3.4 Beaverdam Creek HUC 060101030304

Beaverdam Creek encompasses approximately 20 square miles and is the least populated of all the watersheds. Like other watersheds within the basin, land use is mostly forested with agricultural and rural residential properties. Agricultural lands are a mix of pasture, small row crops and fallow fields with row crops and animal grazing being the primary uses (WRP, 2013). Stone Mountain (Locust Gap) is located on the state line and is identified as an outstanding resource area by the North Carolina Natural Heritage Program (NHP).

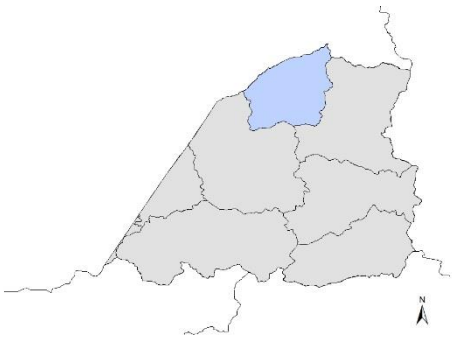


Table 3.23: Land Use and Estimated Population – Beaverdam Creek Watershed

Land Use Type	Acres	Square Miles	Percent
Open Water	0.0	0.0	0.0%
Developed	435.6	0.7	3.3%
Bare Earth	8.0	0.0	0.1%
Forest	10,354.7	16.2	78.8%
Grassland	262.8	0.4	2.0%
Agriculture	2,087.4	3.3	15.9%
Wetland	0.0	0.0	0.0%
Total Area	13,148.5	20.5	100.0%

(NCLD, 2011)

Calendar Year	Population and Projections*
2000	928
2010	969
2020*	-
2030*	-

*Methodology has not been developed to predict population projections on the HUC 12 scale.

(OSBM, 2014)

Overall, water quality in the watershed continues to be good, but Beaverdam Creek remains impaired for aquatic life – fish community. The stream was first listed in 2008 due to a Poor fish bioclassification. The same site was given a Fair bioclassification during cycle 4 (2004-2009) but received a Poor bioclassification again during cycle 5 (2009-2014). Despite the poor fish community ratings, the benthic community received an Excellent bioclassification during the two most recent monitoring cycles (cycle 4 and cycle 5) as well as during a special study conducted in 2009. Several best management practices (BMPs) have been constructed throughout the watershed with several more planned. Two additional streams were sampled for benthic and fish as part of a special study. Both benthic sites were meeting criteria for aquatic life. The two fish sites were Not Rated because criteria and metrics have not been developed by the Biological Assessment Branch (BAB) for Southern Appalachian trout streams.

One minor NPDES wastewater discharge permit has been issued in the watershed (Table 3.24). No non-discharge or stormwater permits were identified.

Table 3.24: NPDES Wastewater Permits in HUC 060101030304

Permit Number	Facility Name	Receiving Stream	Permitted Flow (MGD)
NC0066991	Bethel Elementary School	Beaverdam Creek	0.007

3.4.1 Stream Assessments

3.4.1.1 Beaverdam Creek AU 8-19

Sampling Year	Benthic Rating (LB42)	Benthic Rating (LB1)	Fish Rating (LF12)	Fish Rating (LF5)
2004	-	Good	-	Poor
2008	Excellent*	Excellent	Fair	Fair
2009	-	Excellent**	-	Poor**
2013	-	Excellent	-	Poor

*Special Study (DWQ, June 2008)
**Special Study (DWQ, March 2009)

In 2008, two benthic sites and two fish sites were sampled in Beaverdam Creek. Sites LB42 and LF12 are located upstream and was part of a special study to assess potential impacts from agricultural land use, new construction activities and forest harvesting in the upper reach of the watershed. Land cover was a mix of forest and agriculture with a portion of the Pisgah National Forest in the upper most part of the catchment. Cattle had direct access to the stream, and the riparian zone on one side of the stream provided little cover. Even with the poor riparian area, the benthic community (LB42) received an Excellent bioclassification. The fish community, however, received a Fair bioclassification (LF12). Biologists noted that the site was supporting a rich community of fish but was impacted by incomplete riparian corridors and agricultural sedimentation. No historic data was available for the site and conclusions regarding degradation over time could not be made for this upstream segment.

Located 3.5 miles downstream of site LB42, site LB1 also received an Excellent bioclassification in 2008. The fish community (LF5), however, received a Fair bioclassification. Overall, habitat was good but was impacted by the sedimentation due to upstream land use and nonpoint source pollution.

Samples collected in 2009 and again during basinwide monitoring in 2013 resulted in Excellent benthic ratings at site LB1. Based on previous benthic samples and consistently low specific conductivity, nonpoint sources of pollution likely explain fluctuations in the benthic community. Why? The basin was under Abnormally Dry to Exceptionally Dry conditions between 2000 and 2008 due to drought. Nonpoint source runoff is often associated with rain events. Nonpoint source runoff was reduced significantly due to the drought conditions during the 2008 sampling event. In January, February, April and early May 2013, the entire basin experienced very high flows. Water levels at the USGS stream gage on the Watauga River near Sugar Grove were 12 feet above gage height. The increased flow also increased the amount of nonpoint source runoff entering the stream. There was a slight decrease in species richness in 2013, but overall, the reach was still supporting an Excellent benthic community.

Sampling of the downstream fish site (LF5) in 2009 and 2013 showed the creek was still not meeting criteria for aquatic life – fish. During the most recent cycle, deep deposits of sand were observed along the stream's edge, in the channel and in the pools, but the riparian area was good. Based on the data collected, the fish community continues to be impacted by agriculture and land use practices adjacent to the stream. Continued monitoring is needed in the downstream segment of Beaverdam Creek to document any changes in land use practices and stream restoration activities.

Beaverdam Creek is not meeting criteria for the fish community and will remain on the 303(d) list for aquatic life – fish.

3.4.1.2 Special Studies

Two streams – Rube Creek and West Rube Creek – were sampled in 2009 and 2011 as part of a special study requested by the North Carolina Chapter of the American Fisheries Society (AFS). The special study was requested to determine if the streams are eligible for the supplemental classification of Trout (Tr).

Supporting documentation was provided by the North Carolina Wildlife Resources Commission (WRC), and the fish communities were sampled by DWR in 2009. Where appropriate, benthic macroinvertebrates were also sampled as part of the study to determine if the streams are eligible for the supplemental classification of High Quality Waters (HQW).

Fish communities were evaluated in the two streams in 2009, but ratings were not applied to the sites because criteria and metrics have not been developed by BAB for Southern Appalachian trout streams. IN 2011, benthic macroinvertebrates were also sampled as part of the special study. Both streams received an Excellent bioclassification.

Based on data submitted by WRC and because data collected by the Biological Assessment Branch (BAB) showed evidence of multiple age classes and trout species, Rube Creek and West Rube Creek and all their unnamed tributaries are eligible for the supplemental classification Tr and HQW. Additional information related to land use changes in the watershed may be necessary in order to pursue the supplemental classification for these streams.

Rube Creek AU 8-19-3

Sampling Year	Benthic Rating (LB61)	Fish Rating (LF19)
2009*	-	Not Rated
2011*	Excellent	-
*Special Study (DWQ, 2012)		

Rube Creek is a tributary to the Watauga River. Habitat at the site consisted of riffles, swift runs and side undercut pools. The riparian zone was narrow, but vegetation hanging over the water and watercress provided some cover. Because criteria and metrics have not been developed by BAB for Southern Appalachian trout streams, the fish community (LF19) was reported as Not Rated. Data submitted by NC WRC, however, indicates that habitat supports trout populations.

West Rube Creek AU 8-19-3-2

Sampling Year	Benthic Rating (LB62)	Fish Rating (LF23)
2009*	-	Not Rated
2011*	Excellent	-
*Special Study (DWQ, 2012)		

West Rube Creek is a tributary to Rube Creek. Habitat at the site consisted of riffles and shallow pools but the riparian zone was narrow. West Rube Creek flows through several pastures and livestock have direct access to the stream on the left bank, but the right bank was fenced. Because criteria and metrics have not been developed for Southern Appalachian trout streams, the fish community (LF23) was reported as Not Rated. Data submitted by NC WRC, however, indicates that habitat support trout populations.

3.4.2 Water Use

One non-transient community public water supply (PWS) system is in the watershed (Table 3.25). All residents rely on private groundwater wells for drinking water. No entities or facilities are registered in the Water Withdraw and Transfer Registration (WWATR) database.

Table 3.25: Public Water Supply Systems in HUC 060101030304

PWS Name	PWS ID	PWS Type	Population Served
BETHEL ELEMENTARY SCHOOL	01-95-421	Non-Transient Non-Community	178

3.4.3 Classifications and Management Strategies

Because Beaverdam Creek and Little Beaverdam Creek have the supplement classification of Trout (Tr), special management strategies are in place to protect water quality. A small portion of the watershed

also falls under management strategies for HQW. The entire length of the Watauga River is classified B and HQW. Waters with a B classification are managed for primary recreation which includes frequent or organized swimming and they must meet water quality standards for fecal coliform bacteria. Ordinances are in place for erosion control at the county level and available online.

Table 3.26: Stream Names and Classifications

AU Number	Stream Name	Description	Classification
8-19	Beaverdam Creek	From source to Watauga River	C; Tr
8-19	Little Beaverdam Creek	From source to Beaverdam Creek	C; Tr
8-(16)	Watauga River	From U.S. Hwy. 321 to North Carolina-Tennessee State Line	B; HQW

3.4.4 Protecting Water Resources in the Beaverdam Creek Watershed

Several agencies and organizations are actively working throughout the basin to protect water resources. Agencies or organizations that have identified specific priorities, concerns or restoration projects in the Beaverdam Creek watershed are included here.

3.4.4.1 Watauga River Partners (WRP) – Beaverdam Creek Restoration Project

Beginning in 2010 and with the help of an EPA Section 319 grant, the Watauga River Partners (WRP) started meeting with landowners in the Bethel community to characterize the watershed and identify potential projects that could protect Beaverdam Creek. Nonpoint source pollution, temperature and sediment were identified as the main sources of pollution in the watershed. Baseline samples were collected in April 2011, August 2011, November 2011. Sampling revealed that the benthic community included pollution intolerant species and that temperature, pH and conductivity generally increased as water moved downstream. The project team concluded that the increase in temperature is most likely attributed to poor riparian areas on the two most downstream sites, and without preventative measures, the stream would continue to degrade.

Working with NC WRC, fish were also sampled from two downstream sites in August 2011. Native trout were found, but the trout were small when compared to trout species in similar watersheds. Central stone rollers were also present. Central stone rollers are often indicative of high nutrient levels in the watershed. Land use practices identified as having a negative impact to water quality included stream dredging and berms to prevent flooding, mowing and removing native trees and shrubs along the streambank, moving the stream channel, and animal access.

WRP identified 28 sites for potential projects (Figure 3.2). Sites are located along Beaverdam Creek and its tributaries. Each project was prioritized from high to low based on the extent of erosion and sediment contribution to the stream, visibility and potential improvements to water quality. Implementation of BMPs is voluntary and the project team made the community and landowner interests a priority for all communication that was done. Based on field surveys, the project team identified livestock management (alternate feeding and water stations, fencing and rotational grazing), streambank stabilization, riparian buffer rehabilitation and planting, and stormwater management (rain gardens and cisterns) as potential practices to install throughout the watershed (WRP, 2012).

Between 2012 and 2013, BMPs were installed on private properties, one rain garden was constructed at Bethel Elementary School, and over 5,000 linear feet of stream were rehabilitated. Livestock were

excluded from the streams on three properties and all properties that included planting native vegetation along the streambanks now have good coverage.

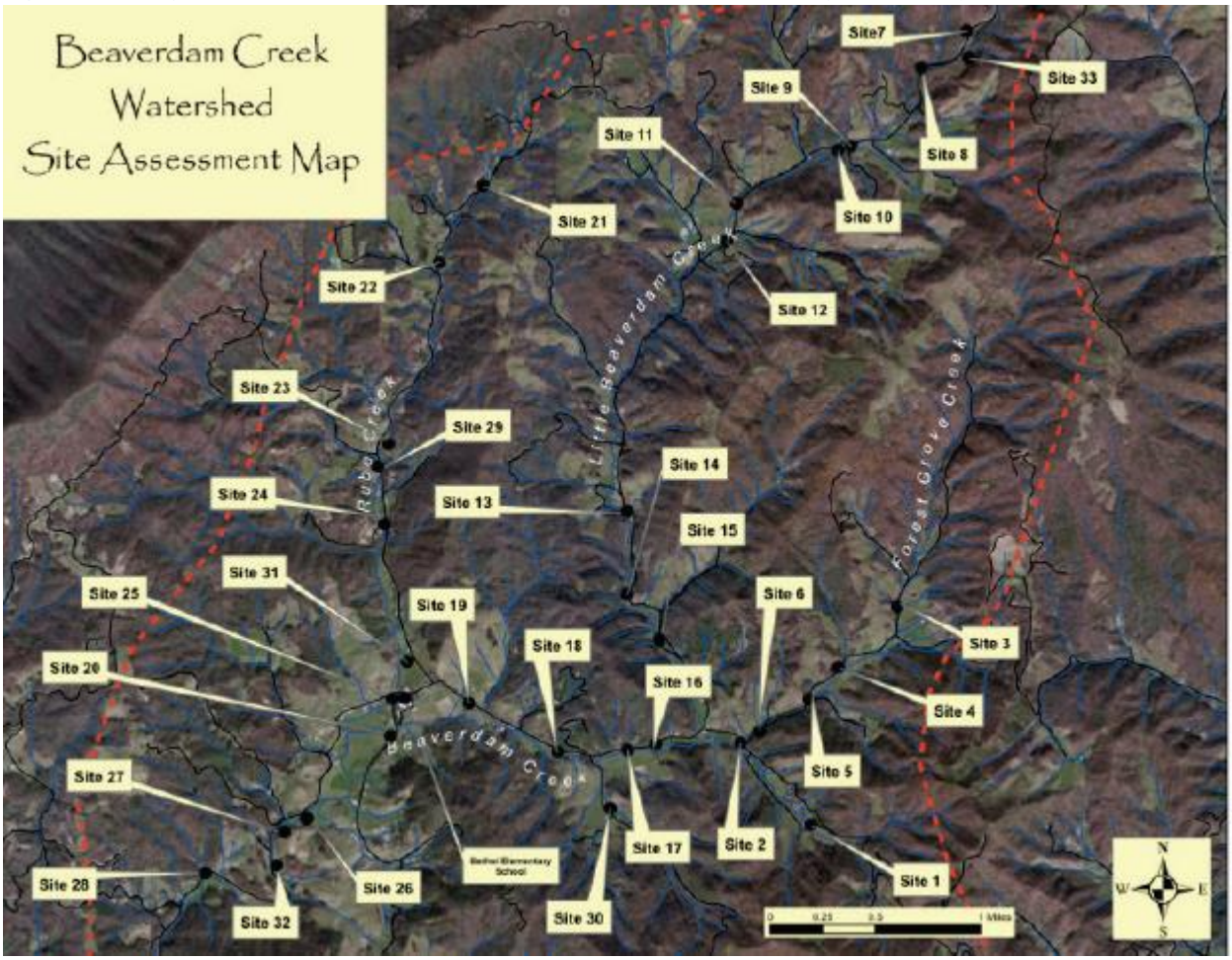
Table 3.27: BMPs Installed in the Beaverdam Creek Watershed

Stream Name	Priority Ranking	BMPs Installed	Before Photo**	After Photo**
Upper Little Beaverdam Creek (site #9)	Moderate	Livestock exclusion fencing (1,494 ft) Alternate watering source (2) Streambank stabilization (included removal of invasive species)		
Rube Creek (site #23)	High	Stream crossing and trails Alternate watering source (1) Riparian buffer planting (forest) Streambank protection (boulders and riprap)		
Rube Creek (site #24)	High	Livestock exclusion fencing (2,269 ft) Alternate watering source (2) Stream crossing and trails Riparian buffer planting (300 livestakes)		
Beaverdam Creek (site #26, site #27)	Moderate	Streambank stabilization and riparian planting (boulders, 100 container plants, 450 livestakes)		
Beaverdam Creek (site #29)	Moderate	Streambank stabilization of an existing ford Riparian buffer planting (forest) Livestock exclusion fencing (520 ft) Alternate water source (2)	No photo available	
Beaverdam Creek & Rube Creek (no site number)	-	Rain Garden (stormwater management)	No photo available	
Rube Creek* (site #31)	-	Riparian buffer plantings (native vegetation)	No photo available	
Beaverdam Creek* (site #32)	-	Riparian buffer plantings (native vegetation)	No photo available	

*Not identified in the Beaverdam Creek Watershed Plan but landowners were willing and interested to participate in the project.

** Photos taken by the Watauga River Partners (WRP) and included in the report titled "Beaverdam Creek Watershed Project: Final Report."

Figure 3.2: Project Sites Identified in the Beaverdam Creek Watershed (WRP, 2014)*



*Beaverdam Creek Watershed Site Assessment Map used with permission from WRP.

Data collected over the three years of the project generally reflected good water quality. Data indicated that temperature followed normal patterns, varied seasonally and generally increased as the water moved downstream. Specific conductance never exceeded 80 µmhos/cm and total suspended solids (TSS) were generally low (<20 mg/L), but specific conductance would increase after rain events and get as high as 113 µmhos/cm in Rube Creek (August 2012). The benthic communities fluctuated seasonally but remained stable with the benthic community located in the headwaters of Beaverdam Creek fluctuating the most between seasons. The project team concluded that this may be the result of hydrological changes between seasons (wet versus dry). It was also noted that there is a road that drains to the stream. Qualitative evaluations noted an increase in sandy sediment during the three years of sampling. No projects were implemented upstream of the sampling site (WRP, 2013).

In addition to the baseline sampling sites, two benthic sites were added within two project areas (site #23 and site #24) and three project sites (site #9, site #23 and site #24) were monitored for vegetation (percent cover). Both benthic and two of the vegetative study sites are located on Rube Creek and included livestock exclusion. The benthic data will provide a baseline for future sampling to evaluate the effectiveness of the BMPs that were installed. Vegetative cover went from 25 percent (April 2012) to 100 percent (August 2013) in the most impacted of the three sites selected for monitoring (site #24). The

project team also noted that once livestock were excluded from the stream, native plant species rebounded and outcompeted the livestakes that were planted (WRP, 2013).

WRP continue to work in the Beaverdam Creek watershed. The project team recognizes that community and landowner interests drive restoration and rehabilitation efforts throughout the watershed. Hundreds of hours were spent talking to individual landowners and educating students, teachers and community leaders on the benefits of the BMPs that were installed (WRP, 2013).

WRP received a second EPA Section 319 grant in 2015. Efforts are currently underway to work with landowners identified in the first phase of the project to install site specific BMPs. Funds will also be used to monitor any existing and newly installed BMPs to document project success. BMPs to be installed include fencing for livestock exclusion, alternate watering sources for livestock, animal waste management, stabilizing eroding streambanks, and planting riparian buffers.

3.4.4.2 NCDEQ Division of Mitigation Services (DMS)

The Beaverdam Creek watershed is one of three targeted local watersheds (TLWs) identified by the Division of Mitigation Services (DMS) for priority planning and restoration project funds. The 2009 River Basin Restoration Priority (RBRP) Plan identifies preservation of high-quality riparian buffers (undisturbed, vegetated with native species) and headwater stream channels as a priority as well as working with landowners on installing BMPs. Like WRP, DMS has identified livestock fencing, stream buffer restoration and alternative watering sources as priority BMPs for the watershed.

3.4.4.3 NCDA&CS DSWC Agriculture Cost Share Program (ACSP)

Beaverdam Creek has been targeted by the local Soil and Water Conservation District (SWCD) and NC Cooperative Extension Service (NCCES) for educational workshops related to keeping and maintaining riparian areas. Initial work has already started in identifying areas of concern and where streambanks are heavily eroded. In addition, several BMPs have already been installed in the watershed. BMPs include measures to reduce sediment, nutrient and erosion and exclude livestock from streams. Additional information about the ACSP and the total number of BMPs installed, total cost as well as the benefits (soil saved and nutrient reduction) can be found in the chapter titled Nonpoint Source Pollution and Programs to Protect Water Resources.

3.4.5 References

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