# UT to Fourth Creek Stream Mitigation Site
# Water Sampling and Benthic Macroinvertebrate Survey
# TIP I-3819A

# Iredell County, North Carolina

# Year 6 Monitoring Report

*UT to Fourth Creek, Site 2 during 2021 survey*

# The North Carolina Department of Transportation
# Environmental Analysis Unit

**July 19, 2021**

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## 1.0 INTRODUCTION

The North Carolina Department of Transportation (NCDOT) is evaluating the benthic macroinvertebrate (BMI) community for the Unnamed Tributary (UT) to Fourth Creek Stream Mitigation Site, related to impacts associated with TIP I-3819A, located in Iredell County, North Carolina. The project includes three sites in UT to Fourth Creek (Figure 1). Three Oaks Engineering (Three Oaks) conducted the Monitoring Year (MY)-06 water sampling and benthic macroinvertebrate surveys on June 15, 2021. UT to Fourth Creek is a tributary to the South Yadkin River and is located within U.S. Geological Survey (USGS) Hydrologic Unit (HUC) #03040102 and NC Division of Water Resources (NCDWR) sub-basin 03-07-06 of the Yadkin-Pee Dee River Basin.

## 2.0 SITE DESCRIPTIONS

Collections of benthic macroinvertebrates were made from three sampling locations: Site 1, Site 2, and Site 3 (Appendix A, Figure 1). The stream conditions for 2021 MY-06 at each site were very similar in most respects to the 2014-2019 survey conditions, however during MY-06 surveys, moderate to significant red silt was present and layered over bottom substrate at Site 1 and Site 2. See Appendix C for MY-06 site photos.

**Site 1.** Site 1 is the most upstream site located on UT to Fourth Creek. At the time of the surveys, top of bank width was approximately 3 meters (m) while wetted width was between 1 and 2 m. The bank height was approximately 3 m from the deepest part of the channel to the top of bank with moderate bank erosion evident on the left descending bank. Water depth ranged from 0.2 to 0.3 m. Flow conditions were moderate and the channel was wetted in most of the reach with substrate exposed at the edges of meanders and in bars. The habitat consisted of a riffle/pool/run complex. Substrate was composed of cobble, gravel, sand, and silt. No aquatic vegetation was present (Appendix C, Photos 1 and 2). The riparian canopy on the left descending bank was narrow with mature trees, shrubs, and grasses; the riparian buffer on right descending bank was moderate with construction beyond the buffer. The surrounding buffer was dominated by shrubs and grasses with few mature trees. Significant red silt was present in the stream channel covering the substrate; this was not observed in previous survey years.

**Site 2.** Site 2 is located approximately 200 m downstream of Site 1. The stream was moderately channelized and narrow. The top of bank width was estimated to be 2 m and stream wetted width was approximately 1 m. The bank height from the deepest part of the channel to the top of bank was approximately 2 m, while water depth ranged from 0.1 to 0.2 m. Flow conditions were normal; the channel was wetted with little to no substrate exposed. In-stream habitat consisted of a riffle/pool/run complex with a run dominating the survey reach. The substrate was composed mainly of sand with some gravel and silt. There was very little aquatic vegetation (Appendix C, Photos 3 and 4). In contrast to Site 1 and Site 3, the riparian buffer was composed mostly of grasses and shrubs with only partial canopy shading by black willow saplings and herbaceous vegetation. Similar to Site 1, the right descending bank buffer was bordered by active construction and significant red silt deposition was present in the stream channel.

**Site 3.** Site 3 is the most downstream sampling site, approximately 600 m downstream of Site 2 and just downstream of Interstate 40. The top of bank width was approximately 4 m and stream wetted width ranged from 2 to 3 m. Bank height from the deepest part of the channel to the top of bank was approximately 3 m and stream depth ranged from 0.25 to 0.75 m. The stream banks exhibited severe erosion over much of the survey reach. Flow conditions were normal; the channel was wetted with little to no substrate exposed. Substrate was made up primarily of boulder, cobble, gravel, and sand with some silt present. Instream habitat consisted of a riffle/pool/run sequence (Appendix C, Photos 5 and 6). The riparian buffer was more mature than at the other sites and provided shade throughout the reach, however recent clearing has reduced the width of the riparian buffer on the right descending bank.

## 3.0 METHODOLOGY
### 3.1 BMI Sampling

MY-06 surveys were conducted on June 15, 2021, by Three Oaks Personnel Lizzy Stokes-Cawley, Evan Morgan, and Marissa Dellinger and NCDOT Personnel Matt Haney.

### 3.1.1 Field Methods

Water quality monitoring programs have been implemented by North Carolina Department of Environmental Quality (NCDEQ, formerly the NC Department of Environment and Natural Resources, NCDENR) Division of Water Resources (NCDWR) to assess water quality trends in North Carolina. One method used is the monitoring of BMI, or benthos, to assess water quality by sampling for selected organisms. The species richness and overall biomass, as well as the presence of various benthic groups intolerant of water quality degradation, are reflections of water quality.

Sites were sampled one time utilizing methodology described in the NCDWR's *Standard Operating Procedures for Collection and Analysis of Benthic Macroinvertebrates, Version 5.0* (NCDEQ 2016). All sites were sampled utilizing the NCDWR Qual 4 collection method with the addition of a log wash with a fine mesh sampler. Qualitative collections of aquatic macroinvertebrates were made with D-frame aquatic dip nets, kick nets, a #30 sieve sand sample, and hand picking organisms from substrates. A multiple habitat approach was used, where specimens from all available habitats (stream margins, leaf packs, aquatic vegetation, detritus, woody debris and logs, and sand accumulations) were combined to form one aggregate sample. Samples were preserved in the field with 90% ethyl alcohol and delivered to Eaton Scientific on June 15, 2021. Habitat scores were determined using the Habitat Assessment Field Data Sheet for Mountain/Piedmont Streams (Appendix D). Benthos Collection Cards are also included (Appendix D).

### 3.1.2 Water Chemistry

Water chemistry was measured at each site in conjunction with BMI sampling. Parameters measured were temperature, dissolved oxygen (DO), specific conductivity, and pH (Table 2).

### 3.1.3   Sample Processing

BMI were sorted from debris, counted, and identified to the lowest taxonomic level with microscopic techniques and taxonomic keys (Appendix B). Eaton Scientific maintains the collected specimens. Please note that a different lab (Pennington and Associates) was used to determine benthic species for MY-02, therefore those results are presented in a different format.

### 3.1.4   Data Analysis

Analysis of, and comparison between, the BMI communities at each site were determined with established indices and metrics described in the *Standard Operating Procedures for Collection and Analysis of Benthic Macroinvertebrates, Version 5.0* (NCDEQ 2016). The metrics used in this evaluation included total taxa richness; Ephemeroptera, Plecoptera, and Trichoptera (EPT) taxa richness; and NC Biotic Index (BI) assigned value (Table 1). Other information used in the analysis included Habitat Assessment Field Data Sheet scores, observations, and best professional judgment (Table 3). The primary output was a taxa list, which included total number of organisms, total number for each taxon, EPT index, and assigned BI values.

Several data-analysis summaries (metrics) can be produced from such samples to evaluate biological conditions. These metrics are based on the idea that unstressed streams and rivers have many invertebrate taxa and are dominated by intolerant species. Conversely, polluted or otherwise stressed 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 BI.

Total taxa, EPT taxa richness, and BI values were compared between sites and monitoring year. In general, higher EPT taxa richness values and lower BI values usually indicate better stream quality. BI ratings range from 1-10 with a score of 1 generally reflecting high stream quality based on benthic macroinvertebrate diversity and habitat availability, while a higher score generally reflects lower stream quality.

## 4.0  RESULTS

### 4.1  BMI Community Analysis

The taxa list, analysis metrics, and additional laboratory data are presented in Appendix B. Table 1 compiles the analysis metrics created from data collected from 2014 through 2021.

**Table 1. BMI Analysis Metrics**

| Date | Site | Total Taxa Richness | EPT Taxa Richness | Biotic Index |
|---|---|---|---|---|
| Baseline MY-00 (2014) | 1 | 31 | 11 | 4.7 |
| | 2 | 32 | 7 | 5.8 |
| | 3 | 40 | 10 | 6.1 |
| MY-01 (2015) | 1 | 17 | 8 | 4.5 |
| | 2 | 38 | 8 | 5.6 |
| | 3 | 26 | 7 | 5.6 |
| MY-02 (2016) | 1 | 39 | 12 | 5.5 |
| | 2 | 52 | 12 | 5.7 |
| | 3 | 55 | 11 | 6.1 |
| MY-03 (2017) | 1 | 23 | 6 | 4.9 |
| | 2 | 18 | 2 | 5.1 |
| | 3 | 27 | 7 | 5.7 |
| MY-04 (2018) | 1 | 18 | 6 | 5.0 |
| | 2 | 26 | 4 | 5.7 |
| | 3 | 35 | 7 | 5.6 |
| MY-05 (2019) | 1 | 38 | 9 | 5.6 |
| | 2 | 40 | 8 | 6.2 |
| | 3 | 24 | 6 | 5.9 |
| MY-06 (2021) | 1 | 33 | 7 | 5.4 |
| | 2 | 36 | 6 | 5.9 |
| | 3 | 27 | 9 | 6.0 |

## 4.2 Physicochemical Analysis

Measured water chemistry data is listed in Table 2.

**Table 2. Physicochemical Data**

| Sampling Date | Site | Water Temp (°C) | pH | Dissolved Oxygen (DO) (mg/L) | Specific Conductivity (uS/cm) |
|---|---|---|---|---|---|
| Baseline MY-00 (2014) | 1 | 18.6 | 8* | 9.6 | 197.3 |
| | 2 | 18.9 | 7.18* | 9.08 | 202.0 |
| | 3 | 20.7 | 7.43 | 8.4 | 110.0 |
| MY-01 (2015) | 1 | 20.3 | 7.85 | 8.13 | 193.2 |
| | 2 | 19.9 | 7.1 | 8.8 | 193.4 |
| | 3 | 24.5 | 7.3 | 7.02 | 106.2 |
| MY-02 (2016) | 1 | 22.0 | 6.95 | 8.07 | 193.2 |
| | 2 | 21.9 | 6.90 | 8.4 | 189.3 |
| | 3 | 24.4 | 7.85 | 8.28 | 129.7 |
| MY-03 (2017) | 1 | 18.6 | 8.1 | 8.2 | 200.8 |
| | 2 | 19.3 | 6.75 | 9.5 | 192.5 |
| | 3 | 25.5 | 7 | 7.5 | 102.7 |
| MY-04 (2018) | 1 | 17.3 | 7.06 | 11.48 | 188.3 |
| | 2 | 17.4 | 6.69 | 10.35 | 190.3 |
| | 3 | 23.1 | 7.55 | 9.6 | 98.0 |
| MY-05 (2019) | 1 | 15.7 | 6.76 | 8.21 | 227.0 |
| | 2 | 15.5 | 6.88 | 8.15 | 217.3 |
| | 3 | 20.6 | 7.2 | 8.29 | 109.2 |
| MY-06 (2021) | 1 | 18.4 | 6.45 | 7.71 | 164.1 |
| | 2 | 18.3 | 6.70 | 7.78 | 166.2 |
| | 3 | 25.0 | 6.78 | 7.71 | 111.9 |

*Re-measured on 5/23/14 due to pH probe malfunction.

## 4.3 Habitat Assessment Scores

Habitat scores were determined using the Habitat Assessment Field Data Sheet for Mountain/Piedmont Streams (Table 3). These visual-based habitat evaluation scores consist of eight parameters that rate channel modification, instream habitat, bottom substrate, pool variety, riffle habitat, bank stability and vegetation, light penetration, and riparian vegetation zone width for each sampling reach. A numerical score is used to rate each parameter and the total score gives a relative measure of overall habitat quality (Appendix D).

**Table 3. Habitat Assessment Scores**

| Sample Year | Site | Channel Modification | Instream Habitat | Bottom Substrate | Pool Variety | Riffle Habitats | Bank Stability and Vegetation | Light Penetration | Riparian Vegetation Zone Width | Total |
|---|---|---|---|---|---|---|---|---|---|---|
| Baseline MY-00 (2014) | 1 | 5 | 16 | 12 | 6 | 14 | 11 | 8 | 5 | 77 |
| | 2 | 3 | 10 | 3 | 4 | 3 | 4 | 2 | 0 | 29 |
| | 3 | 4 | 16 | 11 | 8 | 7 | 12 | 10 | 10 | 78 |
| MY-01 (2015) | 1 | 5 | 16 | 11 | 10 | 16 | 13 | 10 | 5 | 86 |
| | 2 | 4 | 10 | 3 | 6 | 7 | 8 | 7 | 10 | 55 |
| | 3 | 4 | 16 | 11 | 10 | 14 | 13 | 10 | 5 | 88 |
| MY-02 (2016) | 1 | 5 | 16 | 11 | 10 | 16 | 13 | 10 | 10 | 86 |
| | 2 | 4 | 10 | 3 | 6 | 7 | 11 | 7 | 10 | 58 |
| | 3 | 4 | 16 | 11 | 10 | 14 | 13 | 10 | 5 | 86 |
| MY-03 (2017) | 1 | 4 | 16 | 11 | 10 | 16 | 13 | 10 | 10 | 90 |
| | 2 | 4 | 10 | 3 | 6 | 7 | 11 | 7 | 10 | 58 |
| | 3 | 4 | 16 | 14 | 10 | 14 | 13 | 10 | 10 | 91 |
| MY-04 (2018) | 1 | 4 | 16 | 12 | 10 | 14 | 13 | 20 | 10 | 89 |
| | 2 | 4 | 10 | 3 | 6 | 7 | 11 | 7 | 9 | 57 |
| | 3 | 4 | 16 | 12 | 10 | 16 | 13 | 10 | 10 | 91 |
| MY-05 (2019) | 1 | 4 | 16 | 14 | 10 | 14 | 10 | 10 | 10 | 88 |
| | 2 | 4 | 11 | 3 | 6 | 7 | 12 | 7 | 9 | 59 |
| | 3 | 4 | 16 | 15 | 10 | 14 | 13 | 10 | 10 | 92 |
| MY-06 (2021) | 1 | 4 | 16 | 14 | 10 | 14 | 10 | 10 | 8 | 86 |
| | 2 | 4 | 11 | 3 | 6 | 7 | 11 | 7 | 7 | 56 |
| | 3 | 3 | 16 | 12 | 10 | 12 | 10 | 10 | 7 | 78 |
| Highest Possible Score | Total | 5 | 20 | 15 | 10 | 16 | 14 | 10 | 10 | 100 |

## 5.0 DISCUSSION/CONCLUSIONS

The benthic macroinvertebrate fauna were analyzed to produce BI values; physiochemical properties and habitat were measured to assess site quality. The 2021 MY-06 BI values range from 5.4 to 6.0 (mean 5.8) and, when compared to previous monitoring data, there is little change in BI values indicating little change in stream quality.

Water quality parameters measured included temperature, pH, DO, and specific conductivity. Overall, the water chemistry results were similar to previous monitoring years. According to the NCDEQ and U.S. Environmental Protection Agency (EPA) Water Quality Standards Table, all sites have pH and DO levels within the appropriate range for freshwater aquatic life. The pH range for freshwater aquatic wildlife is between 6 and 9 (NCDENR 2013) and Sites 1-3 ranged from 6.45 -

6.78 in 2021. The DO levels for all sites were above the minimum standard of 5.0 m/L ranging from 7.71 to 7.78 mg/L (NCDENR 2013). DO has consistently been above the minimum standard in all monitoring years. Specific conductivity readings within rivers in the United States generally range from 50 to 1500 µS/cm (EPA 2012). Studies of inland fresh waters indicate that streams supporting good mixed fisheries have a specific conductivity range between 150 and 500 µS/cm (EPA 2012). Sites 1-3 had results between 111.9 to 166.2 µS/cm. Specific conductivity ratings for all three sites were in range for streams in the United States: Sites 1 and 2 had specific conductivity readings of 164.1 uS/cm and 166.2 uS/cm, respectively, values which fall into the range for streams supporting good mixed fisheries.  Site 3's value of 111.9 fell outside of this range.

Total taxa values ranged between 27 and 36 and EPT Taxa Richness between 6 and 9 at all three sites. Habitat assessment scores in 2021 were similar to scores in 2019. Prior to 2019, there had been overall improvement in habitat assessment scores with the biggest improvement seen from the baseline surveys in 2014 to MY-01 surveys in 2015. During sampling in 2021, both Sites 1 and 2 exhibited moderate to significant siltation within the stream channel. Red silt, most likely erosion from nearby construction, was evident in both reaches. The siltation was not observed or noted in previous years. In fall 2018, the region was hit by damaging flooding associated with Hurricanes Florence and Michael. Sites 2 and 3 exhibited moderate to severe bank erosion first noted in 2019 sampling; the erosion is still present and worsening in portions of Site 3.

This data provides baseline and post construction conditions for aquatic community parameters in the project area that can be used to monitor changes in water quality over time.

## 6.0 LITERATURE CITED

NC Department of Environment and Natural Resources (NCDENR). 2013. North Carolina Surface Waters and Wetland Standards (NC Administrative Code 15A NCAC 02B. .0100 & .0200) Amended Effective April 1, 2003.

NC Department of Environmental Quality (NCDEQ). 2016. Standard Operating Procedures for the Collection and Analysis of Benthic Macroinvertebrates, Version 5.0. Division of Water Resources. Raleigh, North Carolina. February 2016.

U.S. Environmental Protection Agency (EPA). 2012. Water: Monitoring & Assessment. 5.9 Conductivity. What is conductivity and why is it important? http://water.epa.gov/type/rsl/monitoring/vms59.cfm

**Appendix A.**

**BMI Survey Site Location Map**

Site 1

Site 2

UT to Fourth Creek

Site 3

▲ Sampling Points

—— Streams

Sources: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Prepared For:
STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION

THREE OAKS ENGINEERING · THREE OAKS ENGINEERING ·

UT to Fourth Creek Stream
Mitigation Site (STIP I-3819A)

Water Sampling and Benthic
Macroinvertebrate Survey

Iredell County, North Carolina

Date: July 2021

Scale:
0    50    100 Meters

Job No.: 21-315

Drawn By: LSC      Checked By: TED

Figure

1

**Appendix B.**

**Benthic Macroinvertebrate Survey Results**

**Table 4**.  **Baseline MY-00 (2014) and MY-01 (2015) Taxa list with indications of relative abundance for Sites 1-3.**
**[A=Abundant (>10), C=Common (3-9), and R=Rare (1-2)]**

| | 2014 | | | 2015 | | |
|---|---|---|---|---|---|---|
| Site: | 1 | 2 | 3 | 1 | 2 | 3 |
| **EPHEMEROPTERA** | | | | | | |
| *Maccaffertium modestum* | A | A | C | A | A | A |
| *Baetis flavistriga* | R | - | R | - | - | - |
| *Baetis intercalaris* | R | - | C | - | - | R |
| *Baetis pluto* | A | A | C | A | C | - |
| *Labiobaetis frondale* | C | R | - | - | R | - |
| *Labiobaetis propinquum* | - | R | C | - | R | - |
| *Callibaetis* sp | - | - | - | R | - | - |
| *Eurylophella verisimilis* | R | C | - | - | - | - |
| | | | | | | |
| **PLECOPTERA** | | | | | | |
| *Eccoptura xanthenes* | - | - | R | - | - | - |
| *Amphinemura* sp | - | - | C | - | - | - |
| | | | | | | |
| **TRICHOPTERA** | | | | | | |
| *Cheumatopsyche* spp | R | - | A | C | A | C |
| *Hydropsyche betteni* | C | - | A | C | C | A |
| *Diplectrona modesta* | C | - | - | C | C | - |
| *Chimarra* sp | - | - | - | A | A | C |
| *Oecetis persimilis* | - | - | R | - | - | - |
| *Neophylax atlanta* | A | - | - | A | - | - |
| *Pycnopsyche* sp | R | R | - | - | - | R |
| *Ironoquia punctatissima* | - | R | - | - | - | - |
| *Lype diversa* | - | - | - | - | - | R |
| | | | | | | |
| **COLEOPTERA** | | | | | | |
| *Macronychus glabratus* | - | - | C | - | - | C |
| *Stenelmis* sp | - | - | R | - | C | C |
| *Helichus* spp | R | C | - | - | R | - |
| *Anchytarsus bicolor* | - | - | R | - | - | C |
| *Neoporus* spp | R | C | - | - | C | - |
| *Dineutus* sp | - | - | C | - | - | R |
| *Cymbiodyta* sp | - | - | - | - | R | - |
| | | | | | | |
| **ODONATA** | | | | | | |
| *Calopteryx* sp | A | C | C | - | A | R |
| *Gomphus* sp | - | - | R | - | - | - |
| *Lanthus* sp | - | - | - | - | R | - |
| *Baesiaeschna janata* | - | - | C | - | - | - |
| *Boyeria vinosa* | - | - | R | - | C | C |
| *Cordulegaster* sp | - | - | - | - | R | - |
| | | | | | | |
| **MEGALOPTERA** | | | | | | |
| *Nigronia serricornis* | - | - | R | R | - | C |
| *Corydalus cornutus* | - | - | R | - | - | R |
| | | | | | | |
| **DIPTERA: MISC.** | | | | | | |
| *Dicranota* sp | C | R | R | R | R | - |

| | 2014 | | | 2015 | | |
|---|---|---|---|---|---|---|
| Site: | 1 | 2 | 3 | 1 | 2 | 3 |
| *Anthocha* sp | - | - | - | *R* | - | - |
| *Hexatoma* sp | - | - | R | - | - | - |
| *Pseudolimnophila* sp | *R* | *C* | - | - | *R* | - |
| *Simulium* spp | *A* | *A* | *A* | *R* | *C* | *A* |
| *Dixa* spp | *A* | *R* | *C* | - | *C* | *R* |
| Muscidae (*Limnophora*?) | - | C | - | - | - | - |
| Empididae | - | - | - | - | R | - |

DIPTERA: CHIRONOMIDAE

| | 2014 | | | 2015 | | |
|---|---|---|---|---|---|---|
| *Conchapelopia* group | *C* | *C* | *C* | *C* | *A* | *R* |
| *Zavrelimyia* sp | - | *R* | - | *R* | - | - |
| *Brillia* sp | *R* | - | - | - | - | - |
| *Cricotopus annulator* Gr | *C* | *C* | - | - | - | - |
| *Orthocladius obumbratus* | *R* | *A* | - | - | - | - |
| *Paraphaenocladius* sp | - | *R* | - | - | - | - |
| *Parametriocnemus lundbecki* | *C* | - | - | *R* | *A* | *C* |
| *Tvetenia bavarica* gr | - | - | *R* | - | *R* | - |
| *Eukiefferiella claripennis* gr | *R* | *R* | - | - | - | - |
| *Odontomesa fulva* | *C* | *C* | - | - | - | - |
| *Chironomus* sp | *C* | *C* | *R* | *R* | *C* | - |
| *Cryptochironomus* spp | - | *R* | *R* | - | *C* | - |
| *Microtendipes* sp | - | - | - | - | *R* | - |
| *Paratendipes* sp | *R* | *C* | - | - | *R* | - |
| *Phaenopsectra obediens* gr | - | *C* | *R* | - | *R* | - |
| *Phaenopsectra* sp | - | - | - | - | *R* | - |
| *Polypedilum flavum* | *C* | *R* | *C* | - | *A* | *C* |
| *Polypedilum tritum* | *R* | - | *R* | - | - | - |
| *Polypedilum fallax* | - | *R* | - | - | - | - |
| *Polypedilum illinoense* | - | - | - | - | *R* | - |
| *Stenochironomus* sp | - | - | - | - | - | *R* |
| *Stictochironomus* sp | *C* | - | - | - | *C* | - |
| *Tribelos jucundum* | - | - | *R* | - | - | - |
| *Micropsectra* sp | *C* | *C* | - | - | *C* | - |
| *Paratanytarsus* sp | - | - | *R* | - | - | - |
| *Rheotanytarsus* spp | - | - | *R* | - | - | *R* |

OLIGOCHAETA

| | 2014 | | | 2015 | | |
|---|---|---|---|---|---|---|
| *Stylaria lacustris* | - | - | *R* | - | - | - |
| *Ecclipidrilus* spp | - | - | *R* | - | - | - |

CRUSTACEA

| | 2014 | | | 2015 | | |
|---|---|---|---|---|---|---|
| *Caecidotea* sp *(small)* | - | *C* | *R* | - | *R* | *R* |
| *Cambarus* spp | - | - | *A* | *R* | - | *A* |

MOLLUSCA

| | 2014 | | | 2015 | | |
|---|---|---|---|---|---|---|
| *Corbicula fluminea* | - | - | *A* | - | - | *A* |

OTHER
Hirudinea

| | 2014 | | | 2015 | | |
|---|---|---|---|---|---|---|
| *Placobdella parasitica* | - | - | *R* | - | - | - |

Hemiptera

| | 2014 | | | 2015 | | |
|---|---|---|---|---|---|---|
| Corixidae | - | - | - | - | R | - |

**Table 5.  2016 MY-02 Taxa list.**

| STATION | | | SITE 1 | SITE 2 | SITE 3 |
|---|---|---|---|---|---|
| SPECIES | T.V. | F.F.G. | | | |
| | | | | | |
| **MOLLUSCA** | | | | | |
| **Bivalvia** | | | | | |
| **Veneroida** | | | | | |
| **Corbiculidae** | | | | | |
| *Corbicula fluminea* | 6.6 | FC | | | 6 |
| **Gastropoda** | | | | | |
| **Mesogastropoda** | | | | | |
| **Pleuroceridae** | **2.7** | | | | |
| *Elimia proxima* | 2.7 | SC | | | 9 |
| **Basommatophora** | | | | | |
| Ancylidae | | SC | | | |
| *Ferrissia rivularis* | 6.6 | SC | | | 1 |
| **ANNELIDA** | | | | | |
| **Clitellata** | | | | | |
| **Oligochaeta** | | **CG** | | | |
| **Tubificida** | | | | | |
| **Naididae** | | | | | |
| Naidinae | | CG | | | 1 |
| *Nais behningi* | 8.7 | CG | | | 2 |
| *Nais communis* | 8.7 | CG | | 1 | 2 |
| *Nais sp.* | 8.7 | CG | | | 1 |
| Tubificinae w.h.c. | | CG | | | 2 |
| Tubificinae w.o.h.c. | | CG | 1 | | 9 |
| **Pristininae** | | | | | |
| *Pristina sp.* | 7.7 | CG | | 1 | 2 |
| **ARTHROPODA** | | | | | |
| **Arachnoidea** | | | | | |
| Acariformes | | | | 3 | 2 |
| **Sperchontidae** | | | | | |
| *Sperchon sp.* | | | | | 1 |
| **Crustacea** | | | | | |
| **Isopoda** | | | | | |
| **Asellidae** | | **SH** | | | |
| *Caecidotea sp.* | 8.4 | CG | 3 | 1 | |
| **Decapoda** | | | | | |
| Cambaridae | | | 16 | | |
| *Cambarus sp.* | 7.5 | CG | 2 | 11 | 3 |
| **STATION** | | | **SITE 1** | **SITE 2** | **SITE 3** |

| SPECIES | T.V. | F.F.G. | | | |
|---|---|---|---|---|---|
| **Insecta** | | | | | |
| **Collembola** | | | | | |
| Isotomidae | | | 3 | 8 | |
| **Ephemeroptera** | | | | | |
| Baetidae | | CG | 3 | | 2 |
| *Acentrella sp.* | 2.5 | CG | 1 | | |
| *Baetis sp.* | | CG | | 2 | |
| *Baetis intercalaris* | 5 | CG | | 2 | 5 |
| *Baetis pluto* | 3.4 | | | 2 | |
| *Labiobaetis sp.* | | CG | | 1 | 1 |
| Ephemerellidae | | SC | 1 | | |
| Heptageniidae | | SC | 4 | | 13 |
| *Maccaffertium sp.* | | SC | 59 | 34 | 30 |
| Leptophlebiidae | | CG | | 3 | |
| **Odonata** | | | | | |
| Aeshnidae | | P | | | 1 |
| Calopterygidae | | P | | | |
| *Hetaerina sp.* | 4.9 | P | 8 | 25 | 20 |
| **Coenagrionidae** | | **P** | | | |
| *Argia sp.* | 8.3 | P | | | 2 |
| Cordulegastridae | | P | | | |
| *Cordulegaster sp.* | 5.7 | P | 1 | 1 | |
| Gomphidae | | P | | 1 | 1 |
| *Progomphus obscurus* | 8.2 | P | | 1 | 2 |
| *Stylogomphus albistylus* | 5 | P | 2 | 4 | |
| **Hemiptera** | | | | | |
| Veliidae | | P | 1 | 2 | |
| *Rhagovelia obesa* | | P | 3 | | |
| **Trichoptera** | | | | | |
| Hydropsychidae | | FC | 22 | | 13 |
| *Cheumatopsyche sp.* | 6.6 | FC | | | 17 |
| *Diplectrona modesta* | 2.3 | FC | 8 | 8 | |
| *Hydropsyche depravata gp.* | 7.9 | FC | | 1 | 14 |
| *Hydropsyche sp.* | | FC | 2 | 1 | 19 |
| Lepidostomatidae | | SH | | | |
| *Lepidostoma sp.* | 1 | FC | 11 | 3 | |
| Leptoceridae | | CG | | | 1 |
| Philopotamidae | | FC | | | |
| *Chimarra aterrima* | 3.3 | FC | 27 | 7 | 7 |
| *Dolophilodes distinctus* | 1 | FC | 1 | | |
| **Psychomyiidae** | | **CG** | | | |
| **STATION** | | | **SITE 1** | **SITE 2** | **SITE 3** |

| SPECIES | T.V. | F.F.G. | | | |
|---|---|---|---|---|---|
| *Lype diversa* | 3.9 | SC | 2 | | |
| **Rhyacophilidae** | | **P** | | | |
| *Rhyacophila carolina* | 0.4 | P | | 1 | |
| **Coleoptera** | | | | | |
| **Dryopidae** | | | | | |
| *Helichus sp.* | 4.1 | SC | | 1 | |
| **Elmidae** | | **CG** | | | |
| *Macronychus glabratus* | 4.7 | SH | | | 5 |
| *Optioservus sp.* | 2.1 | SC | | | 1 |
| *Stenelmis sp.* | 5.6 | SC | 5 | 4 | 6 |
| Ptilodactylidae | | SH | | | |
| *Anchytarsus bicolor* | 2.4 | SH | | | 3 |
| **Diptera** | | | | | |
| **Ceratopogonidae** | | **P** | | | |
| *Atrichopogon sp.* | 6.1 | P | 2 | | |
| **Chironomidae** | | | | | |
| *Ablabesmyia mallochi* | 7.4 | P | | | 7 |
| *Conchapelopia sp.* | 8.4 | P | 30 | 35 | 18 |
| *Corynoneura sp.* | 5.7 | CG | 3 | 2 | 5 |
| *Cryptochironomus sp.* | 6.4 | P | | | 1 |
| *Eukiefferiella sp.* | | CG | 2 | | |
| *Eukiefferiella claripennis gp.* | 6.2 | CG | 2 | 1 | |
| *Nilotanypus fimbriatus* | 4.1 | | | | 2 |
| *Odontomesa fulva* | 4.9 | | | 1 | |
| *Paracladopelma sp.* | 6.3 | CG | | | 1 |
| *Parametriocnemus sp.* | 3.9 | CG | 10 | 15 | 14 |
| *Paratanytarsus dissimilis* | 8 | | | | 1 |
| *Paratendipes albimanus/duplicatus* | 5.6 | | | 2 | |
| *Phaenopsectra obediens gp.* | 6.6 | SC | 40 | 2 | 1 |
| *Phaenopsectra punctipes gp.* | 7.1 | SC | 2 | | |
| *Polypedilum fallax gp.* | 6.5 | SH | | 1 | |
| *Polypedilum flavum* | 5.7 | SH | 3 | 15 | 20 |
| *Polypedilum illinoense gp.* | 8.7 | SH | 10 | 4 | |
| *Pseudosmittia sp.* | | CG | | 1 | |
| *Rheotanytarsus exiguus gp.* | 6.5 | FC | 13 | 16 | 14 |
| *Rheotanytarsus pellucidus* | 6.5 | FC | | 2 | |
| *Rheocricotopus robacki* | 7.9 | CG | | | 4 |
| *Stenochironomus sp.* | 6.3 | SH | | | 6 |
| *Tanytarsus sp.* | 6.6 | FC | 3 | 5 | 1 |
| *Thienemanniella xena* | 8 | CG | | | 1 |
| *Tribelos jucundum* | 5.7 | | | | 1 |
| **STATION** | | | **SITE 1** | **SITE 2** | **SITE 3** |

| SPECIES | T.V. | F.F.G. | | | |
|---|---|---|---|---|---|
| *Zavrelimyia sp.* | 8.6 | P | 2 | 1 | 2 |
| **Dixidae** | | **CG** | | | |
| *Dixa sp.* | 2.5 | CG | 1 | 2 | 1 |
| Dolichopodidae | | P | | 2 | |
| Empididae | | P | | 1 | |
| *Hemerodromia sp.* | | P | | 1 | 5 |
| **Psychodidae** | | **CG** | | | |
| *Pericoma sp.* | | CG | | 2 | |
| Sciaridae | | | | 1 | |
| Simuliidae | | FC | | | |
| *Simulium tuberosum* | 4.9 | FC | | 9 | 4 |
| Tabanidae | | PI | | | |
| *Tabanus sp.* | 8.5 | PI | | | 1 |
| Tipulidae | | SH | | 1 | |
| *Dicranota sp.* | 0 | P | 1 | 6 | |
| *Limnophila sp.* | | P | | | 1 |
| *Pseudolimnophila sp.* | 6.2 | P | 17 | 15 | |
| *Tipula sp.* | 7.5 | SH | | 1 | |
| | | | | | |
| TOTAL NO. OF ORGANISMS | | | 327 | 273 | 315 |
| TOTAL NO. OF TAXA | | | 39 | 52 | 55 |
| EPT INDEX | | | 12 | 12 | 11 |
| **NCBI Assigned values** | | | **5.48** | **5.67** | **6.09** |

**Table 6. Taxa richness and summary parameters, UT to Fourth Creek, Iredell County, North Carolina, May 2014, June 2015, and June 2016.**

|  | 2014 | | | 2015 | | | 2016 | | |
|---|---|---|---|---|---|---|---|---|---|
|  | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 |
| Ephemeroptera | 6 | 5 | 5 | 3 | 4 | 2 | 66 | 42 | 49 |
| Plecoptera | - | - | 2 | - | - | - | - | - | - |
| Trichoptera | 5 | 2 | 3 | 5 | 4 | 5 | 73 | 21 | 71 |
| Coleoptera | 2 | 2 | 4 | - | 4 | 4 | 5 | 5 | 15 |
| Odonata | 1 | 2 | 4 | - | 4 | 2 | 11 | 32 | 26 |
| Megaloptera | - | - | 2 | 1 | - | 2 | - | - | - |
| Diptera; Misc. | 4 | 6 | 5 | 4 | 6 | 3 | 2 | - | - |
| Diptera: Chironomidae | 13 | 14 | 10 | 4 | 13 | 5 | 120 | 103 | 99 |
| Oligochaeta | - | - | 2 | - | - | - | 1 | 2 | 19 |
| Crustacea | - | 1 | 2 | - | 2 | 2 | 21 | 12 | 3 |
| Mollusca | - | - | 1 | - | - | 1 | - | - | 6 |
| Other | - | - | 1 | - | 1 | - | 45 | 67 | 37 |
| | | | | | | | | | |
| Total Taxa Richness | 31 | 32 | 41 | 17 | 38 | 26 | 327 | 273 | 315 |
| EPT Taxa Richness | 11 | 7 | 10 | 8 | 8 | 7 | 39 | 52 | 55 |
| NC Biotic Index | 4.7 | 5.8 | 6.1 | 4.5 | 5.6 | 5.6 | 5.5 | 5.7 | 6.9 |
| | | | | | | | | | |
| Bioclassification (Small stream*) | G | G-F | F | G | G-F | G-F | G-F | G-F | F |

*Assumes permanent flow, unlikely for these streams—. Sites 2 and 3 fall right on the dividing line between Good-Fair and Fair; they are not significantly different.
G=Good, G-F=Good-Fair, F=Fair

**Table 7. Taxa list with indications of relative abundance for Sites 1-3, UT to Fourth Creek, Iredell County, North Carolina, MY-03 (2017).**
**[A=Abundant (>10), C=Common (3-9), and R=Rare (1-2)]**

| Taxa / UT Fourth Cr | 1 | 2 | 3 |
|---|---|---|---|
| EPHEMEROPTERA | | | |
| Family Baetidae | | | |
| *Baetis intercalaris (5.0)* | - | - | C |
| *Baetis pluto (3.4)* | C | - | - |
| *Pseudocloeon frondalis (4.6)* | - | R | R |
| Family Heptageniidae | - | - | - |
| *Maccaffertium modestum (5.7)* | A | R | A |
| PLECOPTERA | | | |
| Family Perlidae | - | - | R |
| TRICHOPTERA | | | |
| Family Hydropsychidae | | | |
| *Cheumatopsyche spp (6.6)* | C | - | A |
| *Diplectrona modesta (2.3)* | A | - | - |
| *Hydropsyche betteni (7.9)* | - | - | A |

| | | | |
|---|---|---|---|
| Family Limnephilidae | | | |
| *Neophylax atlanta* | A | - | - |
| Family Philopotamidae | | | |
| *Chimarra spp (3.3)* | A | - | A |
| MISC DIPTERA | | | |
| Family Culicidae | | | |
| *Anopheles sp (8.6)* | - | R | - |
| Family Dixidae | | | |
| *Dixa spp (2.5)* | C | C | - |
| *Dixella spp (4.9)* | R | C | - |
| Family Simuliidae | | | |
| *Simulium spp (4.9)* | C | - | A |
| Family Tipulidae | | | |
| *Antocha spp (4.4)* | R | - | - |
| *Dicranota spp (0)* | - | R | R |
| *Hexatoma spp (3.5)* | | | R |
| *Pseudolimnophila spp (6.2)* | R | R | R |
| *Tipula spp (7.5)* | R | R | C |
| DIPTERA; CHIRONOMIDAE | | | |
| *Brillia flavifrons (5.7)* | - | R | - |
| *Chironomus spp (9.3)* | - | - | R |
| *Corynoneura spp (5.7)* | R | - | R |
| *Nilotanypus spp (4.1)* | - | - | R |
| *Parametriocnemus lundbecki (3.7)* | C | - | R |
| *Paratendipes albimanus (5.6)* | - | R | - |
| *Polypedilum aviceps (3.6)* | C | R | A |
| *Polypedilum flavum (5.7)* | | | A |
| *Polypedilum illinoense (8.7)* | C | C | R |
| *Polypedilum tritum* | R | - | - |
| *Tanypus neopunctipenis* | - | - | R |
| *Thienemannimyia group (8.4)* | C | R | C |
| *Zavrelimyia spp (6.1)* | - | R | - |
| COLEOPTERA | | | |
| Family Dryopidae | | | |
| *Helichus spp (4.1)* | - | R | - |
| Family Dytiscidae | | | |
| *Agabus spp (8.9)* | - | R | - |
| *Neoporus spp (5.0)* | - | R | - |
| Family Elmidae | | | |
| *Stenelmis spp (5.6)* | R | - | R |
| Family Gyrinidae | | | |
| *Dineutus spp (5.0)* | - | - | R |
| ODONATA | | | |

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| | | | |
|---|---|---|---|
| Family Aeshnidae | | | |
| *Boyeria vinosa (5.6)* | - | - | C |
| Family Calopterygidae | | | |
| *Calopteryx spp (7.5)* | R | C | R |
| Family Coenagrionidae | | | |
| *Argia spp (8.3)* | - | - | C |
| OLIGOCHAETA | | | |
| Family Naidae | | | |
| *Pristina spp (7.7)* | R | - | C |
| MEGALOPTERA | | | |
| Family Corydalidae | | | |
| *Nigronia serricornis (4.6)* | - | - | C |
| CRUSTACEA | | | |
| Family Asellidae | | | |
| *Caecidotea spp (8.4)* | C | - | C |
| OTHER TAXA | | | |
| Family Vellidae | | | |
| *Rhagovelia spp* | R | - | - |
| | | | |
| Site | 1 | 2 | 3 |
| Total Taxa Richness | 23 | 18 | 27 |
| EPT Taxa Richness | 6 | 2 | 7 |
| EPT Abundance | 46 | 2 | 45 |
| Taxa $\leq$ 4.0 Biotic Index | 6 | 2 | 5 |
| Biotic Index | 4.88 | 5.09 | 5.71 |

**Table 8**. **Taxa list with indications of relative abundance for Sites 1-3, UT to Fourth Creek, Iredell County, North Carolina, MY-04 (2018).**
**[A=Abundant (>10), C=Common (3-9), and R=Rare (1-2)]**

| Statesville I-3819-A | 1 | 2 | 3 |
|---|---|---|---|
| Taxa / Biotic Index Value | | | |
| EPHEMEROPTERA | | | |
| Family Baetidae | | | |
| *Baetis pluto (3.4)* | R | - | - |
| Family Ephemerellidae | | | |
| *Euryloplella funeralis (2.5)* | R | - | - |
| Family Heptageniidae | | | |
| *Maccaffertium modestum (5.7)* | A | A | A |
| TRICHOPTERA | | | |
| Family Hydropsychidae | | | |
| *Ceratopsyche sparna (2.5)* | | | |
| *Cheumatopsyche spp (6.6)* | C | R | A |

| | | | |
|---|---|---|---|
| *Diplectrona modesta (2.3)* | A | C | R |
| *Hydropsyche betteni (7.9)* | - | - | C |
| Family Limnephilidae | | | |
| *Pycnopsyche sp. (2.5)* | - | - | R |
| Family Philopotamidae | | | |
| *Chimarra spp (3.3)* | A | R | C |
| Family Psychomyiidae | | | |
| *Lype Diversa (3.9)* | - | - | R |
| MISC DIPTERA | | | |
| Family Dixidae | | | |
| *Dixa spp (2.5)* | C | R | R |
| *Dixella spp (4.9)* | R | R | - |
| Dolichopodidae | - | R | - |
| Family Simuliidae | | | |
| *Simulium spp (4.9)* | R | R | A |
| Family Tipulidae | | | |
| *Antocha spp (4.4)* | - | - | R |
| *Dicranota spp (0.0)* | R | - | R |
| *Pseudolimnophila spp (6.2)* | R | - | - |
| *Tipula spp (7.5)* | - | - | R |
| Family Ptychopteridae | | | |
| *Bitticomorpha* | - | R | - |
| DIPTERA; CHIRONOMIDAE | | | |
| *Brillia flavifrons (3.9)* | - | R | R |
| *Corynoneura spp (5.7)* | - | R | - |
| *Parametriocnemus lundbecki (3.7)* | - | R | R |
| *Paratanytarsus spp (8.0)* | - | R | - |
| *Phaenopscetra obediens gp (6.5)* | R | R | - |
| *Polypedilum aviceps (3.6)* | - | R | - |
| *Polypedilum flavum (5.7)* | - | R | C |
| *Polypedilum illinoense (8.7)* | C | R | R |
| *Polypedilum tritum* | R | R | R |
| *Rheotanytarsus spp (6.5)* | | | R |
| *Stictochironomus devinctus (5.4)* | - | R | - |
| *Thienemaniella spp (6.4)* | - | - | R |
| *Thienemannimyia group (8.4)* | R | R | C |
| *Tribelos jacundum (5.7)* | - | - | R |
| *Tvetenia bavarica gp (E sp 1) (3.6)* | - | - | R |
| COLEOPTERA | | | |
| Family Dryopidae | | | |
| *Helichus spp (4.1)* | - | R | R |
| Family Elmidae | | | |
| *Macronychus glabratus (4.7)* | - | - | R |
| Stenelmis spp (5.6) | C | C | R |
| Family Gyrinidae | | | |

| | | 1 | 2 | 3 |
|---|---|---|---|---|
| *Dineutus spp (5.0)* | | - | - | R |
| Family Ptilodactylidae | | | | |
| *Anchytarsus bicolor (2.4)* | | - | - | R |
| ODONATA | | | | |
| Family Aeshnidae | | | | |
| *Boyeria vinosa (5.6)* | | - | R | R |
| Family Calopterygidae | | | | |
| *Calopteryx spp (7.5)* | | A | A | - |
| Family Coenagrionidae | | | | |
| *Argia spp (8.3)* | | - | - | R |
| Family Gomphidae | | | | |
| *Gomphus spp (5.9)* | | - | - | R |
| *Ophiogomphus spp (5.9)* | | - | - | R |
| *Stylogomphus albistylus (5.0)* | | - | C | - |
| OLIGOCHAETA | | | | |
| Family Naidae | | | | |
| *Nais spp (8.7)* | | - | - | R |
| Family Tubificidae | | | | |
| *Immature Tubificidae w/o hair setae (7.1)* | | - | - | R |
| CRUSTACEA | | | | |
| Family Asellidae | | | | |
| *Caecidotea spp (8.4)* | | R | - | - |
| Family Cambaridae | | | | |
| *immature crayfish (7.5)* | | - | - | R |
| OTHER TAXA | | | | |
| Family Veliidae | | | | |
| *Rhagovelia spp* | | - | C | R |

| Site | 1 | 2 | 3 |
|---|---|---|---|
| Total Taxa Richness | 18 | 26 | 35 |
| EPT Taxa Richness | 6 | 4 | 7 |
| EPT Abundance | 35 | 15 | 29 |
| Biotic Index | 4.98 | 5.71 | 5.63 |

**Table 9**. **Taxa list with indications of relative abundance for Sites 1-3, UT to Fourth Creek, Iredell County, North Carolina, MY-05 (2019).**
**[A=Abundant (>10), C=Common (3-9), and R=Rare (1-2)]**

| Statesville restoration sites | 1 | 2 | 3 |
|---|---|---|---|
| Taxa / Biotic Index Value | | | |
| EPHEMEROPTERA | | | |
| Family Baetidae | | | |
| Baetis flavistriga (6.8) | R | R | |
| Baetis intercalaris (5.0) | | | R |
| Baetis pluto (3.4) | A | C | |
| Labiobaetis frondalis (4.6) | R | C | |
| Labiobaetis propinquus (5.8) | | R | |
| Family Heptageniidae | | | |
| Maccaffertium modestum (5.7) | A | C | C |
| TRICHOPTERA | | | |
| Family Hydropsychidae | | | |
| Cheumatopsyche spp (6.6) | A | C | A |
| Diplectrona modesta (2.3) | C | | R |
| Hydropsyche betteni (7.9) | A | C | C |
| Family Philopotamidae | | | |
| Chimarra spp (3.3) | A | R | C |
| Family Psychomyiidae | | | |
| Lype Diversa (3.9) | C | | |
| MISC DIPTERA | | | |
| Family Ceratopogonidae | | | |
| Palpomyia complex (5.7) | | | |
| Family Dixidae | | | |
| Dixa spp (2.5) | R | | |
| Dixella spp (4.9) | | R | |
| Dolichopodidae | | R | |
| Family Simuliidae | | | |
| Simulium spp (4.9) | C | C | A |
| Family Tipulidae | | | |
| Hexatoma spp (3.5) | R | | |
| Polymeda/Ormosa spp (6.5) | | R | |
| Pseudolimnophila spp (6.2) | C | C | |
| Tipula spp (7.5) | R | R | R |
| DIPTERA; CHIRONOMIDAE | | | |
| Ablabesmyia mallochi (7.4) | R | | |
| Brillia flavifrons (5.7) | R | | R |
| Chironomus spp (9.3) | R | | |
| Corynoneura spp (5.7) | R | | |
| Cryptochironomus fulvus (6.7) | | R | R |
| Dicrotendipes neomodestus (7.9) | | R | |
| Microtendipes pedellus (4.6) | R | R | |

| Taxon | | | | |
|---|---|---|---|---|
| Parametriocnemus lundbecki (3.7) | R | | | |
| Paratanytarsus spp (8.0) | R | | | |
| Paratendipes albimanus (5.6) | R | | | |
| Phaenopscetra obediens gp (6.5) | | C | | |
| Phaenopsctra punctipes gr (7.1) | R | C | | |
| Polypedilum aviceps (3.6) | C | | | |
| Polypedilum flavum (5.7) | R | R | R | |
| Polypedilum halterale (7.4) | | | R | |
| Polypedilum illinoense (8.7) | R | C | | |
| Polypedilum tritum | | C | | |
| Rheotanytarsus spp (6.5) | R | R | R | |
| Tanytarsus acifer | | R | | |
| Tanytarsus sp U (6.6) | | R | | |
| Tanytarsus sp Z (6.6) | | R | | |
| Thienemaniella spp (6.4) | R | | | |
| Thienemannimyia group (8.4) | C | A | C | |
| Tribelos jacundum (5.7) | R | R | | |
| COLEOPTERA | | | | |
| Family Dryopidae | | | | |
| Helichus spp (4.1) | | C | | |
| Family Dytiscidae | | | | |
| Neoporus spp (7.0) | | R | | |
| Family Elmidae | | | | |
| Macronychus glabratus (4.7) | | | R | |
| Stenelmis spp (5.6) | | R | | |
| Family Hydrophilidae | | | | |
| Enochrus spp (8.5) | | R | | |
| ODONATA | | | | |
| Family Aeshnidae | | | | |
| Aeshna umbrosa | | R | | |
| Boyeria vinosa (5.6) | | R | R | |
| Family Calopterygidae | | | | |
| Calopteryx spp (7.5) | C | R | | |
| Family Cordulegasteridae | | | | |
| Cordulegaster spp (5.7) | | | R | |
| Family Gomphidae | | | | |
| Ophiogomphus spp (5.9) | | | R | |
| Progomphus obscurus (8.2) | | | C | |
| Stylogomphus albistylus (5.0) | R | R | | |
| OLIGOCHAETA | | | | |
| Family Naidae | | | | |
| Pristinellaa spp (7.7) | | | R | |
| Slavina appendiculata (8.4) | R | | | |
| MEGALOPTERA | | | | |
| Family Corydalidae | | | | |

| Taxa | Site 1 | Site 2 | Site 3 |
|---|---|---|---|
| Nigronia serricornis (4.6) | R | | |
| Family Sialidae | | | |
| Sialis spp (7.0) | R | | |
| CRUSTACEA | | | |
| Family Asellidae | | | |
| Caecidotea spp (8.4) | C | R | |
| Family Cambaridae | | | |
| immature crayfish (7.5) | R | R | |
| MOLLUSCA | | | |
| Family Pleuroceridae | | | |
| Elimia spp (2.7) | | R | C |
| Family Corbiculidae | | | |
| Corbicula fluminea (6.6) | | | C |
| OTHER TAXA | | | |
| Family Hydrachnidae | | | |
| Lebertia spp (5.5) | | | R |
| Family Veliidae | | | |
| Rhagovelia spp | C | C | R |
| | | | |
| Total Taxa Richness | 38 | 40 | 24 |
| EPT Taxa Richness | 9 | 8 | 6 |
| EPT Abundance | 58 | 18 | 21 |
| Biotic Index | 5.61 | 6.18 | 5.89 |
| Qual 4 Bioclassification | Good-Fair | Fair | Fair |

**Table 10**. **Taxa list with indications of relative abundance for Sites 1-3, UT to Fourth Creek, Iredell County, North Carolina, MY-06 (2021).**
**[A=Abundant (>10), C=Common (3-9), and R=Rare (1-2)]**

| Statesville BM 1 sites | | | |
|---|---|---|---|
| Taxa / Biotic Index Value (shaded taxa have BI value ≤ 2.5) | Site 1 | Site 2 | Site 3 |
| EPHEMEROPTERA | | | |
| Family Baetidae | | | |
| *Baetis flavistriga* (6.8) | | C | |
| *Baetis intercalaris* (5.0) | | | A |
| *Baetis pluto* (3.4) | C | A | C |
| Family Heptageniidae | | | |
| *Maccaffertium modestum* (5.7) | C | A | A |
| TRICHOPTERA | | | |
| Family Hydropsychidae | | | |
| *Cheumatopsyche* spp (6.6) | A | A | A |
| *Diplectrona modesta* (2.3) | R | C | R |
| *Hydropsyche betteni* (7.9) | R | A | A |
| Family Leptoceridae | | | |

| Statesville BM 1 sites | | | |
|---|---|---|---|
| **Taxa / Biotic Index Value (shaded taxa have BI value ≤ 2.5)** | **Site 1** | **Site 2** | **Site 3** |
| *Oecetis persimilis* (4.6) | | | R |
| Family Philopotamidae | | | |
| *Chimarra spp* (3.3) | R | A | C |
| Family Psychomyiidae | | | |
| Lype diversa (3.9) | | | R |
| MISC DIPTERA | | | |
| Family Dixidae | | | |
| *Dixa* spp (2.5) | A | A | |
| *Dixella* spp ( 4.9) | C | C | |
| Family Dolichopodidae | R | | |
| Family Empididae | R | | |
| Family Simuliidae | | | |
| *Prosimulium* spp (4.5) | R | | |
| *Simulium* spp (4.9) | C | R | C |
| *Simulium venustum* (7.3) | A | A | |
| Family Tipulidae | | | |
| *Antocha* spp (4.4) | R | | |
| *Tipula* spp (7.5) | | C | |
| DIPTERA; CHIRONOMIDAE | | | |
| *Brillia flavifrons* (5.7) | R | R | |
| *Cardiocladius* spp (6.2) | | | R |
| *Chironomus* spp (9.3) | | R | R |
| *Corynoneura* spp (5.7) | R | R | |
| *Cryptochironomus fulvus* (6.7) | | R | |
| *Micropsectra* spp (2.4) | | R | |
| *Microtendipes pedellus* (4.6) | | | R |
| *Odontomesa fulva* (4.9) | | R | |
| *Parametriocnemus lundbecki* (3.7) | C | R | |
| *Paratanytarsus* spp (8.0) | R | | |
| *Phaenopsctra obediens* (6.5) | | R | |
| *Polypedilum aviceps* (3.6) | A | A | R |
| *Polypedilum fallax* (6.5) | | | R |
| *Polypedilum flavum* (5.7) | A | | |
| *Polypedilum illinoense* (8.7) | C | C | C |
| *Polypedilum scalaenum* (8.5) | | R | |
| *Polypedilum tritum* | R | | |
| *Rheotanytarsus* spp (6.5) | R | R | R |
| *Stenochironomus* spp (5.4) | | | C |
| *Tanytarsus* sp G (6.6) | | R | |
| *Thienemaniella* spp (6.4) | R | | |
| Thienemannimyia group (8.4) | A | A | C |

| Statesville BM 1 sites | | | |
|---|---|---|---|
| **Taxa / Biotic Index Value (shaded taxa have BI value ≤ 2.5)** | **Site 1** | **Site 2** | **Site 3** |
| Tvetenia bavarica gp (E sp 1) (3.6) | C | R | |
| COLEOPTERA | | | |
| Family Dryopidae | | | |
| *Helichus* spp (4.1) | | R | |
| Family Elmidae | | | |
| *Macronychus glabratus* (4.7) | | | R |
| *Stenelmis* spp (5.6) | C | C | R |
| Family Hydrophilidae | | | |
| *Cymbiodyta* spp | | R | |
| ODONATA | | | |
| Family Aeshnidae | | | |
| *Boyeria vinosa* (5.6) | R | | |
| Family Calopterygidae | | | |
| *Calopteryx* spp (7.5) | C | C | R |
| Family Gomphidae | | | |
| *Stylogomphus albistylus* (5.0) | R | | |
| MEGALOPTERA | | | |
| Family Corydalidae | | | |
| *Nigronia* spp (v small) (6.1) | | | C |
| Family Sialidae | | | |
| *Sialis* (7.0) | | R | |
| CRUSTACEA | | | |
| Family Asellidae | | | |
| *Caecidotea* spp (8.4) | R | C | |
| Family Cambaridae | | | |
| immature crayfish (7.5) | | C | R |
| MOLLUSCA | | | |
| Family Pleuroceridae | | | |
| *Elimia* spp (2.7) | R | R | R |
| OTHER TAXA | | | |
| Family Hydrachnidae | | | |
| *Lebertia* spp (5.5) | | | R |
| Family Veliidae | | | |
| *Microvelia* spp | | C | |
| *Rhagovelia* spp | | C | R |
| **Total Taxa Richness** | **33** | **36** | **27** |
| **EPT Taxa Richness** | **7** | **6** | **9** |
| **EPT Abundance** | **56** | **19** | **51** |
| **Taxa ≤ 4 Biotic Index** | **9** | **10** | **7** |
| **Biotic Index** | **5.42** | **5.86** | **6.04** |
| **Bioclassification** | **Good-Fair** | **Fair** | **Fair** |

**Appendix C.**

**MY-06 Site Photos**

**(Sites 1-3)**

**Photo 1.  Upstream facing view of Site 1.**


**Photo 2. Downstream facing view of Site 1**

**Photo 3. Downstream facing view of Site 2.**



**Photo 4. Upstream facing view of Site 2.**

**Photo 5. Silt layering bottom substrate observed at Site 2.**



**Photo 6.  Downstream facing view of site 3.**

**Photo 7.  Upstream facing view of Site 3.**

**Appendix D.**

**Habitat Assessment Field Data Sheet**

**for Mountain/Piedmont Streams and**

**Benthos Collection Cards**

**(Sites 1-3)**

## BENTHOS COLLECTION CARD (Site 2)

**DATE** 6/5/21 **COLLECT TIME** 12:00 **COLLECTORS** LSC, EM, MD, MH **CARD#** Site2
**WATERBODY** UT to Fourth
**STAT. LOC.** Site2 **RIVER BASIN** Yadkin **COUNTY** Iredell

**Substrate:**
| | | |
|---|---|---|
| Boulder (10") | | % |
| Cobble (2 1/2-10") | | % |
| Gravel (1/12-2 1/2") | 20 | % |
| Sand (1/12") | 75 | % |
| Silt, fine Partic. | 5 | % |
| Other | | % |

**River:**
| | | |
|---|---|---|
| Mean depth | .1 m | |
| Maxim. depth | .2 m | |
| Width | 1 m | |
| Current | mod | |
| Recent Rain ? | | |
| Photos (#) | | |

**Field Parameters:**
- Bank Erosion: N — Mod ✓ Sev
- Canopy % 20 Type Deciduous
- Aufwuchs: N Mod Abund.
- Podostemum: N Mod Abund.
- Tribs Present?

**Instream Habitat: (0,+,++)**
| | | |
|---|---|---|
| Pools | + | Backwaters |
| Riffles | + | Detritus |
| Snags | + | Aquatic Weeds |
| Undercut Banks | | Other |
| Root Mats | | |

**Samples: (#)**
| | |
|---|---|
| Kicks | + |
| Sweeps | + |
| Leaf Packs | + |
| Rock-Log | + |
| Sand | |
| Visuals | |
| Other | |

**Water Chemistry:**
- Temperature (°C) 18.3
- Dissolved Oxygen (mg/L) 7.78  82.1%
- Conductivity (μmhos/cm) 166.2
- pH 6.7

**Field Observations:**

---

## BENTHOS COLLECTION CARD (Site 1)

**DATE** 6/15/2021 **COLLECT TIME** 1:25 pm **COLLECTORS** LSC, EM, MD, MH **CARD#** Site 1
**WATERBODY** UT to Fourth
**STAT. LOC.** Site 1 **RIVER BASIN** Yadkin **COUNTY** Iredell

**Substrate:**
| | | |
|---|---|---|
| Boulder (10") | | % |
| Cobble (2 1/2-10") | 25 | % |
| Gravel (1/12-2 1/2") | 40 | % |
| Sand (1/12") | 20 | % |
| Silt, fine Partic. | 5 | % |
| Other | | % |

**River:**
| | | |
|---|---|---|
| Mean depth | .2 | |
| Maxim. depth | .3 | |
| Width | 3 | |
| Current | mod | |
| Recent Rain ? | | |
| Photos (#) | | |

**Field Parameters:**
- Bank Erosion: N ✓ Mod Sev
- Canopy % 70 Type Deciduous
- Aufwuchs: N Mod Abund.
- Podostemum: N Mod Abund.
- Tribs Present?

**Instream Habitat: (0,+,++)**
| | | |
|---|---|---|
| Pools | + | Backwaters |
| Riffles | | Detritus |
| Snags | | Aquatic Weeds |
| Undercut Banks | + | Other |
| Root Mats | + | |

**Samples: (#)**
| | |
|---|---|
| Kicks | + |
| Sweeps | + |
| Leaf Packs | + |
| Rock-Log | + |
| Sand | |
| Visuals | |
| Other | |

**Water Chemistry:**
- Temperature (°C) 18.4
- Dissolved Oxygen (mg/L) 7.71
- Conductivity (μmhos/cm) 164.1
- pH 6.45

**Field Observations:**

---

## BENTHOS COLLECTION CARD (Site 3)

**DATE** 6/15/2021 **COLLECT TIME** 2:15 pm **COLLECTORS** LSC, EM, MD, MH **CARD#** Site3
**WATERBODY** Fourth Creek
**STAT. LOC.** **RIVER BASIN** **COUNTY** Iredell

**Substrate:**
| | | |
|---|---|---|
| Boulder (10") | 10 | % |
| Cobble (2 1/2-10") | 20 | % |
| Gravel (1/12-2 1/2") | 30 | % |
| Sand (1/12") | 30 | % |
| Silt, fine Partic. | 10 | % |
| Other | | % |

**River:**
| | | |
|---|---|---|
| Mean depth | .25 m | |
| Maxim. depth | .75 m | |
| Width | 3 m | |
| Current | mod | |
| Recent Rain ? | | |
| Photos (#) | | |

**Field Parameters:**
- Bank Erosion: N Y Mod Sev
- Canopy % 65 Type Deciduous
- Aufwuchs: N Mod Abund.
- Podostemum: N Mod Abund.
- Tribs Present?

**Instream Habitat: (0,+,++)**
| | | |
|---|---|---|
| Pools | + | Backwaters |
| Riffles | + | Detritus |
| Snags | + | Aquatic Weeds |
| Undercut Banks | + | Other |
| Root Mats | | |

**Samples: (#)**
| | |
|---|---|
| Kicks | + |
| Sweeps | + |
| Leaf Packs | + |
| Rock-Log | + |
| Sand | |
| Visuals | + |
| Other | |

**Water Chemistry:** 25.0 C
- Temperature (°C)
- Dissolved Oxygen (mg/L) 7.71  93.3%
- Conductivity (μmhos/cm) 111.9
- pH 6.78

**Field Observations:**

---

## BENTHOS COLLECTION CARD

**DATE** **COLLECT TIME** **COLLECTORS** **CARD#**
**WATERBODY**
**STAT. LOC.** **RIVER BASIN** **COUNTY**

**Substrate:**
| | | |
|---|---|---|
| Boulder (10") | | % |
| Cobble (2 1/2-10") | | % |
| Gravel (1/12-2 1/2") | | % |
| Sand (1/12") | | % |
| Silt, fine Partic. | | % |
| Other | | % |

**River:**
| | |
|---|---|
| Mean depth | |
| Maxim. depth | |
| Width | |
| Current | |
| Recent Rain ? | |
| Photos (#) | |

**Field Parameters:**
- Bank Erosion: N Mod Sev
- Canopy % Type
- Aufwuchs: N Mod Abund.
- Podostemum: N Mod Abund.
- Tribs Present?

**Instream Habitat: (0,+,++)**
| | |
|---|---|
| Pools | Backwaters |
| Riffles | Detritus |
| Snags | Aquatic Weeds |
| Undercut Banks | Other |
| Root Mats | |

**Samples: (#)**
| | |
|---|---|
| Kicks | |
| Sweeps | |
| Leaf Packs | |
| Rock-Log | |
| Sand | |
| Visuals | |
| Other | |

**Water Chemistry:**
- Temperature (°C)
- Dissolved Oxygen (mg/L)
- Conductivity (μmhos/cm)
- pH

**Field Observations:**

6/15/2021
@ 1:25 pm

11/13 Revision 8

**Habitat Assessment Field Data Sheet**
**Mountain/ Piedmont Streams**

**Biological Assessment Branch, DWR**

TOTAL SCORE __86__

Directions for use: The observer is to survey a **minimum of 100 meters with 200 meters preferred** of stream, preferably in an **upstream** direction starting above the bridge pool and the road right-of-way. The segment which is assessed should represent average stream conditions. To perform a proper habitat evaluation the observer needs to get into the stream. To complete the form, select the description which best fits the observed habitats and then circle the score. If the observed habitat falls in between two descriptions, select an intermediate score. A final habitat score is determined by adding the results from the different metrics.

Stream __UT to Fourth Creek__ Location/road: __Site 1__ (Road Name __I-77__ )County __Iredell__

Date __6/15/2021__ CC# __Site 1__ Basin __Yadkin__ Subbasin __Fourth Creek__

Observer(s)__LSC, EM, MD, MH__ Type of Study: ☐ Fish ☒Benthos ☐ Basinwide ☐Special Study (Describe) _____

Latitude __35.814687__ Longitude __-80.859520__ Ecoregion: ☐ MT ☒R ☐ Slate Belt ☐ Triassic Basin

**Water Quality:** Temperature__18.4__ ºC DO __7.71__ mg/l Conductivity (corr.)__164.1__ µS/cm pH __6.45__

**Physical Characterization:** Visible land use refers to immediate area that you can see from sampling location - include what you estimate driving thru the watershed in watershed land use.

Visible Land Use: __60__ %Forest _____ %Residential __20__ %Active Pasture _____ % Active Crops _____ %Fallow Fields _____ %
Commercial _____ %Industrial __20__ %Other - Describe: __Construction area__

Watershed land use : ☐Forest ☐Agriculture ☐Urban ☐ Animal operations upstream

**Width:** (meters) Stream __1-2m__ Channel (at top of bank) __3m__ **Stream Depth:** (m) Avg.__.2__ Max .__3__
☐ Width variable ☐ Large river >25m wide
**Bank Height** (from deepest part of riffle to top of bank-first flat surface you stand on): (m)__3m__

**Bank Angle:** __70__ º or ☐ NA (Vertical is 90º, horizontal is 0º. Angles > 90º indicate slope is towards mid-channel, < 90º indicate slope is away from channel. NA if bank is too low for bank angle to matter.)
☐ Channelized Ditch
☒Deeply incised-steep, straight banks ☐Both banks undercut at bend ☐Channel filled in with sediment
☐ Recent overbank deposits ☒Bar development ☐Buried structures ☐Exposed bedrock

*Appendix A – Mountain/Piedmont Habitat Assessment Form*

☐ Excessive periphyton growth      ☐ Heavy filamentous algae growth ☐Green tinge      ☐ Sewage smell
**Manmade Stabilization:** ☐N ⟋ ☐Y: ☐Rip-rap, cement, gabions ☐ Sediment/grade-control structure ☐Berm/levee
**Flow conditions** : ☐High ☒Normal ☐Low
**Turbidity:** ☒Clear ☐ Slightly Turbid ☐Turbid ☐Tannic ☐Milky ☐Colored (from dyes) *with red clay silt deposits*
**Good potential for Wetlands Restoration Project??** ☐ YES ☐NO **Details**_____

_____

**Channel Flow Status**
　　　Useful especially under abnormal or low flow conditions.
　　　A. Water reaches base of both lower banks, minimal channel substrate exposed ........................... ☐
　　　B. Water fills >75% of available channel, or <25% of channel substrate is exposed...................... ☐
　　　C. Water fills 25-75% of available channel, many logs/snags exposed.................................... ☒
　　　D. Root mats out of water.............................................................................................. ☐
　　　E. Very little water in channel, mostly present as standing pools........................................... ☐

**Weather Conditions:** Sunny 80°　　　**Photos:** ☐N ☒Y ☒Digital ☐35mm

**Remarks:** Significant red clay silt is observed in channel
this is a new development from previous years

_____

_____

**I. Channel Modification**　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　Score
　　　　　A. channel natural, frequent bends.................................................................... 5 ☐
　　　　　B. channel natural, infrequent bends (channelization could be old)....................... 4 ☒
　　　　　C. some channelization present.................................................................... 3 ☐
　　　　　D. more extensive channelization, >40% of stream disrupted.............................. 2 ☐
　　　　　E. no bends, completely channelized or rip rapped or gabioned, etc...................... 0 ☐
☐ Evidence of dredging ☐Evidence of desnagging=no large woody debris in stream ☐Banks of uniform shape/height
Remarks_____　　Subtotal 4

**II. Instream Habitat:** Consider the percentage of the reach that is favorable for benthos colonization or fish cover. If >70% of the reach is rocks, 1 type is present, circle the score of 17. Definition: leafpacks consist of older leaves that are packed together and have begun to decay (not piles of leaves in pool areas). Mark as **Rare, Common, or Abundant.**

A **Rocks**　R **Macrophytes**　C **Sticks and leafpacks**　R **Snags and logs**　R **Undercut banks or root mats**

## AMOUNT OF REACH FAVORABLE FOR COLONIZATION OR COVER

|  | >70% Score | 40-70% Score | 20-40% Score | <20% Score |
|---|---|---|---|---|
| 4 or 5 types present.............. | 20 ☐ | 16 ☒ | 12 ☐ | 8 ☐ |
| 3 types present...................... | 19 ☐ | 15 ☐ | 11 ☐ | 7 ☐ |
| 2 types present...................... | 18 ☐ | 14 ☐ | 10 ☐ | 6 ☐ |
| 1 type present....................... | 17 ☐ | 13 ☐ | 9 ☐ | 5 ☐ |
| No types present.................... | 0 ☐ | | | |

☐ No woody vegetation in riparian zone    Remarks_____    Subtotal 16

**III. Bottom Substrate (silt, sand, detritus, gravel, cobble, boulder)** Look at entire reach for substrate scoring, but only look at riffle for embeddedness, and use rocks from all parts of riffle-look for "mud line" or difficulty extracting rocks.

**A. substrate with good mix of gravel, cobble and boulders**     **Score**
1. embeddedness <20% (very little sand, usually only behind large boulders)........................ 15 ☐
2. embeddedness 20-40%................................................................................................ 12 ☐
3. embeddedness 40-80%................................................................................................ 8 ☐
4. embeddedness >80%.................................................................................................. 3 ☐

**B. substrate gravel and cobble**
1. embeddedness <20%................................................................................................... 14 ☒
2. embeddedness 20-40%................................................................................................ 11 ☐
3. embeddedness 40-80% ............................................................................................... 6 ☐
4. embeddedness >80%.................................................................................................. 2 ☐

**C. substrate mostly gravel**
1. embeddedness <50%................................................................................................... 8 ☐
2. embeddedness >50%................................................................................................... 4 ☐

**D. substrate homogeneous**
1. substrate nearly all bedrock...................................................................................... 3 ☐
2. substrate nearly all sand .......................................................................................... 3 ☐
3. substrate nearly all detritus....................................................................................... 2 ☐
4. substrate nearly all silt/ clay..................................................................................... 1 ☐

Remarks_____    Subtotal 14

**IV. Pool Variety** Pools are areas of deeper than average maximum depths with little or no surface turbulence. Water velocities associated with pools are always slow. Pools may take the form of "pocket water", small pools behind boulders or obstructions, in large high gradient streams, or side eddies.

**A. Pools present**     Score
1. Pools Frequent (>30% of 200m area surveyed)
   a. variety of pool sizes.......................................................................................... 10 ☒
   b. pools about the same size (indicates pools filling in).............................................. 8 ☐

2. Pools Infrequent (<30% of the 200m area surveyed)
    a. variety of pool sizes.................................................................................... 6 ☐
    b. pools about the same size.......................................................................... 4 ☐
**B. Pools absent**........................................................................................... 0 ☐

Subtotal \O

☐ Pool bottom boulder-cobble=hard  ☐ Bottom sandy-sink as you walk  ☐ Silt bottom  ☐ Some pools over wader depth
Remarks_____

Page Total 44

## V. Riffle Habitats

Definition: Riffle is area of reaeration-can be debris dam, or narrow channel area.     Riffles **Frequent** ☐  Riffles **Infrequent** ☐

| | Score | Score |
|---|---|---|
| A. well defined riffle and run, riffle as wide as stream and extends 2X width of stream.... | 16 ☐ | 12 ☐ |
| B. riffle as wide as stream but riffle length is not 2X stream width ................................. | 14 ☒ | 7 ☐ |
| C. riffle not as wide as stream and riffle length is not 2X stream width ........................... | 10 ☐ | 3 ☐ |
| **D. riffles absent**........................................................................................ | 0 ☐ | |

Channel Slope: ☐Typical for area  ☐Steep=fast flow  ☐Low=like a coastal stream          Subtotal 14

## VI. Bank Stability and Vegetation
**A. Erosion**
    1. No, or very little, erosion present ..................................... 7 ☐
    2. Erosion mostly at outside of meanders ................................. 6 ☐
    3. Less than 50% of banks eroding............................................. 3 ☒
    4. Massive erosion................................................................. 0 ☐     Erosion Score 3
**B. Bank Vegetation**
    1. Mostly mature trees (>12" DBH) present............................. 7 ☒
    2. Mostly small trees (<12" DBH) present, large trees rare ...... 5 ☐
    3. No trees on bank, can have some shrubs and grasses............ 3 ☐
    4. Mostly grasses or mosses on bank..................................... 2 ☐
    5. Little or no bank vegetation, bare soil everywhere................ 0 ☐  Vegetation Score 7

Remarks_____          Subtotal 10

## VII. Light Penetration
Canopy is defined as tree or vegetative cover directly above the stream's surface. Canopy would block out sunlight when the sun is directly overhead. Note shading from mountains, but not use to score this metric.

| | Score |
|---|---|
| A. Stream with **good** canopy with some breaks for light penetration ............................................. | 10 ☒ |
| B. Stream with **full canopy** - breaks for light penetration absent........................................................ | 8 ☐ |
| C. Stream with **partial** canopy - sunlight and shading are essentially equal..................................... | 7 ☐ |
| D. Stream with **minimal** canopy - full sun in all but a few areas....................................................... | 2 ☐ |
| E. **No canopy** and no shading................................................................................................. | 0 ☐ |

40

Remarks_____ Subtotal 10

## VIII. Riparian Vegetative Zone Width

Definition: Riparian zone for this form is area of natural vegetation adjacent to stream (can go beyond floodplain). Definition: A break in the riparian zone is any place on the stream banks which allows sediment or pollutants to directly enter the stream, such as paths down to stream, storm drains, uprooted trees, otter slides, etc.

FACE UPSTREAM

| | Lft. Bank Score | Rt. Bank Score |
|---|---|---|

Dominant vegetation: ☐ Trees ☐ Shrubs ☐ Grasses ☐ Weeds/old field ☐Exotics (kudzu, etc)

A. Riparian zone **intact** (no breaks)

| | Lft. Bank Score | Rt. Bank Score |
|---|---|---|
| 1. width > 18 meters........................................................ | 5 ☒ | 5 ☐ |
| 2. width 12-18 meters...................................................... | 4 ☐ | 4 ☐ |
| 3. width 6-12 meters........................................................ | 3 ☐ | 3 ☒ |
| 4. width < 6 meters.......................................................... | 2 ☐ | 2 ☐ |

B. Riparian zone **not intact** (breaks)

1. breaks rare

| | Lft. Bank Score | Rt. Bank Score |
|---|---|---|
| a. width > 18 meters.................................................. | 4 ☐ | 4 ☐ |
| b. width 12-18 meters................................................ | 3 ☐ | 3 ☐ |
| c. width 6-12 meters.................................................. | 2 ☐ | 2 ☐ |
| d. width < 6 meters.................................................... | 1 ☐ | 1 ☐ |

2. breaks common

| | Lft. Bank Score | Rt. Bank Score |
|---|---|---|
| a. width > 18 meters.................................................. | 3 ☐ | 3 ☐ |
| b. width 12-18 meters................................................ | 2 ☐ | 2 ☐ |
| c. width 6-12 meters.................................................. | 1 ☐ | 1 ☐ |
| d. width < 6 meters.................................................... | 0 ☐ | 0 ☐ |

Remarks_____ Subtotal 8

Page Total 42

☐ Disclaimer-form filled out, but score doesn't match subjective opinion-atypical stream.     **TOTAL SCORE** 86

*Appendix A – Mountain/Piedmont Habitat Assessment Form*

6/15/2021
@ 12:00

11/13  Revision 8

## Habitat Assessment Field Data Sheet
## Mountain/ Piedmont Streams

**Biological Assessment Branch, DWR**                    TOTAL SCORE  56

Directions for use:  The observer is to survey a **minimum of 100 meters with 200 meters preferred** of stream, preferably in an **upstream** direction starting above the bridge pool and the road right-of-way.  The segment which is assessed should represent average stream conditions.  To perform a proper habitat evaluation the observer needs to get into the stream. To complete the form, select the description which best fits the observed habitats and then circle the score. If the observed habitat falls in between two descriptions, select an intermediate score.  A final habitat score is determined by adding the results from the different metrics.

**Stream** UT to Fourth Creek   **Location/road:** I-40 exit 152B  (Road Name I-77 )**County** Iredell

**Date** 6/15/2021 **CC#** Site2 **Basin** Yadkin  **Subbasin** Fourth Creek

**Observer(s)** LSC, EM, MD, MH  **Type of Study:** ☐ Fish  ☒Benthos  ☐ Basinwide  ☐Special Study (Describe) _____

**Latitude** 35.813127 **Longitude** -80.85.8322 **Ecoregion:** ☐ MT  ☒P ☐ Slate Belt ☐ Triassic Basin

**Water Quality:** Temperature 18.3 °C  DO 7.78 ⁸²·¹ mg/l  Conductivity (corr.) 166.2 µS/cm   pH 6.7

**Physical Characterization:  Visible land use refers to immediate area that you can see from sampling location - include what you estimate driving thru the watershed in watershed land use.**

Visible Land Use:    30 %Forest _____ %Residential _____ %Active Pasture 50 % Active Crops _____ %Fallow Fields _____ %
Commercial _____ %Industrial 20 %Other - Describe: Construction

Watershed land use :    ☒Forest ☒Agriculture ☒Urban ☐ Animal operations upstream

**Width**: (meters) Stream 1m  Channel (at top of bank) 2m  **Stream Depth:** (m)  Avg. 1m Max .2m
☐ Width variable    ☐ Large river >25m wide
**Bank Height** (from deepest part of riffle to top of bank-first flat surface you stand on): (m) 2m

**Bank Angle:** 75 ° or ☐ NA    (Vertical is 90°, horizontal is 0°. Angles > 90° indicate slope is towards mid-channel, < 90° indicate slope is away from channel.  NA if bank is too low for bank angle to matter.)
☐ Channelized Ditch
☐Deeply incised-steep, straight banks ☐Both banks undercut at bend    ☐Channel filled in with sediment
☐ Recent overbank deposits     ☐Bar development     ☐Buried structures    ☐Exposed bedrock

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☐ Excessive periphyton growth     ☐ Heavy filamentous algae growth ☐Green tinge     ☐ Sewage smell
**Manmade Stabilization:** ☐N    ☐Y: ☐Rip-rap, cement, gabions ☐ Sediment/grade-control structure ☐Berm/levee
**Flow conditions :** ☐High ☒Normal ☐Low
**Turbidity:** ☒Clear ☐ Slightly Turbid ☐Turbid ☐Tannic ☐Milky ☐Colored (from dyes)
**Good potential for Wetlands Restoration Project??** ☐ YES ☐NO **Details**_____

**Channel Flow Status**
        Useful especially under abnormal or low flow conditions.
        A. Water reaches base of both lower banks, minimal channel substrate exposed ............................. ☐
        B. Water fills >75% of available channel, or <25% of channel substrate is exposed........................ ☒
        C. Water fills 25-75% of available channel, many logs/snags exposed............................................ ☐
        D. Root mats out of water.......................................................................................................... ☐
        E. Very little water in channel, mostly present as standing pools................................................ ☐

**Weather Conditions:** _80°F Sunny_     **Photos:** ☐N ☒Y ☒Digital ☐35mm

**Remarks:** _Nearby contruction impacts are seen in stream_
_Red silt is deposited_

**I. Channel Modification**                                                <u>Score</u>
        A. channel natural, frequent bends....................................................................... 5 ☒
        B. channel natural, infrequent bends (channelization could be old)............................... 4 ☒
        C. some channelization present............................................................................... 3 ☐
        D. more extensive channelization, >40% of stream disrupted...................................... 2 ☐
        E. no bends, completely channelized or rip rapped or gabioned, etc............................. 0 ☐
☐ Evidence of dredging ☐Evidence of desnagging=no large woody debris in stream ☐Banks of uniform shape/height
Remarks_____     Subtotal _4_

**II. Instream Habitat:** Consider the percentage of the reach that is favorable for benthos colonization or fish cover. If >70% of the reach is rocks, 1 type is present, circle the score of 17. Definition: leafpacks consist of older leaves that are packed together and have begun to decay (not piles of leaves in pool areas). <u>Mark as Rare, Common, or Abundant.</u>

_R_ **Rocks** _R_ **Macrophytes** _R_ **Sticks and leafpacks** _R_ **Snags and logs** _R_ **Undercut banks or root mats**

## AMOUNT OF REACH FAVORABLE FOR COLONIZATION OR COVER

| | >70% Score | 40-70% Score | 20-40% Score | <20% Score |
|---|---|---|---|---|
| 4 or 5 types present................. | 20 ☐ | 16 ☐ | 12 ☐ | 8 ☐ |
| 3 types present........................ | 19 ☐ | 15 ☐ | 11 ☒ | 7 ☐ |
| 2 types present........................ | 18 ☐ | 14 ☐ | 10 ☐ | 6 ☐ |
| 1 type present.......................... | 17 ☐ | 13 ☐ | 9 ☐ | 5 ☐ |
| No types present...................... | 0 ☐ | | | |

☐ No woody vegetation in riparian zone        Remarks _____        Subtotal __11__

**III. Bottom Substrate (silt, sand, detritus, gravel, cobble, boulder)**  Look at entire reach for substrate scoring, but only look at riffle for embeddedness, and use rocks from all parts of riffle-look for "mud line" or difficulty extracting rocks.

**A. substrate with good mix of gravel, cobble and boulders**                                    **Score**
 1. embeddedness <20% (very little sand, usually only behind large boulders)........................  15 ☐
 2. embeddedness 20-40%.....................................................................................................  12 ☐
 3. embeddedness 40-80%.....................................................................................................  8 ☐
 4. embeddedness >80%.........................................................................................................  3 ☐

**B. substrate gravel and cobble**
 1. embeddedness <20%.........................................................................................................  14 ☐
 2. embeddedness 20-40%.....................................................................................................  11 ☐
 3. embeddedness 40-80% .....................................................................................................  6 ☐
 4. embeddedness >80%.........................................................................................................  2 ☐

**C. substrate mostly gravel**
 1. embeddedness <50%.........................................................................................................  8 ☐
 2. embeddedness >50%.........................................................................................................  4 ☐

**D. substrate homogeneous**
 1. substrate nearly all bedrock...........................................................................................  3 ☐
 2. substrate nearly all sand ...............................................................................................  3 ☒
 3. substrate nearly all detritus...........................................................................................  2 ☐
 4. substrate nearly all silt/ clay..........................................................................................  1 ☐

Remarks _____        Subtotal __3__

**IV. Pool Variety**  Pools are areas of deeper than average maximum depths with little or no surface turbulence.  Water velocities associated with pools are always slow.  Pools may take the form of "pocket water", small pools behind boulders or obstructions, in large high gradient streams, or side eddies.

**A. Pools present**                                                                                                                **Score**
1. Pools Frequent (>30% of 200m area surveyed)
 a. variety of pool sizes.......................................................................................................  10 ☐
 b. pools about the same size (indicates pools filling in).................................................  8 ☐

2. Pools Infrequent (<30% of the 200m area surveyed)
      a. variety of pool sizes........................................................................... 6 ☒
      b. pools about the same size.................................................................. 4 ☐
**B. Pools absent**........................................................................... 0 ☐

Subtotal   6

☐ Pool bottom boulder-cobble=hard   ☐ Bottom sandy-sink as you walk   ☐ Silt bottom   ☐ Some pools over wader depth
Remarks_____

Page Total 24

## V. Riffle Habitats

Definition: Riffle is area of reaeration-can be debris dam, or narrow channel area.     Riffles **Frequent** ☐ Riffles **Infrequent** ☐

| | Score | Score |
|---|---|---|
| A. well defined riffle and run, riffle as wide as stream and extends 2X width of stream.... | 16 ☐ | 12 ☐ |
| B. riffle as wide as stream but riffle length is not 2X stream width ................................ | 14 ☐ | 7 ☒ |
| C. riffle not as wide as stream and riffle length is not 2X stream width ........................... | 10 ☐ | 3 ☐ |
| **D. riffles absent**.................................................................. | 0 ☐ | |

Channel Slope: ☐Typical for area   ☐Steep=fast flow   ☐Low=like a coastal stream      Subtotal 7

## VI. Bank Stability and Vegetation

**A. Erosion**
    1. No, or very little, erosion present ............................................ 7 ☐
    2. Erosion mostly at outside of meanders .................................. 6 ☒
    3. Less than 50% of banks eroding............................................. 3 ☐
    4. Massive erosion................................................................ 0 ☐    Erosion Score 6

**B. Bank Vegetation**
    1. Mostly mature trees (>12" DBH) present............................. 7 ☐
    2. Mostly small trees (<12" DBH) present, large trees rare ...... 5 ☒
    3. No trees on bank, can have some shrubs and grasses............ 3 ☐
    4. Mostly grasses or mosses on bank........................................ 2 ☐
    5. Little or no bank vegetation, bare soil everywhere................ 0 ☐   Vegetation Score 5

Remarks_____    Subtotal 11

## VII. Light Penetration
Canopy is defined as tree or vegetative cover directly above the stream's surface. Canopy would block out sunlight when the sun is directly overhead. Note shading from mountains, but not use to score this metric.

| | Score |
|---|---|
| A. Stream with **good** canopy with some breaks for light penetration ............................................ | 10 ☐ |
| B. Stream with **full canopy** - breaks for light penetration absent............................................... | 8 ☐ |
| C. Stream with **partial** canopy - sunlight and shading are essentially equal.................................. | 7 ☒ |
| D. Stream with **minimal** canopy - full sun in all but a few areas................................................ | 2 ☐ |
| E. **No canopy** and no shading................................................................................................. | 0 ☐ |

Remarks_____ Subtotal __7__

## VIII. Riparian Vegetative Zone Width

Definition: Riparian zone for this form is area of natural vegetation adjacent to stream (can go beyond floodplain). Definition: A break in the riparian zone is any place on the stream banks which allows sediment or pollutants to directly enter the stream, such as paths down to stream, storm drains, uprooted trees, otter slides, etc.

FACE UPSTREAM

Dominant vegetation: ☐ Trees ☐ Shrubs ☐ Grasses ☐ Weeds/old field ☐Exotics (kudzu, etc)

|  | Lft. Bank Score | Rt. Bank Score |
|---|---|---|
| A. Riparian zone **intact** (no breaks) | | |
| 1. width > 18 meters | 5 ☒ | 5 ☐ |
| 2. width 12-18 meters | 4 ☒ | 4 ☐ |
| 3. width 6-12 meters | 3 ☐ | 3 ☒ |
| 4. width < 6 meters | 2 ☐ | 2 ☐ |
| B. Riparian zone **not intact** (breaks) | | |
| 1. breaks rare | | |
| a. width > 18 meters | 4 ☐ | 4 ☐ |
| b. width 12-18 meters | 3 ☐ | 3 ☐ |
| c. width 6-12 meters | 2 ☐ | 2 ☐ |
| d. width < 6 meters | 1 ☐ | 1 ☐ |
| 2. breaks common | | |
| a. width > 18 meters | 3 ☐ | 3 ☐ |
| b. width 12-18 meters | 2 ☐ | 2 ☐ |
| c. width 6-12 meters | 1 ☐ | 1 ☐ |
| d. width < 6 meters | 0 ☐ | 0 ☐ |

Remarks_____

Subtotal __7__

Page Total __32__

TOTAL SCORE __56__

☐ Disclaimer-form filled out, but score doesn't match subjective opinion-atypical stream.

*Appendix A – Mountain/Piedmont Habitat Assessment Form*

6/15/2021
@ 2:15

11/13  Revision 8

**Habitat Assessment Field Data Sheet**
**Mountain/ Piedmont Streams**

**Biological Assessment Branch, DWR**                    **TOTAL SCORE** 78

Directions for use:  The observer is to survey a **minimum of 100 meters with 200 meters preferred** of stream, preferably in an **upstream** direction starting above the bridge pool and the road right-of-way.  The segment which is assessed should represent average stream conditions.  To perform a proper habitat evaluation the observer needs to get into the stream. To complete the form, select the description which best fits the observed habitats and then circle the score. If the observed habitat falls in between two descriptions, select an intermediate score.  A final habitat score is determined by adding the results from the different metrics.

Stream Fourth Creek ____ Location/road: I-77 I-40 Below ____ (Road Name ____ )County Irredell

Date 6/15/2021 ____ CC# ____ Basin Yadkin ____ Subbasin Fourth Creek

Observer(s) LSC, EM MD, MH ____ Type of Study: ☐ Fish  ☒ Benthos  ☐ Basinwide  ☐ Special Study (Describe) ____

Latitude 35.809652 Longitude -80.55441 Ecoregion:  ☐ MT  ☒ P  ☐ Slate Belt  ☐ Triassic Basin

**Water Quality:**  Temperature 25.0 °C  DO 7.71 mg/l  Conductivity (corr.) 111.9 93.3 µS/cm    pH 6.78

**Physical Characterization:  Visible land use refers to immediate area that you can see from sampling location - include what you estimate driving thru the watershed in watershed land use.**

Visible Land Use: 40 %Forest ____ %Residential ____ %Active Pasture ____ % Active Crops ____ %Fallow Fields ____ %
Commercial 10 %Industrial 50 %Other - Describe: Clearing along roadside

Watershed land use :    ☐Forest  ☐Agriculture  ☐Urban  ☐ Animal operations upstream

**Width:** (meters)  Stream 2-3 ____ Channel (at top of bank) 4m  **Stream Depth:** (m)  Avg .25 Max .75m
          ☐ Width variable    ☐ Large river >25m wide
**Bank Height** (from deepest part of  riffle to top of bank-first flat surface you stand on): (m) 3 m

**Bank Angle:** 75 ° or ☐ NA    (Vertical is 90°, horizontal is 0°. Angles > 90° indicate slope is towards mid-channel, < 90° indicate slope is away from channel.  NA if bank is too low for bank angle to matter.)
☐ Channelized Ditch
☐Deeply incised-steep, straight banks  ☐Both banks undercut at bend      ☐Channel filled in with sediment
☐ Recent overbank deposits          ☐Bar development          ☐Buried structures    ☐Exposed bedrock

37

☐ Excessive periphyton growth        ☐ Heavy filamentous algae growth ☐Green tinge        ☐ Sewage smell
**Manmade Stabilization:** ☐N    ☐Y: ☐Rip-rap, cement, gabions  ☐ Sediment/grade-control structure ☐Berm/levee
**Flow conditions :** ☐High  ☒Normal  ☐Low
**Turbidity:** ☐Clear  ☐ Slightly Turbid  ☐Turbid  ☐Tannic  ☐Milky ☐Colored (from dyes)
**Good potential for Wetlands Restoration Project??**  ☐ **YES**  ☐**NO Details**_____

---

**Channel Flow Status**
    Useful especially under abnormal or low flow conditions.
    A. Water reaches base of both lower banks, minimal channel substrate exposed ............................ ☐
    B. Water fills >75% of available channel, or <25% of channel substrate is exposed....................... ☒
    C. Water fills 25-75% of available channel, many logs/snags exposed............................................ ☐
    D. Root mats out of water.................................................................................................... ☐
    E. Very little water in channel, mostly present as standing pools................................................. ☐

**Weather Conditions:**_____ **Photos:** ☐N  ☐Y ☐ Digital ☐35mm

**Remarks:**_____
_____
_____
_____

---

**I. Channel Modification**                                                                                    Score
    A. channel natural, frequent bends.......................................................................... 5 ☐
    B. channel natural, infrequent bends (channelization could be old)................................. 4 ☐
    C. some channelization present.............................................................................. 3 ☒
    D. more extensive channelization, >40% of stream disrupted....................................... 2 ☐
    E. no bends, completely channelized or rip rapped or gabioned, etc............................... 0 ☐
☐ Evidence of dredging ☐Evidence of desnagging=no large woody debris in stream ☐Banks of uniform shape/height   3
Remarks_____                              Subtotal 3

**II. Instream Habitat:**  Consider the percentage of the reach that is favorable for benthos colonization or fish cover. If >70% of the reach is rocks, 1 type is present, circle the score of 17. Definition:  leafpacks consist of older leaves that are packed together and have begun to decay (not piles of leaves in pool areas). Mark as **Rare, Common, or Abundant.**

C ___**Rocks**  R ___**Macrophytes**  R ___**Sticks and leafpacks**  C ___**Snags and logs**  C ___**Undercut banks or root mats**

## AMOUNT OF REACH FAVORABLE FOR COLONIZATION OR COVER

| | >70% Score | 40-70% Score | 20-40% Score | <20% Score |
|---|---|---|---|---|
| 4 or 5 types present................ | 20 ☐ | 16 ☒ | 12 ☐ | 8 ☐ |
| 3 types present....................... | 19 ☐ | 15 ☐ | 11 ☐ | 7 ☐ |
| 2 types present....................... | 18 ☐ | 14 ☐ | 10 ☐ | 6 ☐ |
| 1 type present........................ | 17 ☐ | 13 ☐ | 9 ☐ | 5 ☐ |
| No types present.................... | 0 ☐ | | | |

☐ No woody vegetation in riparian zone    Remarks_____    Subtotal __16__

**III. Bottom Substrate (silt, sand, detritus, gravel, cobble, boulder)** Look at entire reach for substrate scoring, but only look at riffle for embeddedness, and use rocks from all parts of riffle-look for "mud line" or difficulty extracting rocks.

**A. substrate with good mix of gravel, cobble and boulders**           **Score**
    1. embeddedness <20% (very little sand, usually only behind large boulders)........................ 15 ☐
    2. embeddedness 20-40%................................................................................ 12 ☒
    3. embeddedness 40-80%................................................................................ 8 ☐
    4. embeddedness >80%.................................................................................. 3 ☐

**B. substrate gravel and cobble**
    1. embeddedness <20%.................................................................................. 14 ☐
    2. embeddedness 20-40%................................................................................ 11 ☐
    3. embeddedness 40-80% ............................................................................... 6 ☐
    4. embeddedness >80%.................................................................................. 2 ☐

**C. substrate mostly gravel**
    1. embeddedness <50%.................................................................................. 8 ☐
    2. embeddedness >50%.................................................................................. 4 ☐

**D. substrate homogeneous**
    1. substrate nearly all bedrock........................................................................ 3 ☐
    2. substrate nearly all sand ............................................................................ 3 ☐
    3. substrate nearly all detritus......................................................................... 2 ☐
    4. substrate nearly all silt/ clay....................................................................... 1 ☐

Remarks_____ Subtotal __12__

**IV. Pool Variety** Pools are areas of deeper than average maximum depths with little or no surface turbulence. Water velocities associated with pools are always slow. Pools may take the form of "pocket water", small pools behind boulders or obstructions, in large high gradient streams, or side eddies.

**A. Pools present**           Score
  1. Pools Frequent (>30% of 200m area surveyed)
    a. variety of pool sizes............................................................................... 10 ☒
    b. pools about the same size (indicates pools filling in)........................................ 8 ☐

2. Pools Infrequent (<30% of the 200m area surveyed)
      a. variety of pool sizes.................................................................................. 6 ☐
      b. pools about the same size....................................................................... 4 ☐
**B. Pools absent**................................................................................................... 0 ☐

Subtotal 10

☐ Pool bottom boulder-cobble=hard  ☐ Bottom sandy-sink as you walk  ☐ Silt bottom  ☐ Some pools over wader depth
Remarks_____

Page Total 41

## V. Riffle Habitats
Definition: Riffle is area of reaeration-can be debris dam, or narrow channel area.  Riffles **Frequent**☐ Riffles **Infrequent**☒

| | Score | Score |
|---|---|---|
| A. well defined riffle and run, riffle as wide as stream and extends 2X width of stream.... | 16 ☐ | 12 ☒ |
| B. riffle as wide as stream but riffle length is not 2X stream width ................................. | 14 ☐ | 7 ☐ |
| C. riffle not as wide as stream and riffle length is not 2X stream width ........................... | 10 ☐ | 3 ☐ |
| **D. riffles absent**................................................................................ | 0 ☐ | |

Channel Slope: ☐Typical for area  ☐Steep=fast flow  ☐Low=like a coastal stream

Subtotal 12

## VI. Bank Stability and Vegetation
**A. Erosion**
    1. No, or very little, erosion present ............................................. 7 ☐
    2. Erosion mostly at outside of meanders ................................... 6 ☐
    3. Less than 50% of banks eroding............................................. 3 ☒
    4. Massive erosion..................................................................... 0 ☐
Erosion Score 3

**B. Bank Vegetation**
    1. Mostly mature trees (>12" DBH) present............................. 7 ☒
    2. Mostly small trees (<12" DBH) present, large trees rare ...... 5 ☐
    3. No trees on bank, can have some shrubs and grasses............ 3 ☐
    4. Mostly grasses or mosses on bank......................................... 2 ☐
    5. Little or no bank vegetation, bare soil everywhere................ 0 ☐ Vegetation Score 7
Remarks_____

Subtotal 10

## VII. Light Penetration
Canopy is defined as tree or vegetative cover directly above the stream's surface.  Canopy would block out sunlight when the sun is directly overhead.  Note shading from mountains, but not use to score this metric.

| | Score |
|---|---|
| A. Stream with **good** canopy with some breaks for light penetration ............................................. | 10 ☒ |
| B. Stream with **full** canopy - breaks for light penetration absent............................................. | 8 ☐ |
| C. Stream with **partial** canopy - sunlight and shading are essentially equal................................... | 7 ☐ |
| D. Stream with **minimal** canopy - full sun in all but a few areas............................................. | 2 ☐ |
| E. **No canopy** and no shading................................................................. | 0 ☐ |

40

Remarks_____    Subtotal 10

## VIII. Riparian Vegetative Zone Width

Definition: Riparian zone for this form is area of natural vegetation adjacent to stream (can go beyond floodplain). Definition: A break in the riparian zone is any place on the stream banks which allows sediment or pollutants to directly enter the stream, such as paths down to stream, storm drains, uprooted trees, otter slides, etc.

FACE UPSTREAM

Dominant vegetation: ☐ Trees ☐ Shrubs ☐ Grasses ☐ Weeds/old field ☐Exotics (kudzu, etc)

|  | Lft. Bank Score | Rt. Bank Score |
|---|---|---|
| A. Riparian zone **intact** (no breaks) | | |
| 1. width > 18 meters............................ | 5 ☐ | 5 ☐ |
| 2. width 12-18 meters........................... | 4 ☐ | 4 ☐ |
| 3. width 6-12 meters............................ | 3 ☐ | 3 ☐ |
| 4. width < 6 meters............................. | 2 ☐ | 2 ☐ |
| B. Riparian zone **not intact** (breaks) | | |
| 1. breaks rare | | |
| a. width > 18 meters........................ | 4 ☐ | 4 ☒ |
| b. width 12-18 meters...................... | 3 ☒ | 3 ☐ |
| c. width 6-12 meters....................... | 2 ☐ | 2 ☐ |
| d. width < 6 meters........................ | 1 ☐ | 1 ☐ |
| 2. breaks common | | |
| a. width > 18 meters........................ | 3 ☐ | 3 ☐ |
| b. width 12-18 meters...................... | 2 ☐ | 2 ☐ |
| c. width 6-12 meters....................... | 1 ☐ | 1 ☐ |
| d. width < 6 meters........................ | 0 ☐ | 0 ☐ |

Remarks_____    Subtotal 7

Page Total 37

☐ Disclaimer-form filled out, but score doesn't match subjective opinion-atypical stream.    **TOTAL SCORE** 78