Environmental Sciences Section
Biological Assessment Unit

October 03, 2007

MEMORANDUM

To: Jimmie Overton

Through: Trish F. MacPherson

From: Bryn H. Tracy

Subject: Walnut Creek Reclassification/Use Attainability Study (Polk County, Subbasin 030802, Classification Index No. 9-29-44)

INTRODUCTION

DWQ's stream fish community assessment ratings for Walnut Creek at SR 1315 in Polk County have been Excellent in two consecutive, 2000 and 2005, basinwide monitoring cycles (NCDENR 2006a). The existing water quality classification for the creek and all of its named and unnamed tributaries is C (Table 1). The watershed was nominated for supplemental classification to Outstanding Resource Waters or High Quality Waters by Wunsche (2006). The purpose of this memorandum is:

- to summarize the current knowledge of this watershed;
- to determine if reclassification to ORW, HQW, or both is warranted for the entire watershed or portions there-of; and
- where appropriate, to recommend the limits of the downstream extent of the supplemental reclassification(s).

Table 1. Existing water quality classification and proposed water quality classification within the Walnut Creek watershed, Polk County.

Stream	Description	Index No.	Existing Class	Proposed Class
Walnut Creek	From source to Green River	9-29-44	C	HQW or ORW

SUPPLEMENTAL WATER QUALITY CLASSIFICATIONS

HIGH QUALITY WATERS

High Quality Waters (HQW) is a supplemental classification *"intended to protect waters with quality higher than state water quality standards". HQW* are ". . . *waters which are rated as excellent based on biological and physical/chemical characteristics through Division monitoring or special studies, native and special native trout waters (and their tributaries)* (now known as Wild Trout Waters) *designated by the Wildlife Resources Commission, all water supply watersheds which are either classified as WS-I or WS-II or those for which a formal petition for reclassification as WS-I or WS-II has been received from the appropriate local government and accepted by the Division of Water Quality . . .* " (NCAC 2007).

OUTSTANDING RESOURCE WATERS

Outstanding Resource Waters (ORW) are: *"unique and special waterbodies of exceptional state or national recreational or ecological significance which require special protection to maintain existing uses. These waterbodies may be classified as ORW upon finding that such waters have exceptional water quality while meeting these conditions:*

- *there are no significant impacts from pollution with the water quality rated as excellent based on physical, chemical, or biological information; and*
- *the characteristics which make these waters unique and special may not be protected by the assigned narrative and numerical water quality standards*" (NCAC 2007).

To be supplementally classified as ORW, a waterbody must exhibit one or more values or uses:

- *"there are outstanding fish (or commercially important aquatic species) habitat and fisheries;*
- *there is an unusually high level of water-based recreation or the potential for such recreation;*
- *the waters have already received some special designation such as North Carolina or National Wild and Scenic River, Native or Special Native Trout Waters* (now known as Wild Trout Waters), *National Wildlife Refuge, etc. which do not provide any water quality protection;*
- *the waters represent an important component of a state or national park or forest; or*
- *the waters are of special ecological or scientific significance such as habitat for rare or endangered species or as areas for research and education"* (NCAC 2007).

INFORMATION SOURCES

- Stream water quality classifications and National Pollutant Discharge Elimination System dischargers – DWQ's Basinwide Information Management System;
- Watershed characteristics -- Griffith *et al*. (2002), 2001 National Land Cover Database (http://www.mrlc.gov/), and DWQ's GIS data layers;
- North Carolina Natural Heritage Program's Significant Natural Heritage Areas – North carolina Natural Heritage Program's GIS data layers, Rayner (1994), and personal communications with Ms. Angelina Rogers (North Carolina Natural Heritage Program) during September 2007;
- Threatened and endangered aquatic fauna -- personal communication with Dr. John Cooper and Dr. Art Bogan (North Carolina State Museum of Natural Sciences) and Ms. Angelina Rogers during September 2007, LeGrand, *et al*. (2006), and DWQ unpublished data;
- Water quality, specific conductance, instream and riparian habitat, and benthic macroinvertebrate data -- DWQ's Broad River basinwide monitoring program (NCDEHNR 1997, NCDENR 2001, NCDENR 2006a), and DWQ unpublished data; and
- Fisheries data -- Messer *et al.* (1965) and DWQ's Broad River basinwide monitoring program (NCDENR 2001 and NCDENR 2006a).

THE WATERSHED

Walnut Creek is a tributary to the Green River (Figure 1). The 18.1 square mile watershed drains the extreme northeast corner of Polk County and lies within the Southern Inner Piedmont Level IV ecoregion (Griffith *et al*. 2002). The watershed is shown on the Lake Lure, Shingle Hollow, Mill Spring, and Pea Ridge USGS 7.5 minute quadrangle maps. Almost three-fourths of the watershed is forested; 21 percent is in pasture, 5 percent is developed (primarily state-maintained secondary roads and rural residential areas), and less than one percent is in row crops (Figure 2). There are no municipalities in the rural watershed, nor any permitted wastewater treatment plant dischargers. There are no state parks, U.S. Forest Service lands, or North Carolina Wildlife Resource Commission gamelands within the watershed. There is one North Carolina Natural Heritage Program's Significant Natural Heritage Area in the south central portion of the watershed (Figure 1). The Big Level Natural Area encompasses approximately 40 acres; it is of Regional Significance and is privately owned (Rayner 1994).

THREATENED AND ENDANGERED AQUATIC FAUNA

There are no known occurrences of any state or federally listed threatened or endangered species of fish or mussels in the watershed. The Santee Chub, *Cyprinella zanema*, collected in 2000, is listed as Significantly Rare by LeGrand, *et al*. (2006). The crayfish fauna of the Broad River basin is known for its endemicity and localized distributions of several of the species (Cooper 2000, Cooper 2002, LeGrand, *et al*. 2006). Species that have been collected from the creek or from nearby drainages include:

- *Cambarus* (*Cambarus*) *lenati* Cooper, the Broad River stream crayfish, is currently listed as a Significantly Rare species. It has been recommended to be considered as a species of Special Concern or as a Threatened species because of its endemicity and limited known distribution (Dr. John E. Cooper, pers. com. October 2004 and September 2007). It is also considered an imperiled species (Taylor, *et al*. 2007).

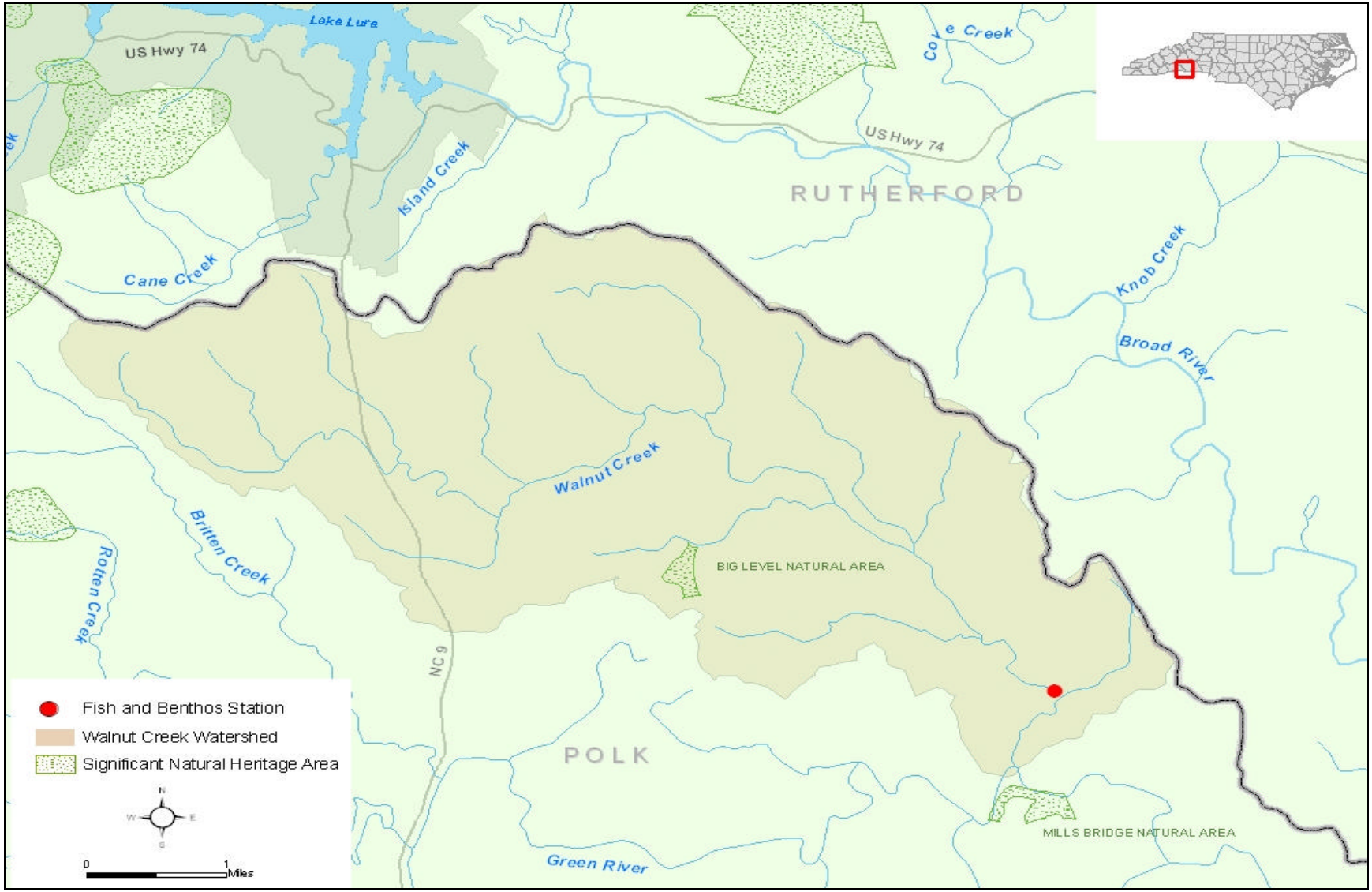

Figure 1. **Location of the Walnut Creek watershed, Polk County. The biological monitoring site is shown along with the North Carolina Natural Heritage Program's Significant Natural Heritage Areas.**

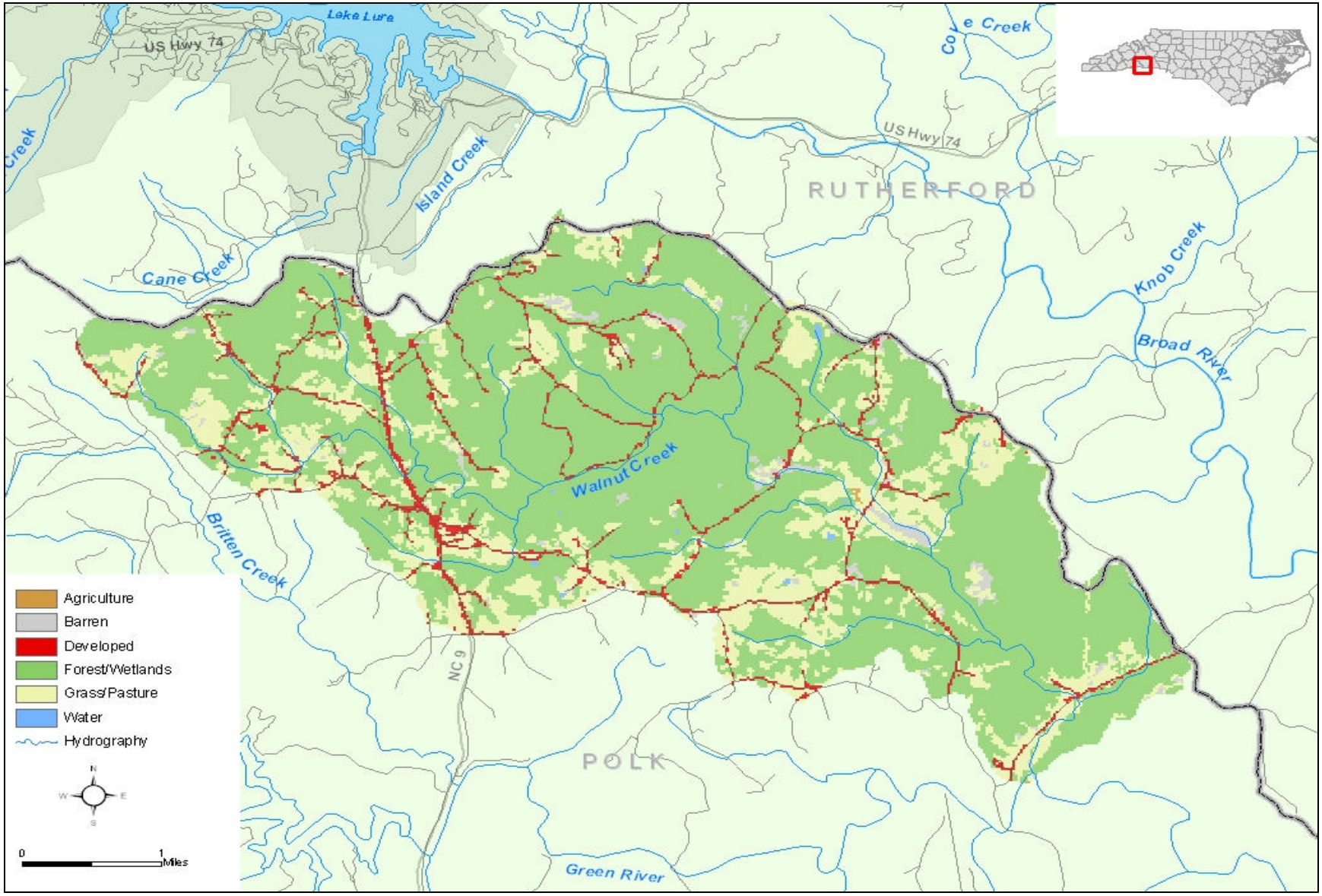

Figure 2. **Landuse types within the Walnut Creek watershed, Polk County.**

- *Cambarus* (*Puncticambarus*) *johni* Cooper, the Carolina Foothills crayfish, was collected nearby from the Green River at SR 1331, Polk County. This species will also be nominated as a species of Special Concern (Dr. John E. Cooper, pers. com. September 2007) and is also considered an species vulnerable to extirpation or extinction (Taylor, *et al*. 2007).
- *Cambarus* (*Puncticambarus*) *spicatus* Hobbs, the Broad River Spiny Crayfish, has yet to be collected from the creek; it should be expected to occur there (Dr. John E. Cooper, pers. com., September 2007). It is a Special Concern species and, like the Broad River stream crayfish, considered imperiled (Taylor, *et al*. 2007).

BIOLOGICAL DATA COLLECTED BY DWQ

Data from this watershed have been summarized in DWQ's Broad River basinwide monitoring program reports (NCDEHNR (1997), NCDENR (2001), and NCDENR (2006a) (Table 2).

Table 2. Monitoring sites within the Walnut Creek watershed proposed for reclassification, Polk County

Program	Waterbody	Location	County	Latitude	Longitude	Date
Benthic	Walnut Creek	SR 1315	Polk	35.35388889	-82.1033333	07/11/1995 07/11/2000 09/21/2005
Fish	Walnut Creek	SR 1315	Polk	35.35388889	-82.1033333	05/12/2000 06/23/2005

WATER QUALITY ASSESSMENTS BY THE DWQ

There is no Ambient Monitoring System station in this small watershed (NCDENR 2006). Specific conductance (a measurement of the dissolved salts in water and of point and nonpoint sources of pollutants) is often measured by DWQ's Biological Assessment Unit staff wherever benthic macroinvertebrate and fish community data are collected. Although these measurements are one-time events, the conductivity during fish community monitoring events has been low, < 35 µmhos/cm. The measurements were lower than those in any other streams in Subbasin 02 of the Broad River basin (NCDENR 2001 and NCDENR 2006a) and typical of streams draining forested watersheds where there is no or minimal nonpoint pollutant sources (NCDENR 2006a) (Table 3). Temperature, dissolved oxygen, dissolved oxygen saturation, and pH were unremarkable. During fish community sampling water clarity has either been clear or very slightly turbid.

Table 3. Water quality data from Walnut Creek at SR 1315, Polk County, 2000 and 2005.

Date/Variable	May 12, 2000	Jun 23, 2005
Temperature (°C)	16.1	18.2
Specific Conductance (µmhos/cm)	34	33
Dissolved Oxygen (mg/L)	9.1	8.3
Dissolved Oxygen Saturation (%)	92	88
pH (s.u.)	7.5	6.4
Water clarity	Clear	Very slightly turbid

INSTREAM AND RIPARIAN HABITAT ASSESSMENTS BY DWQ

A method and scoring system has been developed to evaluate the physical habitats of a stream (NCDENR 2006c). The narrative descriptions of eight habitat characteristics, including channel modification, amount of instream habitat, type of bottom substrate, pool variety, 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 site, whereas scores less than 65 generally represent low to poor quality habitat sites (DWQ unpublished data).

During fish community assessments, the creek had a mean width of approximately 8 meters, a natural channel width of 9 meters, an average depth of 30 – 40 cm, and a maximum depth of 1 meter. The

creek's riparian zones were 12–18 meters wide along the left shoreline and less than 6 meters wide along the right shoreline. The riparian zones offered some shading to the creek, but sunlit and shaded areas were essentially equal. The banks were stable with trees, shrubs, grasses, and good root systems to minimize bank erosion. The sampled reach had two distinct segments (Figures 3 and 4):

- the lower one-third (approximately 200 ft. long) had a cobble and boulder substrate with some patches of *Podostemum*, swift flow through cobble runs and riffles, and a few deep boulder runs (Figure 3); and
- the upper two-thirds (approximately 400 ft. long) had a sand and gravel substrate with instream bar development, shallow sandy runs, side snags, and side pools (Figure 4).

Figure 3. The lower one-third segment of the 600 ft. sample reach at Walnut Creek, SR 1315, Polk County, June 23, 2005.

Figure 4. The upper two-thirds segment of the 600 ft. sample reach at Walnut Creek, SR 1315, Polk County, June 23, 2005.

Because the upper two-thirds of the 600 ft. reach segment was sandy and shallow, the overall habitat assessments at the creek were only in the low range (Table 4). The least embedded and higher quality habitats were in the lower one-third of the reach.

Table 4. Habitat assessment scores at Walnut Creek at SR 1315, Polk County, 2000 and 2005.

Date/Habitat Characteristics	May 12, 2000	Jun 23, 2005	Maximum Possible Score
Channel modification	4	5	5
Instream habitats	12	13	20
Bottom substrate	8	7	15
Pool variety	4	4	10
Riffle habitats	5	3	16
Bank stability & vegetation			
Left bank	5	6	7
Right bank	5	6	7
Light penetration	8	6	10
Riparian vegetative zone width			
Left bank	2	4	5
Right bank	2	2	5
Total Habitat Score	**55**	**56**	**100**

BENTHIC MACROINVERTEBRATE COMMUNITY ASSESSMENTS BY DWQ

The benthic macroinvertebrate community has been assessed three times, once every five years, since 1995 (Table 5). The ratings have varied from Fair to Excellent to Good. There seemed to have been an actual improvement in water quality, beyond the effects from reduced scour during a low flow year (NCDENR 2001), although the reason for the low EPT diversity in 1995 was unknown. In 2000 the community was considered intolerant and indicative of good water quality (NCDENR 2001). In 2005, the community was still indicative of a minimally impacted stream. Seasonality (mid-summer vs. late summer) and scour from heavy rains due to hurricanes in 2004 and 2005 may have contributed to the differences in taxa between 2000 and 2005 (NCDENR 2006a).

Table 5. Bioclassifications based upon benthic macroinvertebrate data from Walnut Creek at SR 1315, Polk County, 1995 – 2005.

Waterbody	Location	County	Date	EPT S[1]	EPT NCBI[1]	Bioclassification
Walnut Creek	SR 1315	Polk	07/11/1995	14	3.9	Fair
			07/11/2000	38	3.3	Excellent
			09/21/2005	33	4.0	Good

[1]EPT S = Ephemeroptera+Plecoptera+Trichoptera taxa richness and EPT NCBI = Ephemeroptera+Plecoptera+Trichoptera North Carolina Biotic Index (NCDENR 2006b).

FISH COMMUNITY ASSESSMENTS

In 1964 as part of the North Carolina Wildlife Resources Commission's Broad River basin survey, Messer *et al.* (1965) sampled Walnut Creek at SR 1310, Polk County. From a 180 ft. reach, 247 fish constituting 13 species were collected, including three intolerant species and three species of darters. The more common species included the Bluehead Chub and the Piedmont Shiner.

DWQ has monitored the fish community in the creek twice as part of the Broad River basinwide monitoring program. The community is very diverse; 25 species have been collected from the creek, including 10 species of minnows, 5 species of suckers, and 4 species of darters (Table 6). Game species include Redbreast Sunfish, Bluegill, and Largemouth Bass. The fish community is unique in several other respects:

- Walnut Creek was only 1 of 2 streams monitored by DWQ in the Broad River basin in 2004/2005 where 23 species were collected at any particular time;
- Walnut Creek was only 1 of 2 streams monitored by DWQ in the Broad River basin in 2004/2005 where 4 species of darters were found;
- Walnut Creek was the only stream monitored by DWQ in the Broad River basin in 2004/2005 where 5 species of suckers were found; and
- Walnut Creek was only 1 of 3 streams monitored by DWQ in the Broad River basin since 1995 where 6 intolerant species have been found.

- Regional endemics include the Thicklip Chub, Santee Chub, Highback Chub, Striped Jumprock, and Seagreen Darter.
- Based upon DWQ data and records from other researchers, two species found in Walnut Creek -- the Brassy Jumprock and the Piedmont Darter -- are uncommon and rare to uncommon, respectively in the Broad River basin.
- The only non-indigenous (exotic) species collected from this creek has been the Green Sunfish and only one specimen was collected in 2005. The other 22 species are indigenous to the river basin. The Thicklip Chub, Santee Chub, Highback Chub, and Fieryblack Shiner are endemic to the Yadkin, Broad, and Catawba River basins; the Seagreen Darter is endemic to the Broad and Catawba River basins; and the Piedmont Shiner (Yellowfin Shiner) is endemic to the Broad River basin.

Table 6. Scientific and common name, tolerance rating, trophic guild of adults, and number of individuals of fish in Walnut Creek at SR 1315, Polk County, 2000 and 2005.

				Date	
				May 12, 2000	Jun 23, 2005
Scientific Name	Common Name	Tolerance Rating	Trophic Guild of Adults	No. of Fish	No. of Fish
Clinostomus funduloides	Rosyside Dace	Intermediate	Insectivore	7	27
Cyprinella labrosa	Thicklip Chub	Intolerant	Insectivore	3	2
C. pyrrhomelas	Fieryblack Shiner	Intolerant	Insectivore	6	48
C. zanema	Santee Chub	Intolerant	Insectivore	2	---
Hybopsis hypsinotus	Highback Chub	Intolerant	Insectivore	3	21
Nocomis leptocephalus	Bluehead Chub	Intermediate	Omnivore	170	117
Notropis hudsonius	Spottail Shiner	Intermediate	Omnivore	13	23
N. scepticus	Sandbar Shiner	Intermediate	Insectivore	15	69
N. sp. cf. *chlorocephalus*	Piedmont Shiner	Intermediate	Insectivore	22	37
Semotilus atromaculatus	Creek Chub	Tolerant	Insectivore	2	18
Catostomus commersonii	White Sucker	Tolerant	Omnivore	---	10
Hypentelium nigricans	Northern Hog Sucker	Intermediate	Insectivore	11	10
Moxostoma collapsum	Notchlip Redhorse	Intermediate	Insectivore	3	1
Scartomyzon rupiscartes	Striped Jumprock	Intermediate	Insectivore	23	15
S. sp. cf. *lachneri*	Brassy Jumprock	Intermediate	Insectivore	---	1
Noturus insignis	Margined Madtom	Intermediate	Insectivore	32	17
Ameiurus platycephalus	Flat Bullhead	Tolerant	Insectivore	4	1
Lepomis auritus	Redbreast Sunfish	Tolerant	Insectivore	7	29
L. cyanellus	Green Sunfish	Tolerant	Insectivore	---	1
L. macrochirus	Bluegill	Intermediate	Insectivore	2	1
Micropterus salmoides	Largemouth Bass	Intermediate	Piscivore	5	Y-O-Y[1]
Etheostoma flabellare	Fantail Darter	Intermediate	Insectivore	5	3
E. olmstedi	Tessellated Darter	Intermediate	Insectivore	38	18
E. thalassinum	Seagreen Darter	Intolerant	Insectivore	43	30
Percina crassa	Piedmont Darter	Intolerant	Insectivore	12	23

[1]Young-of-year, only.

The fish community was rated using the North Carolina Index of Biotic Integrity (NCIBI) (NCDENR 2006c). The NCIBI is an assessment of the biological integrity of the fish community incorporating 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, an even number between 12 and 60. The score is then used to determine the ecological integrity class of the stream. A fish community rated Excellent would have an NCIBI score of 54 - 60.

Although not a regional reference site, the community was rated Excellent in May 2000 and June 2005 (Table 7). There was a slight increase in the percentage of tolerant fish between 2000 and 2005 due to a slight increase in the abundance of the tolerant Creek Chub, White Sucker, and Redbreast Sunfish. The percentage of piscivores also decreased due to an absence of Largemouth Bass. These slight changes were offset by a more balanced percentage of omnivores+herbivores (due to a decrease in the omnivorous Bluehead Chub) and insectivores in 2005 than in 2000. Overall, the community was diverse, abundant, trophically balanced, healthy, and compared favorably to regional reference sites in the Broad, Catawba, and Yadkin River basins that were also rated Excellent.

Table 7. NCIBI metric values (and scores within parentheses) for fish community samples collected from Walnut Creek at SR 1315, Polk County, 2000 and 2005.

	Date	
NCIBI Metric (and NCIBI Score in parentheses)	**May 12, 2000**	**Jun 23, 2005**
No. of species	22 (5)	23 (5)
No. of fish	428 (5)	522 (5)
No. of species of darters	4 (5)	4 (5)
No. of species of sunfish, bass, trout	3 (5)	3 (5)
No. of species of suckers	3 (5)	5 (5)
No. of intolerant species	6 (5)	5 (5)
% of tolerant fish	3 (5)	11 (5)
% of omnivores+herbivores	43 (3)	29 (5)
% of insectivores	56 (3)	71 (5)
% of piscivores	1.17 (5)	0.00 (1)
% of diseased fish	0.00 (5)	0.00 (5)
% of species with multiple age groups	77 (5)	57 (5)
CPUE (No. fish/100 seconds shocking)	10.8	10.6
NCIBI Score	56	56
NCIBI Rating	Excellent	Excellent

CONCLUSIONS

To be reclassified as either Outstanding Resource Waters or High Quality Waters, the waters of Walnut Creek and all its tributaries must meet the aforementioned criteria (pages 1 and 2). The HQW criterion, Excellent water quality based on biological and physical/chemical characteristics, has been met. The ORW criteria are more strict and difficult to meet. The watershed does not represent an important component of a state or national park or forest. It does, however, support species of crayfish and fish that are Significantly Rare or of Special Concern. There are no significant impacts from pollution with the most recent water quality rating of Excellent based on data from the fish community.

RECOMMENDATIONS

Based upon the information presented, it is recommended that Walnut Creek and all its tributaries, from its source to the Green River qualify for supplemental classification of High Quality Waters (18.1 square miles).

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Wunsche, C. 2006. North Carolina's pristine rivers: preserving our last unspoiled waters. Environment North Carolina. Research & Policy Center. Raleigh, NC.

INTERNET WEB SITES

Stream Fish Community Assessment Standard Operating Procedures
http://www.esb.enr.state.nc.us/BAU.html

Habitat Assessment Standard Operating Procedures
http://www.esb.enr.state.nc.us/BAU.html

Benthic Macroinvertebrate Standard Operating Procedures
http://www.esb.enr.state.nc.us/BAUwww/benthossop.pdf

North Carolina Administrative Code
http://h2o.enr.state.nc.us/csu/documents/Redbook2007_000.pdf

Division of Water Quality's Surface Water Classifications and Standards
http://h2o.enr.state.nc.us/csu/swc.html

Division of Water Quality's Outstanding Resource Waters Stream Classification
http://h2o.enr.state.nc.us/csu/swc.html - ORW

Division of Water Quality's High Quality Waters Stream Classification
http://h2o.enr.state.nc.us/csu/swc.html - HQW

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