

Division of Water Quality
Biological Assessment Unit
December 14, 2005

Memorandum

To: Jimmie Overton
Through: Trish MacPherson
From: Cathy Tyndall
Subject: Broad River Basin
Special Sampling, subbasins 01-03, Rutherford, Polk and Henderson Counties

BACKGROUND

The Asheville Regional Office (ARO) and DWQ Planning Section requested benthic sampling at six locations in the Broad River Basin, subbasins 01-03, during 2005 basinwide sampling. The primary reasons for the requests were to address the impacts on streams that are experiencing rapid growth and development. Due to time constraints, four of the six locations were sampled for macroinvertebrates. The four locations were:

1. Buffalo Creek at SR 1314 (Buffalo Creek Road) (subbasin 01)

ARO and DWQ Planning Section requested a sample from this tributary to the northern arm of Lake Lure. ARO requested a sample at the bridge just north of Fairfield Mountain Lake. A benthic sample had not been collected in Buffalo Creek before.

2. Little Whiteoak Creek at SR 1324 (subbasin 02)

Little Whiteoak Creek is a tributary to Whiteoak Creek, which flows into the Green River. A benthic sample had not been collected in Little Whiteoak Creek previous to 2005.

3. Green River off SR 1106 (subbasin 03)

ARO requested a sample on the Green River in the upper portion of the watershed above Lake Summit. Benthic samples were collected in 1989 and 1993 at three different locations upstream of Lake Summit.

4. Joe Creek at SR 1106 (subbasin 03)

Joe Creek was sampled in 2005 as a follow-up to special studies conducted in 1989 and 2000 to determine if the stream was supporting its designated use.

METHODS

Benthic Macroinvertebrates

All four of the benthic macroinvertebrate samples were collected using the Division of Water Quality's EPT method. The EPT sampling method consists of one kick, one sweep, one leaf pack, and visuals. Only EPT taxa are collected.

EPT taxa richness (EPT S) criteria have been developed by DWQ to assign water quality ratings (bioclassifications) for EPT samples. "EPT" is an abbreviation for Ephemeroptera + Plecoptera + Trichoptera, insect groups that are generally intolerant of many kinds of pollution. Higher EPT taxa richness values usually indicate better water quality. EPT sample ratings were based only on EPT taxa richness. Criteria for Mountain streams were used.

The purpose of these collections is to inventory the aquatic fauna and produce an indication of the relative abundance for each taxon. Organisms are classified as Rare (1-2 specimens, denoted by "R" on taxa tables), Common (3-9 specimens, "C"), or Abundant (≥ 10 specimens, "A").

Several data summaries (metrics) can be produced from benthos samples to detect water quality problems. These metrics are based on the fact that unstressed streams and rivers have many invertebrate taxa and have a relatively high proportion of intolerant species. Conversely, polluted streams have fewer numbers of invertebrate taxa and are dominated by tolerant species. The diversity of the invertebrate fauna is evaluated using taxa richness counts; the tolerance of the stream community is evaluated using a biotic index.

Habitat Evaluation

Habitat evaluations were made using the Biological Assessment Unit's Habitat Assessment Field Data Sheet for Mountain/Piedmont Streams. This assessment assigns a numerical score from 0-100 for the reach of stream sampled, based on channel modification, instream habitat, bottom substrate, pool variety, riffle habitats, bank stability and vegetation, light penetration, and width of the riparian zone. No criteria have been developed to rate habitat scores; however, higher scores generally indicate better overall habitat.

Physical-Chemical

Field measurements were taken at the time of sampling for temperature, dissolved oxygen, conductivity, and pH using a YSI 85 meter and an Accumet pH meter.

SAMPLING LOCATIONS

Buffalo Creek at SR 1314



This tributary to the northern arm of Lake Lure was three meters wide at the time of sampling. Boulder comprised 30% of the substrate and the remainder was an even mix of gravel, rubble, and sand. The habitat score was 85, reflecting the frequent riffles, ample shading and stable banks. The riparian zone was wide and intact. Due to the gradient and riffle/run nature of the stream, pools were infrequent. The drainage area of Buffalo Creek at this location is 3 square miles. As the picture shows, the stream quickly became very turbid from heavy rainfall while sampling. Conductivity was 16 $\mu\text{mhos/cm}$.

Little Whiteoak Creek at SR 1324



Little Whiteoak Creek is a tributary to Whiteoak Creek, which flows into the Green River. The Little Whiteoak Creek watershed is located southeast of Lake Adger. The drainage area at SR 1324 is 11 square miles. Cows had unlimited access to the stream. Substrate was mostly sand (75%) with a small amount of gravel and silt. The site received a low habitat score (40), mostly due to homogeneous substrate composition, absence of riffles, poor riparian zones, and severe bank erosion. Bank erosion was a result of narrow riparian zones and cow access. The conductivity was elevated (55 $\mu\text{mhos/cm}$).

Figure 1. Benthic Macroinvertebrate Sampling Sites, Broad River Basin Special Studies. Subbasins 1-2, Rutherford and Polk Counties, September 2005.

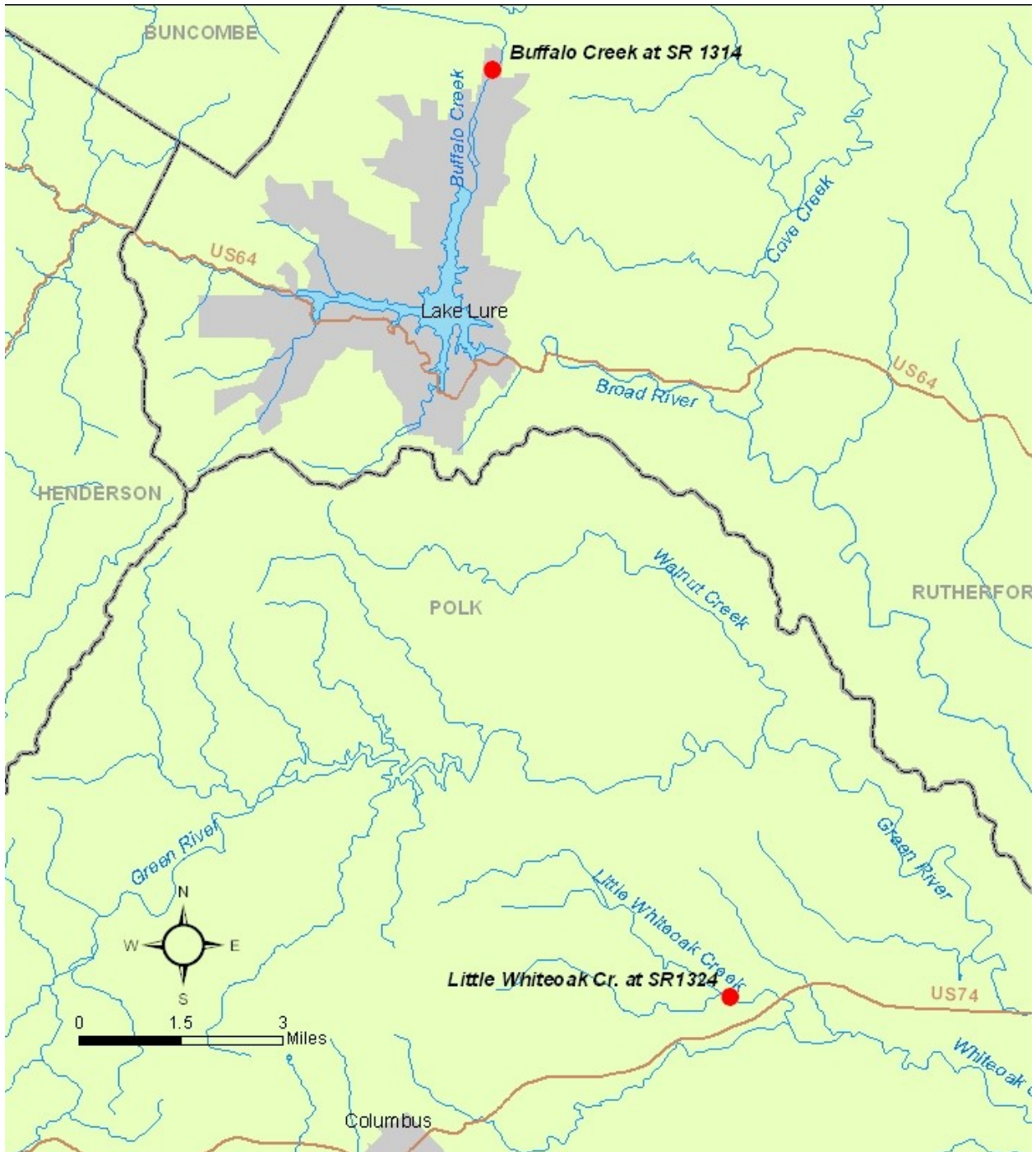
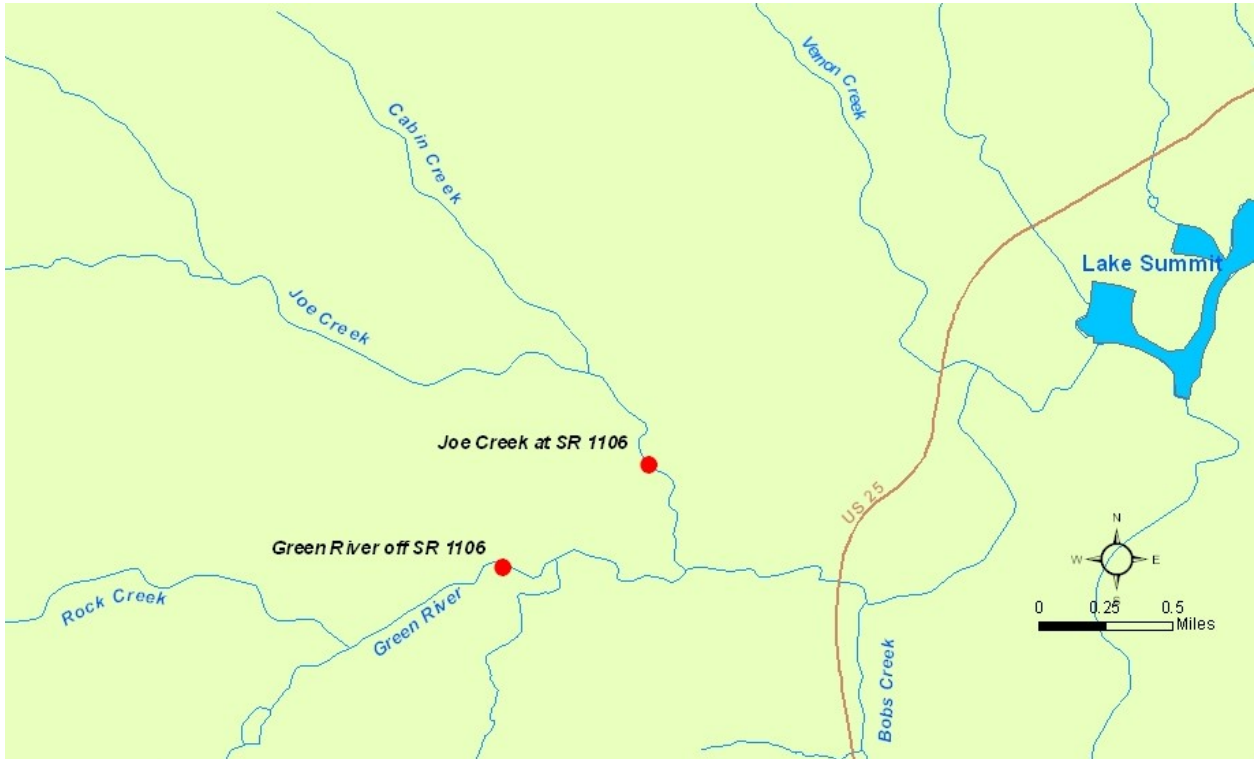


Figure 2. Benthic Macroinvertebrate Sampling Sites, Broad River Basin Special Studies. Subbasin 3 Henderson County, September 2005.



Green River off SR 1106



Located approximately three miles upstream of Lake Summit, this site on the Green River was 10 meters wide. The watershed appeared to be mostly agriculture, forest and residential. The drainage area of this location is 20 square miles. The substrate was a mix of boulder (15%), rubble (25%), gravel (15%), sand (35%), and silt (10%). Riffles were abundant, stream bank erosion was moderate, and the canopy provided ample shade. Riparian zones were narrow and lowered the overall habitat score (75). Conductivity was 21 $\mu\text{mhos/cm}$.

Joe Creek at SR 1106



Joe Creek is a small tributary to the Green River upstream of Lake Summit. At SR 1106, the drainage area is 5 square miles. The stream width was four meters. Agricultural fields were present on both sides of the stream and lowered the overall habitat score (61) by reducing the riparian zone width and the canopy. The substrate was a mixture of boulder (5%), rubble (35%), gravel (30%), and sand (30%). Conductivity was 29 $\mu\text{mhos/cm}$.

RESULTS AND CONCLUSIONS

Buffalo Creek, SR 1314 – Buffalo Creek rated Good (31 taxa) based on EPT criteria for mountain streams. Numerous intolerant taxa were collected, producing a low EPT BI (1.56). Notable intolerant taxa included *Danella lita*, *Drunella conestee*, *Stenonema meririvulanum*, and *Parapsyche cardis*. Sediment sensitive caddisflies (*Glossosoma*, *Goera*, *Neophylax mitchelli*, *N. oligius*, and *N. ornatus*) were collected on rocks. Considering the intolerant taxa collected and the Good rating, this site was not adversely affected by stressors in the watershed at the time of sampling. However, it is evident that extensive residential growth is occurring in this area. In addition, the rapid turbidity that occurred in the stream shortly after a rain event indicated land disturbance in the watershed. Future sampling is recommended to insure that watershed development does not adversely affect this small tributary to Lake Lure.

Little Whiteoak Creek, SR 1324 – Little Whiteoak Creek rated Good-Fair (19 EPT taxa). Cows had unlimited access to the stream at this location. The next upstream road crossing would not have included the South Branch Little Whiteoak Creek watershed, so SR 1324 was sampled for benthos. The presence of animal wastes confounds the analysis of stressors since the sampling was requested due to development concerns in the watershed. It is recommended that cow access to the stream be addressed by the appropriate agency. In addition, Polk Central High School discharges to Little Whiteoak Creek (as of 2003). The discharge is considered minor (<1 MGD per day) and is 100 percent domestic waste. Although the source or combination of sources was unclear, the conductivity (55 μ mhos/cm) was elevated at this location. For the most part, the taxa collected were moderately tolerant to tolerant (EPT BI = 5.20); however, several fairly intolerant taxa (*Eccopectura xanthenes*, *Pteronarcys*, and *Brachycentrus nigrosoma*) were collected in the sample.

Green River, off SR 1106 – The Green River off SR 1106 upstream of Lake Summit rated Good-Fair (21 EPT taxa and EPT BI = 3.08). Five benthic samples (four Full Scales and one EPT) have been collected at several locations above Lake Summit since 1989 and all samples resulted in Good or Excellent bioclassifications. The 2005 sample contained the lowest number of EPT taxa (21) ever for this stretch of the river. Samples from 1989 and 1993 ranged from 38 to 51 EPT. Though the 1989 and 1993 samples were collected in winter (January and late October) and the fact that Full Scale sampling methods typically produce more EPT taxa than EPT sampling methods, the 2005 sample still shows a decline in taxa. The 2005 sample contained a combination of tolerant and intolerant taxa. Intolerant taxa included *Heptagenia pulla*, *Epeorus rubidus*, *Neophemera purpurea*, *Beloneuria*, *Suwallia*, and *Brachycentrus spinae*. However, year round taxa (*Isonychia*, *Paragnetina immarginata*, *Rhyacophila fuscula*) and sediment sensitive caddisflies (*Glossosoma*, *Goera*) were not collected in 2005. Similar to other areas in the Broad basin, this area is impacted by increasing development as mountain property continues to be desirable for commercial and residential development. It is recommended that macroinvertebrate monitoring continue in the upper portion of the Green River watershed to determine if the 2005 decline in taxa was a real indication of declining water quality.

In addition, the Green River from its source to the downstream side of the mouth of Rock Creek is designated as High Quality Waters (HQW). The HQW section ends approximately one mile above the 2005 site. Future sampling is warranted based on the close proximity to HQW waters and the Good-Fair rating.

Joe Creek, SR 1106 – Joe Creek, a small tributary to the Green River above Lake Summit rated Good-Fair (27 EPT taxa) in 2005, barely missing a Good rating by one taxa. The same location was sampled in 1989 (Good-Fair rating, 28 EPT taxa, seasonal correction) and 2000 (Excellent rating, 38 EPT taxa) using the EPT method. The July 2000 sample contained 19 mayfly taxa while only 7 mayfly taxa were collected in the September 2005 sample. This difference in numbers would be affected partially by seasonality, but year round taxa (*Caenis*, *Isonychia*, *Baetis flavistriga*, and *B. intercalaris*) were not collected in 2005. In addition, sediment sensitive caddisflies (*Goera* and *Glossosoma*) were not as abundant in 2005 as in

2000. Similar to most of the Broad River Basin, this upper portion of the Green River watershed warrants future benthic sampling to monitor water quality.

Table 1. Benthic Macroinvertebrates Results and Site Characteristics. Broad River Basin Special Studies. 2005

Stream	Buffalo Creek	L White Oak Creek	Green River	Joe Creek
Location	SR 1314	SR 1324	Off SR 1106	SR 1106
Sample Type	EPT	EPT	EPT	EPT
Date	7/11/05	9/23/05	9/22/05	9/22/05
Ephemeroptera	11	10	10	7
Plecoptera	6	4	5	6
Trichoptera	14	5	6	14
EPT Richness	31	19	21	27
EPT Abundance	97	76	75	97
EPT Biotic Index	1.55	5.20	3.07	2.95
Bioclassification	Good	Good-Fair	Good-Fair	Good-Fair
Width	3	5	10	4
Depth	0.5	.3	.4	0.2
Drainage area (mi ²)	3	11	20	5
Canopy (%)	80	50	70	50
Substrate (%)				
Boulder	30	0	15	5
Rubble	30	0	25	35
Gravel	20	10	15	30
Sand	20	75	35	30
Silt	0	15	10	0
Channel modification	5	5	5	5
Instream habitat	14	13	16	13
Bottom substrate	12	3	12	14
Pool variety	6	6	6	6
Riffle habitats	16	0	14	7
Bank stability/vegetation	12	4	8	6
Light penetration	10	7	10	7
Riparian zone width	10	2	4	3
Total Score	85	40	75	61
Temperature (°C)	19	19	19	19
DO (mg/l)	8.0	7.1	8.1	8.1
Conductivity (µmhos/cm)	16	55	21	29
pH	6.0	6.6	6.5	6.8
County	Rutherford	Polk	Henderson	Henderson
Latitude	352908	351718	351211	351232
Longitude	821103	820652	822825	822751

Cc: Darlene Kucken, Planning Section
Roger Edwards, ARO

Table 2. List of Benthic Macroinvertebrates. Broad River Basin Special Studies. 2005

	Buffalo Cr SR 1314 7/11/2005	L Whiteoak CR SR 1324 9/23/2005	Green R off SR 1106 9/22/2005	Joe Cr SR 1106 9/22/2005
EPHEMEROPTERA				
ACENTRELLA PARVULA		R		
ACENTRELLA ALACHUA			R	
PLAUDITUS PUNCTIVENTRIS			C	
PLAUDITUS DUBIUS GP	C	R	A	A
BAETIS FLAVISTRIGA		C		
BAETIS INTERCALARIS		A		
BAETIS PLUTO		C		A
PSEUDOCLOEON PROPINQUUM		A		
BAETIS TRICAUDATUS	A			R
BAETISCA CAROLINA			R	
DANNELLA LITA	R			
DRUNELLA CONESTEE	A			
EPEORUS RUBIDUS	C			
EURYLOPHELLA SPP			R	R
HEPTAGENIA PULLA			R	
ISONYCHIA SPP	C	A		
LEUCROCUTA SPP	C		R	
NEOEPHEMERA PURPUREA			C	C
PARALEPTOPHLEBIA SPP		R	R	R
STENONEMA MERIRIVULANUM	R			
STENONEMA MODESTUM		A	A	A
STENONEMA PUDICUM	R			
SERRATELLA CAROLINA	R			
STENACRON CAROLINA	R			
TRICORYTHODES SPP		C		
PLECOPTERA				
ACRONEURIA ABNORMIS	A		C	A
BELONEURIA SP			R	
ECCOPTURA XANTHENES		R		
ISOPERLA HOLOCHLORA	R			
LEUCTRA SPP	C	C		C
MALIREKUS HASTATUS	C		R	A
PTERONARCYS SPP	C		C	C
PTERONARCYS PROTEUS		C		
SUWALLIA SPP			C	R
TALLAPERLA SPP	A	R		C
TRICHOPTERA				
BRACHYCENTRUS NIGROSOMA		R		
BRACHYCENTRUS SPINAE			A	A
CHEUMATOPSYCHE SPP	R	A	C	C
CHIMARRA SPP		R		
DIPLECTRONA MODESTA	C			
DOLOPHILODES SPP			C	R
GLOSSOSOMA SPP	C			R
GOERA SPP	C			
HYDROPSYCHE BETTENI		R		R
LEPIDOSTOMA SPP	R			R
NEOPHYLAX SPP				R
NEOPHYLAX MITCHELLI	C			
NEOPHYLAX OLIGIUS	R			

	Buffalo Cr SR 1314 7/11/2005	L Whiteoak CR SR 1324 9/23/2005	Green R off SR 1106 9/22/2005	Joe Cr SR 1106 9/22/2005
NEOPHYLAX ORNATUS	C			
PARANYCTIOPHYLAX CELTA	R			
PARAPSYCHE SPP				R
PARAPSYCHE CARDIS	R			
PSILOTRETA LABIDA				R
PYCNOPSYCHE SPP	R		A	C
PYCNOPSYCHE LEPIDA				R
RHYACOPHILA FUSCULA	C			R
RHYACOPHILA NIGRITA	C			
SYMPHITOPSYCHE SPARNA	C		C	C
TRIAENODES IGNITUS		C	C	C