pH measurements were not taken at Crowders Creek (at SR 1131) or South Crowders Creek due to a malfunctioning probe.] No dissolved oxygen concentrations were less than the water quality standard of 5 mg/L. Dissolved oxygen saturation ranged from 62 percent at McAlpine Creek to 125 percent at Irwin Creek. Supersaturation of dissolved oxygen was associated with mid-late afternoon photosynthesis by periphyton. Twelve percent of the pH measurements (5 of the 42 measurements) were less than 6.0 s.u.; all of these measurements were from sites in the upper part of the basin.

Conductivity (specific conductance) ranged from 16 µS/cm at Paddy Creek to 347 µS/cm at McMullen Creek (Table 1 and Figure 1). Elevated readings were associated with dischargers from upstream wastewater treatment plants (e.g., at Little Sugar Creek and Clark Creek) or from nonpoint sources in urban runoff, leaking sewer pipes, or illegal discharges (e.g. at Irwin Creek and McMullen Creek). Conductivity was generally lower in streams draining more forested watersheds in the upper part of the basin (Catawba River Headwaters HUC) and greater in streams draining more agricultural and developed watersheds in the lower part of the basin.

Since 1993, 142 rateable fish community samples with associated conductivity evaluations have been collected throughout the basin. [Two data points – Smoky Creek (1993) and Mackey Creek (1998 below a toxic point source discharge) were not included in this data set.] This data set showed that as conductivity increased, the fish community ratings declined (Figure 2). Median measurements for Excellent, Good, Good-Fair, Fair, and Poor sites were 38, 49, 58, 124, and 188 µS/cm, respectively.

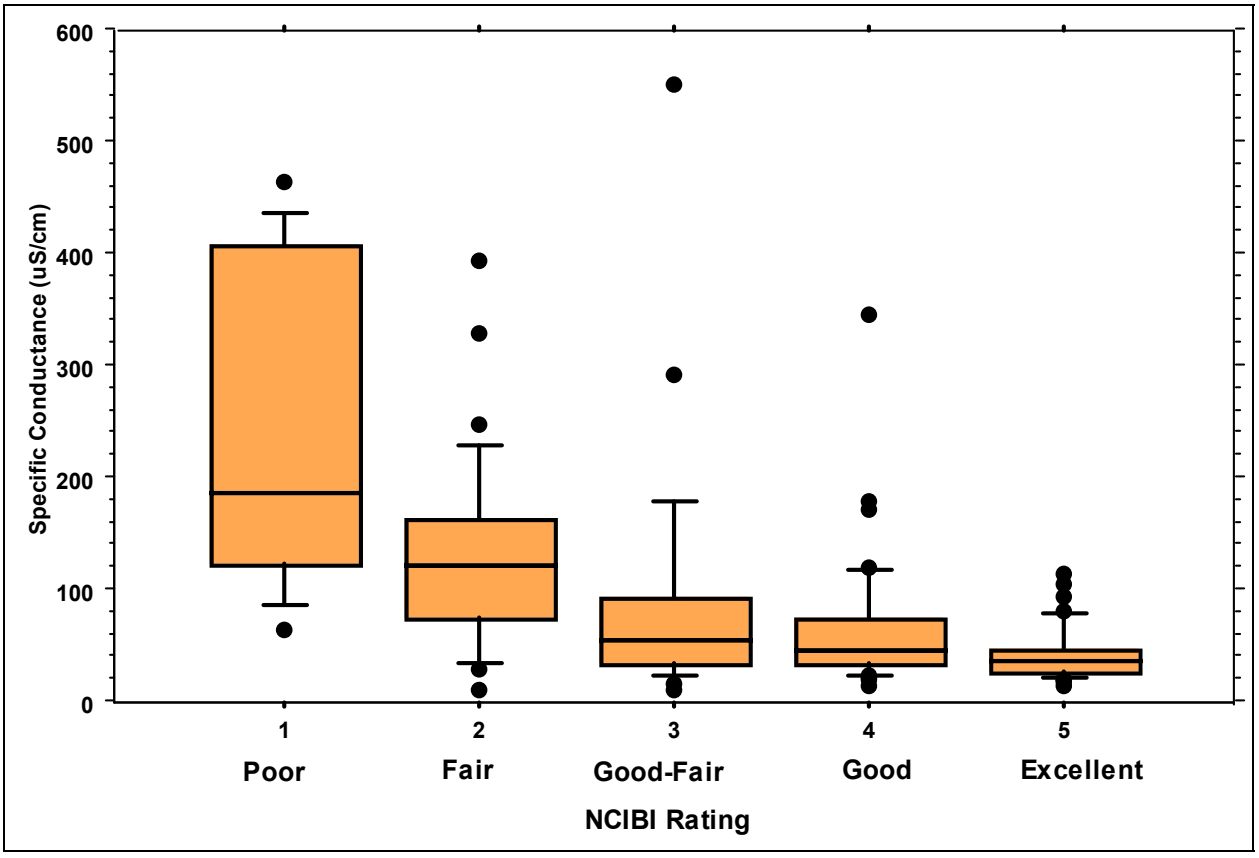


Figure 2. Relationships between conductivity (µS/cm) and NCIBI ratings in the Catawba River basin, 1993 – 2007.

Table 1. Water quality measurements at 44 fish community sites in the Catawba River basin, 2004 - 2007. Red bold denotes less than the water quality standard.

HUC/ Waterbody	Location	County	Date	Temperature (˚C)	Specific conductance (µS/cm)	Dissolved oxygen (mg/L)	Saturation (%)	pH (s.u.)
03050101 Catawba River Headwaters								
Curtis Cr	US 70	McDowell	05/24/07	17.5	21	8.2	86	6.1
Crooked Cr	SR 1135	McDowell	05/24/07	16.6	40	8.5	87	**5.5**
Paddy Cr	NC 126	Burke	05/23/07	17.1	16	8.4	87	6.3
S Muddy Cr	SR 1764	McDowell	05/23/07	18.7	45	8.2	88	6.2
N Muddy Cr	SR 1760	McDowell	05/23/07	19.2	71	8.8	95	7.9
Silver Cr	SR 1149	Burke	05/22/07	18.6	50	8.7	93	6.3
Irish Cr	SR 1439	Burke	05/22/07	18.6	37	9.4	101	6.0
Johns R	off SR 1367	Caldwell	05/22/07	16.6	42	10.0	103	7.4
Gragg Prong	SR 1367	Caldwell	05/22/07	14.7	33	9.3	92	**5.9**
Mulberry Cr	NC 90	Caldwell	05/21/07	19.1	40	9.6	104	6.1
Smoky Cr	SR 1515	Burke	05/21/07	16.6	38	10.0	103	6.4
Drowning Cr	SR 1647	Burke	05/21/07	14.4	43	10.1	99	**5.8**
Upper Little R	SR 1712	Caldwell	04/27/07	16.7	40	9.7	100	6.3
Middle Little R	SR 1002	Alexander	04/27/07	16.8	31	8.6	89	**5.5**
Duck Cr	NC 90	Alexander	04/26/07	18.3	38	9.1	97	6.3
Lambert Fk	SR 1317	Alexander	04/26/07	18.3	27	8.8	94	6.7
Muddy Fk	SR 1313	Alexander	06/21/04	19.0	65	8.1	87	6.2
Glade Cr	SR 1610	Alexander	04/26/07	16.7	49	9.5	98	6.5
Lyle Cr	US 70	Catawba	07/14/04	23.4	95	6.5	76	6.2
Buffalo Shoals Cr	SR 1503	Iredell	04/26/07	15.9	80	8.5	86	6.3
Leepers Cr	NC 73	Lincoln	04/25/07	16.0	65	8.7	88	6.1
Killian Cr	NC 73	Lincoln	04/25/07	17.5	117	8.7	91	7.2
Anderson Cr	SR 1383	Lincoln	04/25/07	16.4	74	8.9	91	6.8
Forney Cr	SR 1386	Lincoln	04/25/07	21.1	164	8.2	92	7.1
Long Cr	SR 2042	Mecklenburg	07/15/04	23.9	173	6.3	75	6.5
Catawba Cr	SR 2435	Gaston	04/24/07	16.4	155	8.5	87	7.0
Crowders Cr	SR 1131	Gaston	06/22/04	25.2	151	9.4	114	ND
Crowders Cr	SR 1108	Gaston	04/24/07	16.8	156	8.7	90	6.8
S Fk Crowders Cr	SR 1109	Gaston	06/22/04	22.1	95	7.4	85	ND
03050102 South Fork Catawba River								
Henry Fk	SR 1922	Burke	05/23/07	15.6	26	9.2	92	**5.5**
Pott Cr	SR 1217	Lincoln	05/31/06	24.6	61	7.1	85	6.1
Howards Cr	SR 1185	Lincoln	04/24/07	17.5	54	8.7	91	6.8
Clark Cr	SR 2012	Catawba	07/14/04	23.1	221	7.1	83	6.6
Indian Cr	SR 1252	Lincoln	06/01/06	20.7	76	7.4	83	6.0
Beaverdam Cr	SR 1609	Gaston	05/31/06	19.8	75	7.8	85	6.2
Hoyle Cr	SR 1836	Gaston	05/31/06	19.0	84	8.3	90	6.0
Long Cr	SR 1456	Gaston	07/15/04	22.5	115	6.9	80	6.3
03050103 Catawba River								
Irwin Cr	off US 521	Mecklenburg	07/15/04	28.5	230	9.7	125	8.2
Little Sugar Cr	NC 51	Mecklenburg	04/24/07	18.1	330	6.9	73	6.9
McAlpine Cr	NC 51	Mecklenburg	07/16/04	23.5	158	5.3	62	6.3
McMullen Cr	off NC 51	Mecklenburg	03/27/07	17.8	347	7.8	82	6.1
W Fk Twelvemile Cr	SR 1321	Union	04/23/07	17.7	112	8.9	93	6.9
E Fk Twelvemile Cr	SR 1008	Union	04/23/07	18.0	180	8.5	90	7.1
Waxhaw Cr	SR 1103	Union	04/23/07	15.2	109	8.3	83	6.8

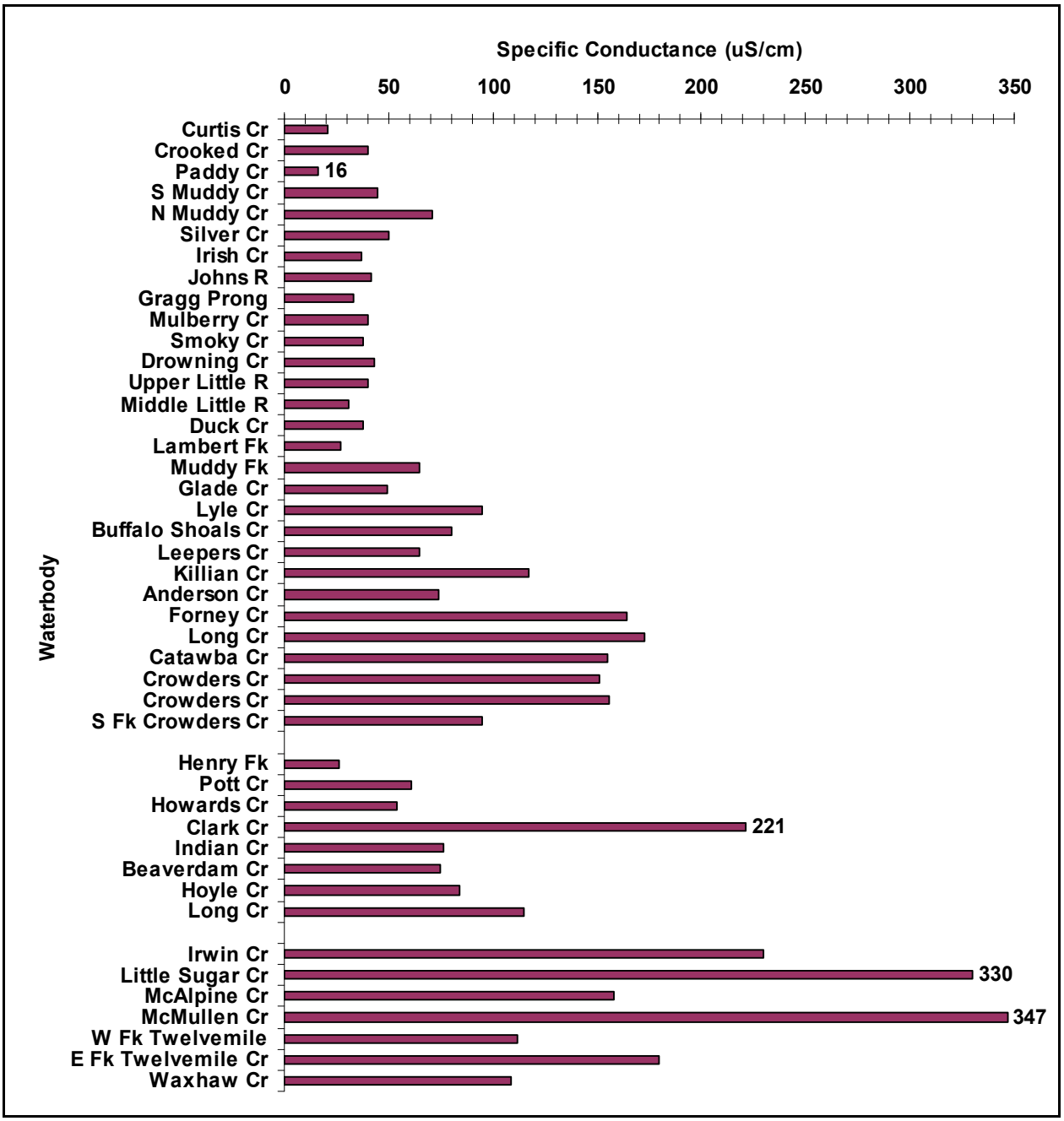


Figure 1. **Specific conductance at 44 fish community sites in the Catawba River basin, 2004 - 2007.**

Appendix F-8. Fish kills in the Catawba River Basin, 2003- 2007.

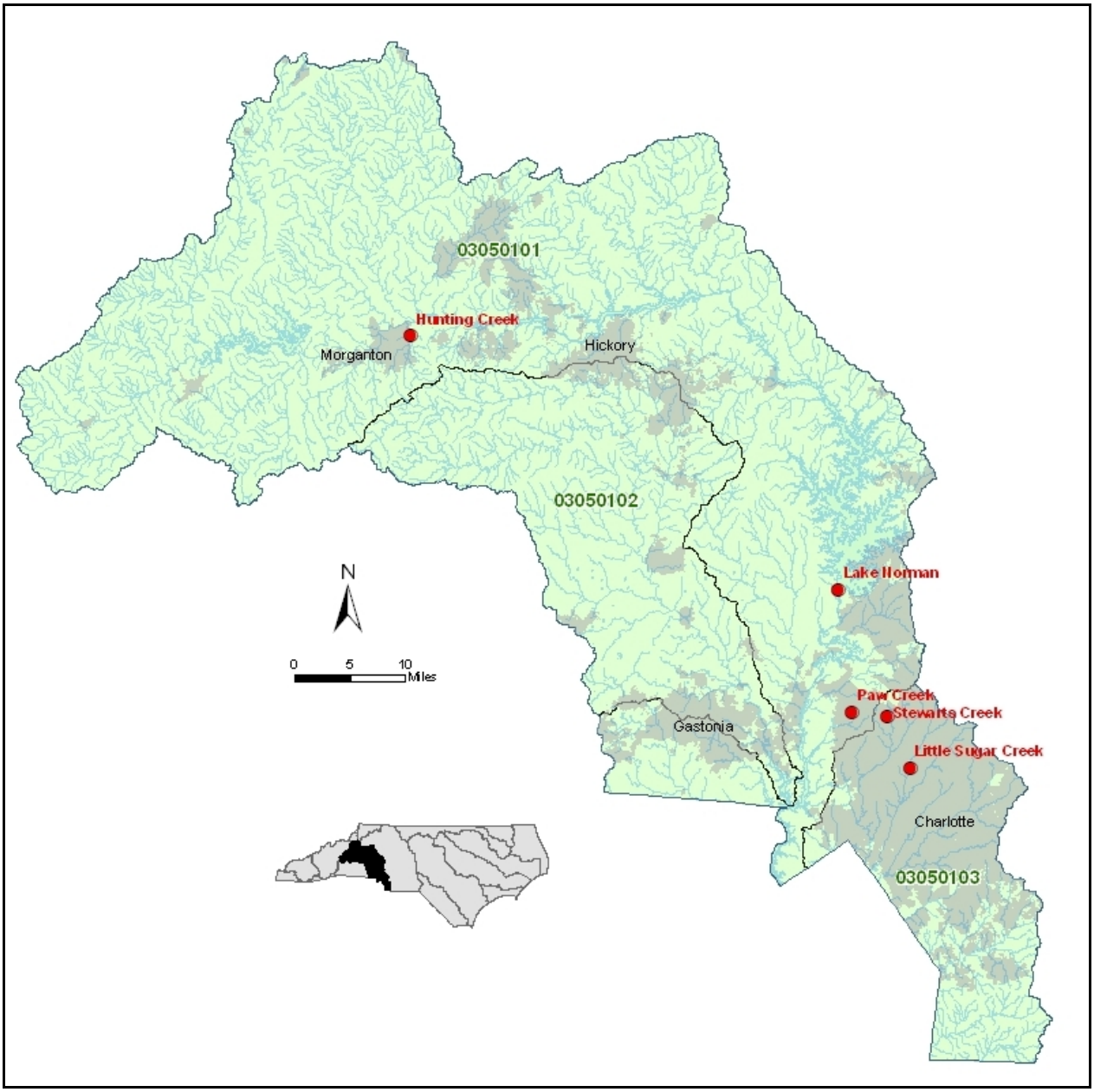


Figure 1. Locations of fish kills in the Catawba River Basin, 2003 – 2007.

Table 1. Fish kills in the Catawba River Basin, 2003 – 2007.

Date	Kill Number	Waterbody	Location	County	Subbasin	Species	Mortality
2/2/2006	AS06001	Hunting Creek	near Morganton	Burke	030831	Chub Sunfish Darter Stoneroller Suckers	1000
Notes: The event was the result of an explosion and fire at the Synthron chemical manufacturing facility in Morganton NC and was investigated by both Catawba River Keeper Foundation and NCWRC staff. The fish kill began at site of Synthron explosion (intersection of Kirksey and Amherst Roads) downstream to the confluence of Hunting Creek and Catawba River. The Catawba Riverkeeper Foundation estimated over 1,000 fish were killed in approximately 2 miles of Hunting Creek. Catawba Foundation observed large fish , some as long as 14 inches during the assessment. They identified dead creek chubs, suckers, and sunfish species. On February 2, NCWRC staff examined Hunting Creek to determine the extent of the fish kill and the feasibility of executing a formal investigation. NCWRC staff were able to inspect two sites along the approximately 3-km reach of the fish kill. NCWRC staff walked the stream bank which consisted of approximately 775 m of stream below the input source (Synthron, Inc). Evaluation of this reach resulted in the visual location of approximately 130 dead sucker species; no live fish were observed within this reach. NCWRC staff also visually examined the confluence of Hunting Creek and Catawba River. No dead or moribund fish were observed, but one live fish (unidentified species) was observed surfacing approximately 70 m below the culvert on Hunting Creek. NCWRC staff were forced to halt further examination due to the development of physical ailments (headache and nausea) that were probably caused by exposure to fumes from ongoing chemical fires at the Synthron facility.							
7/22/2004	MO04002	Lake Norman	near Cowans Ford	Lincoln	030832	Striped Bass	2500
Notes: NC Wildlife Resources Commission biologists investigated this kill and worked with personnel from Duke Power to collect needed data throughout the event. Duke Power personnel first observed an abnormally high number of dead striped bass on July 22 during their weekly survey of the lake. A total of 2,497 dead striped bass were collected between July 22 and August 13. All but 40 fish were collected within several miles of Cowans Ford Dam. The die-off resulted when a group of striped bass became trapped in the hypolimnion by an anoxic metalimnetic layer. As water temperatures began to rise in the late spring, the lake stratified. The epilimnion, from the surface to a depth of about 10 m, remained oxygenated throughout the summer. Dissolved oxygen levels deeper in water column from about 10 m to the bottom (about 34 m near the dam), were fixed as the lake stratified and continued to decrease throughout the summer due to normal biological processes. However, these processes occurred at a slightly faster rate in the metalimnion from about 10 to 20 m, and by late July this portion of the water column was nearly devoid of oxygen. The striped bass located in the hypolimnion below 20 m were trapped in pockets of water that had cool temperatures, forage, and sufficient oxygen. Over the following weeks, mortality occurred as hypolimnetic dissolved oxygen levels decreased, and dead striped bass were observed at the surface. Measurements of dissolved oxygen indicated that by the second week of August, metalimnetic and hypolimnetic dissolved oxygen values were at or near 0 mg/L, and a majority of the striped bass mortality was observed over the next several days. As many of the striped bass reached the surface, they were already in the later stages of decomposition. The operations of Duke Power facilities at Lake Norman were within the limits of their permits and were similar to previous years. Presence of a parasitic copepod affecting only striped bass was also considered as factor. Although nearly all striped bass collected were infected, infection rates for individual fish were relatively low. A small sample of freshly dead fish was sent to Auburn University for analysis, and there was no indication that the copepod was responsible for the kill. In addition, organs from several freshly dead striped bass were sent to North Carolina State University for analysis, and the results indicated nothing atypical related to disease or pathogens.							
11/29/2006	MO06002	Paw Creek	Charlotte	Mecklenburg	030834	Sucker Sunfish Minnow Bass	180
Notes: Fish kill due to gasoline release from the BP Delivery Line (7401 Old Mt. Holly Rd) owned by Plantation Pipeline in Paw Creek, Mecklenburg County. State Incident No. 200604155, EPA Incident # 819250. A site investigation was conducted along the impacted stream segment on 11/29/2006 and 12/4/2006 by CH2MHill consultants.							
7/25/2007	MO07001	Stewarts Creek	Lawton Road,	Mecklenburg	030834	Sunfish	40
Notes: Fishkill due to sanitary sewer overflow from industrial property. Overflow reached Stewarts Creek. Overflow contained at least one type of dye with colored the water purple/blue. The overflow was stopped at the time MCWQP arrived at the site around 9:00am and may have been ongoing for some time before 8:00am. The event occurred at 701 Lawton Road in Charlotte NC.							

Table 1(continued).

Date	Kill Number	Waterbody	Location	County	Subbasin	Species	Mortality
9/1/2007	MO07002	Little Sugar Creek	Charlotte	Mecklenburg	030834	Minnows Mosquito Fish Bluegill Sunfish Redbreast Sunfish Catfish	15000

Notes: Kill event caused by runoff of degreaser (Orange Tough 90) used to powerwash concrete areas at Carolina Medical Center in Charlotte. Product was entering the storm drain system and discharging into Little Sugar Creek. Degreaser had been applied for 11 hours beginning at 10:00 PM on 8/31/07. Enforcement action initiated by DWQ Mooresville office.

Appendix F-9. Web links.

NC Division of Water Quality, Stream Fish Community Assessment (including Habitat Assessment) Standard Operating Procedures
http://www.esb.enr.state.nc.us/BAU.html

NC Division of Water Resources, Drought Monitoring
http://www.ncwater.org/Drought_Monitoring/

NC Division of Water Quality (native and exotic freshwater fish in North Carolina)
http://www.esb.enr.state.nc.us/Native%20and%20Introduced%20Freshwater%20Fish%20in%20North%20Carolina.2-1.htm

National Weather Service and North carolina State University's Marine, Earth, and Atmospheric Sciences Case Studies
http://www.meas.ncsu.edu/nws/www/cases/

US Geological Survey (real-time streamflow data for North Carolina)
http://waterdata.usgs.gov/nc/nwis/current?type=flow

Appendix F-10. Fish community references.

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Appendix G-1. Flow measurement and flow conditions in the Catawba River basin.

The onset of the 2007 drought began to be noticed in early March 2007 when the entire basin was first described as being abnormally to moderately dry. By September 04, 2007 the entire basin was in an extreme drought and by October 02, 2007 in an exceptional drought. This level of severity has persisted into 2008.

During fish community sampling from late April to late May 2007 flows were generally less than median daily flows at nearby USGS gauge sites with occasional above median flows for short durations (Figures 1 – 6). Typical of urban streams with altered hydrology, flows in Little Sugar Creek had several spikes in mid- to late-April. During benthic macroinvertebrate sampling from July through August water levels were often well below median flow, except for Little Sugar Creek which responded in typical fashion to localized, heavy summer thunderstorms.

However, even before the last basinwide monitoring cycle was completed in 2002, the Catawba River basin had been experiencing a prolonged drought which started in 1998 and continued through 2002 (NCDENR 2003; Table 1; Figures 1- 6). The drought was abruptly halted by above normal precipitation in late 2002 and into 2003. Extremely high flows were then recorded in 2004. The 1998 – 2002 drought was most severe during summer 2002 (Weaver 2002). The lowest daily mean discharges flows ever recorded occurred in August and September 2002 at several sites in the basin (Table 1).

Table 1. Record-low daily mean discharges at select U. S. Geological Survey stream gaging stations. Data adopted from Weaver (2005).

			Lowest Daily Mean Discharge			
			Prior to 1988 Water Year		During 1998-2002 Water Year	
Station, County	Drainage Area (mi^2)	Annual 90% exceedances flow (ft^3/s)	Min (ft^3/s)	Date	Min (ft^3/s)	Date
Linville River near Nebo, Burke	66.7	37	8	09/07/1925	13	10/16/1997
Johns River at Arneys Store, Burke	201	99	35	08/19/1988	19	09/13/2002
Lower Little River at All Healing Springs, Alexander	28.2	11	3.1	09/20/1955	1.5	09/12/2002
Henry Fork near Henry River, Catawba	83.2	41	4	11/15/1942	5.5	08/11/2002
Jacob Fork at Ramsey, Burke	25.7	13	4.7	08/27/1988	0.87	08/13/2002
Indian Creek near Laboratory, Lincoln	69.2	22	2.1	07/20/1986	0.32	08/12/2002
Irwin Creek near Charlotte, Mecklenburg	30.7	8.5	3.1	09/25/1983	4.1	09/13/2002
McAlpine Creek at Sardis Road near Charlotte, Mecklenburg	39.6	3.7	0.26	07/19/1986	0.01	08/14/2002

During the drought, many of the streams draining smaller Piedmont watersheds (i.e., those in the Northern Inner Piedmont, Southern Outer Piedmont, and the Carolina Slate Belt) probably went completely dry or became a series of isolated pools with subsurface flows. A fish community's recovery is affected by the limited avenues available for recolonization, proximity to riverine reservoirs such as Catawba Chain of Lakes, blockage of upstream migration routes by hydroelectric and old mill dams, and by the lack of larger nearby tributaries as recolonization sources. Run-of-the-river reservoirs, even those on short reaches of rivers, can be inhospitable for many of the smaller species such as darters and shiners. Many of these species also have limited home ranges and are not migratory.

Changes in the benthic macroinvertebrate community are often used to help assess between-year changes in water quality. However, some between-year changes in the communities may be due partly to changes in flow. High flows magnify the potential effects of nonpoint source runoff and in areas of high imperviousness, this can lead to scour, substrate instability, and reduced periphyton. Low flows may accentuate the effect of point source dischargers by providing less dilution of wastes. Whether a change is flow-related is decided on a site-by-site basis, looking at:

- Flow. The daily flow patterns over a six to twelve month period prior to the collections are examined using the most comparable records from USGS gaging stations. Areas primarily

affected by nonpoint source runoff are expected to have a decline in water quality after high flow, but may improve during low flow. The exception to this rule is the smaller headwater streams, which may cease flowing during extreme droughts. Streams affected primarily by point source dischargers may improve after high flow (with dilution of the effluent) and decline after low flows. These changes, however, occasionally produce a between-year change of only one bioclassification.

- Changes throughout the subbasin, especially at reference sites. Flow-related changes usually affect a whole group of sites, not just single sites.
- Changes in species composition. Real changes in water quality are usually reflected in a significant change in the composition of the invertebrate community.

Consequently, all between-year changes in the biological communities are considered in light of flow conditions. Daily flow information is obtained from the closest available USGS monitoring site and compared to the long-term median flows. High flow is defined by BUA Staff as a median flow greater than 140 percent of the long-term median for that time period, usually July or August. Low flow is defined as a median flow less than 60 percent of the long-term median, while normal flow is 60 - 140% of the median. Although broad scale regional patterns are often observed, there may be large geographical variation within the state and large variation within a single summer period.

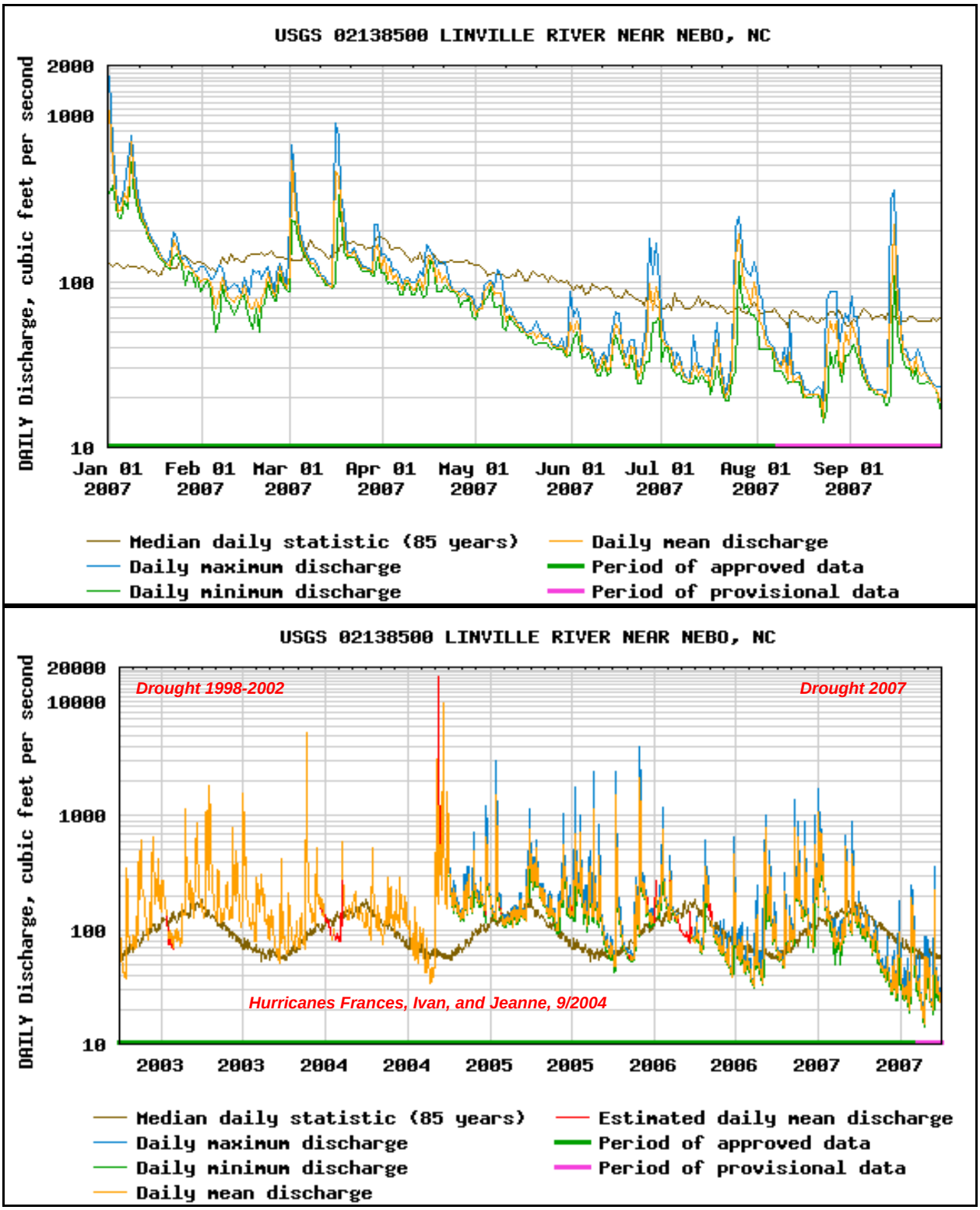


Figure 1. **Flows in the Linville River near Nebo, January 01, 2007 – September 30, 2007 (top) and September 30, 2002 to September 30, 2007 (bottom).**

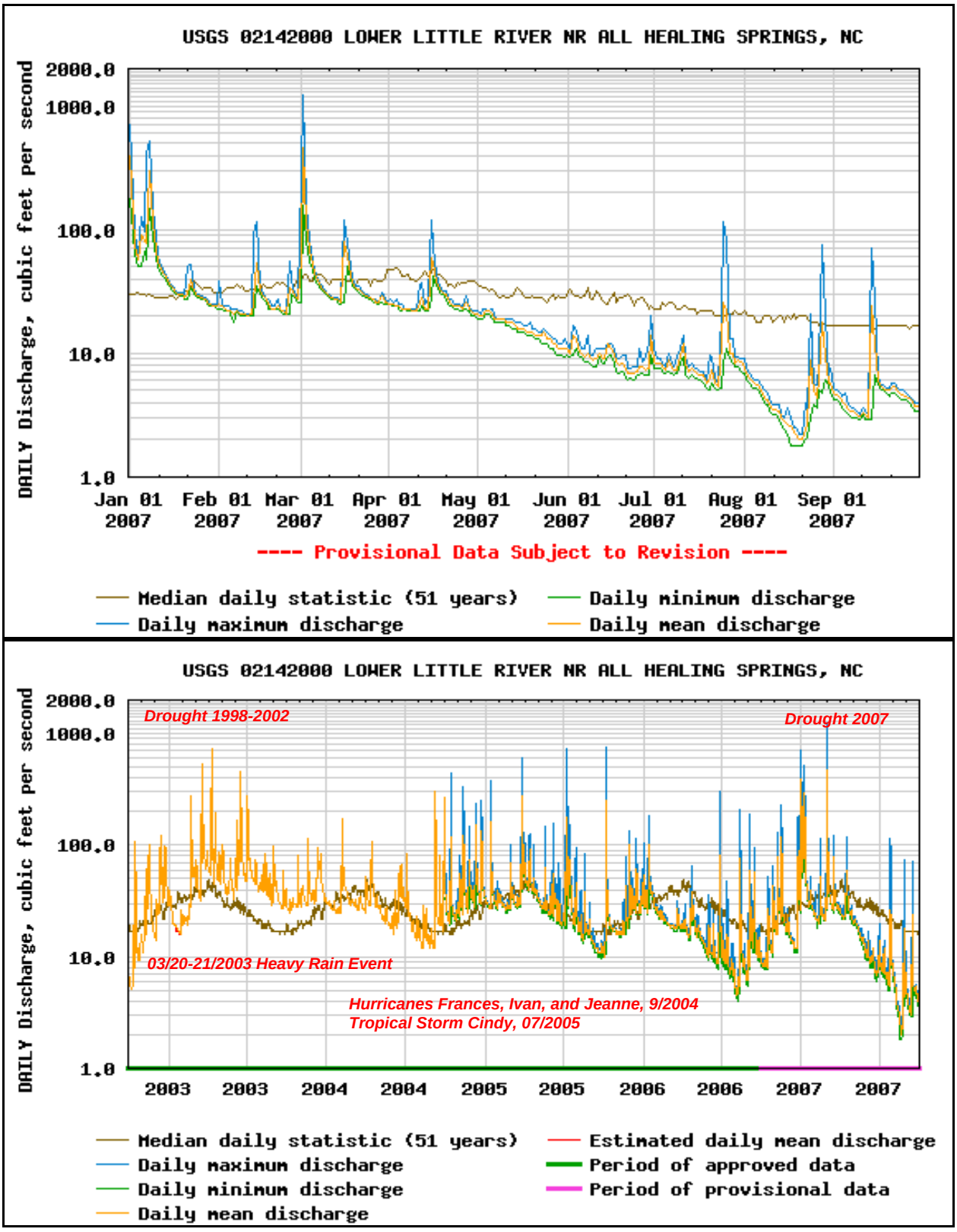


Figure 2. **Flows in the Lower Little River near All Healing Springs, January 01, 2007 – September 30, 2007 (top) and September 30, 2002 to September 30, 2007 (bottom).**

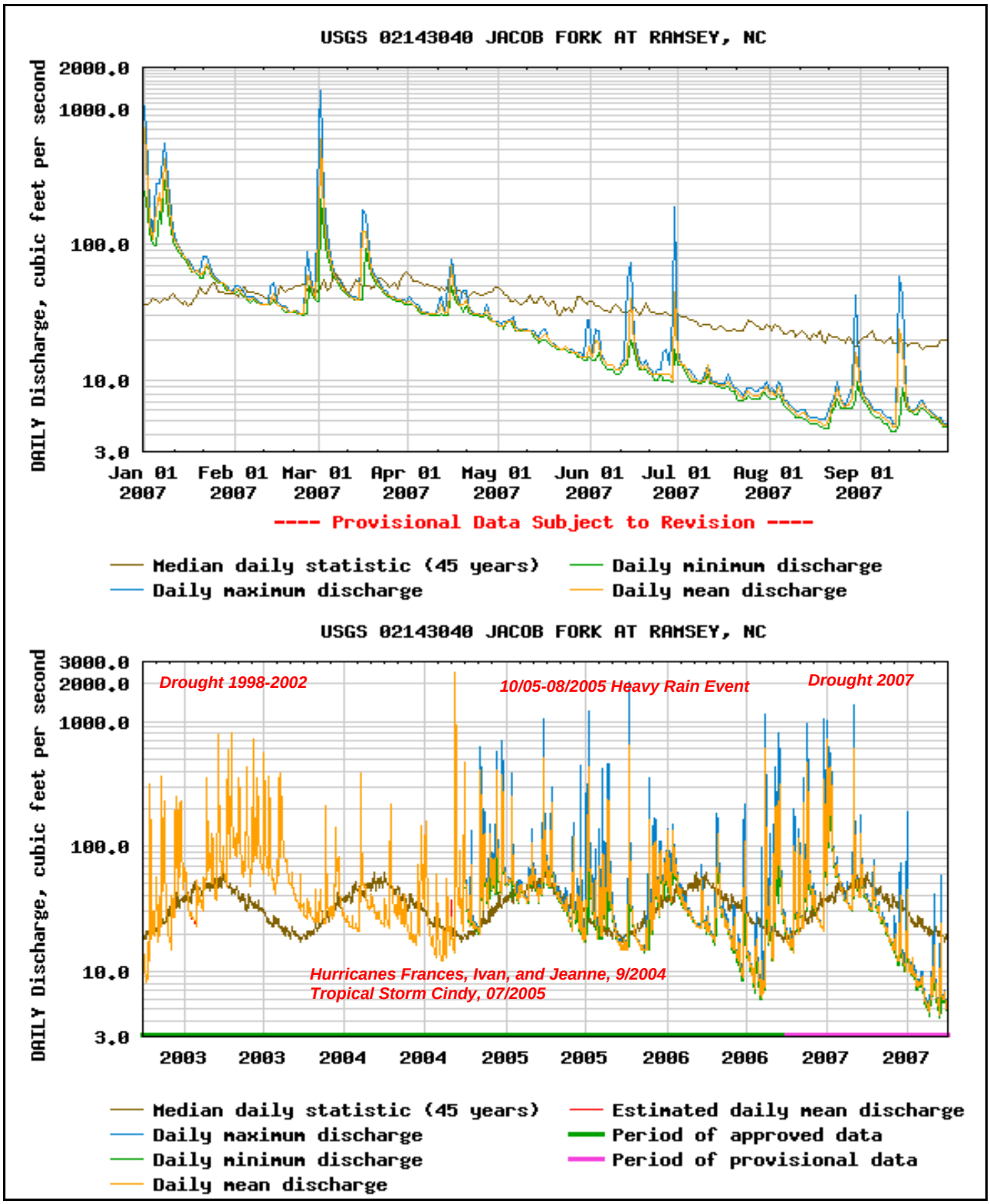


Figure 3. **Flows in Jacob Fork at Ramsey, January 01, 2007 – September 30, 2007 (top) and September 30, 2002 to September 30, 2007 (bottom).**

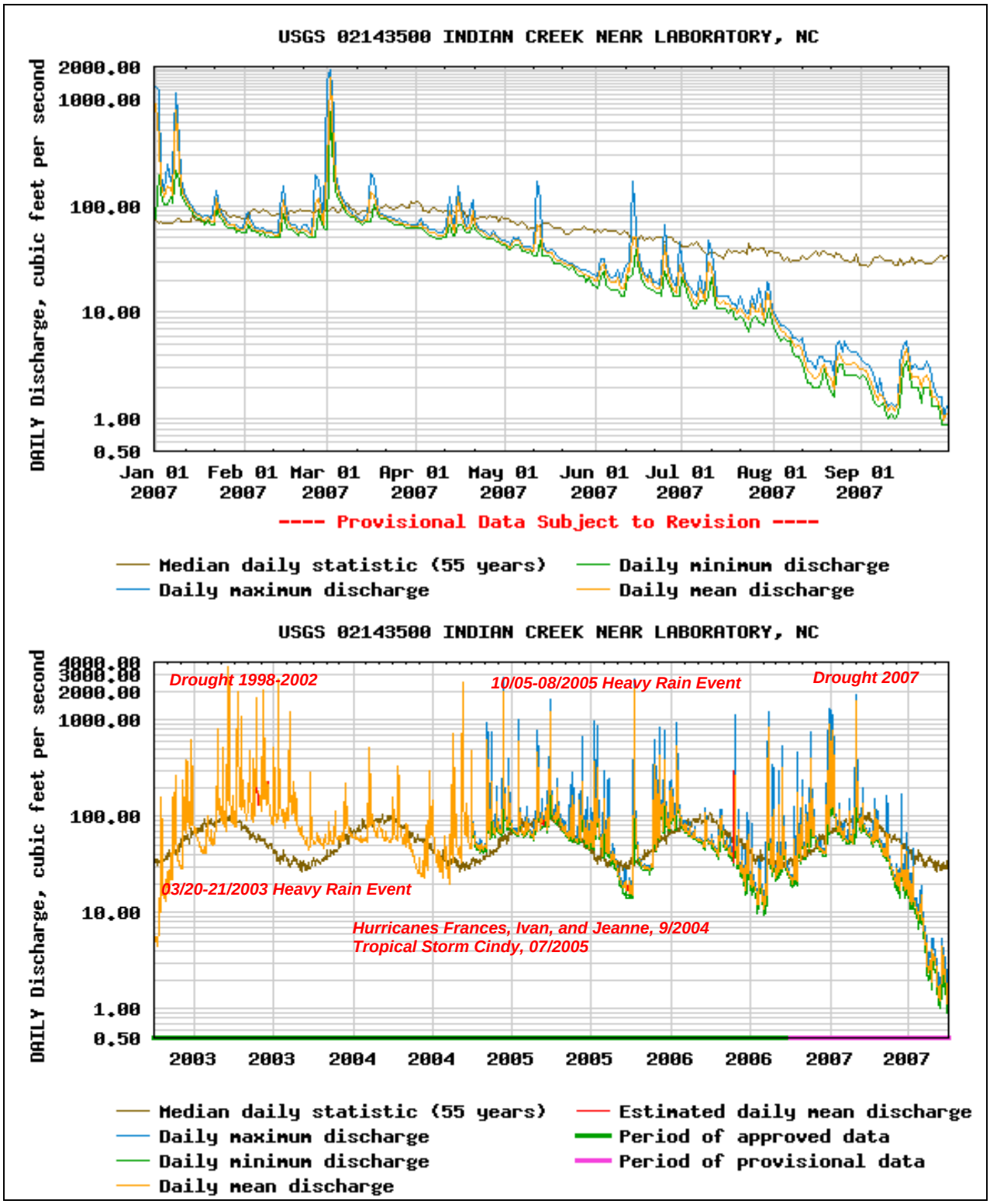


Figure 4. **Flows in Indian Creek near Laboratory, January 01, 2007 – September 30, 2007 (top) and September 30, 2002 to September 30, 2007 (bottom).**

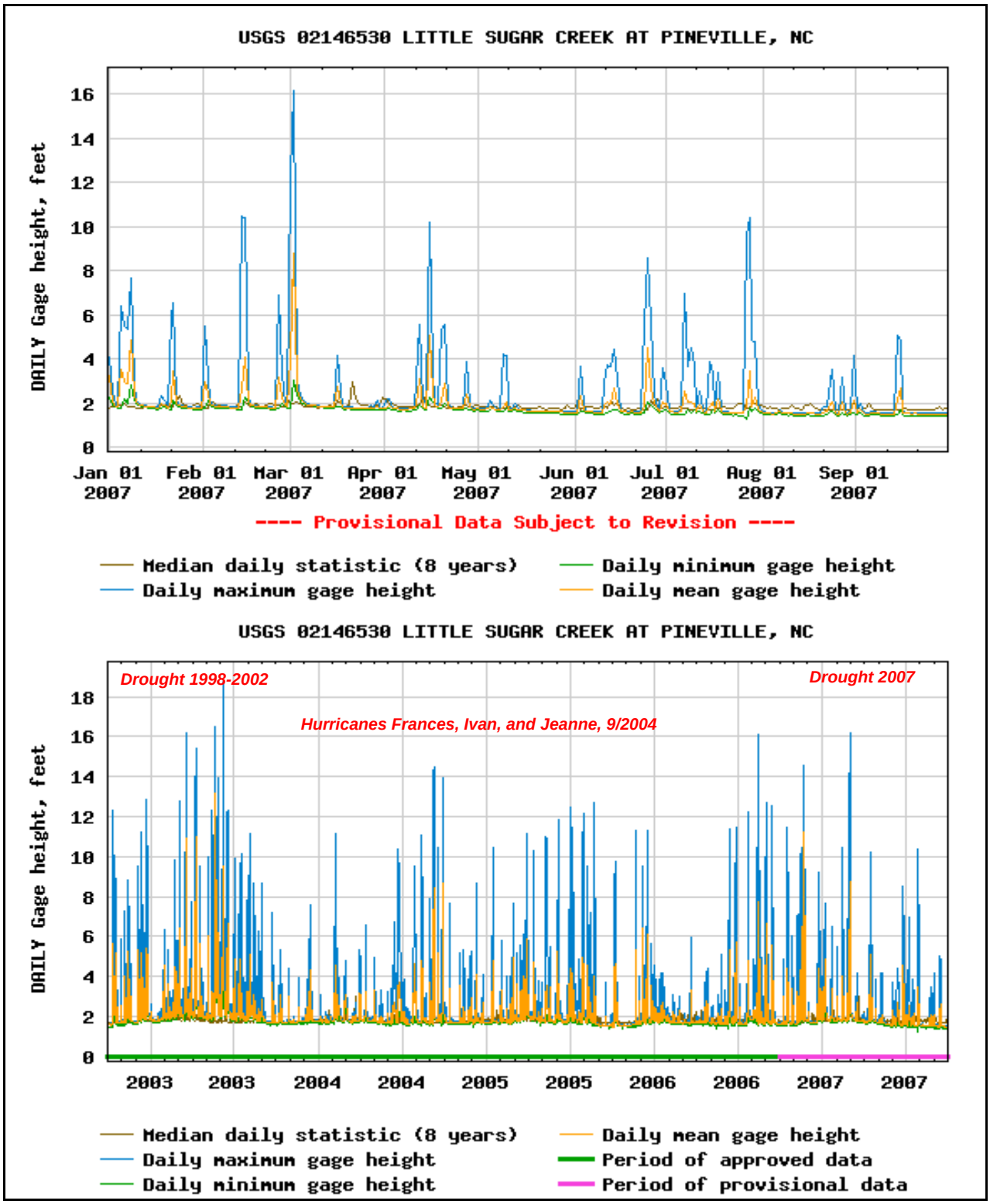


Figure 5. **Flows in Little Sugar Creek at Pineville, January 01, 2007 – September 30, 2007 (top) and September 30, 2002 to September 30, 2007 (bottom).**

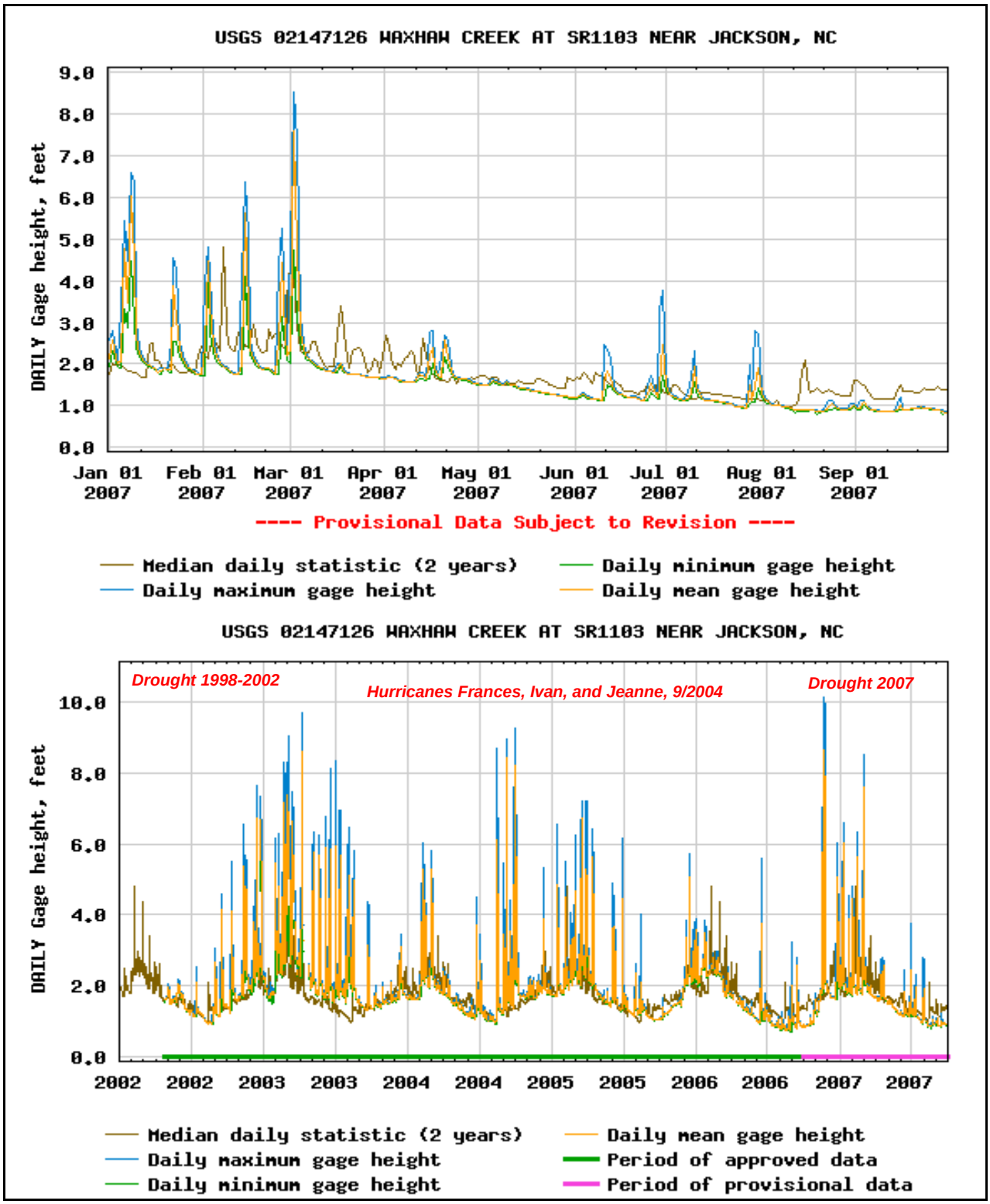


Figure 6. **Flows in Waxhaw Creek at SR 1103 near Jackson, January 01, 2007 – September 30, 2007 (top) and September 30, 2002 to September 30, 2007 (bottom).**

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
Catawba R	**SR 1274**	**CB14**	**07/12/07**	**Excellent**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
McDowell	30	03050101	353652	821348	11-(1)	Southern Crystalline Ridges and Mountains

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
C;Tr	4.5	1600	6	0.4

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	50	20	30	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)	6.0
Specific Conductance (µS/cm)	62
pH (s.u.)	6.8
Water Clarity	clear

Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	14
Bottom Substrate (15)	14
Pool Variety (10)	8
Riffle Habitat (16)	15
Left Bank Stability (7)	6
Right Bank Stability (7)	6
Light Penetration (10)	8
Left Riparian Score (5)	5
Right Riparian Score (5)	1
Total Habitat Score (100)	81

Site Photograph

Substrate cobble, boulder, gravel, and sand

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
07/12/07	10255	---	42	---	2.64	Excellent
08/08/02	8934	---	26	---	2.75	Good-Fair
08/07/97	7404	---	24	---	2.88	Good-Fair

Taxonomic Analysis

The 2007 sample produced a record high EPT taxa richness, EPT abundance (195 in 2007, 139 and 122 in 2002 and 1997 respectively) , and record low EPTBI. EPT taxa collected in 2007 but not present at any other sampling include the mayflies *Diphetor hageni* , *Epeorus dispar* , *Rhithrogena exilis* , *Maccaffertium ithaca* , and the caddisflies *Apatania* , *Neophylax consimilis* , *N. mitchelli* , *Psychomyia flavida* , *Pycnopsyche gentilis* , *Rhyacophila acutiloba* , and *R. carolina* .

Data Analysis

Although large portions of the catchment upstream of this location are forested, there are some rural residences and runoff from both SR 1274 and I-40 are potential stressors. As is typical in a watershed where there are no point discharges, and where nonpoint pollution is the greatest potential source for pollution, the 2007 drought and corresponding reduced runoff may be a reason why the invertebrate community has improved greatly in 2007. Other factors may also be involved since 2002 was also a drought year.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
Catawba R	**SR 1234**	**CB12**	**07/10/07**	**Good**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
McDowell	30	03050101	353813	820838	0	Eastern Blue Ridge Foothills

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
C	55	1380	12	0.4

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	60	10	20	10 (intersate highway)

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
Old Fort WWTP	NC0021229001	0.8

Water Quality Parameters

Temperature (°C)	26.8
Dissolved Oxygen (mg/L)	6.3
Specific Conductance (µS/cm)	75
pH (s.u.)	7.5
Water Clarity	clear

Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	15
Bottom Substrate (15)	10
Pool Variety (10)	4
Riffle Habitat (16)	14
Left Bank Stability (7)	6
Right Bank Stability (7)	6
Light Penetration (10)	8
Left Riparian Score (5)	5
Right Riparian Score (5)	4
Total Habitat Score (100)	76

Site Photograph

Substrate boulder, cobble, gravel, and sand

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
07/10/07	10250	104	38	4.73	3.58	Good
08/08/02	8933	89	36	4.73	3.56	Good
08/07/97	7406	70	31	5.32	4.19	Good-Fair
07/09/92	5897	102	41	4.14	3.20	Good
07/26/90	5404	84	38	4.43	3.72	Good

Taxonomic Analysis

Excluding the spring (April 18, 1985; Fair) and the post-soybean oil 1997 (Good-Fair) sample, this location has had a stable macroinvertebrate community. Some taxa that have been consistently common or abundant at this location since sampling first started here include the mayflies *Baetis flavistriga* , *B. pluto* , *Isonychia* , as well as three species of *Maccaffertium* , the stoneflies *Acroneuria abnormis, Paragnetina immarginata,* and *Perlesta* and the caddisflies *Ceratopsyche bronta* , *C. sparna* , and *Psychomyia flavida* .

Data Analysis

With the exception of the April 1985 (Fair) and August 1997 (Good-Fair) samples, this site has always maintained a bioclassification of Good. The decline in rating measured in 1997 was related to a large soybean-oil spill upstream on nearby tributary (Swannanoa Creek). Since that sample, the community continues to maintain a stable ecological invertebrate community despite the proximity to the Old Fort WWTP discharge which is upstream on the tributary Curtis Creek. It was also noted that there are numerous active cow pastures located near this site as the odor of cow manure was obvious and persistent throughout the sample collection.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
Catawba R	**SR 1221**	**CB11**	**07/12/07**	**Good**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
McDowell	30	03050101	354109	820340	0	Eastern Blue Ridge Foothills

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
C	126	1270	26	0.5

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	70	10	0	20 (RV park)

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

Water Quality Parameters

Temperature (°C)	24.6
Dissolved Oxygen (mg/L)	6.0
Specific Conductance (µS/cm)	55
pH (s.u.)	6.8
Water Clarity	slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	13
Bottom Substrate (15)	8
Pool Variety (10)	3
Riffle Habitat (16)	7
Left Bank Stability (7)	6
Right Bank Stability (7)	6
Light Penetration (10)	7
Left Riparian Score (5)	3
Right Riparian Score (5)	2
Total Habitat Score (100)	59

Site Photograph

Substrate cobble, sand, gravel, silt, and some boulder

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
07/12/07	10251	93	35	5.17	3.88	Good
08/07/02	8931	73	27	5.38	4.11	Good-Fair
08/06/97	7399	75	35	4.46	3.90	Good
07/08/92	5894	90	42	4.42	3.61	Good
07/26/90	5405	77	43	4.28	3.77	Good

Taxonomic Analysis

EPT taxa collected in 2007 that had been previously abundant or common from the 1990, 1992, and 1997 collections but were absent in 2002 included the mayflies *Baetis intercalaris* , *Baetis pluto* , *Serratella serratoides* , the stoneflies *Acroneuria abnormis* , *Paragnetina immarginata* , and *Perlesta* , and the caddisfly *Hydropsyche venularis* . While *B. intercalaris* and *B. pluto* are somewhat pollution tolerant, the stoneflies *A. abnormis* and *P. immarginata* are both pollution intolerant and long-lived. Their absence for the first time at this location in 2002 suggests a temporary decline in water quality that year. Their reappearance in 2007 may indicate that conditions have since recovered.

Data Analysis

Including the 2007 collection, this segment of the Catawba River has been sampled on 11 occasions with four samples producing Good bioclassifications and the remaining seven producing Good-Fair ratings. Starting with the initial collection in 1983, five subsequent annual samples (1984-1988) produced Good-Fair bioclassifications. In 1990, the bioclassification improved to Good and remained so with subsequent samples in 1992, and 1997. However, the 2002 sample reverted back to the Good-Fair rating seen in the early and mid 1980's and this decrease in bioclassification was thought at that time to be the result of low flows and lower dissolved oxygen levels. However, the 2007 sample was collected during a drought so the decline in 2002 was likely not a result of poor flows. Since 1983 and through 11 samples, it appears that water quality in this large catchment has mostly been stable. Why this site suddenly reverted in 2002 to bioclassifications seen through the 1980's is unknown but conditions in the invertebrate community in 2007 have recovered to levels measured from the early and mid 1990's.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
Catawba R	**SR 1147**	**CB10**	**07/10/07**	**Good**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
Burke	30	03050101	354440	814620	0	Northern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
WS-IV;Tr	506	1100	50	0.5

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

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

Water Quality Parameters

Temperature (°C)	13.4
Dissolved Oxygen (mg/L)	9.0
Specific Conductance (µS/cm)	49
pH (s.u.)	6.5
Water Clarity	clear

Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	16
Bottom Substrate (15)	13
Pool Variety (10)	4
Riffle Habitat (16)	10
Left Bank Stability (7)	6
Right Bank Stability (7)	6
Light Penetration (10)	3
Left Riparian Score (5)	4
Right Riparian Score (5)	5
Total Habitat Score (100)	71

Site Photograph

Substrate cobble, boulder, gravel, and sand

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
07/10/07	10094	88	33	4.61	3.35	Good
08/08/02	8913	60	21	4.04	2.98	Good
08/08/97	7409	66	30	4.17	3.13	Good
08/12/88	4697	79	34	4.83	3.37	Good

Taxonomic Analysis

Although there is some variation among the major community metrics, the overall invertebrate community here has been largely stable through time with several of the same mayflies (*Baetis pluto* , *Maccaffertium modestum, Serratella serratoides*), stoneflies (*Acroneuria abnormis* , *Perlesta* , *Pteronarcys*), and caddisflies (*Brachycentrus numerosus* , *Ceratopsyche sparna* , *Glossosoma* , *Lepidostoma* , *Micrasema wataga* , *Neophylax oligius*) present from each sample.

Data Analysis

This site is located approximately 10 miles downstream of the powerhouse at Lake James. As a result, this river segment is subjected to large diurnal swings in discharge. Nevertheless, this site continues to exhibit a very stable macoinvertebrate community with all samples producing Good bioclassifications with very small ranges in the BI and EPT BI.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
Curtis Cr	**SR 1227**	**CB22**	**07/12/07**	**Excellent**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
McDowell	30	03050101	354023	821132	0	Southern Crystalline Ridges and Mountains

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
C;Tr	13	1700	6	0.4

	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)	23.1
Dissolved Oxygen (mg/L)	6.5
Specific Conductance (µS/cm)	19
pH (s.u.)	7.1
Water Clarity	clear

Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	17
Bottom Substrate (15)	14
Pool Variety (10)	9
Riffle Habitat (16)	15
Left Bank Stability (7)	7
Right Bank Stability (7)	6
Light Penetration (10)	9
Left Riparian Score (5)	4
Right Riparian Score (5)	5
Total Habitat Score (100)	90

Site Photograph

Substrate boulder, cobble, gravel, and sand

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
07/12/07	10253	---	40	---	2.70	Excellent
08/08/02	8936	---	30	---	3.35	Good
08/07/97	7405	---	34	---	2.47	Good
02/10/92	5776	---	42	---	2.10	Good

Taxonomic Analysis

The 2007 EPT sample produced the highest EPT species richness for a summer sample at this location. Pollution intolerant taxa collected in 2007 but absent from all previous collections included the stonefly *Isoperla holochlora* and the caddisflies *Nyctiophylax celta* , *Polycentropus* , and *Psychomyia flavida* .

Data Analysis

Although nearly all of the Curtis Creek catchment is forested, there are some small breaks in the riparian zone that may cause impacts from SR 1227 especially during wet years. The high 2007 EPT taxa richness is not entirely explained by less nonpoint runoff in a drought because 2002 was also a drought year.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
CURTIS CR	**US 70**	**05/24/07**	**CF112**	**Excellent**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
MCDOWELL	30	03050101	35.645	-82.15916667	11-10	Eastern Blue Ridge Foothills

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C;Tr	16.6	1442	12	0.4	Yes

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	65	0	25	10 (rural commercial)

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

Water Quality Parameters

Temperature (°C)	17.5
Dissolved Oxygen (mg/L)	8.2
Specific Conductance (µS/cm)	21
pH (s.u.)	6.1

Water Clarity	Clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	18
Bottom Substrate (15)	12
Pool Variety (10)	9
Riffle Habitat (16)	14
Left Bank Stability (7)	6
Right Bank Stability (7)	6
Light Penetration (10)	8
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	**88**

Site Photograph

Substrate cobble, boulder, gravel, sand

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
05/24/07	2007-68	20	60	Excellent
04/30/02	2002-34	19	60	Excellent

Most Abundant Species Central Stoneroller

Exotic Species Green Sunfish, Smallmouth Bass, Rainbow Trout, and Brown Trout

Species Change Since Last Cycle **Gains** -- Green Sunfish, Piedmont Darter, and Western Blacknose Dace. **Losses** -- Notchlip Redhorse and Yellow Perch.

Data Analysis

Watershed -- a headwater tributary to the Catawba River located about 7/10 of a mile above its confluence; drainage area is almost entirely within the Southern Crystalline Ridges and Mountains ecoregion and the Pisgah National Forest. **Habitat** -- long runs, good riffles, chutes, side snags, and a few undercuts; nice forested riparian zone widths; very low conductivity. **2007** -- an abundant (n = 746) and diverse fish community including 4 intolerant species (Smallmouth Bass, Fieryblack Shiner, Piedmont Darter, and Rainbow Trout) was collected with a maximum NCIBI score and rating. **2002 - 2007** -- a total of 22 fish species are known from this watershed including 8 minnow species, 4 sucker species, and 3 darter species; based on two consecutive Excellent ratings, this regional reference site qualifies for HQW or ORW status if petitioned.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
Crooked Cr	**SR 1135**	**CB20**	**07/12/07**	**Good-Fair**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
McDowell	30	3050101	353620	820701	11-12	Eastern Blue Ridge Foothills

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
C	29	1520	9	0.4

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	50	10	10	30

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

Water Quality Parameters

Temperature (°C)	25.4
Dissolved Oxygen (mg/L)	6.3
Specific Conductance (µS/cm)	42
pH (s.u.)	7.3
Water Clarity	slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	15
Bottom Substrate (15)	13
Pool Variety (10)	3
Riffle Habitat (16)	14
Left Bank Stability (7)	6
Right Bank Stability (7)	6
Light Penetration (10)	9
Left Riparian Score (5)	3
Right Riparian Score (5)	5
Total Habitat Score (100)	78

Site Photograph

Substrate cobble, gravel, bedrock, boulder, sand, and silt

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
07/12/07	10254	---	27	---	3.29	Good-Fair
08/07/02	8932	74	32	4.41	3.66	Good
08/06/97	7401	69	38	4.25	3.74	Good
07/08/92	5895	---	32	---	3.03	Good

Taxonomic Analysis

EPT taxa present from all previous samples but absent in 2007 were restricted to just mayflies and included *Baetis flavistriga* , *Baetis pluto* , and *Caenis* . As these are fairly tolerant EPT taxa their absence in 2007 does not support a conclusion of deteriorating water chemistry.

Data Analysis

Although the 2007 sample had fewer EPT than any other collection, the 2007 collection was just one EPT taxon short of receiving a bioclassification of Good. In addition, the EPT BI was the second lowest ever measured at this location. These data suggest that the overall water quality remains essentially unchanged from earlier collections. This is supported by the 2007 conductivity value (43 µS/cm) which was down from 50 µS/cm in 2002 and 70 µS/cm in 1997. These data are consistent with a watershed where nonpoint pollution is the largest potential source of stress and in a drought year reduced runoff would be expected to result in lower stream conductivity. Why the reduced runoff did not translate into additional EPT taxa is unknown and is not likely the result of drought-induced habitat limitations as several edge taxa were present in 2007. However, despite the lower EPT richness, the EPT BI was the second lowest measured.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
CROOKED CR	SR 1135	05/24/07	CF9	Good

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
MCDOWELL	30	03050101	35.60527778	-82.11694444	11-12	Eastern Blue Ridge Foothills

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	28.6	1438	12	0.3	Yes

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	90	5 (rural residential)	0	5 (construction site)

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

Water Quality Parameters

Temperature (°C)	16.6
Dissolved Oxygen (mg/L)	8.5
Specific Conductance (µS/cm)	40
pH (s.u.)	5.5

Water Clarity	Slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	16
Bottom Substrate (15)	7
Pool Variety (10)	6
Riffle Habitat (16)	15
Left Bank Stability (7)	5
Right Bank Stability (7)	6
Light Penetration (10)	10
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	**80**

Site Photograph

Substrate sand, gravel, cobble, bedrock

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
05/24/07	2007-67	19	52	Good
04/30/02	2002-35	22	56	Excellent

Most Abundant Species Fantail Darter

Exotic Species Brown Trout

Species Change Since Last Cycle

Gains -- Flat Bullhead, Western Blacknose Dace, and Brown Trout. **Losses** -- Fieryblack Shiner, Eastern Silvery Minnow, Bluegill, Smallmouth Bass, Notchlip Redhorse, and Yellow Perch.

Data Analysis

Watershed -- a tributary to the Catawba River, located about 4.5 miles above its confluence; drains the extreme southwest corner of McDowell County, just below the town of Old Fort; the headwaters of this watershed lie within the Southern Crystalline Ridges and Mountains ecoregion. **Habitat** -- shallow sandy runs, good riffles, and stick snags; good canopy and forested riparian zone widths; the low morning pH tracks the overnight highs in stream respiration. **2007** -- a diverse and abundant (n = 466) fish community collected including the intolerant Piedmont Darter. **2002 - 2007** -- overall, the NCIBI metrics have remained stable in this stream; the loss of two intolerant species (Fieryblack Shiner and Smallmouth Bass) are driving the slight decline in NCIBI score and rating; this regional reference watershed is supporting a diverse fish community including 25 known fish species; there are no apparent water quality issues in this watershed.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
Mackey Cr	**US 70**	**CB34**	**07/12/07**	**Good**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
McDowell	30	03050101	354011	820651	0	Eastern Blue Ridge Foothills

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
WS-I;Tr;HQW	7.5	1360	7	0.4

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

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

Water Quality Parameters

Temperature (°C)	26.2
Dissolved Oxygen (mg/L)	5.9
Specific Conductance (µS/cm)	35
pH (s.u.)	7.1
Water Clarity	slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	14
Bottom Substrate (15)	13
Pool Variety (10)	9
Riffle Habitat (16)	14
Left Bank Stability (7)	6
Right Bank Stability (7)	6
Light Penetration (10)	8
Left Riparian Score (5)	5
Right Riparian Score (5)	3
Total Habitat Score (100)	82

Site Photograph

Substrate boulder, cobble, gravel, sand, and bedrock

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
07/12/07	10252	---	33	---	3.14	Good
08/06/02	8911	67	30	4.25	3.68	Good
03/25/98	7541	29	15	4.44	3.93	Fair
10/21/96	7218	43	25	4.90	4.47	Good-Fair

Taxonomic Analysis

The 2007 EPT sample resulted in the highest EPT taxa richness ever at this site. This is particularly significant as all but the 1998 sample were collected using the more intensive Full-Scale methodology. EPT taxa collected in 2007 not previously observed here included the mayfly *Eurylophella verisimilis* , *Hexagenia* , the stonefly *Paragnetina fumosa* , and the caddisflies *Goera* , *Heteroplectron americanum* , *Oecetis persimilis* , and *Triaenodes perna* .

Data Analysis

Historically, a metal plating facility (Metal Industries, Inc.) had maintained a small (0.01 MGD) NPDES discharge upstream of this location. However, this facility ceased its discharge just prior to July, 2002 and an immediate and dramatic improvement in the invertebrate community was noted just one month later as the August 6, 2002 sample produced a doubling of the EPT taxa richness over the previous sample in 1998. In addition to the improving EPT taxa richness measured here, the BI and EPT BI continue to decrease demonstrating that the invertebrate community continues recovery following the removal of the discharge.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
Buck Cr	**NC 80**	**CB6**	**07/11/07**	**Excellent**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
McDowell	30	03050101	354405	820605	0	Southern Crystalline Ridges and Mountains

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
WS-III;Tr;HQW	14	1600	17	0.4

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

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

Water Quality Parameters

Temperature (°C)	22.4
Dissolved Oxygen (mg/L)	7.0
Specific Conductance (µS/cm)	28
pH (s.u.)	6.9
Water Clarity	clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	17
Bottom Substrate (15)	14
Pool Variety (10)	10
Riffle Habitat (16)	15
Left Bank Stability (7)	7
Right Bank Stability (7)	7
Light Penetration (10)	9
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	94

Site Photograph

Substrate cobble, boulder, bedrock, and gravel

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
07/11/07	10248	---	45	---	2.88	Excellent
08/05/02	8905	---	31	---	3.04	Good
08/06/97	7397	---	38	---	2.59	Excellent
06/14/94	6558	75	41	3.28	2.47	Excellent
02/10/94	5773	---	42	---	2.20	Excellent

Taxonomic Analysis

The 2007 EPT collection produced the highest EPT taxa richness ever measured at this site. Even the more intensive Full-Scale collection from June 1994 did not produce as many EPT taxa as seen in 2007. EPT collected in 2007 and not previously observed here included the intolerant mayflies *Ephemerella dorothea* , *Serratella carolina* , and the caddisflies *Lepidostoma* and *Psychomyia flavida* .

Data Analysis

Almost all of the Buck Creek catchment is forested with only a few residences observed upstream. However, large portions of the NC 80 corridor are contained in this watershed. Despite the presence of NC 80, this site has been quite stable through time in terms of EPT species richness and EPT BI. The 2007 high EPT species diversity was most similar to that found in 1994.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
Little Buck Cr	**SR 1436**	**CB27**	**07/11/07**	**Excellent**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
McDowell	30	03050101	354403	820502	0	Southern Crystalline Ridges and Mountains

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
WS-II;B;Tr;HQW	5.7	1430	7	0.4

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

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

Water Quality Parameters

Temperature (°C)	21.7
Dissolved Oxygen (mg/L)	7.1
Specific Conductance (µS/cm)	23
pH (s.u.)	6.9
Water Clarity	clear

Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	17
Bottom Substrate (15)	14
Pool Variety (10)	8
Riffle Habitat (16)	14
Left Bank Stability (7)	7
Right Bank Stability (7)	6
Light Penetration (10)	10
Left Riparian Score (5)	5
Right Riparian Score (5)	4
Total Habitat Score (100)	89

Site Photograph

Substrate boulder, cobble, gravel, and bedrock

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
07/11/07	10100	---	49	---	2.51	Excellent
08/06/02	8910	---	35	---	2.75	Good
08/06/97	7398	---	37	---	2.44	Excellent
02/10/92	5774	---	43	---	2.01	Excellent
07/09/91	5652	60	37	2.75	2.32	Good

Taxonomic Analysis

The 2007 Little Buck Creek sample produced the highest EPT species richness ever measured at this location. Numerous EPT taxa not previously collected here but present in 2007 included: the mayflies *Diphetor hageni* , *Habrophlebioides* , and *Serratella serratoides;* the stoneflies *Acroneuria arenosa* and *A. carolinensis;* and the caddisflies *Neophylax consimilis* , and *N. ornatus* .

Data Analysis

This site has oscillated between Good and Excellent since sampling first started here in 1991. Nearly all of the Little Buck Creek watershed is forested with only a few rural residences observed. Predictably, the invertebrate community here is not only temporally stable, but it is also pollution intolerant and diverse. In addition to the few residences, there are small breaks in the riparian zone associated with SR 1436.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
N Fk Catawba R	**SR 1573**	**CB42**	**07/11/07**	**Good**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
McDowell	30	03050101	355005	820010	0	Southern Metasedimentary Ridges and Mountains

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
B;Tr	32	1420	8	0.4

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	60	20	0	20 (commercial, industrial)

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
Baxter Healthcare	NC0006564001	1.2

Water Quality Parameters

Temperature (°C)	22.2
Dissolved Oxygen (mg/L)	7.6
Specific Conductance (µS/cm)	107
pH (s.u.)	7.5
Water Clarity	slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	13
Bottom Substrate (15)	12
Pool Variety (10)	3
Riffle Habitat (16)	13
Left Bank Stability (7)	6
Right Bank Stability (7)	6
Light Penetration (10)	7
Left Riparian Score (5)	3
Right Riparian Score (5)	2
Total Habitat Score (100)	69

Site Photograph

Substrate boulder, gravel, cobble, sand, and silt

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
07/11/07	10097	---	31	---	4.20	Good
08/06/02	8907	---	29	---	3.80	Good
08/08/97	7408	---	37	---	2.97	Excellent
01/09/91	5510	---	37	---	2.83	Good

Taxonomic Analysis

Considering the last three summer samples, EPT taxa richness has never reached the highest level seen in 1997. Several intolerant EPT taxa present in 1997 but absent in 2002 and 2007 included the mayfly *Paraleptophlebia* , the stoneflies *Acroneuria abnormis* , *Leuctra* , *Malirekus hastatus* , and *Perlesta* , and the caddisflies *Dolophilodes* , *Glossosoma* , *Goera* , *Neophylax consimilis* , and *Helicopsyche borealis* . Moreover, at least two taxa of pollution tolerant caddisflies (*Hydropsyche betteni* and *H. venularis*) were collected for the first time at this location in 2002 and 2007. These data suggest slightly worsening conditions in this catchment.

Data Analysis

In addition to lower trending EPT taxa richness at this site since 1997, this location has also been experiencing an increasing trend in EPT BI over the same timeframe. Moreover, there has been a decreasing trend in EPT abundance with the 2007 and 2002 samples producing the lowest abundance totals (121 and 97 respectively) whereas samples in 1997 and 1991 resulted in 167 and 185 individuals respectively. Collectively, these trends suggest deteriorating conditions in this catchment.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
N Fk Catawba R	**SR 1560**	**CB41**	**07/11/07**	**Good-Fair**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
McDowell	30	03050101	354804	820107	0	Southern Crystalline Ridges and Mountains

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
B;Tr	44	1380	20	0.4

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

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
Coats American-Sevier Plant	NC0004243001	2.0
Baxter Healthcare	NC0006564001	1.2

Water Quality Parameters

Temperature (°C)	24.4
Dissolved Oxygen (mg/L)	6.4
Specific Conductance (µS/cm)	206
pH (s.u.)	7.0
Water Clarity	slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	14
Bottom Substrate (15)	12
Pool Variety (10)	4
Riffle Habitat (16)	13
Left Bank Stability (7)	6
Right Bank Stability (7)	6
Light Penetration (10)	7
Left Riparian Score (5)	2
Right Riparian Score (5)	1
Total Habitat Score (100)	69

Site Photograph

Substrate cobble, boulder, gravel, and sand

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
07/11/07	10098	---	21	---	4.16	Good-Fair
08/27/03	9295	78	33	4.24	3.71	Good
08/06/02	8909	74	23	5.90	4.92	Fair
08/05/97	7394	81	39	3.90	3.09	Good
07/07/92	5889	95	41	4.20	3.31	Good

Taxonomic Analysis

The 2007 (EPT) sample produced the fewest EPT taxa ever noted at this location although the 2002 (Full-Scale) sample had the second lowest EPT taxa richness. In both 2007 and 2002 there were numerous EPT taxa that were absent but which had been present at all other summer sampling events and included the mayflies *Epeorus rubidus* and *Leucrocuta*, the stoneflies *Acroneuria abnormis*, *Leuctra*, *Paragnetina immarginata*, and *Tallaperla*, and the caddisflies *Glossosoma*, and *Micrasema wataga*. The 2007 and 2002 samples were taken during severe droughts. The absence of these taxa, along with the lowered bioclassifications in 2007 and 2002, were likely the result of concentrated effluent from the upstream dischargers (Coats American and Baxter Healthcare).

Data Analysis

The 2002 and 2007 drought year samples had by far the highest conductivity (400 µS/cm and 206 µS/cm respectively) with the next highest (133 µS/cm) being measured in 2003. Increased stream conductivity would be expected under drought conditions where there are significant upstream NPDES inputs as is the case here. Although these two samples were taken in drought years, it appears that lowered flows did not adversely effect available habitat (and therefore EPT diversity) as the edge-dwelling caddisflies *Oecetis persimilis* and *Triaenodes ignitus* were plentiful from both sampling events. Moreover, although the 2007 sample was collected using the less intense EPT collection method (where all other samples had been obtained using the more intense Full-Scale collection method) this sampling discrepancy did not account for the lower EPT richness as all taxa absent in 2007 are readily collected using EPT methods and are not specific to Full-Scale collection methods.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
Armstrong Cr	**Armstrong Creek Rd**	**CB1**	**07/11/07**	**Excellent**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
McDowell	30	03050101	354830	820428	0	Southern Crystalline Ridges and Mountains

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
C;Tr;HQW	14	1800	7	0.5

	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)	20.8
Dissolved Oxygen (mg/L)	7.0
Specific Conductance (µS/cm)	28
pH (s.u.)	6.1
Water Clarity	clear

Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	17
Bottom Substrate (15)	13
Pool Variety (10)	9
Riffle Habitat (16)	15
Left Bank Stability (7)	7
Right Bank Stability (7)	6
Light Penetration (10)	9
Left Riparian Score (5)	5
Right Riparian Score (5)	3
Total Habitat Score (100)	88

Site Photograph

Substrate boulder, cobble, gravel, and bedrock

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
07/11/07	10049	---	44	---	2.55	Excellent
08/06/02	8908	---	38	---	2.80	Excellent
08/05/97	7390	---	36	---	2.15	Excellent
07/07/92	5890	---	38	---	2.11	Excellent

Taxonomic Analysis

The 2007 sample resulted in the highest EPT taxa richness recorded for this location. EPT collected in 2007 not previously observed here included the intolerant mayflies *Drunella cornutella* , *Epeorus dispar* , *Serratella carolina* , and the caddisflies *Ceratopsyche morosa* , and *Neophylax mitchelli* .

Data Analysis

Nearly all of the Armstrong Creek watershed is forested with only a few rural residences observed. Predictably, the invertebrate community here is not only temporally stable, but it is also pollution intolerant and diverse. The 2007 sample had the highest EPT taxa richness noted at this location and the EPT abundance was also the highest every measured (261) with a previous high of 176 seen in 1997. There is very little disturbance in this catchment, though there are some small breaks in the riparian zone associated with Armstrong Creek Road.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
PADDY CR	**NC 126**	**05/23/07**	**CF47**	**Good-Fair**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
BURKE	30	03050101	35.7661111	-81.905	11-28	Northern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C;Tr	6.7	1315	7	0.3	No

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

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

Water Quality Parameters

Temperature (°C)	17.1
Dissolved Oxygen (mg/L)	8.4
Specific Conductance (µS/cm)	16
pH (s.u.)	6.3

Water Clarity	Clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	18
Bottom Substrate (15)	15
Pool Variety (10)	9
Riffle Habitat (16)	16
Left Bank Stability (7)	5
Right Bank Stability (7)	6
Light Penetration (10)	9
Left Riparian Score (5)	0
Right Riparian Score (5)	3
Total Habitat Score (100)	**86**

Site Photograph

Substrate Large cobble and bedrock

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
05/23/07	2007-64	12	46	Good-Fair
05/01/02	2002-38	13	46	Good-Fair
05/05/97	97-31	9	40	Fair

Most Abundant Species Central Stoneroller

Exotic Species Brown Trout and Smallmouth Bass

Species Change Since Last Cycle

Gains -- Bluehead Chub X Rosyside Dace hybrids (2), Flat Bullhead, and Brown Trout. **Losses** -- White Sucker, Striped Jumprock, and Snail Bullhead.

Data Analysis

Watershed -- tributary to Lake James (the Catawba River); borders the Northern Inner Piedmont and the Eastern Blue Ridge Foothills; rural; forested watershed with pasture in the lower reaches; livestock with direct access to the stream from both banks. **Habitat** -- shallow riffles and runs; high gradient plunge pools with bedrock shelves and chutes; *Podostemum* ; barren riparian areas due to cattle grazing and trampling. **2007** -- very low flow; conductivity consistently low (the lowest of any fish community site in the Catawba River basin in 2007) even though cattle have access to the stream. **1997 - 2007** -- no real change in fish community; the dominant species continued to be the Central Stoneroller, a species that successfully exploits mountain streams that have been altered by livestock; 15 species known from the site, but only 1 species of darter; percentage of omnivores and insectivores ~ 50%; community is isolated by Lake James which continues to serve as a barrier to recolonization by some species; community also affected by hydrologic extremes in flows (i.e., prolonged droughts followed by hurricane-induced flooding); habitat scores have ranged from 75 to 87.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
Linville R	**US 221**	**CB33**	**07/10/07**	**Good-Fair**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
Avery	30	03050101	360144	815345	11-29-(4.5)	Southern Metasedimentary Mountains

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
C;Tr	20	2650	11	0.3

	Forested/Wetland	Urban	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)	22.4
Dissolved Oxygen (mg/L)	6.6
Specific Conductance (µS/cm)	70
pH (s.u.)	7.3
Water Clarity	slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	14
Bottom Substrate (15)	12
Pool Variety (10)	3
Riffle Habitat (16)	11
Left Bank Stability (7)	6
Right Bank Stability (7)	6
Light Penetration (10)	7
Left Riparian Score (5)	1
Right Riparian Score (5)	3
Total Habitat Score (100)	67

Site Photograph

Substrate bedrock, cobble, boulder, gravel and sand

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
07/10/07	10096	101	29	5.81	4.21	Good-Fair
08/06/02	8906	---	28	---	3.90	Good
08/05/97	7396	---	27	---	3.25	Good-Fair
06/10/97	7280	---	24	---	3.24	Good-Fair
07/06/92	5887	---	30	---	3.27	Good

Taxonomic Analysis

A Full-Scale sample was taken here for the first time in order to better assess potential impacts due to the rapidly expanding upstream areas of Newland, Linville, and Grandfather Mountain. Despite the more intensive collection methodology, the 2007 sample still produced EPT taxa richness and EPT abundance levels comparable to earlier, less intensive EPT samples. In addition, the 2007 sample resulted in the highest EPT BI ever measured here and may suggest a slightly more tolerant invertebrate community relative to earlier samples. Facultative EPT taxa collected for the first time in 2007 include the mayflies *Plauditus dubius* , and *Procloeon* , and the caddisfly *Hydropsyche venularis* . In addition, the gastropod *Physella* , which can thrive in low dissolved oxygen conditions, was abundant and suggests that low dissolved oxygen may be a stress to this system.

Data Analysis

Conductivity was the highest ever measured at this location in 2007 (70µS/cm) and has been steadily increasing since 1997 with two measurements in 1997 at 20 µS/cm and 34 µS/cm respectively and one in 2002 measured at 59 µS/cm. Landuse activities stream of this location is a mix of forest, residential areas, and several golf courses. The high conductivity level despite the 2007 drought in this nonpoint driven system suggests increased levels of land disturbance or possibly increased point sources such as straight piping, or effects from upstream lakes. However, water temperature (22 degrees in 2007, 2002 and 1997) and pH (7.3 in 2007, 7.1 in 2002, 7.3 in 1997) and dissolved oxygen (6.6 mg/L in 2007, 6.3 mg/L in 2002, and 7.5 mg/L in 1997) have all been very stable and therefore do not suggest any changes due to the lakes.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
Linville R	**NC 126**	**CB32**	**07/10/07**	**Excellent**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
Burke	30	03050101	354741	815325	0	Northern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
B;HQW	67	1220	35	0.4

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

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

Water Quality Parameters

Temperature (°C)	25.6
Dissolved Oxygen (mg/L)	7.6
Specific Conductance (µS/cm)	53
pH (s.u.)	7.1
Water Clarity	clear

Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	17
Bottom Substrate (15)	10
Pool Variety (10)	5
Riffle Habitat (16)	15
Left Bank Stability (7)	6
Right Bank Stability (7)	6
Light Penetration (10)	5
Left Riparian Score (5)	2
Right Riparian Score (5)	4
Total Habitat Score (100)	74

Site Photograph

Substrate boulder, cobble, gravel, sand, and silt

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
07/10/07	10095	95	45	4.01	3.41	Excellent
08/23/02	8978	91	48	4.22	3.48	Excellent
08/04/97	7386	107	53	4.05	3.12	Excellent
07/07/92	5886	108	48	4.15	3.15	Excellent
07/09/91	5650	84	43	4.03	3.03	Excellent

Taxonomic Analysis

The benthic macroinvertebrate community at this location is remarkably stable and is indicative of the largely protected nature of this catchment. Several intolerant taxa have been collected here at every sampling attempt and include: the mayflies *Epeorus rubidus* , *Leucrocuta* , *Heptagenia marginalis;* the stoneflies *Acroneuria abnormis* , *Leuctra* , and *Paragnetina ichusa;* and the caddisflies *Ceratopsyche morosa* , *C. sparna* , *Chimarra* , *Lepidostoma* , *Micrasema wataga* , *Polycentropus* , and *Nyctiophylax* .

Data Analysis

This location has been sampled 23 times since 1983. Twenty of these samples produced bioclassifications of Excellent with only three samples (8/10/1983, 8/16/1985, and 3/29/1989) producing bioclassifications of Good. This location is immediately downstream of the Linville Gorge Wilderness Area and nearly all of the immediate catchment is protected. The stable, protected nature of most of the watershed upstream of this location helps explain the remarkable consistency of Excellent bioclassifications here through time. However, the last two samples have produced two of the highest EPT BIs (3.41 and 3.40 respectively) since sampling started here and may reflect increased residential growth adjacent to nearby river segments which are outside of the protected Wilderness Area.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
N MUDDY CR	**SR 1760**	**05/23/07**	**CF46**	**Excellent**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
MCDOWELL	30	03050101	35.675	-81.90638889	11-32-(0.5)	Northern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	42.8	1100	11	0.4	No

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

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
City of Marion - Corpening Creek WWTP (approximately 6 miles upstream)	NC0031879	3.0

Water Quality Parameters

Temperature (°C)	19.2
Dissolved Oxygen (mg/L)	8.8
Specific Conductance (µS/cm)	71
pH (s.u.)	7.9

Water Clarity	Clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	16
Bottom Substrate (15)	5
Pool Variety (10)	6
Riffle Habitat (16)	14
Left Bank Stability (7)	7
Right Bank Stability (7)	7
Light Penetration (10)	9
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	**79**

Site Photograph

Substrate bedrock, sand, gravel

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
05/23/07	2007-65	23	54	Excellent
04/30/02	2002-36	19	48	Good
05/07/97	97-36	20	52	Good

Most Abundant Species Bluehead Chub

Exotic Species Green Sunfish

Species Change Since Last Cycle

Gains -- Flat Bullhead, Green Sunfish, Pumpkinseed, Bluegill, and Creek Chub. **Losses** -- Warmouth.

Data Analysis

Watershed -- a tributary to Muddy Creek located about 3 miles upstream of its confluence; drains part of southeastern McDowell County including most of the City of Marion. **Habitat** -- runs, fast plunge chutes, and bedrock ledge pools; nicely forested riparian zones with tall bluffs and bedrock outcrops. **2007** -- the highest number of species collected in the Catawba River basin for the year, including 4 species of suckers, 4 species of sunfish, 9 species of minnows, 3 species of catfish, and 3 species of darters. **1997 - 2007** -- a more balanced trophic structure of the fish community is the main reason for the improvements seen in the 2007 NCIBI score and rating. This watershed continues to support a highly diverse fish community with no apparent detrimental water quality issues.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
N Muddy Cr	**SR 1760**	**CB44**	**07/09/07**	**Good-Fair**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
McDowell	30	03050101	354031	815423	0	Northern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
C	43	1100	12	0.5

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

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
City of Marion, Corpening Creek WWTP	NC0031879	3

Water Quality Parameters

Temperature (°C)	23.9
Dissolved Oxygen (mg/L)	8.3
Specific Conductance (µS/cm)	76
pH (s.u.)	7.8
Water Clarity	slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	17
Bottom Substrate (15)	12
Pool Variety (10)	5
Riffle Habitat (16)	14
Left Bank Stability (7)	7
Right Bank Stability (7)	6
Light Penetration (10)	7
Left Riparian Score (5)	5
Right Riparian Score (5)	4
Total Habitat Score (100)	81

Site Photograph

Substrate boulder, cobble, gravel, and sand

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
07/09/07	10092	78	25	5.36	4.39	Good-Fair
08/05/02	8902	79	32	5.51	4.59	Good-Fair
08/04/97	7388	63	33	4.76	4.26	Good
07/08/92	5892	80	32	4.95	4.47	Good-Fair
04/17/85	1426	85	35	5.48	4.16	Good-Fair

Taxonomic Analysis

The 2007 sample produced by far the fewest EPT taxa ever collected although total species richness remained consistent with previous samples. This fact, combined with the collection of many edge-dwelling caddisflies in 2007, suggests that there were no drought-related habitat effects. Among the most notably intolerant and long-lived taxa absent in 2007 but collected previously included two species of stonefly (*Paragnetina fumosa* and *Paragnetina immarginata*) as well as the intolerant caddisflies *Goera* and *Glossosoma*.

Data Analysis

The sharp decline in EPT taxa richness in 2007 is likely the result of drought effects concentrating effluent from upstream dischargers. This may explain the disappearance of the long-lived *Paragnetina* species as well as the intolerant caddisflies *Goera* and *Glossosoma*. While the overall BI and EPT BI have been relatively stable since 1985, the drastic decline in numerous EPT taxa suggests a decline in water quality at this location for 2007.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
Corpening Cr	**SR 1819**	**CB17**	**07/09/07**	**Poor**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
McDowell	30	03050101	353914	815747	0	Eastern Blue Ridge Foothills

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
C	6.5	1210	6	0.3

	Forested/Wetland	Urban	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)	21.8
Dissolved Oxygen (mg/L)	7.6
Specific Conductance (µS/cm)	52
pH (s.u.)	7.0
Water Clarity	slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	15
Bottom Substrate (15)	12
Pool Variety (10)	6
Riffle Habitat (16)	14
Left Bank Stability (7)	6
Right Bank Stability (7)	5
Light Penetration (10)	8
Left Riparian Score (5)	5
Right Riparian Score (5)	3
Total Habitat Score (100)	78

Site Photograph

Substrate cobble, sand, and gravel

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
07/09/07	10091	---	7	---	5.99	Poor
08/07/02	8930	65	21	5.79	4.62	Fair
04/09/01	8404	52	15	5.36	4.73	Fair
08/08/97	7407	---	16	---	5.02	Fair
09/12/90	5443	55	17	6.11	5.36	Fair

Taxonomic Analysis

The 2007 EPT sample produced the fewest EPT, highest EPT BI, and lowest EPT abundance ever measured at this location. Although several tolerant mayflies (*Baetis flavistriga* and *B. pluto*) and caddisflies (*Cheumatopsyche* and *Hydropsyche betteni)* remained either common or abundant in 2007 (as they were in previous samples) no stoneflies were collected here for the first time since sampling started in 1985. In addition, no heptageniid mayflies were collected in 2007 for the first time. All previous samples had at least two of these taxa (always common or abundant) present. Heptageniid mayflies have been shown to be sensitive to metal toxicity. Their absence in 2007 may suggest metal toxicity.

Data Analysis

All previous samples had at least one habitat-edge taxa present (either *Triaenodes* or *Pycnopyche* or both). The 2007 sample lacked all such taxa. This suggests that the drought had lowered water levels enough to preclude their collection. Nonetheless, the absence of just one or two of these taxa would not improve the bioclassification from Poor and therefore their absence does not explain the decrease in bioclassification in 2007. Moreover, the absence of heptageniids and stoneflies for the first time suggest worsening water quality in this catchment. This is surprising since the catchment is dominated by non-point pollution and would likely improve with lessened runoff due to drought. Indeed, the 2007 conductivity (51.6µS/cm) was significantly less than the three previous measurements from 1997, 2001, and 2002 (120 µS/cm, 91 µS/cm, and 130 µS/cm respectively). The 2007 and 1997 sample were both sampled by EPT collection methods. Every other sample was taken usuing more intensive Full-Scale methods. That the 1997 EPT sample had better EPT metrics versus the 2007 EPT sample supports worsening conditions rather than sample method bias.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
S MUDDY CR	**SR 1764**	**05/23/07**	**CF50**	**Good**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
MCDOWELL	30	03050101	35.64972222	-81.855	11-32-2	Northern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	33.2	1100	8	0.4	No

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

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

Water Quality Parameters

Temperature (°C)	18.7
Dissolved Oxygen (mg/L)	8.2
Specific Conductance (µS/cm)	45
pH (s.u.)	6.2

Water Clarity	Slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	14
Bottom Substrate (15)	4
Pool Variety (10)	4
Riffle Habitat (16)	12
Left Bank Stability (7)	6
Right Bank Stability (7)	6
Light Penetration (10)	10
Left Riparian Score (5)	3
Right Riparian Score (5)	3
Total Habitat Score (100)	**66**

Site Photograph

Substrate sand, cobble, boulder

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
05/23/07	2007-66	16	52	Good
05/01/02	2002-37	14	48	Good
07/02/97	97-70	15	50	Good
06/28/93	93-27	11	50	Good

Most Abundant Species Greenhead Shiner

Exotic Species None

Species Change Since Last Cycle **Gains** -- Flat Bullhead, Northern Hogsucker, and Warmouth. **Losses** -- Notchlip Redhorse.

Data Analysis

Watershed -- a tributary to Muddy Creek located about 3.5 miles above its confluence; drains the extreme southeast corner of McDowell County including parts of the Northern Inner Piedmont and the Eastern Blue Ridge Foothills ecoregions. **Habitat** -- primarily one long sandy run with side snags and a few riffles; both the left and right 6-12 meter riparian zones are bordered by active crops; chicken manure had just been applied to the adjacent fields, yet relatively low stream conductivity. **2007** -- good abundance and diversity of the fish community with the highest number of species collected at this site; improvement of NCIBI comes from a very slight shift in the fish community trophic structure. **1993 - 2007** -- stable NCIBI metrics and scores over a 14 year period; the Muddy Creek Watershed Restoration Initiative is likely a contributing factor to the Good water quality in this watershed.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
Canoe Cr	**SR 1250**	**CB8**	**07/10/07**	**Good-Fair**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
Burke	30	03050101	354549	814553	0	Northern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
C	12	1100	6	0.4

	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)	21.4
Dissolved Oxygen (mg/L)	7.9
Specific Conductance (µS/cm)	49
pH (s.u.)	6.5
Water Clarity	turbid

Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	14
Bottom Substrate (15)	12
Pool Variety (10)	3
Riffle Habitat (16)	9
Left Bank Stability (7)	6
Right Bank Stability (7)	6
Light Penetration (10)	9
Left Riparian Score (5)	4
Right Riparian Score (5)	4
Total Habitat Score (100)	71

Site Photograph

Substrate sand, silt, gravel, cobble, and boulder

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
07/10/07	10249	---	27	---	4.11	Good-Fair
08/21/02	8971	---	28	---	3.51	Good
08/04/97	7411	---	19	---	4.05	Good-Fair
08/03/92	5958	---	25	---	3.14	Good-Fair

Taxonomic Analysis

The mayfly *Paraleptophlebia* , and the caddisfly *Brachycentrus nigrosoma* were all collected from each previous sample but were absent in 2007. Conversely, there were several mayflies (e.g., *Plauditus punctiventris* and *Leucrocuta*) and caddisflies (e.g., *Diplectrona modesta* , *Lype diversa* , and *Polycentropus*) that were present in 2007 but were absent from all other previous samples. These data suggest overall stable conditions in this watershed.

Data Analysis

Although this site technically decreased in bioclassification from Good in 2002 to Good-Fair in 2007, the 2007 sample was only one EPT taxon short of receiving a Good bioclassification. In addition, the 27 EPT taxa collected in 2007 was still higher than levels measured in 1997 and 1992. Overall, the EPT community apepars to be relatively stable in this catchment.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
Silver Cr	**SR 1127**	**CB86**	**08/03/07**	**Good**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
Burke	31	03050101	354057	814800	11-34-(0.5)	Northern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
C	21	1080	8	0.3

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

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

Water Quality Parameters

Temperature (°C)	20.2
Dissolved Oxygen (mg/L)	9.1
Specific Conductance (µS/cm)	50
pH (s.u.)	7.0
Water Clarity	clear

Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	15
Bottom Substrate (15)	8
Pool Variety (10)	6
Riffle Habitat (16)	7
Left Bank Stability (7)	4
Right Bank Stability (7)	4
Light Penetration (10)	10
Left Riparian Score (5)	1
Right Riparian Score (5)	1
Total Habitat Score (100)	60

Site Photograph

Substrate mostly sand; remainder a mix of cobble, boulder, and gravel

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/03/07	10291	---	31	---	4.11	Good
08/21/02	8970	---	25	---	3.74	Good-Fair

Taxonomic Analysis

Abundant EPT taxa collected from the site in 2007 were: *Baetis intercalaris, B. pluto, Serratella deficiens, Maccaffertium modestum, Maccaffertium pudicum, Stenacron pallidum, Isonychia, Leuctra, Pteronarcys proteus, Brachycentrus nigrosoma, Cheumatopsyche, Hydropsyche betteni,* and *Triaenodes ignitus.* Most of the difference between EPT taxa present in the 2002 and 2007 samples involved rare taxa in one or the other. Exceptions are: *Maccaffertium pudicum*-- absent in 2002 and abundant in 2007; *Eccoptura xanthenes*-- common in 2002 and absent in 2007; *Ceratopsyche sparna*-- absent in 2002 and common in 2007; and *Polycentropus*-- absent in 2002 and common in 2007.

Data Analysis

The site is eight miles southwest of Morganton. Six additional EPT taxa collected in 2007 over 2002 pushes the site into the classification of Good. The bottom substrate was dominated by sand; cobbles and boulders were about half embedded in the sand. Such habitat characteristics can limit the benthic community.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
SILVER CR	SR 1149	05/22/07	CF51	Good

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
BURKE	31	03050101	35.69805556	-81.76305556	11-34-(0.5)	Northern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	26.1	1095	11	0.3	No

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

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

Water Quality Parameters

Temperature (°C)	18.6
Dissolved Oxygen (mg/L)	8.7
Specific Conductance (µS/cm)	50
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)	4
Riffle Habitat (16)	2
Left Bank Stability (7)	3
Right Bank Stability (7)	3
Light Penetration (10)	10
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	**51**

Site Photograph

Substrate sand, gravel

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
05/22/07	2007-62	13	50	Good
05/01/02	2002-39	19	60	Excellent

Most Abundant Species Greenhead Shiner

Exotic Species None

Species Change Since Last Cycle

Gains -- None. **Losses** -- Redfin Pickerel, Highback Chub, Green Sunfish, Bluegill, Largemouth Bass, and Yellow Perch.

Data Analysis

Watershed -- a tributary to the Catawba River located almost 5 miles above its confluence; drains the extreme southwest corner of Burke County below Glen Alpine. **Habitat** -- sandy runs with side snags and a few small pools; low flow; good riparian zone widths. **2007** -- the decline in NCIBI score and rating at this site reflects the reduction in total abundance (n= 152 vs. 384 in 2002) and diversity, including the loss of all three piscivorous species collected in 2002 (Redfin Pickerel, Largemouth Bass, and Yellow Perch); low flows and possibly non-point sources of sediment are likely responsible, evidenced by the marginal pool habitats and exposed substrates present. **2002 - 2007** -- there are 19 known species from this stream including 2 species of suckers, 7 species of minnows, and 3 species of darters. Overall, water quality continues to be good.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
Warrior Fk	**SR 1440**	**CB102**	**08/02/07**	**Excellent**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
Burke	31	03050101	354749	814307	11-35-(1)	Northern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
WS-III	82	1000	17	0.4

	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)	25.4
Dissolved Oxygen (mg/L)	7.9
Specific Conductance (µS/cm)	37
pH (s.u.)	6.8
Water Clarity	clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	14
Bottom Substrate (15)	10
Pool Variety (10)	10
Riffle Habitat (16)	12
Left Bank Stability (7)	5
Right Bank Stability (7)	5
Light Penetration (10)	5
Left Riparian Score (5)	2
Right Riparian Score (5)	2
Total Habitat Score (100)	70

Site Photograph

Substrate mix of gravel, cobble, sand, and silt

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/02/07	10288	---	39	---	4.14	Excellent
08/21/02	8972	---	34	---	3.31	Good
08/04/97	7413	---	41	---	3.26	Excellent

Taxonomic Analysis

Along with *Oectis persimilis* , two species of *Oecetis* rarely identified from BAU samples were collected from the site for the first time in 2007: *O. avara* and *O. sphyra* . Though abundant in the 1997 collection, both *Epeorus rubidus* and *Psychomyia nomada* have not been collected from the site during the most recent two sampling events. Similarly, *Lepidostoma* , which was common in the 1997 collection, was not collected in the two latest samples. Abundant EPT taxa collected in 2007 were: *Caenis, Hexagenia, Maccaffertium modestum, Stenacron pallidum, Isonychia, Cheumatopsyche, Triaenodes ignitus,* and *Polycentropus.*

Data Analysis

The site is four miles NNW of Morganton and three stream-miles upstream of Catawba River. Five more EPT taxa were collected in 2007 than in 2002, putting the site back into the Excellent classification in 2007.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
S Muddy Cr	**SR 1764**	**CB51**	**07/09/07**	**Good**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
McDowell	30	03050101	353900	815118	0	Northern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
C	31	1100	10	0.5

	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)	23.6
Dissolved Oxygen (mg/L)	7.5
Specific Conductance (µS/cm)	47
pH (s.u.)	6.8
Water Clarity	slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	3
Instream Habitat (20)	14
Bottom Substrate (15)	11
Pool Variety (10)	3
Riffle Habitat (16)	12
Left Bank Stability (7)	5
Right Bank Stability (7)	5
Light Penetration (10)	7
Left Riparian Score (5)	2
Right Riparian Score (5)	3
Total Habitat Score (100)	65

Site Photograph

Substrate boulder, cobble, gravel, sand, and silt

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
07/09/07	10093	---	32	---	3.94	Good
08/05/02	8903	---	23	---	4.22	Good-Fair
08/04/97	7387	---	24	---	3.68	Good-Fair
07/08/92	5893	---	27	---	3.64	Good-Fair

Taxonomic Analysis

The 2007 sample resulted in the highest EPT taxa richness ever recorded at this location. EPT taxa not previously collected from this site but observed in 2007 include the mayflies *Procloeon* , *Serratella serratoides* , the stonefly *Paragnetina fumosa* , and the caddisflies *Lype diversa* , *Neophylax oligius* , and *Pycnopsyche lepida* . Like most streams in this subbasin, the drought does not seem to be adversely affecting the instream habitat of South Muddy Creek as numerous edge caddisflies were collected in 2007 and included *Oecetis persimilis* and *Triaenodes ignitus* .

Data Analysis

The South Muddy Creek watershed is dominated by agricultural uses. The large increase in EPT taxa measured in 2007 is likely related to reduced non-point pollution runoff due to the severe drought.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
IRISH CR	**SR 1439**	**05/22/07**	**CF22**	**Excellent**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
BURKE	31	03050101	35.81638889	-81.74805556	11-35-3-(2)b	Northern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
WS-III	31.7	1100	11	0.5	No

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

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

Water Quality Parameters

Temperature (°C)	18.6
Dissolved Oxygen (mg/L)	9.4
Specific Conductance (µS/cm)	37
pH (s.u.)	6.0

Water Clarity	Very slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	12
Bottom Substrate (15)	3
Pool Variety (10)	6
Riffle Habitat (16)	1
Left Bank Stability (7)	5
Right Bank Stability (7)	5
Light Penetration (10)	7
Left Riparian Score (5)	3
Right Riparian Score (5)	3
Total Habitat Score (100)	**50**

Site Photograph

Substrate sand, gravel

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
05/22/07	2007-61	21	54	Excellent
07/30/03	2003-48	13	40	Fair
05/02/02	2002-42	17	38	Fair

Most Abundant Species Tessellated Darter

Exotic Species Smallmouth Bass

Species Change Since Last Cycle

Gains -- Central Stoneroller, Rosyside Dace, Greenfin Shiner, Seagreen Darter, Warmouth, Warpaint Shiner, Greenhead Shiner, Margined Madtom, Piedmont Darter, and Striped Jumprock. **Losses** -- Rock Bass and Yellow Perch.

Data Analysis

Watershed -- a tributary to Warrior Fork, located less than 1 mile above its confluence; drains a portion of northwestern Burke County; the upper reaches of this watershed lie within the Pisgah National Forest and the lower reaches flow through land used extensively for tree farming. **Habitat** -- sandy runs with side snags, root mats, and a few stick riffles; tree farms flank the site outside of its 6-12 meter riparian zones. **2007** -- a diverse and trophically balanced fish community was collected; a major improvement from the 2003 sample with 8 more species collected, including two intolerant species (Seagreen Darter, and Piedmont Darter), and greater than triple the total abundance (n = 194 vs. 52 in 2003). **2002 - 2007** -- there are 26 known species fish from this site, including 4 species of suckers, 9 species of minnows, and 4 species of darters. The reason for the dramatic change in the NCIBI rating is unknown since land use, riparian coverage, and instream habitats appear the same as in previous samples.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
JOHNS R	**off SR 1367**	**05/22/07**	**CF73**	**Excellent**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
CALDWELL	31	03050101	36.0517131	-81.70123	11-38-(1)	Southern Crystalline Ridges and Mountains

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C;Tr	18.4	1400	11	0.3	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)	16.6
Dissolved Oxygen (mg/L)	10.0
Specific Conductance (µS/cm)	42
pH (s.u.)	7.4

Water Clarity	Clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	19
Bottom Substrate (15)	15
Pool Variety (10)	8
Riffle Habitat (16)	15
Left Bank Stability (7)	7
Right Bank Stability (7)	7
Light Penetration (10)	5
Left Riparian Score (5)	4
Right Riparian Score (5)	5
Total Habitat Score (100)	**90**

Site Photograph

Substrate cobble, bedrock, boulder, gravel, sand

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
05/22/07	2007-60	17	56	Excellent

Most Abundant Species	Central Stoneroller	**Exotic Species**	Smallmouth Bass, Rainbow Trout, and Brown Trout

Species Change Since Last Cycle N/A

Data Analysis

This is the first fish community sample collected at this site. **Watershed** -- a headwater tributary to the Catawba River located in the northwest corner of Caldwell County; this catchment is situated directly between the Gragg Prong and Mulberry Creek watersheds within the Pisgah National Forest lands. **Habitat** -- riffles, plunge pools and runs; good riparian zones, and fairly open canopy; similar to the Gragg Prong site, substrates were minimally embedded. **2007** -- good diversity and high abundance (n = 793) including 3 intolerant species collected (Smallmouth Bass, Fieryblack Shiner, and Rainbow Trout); within the 17 species collected, there were 3 species of suckers, 6 species of minnows, and 2 species of darters. There are no indications of any water quality issues in this watershed.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
Johns R	**SR 1356**	**CB73**	**07/13/07**	**Excellent**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
Caldwell	31	03050101	355603	814129	11-38-(28)	Southern Crystalline Ridges and Mountains

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
C	64	1080	17	0.4

	Forested/Wetland	Urban	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)	23.3
Dissolved Oxygen (mg/L)	6.9
Specific Conductance (µS/cm)	40
pH (s.u.)	6.9
Water Clarity	slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	17
Bottom Substrate (15)	14
Pool Variety (10)	5
Riffle Habitat (16)	12
Left Bank Stability (7)	7
Right Bank Stability (7)	7
Light Penetration (10)	7
Left Riparian Score (5)	5
Right Riparian Score (5)	1
Total Habitat Score (100)	79

Site Photograph

Substrate mix of cobble, gravel, and sand; some boulder, silt also present

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
07/13/07	10256	---	45	---	2.84	Excellent
08/22/02	8975	---	43	---	3.38	Excellent
08/05/97	7415	---	49	---	2.56	Excellent
08/03/92	5957	---	43	---	3.15	Excellent

Taxonomic Analysis

No significant changes in the biota were noted between the four basinwide sampling events at the site. Abundant taxa in 2007 were *Epeorus rubidus, Heptagenia marginalis, Maccaffertium modestum, Stenacron pallidum, Isonychia, Tallaperla, Acroneuria abnormis, Apatania, Ceratopsyche morosa, Cheumatopsyche, Triaenodes ignitus, Chimarra, Neophylax fuscus* , and *Neophylax oligius* . *Brachycentrus lateralis* , rarely identified from BAU samples, has been collected from the site during three of the four basinwide sampling events.

Data Analysis

The site is about 8 miles west of Lenoir and 1.5 stream-miles upstream of the mouth of Mulberry Creek. The catchment is contained within Pisgah National Forest. The benthic community continues to indicate a high-quality site in terms of water quality.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
Johns R	**SR 1438**	**CB269**	**08/01/07**	**Excellent**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
Burke	31	03050101	355002	814242	0	Northern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
WS-IV;HQW	201	1000	35	0.4

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	80	0	20	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)	7.4
Specific Conductance (µS/cm)	31
pH (s.u.)	6.7
Water Clarity	clear

Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	20
Bottom Substrate (15)	6
Pool Variety (10)	6
Riffle Habitat (16)	16
Left Bank Stability (7)	7
Right Bank Stability (7)	7
Light Penetration (10)	2
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	78

Site Photograph

Substrate mix of cobble, gravel, sand; some bedrock and silt

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/01/07	10285	---	39	---	2.98	Excellent
08/22/02	8974	---	35	---	3.45	Good
03/28/89	4872	116	63	3.85	2.69	Excellent
08/10/83	3113	89	43	4.04	3.32	Excellent

Taxonomic Analysis

A few Trichoptera rarely identified from BAU samples were collected for the first time from the site in 2007: *Micrasema rickeri* prefers clean mountain streams; *Ceraclea slossonae* had only seven prior BAU records, all from the New River basin; and *Oecetis avara* has a wide distribution across state and a strong preference for clean streams. Abundant EPT taxa at the site were: *Heterocloeon anoka, Maccaffertium modestum, Pteronarcys dorsata, Brachycentrus lateralis* (another Trichoptera rarely identified from BAU samples though collected in 2002 from the site), *Hydropsyche venularis, Lepidostoma,* and *Neophylax fuscus.*

Data Analysis

The site is six miles NNW of Lenoir. The site slipped into the Good classification in 2002 (missing Excellent by the collection of a single additional EPT taxon for that sampling event). The four additional EPT taxa and lower EPT BI is suggestive of better water quality in 2007 over 2002.

Note that EPT richness values are not comparable between the Full-Scale samples collected in the earlier two sampling events and the latter two that were collected using EPT methods. The Full-Scale collection method is more extensive than the EPT method; it is therefore expected that collections using the Full-Scale method would result in higher richness values over EPT collections.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
GRAGG PRONG	**SR 1367**	**05/22/07**	**CF16**	**Excellent**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
CALDWELL	31	03050101	36.0463252	-81.7074049	11-38-10	Southern Crystalline Ridges and Mountains

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C;Tr	15	1385	10	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)	14.7
Dissolved Oxygen (mg/L)	9.3
Specific Conductance (µS/cm)	33
pH (s.u.)	5.9

Water Clarity	Clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	19
Bottom Substrate (15)	15
Pool Variety (10)	10
Riffle Habitat (16)	16
Left Bank Stability (7)	7
Right Bank Stability (7)	7
Light Penetration (10)	6
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	**95**

Site Photograph

Substrate cobble, boulder, bedrock

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
05/22/07	2007-59	17	60	Excellent
05/25/99	99-37	18	56	Excellent
10/01/98	98-79	17	56	Excellent

Most Abundant Species Fantail Darter

Exotic Species Smallmouth Bass, Rainbow Trout, and Brown Trout

Species Change Since Last Cycle **Gains** -- Seagreen Darter and Creek Chub. **Losses** -- Rock Bass, Flat Bullhead, and Sandbar Shiner.

Data Analysis

Watershed -- a tributary to the Johns River located about one quarter mile above its confluence; drains the extreme northwest corner of Caldwell County; this watershed is largely encompassed by the Pisgah National Forest. **Habitat** -- highest habitat score for all 2007 Catawba basin fish sites; riffles, boulder pools, plunge pools and side snags; very little embeddedness of substrates; great riparian zone widths. **2007** -- diverse and highly abundant (n = 1,080, highest for all 2007 sites in the Catawba River basin) fish community collected, including 4 intolerant species; several large adult specimens and young of year wild Brown Trout collected. **1998 - 2007** -- 22 species of fish are known from this site including 9 species of minnows, 3 species of suckers, and 3 species of darters; this regional reference site has rated Excellent on 3 occasions, and would qualify for HQW or ORW status if petitioned.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
MULBERRY CR	**NC 90**	**05/21/07**	**CF45**	**Excellent**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
CALDWELL	31	03050101	35.9430555	-81.6338888	11-38-32-(15)	Northern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	33	1150	14	0.3	Yes

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	60	10 (rural residential)	30	0

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

Water Quality Parameters

Temperature (°C)	19.1
Dissolved Oxygen (mg/L)	9.6
Specific Conductance (µS/cm)	40
pH (s.u.)	6.1

Water Clarity	Clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	16
Bottom Substrate (15)	7
Pool Variety (10)	6
Riffle Habitat (16)	10
Left Bank Stability (7)	5
Right Bank Stability (7)	5
Light Penetration (10)	8
Left Riparian Score (5)	4
Right Riparian Score (5)	3
Total Habitat Score (100)	**69**

Site Photograph

Substrate cobble, gravel

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
05/21/07	2007-58	22	60	Excellent
09/22/99	99-61	27	60	Excellent
06/21/99	99-51	23	58	Excellent
04/16/99	99-19	26	56	Excellent
05/08/97	97-39	23	60	Excellent

Most Abundant Species Tessellated Darter

Exotic Species Smallmouth Bass and Mountain Redbelly Dace

Species Change Since Last Cycle **Gains** -- Mountain Redbelly Dace. **Losses** -- Rock Bass, Thicklip Chub, Eastern Silvery Minnow, Pumkinseed, and Largemouth Bass

Data Analysis

Watershed -- a fairly large tributary to the Johns River, located about 2.7 miles above its confluence; drains part of the Pisgah National Forest in central Caldwell County; although this site is located in the Northern Inner Piedmont ecoregion, the vast majority of the catchment is located within the Southern Crystalline Ridges and Mountains ecoregion. **Habitat** -- shallow runs, one long pool, riffles, and a few small side pools; although adequate, the riparian zones include mowed lawns and tree crops. **2007** -- very diverse and abundant (n = 421) fish community; maximum scores for all NCIBI metrics. **1997 -2007** -- based on its fish community, this regional reference site has rated Excellent on 5 occasions and would qualify for HQW or ORW status if petitioned. Many of the headwater tributaries to Mullberry Creek are currently classified as HQW, and a current benthic study supports the reclassification of this reach.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
DROWNING CR	**SR 1647**	**05/21/07**	**CF72**	**Good-Fair**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
BURKE	32	03050101	35.7464062	-81.4161312	11-52-(1)	Northern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
WS-IV	15	1000	6	0.5	No

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

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

Water Quality Parameters

Temperature (°C)	14.4
Dissolved Oxygen (mg/L)	10.1
Specific Conductance (µS/cm)	43
pH (s.u.)	5.8

Water Clarity	Slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	14
Bottom Substrate (15)	3
Pool Variety (10)	10
Riffle Habitat (16)	3
Left Bank Stability (7)	7
Right Bank Stability (7)	5
Light Penetration (10)	10
Left Riparian Score (5)	5
Right Riparian Score (5)	4
Total Habitat Score (100)	**66**

Site Photograph

Substrate sand, gravel, bedrock

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
05/21/07	2007-56	12	44	Good-Fair

Most Abundant Species	Bluehead Chub	**Exotic Species**	None

Species Change Since Last Cycle N/A

Data Analysis

This is the first fish community sample collected at this site. **Watershed** -- a tributary to Lake Hickory located to its southwest; the site is about 1.5 miles upstream of the lake and drains the eastern corner of Burke County between the towns of Hickory and Connelly Springs. **Habitat** -- primarily runs and pools with some coarse woody snags and a few bedrock outcrop chutes. **2007** - a moderate to low diversity fish community including 2 species of suckers, 4 species of minnows, and 1 darter species. Abundance of the collected population was good (n = 392), but the Bluehead Chub represented 48% of the total, and no intolerant species were collected. The urban nature of this watershed is likely having an impact on the fish community here. Although the specific conductance was not elevated, the stream did become very turbid during sampling, an indication of non-point source sedimentation.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
SMOKY CR	**SR 1515**	**05/21/07**	**CF53**	**Excellent**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
BURKE	31	03050101	35.79944444	-81.605	11-41-(1)	Northern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
WS-IV	7.6	1100	6	0.3	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)	16.6
Dissolved Oxygen (mg/L)	10.0
Specific Conductance (µS/cm)	38
pH (s.u.)	6.4

Water Clarity	Clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	16
Bottom Substrate (15)	8
Pool Variety (10)	7
Riffle Habitat (16)	9
Left Bank Stability (7)	7
Right Bank Stability (7)	6
Light Penetration (10)	9
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	**77**

Site Photograph

Substrate sand, cobble, boulder, bedrock

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
05/21/07	2007-57	17	54	Excellent
05/03/02	2002-44	16	58	Excellent

Most Abundant Species Central Stoneroller

Exotic Species None

Species Change Since Last Cycle **Gains** -- Notchlip Redhorse, Spottail Shiner, and Brassy Jumprock. **Losses** -- Flat Bullhead and Warmouth.

Data Analysis

Watershed -- a small tributary to Lake Rhodhiss located less than a mile to the north of the lake; drains small portions of Caldwell and Burke Counties, just south of the Towns of Gamewell and Lenoir. **Habitat** -- cobble riffles, shallow sandy runs, shallow bedrock plunge pools, and side snags; good canopy and forested riparian zone widths. **2007** -- a diverse and abundant fish community was collected including 4 species of suckers, 7 species of minnows, and 2 species of darters. **1993 - 2007** -- very stable metrics since the 2002 sample; the stream was clear, but became extremely turbid during sampling; this watershed is subject to sedimentation, maybe from non-point sources. However, if petitioned this regional reference site would qualify for reclassification to either HQW or ORW status.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
Smoky Cr	**SR 1515**	**CB88**	**08/02/07**	**Good**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
Burke	31	03050101	354757	813618	11-41-(1)	Northern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
WS-IV	8.0	1010	5	0.3

	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)	21.6
Dissolved Oxygen (mg/L)	8.8
Specific Conductance (µS/cm)	41
pH (s.u.)	6.8
Water Clarity	clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	16
Bottom Substrate (15)	13
Pool Variety (10)	9
Riffle Habitat (16)	15
Left Bank Stability (7)	6
Right Bank Stability (7)	6
Light Penetration (10)	7
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	87

Site Photograph

Substrate mostly cobble, gravel, sand, and silt; some boulder and bedrock

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/02/07	10287	---	28	---	3.59	Good
08/21/02	8969	---	26	---	3.56	Good-Fair
08/05/97	7416	---	32	---	3.60	Good
08/04/92	5960	---	30	---	3.24	Good

Taxonomic Analysis

Abundant EPT taxa collected from the site in 2007 were: *Baetis pluto, Serratella deficiens, Hexagenia, Maccaffertium modestum, Stenacron pallidum, Isonychia, Leuctra, Acroneuria abnormis, Pteronarcys,* and *Cheumatopsyche* . Other than a significant loss of six Ephemeroptera taxa between the sampling events in 1997 and 2002, the EPT taxa present at the site are relatively similar between sampling efforts.

Data Analysis

The site is about 6 miles northeast of downtown Morganton and 1.5 miles upstream of the confluence with Catawba River. The collection of two additional EPT taxa in 2007 over the previous sampling effort in 2002 pushed the resulting classification back into Good from Good-Fair. Silt, which can stifle macroinvertebrate habitat, was implicated as a causative factor in the decline of EPT richness between 1997 and 2002 in the prior basinwide report. Visual estimates of the amount of silt present was less in 2007 than 2002.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
McGalliard Cr	**SR 1538**	**CB82**	**08/02/07**	**Good-Fair**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
Burke	31	03050101	354549	813411	11-44-(3)	Northern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
WS-IV	8.0	1000	5	0.4

	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)	21.8
Dissolved Oxygen (mg/L)	6.8
Specific Conductance (µS/cm)	109
pH (s.u.)	6.0
Water Clarity	turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	12
Bottom Substrate (15)	2
Pool Variety (10)	10
Riffle Habitat (16)	5
Left Bank Stability (7)	3
Right Bank Stability (7)	3
Light Penetration (10)	10
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	60

Site Photograph

Substrate mostly silt and sand; small amounts of boulder, cobble, gravel

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/02/07	10286	---	22	---	5.06	Good-Fair
08/27/03	9294	---	18	---	4.30	Fair
08/21/02	8968	---	16	---	5.09	Fair
08/05/97	7417	---	21	---	4.81	Good-Fair

Taxonomic Analysis

Abundant taxa at the site were: *Baetis pluto, Maccaffertium modestum, Eccoptura xanthenes, Cheumatopsyche,* and *Hydropsyche betteni*. Three of the five abundant taxa are tolerant to the presence of pollutants: *M. modestum, Cheumatopsyche,* and *H. betteni* have tolerance values of 5.5, 6.2, and 7.8 respectively.

Data Analysis

The site--along with nearly the entire catchment--is in the city of Valdese and about 2 stream-miles above the confluence with Catawba River. The highest number of EPT taxa for the four basinwide sampling events at the site were collected in 2007, returning the resulting classification to the Good-Fair it received in 1997.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
Gunpowder Cr	**SR 1718**	**CB114**	**08/01/07**	**Fair**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
Caldwell	32	03050101	355039	812610	11-55-(1.5)	Northern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
WS-IV	19	1070	10	0.3

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	60	20	20	0

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
City of Lenoir, Gunpowder Creek WWTP	NC0023736	2

Water Quality Parameters

Temperature (°C)	20.6
Dissolved Oxygen (mg/L)	7.4
Specific Conductance (µS/cm)	103
pH (s.u.)	6.7
Water Clarity	slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	8
Bottom Substrate (15)	3
Pool Variety (10)	8
Riffle Habitat (16)	7
Left Bank Stability (7)	6
Right Bank Stability (7)	6
Light Penetration (10)	10
Left Riparian Score (5)	1
Right Riparian Score (5)	4
Total Habitat Score (100)	57

Site Photograph

Substrate mostly sand with small amounts of cobble and gravel near bridge

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/01/07	10283	---	14	---	4.80	Fair
08/21/02	8967	---	23	---	4.73	Good-Fair

Taxonomic Analysis

There was a loss of nine EPT taxa from the sampling event in 2002 compared to the effort in 2007. Most of the loss occurred within the Ephemeroptera as eight of those taxa collected in 2002 were not collected in 2007: *Heterocloeon, Plauditus, Pseudocloeon propinquum, Baetisca, Caenis, Hexagenia, Heptagenia marginalis,* and *Stenacron pallidum* . *Maccaffertium pudicum* was uncollected in 2002 and rare in 2007. Plecoptera were entirely different between the two sampling events: *Leuctra, Acroneuria abnormis,* and *Pteronarcys* were collected in 2002; *Tallaperla* and *Perlesta* in 2007. All stonefly taxa were rare in the sample from each year except for *Pteronarcys* , which was common in 2002. Conversely, Trichoptera were very similar in both years with only the loss of *Leucotrichia pitciptes* in 2007 (it was abundant in 2002). Abundant taxa in 2007 were *Baetis pluto, Maccaffertium modestum, Isonychia, Cheumatopsyche, Hydropsyche betteni,* and *Neophylax oligius* .

Data Analysis

The site is 7.5 miles southeast of Lenoir and about 2.5 miles stream-miles downstream of the City of Lenoir Gunpowder Creek WWTP. Macroinvertebrate habitat is quite limited at the site. The only rocky sustrate is an artifact of the bridge; otherwise bottom sustrate is almost entirely sand. The large loss of EPT taxa between 2002 and 2007 is not reflected by the EPT BI, i.e. it was not just sensitive taxa that were eliminated from the latter sample. However, the loss of 39% of the number of EPT taxa between the sampling events from 2002 to 2007 is significant. No particular stressor is indicated by the taxa lost. Macroinvertebrate habitat was limited for both sampling events and specific conductance is elevated, so differences in the benthic community are very likely due to additional water-borne stressors.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
UPPER LITTLE R	**SR 1712**	**04/27/07**	**CF66**	**Good-Fair**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
CALDWELL	32	03050101	35.896149	-81.421808	11-58	Northern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	11.3	1200	6	0.3	No

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	35	0	40	25 (tree nursery farm)

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
Caldwell County Board of Education's Oak Hill Elementary School WWTP	NC0041220	0.003

Water Quality Parameters

Temperature (°C)	16.7
Dissolved Oxygen (mg/L)	9.7
Specific Conductance (µS/cm)	40
pH (s.u.)	6.3

Water Clarity	Clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	16
Bottom Substrate (15)	4
Pool Variety (10)	4
Riffle Habitat (16)	11
Left Bank Stability (7)	3
Right Bank Stability (7)	5
Light Penetration (10)	9
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	**67**

Site Photograph

Substrate Sand and gravel

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
04/27/07	2007-38	10	46	Good-Fair

Most Abundant Species Rosyside Dace and Greenhead Shiner **Exotic Species** None

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

Data Analysis

This is the first fish community sample collected at this site. **Watershed** -- drains east central Caldwell County and the southeastern facing slopes of the Brushy Mountains; borders the Eastern Blue Ridge Foothills ecoregion; no municipalities in the watershed; site is ~ 6 miles upstream from and about one-half the drainage area of the basinwide site sampled in 2002; WWTP is ~ 0.8 miles above the site. **Habitat** -- shallow, sandy flats and chutes; logs across the stream creating riffles; channel filled with sand; good riparian; deeply entrenched (natural?) with some badly eroded and bare banks; except for the entrenchment, site would have qualified as a reference site. **2007** -- very low flow (becomes intermittent during low flow?); low conductivity; a very abundant community, but species diversity was lower than expected, only one species of sunfish was collected and intolerant species were absent.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
Upper Little R	**SR 1740**	**CB130**	**07/31/07**	**Excellent**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
Caldwell	32	03050101	355032	812145	11-58-(5.5)	Northern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
WS-IV	34	980	16	0.3

	Forested/Wetland	Urban	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)	24.2
Dissolved Oxygen (mg/L)	8.2
Specific Conductance (µS/cm)	38
pH (s.u.)	7.4
Water Clarity	milky

Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	20
Bottom Substrate (15)	13
Pool Variety (10)	10
Riffle Habitat (16)	10
Left Bank Stability (7)	7
Right Bank Stability (7)	7
Light Penetration (10)	2
Left Riparian Score (5)	1
Right Riparian Score (5)	5
Total Habitat Score (100)	79

Site Photograph

Substrate about half of area boulder; remainder sand, cobble, and gravel

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
07/31/07	10282	111	50	4.65	3.73	Excellent
08/20/02	8965	83	33	4.91	3.94	Good
08/06/97	7419	90	39	4.35	3.47	Good
08/04/92	5961	74	38	4.18	3.56	Good

Taxonomic Analysis

The greatest number of both Ephmeroptera and Trichoptera taxa were collected in 2007 over all sampling events at the site; the number of Plecoptera taxa collected in 2007 was equal to the number collected in 1992. *Acroneuria evoluta* and *Ochrotrichia* , taxa rarely identified from BAU samples, were collected for the first time from this site in 2007. Abundant taxa collected from the site in 2007 were: *Baetis flavistriga, Caenis, Serratella deficiens, Hexagenia, Heptagenia marginalis, Leucrocuta, Maccaffertium modestum, Stenacron pallidum, Isonychia, Leuctra, Acroneuria abnormis, Ceratopsyche sparna, Cheumatopsyche, Triaenodes ignitus, Paranyctiophylax, Boyeria vinosa, Gomphus, Helichus basalis, Macronychus glabratus, Simulium, Microtendipes pedellus* sp. group*, Polypedilum flavum, Tribelos jucundum,* Branchiobdellida, Lumbriculidae, *Elimia,* and *Corbicula fluminea* .

Data Analysis

The site is about 8 miles north of downtown Hickory and 5 stream-miles upstream of the confluence with Catawba River. The high number of EPT taxa collected resulted in a classification of Excellent for the first time for the site; the NCBI remained somewhat high though. Very good in-stream habitat helps to support macroinvertebrate diversity.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
MIDDLE LITTLE R	**SR 1002**	**04/27/07**	**CF42**	**Good**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
ALEXANDER	32	03050101	35.88916667	-81.32138889	11-62	Northern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	16.3	1200	7	0.4	Yes

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	95	5 (rural residential)	0	0

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

Water Quality Parameters

Temperature (°C)	16.8
Dissolved Oxygen (mg/L)	8.6
Specific Conductance (µS/cm)	31
pH (s.u.)	5.5

Water Clarity	Clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	18
Bottom Substrate (15)	8
Pool Variety (10)	8
Riffle Habitat (16)	12
Left Bank Stability (7)	6
Right Bank Stability (7)	6
Light Penetration (10)	10
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	**83**

Site Photograph

Substrate Sand, gravel, cobble, and boulder

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
04/27/07	2007-37	12	48	Good
05/23/02	2002-59	13	56	Excellent
05/08/97	97-41	12	52	Good
05/11/93	93-19	9	46	Good-Fair

Most Abundant Species Bluehead Chub **Exotic Species** None

Species Change Since Last Cycle **Gains** -- Highback Chub and Flat Bullhead. **Losses** -- White Sucker, Bluegill, and Largemouth Bass.

Data Analysis

Watershed -- tributary to Lake Hickory; downstream are Moretz Lake and Rink dams; drains western Alexander and eastern Caldwell counties, including the southeast facing slopes of the Brushy Mountains; no municipalities in the watershed. **Habitat** -- old mill site at the end of the reach; runs; pools with sand bottoms; snags; great riparian habitats. **2007** -- low specific conductance and very low pH; diversity metrics lower than expected and accounted for the decline in the rating from Excellent to Good; the intolerant Highback Chub was collected for the first time; declines noted in the relative abundance of Rosyside dace and Greenhead Shiner. **1993 - 2007** -- consistently low conductivity, ranging from 24 to 31 µS/cm; a relatively low species diversity, only 15 species known from the site; no exotic species have ever been collected at the site; dominant species are Bluehead Chub, Rosyside Dace, and Greenhead Shiner; no changes in the percentage of tolerant fish or in the trophic metrics; number of fish collected in 2007 (n = 295) was two-thirds of the number collected in 2002 (a low flow year), but similar to the number in 1997 (n = 230); habitat scores have ranged from 72 in 1997 to 83 in 2007.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
Middle Little R	**SR 1153**	**CB123**	**07/31/07**	**Good-Fair**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
Alexander	32	03050101	355148	811719	11-62	Northern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
C	43	1000	8	0.5

	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)	21.2
Dissolved Oxygen (mg/L)	7.5
Specific Conductance (µS/cm)	38
pH (s.u.)	6.6
Water Clarity	slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	7
Bottom Substrate (15)	3
Pool Variety (10)	10
Riffle Habitat (16)	2
Left Bank Stability (7)	6
Right Bank Stability (7)	5
Light Penetration (10)	10
Left Riparian Score (5)	4
Right Riparian Score (5)	3
Total Habitat Score (100)	55

Site Photograph

Substrate almost entirely sand; some silt present

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
07/31/07	10280	---	24	---	3.84	Good-Fair
08/27/03	9293	---	26	---	3.18	Good-Fair
08/20/02	8964	---	18	---	3.75	Fair
08/06/97	7420	---	26	---	3.96	Good-Fair
08/04/92	5963	---	32	---	4.15	Good

Taxonomic Analysis

Abundant EPT taxa collected from the site in 2007 were: *Serratella deficiens, Hexagenia, Maccaffertium modestum, Isonychia, Acroneuria abnormis, Brachycentrus nigrosoma,* and *Cheumatopsyche* . The EPT community was fairly similar between 2003 and 2007, though there are a few notable exceptions. *Heptagenia marginalis* and *Pycnopsyche lepida* were both common in 2003 though uncollected in 2007. *Neoperla* and *Triaenodes ignitus* were both uncollected in 2003 and were common in 2007.

Data Analysis

The site is 1.7 miles southwest of Bald Mountain of Barrett Mountain Range, about nine miles NNE of downtown Hickory, and about six stream-miles upstream of the confluence with Catawba River. Specific conductance is relatively low at the site. However, macroinvertebrate habitat is quite limited; reduced EPT richness generally at the site is more likely due to habitat limitations rather than water-borne pollutants.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
DUCK CR	**NC 90**	**04/26/07**	**CF13**	**Good**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
ALEXANDER	32	03050101	35.91777778	-81.31277778	11-62-2-(1)	Northern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C;Tr	14.6	1200	7	0.4	No

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	55	20 (rural residential)	25	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)	9.1
Specific Conductance (µS/cm)	38
pH (s.u.)	6.3

Water Clarity	Clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	16
Bottom Substrate (15)	9
Pool Variety (10)	8
Riffle Habitat (16)	12
Left Bank Stability (7)	6
Right Bank Stability (7)	4
Light Penetration (10)	10
Left Riparian Score (5)	5
Right Riparian Score (5)	2
Total Habitat Score (100)	**77**

Site Photograph

Substrate Sand, gravel, and cobble

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
04/26/07	2007-35	11	48	Good
05/23/02	2002-60	10	48	Good
05/08/97	97-40	10	48	Good
05/11/93	93-20	10	40	Fair

Most Abundant Species Bluehead Chub **Exotic Species** Fathead Minnow

Species Change Since Last Cycle **Gains** -- Fathead Minnow and White Sucker. **Losses** -- Seagreen Darter.

Data Analysis

Watershed -- tributary to the Middle Little River; drains the northeast portion of the Brushy Mountains in western Alexander and eastern Caldwell counties; no municipalities in the watershed. **Habitat** -- cattle continued to be fenced out of the stream; more sand and gravel in the stream than in 2002, bar development. **2007** -- lower species diversity and diversities of sunfish and darters than expected; percentage of tolerant fish increased from 6 to 21% between 2002 and 2007; first exotic species ever collected from the site. **1993 - 2007** -- conductivity ranged from 35 to 42 µS/cm; only 13 species known from the site, but only one species of sunfish; 10 or 11 of these species have been collected each time; the intolerant Highback Chub was not collected until 2002; no Tessellated Darter or trout have ever been collected from this site; dominant species have been Bluehead Chub, Greenhead Shiner, and Rosyside Dace; number of fish in 2002 (a low flow year) was an anomaly compared to 1997 and 2007 (n = 1,665, 421, and 387, respectively); a gradually improving trophic structure -- omnivores decreasing from 42 to 22% and the insectivores increasing from 58 to 78%.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
Duck Cr	**NC 127**	**CB112**	**07/31/07**	**Good**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
Alexander	32	03050101	355333	811811	11-62-2-(4)	Northern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
C	18	1040	17	0.4

	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)	22.0
Dissolved Oxygen (mg/L)	8.5
Specific Conductance (µS/cm)	41
pH (s.u.)	6.7
Water Clarity	clear

Habitat Assessment Scores (max)

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

Site Photograph

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

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
07/31/07	10281	---	33	---	3.35	Good
08/20/02	8963	---	33	---	3.76	Good
08/06/97	7421	---	26	---	4.00	Good-Fair
08/04/92	5962	---	26	---	3.42	Good-Fair

Taxonomic Analysis

The difference in EPT richness between the first two sampling efforts at the site and the two most recent is driven primarily by an increase in the number of Trichoptera taxa collected during the latter two events: nine and seven Trichoptera taxa were collected in 1992 and 1997; 13 and 14 in 2002 and 2007 respectively. Abundant taxa at the site in 2007 were *Baetis pluto* , *Heterocloeon curiosum* , *Serratella deficiens* , *Maccaffertium modestum* , *Isonychia* , *Leuctra* , *Acroneuria abnormis* , *Pteronarcys proteus* , *Micrasema wataga* , *Ceratopsyche sparna* , and *Cheumatopsyche* . *Tallaperla* and *Micrasema bennetti* were among the taxa collected for the first time from the site in 2007; both taxa were common in the sample. *Epeorus rubidus* , which was abundant in 1992, has not been collected from the site during the latter sampling events.

Data Analysis

The site is 13 miles east of Lenoir and about 0.7 stream-miles above the confluence with Middle Little River. Except for the loss of a coldwater taxon (*Epeorus rubidus*) between 1992 and the more recent sampling events, no specific water-quality problems are indicated by the taxa present at the site.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
Lower Little R	**SR 1131**	**CB120**	**07/31/07**	**Good-Fair**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
Alexander	32	03050101	355150	811239	11-69-(5.5)	Northern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
WS-IV	77	940	14	0.3

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

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

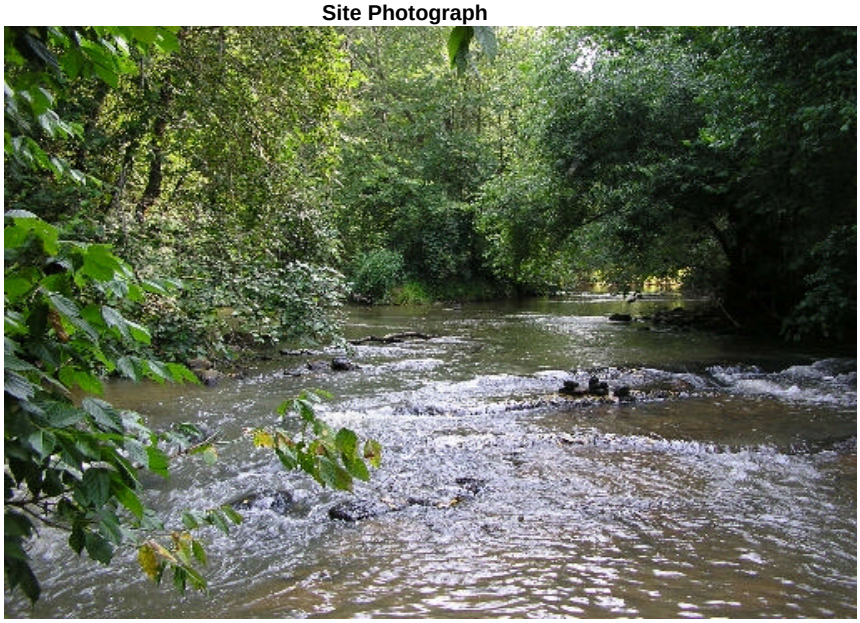
Water Quality Parameters

Temperature (°C)	22.0
Dissolved Oxygen (mg/L)	7.5
Specific Conductance (µS/cm)	54
pH (s.u.)	6.4
Water Clarity	slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	16
Bottom Substrate (15)	8
Pool Variety (10)	10
Riffle Habitat (16)	10
Left Bank Stability (7)	6
Right Bank Stability (7)	6
Light Penetration (10)	10
Left Riparian Score (5)	4
Right Riparian Score (5)	4
Total Habitat Score (100)	79

Site Photograph



Substrate half of area sand; remainder a mix of the remaining classes

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
07/31/07	10279	89	32	5.08	4.11	Good-Fair
08/20/02	8962	61	28	4.85	3.92	Good-Fair
08/06/97	7423	74	34	4.95	4.19	Good
08/04/92	5964	70	29	4.60	3.86	Good

Taxonomic Analysis

Abundant taxa at the site in 2007 were: *Baetis flavistriga, B. intercalaris, Heptagenia marginalis, Maccaffertium modestum, Stenacron pallidum, Isonychia, Ceratopsyche sparna, Cheumatopsyche, Psychomyia nomada, Neophylax oligius, Gomphus, Helichus basalis, Dineutus, Simulium, Antocha, Rheotanytarsus, Corbicula fluminea,* and *Pisidium.*

Data Analysis

The site is 1.7 miles east of Barrett Mountain peak, about 12 miles northeast of downtown Hickory and about 6 stream-miles from the confluence with Catawba River. In spite of the difference in bioclassification between the first two sampling events and the latter two, the macroinvertebrate community at the site has been relatively stable. The Good classifications resulting from collections in 1992 and 1997 were bordering on Good-Fair; small shifts in either EPT richness or NCBI value resulted in Good-Fair classifications for 2002 and 2007.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
LAMBERT FK	**SR 1317**	**04/26/07**	**CF65**	**Good-Fair**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
ALEXANDER	32	03050101	35.945923	-81.251191	11-69-3	Northern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	10.3	1200	8	0.3	No

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	80	5 (rural residential)	15	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)	8.8
Specific Conductance (µS/cm)	27
pH (s.u.)	6.7

Water Clarity	Clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	16
Bottom Substrate (15)	6
Pool Variety (10)	2
Riffle Habitat (16)	12
Left Bank Stability (7)	4
Right Bank Stability (7)	4
Light Penetration (10)	10
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	**69**

Site Photograph

Substrate Sand, cobble, gravel, and bedrock

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
04/26/07	2007-36	9	46	Good-Fair

Most Abundant Species Bluehead Chub **Exotic Species** None

Species Change Since Last Cycle N/A

Data Analysis

This is the first fish community sample collected at this site. **Watershed** -- tributary to the Lower Little River; drains rural northwest Alexander County, including the southeast facing slopes of the Brushy Mountains; borders the Eastern Blue Ridge Foothills ecoregion; no municipalities in the watershed. **Habitat** -- good riparian zones; gravel and cobble riffles and runs; very shallow pools; bar development; deeply entrenched (natural?); except for the entrenchment, site would have qualified as a reference site. **2007** -- very low flow (becomes intermittent during low flow?); very low conductivity; an abundant community, but species diversity was lower than expected, only one species of darter and sucker were collected; only site in the Catawba River basin in 2007 where no sunfish, bass, or trout were collected; Tessellated Darter were also absent; Highback Chub, an intolerant species, was abundant.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
Muddy Fk	**SR 1313**	**CB127**	**07/30/07**	**Fair**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
Alexander	32	03050101	355546	811248	11-69-4	Northern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
C	12	1060	5	0.3

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

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

Water Quality Parameters

Temperature (°C)	22.3
Dissolved Oxygen (mg/L)	7.1
Specific Conductance (µS/cm)	79
pH (s.u.)	6.6
Water Clarity	slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	8
Bottom Substrate (15)	2
Pool Variety (10)	4
Riffle Habitat (16)	3
Left Bank Stability (7)	5
Right Bank Stability (7)	5
Light Penetration (10)	10
Left Riparian Score (5)	4
Right Riparian Score (5)	4
Total Habitat Score (100)	49

Site Photograph

Substrate almostly entirely silt and sand; small amount of cobble present

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
07/30/07	10278	---	8	---	5.39	Fair
08/27/03	9292	---	18	---	5.38	Good-Fair
08/19/02	8961	---	12	---	6.05	Fair
08/06/97	7422	76	22	6.27	5.42	Good-Fair

Taxonomic Analysis

All eight taxa collected in 2007 were also collected in 2003; the difference in EPT richness between the two sampling events is due strictly to the 2003 taxa uncollected in 2007. Richness in all three orders declined: Ephemeroptera from nine to six taxa; Plecoptera from three to zero; Trichoptera from six to two. Of the eight EPT taxa collected from the site in 2007, five were abundant in the sample: *Hexagenia, Maccaffertium modestum, Isonychia, Cheumatopsyche,* and *Hydropsyche betteni.*

Data Analysis

The site is two miles WNW of Taylorsville and about 250 meters upstream of the confluence with Lower Little River. EPT richness took a sharp decline between sampling events in 2003 and 2007. There was more silt noted at the site in 2007 than in any previous sampling event; macroinvertebrate habitat smothered by silt may be part of the reason for the decline in the benthic community. Also, as reported previously, cattle had access to the stream above the site and are therefore contributing to overall depressed EPT richness values.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
MUDDY FK	**SR 1313**	**06/21/04**	**CF44**	**Good-Fair**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
ALEXANDER	32	03050101	35.92944444	-81.2125	11-69-4	Northern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	12.6	1095	4	0.3	No

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

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)	8.1
Specific Conductance (µS/cm)	65
pH (s.u.)	6.2

Water Clarity	Turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	9
Bottom Substrate (15)	3
Pool Variety (10)	4
Riffle Habitat (16)	1
Left Bank Stability (7)	2
Right Bank Stability (7)	2
Light Penetration (10)	5
Left Riparian Score (5)	1
Right Riparian Score (5)	1
Total Habitat Score (100)	**33**

Site Photograph

Substrate Sand

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
06/21/04	2004-96	11	42	Good-Fair

Most Abundant Species Bluehead Chub and Greenfin Shiner

Exotic Species None

Species Change Since Last Cycle N/A

Data Analysis

This is the first fish community sample collected at this site. **Watershed** -- tributary to the Lower Little River; drains central Alexander County and the northern part of the Town of Taylorsville; one small (0.78 MGD) discharger located ~1.5 miles upstream. **Habitat** -- very shallow runs; no riffles; cattle with access to stream from both banks; confined animal operations proximal to the stream. **2004** -- almost 75% of all the fish were the two dominant species; total diversity lower than expected; darters were absent; omnivores (Bluehead Chub and White Sucker) abundant; Largemouth Bass represented only by young-of-year; data were also used as part of a NCSU Urban Fish Study.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
GLADE CR	**SR 1610**	**04/26/07**	**CF64**	**Excellent**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
ALEXANDER	32	03050101	35.853337	-81.183432	"11-69-7-(0.7)	Northern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
WS-IV	12.7	1070	8	0.4	No

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	55	35 (rural businesses)	0	10 (church)

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

Water Quality Parameters

Temperature (°C)	16.7
Dissolved Oxygen (mg/L)	9.5
Specific Conductance (µS/cm)	49
pH (s.u.)	6.5

Water Clarity	Clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	16
Bottom Substrate (15)	6
Pool Variety (10)	10
Riffle Habitat (16)	11
Left Bank Stability (7)	6
Right Bank Stability (7)	6
Light Penetration (10)	9
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	**79**

Site Photograph

Substrate Bedrock and sand

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
04/26/07	2007-34	14	54	Excellent

Most Abundant Species Redlip Shiner **Exotic Species** Redlip Shiner

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

Data Analysis

This is the first fish community sample collected at this site. **Watershed** -- tributary to the Lower Little River; site is ~ 0.4 miles above the creek's confluence; confluence is flanked by Millersville Dam upstream and North State Dam downstream; drains the southeastern portion of the Town of Taylorsville and south central Alexander County. **Habitat** -- *Podostemum* on shelf bedrock; plunge pools and runs; nice bluff on the right; pools filled in with sediment. **2007** -- a diverse and abundant community for a stream of its size; only metrics not to score a "5" were the number of Sunfish, Bass, and Trout and the Percentage of Piscivores; one-third of all the fish were Redlip Shiner; two intolerant species (Highback Chub and Fieryblack Shiner) and two species of darters (Tessellated Darter and Fantail Darter) were present.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
Elk Shoal Cr	**SR 1605**	**CB113**	**07/30/07**	**Good-Fair**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
Alexander	32	03050101	354836	810555	11-73-(0.5)	Northern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
WS-IV	13	880	4	0.2

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

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

Water Quality Parameters

Temperature (°C)	21.1
Dissolved Oxygen (mg/L)	8.5
Specific Conductance (µS/cm)	62
pH (s.u.)	6.6
Water Clarity	clear

Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	11
Bottom Substrate (15)	3
Pool Variety (10)	4
Riffle Habitat (16)	3
Left Bank Stability (7)	5
Right Bank Stability (7)	5
Light Penetration (10)	10
Left Riparian Score (5)	1
Right Riparian Score (5)	1
Total Habitat Score (100)	47

Site Photograph

Substrate nearly entirely sand with some silt

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
07/30/07	10275	---	18	---	4.62	Good-Fair
08/20/02	8960	---	16	---	5.04	Good-Fair
08/07/97	7426	---	18	---	4.49	Good-Fair
08/05/92	5966	---	15	---	4.93	Good-Fair

Taxonomic Analysis

Abundant taxa at the site in 2007 were *Serratella deficiens* , *Maccaffertium modestum* , *Isonychia* , and *Cheumatopsyche* . The same taxa were abundant in most cases (otherwise common) for all prior sampling events at the site. *Pseudocloeon propinquum* , which was abundant from the earliest three sampling events, was rare in 2007.

Data Analysis

The site is 12 miles west of Statesville and three stream-miles upstream of the confluence with Catawba River. The benthic community has been relatively stable over the four sampling events beginning in 1992. Macroinvertebrate habitat is deficient as the substrate is sand with little else other than a small amount of silt, and is certainly depressing EPT richness at the site. Other water-quality problems may also exist though no specific stressors are indicated.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
Lyle Cr	**US 64/70**	**CB122**	**07/30/07**	**Good-Fair**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
Catawba	32	03050101	354315	810632	11-76-(3.5)	Northern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
WS-IV	44	780	9	0.3

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

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
City of Conover Northeast WWTP	NC0024252	1.5

Water Quality Parameters

Temperature (°C)	22.7
Dissolved Oxygen (mg/L)	8.6
Specific Conductance (µS/cm)	122
pH (s.u.)	7.0
Water Clarity	slightly turbid

Habitat Assessment Scores (max)

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

Site Photograph

Substrate mostly sand; some gravel, cobble; small amount boulder, silt

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
07/30/07	10276	---	22	---	4.42	Good-Fair
08/19/02	8958	---	22	---	4.70	Good-Fair
09/07/97	7424	51	23	4.95	4.22	Good-Fair
08/05/92	5965	62	22	5.66	4.89	Good-Fair

Taxonomic Analysis

Abundant EPT taxa in the sample collected in 2007 were: *Baetis intercalaris, Serratella deficiens, Heptagenia marginalis, Maccaffertium modestum, Isonychia, Ceratopsyche sparna, Cheumatopsyche, Hydropsyche betteni, Leucotrichia pictipes, Triaenodes ignitus,* and *Neophylax oligius* . The taxa present at the site during each sampling event have been fairly consistent over time with the exception that no Plecoptera were collected in 1992; three, three, and two stonefly taxa were collected in 1997, 2002, and 2007 respectively.

Data Analysis

The site is six miles east of Conover, three stream-miles above the confluence with Catawba River, and about seven stream-miles downstream of the City of Conover Northeast WWTP. The site had the highest specific conductance of all benthos basinwide sites sampled in 2007 in subbasin 32. The macroinvertebrate community is likely limited by both poor in-stream habitat and water quality. There has been no notable change in the benthic community over the course of the four sampling events at the site.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
LYLE CR	**US 70**	**07/14/04**	**CF35**	**Excellent**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
CATAWBA	32	03050101	35.72083333	-81.10888889	11-76-(4.5)	Northern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
WS-IV	43.2	810	8	0.4	No

	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)
City of Conover's Northeast WWTP	NC0024252	1.5

Water Quality Parameters

Temperature (°C)	23.4
Dissolved Oxygen (mg/L)	6.5
Specific Conductance (µS/cm)	95
pH (s.u.)	6.2

Water Clarity	Slightly turbid

Habitat Assessment Scores (max)

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

Site Photograph

Substrate Sand and gravel

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
07/14/04	2004-118	19	58	Excellent
07/01/97	97-68	22	48	Good
05/11/93	93-23	18	50	Good

Most Abundant Species Bluehead Chub

Exotic Species Green Sunfish

Species Change Since Last Cycle

Gains -- Flat Bullhead; Green Sunfish, Largemouth Bass, and Fantail Darter. **Losses** -- Whitefin Shiner, Common Carp, Greenhead Shiner, Creek Chub (young-of-year only), V-lip Redhorse, and Brassy Jumprock.

Data Analysis

Watershed -- tributary to the Catawba River; drains northeast Catawba County including the north and northeast portions of the cities of Conover and Hickory and the Interstate 40 corridor; site is ~ 3.3 miles above mouth. **Habitat** -- sandy runs, snags, a couple of decent gravel riffles; old sand-dipping operation in the middle of the reach along right shoreline. **2004** -- conductivity only slightly elevated; faint odor of chlorine; except for a slightly elevated percentage of omnivores+herbivores (White Sucker, Eastern Silvery Minnow, Bluehead Chub, and Spottail Shiner) all other metrics were indicative of an Excellent site; data were also used as part of a NCSU Urban Fish Study. **1993 - 2004** -- was a basinwide site in 1993 and 1997; high diversity, 30 species known from the site, including 10 species of cyprinids, 6 species of suckers, and 3 species of darters; except for Fantail Darter, gains or losses of species between 1997 and 2004 were represented by 1-5 fish/species; total habitat score declined from 73 in 1997 to 46 in 2004 due to loss of riffles, canopy, and instream habitats.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
McLin Cr	**SR 1722**	**CB124**	**07/30/07**	**Fair**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
Catawba	32	03050101	354228	810552	11-76-5-(3)	Northern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
WS-IV	26	780	8	0.3

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	10	0	90	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)	9.0
Specific Conductance (µS/cm)	92
pH (s.u.)	7.3
Water Clarity	clear

Habitat Assessment Scores (max)

Channel Modification (5)	3
Instream Habitat (20)	7
Bottom Substrate (15)	3
Pool Variety (10)	10
Riffle Habitat (16)	3
Left Bank Stability (7)	2
Right Bank Stability (7)	3
Light Penetration (10)	3
Left Riparian Score (5)	1
Right Riparian Score (5)	2
Total Habitat Score (100)	37

Site Photograph

Substrate about half sand; remainder gravel, silt, and cobble

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
07/30/07	10277	---	18	---	5.28	Fair
08/19/02	8959	---	23	---	5.14	Good-Fair
08/07/97	7425	57	27	5.18	4.33	Good-Fair

Taxonomic Analysis

Abundant taxa collected from the site in 2007 were: *Baetis intercalaris, Serratella deficiens, Maccaffertium modestum, Isonychia, Tricorythodes, Eccoptura xanthenes, Cheumatopsyche, Hydropsyche betteni,* and *Hydroptila.* The difference in EPT richness between the latest two sampling events is due to several Ephemeroptera and Plecoptera that were rare in 2002 and uncollected in 2007: *Acentrella alachua, Baetis pluto, Hexagenia, Leucrocuta,* and *Leuctra.* Though the number of Trichoptera taxa were the same (at six) for the two most recent sampling events, only three taxa were in common between 2002 and 2007: *Cheumatopsyche, Hydropsyche betteni,* and *Triaenodes ignitus.*

Data Analysis

The site is about 6 miles east of Conover and about 0.8 stream-miles above the confluence with Catawba River. The resultant classification fell to Fair in 2007, though the addition of a single EPT taxon would have resulted in a Good-Fair. Poor habitat and elevated specific conductance implicate both physical and water-borne sources for impact to the biota.

Note that EPT richness values are not comparable between the Full-Scale samples collected in the earliest sampling event and the latter two that were collected using EPT methods. The Full-Scale collection method is more extensive than the EPT method; it is therefore expected that collections using the Full-Scale method would result in higher richness values over EPT collections.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
BUFFALO SHOALS CR	**SR 1503**	**04/26/07**	**CF3**	**Good**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
IREDELL	32	03050101	35.75277778	-81.04583333	11-78-(0.5)	Northern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
WS-IV	13.8	830	9	0.5	No

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	70	5 (rural residential)	25	0

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

Water Quality Parameters

Temperature (°C)	15.9
Dissolved Oxygen (mg/L)	8.5
Specific Conductance (µS/cm)	80
pH (s.u.)	6.3

Water Clarity	Clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	16
Bottom Substrate (15)	10
Pool Variety (10)	10
Riffle Habitat (16)	15
Left Bank Stability (7)	7
Right Bank Stability (7)	7
Light Penetration (10)	10
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	**90**

Site Photograph

Substrate Sand, gravel, cobble, bedrock, and boulder

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
04/26/07	2007-33	13	52	Good
06/04/97	97-54	20	58	Excellent

Most Abundant Species Bluehead Chub

Exotic Species None

Species Change Since Last Cycle

Gains -- Sunfish hybrid. **Losses** -- Common Carp (migrant from lake), Eastern Silvery Minnow, Shorthead Redhorse (migrant from lake), Brassy Jumprock, Brown Bullhead, Flat Bullhead, and Piedmont Darter.

Data Analysis

Watershed -- small tributary to the Lake Norman (Catawba River); drains western Iredell County, west of the City of Statesville, including the Interstate 40 corridor; no municipalities in the watershed; site is ~ 3.5 miles above the creek's mouth. **Habitat** -- an old mill site; boulder and bedrock shelves; gravel and sand bottomed pools; good riffles and instream and riparian habitats. **2007** -- intolerant species were absent which caused the rating to decline from Excellent to Good. **1997 & 2007** -- for a stream of its size, the community was abundant and diverse with 20 species known from the site, including 5 species of suckers; however 7 fewer species were present in 2007 than in 1997 including the intolerant Piedmont Darter; a noticeable decline in the relative abundance of the Greenhead Shiner between 1997 and 2007; downstream reservoir may prevent the community from recovering/recolonizing after low flow events; total habitat score was 71 in 1997 and 90 in 2007 due to higher quality riffles and greater bank stability in the reach below the bridge (sampled in 2007) than above the bridge (sampled in part in 1997).

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
McDowell Cr	**SR 2128**	**CB139**	**07/17/07**	**Fair**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
Mecklenburg	33	3050101	352323	805517	0	Southern Outer Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
C	24	700	6	0.2

	Forested/Wetland	Urban	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)	25.3
Dissolved Oxygen (mg/L)	6.6
Specific Conductance (µS/cm)	125
pH (s.u.)	7.2
Water Clarity	clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	11
Bottom Substrate (15)	3
Pool Variety (10)	4
Riffle Habitat (16)	3
Left Bank Stability (7)	4
Right Bank Stability (7)	4
Light Penetration (10)	7
Left Riparian Score (5)	4
Right Riparian Score (5)	4
Total Habitat Score (100)	49

Site Photograph

Substrate nearly all sand with a small amount of silt

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
07/17/07	10241	59	8	6.61	6.08	Fair
08/20/02	8939	48	8	6.65	5.74	Fair

Taxonomic Analysis

Abundant taxa included *Baetis pluto* , *Pseudocloeon propinquum* , *Maccaffertium modestum* , *Cheumatopsyche* , *Ancyronyx variegatus* , *Boyeria vinosa* , *Calopteryx* , *Gomphus* , *Polypedilum illinoense* , *Tribelos jucundum* , *Simulium* and *Corbicula fluminea* .

Data Analysis

This stream drains the northwestern portion of Mecklenburg County between Huntersville and Charlotte. This site was added as a basinwide site in 2002 to monitor this rapidly developing portion of Mecklenburg County. Based on the benthic data no major change in water quality was observed, and it continues to be a degraded stream.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
Gar Cr	**SR 2074**	**CB133**	**07/11/07**	**Good-Fair**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
Mecklenburg	33	3050101	352140	805353	0	Southern Outer Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
WS-IV	3.3	700	4	0.2

	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)	24.0
Dissolved Oxygen (mg/L)	---
Specific Conductance (µS/cm)	168
pH (s.u.)	7.4
Water Clarity	turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	17
Bottom Substrate (15)	15
Pool Variety (10)	8
Riffle Habitat (16)	16
Left Bank Stability (7)	6
Right Bank Stability (7)	6
Light Penetration (10)	10
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	93

Site Photograph

Substrate mostly cobble and boulder with small amounts of gravel and silt

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
07/11/07	10240	---	16	---	5.60	Good-Fair
08/20/97	7439	---	21	---	4.93	Good
06/08/94	6543	64	20	5.64	4.97	Good
08/20/92	5988	87	24	5.55	4.69	Good

Taxonomic Analysis

With the exception of presence/absence of Rare taxa, there were no major changes in the community structure. Abundant taxa included *Baetis flavistriga* , *Maccaffertium modestum* , *Cheumatopsyche* , *Chimarra* and *Hydropsyche betteni* . The caddisfly *Triaenodes marginatus* was collected for the first time from the site in 2007.

Data Analysis

Gar Creek is a tributary to the lower reaches of Mountain Island Lake. This stream tends to have very low flows during the summer and was not sampled in 2002 for that reason. This stream had rated Good in 1992, 1994 and 1997 but decreased to Good-Fair in 2007. This decline in water quality may be due to the 2007 drought effects, or to impacts from increasing development that is occurring in Mecklenburg County. However, no definitive conclusions can be drawn because this site was not sampled in 2002, which was also a dry year.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
Dutchmans Cr	**SR 1918**	**CB132**	**07/10/07**	**Good-Fair**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
Gaston	33	3050101	352012	810051	0	Southern Outer Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
WS-IV	117	600	12	0.4

	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)	26.7
Dissolved Oxygen (mg/L)	---
Specific Conductance (µS/cm)	114
pH (s.u.)	7.0
Water Clarity	turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	12
Bottom Substrate (15)	12
Pool Variety (10)	10
Riffle Habitat (16)	7
Left Bank Stability (7)	7
Right Bank Stability (7)	7
Light Penetration (10)	10
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	80

Site Photograph

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

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
07/10/07	10237	---	18	---	5.28	Good-Fair
08/21/02	8942	---	19	---	5.08	Good-Fair
08/19/97	7435	73	33	5.26	4.54	Good
08/06/92	5970	77	33	5.68	4.76	Good

Taxonomic Analysis

Dutchmans Creek, like its tributary Killian Creek, experienced a sharp decline in the number of mayfly taxa between 1997 and 2002. Seventeen mayfly taxa were collected in 1997 compared with nine taxa in 2002 and ten taxa in 2007.

Data Analysis

Dutchmans Creek drains southeast Lincoln County and northeast Gason County and enters the Catawba River below Mountain Island Lake. This site rated Good in 1992 and 1997 but declined to Good-Fair in 2002 and 2007. The lower bioclassification ratings could be due to drought effects as evidenced by the decrease in wetted stream width from 15 meters in 1997 to seven meters in 2002. Flows could have been low enough to reduce habitat, increase temperature and reduce dissolved oxygen, producing a cumulative stress on the benthic community.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
LEEPERS CR	**NC 73**	**04/25/07**	**CF27**	**Good-Fair**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
LINCOLN	33	03050101	35.47055556	-81.12027778	11-119-1-(1)	Southern Outer Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	28.2	740	12	0.4	No

	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)	16.0
Dissolved Oxygen (mg/L)	8.7
Specific Conductance (µS/cm)	65
pH (s.u.)	6.1

Water Clarity: Very slightly turbid

Habitat Assessment Scores (max)

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

Site Photograph

Substrate: Sand and gravel

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
04/25/07	2007-29	17	46	Good-Fair
05/20/97	97-48	18	52	Good
06/29/93	93-31	19	56	Excellent

Most Abundant Species: Bluehead Chub

Exotic Species: Redlip Shiner

Species Change Since Last Cycle

Gains -- Swallowtail Shiner, Notchlip Redhorse, and Bluegill. **Losses** -- Fieryblack Shiner, Flat Bullhead, Seagreen Darter, and Piedmont Darter.

Data Analysis

Watershed -- tributary to Dutchmans Creek; drains east central Lincoln County, north and east of the City of Lincolnton, and southern Catawba County; no true municipalities in the watershed. **Habitat** -- very large coarse woody debris (snags and deadfalls) in the channel; deeply entrenched; severe bank erosion. **2007** -- relatively low specific conductance and pH for a Piedmont stream; abundance low for a stream of its size (n = 147); intolerant species absent. **1993 - 2007** -- conductivity has ranged from 49 to 63 µS/cm; a fairly diverse community, 24 species known from the site, including 10 species of cyprinids, 4 species of darters, and 3 species of suckers; dominant species has been the Bluehead Chub; ratings have declined, primarily due to loss of intolerant species of darters; three intolerant species lost between 1997 and 2007 (Fieryblack Shiner, Seagreen Darter, and Piedmont Darter); no change in the trophic metrics; total habitat scores have ranged from 57 in 2007 to 62 in 2002; stream appears to experience dramatic extremes in flows.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
KILLIAN CR	**NC 73**	**04/25/07**	**CF25**	**Good**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
LINCOLN	33	03050101	35.45666667	-81.03416667	11-119-2-(0.5)a	Southern Outer Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	12.1	690	9	0.2	No

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

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

Water Quality Parameters

Temperature (°C)	17.5
Dissolved Oxygen (mg/L)	8.7
Specific Conductance (µS/cm)	117
pH (s.u.)	7.2

Water Clarity	Very slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	15
Bottom Substrate (15)	3
Pool Variety (10)	5
Riffle Habitat (16)	2
Left Bank Stability (7)	5
Right Bank Stability (7)	5
Light Penetration (10)	9
Left Riparian Score (5)	4
Right Riparian Score (5)	4
Total Habitat Score (100)	**57**

Site Photograph

Substrate Sand and silt

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
04/25/07	2007-31	14	52	Good
05/21/02	2002-49	10	46	Good-Fair
05/20/97	97-47	16	52	Good

Most Abundant Species Tessellated Darter

Exotic Species Redlip Shiner and Green Sunfish

Species Change Since Last Cycle **Gains** --Golden Shiner, White Sucker, Flat Bullhead, and Green Sunfish. **Losses** -- none.

Data Analysis

Watershed -- small tributary to upper Dutchmans Creek in east-southeast Lincoln County; watershed is between Forney and Anderson creeks; no municipalities in the watershed. **Habitat** -- very silty and sandy; shallow flats; a few runs; roots and undercut snags; periphyton thick on the sand; stick riffles; low flow. **2007** -- a diverse and abundant community; species gained in 2007 improved the overall rating from Good-Fair to Good; intolerant species absent. **1997 - 2007** -- conductivity has ranged from 86 to 131 µS/cm; 19 species are known from the site, but intolerant species are absent; dominant species are Bluehead Chub and Speckled Killifish; a gradually changing trophic structure -- omnivores decreasing from 34 to 24 to 17% and the insectivores increasing from 65 to 76 to 83%; the fauna was typical of that of a piedmont Catawba River basin stream; total habitat scores have ranged from 40 to 57 and increased from 40 in 2002 (a very low flow year) to 57 in 2007 due to deeper pools, better bank stability, and slightly wide riparian zones; due to its size, stream is probably low flow affected.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
Killian Cr	**SR 1511**	**CB134**	**07/17/07**	**Good-Fair**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
Lincoln	33	3050101	352457	810144	0	Southern Outer Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
C	47	690	7	0.3

	Forested/Wetland	Urban	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)	25.0
Dissolved Oxygen (mg/L)	7.5
Specific Conductance (µS/cm)	149
pH (s.u.)	7.6
Water Clarity	slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	18
Bottom Substrate (15)	12
Pool Variety (10)	10
Riffle Habitat (16)	12
Left Bank Stability (7)	5
Right Bank Stability (7)	5
Light Penetration (10)	7
Left Riparian Score (5)	4
Right Riparian Score (5)	4
Total Habitat Score (100)	82

Site Photograph

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

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
07/17/07	10242	---	19	---	5.38	Good-Fair
08/20/02	8941	---	12	---	5.04	Not Rated
08/19/97	7434	---	24	---	3.91	Good
08/05/92	5969	---	28	---	4.94	Excellent

Taxonomic Analysis

A sharp decline in the number of mayfly taxa, specifically baetids, occurred between 1997 and 2002. No baetid species were collected in 2002; whereas in 1997 six species of baetids were collected. In 2002 the wetted width was only four meters indicative of a very dry, low flow year. In 2007, the wetted width was seven meters and three species of baetids were collected. Even though 2007 was a dry year as well, the stream may have been just beginning to recover from the drought of 2002.

Data Analysis

Killian Creek is a tributary to upper Dutchmans Creek in southeastern Lincoln County. The water quality appears to have declined since 1992 but it is unclear as to the cause. The lower bioclassification may be due to drought effects alone or a combination of drought effects and other factors. Because of the 2002 drought and a followup drought study, BAU staff decided not to rate this site in 2002. A Good-Fair rating was assigned in 2007, even though there was again a drought. However 2007 was not preceded by low flow years as was 2002.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
ANDERSON CR	**SR 1383**	**04/25/07**	**CF62**	**Good**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
LINCOLN	33	03050101	35.446963	-81.042733	11-119-2-2	Southern Outer Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	21.5	695	9	0.3	No

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	85	15 (rural family residence)	0	0

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

Water Quality Parameters

Temperature (°C)	16.4
Dissolved Oxygen (mg/L)	8.9
Specific Conductance (µS/cm)	74
pH (s.u.)	6.8

Water Clarity	Clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	14
Bottom Substrate (15)	3
Pool Variety (10)	6
Riffle Habitat (16)	5
Left Bank Stability (7)	5
Right Bank Stability (7)	5
Light Penetration (10)	10
Left Riparian Score (5)	1
Right Riparian Score (5)	5
Total Habitat Score (100)	**59**

Site Photograph

Substrate Sand and gravel

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
04/25/07	2007-30	15	48	Good

Most Abundant Species Speckled Killifish

Exotic Species Redlip Shiner and Green Sunfish

Species Change Since Last Cycle N/A

Data Analysis

This is the first fish community sample collected at this site. **Watershed** -- tributary to Killian Creek in east-southeast Lincoln County; watershed is between Killian Creek and Leepers Creek; no municipalities in the watershed. **Habitat** -- shallow sandy runs; snags and deadfalls, but not as many as in Leepers Creek; quality pools and chutes were rare; no true riffles, riffles formed by logs in the current; American beech bluff on the east side; entrenched; low flow. **2007** -- a diverse and abundant community, but intolerant species were absent and only one species of sucker was present; except for the Redlip Shiner, the fauna was typical of that of a piedmont Catawba River basin stream.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
FORNEY CR	**SR 1386**	**04/25/07**	**CF63**	**Fair**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
LINCOLN	33	03050101	35.447382	-81.010887	11-119-2-3	Southern Outer Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	7.8	695	7	0.3	No

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

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
East Lincoln Water & Sewer District's Forney Creek WWTP	NC0074012	0.975

Water Quality Parameters

Temperature (°C)	21.1
Dissolved Oxygen (mg/L)	8.2
Specific Conductance (µS/cm)	164
pH (s.u.)	7.1

Water Clarity	Clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	13
Bottom Substrate (15)	3
Pool Variety (10)	4
Riffle Habitat (16)	2
Left Bank Stability (7)	3
Right Bank Stability (7)	3
Light Penetration (10)	7
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	**50**

Site Photograph

Substrate Sand

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
04/25/07	2007-32	11	40	Fair

Most Abundant Species Bluegill and Speckled Killifish

Exotic Species Redlip Shiner and Redear Sunfish

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

Data Analysis

This is the first fish community sample collected at this site. **Watershed** -- drains eastern Lincoln County, west of NC 16; no municipalities in the watershed, suburbs; site is immediately downstream from the WWTP; WWTP provides all of the summer flow to the creek (7Q10 = 0.6 MGD). **Habitat** -- sandy runs with side snags; stick riffles; some deadfalls; eroded and unstable banks; open canopy in places; channel filled with sediment; low flow. **2007** -- elevated conductivity; for its size, a diverse and abundant community, but suckers and intolerant species were absent; trophic structure skewed, 97% of all the fish were insectivores.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
LONG CR	**SR 2042**	**07/15/04**	**CF30**	**Good**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
MECKLENBURG	34	03050101	35.32833333	-80.90972222	11-120-(2.5)	Southern Outer Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
WS-IV	16.4	695	6	0.3	No

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	25	25 (industrial)	25	25 (pre-development)

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

Water Quality Parameters

Temperature (°C)	23.9
Dissolved Oxygen (mg/L)	6.3
Specific Conductance (µS/cm)	173
pH (s.u.)	6.5

Water Clarity	Turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	9
Bottom Substrate (15)	3
Pool Variety (10)	4
Riffle Habitat (16)	1
Left Bank Stability (7)	2
Right Bank Stability (7)	2
Light Penetration (10)	10
Left Riparian Score (5)	5
Right Riparian Score (5)	3
Total Habitat Score (100)	**44**

Site Photograph

Substrate Sand

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
07/15/04	2004-123	17	48	Good

Most Abundant Species Bluehead Chub and Redbreast Sunfish

Exotic Species None

Species Change Since Last Cycle N/A

Data Analysis

This is the first fish community sample collected at this site. **Watershed** -- tributary to the Catawba River; drains the northwest portion of the City of Charlotte metropolitan area, west of the Interstate 77 corridor. **Habitat** -- shallow sandy runs; severe bank erosion; coarse woody debris and snags; stick riffles; deeply entrenched; densely shaded. **2004** -- conductivity elevated, diverse community but with only one species of sucker and darter; intolerant species absent; percentage of tolerant fish (Golden Shiner, Creek Chub, White Sucker, White Catfish, Flat Bullhead, Eastern Mosquitofish, and Redbreast Sunfish) slightly elevated; Striped Jumprock represented by only young-of-year; data were also used as part of a NCSU Urban Fish Study.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
CATAWBA CR	**SR 2435**	**04/24/07**	**CF5**	**Poor**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
GASTON	37	03050101	35.19472222	-81.08138889	11-130c	Southern Outer Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	23.4	600	9	0.3	No

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	75	0	20	5 (tree farm nursery)

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

Water Quality Parameters

Temperature (°C)	16.4
Dissolved Oxygen (mg/L)	8.5
Specific Conductance (µS/cm)	155
pH (s.u.)	7.0

Water Clarity	Clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	9
Bottom Substrate (15)	3
Pool Variety (10)	6
Riffle Habitat (16)	1
Left Bank Stability (7)	2
Right Bank Stability (7)	2
Light Penetration (10)	8
Left Riparian Score (5)	5
Right Riparian Score (5)	0
Total Habitat Score (100)	**41**

Site Photograph

Substrate Sand

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
04/24/07	2007-26	10	34	Poor
05/22/02	2002-55	11	40	Fair
05/19/97	97-44	11	42	Good-Fair

Most Abundant Species Bluehead Chub **Exotic Species** None

Species Change Since Last Cycle **Gains** -- Greenfin Shiner. **Losses** -- White Catfish and Pumpkinseed.

Data Analysis

Watershed -- tributary to Lake Wylie (Catawba River); drains southeastern Gaston County, including the southeast portion of the City of Gastonia metropolitan area; three small water treatment plants within the watershed (combined flow = unlimited); plant nursery and active cattle pasture along the right shoreline. **Habitat** -- very large woody debris, blow downs and deadfalls (tree trunks); very soft, shifting sand; infrequent stick riffles; severe erosion with sloughing banks; cattle fenced out of the stream, not so in 2002. **2007** -- specific conductance elevated, but similar to 2002 measurement; low diversity and abundance (n = 10 and 117, respectively); elevated percentage of omnivores. **1997 - 2007** -- low total diversity for a stream of its size, only 14 species known from the site, including one species of darter and sucker; no intolerant species known from the site; number of fish collected in 2007 (n = 117) was only one-third of the number collected in 2002 (a low flow year), but similar to the number in 1997 (n = 138); total habitat scores declined from 59 in 1997 to 45 in 2002 to 41 in 2007 due to loss of gravel riffles and poorer bank stability.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
CROWDERS CR	**SR 1131**	**06/22/04**	**CF11**	**Poor**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
GASTON	37	03050101	35.23361111	-81.23305556	11-135c	Southern Outer Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	23.5	695	8	0.4	No

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

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

Water Quality Parameters

Temperature (°C)	25.2
Dissolved Oxygen (mg/L)	9.4
Specific Conductance (µS/cm)	151
pH (s.u.)	---

Water Clarity	Clear

Habitat Assessment Scores (max)

Channel Modification (5)	3
Instream Habitat (20)	6
Bottom Substrate (15)	3
Pool Variety (10)	6
Riffle Habitat (16)	0
Left Bank Stability (7)	2
Right Bank Stability (7)	2
Light Penetration (10)	0
Left Riparian Score (5)	1
Right Riparian Score (5)	1
Total Habitat Score (100)	**24**

Site Photograph

Substrate Gravel and sand

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
06/22/04	2004-101	9	30	Poor

Most Abundant Species Redbreast Sunfish **Exotic Species** None

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

Data Analysis

This is the first fish community sample collected at this site. **Watershed** -- tributary to Lake Wylie (Catawba River); drains central Gaston County, including portions of the municipal areas of Kings Mountain, Bessemer City, and Gastonia, and the Interstate 85 corridor. **Habitat** -- the lowest total habitat score of any fish community site in the Catawba River basin 2004 - 2007; a golf course stream - no canopy or forested riparian zones ; sandy runs; uniform width; one deep pool on the left. **2004** -- conductivity elevated; low diversity and abundance for a stream of its size; darters and intolerant species were absent; percentage of tolerant fish (Golden Shiner, White Sucker, Flat Bullhead, and Redbreast Sunfish) was high; skewed trophic structure, ~ 95% of all the fish were insectivores; 80% of all the fish were Redbreast Sunfish; very low percentage of species, only 2 of the 9 species, with multiple age groups ; two-thirds of the species represented by only 1 or 2 fish per species; data were also used as part of a NCSU Urban Fish Study.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
CROWDERS CR	**SR 1108**	**04/24/07**	**CF10**	**Fair**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
GASTON	37	03050101	35.17638889	-81.21611111	11-135d	Southern Outer Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	40.7	650	7	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)	16.8
Dissolved Oxygen (mg/L)	8.7
Specific Conductance (µS/cm)	156
pH (s.u.)	6.8

Water Clarity	Clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	14
Bottom Substrate (15)	3
Pool Variety (10)	6
Riffle Habitat (16)	3
Left Bank Stability (7)	4
Right Bank Stability (7)	4
Light Penetration (10)	9
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
04/24/07	2007-27	12	40	Fair
05/22/02	2002-56	12	38	Fair
05/19/97	97-45	9	36	Fair

Most Abundant Species Bluehead Chub **Exotic Species** None

Species Change Since Last Cycle

Gains -- Striped Jumprock, Warmouth, and Fantail Darter. **Losses** -- Rosyside Dace, Greenhead Shiner, and Flat Bullhead.

Data Analysis

Watershed -- tributary to Lake Wylie (Catawba River); drains central Gaston County, including portions of the municipal areas of Kings Mountain, Bessemer City, Gastonia, and the Interstate 85 corridor; six small permitted dischargers within the watershed (combined flow = 1.00 MGD). **Habitat** -- very shallow, sandy runs; woody debris and woody debris riffles. **2007** -- low diversity and abundance (n = 12 and 96, respectively); elevated percentage of omnivores; Striped Jumprock and Fantail Darter collected for the first time. **1997 - 2007** -- conductivity elevated, has ranged from 155 to 178 µS/cm; 18 species known from the site, but only one specimen of White Sucker and Striped Jumprock have ever been collected from the site; number of fish collected in 2007 (n = 96) was only one-third of the number collected in 2002 (a low flow year), but similar to the number in 1997 (n = 90); a gradually improving trophic structure -- omnivores decreasing from 68 to 52 to 42% and the insectivores increasing from 30 to 48 to 58%; total habitat scores have ranged from 45 to 58 and increased from 45 in 2002 to 58 in 2007 due to better quality riffles, bank stability, and wider riparian zones.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
Crowders Cr	**SC 564**	**CB234**	**07/10/07**	**Good-Fair**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
York, SC	37	3050101	350837	810903	0	Southern Outer Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
C	---	600	12	0.2

	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)
Crowders Creek WWTP	NC0074268	6.0

Water Quality Parameters

Temperature (°C)	26.0
Dissolved Oxygen (mg/L)	---
Specific Conductance (µS/cm)	213
pH (s.u.)	7.4
Water Clarity	slightly turbid

Habitat Assessment Scores (max)

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

Site Photograph

Substrate mostly sand with small amounts of boulder, gravel and silt

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
07/10/07	10236	51	19	5.81	5.34	Good-Fair
05/20/02	8714	57	14	6.31	5.94	Fair
08/20/97	7438	67	11	6.64	5.94	Fair
08/18/92	5979	66	18	6.28	5.53	Good-Fair

Taxonomic Analysis

EPT taxa collected in 2007 that had not been previously collected include *Procloeon* , *Oecetis persimilis* , *Polycentropus* and *Triaenodes perna* . The number of midge taxa collected in 2007 (10) had decreased by about 50% from the number of midge taxa collected in previous years. No midge taxa collected in 2007 were abundant and only two taxa were common (*Polypedilum flavum* and *Tribelos jucundum*).

Data Analysis

Crowders Creek, a tributary to Lake Wylie, drains the south and western region of the city of Gastonia, the Interstate 85 corridor, and the eastern area of the town of Kings Mountain. This site rated Good-Fair in 1992 and dropped to Fair in 1997 and 2002. In 2007, the bioclassification increased to Good-Fair and had the highest EPT taxa richness and lowest Biotic Index ever recorded for this site. Between 1997 and 2002 Bessemer City ceased its discharges to Abernethy Creek, which is a tributary to Crowders Creek, and Carolina and Southern Processing (a chicken processing plant) tied its facility into Crowders Creek WWTP. Before Carolina and Southern Processing tied its facility into Crowders Creek WWTP, this site had rated Poor. Due to these discharge changes and facility upgrades, the water quality here seems to be improving.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
S FK CROWDERS CR	SR 1109	06/22/04	CF49	Good-Fair

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
GASTON	37	03050101	35.16194444	-81.21777778	11-135-10	Southern Outer Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	27.6	695	7	0.6	No

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

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)	7.4
Specific Conductance (µS/cm)	95
pH (s.u.)	---

Water Clarity	Turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	12
Bottom Substrate (15)	3
Pool Variety (10)	9
Riffle Habitat (16)	1
Left Bank Stability (7)	2
Right Bank Stability (7)	2
Light Penetration (10)	10
Left Riparian Score (5)	2
Right Riparian Score (5)	2
Total Habitat Score (100)	**48**

Site Photograph

Substrate Sand

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
06/22/04	2004-100	13	42	Good-Fair

Most Abundant Species Bluehead Chub

Exotic Species None

Species Change Since Last Cycle N/A

Data Analysis

This is the first fish community sample collected at this site. **Watershed** -- tributary to Crowders Creek; drains southwestern Gaston County; no municipalities in the watershed. **Habitat** -- deadfalls, snags; stick riffles; good pools and canopy cover; deeply entrenched; active cattle pastures along both banks. **2004** -- diversity and total abundance slightly lower than expected; only one species of darter (Tessellated Darter) and sucker (White Sucker) were present; intolerant species were absent; highest percentage of tolerant fish (83%) of any fish community site in the Catawba River basin, 2004 - 2007; data were also used as part of a NCSU Urban Fish Study.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
HENRY FORK	**SR 1922**	**05/23/07**	**CF18**	**Good**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
BURKE	35	03050102	35.66194444	-81.63611111	11-129-1-(2)	Eastern Blue Ridge Foothills

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C;ORW	19.2	1300	11	0.3	Yes

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	90	5 (rural residential)	5	0

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

Water Quality Parameters

Temperature (°C)	15.6
Dissolved Oxygen (mg/L)	9.2
Specific Conductance (µS/cm)	26
pH (s.u.)	5.5

Water Clarity	Clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	18
Bottom Substrate (15)	12
Pool Variety (10)	8
Riffle Habitat (16)	15
Left Bank Stability (7)	7
Right Bank Stability (7)	7
Light Penetration (10)	10
Left Riparian Score (5)	5
Right Riparian Score (5)	3
Total Habitat Score (100)	**90**

Site Photograph

Substrate cobble, sand, bedrock

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
05/23/07	2007-63	13	52	Good
09/28/98	98-72	12	52	Good

Most Abundant Species Central Stoneroller

Exotic Species Rock Bass and Smallmouth Bass

Species Change Since Last Cycle **Gains** -- Central Stoneroller, White Sucker, and Warpaint Shiner. **Losses** -- Sandbar Shiner and Creek Chub.

Data Analysis

Watershed -- headwaters of the South Fork Catawba River; drains south-central Burke County below Morganton, including a portion of the South Mountain State Park lands. **Habitat** -- shallow runs with boulder eddies, riffles, chutes, and side snags; low flow; low conductivity; low morning pH from overnight respiration; densely forested riparian zones, with the exception of a hay field above the right bank. **2007** -- an abundant (n = 463) and fairly diverse community of fish including 4 intolerant species were collected, but with few darters; 84% of the sampled fish were minnows, about half of which were Central Stonerollers and Warpaint Shiners. **1998 - 2007** -- this site has maintained very stable NCIBI metrics over a 9 year period. Fifteen species of fish are known from this watershed including 7 species of minnows, 2 species of suckers, and 2 species of darters. This ORW catchment is showing no apparent water quality issues.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
HENRY FK	**SR 1124**	**CB178**	**05/01/06**	**Good**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
CATAWBA	35	3050102	354103	812410	0	Northern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
C	81	970	20	0.75

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

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

Water Quality Parameters

Temperature (°C)	14.4
Dissolved Oxygen (mg/L)	9.8
Specific Conductance (µS/cm)	29
pH (s.u.)	6.7
Water Clarity	slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	16
Bottom Substrate (15)	12
Pool Variety (10)	8
Riffle Habitat (16)	14
Left Bank Stability (7)	6
Right Bank Stability (7)	6
Light Penetration (10)	7
Left Riparian Score (5)	3
Right Riparian Score (5)	4
Total Habitat Score (100)	71

Site Photograph

Substrate Moderate amount of sand with some boulder, rubble and gravel

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
05/01/06	9857	126	61	4.13	3.06	Good
08/22/02	8952	94	38	4.81	3.34	Good
08/18/97	7428	76	38	4.10	3.49	Good
08/22/92	6005	74	38	4.55	3.76	Good

Taxonomic Analysis

No major changes in the benthic community were observed. Abundant taxa included *Pseudocloeon propinquum* , *Epeorus rubidus* , *Heptagenia marginalis* , *Isonychia* , *Rhithrogena uhari* , *Maccaffertium modestum* , *Acroneuria abnormis* , *Perlesta* , *Cheumatopsyche* , *Dolophilodes* , *Micrasema wataga* , *Ceratopsyche sparna* , *Dubiraphia* , *Helichus* , *Boyeria vinosa* , *Progomphus obscurus* , *Corydalus cornutus* , *Ablabesmyia parajanta/janta* , *Conchapelopia* , *Parametriocnemus lundbecki* , *Tanytarsus* , *Simulium* , *Corbicula fluminea* and *Elimia* .

Data Analysis

This site is located south of the city of Hickory and the town of Icard. Since this location had been sampled in 2006, those data were used for this basinwide cycle. When corrected for seasonality, the 2006 sampled had an EPT richness of 43 and Biotic Index of 4.52 thereby placing it in the Good category. Henry Fork has consistently rated Good since 1992. Based on the benthic data no major changes in water quality have been observed.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
JACOB FK	**SR 1924**	**CB192**	**05/02/06**	**Excellent**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
BURKE	35	3050102	353526	813402	0	Northern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
WS-III; Tr, ORW	25.4	1150	14	0.2

	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)	16.6
Dissolved Oxygen (mg/L)	9.8
Specific Conductance (µS/cm)	21
pH (s.u.)	6.8
Water Clarity	clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	13
Bottom Substrate (15)	11
Pool Variety (10)	8
Riffle Habitat (16)	14
Left Bank Stability (7)	6
Right Bank Stability (7)	6
Light Penetration (10)	10
Left Riparian Score (5)	5
Right Riparian Score (5)	3
Total Habitat Score (100)	81

Site Photograph

Substrate Mostly rubble and gravel with some sand and silt

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
05/02/06	9862	136	60	3.92	2.37	Excellent
08/22/02	8953	---	35	---	3.31	Good
08/18/97	7427	100	47	4.26	3.51	Excellent
08/20/92	6006	106	48	4.36	3.22	Good

Taxonomic Analysis

With the exception of 2002, no major changes in the benthic community were observed. In 2002, mayfly taxa richness decreased from previous years but had recovered in 2006. Abundant EPT taxa included *Drunella cornutella* , *Epeorus rubidus* , *Isonychia* , *Leucrocuta* , *Rhithrogena uhari* , *Maccaffertium modestum* , *Stenacron pallidum* , *Acroneuria abnormis* , *Isoperla holochlora* , *Perlesta* , *Dolophiloides* , *Glossosoma* , *Lepidostoma* , *Neophylax oligius* , *Rhyacophila fuscula* , *R. nigrita* and *Ceratopsyche sparna* .

Data Analysis

This site is located downstream of South Mountains State Park and was designated ORW in 1989. With the exception of 2002, a dry year, the water quality appears to be stable. Although the site received a Good rating in 1992, EPT taxa richness and EPT Biotic Index scores are consistent with values recorded in 1997 and 2006 when the site received Excellent ratings suggesting the site was borderline Good/Excellent.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
POTT CR	**SR 1217**	**05/31/06**	**CF48**	**Fair**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
LINCOLN	35	03050102	35.55166667	-81.31916667	11-129-3-(0.7)	Northern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
WS-IV	21	840	9	0.4	No

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	70	10 (rural residential)	20	0

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

Water Quality Parameters

Temperature (°C)	24.6
Dissolved Oxygen (mg/L)	7.1
Specific Conductance (µS/cm)	61
pH (s.u.)	6.1

Water Clarity	Slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	13
Bottom Substrate (15)	3
Pool Variety (10)	9
Riffle Habitat (16)	2
Left Bank Stability (7)	3
Right Bank Stability (7)	3
Light Penetration (10)	7
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	**55**

Site Photograph

Substrate Sand

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
05/31/06	2006-69	13	40	Fair
05/21/02	2002-50	20	50	Good
05/21/97	97-49	15	50	Good

Most Abundant Species Bluehead Chub and Bluegill

Exotic Species Fathead Minnow

Species Change Since Last Cycle

Gains -- Fathead Minnow and Eastern Mosquitofish. **Losses** -- Greenfin Shiner, Santee Chub, Greenhead Shiner, Creek Chub, Notchlip Redhorse, Flat Bullhead, Pumpkinseed, and Largemouth Bass.

Data Analysis

Watershed -- tributary to the South Fork Catawba River; drains southern Catawba and northern Lincoln counties; no municipalities in the watershed; two small permitted dischargers within the watershed (combined flow = 0.045 MGD). **Habitat** -- seemed to be more severely eroded in 2006 than in 2002 as a result of 2004 hurricane flows; eroding banks; only snag and log riffles and one gravel riffle. **2006** -- 18 of 20 species collected in 2002 declined in number (e.g. Rosyside Dace, Bluehead Chub, Sandbar Shiner, and White Sucker) or were not collected in 2006 Creek Chub); number of fish decreased from 265 to 73, the fewest ever collected at the site and the fewest of any site in the basin 2004 - 2007; only one-third of the species were represented by multiple age groups; sampled as part of a Catawba River Basin Biological TMDL Study (Biological Assessment Unit Memorandum F-20061207). **1997 - 2006** -- conductivity has ranged from 47 to 61 µS/cm; 22 species are known from the site, including the intolerant Santee Chub, Highback Chub, and Seagreen Darter; no exotic species known from the site until 2006; community affected by flow extremes and by limited avenues for recolonization.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
HOWARDS CR	**SR 1200**	**CB185**	**05/03/06**	**Good**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
LINCOLN	35	3050102	352954	812026	0	Southern Outer Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
C	17	800	712	0.5

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

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

Water Quality Parameters

Temperature (°C)	15.7
Dissolved Oxygen (mg/L)	9.8
Specific Conductance (µS/cm)	48
pH (s.u.)	7.2
Water Clarity	turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	7
Bottom Substrate (15)	4
Pool Variety (10)	6
Riffle Habitat (16)	3
Left Bank Stability (7)	6
Right Bank Stability (7)	6
Light Penetration (10)	7
Left Riparian Score (5)	2
Right Riparian Score (5)	5
Total Habitat Score (100)	51

Site Photograph

Substrate Mostly sand with a moderate amount of gravel

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
05/03/06	9864	121	40	5.63	4.64	Good
08/21/02	8947	---	17	---	4.58	Good-Fair
08/19/97	7431	---	25	---	4.16	Good
08/17/92	5977	---	25	---	4.07	Good

Taxonomic Analysis

When corrected for season, EPT taxa richness increased in 2006 from previous samples. Several EPT taxa either Common or Rare in 2006 were not previously collected from this site: *Plauditus dubius* group, *P. cestus* , *Habrophlebioides* , *Procloeon, Ironoquia punctatissima* , *Lepidostoma* and *Rhyacophila fuscula* . Other Abundant EPT taxa at this site were: *Baetis pluto* , *Pseudocloeon propinquum* , *Isonychia* , *Stenacron interpunctatum* , *Perlesta* , *Cheumatopsyche* and *Triaenodes ignitus* .

Data Analysis

Howards Creek drains the northwestern portion of Lincoln County. Since this location had been sampled in 2006, those data corrected for season were used for the 2007 basinwide cycle. The water quality at this site appears to be fairly stable with Good bioclassifications in 1992, 1997, and 2006. During the drought of 2002, the bioclassification dropped to Good-Fair with only 17 EPT taxa collected.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
HOWARDS CR	**SR 1185**	**04/24/07**	**CF61**	**Good**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
LINCOLN	35	03050102	35.496116	-81.319681	11-129-4	Southern Outer Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	17.1	790	11	0.4	No

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

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

Water Quality Parameters

Temperature (°C)	17.5
Dissolved Oxygen (mg/L)	8.7
Specific Conductance (µS/cm)	54
pH (s.u.)	6.8

Water Clarity	Clear

Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	14
Bottom Substrate (15)	4
Pool Variety (10)	6
Riffle Habitat (16)	7
Left Bank Stability (7)	4
Right Bank Stability (7)	4
Light Penetration (10)	8
Left Riparian Score (5)	0
Right Riparian Score (5)	1
Total Habitat Score (100)	**52**

Site Photograph

Substrate Soft sand and gravel

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
04/24/07	2007-28	20	48	Good

Most Abundant Species Bluehead Chub

Exotic Species Green Sunfish and Redear Sunfish

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

Data Analysis

This is the first fish community sample collected at this site. **Watershed** -- tributary to the South Fork Catawba River; drains northwest Lincoln County and the extreme southwestern portion of Catawba County; no municipalities in the watershed. **Habitat** -- sandy/gravely runs; snags; cattle with access to the stream on the left; poor riparian zones, widths were only one-tree wide. **2007** -- conductivity was relatively low; a very diverse community for a stream of its size, including 6 species of sunfish and 3 species of darters, but the percentage of tolerant fish (Creek Chub, White Sucker, Flat Bullhead, Eastern Mosquitofish, Redbreast Sunfish, and Green Sunfish) and the trophic metrics (elevated percentage of omnivores) were indicative of some slight nutrient enrichment; two intolerant species were present, Seagreen Darter and Piedmont Darter.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
CLARK CR	SR 2012	07/14/04	CF7	Poor

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
CATAWBA	35	03050102	35.60861111	-81.23083333	11-129-5-(0.3)b	Northern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	30.8	840	7	0.3	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)
City of Newton's Clark Creek WWTP (~1.5 miles upstream)	NC0036196	7.5

Water Quality Parameters

Temperature (°C)	23.1
Dissolved Oxygen (mg/L)	7.1
Specific Conductance (µS/cm)	221
pH (s.u.)	6.6

Water Clarity	Slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	14
Bottom Substrate (15)	3
Pool Variety (10)	6
Riffle Habitat (16)	1
Left Bank Stability (7)	2
Right Bank Stability (7)	2
Light Penetration (10)	9
Left Riparian Score (5)	2
Right Riparian Score (5)	2
Total Habitat Score (100)	**47**

Site Photograph

Substrate Sand

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
07/14/04	2004-119	9	34	Poor

Most Abundant Species Redbreast Sunfish **Exotic Species** None

Species Change Since Last Cycle N/A

Data Analysis

This is the first fish community sample collected at this site. **Watershed** -- tributary to the South Fork Catawba River; drains portions of the cities of Hickory, Conover, and Newton in central Catawba County; sand dipping operations downstream from the bridge. **Habitat** -- very shallow sandy runs; stick riffles; side deadfalls, snags, roots, and undercuts; cattle with access to stream; cattle exclusion barrier across the channel; urban debris in the stream. **2004** -- conductivity elevated; low diversity and very low fish abundance (n = 75) for a stream of its size; intolerant species were absent; only one species of sucker and darter were collected; percentage of tolerant fish (White Sucker, Flat Bullhead, and Redbreast Sunfish) was high; data were also used as part of a NCSU Urban Fish Study.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
CLARK CR	**SR 1008**	**CB165**	**07/09/07**	**Fair**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
LINCOLN	35	3050102	352830	811603	0	Southern Outer Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
WS-IV	91	775	20	0.3

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

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
Clark Creek WWTP	NC0036196	7.5
Delta Apparel/Maiden	NC0006190	1.0
Maiden WWTP	NC0039594	1.0

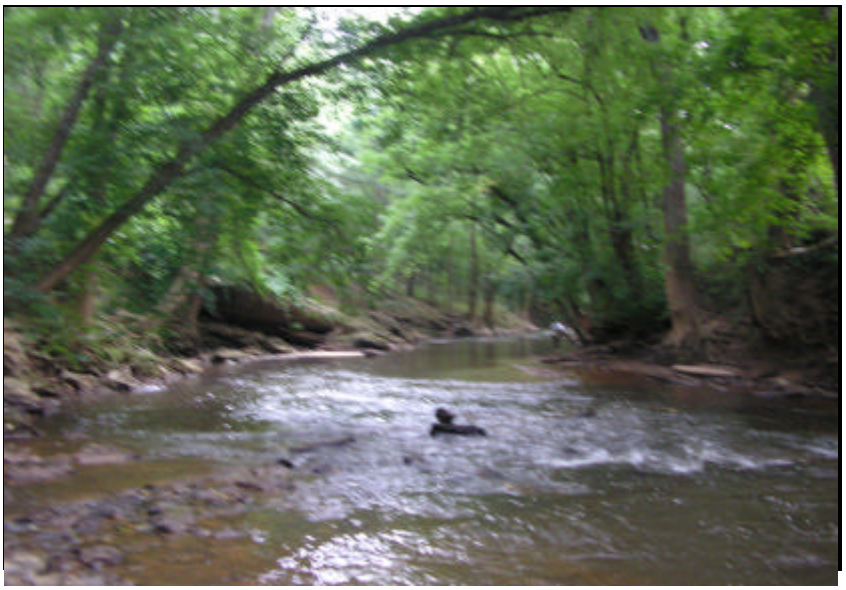
Water Quality Parameters

Temperature (°C)	24.4
Dissolved Oxygen (mg/L)	0
Specific Conductance (µS/cm)	586
pH (s.u.)	7.4
Water Clarity	clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	15
Bottom Substrate (15)	8
Pool Variety (10)	10
Riffle Habitat (16)	14
Left Bank Stability (7)	3
Right Bank Stability (7)	3
Light Penetration (10)	10
Left Riparian Score (5)	3
Right Riparian Score (5)	3
Total Habitat Score (100)	74

Site Photograph



Substrate Mix of boulder, rubble, gravel and sand with a fair amount of silt

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
07/09/07	10234	49	12	6.21	5.87	Fair
08/21/02	8948	47	9	6.20	5.19	Fair
08/19/97	7432	48	16	5.98	5.50	Good-Fair
08/05/92	5968	48	10	6.42	5.39	Fair

Taxonomic Analysis

The mayfly taxa richness had significantly decreased from eight taxa in 1997 to two taxa in 2002. In 2007, the mayfly taxa richness increased to four, possibly showing some signs of recovery from the drought. The decrease in the number of mayfly taxa may have been due to drought effects alone or a combination of drought effects and effluent from three dischargers located upstream of this site. Absent in 2002 were the tolerant caddisfly *Hydropsyche venularis* and the ubiquitous and tolerant mayfly *Maccaffertium modestum*, which had been Common or Abundant in previous samples. Both taxa were present in 2007. *Maccaffertium modestum* were Abundant and *Hydropsyche venularis* were Common.

Data Analysis

This site is located downstream of three dischargers, two WWTPs and a textile mill. In 1997 and 2002, it was noted that the water in Clark Creek was red, possibly from dyes used in the textile mill. However, the water was clear in 2007. The Biotic Index and the EPT Biotic Index indicate that water quality has remained fairly constant for the previous 15 years. The Good-Fair rating in 1997 was borderline Fair/Good-Fair.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
INDIAN CR	**SR 1252**	**CB188**	**05/03/06**	**Good**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
LINCOLN	35	3050102	352522	811533	0	Southern Outer Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
C	69.7	780	15	0.3

	Forested/Wetland	Urban	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)	17.5
Dissolved Oxygen (mg/L)	8.9
Specific Conductance (µS/cm)	42
pH (s.u.)	7.1
Water Clarity	turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	12
Bottom Substrate (15)	4
Pool Variety (10)	0
Riffle Habitat (16)	5
Left Bank Stability (7)	6
Right Bank Stability (7)	6
Light Penetration (10)	7
Left Riparian Score (5)	5
Right Riparian Score (5)	3
Total Habitat Score (100)	53

Site Photograph

Substrate Mostly sand and hardpacked clay with some gravel

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
05/03/06	9866	81	26	5.52	4.86	Good
08/21/02	8946	---	13	---	4.81	Not Rated
08/19/97	7433	73	24	5.38	4.93	Good
08/17/92	5978	79	29	5.78	5.18	Good

Taxonomic Analysis

Taxa observed in the 2006 sample indicated an increase in mayfly and caddisfly taxa which had decreased significantly in 2002 due to drought conditions. Abundant EPT taxa included *Baetis intercalaris* , *Pseudocloeon propinquum* , *Hexagenia* , *Maccaffertium modestum* , *Perlesta* , *Oecetis persimilis* and *Triaenodes ignitus* .

Data Analysis

The Indian Creek watershed includes western Lincoln County and the extreme northwestern corner of Gaston County. In 2002, the site was moved 1.5 miles upstream due to low flows at SR 1252. However, 2002 was a dry year and BAU staff decided not to rate this site in 2002. With the exception of 2002, water quality has remained stable and Indian Creek has consistently rated Good.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
INDIAN CR	**SR 1252**	**06/01/06**	**CF21**	**Fair**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
LINCOLN	35	03050102	35.42277778	-81.25916667	11-129-8-(6.5)	Southern Outer Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
WS-IV	69.2	760	13	0.5	No

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

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
City of Cherryville's Cherryville WWTP	NC0044440	2

Water Quality Parameters

Temperature (°C)	20.7
Dissolved Oxygen (mg/L)	7.4
Specific Conductance (µS/cm)	76
pH (s.u.)	6.0

Water Clarity	Turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	16
Bottom Substrate (15)	3
Pool Variety (10)	9
Riffle Habitat (16)	10
Left Bank Stability (7)	6
Right Bank Stability (7)	4
Light Penetration (10)	9
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	**72**

Site Photograph

Substrate Sand, gravel, cobble, and boulder

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
06/01/06	2006-70	14	38	Fair
05/21/02	2002-51	11	38	Fair
07/01/97	97-67	11	38	Fair

Most Abundant Species Bluehead Chub and Green Sunfish **Exotic Species** Green Sunfish

Species Change Since Last Cycle **Gains** -- Margined Madtom and Eastern Mosquitofish. **Losses** -- None.

Data Analysis

Watershed -- tributary to the South Fork Catawba River; historically impounded by the Laboratory Mill Dam; watershed includes western Lincoln County and the extreme northwestern corner of Gaston County encompassing the north side of the Town of Cherryville; site is ~ 1.1 miles upstream from the creek's confluence with the river. **Habitat** -- Carolina Slate Belt type stream; outcrops; riffles with *Podostemum.* **2006** -- total number of fish declined from 207 to 111 between 2002 and 2006; darters and intolerant species absent; sampled as part of a Catawba River Basin Biological TMDL Study (Biological Assessment Unit Memorandum F-20061207). **1997 - 2006** -- conductivity has ranged from 75 to 86 µS/cm; very low diversity for a stream of its size; only 15 species are known from the site, but no darters or intolerant species have ever been collected; percentage of tolerant fish (Creek Chub, White Sucker, Flat Bullhead, Eastern Mosquitofish, Redbreast Sunfish, and Green Sunfish) has increased from 16% to 29% to 49% since 1997; community affected by extremes in flows and by limited avenues for recolonization.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
BEAVERDAM CR	**SR 1609**	**05/31/06**	**CF2**	**Excellent**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
GASTON	35	03050102	35.40444444	-81.24583333	11-129-9-(0.7)	Southern Outer Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
WS-IV	23	750	10	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)	19.8
Dissolved Oxygen (mg/L)	7.8
Specific Conductance (µS/cm)	75
pH (s.u.)	6.2

Water Clarity	Turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	16
Bottom Substrate (15)	3
Pool Variety (10)	9
Riffle Habitat (16)	7
Left Bank Stability (7)	7
Right Bank Stability (7)	7
Light Penetration (10)	8
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	**72**

Site Photograph

Substrate Bedrock, sand, and gravel

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
05/31/06	2006-68	18	54	Excellent
05/21/02	2002-52	13	50	Good

Most Abundant Species Redbreast Sunfish

Exotic Species Green Sunfish

Species Change Since Last Cycle

Gains -- Whitefin Shiner, Golden Shiner, Spottail Shiner, Green Sunfish, Pumpkinseed, Warmouth, and Piedmont Darter. **Losses** -- Rosyside Dace and Highback Chub.

Data Analysis

Watershed -- tributary to the South Fork Catawba River; drains the northwestern portion of Gaston County, including the eastern and southeastern portion of the Town of Cherryville; site is ~ 1.3 miles above the creek's confluence with the river. **Habitat** -- good pools; bedrock outcrops; riffle at end of reach; forested riparian zones. **2006** -- total number of fish decreased, but the diversity was greater in 2006 than in 2002; 10 of 13 species collected in 2002 declined in number or were not collected in 2006; large suckers abundant and continued to use the creek as a spawning and nursery tributary; sampled as part of a Catawba River Basin Biological TMDL Study (Biological Assessment Unit Memorandum F-20061207). **2002 & 2006** -- 20 species known from the site, including the intolerant Highback Chub, Seagreen Darter, and Piedmont Darter.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
HOYLE CR	**SR 1836**	**05/31/06**	**CF19**	**Fair**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
GASTON	35	03050102	35.335	-81.13361111	11-129-15-(6)	Southern Outer Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
WS-IV	27.5	695	7	0.3	No

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	55	10 (rural residential)	35	0

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

Water Quality Parameters

Temperature (°C)	19.0
Dissolved Oxygen (mg/L)	8.3
Specific Conductance (µS/cm)	84
pH (s.u.)	6.0

Water Clarity	Turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	12
Bottom Substrate (15)	3
Pool Variety (10)	8
Riffle Habitat (16)	1
Left Bank Stability (7)	3
Right Bank Stability (7)	3
Light Penetration (10)	9
Left Riparian Score (5)	3
Right Riparian Score (5)	3
Total Habitat Score (100)	**50**

Site Photograph

Substrate Sand and gravel

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
05/31/06	2006-67	15	40	Fair
05/22/02	2002-53	15	42	Good-Fair
06/12/97	97-59	14	48	Good

Most Abundant Species Spottail Shiner

Exotic Species Green Sunfish

Species Change Since Last Cycle

Gains -- Pumpkinseed and Warmouth. **Losses** -- Highback Chub, Greenhead Shiner, Flat Bullhead, Fantail Darter, and Piedmont Darter.

Data Analysis

Watershed -- tributary to the South Fork Catawba River; drains south central Lincoln County and north central Gaston County, west of the Town of Stanley; two small permitted dischargers within the watershed (combined flow = 0.5 MGD); site is ~ 0.4 miles above the creek's confluence with the river. **Habitat** -- sandy, shallow runs; undercuts; stick riffles; entrenched with easily eroded banks, especially the left bank. **2006** -- number of fish declined from 600 in 2002 (a low flow year) to 218 in 2006; 11 of 15 species collected in 2002 declined in number (e.g. Bluehead Chub and Sandbar Shiner) or were not collected in 2006 (Greenhead Shiner); due to proximity to the river, the number of species of sunfish increased from 1 in 2002 to 6 in 2006; intolerant species absent; sampled as part of a Catawba River Basin Biological TMDL Study (Biological Assessment Unit Memorandum F-20061207). **1997 - 2006** -- conductivity has ranged from 68 to 88 µS/cm; 23 species are known from the site; community affected by extremes in flows and by limited avenues for recolonization.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
LONG CR	**SR 1456**	**07/15/04**	**CF29**	**Excellent**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
GASTON	36	03050102	35.30527778	-81.23277778	11-129-16-(4)	Southern Outer Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	31.1	695	7	0.4	No

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	75	5 (developed)	0	20 (church 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)	6.9
Specific Conductance (µS/cm)	115
pH (s.u.)	6.3

Water Clarity	Slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	12
Bottom Substrate (15)	3
Pool Variety (10)	7
Riffle Habitat (16)	3
Left Bank Stability (7)	3
Right Bank Stability (7)	3
Light Penetration (10)	10
Left Riparian Score (5)	4
Right Riparian Score (5)	5
Total Habitat Score (100)	**55**

Site Photograph

Substrate Sand

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
07/15/04	2004-122	17	54	Excellent

Most Abundant Species Redbreast Sunfish

Exotic Species Redear Sunfish

Species Change Since Last Cycle N/A

Data Analysis

This is the first fish community sample collected at this site. **Watershed** -- tributary to the South Fork Catawba River; drains central Gaston County, including portions of the municipal areas of Kings Mountain, Bessemer City, and Gastonia; site is ~ 3.4 miles above the basinwide site monitored in 1993, 1997, and 2002. **Habitat** -- sandy runs; snags; undercuts; deadfalls; good canopy; below a natural bedrock shelves/waterfall. **2004** -- community was diverse and abundant; percentage of tolerant fish (White Sucker, Flat Bullhead, Eastern Mosquitofish, and Redbreast Sunfish) slightly elevated; percentage of species with multiple age groups slightly lower than expected; intolerant species included Highback Chub and Seagreen Darter; data were also used as part of a NCSU Urban Fish Study.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
LONG CR	**SR 1456**	**CB224**	**07/10/07**	**Good-Fair**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
GASTON	36	3050102	351820	811356	0	Southern Outer Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
C	31.1	700	13	0.3

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

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

Water Quality Parameters

Temperature (°C)	23.3
Dissolved Oxygen (mg/L)	0
Specific Conductance (µS/cm)	135
pH (s.u.)	6.9
Water Clarity	slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	16
Bottom Substrate (15)	8
Pool Variety (10)	10
Riffle Habitat (16)	3
Left Bank Stability (7)	6
Right Bank Stability (7)	6
Light Penetration (10)	10
Left Riparian Score (5)	4
Right Riparian Score (5)	3
Total Habitat Score (100)	71

Site Photograph

Substrate Mostly sand with some gravel and silt

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
07/10/07	10235	74	23	6.13	5.51	Good-Fair
08/20/97	7437	62	21	5.95	5.10	Good-Fair
07/25/90	5395	67	18	6.18	5.22	Good-Fair

Taxonomic Analysis

No major changes in the benthic community were observed. Abundant taxa included *Baetis flavistriga* , *B. intercalaris* , *Isonychia* , *Maccaffertium modestum* , *Cheumatopsyche* , *Hydropsyche betteni* , *Triaenodes ignitus* , *Ancyronyx variegatus* , *Dineutus* , *Macronychus glabrus* , *Boyeria vinosa* , *Ophiogomphus* , *Progomphus obscurus* , *Tribelos fusicorne* and *Corbicula fluminea* .

Data Analysis

Long Creek drains the western portion of Gaston County. This particular location is also an ambient monitoring site. It was not sampled for benthos in 2002 due to low flows. Althogh EPT taxa richness has gradually increased since 1990, the bioclassification has remained at Good-Fair.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
IRWIN CR	**off US 521**	**07/15/04**	**CF23**	**Poor**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
MECKLENBURG	34	03050103	35.19777778	-80.90472222	11-137-1	Southern Outer Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	30.7	595	7	0.3	No

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	5	95	0	0

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

Water Quality Parameters

Temperature (°C)	28.5
Dissolved Oxygen (mg/L)	9.7
Specific Conductance (µS/cm)	230
pH (s.u.)	8.2

Water Clarity	Clear

Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	15
Bottom Substrate (15)	6
Pool Variety (10)	4
Riffle Habitat (16)	12
Left Bank Stability (7)	5
Right Bank Stability (7)	5
Light Penetration (10)	7
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	**68**

Site Photograph

Substrate Gravel, cobble, and sand

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
07/15/04	2004-124	8	32	Poor

Most Abundant Species Redbreast Sunfish **Exotic Species** Green Sunfish

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

Data Analysis

Watershed -- tributary to Sugar Creek; drains the northwest portion of the City of Charlotte; site is on the property of the Charlotte Mecklenburg Utility District's Irwin Creek WWTP, but above its discharge. **Habitat** -- an open canopy; gravel runs; thick periphyton; no deadfalls or snags; urban debris in stream and along the banks. **2004** -- elevated conductivity due to urban runoff; elevated pH and dissolved oxygen due to afternoon periphytic photosynthesis; typical urban stream -- almost 60% of all the fish were the tolerant Redbreast Sunfish; total diversity lower than expected; fewest species of any fish community site in the basin, 2004 - 2007; darters, suckers, and intolerant species were absent; skewed trophic structure, more than 90% of all the fish were insectivores; Creek Chubsucker was represented only by young-of-year; data were also used as part of a NCSU Urban Fish Study. Similar to downstream site on Sugar Creek at SR 1156 which was also rated Poor in 1999.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
SUGAR CR	**SR 1156**	**CB157**	**07/11/07**	**Fair**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
MECKLENBURG	34	3050103	351124	805451	0	Southern Outer Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
C	37	600	13	0.3

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

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
Irwin Creek WWTP	NC0024945	15.0

Water Quality Parameters

Temperature (°C)	25.9
Dissolved Oxygen (mg/L)	0
Specific Conductance (µS/cm)	294
pH (s.u.)	7.2
Water Clarity	slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	12
Bottom Substrate (15)	8
Pool Variety (10)	10
Riffle Habitat (16)	12
Left Bank Stability (7)	6
Right Bank Stability (7)	6
Light Penetration (10)	3
Left Riparian Score (5)	4
Right Riparian Score (5)	4
Total Habitat Score (100)	70

Site Photograph

Substrate Mix of boulder, rubble, gravel and sand

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
07/11/07	10238	---	8	---	6.66	Fair
08/20/02	8929	---	5	---	7.00	Poor
08/21/97	7440	---	7	---	6.15	Fair
08/18/92	5982	45	4	7.97	7.03	Poor

Taxonomic Analysis

Minor shifts in the abundance and/or presence/absence of mayfly taxa have occurred between sampling events. *Baetis flavistriga* were Abundant in all four samples. *Baetis intercalaris* were not collected in 1992 or 1997 but were Common in 2002 and Abundant in 2007. *Pseudocloeon propinquum* had not been collected prior to 2007 and *Tricorythodes* had not been collected prior to 2002. *Maccaffertium modestum* were Common in 2007 but either absent or Rare in previous samples.

Data Analysis

This site is located in downtown Charlotte and below Irwin Creek WWTP. Although Sugar Creek has alternated between Poor and Fair bioclassifications the four times it has been sampled, there have been no major changes in water quality. The 1997 and 2007 samples were borderline Poor/Fair. For EPT samples taken in the Piedmont ecoregion, sites with less than six EPT taxa would receive a Poor rating.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
L SUGAR CR	**NC 51**	**CB146**	**07/11/07**	**Fair**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
MECKLENBURG	34	3050103	350506	805256	0	Southern Outer Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
C	49	545	20	0.2

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

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
Sugar Creek WWTP	NC0024937	20.0

Water Quality Parameters

Temperature (°C)	30.4
Dissolved Oxygen (mg/L)	0
Specific Conductance (µS/cm)	338
pH (s.u.)	7.3
Water Clarity	slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	10
Bottom Substrate (15)	6
Pool Variety (10)	6
Riffle Habitat (16)	4
Left Bank Stability (7)	3
Right Bank Stability (7)	3
Light Penetration (10)	2
Left Riparian Score (5)	2
Right Riparian Score (5)	2
Total Habitat Score (100)	43

Site Photograph

Substrate Mostly sand with some boulder, rubble and gravel

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
07/11/07	10239	---	8	---	6.41	Fair
08/19/02	8925	---	6	---	6.71	Poor
08/21/97	7441	---	7	---	6.92	Fair
09/19/92	5983	43	3	8.11	6.37	Poor

Taxonomic Analysis

Taxa observed in 2007 indicated a gradual increase in mayfly taxa. Only one mayfly species was collected in 1992. Three mayfly taxa were collected in 1997. Four mayfly taxa were collected in 2002 and five mayfly taxa were collected in 2007. Mayfly taxa collected in 2007 that had not been previously collected include *Pseudocloeon propinquum* , *Maccaffertium modestum* and *Tricorythodes* .

Data Analysis

This site is located below Sugar Creek WWTP and its entire watershed is located within the city of Charlotte. The bioclassification rating has alternated between Poor and Fair since 1992. Although the site received Fair ratings in 1997 and 2007, the EPT taxa richness increased by one taxa in 1997 and by two taxa in 2007 to make it a borderline Fair/Poor rating.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
LITTLE SUGAR CR	**NC 51**	**04/24/07**	**CF28**	**Fair**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
MECKLENBURG	34	03050103	35.085	-80.88277778	11-137-8b	Southern Outer Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	49.2	540	13	0.4	No

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

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
Charlotte Mecklenburg Utility District's Sugar Creek WWTP	0024937	20

Water Quality Parameters

Temperature (°C)	18.1
Dissolved Oxygen (mg/L)	6.9
Specific Conductance (µS/cm)	330
pH (s.u.)	6.9

Water Clarity	Clear

Habitat Assessment Scores (max)

Channel Modification (5)	3
Instream Habitat (20)	9
Bottom Substrate (15)	3
Pool Variety (10)	6
Riffle Habitat (16)	3
Left Bank Stability (7)	2
Right Bank Stability (7)	2
Light Penetration (10)	2
Left Riparian Score (5)	2
Right Riparian Score (5)	3
Total Habitat Score (100)	**35**

Site Photograph

Substrate Sand and some cobble

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
04/24/07	2007-25	14	40	Fair
04/15/99	99-16	12	42	Good-Fair
06/30/97	97-65	12	40	Fair

Most Abundant Species Redbreast Sunfish

Exotic Species Green Sunfish

Species Change Since Last Cycle

Gains -- Swallowtail Shiner, Brassy Jumprock, Margined Madtom, Warmouth, and Tessellated Darter. **Losses** - Creek Chubsucker, White Catfish, and Largemouth Bass

Data Analysis

Watershed -- tributary to Sugar Creek; drains southern Mecklenburg County, including the City of Charlotte metropolitan area. **Habitat** -- poor habitats; sandy, shallow runs with willow snags and rip/rap; urban debris and tires in the stream and along the banks; periphyton atop the rocks; slight sewage odor; black iron pipe across the stream created a riffle/plunge; artificial wetland constructed along the right shoreline. **2007** -- second highest conductivity at a fish community site in the basin in 2007; a very abundant, but tolerant community; diversity lower than expected for a streams of its size; all species gained in 2007 were collected for the first time from the site, but their numbers were 1-4 fish/species; Eastern Mosquitofish abundant in the shallow areas; intolerant species were absent. **1997 - 2007** -- conductivity has ranged from 330 to 552 µS/cm; 19 species known from the site; the tolerant Redbreast Sunfish has always been the dominant species; no intolerant species known from the site; total habitat scores have ranged from 30 to 35.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
MCALPINE CR	**NC 51**	**07/16/04**	**CF39**	**Fair**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
MECKLENBURG	34	03050103	35.08527778	-80.83416667	11-137-9c	Southern Outer Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	52.6	550	13 (variable)	0.2	No

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

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

Water Quality Parameters

Temperature (°C)	23.5
Dissolved Oxygen (mg/L)	5.3
Specific Conductance (µS/cm)	158
pH (s.u.)	6.3

Water Clarity	Slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	9
Bottom Substrate (15)	3
Pool Variety (10)	6
Riffle Habitat (16)	1
Left Bank Stability (7)	1
Right Bank Stability (7)	1
Light Penetration (10)	8
Left Riparian Score (5)	5
Right Riparian Score (5)	4
Total Habitat Score (100)	**42**

Site Photograph

Substrate Sand

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
07/16/04	2004-125	13	36	Fair

Most Abundant Species Redbreast Sunfish **Exotic Species** Green Sunfish

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

Data Analysis

This is the first fish community sample collected at this site. **Watershed** -- tributary to Sugar Creek; drains the southeastern portion of the City of Charlotte metropolitan area. **Habitat** -- very shallow, sandy, braided runs; stick riffles; side undercuts and snags; severe bank erosion and deeply entrenched; urban debris in stream and along the banks. **2004** -- elevated conductivity; low diversity for a stream of its size, only one species of darter and sucker collected; Bluehead Chub and White Sucker represented only by young-of-year; intolerant species absent; almost 60% of all the fish were Redbreast Sunfish; percentage of tolerant fish (White Catfish, Flat Bullhead, Eastern Mosquitofish, Green Sunfish, and Redbreast Sunfish) was high; skewed trophic structure, 95% of all the fish were insectivores; data were also used as part of a NCSU Urban Fish Study.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
MCMULLEN CR	**off NC 51**	**03/27/07**	**CF71**	**Good**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
MECKLENBURG	34	03050103	35.0789656	-80.8611333	11-137-9-5	Southern Outer Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	13.9	540	5	0.4	No

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

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

Water Quality Parameters

Temperature (°C)	17.8
Dissolved Oxygen (mg/L)	7.8
Specific Conductance (µS/cm)	347
pH (s.u.)	6.1

Water Clarity	Clear

Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	11
Bottom Substrate (15)	3
Pool Variety (10)	6
Riffle Habitat (16)	0
Left Bank Stability (7)	3
Right Bank Stability (7)	3
Light Penetration (10)	10
Left Riparian Score (5)	4
Right Riparian Score (5)	5
Total Habitat Score (100)	**49**

Site Photograph

Substrate Sand

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
03/27/07	2007-01	14	50	Good

Most Abundant Species Spottail Shiner **Exotic Species** Green Sunfish

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

Data Analysis

This is the first fish community sample collected at this site. **Watershed** -- tributary to the Catawba River; drains the southeastern portion of the City of Charlotte metropolitan area. **Habitat** -- sandy runs; side snags; wide and shallow with sand bars; eroding banks; no riffles; wide and forested riparian zones in a bottomland forest; good canopy. 2**007** -- very low flow; elevated specific conductance due to urban runoff (no WWTP in the watershed), the highest conductivity of any fish community site in the basin in 2007; only one species of darter (Tessellated Darter) present; intolerant species were absent; moderately elevated percentage of tolerant fish (White Sucker, White Catfish, Flat Bullhead, Eastern Mosquitofish, Redbreast Sunfish, and Green Sunfish); data were also used as part of the 2007 Probabilistic Monitoring Special Study.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
W FK TWELVEMILE CR	SR 1321	04/23/07	CF59	Good

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
UNION	38	03050103	34.957603	-80.751853	11-138-1	Carolina Slate Belt

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	22.3	495	9	0.4	No

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	75	0	20	5 (sewer right-of-way)

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

Water Quality Parameters

Temperature (°C)	17.7
Dissolved Oxygen (mg/L)	8.9
Specific Conductance (µS/cm)	112
pH (s.u.)	6.9

Water Clarity	Clear

Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	16
Bottom Substrate (15)	10
Pool Variety (10)	6
Riffle Habitat (16)	7
Left Bank Stability (7)	4
Right Bank Stability (7)	6
Light Penetration (10)	6
Left Riparian Score (5)	4
Right Riparian Score (5)	4
Total Habitat Score (100)	**67**

Site Photograph

Substrate Gravel, sand, and a little bit of cobble

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
04/23/07	2007-23	18	48	Good

Most Abundant Species Tessellated Darter

Exotic Species Black Bullhead and Green Sunfish

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

Data Analysis

This is the first fish community sample collected at this site. **Watershed** -- tributary to Twelvemile Creek (and ultimately the Catawba River); drains southwestern Union County including the City of Charlotte metropolitan area suburbs, but no true municipalities in the watershed. **Habitat** -- side snags; riffle at sewer right-of-way; open canopy; a Carolina Slate Belt type stream. **2007** -- a very diverse and abundant community; intolerant species were absent, also absent from Twelvemile Creek at NC 16 and East Fork Twelvemile Creek at SR 1008; many Tessellated Darters were in the gravel and woody debris along the sides; Creek Chubsucker was abundant, but represented only by young-of-year; fauna typical of a lower piedmont Catawba River basin stream.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
E FK TWELVEMILE CR	SR 1008	04/23/07	CF60	Good

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
UNION	38	03050103	34.963781	-80.710425	11-138-2	Carolina Slate Belt

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	33.7	550	11	0.5	No

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	95	5 (rural residential)	0	0

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

Water Quality Parameters

Temperature (°C)	18.0
Dissolved Oxygen (mg/L)	8.5
Specific Conductance (µS/cm)	180
pH (s.u.)	7.1

Water Clarity	Slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	16
Bottom Substrate (15)	3
Pool Variety (10)	10
Riffle Habitat (16)	7
Left Bank Stability (7)	3
Right Bank Stability (7)	3
Light Penetration (10)	9
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	**66**

Site Photograph

Substrate Gravel, sand, and some cobble

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
04/23/07	2007-24	14	48	Good

Most Abundant Species Bluehead Chub and Carolina Darter

Exotic Species Green Sunfish

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

Data Analysis

This is the first fish community sample collected at this site. **Watershed** -- tributary to Twelvemile Creek (and ultimately the Catawba River); drains southwestern Union County; no municipalities in the watershed. **Habitat** -- entrenched and eroding banks; one large "blow-out" claypan deep pool; coarse woody debris; snags, roots, and undercuts. **2007** -- conductivity elevated, much greater than at nearby West Fork Twelvemile Creek, but no WWTPs in the watershed, probably from nonpoint source runoff; diversity slightly lower than expected, only one species of darter present; Redfin Pickerel represented by only young-of-year; intolerant species were absent, also absent from Twelvemile Creek at NC 16 and West Fork Twelvemile Creek at SR 1321.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
WAXHAW CR	**SR 1103**	**04/23/07**	**CF58**	**Good**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
UNION	38	03050103	34.83666667	-80.79166667	11-139	Southern Outer Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	35	495	7	0.3	No

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

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

Water Quality Parameters

Temperature (°C)	15.2
Dissolved Oxygen (mg/L)	8.3
Specific Conductance (µS/cm)	109
pH (s.u.)	6.8

Water Clarity	Slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	16
Bottom Substrate (15)	3
Pool Variety (10)	10
Riffle Habitat (16)	1
Left Bank Stability (7)	4
Right Bank Stability (7)	4
Light Penetration (10)	9
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	**62**

Site Photograph

Substrate Sand and clay

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
04/23/07	2007-22	14	48	Good
06/11/97	97-55	19	56	Excellent

Most Abundant Species Golden Shiner

Exotic Species None

Species Change Since Last Cycle

Gains -- Golden Shiner, Coastal Shiner, Brassy Jumprock, and Carolina Darter. **Losses** -- Rosyside Dace, Greenfin Shiner, Greenhead Shiner, Spottail Shiner, Creek Chub, Flat Bullhead, Margined Madtom, Largemouth Bass, and Piedmont Darter.

Data Analysis

Watershed -- tributary to the Catawba River; drains the extreme southwestern corner of Union County; no municipalities within the watershed. **Habitat** -- snags; undercuts; roots; woody debris in the current creating stick riffles; Chinese privet in the riparian zones. **2007** -- lower than expected scores for abundance and diversity metrics; intolerant species were absent; percentage of tolerant fish (Golden Shiner and Redbreast Sunfish) was slightly elevated. **1997 & 2007** -- site was a reference site in 1997 (total habitat score = 74), but in 2007 the substrate was sandier than in 1997 and there was the loss of small gravelly riffles; 23 species known from the site, including 11 species of cyprinids and 3 species of darters; no exotic species known from the site; Greenfin Shiner, Greenhead Shiner, and Spottail Shiner were abundant in 1997 but absent in 2002; a naturally low flow affected stream.