

# Streams of Boone County 2018-2019 Water Year Summary



Boone County Resource Management  
October 31, 2019

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Cover photo: Beneath the rock bridge at Rock Bridge Memorial State Park, October 22, 2019

U.S. Environmental Protection Agency Region VII, through the Missouri Department of Natural Resources, has provided partial funding for the Bonne Femme Watershed Project under Section 319 of the Clean Water Act.

# I. Introduction



Bass Creek in Three Creeks Conservation Area after a winter rain, December 1, 2018.

Welcome to the third edition of the Streams of Boone County Water Year Summary. We faced a different set of challenges during this very wet year in Central Missouri – a stark contrast to last year’s drought. Our ability to conduct water quality monitoring was restricted by flooding waters simultaneously increasing and diluting the chemicals that we sample in our streams. The high numbers and diversity of macroinvertebrates in the streams in and around Rock Bridge Memorial

State Park at our fall monitoring blitz on October 12<sup>th</sup> was a great relief and very encouraging.  
Thank you for reading.

## II. Hinkson Creek



A view of Hinkson Creek, May 5, 2019

**A brief history.** Hinkson Creek was placed on the list of impaired waters in 1998 for failure to fully support aquatic life. Under the Federal Clean Water Act, the list is generated by the

Missouri Department of Natural Resources (MDNR) every other year and approved by the Missouri Clean Water Commission and the United States Environmental Protection Agency (USEPA). Failure to fully support aquatic life in this context means that the community of macroinvertebrates in the stream does not contain sufficient diversity of organisms, particularly organisms that are intolerant of pollutants in the water. Despite many years of research, MDNR and others have not been able to identify a pollutant in Hinkson Creek that is causing the impairment.

As a pollutant could not be identified, USEPA issued a Total Maximum Daily Load (TMDL) document that identified stormwater as a surrogate for a known pollutant. The TMDL would have required Boone County, the City of Columbia, and the University of Missouri (PARTNERS) to reduce the loading of stormwater into the creek by approximately 37%. Because of the financial burden that would have accompanied such a massive stormwater reduction, PARTNERS sued the USEPA to have the TMDL rescinded. In 2011, an agreement was reached between USEPA, MDNR and the PARTNERS to settle the lawsuit and the Hinkson Creek Collaborative Adaptive Management process was implemented.

**What is Collaborative Adaptive Management?** Collaborative Adaptive Management (CAM) is a process by which stakeholders involved in an issue work to identify and implement strategies for improving that issue. In this case, the issue is the impairment of Hinkson Creek. Strategies range from research to help identify the cause of the impairment to projects designed to reduce the transport of pollutants into the stream. Three groups work together on the CAM process: a stakeholder committee, an action team, and a science team. The process is iterative, so as more information becomes available, that new information informs the process moving forward.

Projects that are implemented can discover decision-relevant science or generally improve the health of Hinkson Creek. For more information on CAM participation and processes, please see [www.helpthehinkson.org](http://www.helpthehinkson.org) .

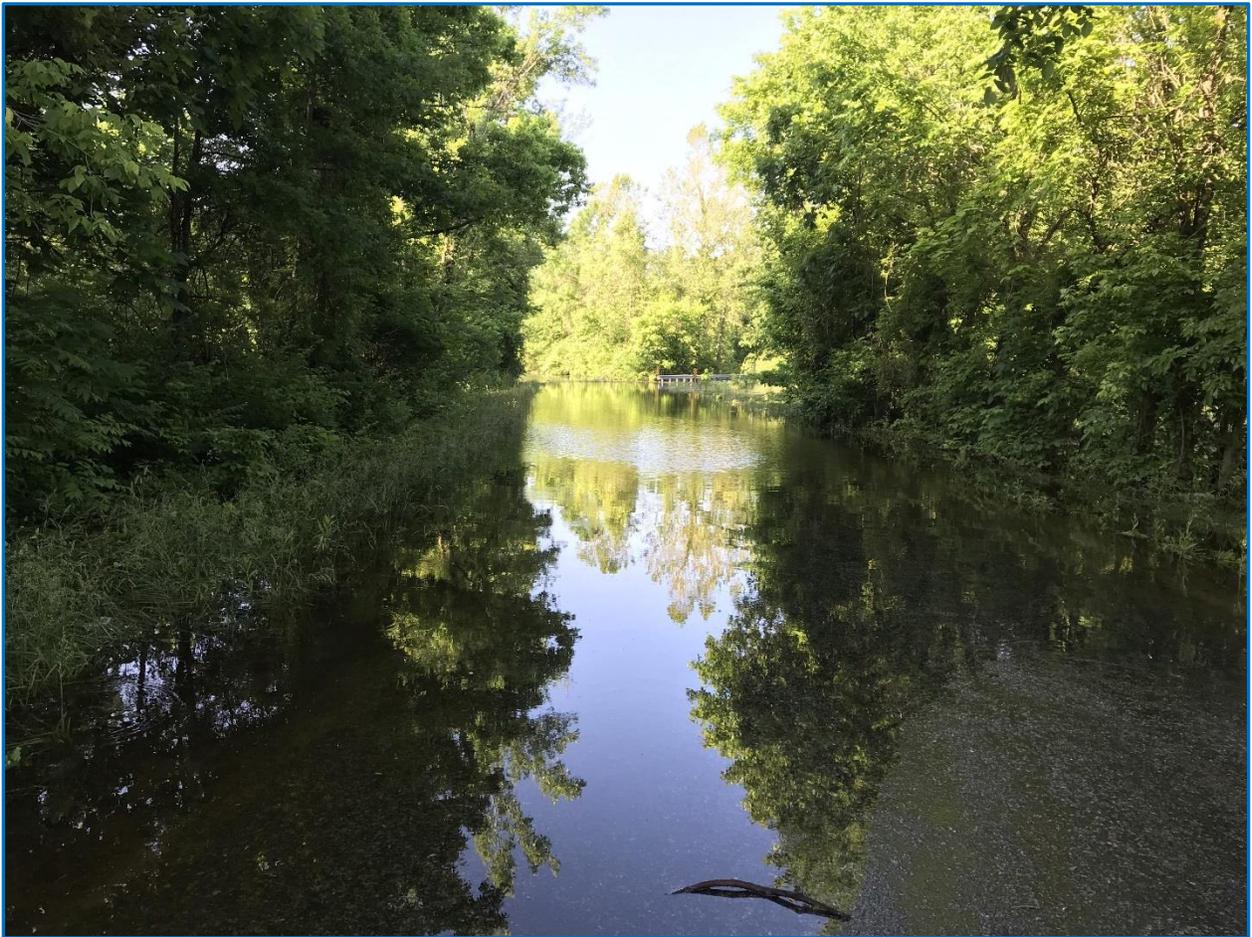
**What's new in 2019?** Analysis of the data collected during the sediment survey in Hinkson Creek during the summer of 2018 is still ongoing. These data are being compared to data collected during a physical habitat assessment in Hinkson Creek that was conducted between 2013 and 2015. The analysis seeks to identify patterns of sediment deposition in the stream that can help illustrate sources of sediment and what happens to the sediment once it has entered the stream system. This information is important for several reasons. Sediment deposition (as opposed to sediment that is simply transported downstream) can smother habitat available for aquatic organisms. Also, sediment, itself a pollutant, can transport other pollutants of concern that may be causing impairment in the stream. We hope to have the analysis completed in the near future.

Boone County is currently hosting a study that further explores macroinvertebrate data collected by MDNR in Hinkson Creek over the last several years. The purpose of the study is to gather additional information about the macroinvertebrate communities living in the stream using data we already have – a data mining study if you will. An interim presentation on the study results is planned for presentation to the CAM teams and interested members of the general public on April 14, 2020. The time and place of the presentation will be announced closer to the date.

Dr. Alba Argerich, a stream ecologist and professor at the University of Missouri, is conducting water quality analysis for several parameters of concern in Hinkson Creek. She and

her students began sampling in 2019 and in collaboration with the CAM teams, is making plans to continue sampling for two more years. Data analysis from the initial sampling runs is ongoing and we hope to have more information to present about results of this study in the next annual report.

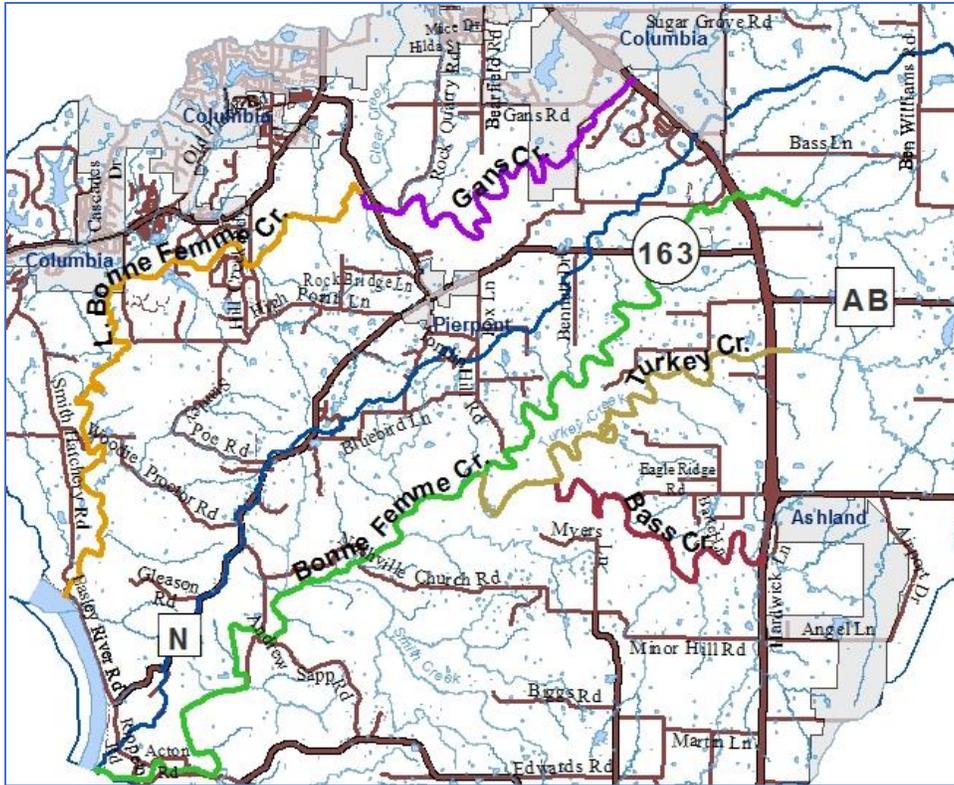
### III. Bonne Femme Watershed Project



Little Bonne Femme Creek in flood over Woodie Proctor Road, June 5, 2019

**What is the Bonne Femme Watershed Project?** The Bonne Femme Watershed Project is the revitalization and continuation of several projects from the past that sought to protect and conserve water quality in the Little Bonne Femme and Bonne Femme Watersheds (known

together as the Greater Bonne Femme Watershed) in Boone County. The current project includes the development of a watershed-based plan (WBP) for the Greater Bonne Femme Watershed, as well as a stormwater best management practice (BMP) demonstration project and an outreach initiative to inform local stakeholders of the need for the current planning and future implementation process. The WBP will consist of nine specific elements required by U.S. EPA; approval of the plan by EPA and the Missouri Department of Natural Resources will provide eligibility for future funding to address water quality concerns identified in the plan. The previous watershed project, which concluded in 2007, resulted in the Bonne Femme Watershed Plan. The plan may be viewed in its entirety on [www.cavewatershed.org](http://www.cavewatershed.org). The map below shows much of the watershed with roads marked for reference. The five streams highlighted with bright colors show reaches that are impaired because *E. coli* levels in the water, on average (calculated as a geomean during the recreational season which runs from April through October of each year), exceed the water quality standards set by USEPA and MDNR and codified in state law.

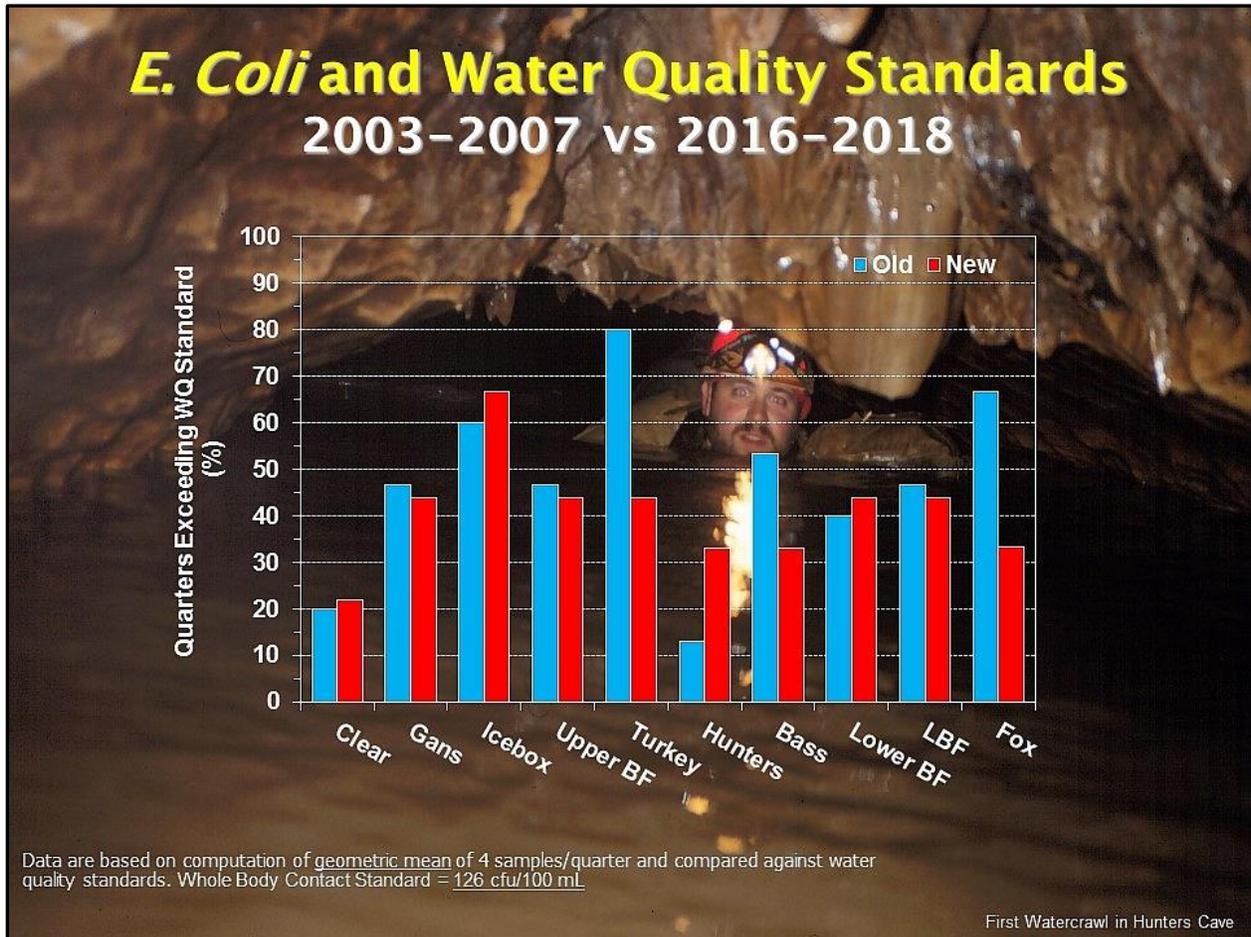


A map of the Greater Bonne Femme Watershed in Boone County, Missouri.

The blue line marks the division between the Bonne Femme and Little Bonne Femme watersheds. The impairment in the watershed is of concern as these stream reaches are also classified as outstanding state resource waters, known for clarity and quality of habitat for aquatic life.

**Science update 2019.** Quarterly water quality monitoring is ongoing in the Greater Bonne Femme Watershed. Samples are analyzed for Acetochlor, Alachlor, Atrazine, Deethylatrazine, Deisopropylatrazine, Metolachlor, Metribuzin, and Simazine (agricultural chemicals or their breakdown products); Nitrate, Ammonium and Phosphate (nutrients used in agricultural fertilization or found in animal / human waste); and *E. coli*. Based on analyses by the local USDA / ARS office, concentrations of these chemicals have varied over the years but do not

seem to be increasing. Dr. Robert Lerch from the USDA / ARS office presented the slide below comparing *E. coli* levels in streams in the watershed during different time periods at the land management workshop held on March 22, 2019.



This graph summarizes data collected through the last quarter of 2018. Sites are located on Clear Creek, Gans Creek, the Devil’s Icebox Spring Branch, upper Bonne Femme Creek, Turkey Creek, the stream running through Hunters Cave, Bass Creek, lower Bonne Femme Creek, Little Bonne Femme Creek and Fox Hollow Branch.

Microbial source tracking (MST) has been ongoing in the watershed to help identify the source of the *E. coli* in the streams. We have confirmed the presence of DNA from *E. coli* found in humans (low concentrations), cow (generally low to mid-range concentrations), ruminant (category includes goats, sheep, deer, alpaca and cows – generally mid to high range concentrations), and dog (generally very low to low concentrations – only 1 sample analyzed for

dog) in streams in the watershed. Further exploration of land use in the watershed revealed several farms that raise goats, so for our purposes ruminant now includes cow, deer and goats. It is important to note that the concentrations mentioned above refer to just the samples collected and do not necessarily represent the bacteria levels in the entire stream. The results from the MST analysis will be used by Boone County to help identify critical source areas for bacteria in the impaired streams to give us a better idea of where to place best management practices on the landscape. Best management practices will slow the overland flow of stormwater, causing sediment and other contaminants to drop out onto the land before entering the streams. Soil microbes and ultraviolet radiation (e.g. sunlight) can kill *E. coli* if given the opportunity to do so.

Understanding stream flow volumes is important when modeling pollutant loading conditions, and loading response to BMP implementation, in watershed streams. Having good flow data for local streams is critical for these analyses. There are some gaps in gauging station data during the last water year due to high flow levels from flooding in the watershed. The County maintains these stations to monitor the depth of stream water on Turkey Creek, Bonne Femme Creek and Little Bonne Femme Creek. The stations were removed during periods of flooding in Bonne Femme and Little Bonne Femme Creeks as they have electronic components that cannot be exposed to water. Due to these data gaps and the relatively short time that the County has been collecting data, MDNR will be modeling flows for the five impaired streams during development of the initial 9-element watershed based plan. The plan will be revised in five years, and at that time we will use actual data from the gauges on the three monitored streams to help model current and future watershed water quality conditions.

**Education and outreach update 2019.** Boone County and our partners continued to participate in outreach and education events that focus on water quality and the unique natural resources

found in the Greater Bonne Femme Watershed. These events included participation at the Rock Bridge Memorial State Park Water Festival during the summer of 2019 and hosting a spring and fall Stream Team Water Quality Monitoring Blitz in and around Rock Bridge Memorial State Park. The spring monitoring blitz was held on May 11, 2019. The weather was not favorable that day (what started as a light rain became a deluge after we got to the park) and data collection was incomplete. The cumulative results from the macroinvertebrate scores from the monitoring blitzes to date is offered below:

Stream	WQ Rating Fall 2016	WQ Rating Spring 2017	WQ Rating Fall 2017	WQ Rating Spring 2018	WQ Rating Fall 2018	WQ Rating Fall 2019
Gans Creek Upstream	Fair	Excellent	Not monitored during the event	Good	Fair	Excellent
Gans Creek Downstream	Good	Excellent	Good	Good	Good	Fair
Little Bonne Femme Creek Upstream	Excellent	Excellent	Good	Good	Good	Excellent **
Little Bonne Femme Creek Downstream	Excellent	Excellent	Good	Good	Not monitored during the event	Not monitored during the event
Clear Creek	Fair	Good	Excellent	Good	Excellent	Excellent **
Devil's Icebox Spring Branch	Poor *	Poor *	Poor *	Poor *	Not monitored	Poor *

\* The water quality (WQ) rating in the Devil's Icebox Spring Branch (site is at the cave mouth) is consistently poor because only two types of macroinvertebrates live in the cave system – since this rating system is primarily based upon macroinvertebrate diversity, the “poor” rating at this site is more reflective of natural habitat conditions than poor water quality.

\*\* These two streams scored in excess of the normal excellent range established by Missouri Stream Teams.

Macroinvertebrate scoring is calculated based upon diversity and pollution tolerances of organisms found. In a high precipitation year like 2019, we were concerned that the macroinvertebrate scores would decline because of population displacement during high flow events, but were pleasantly surprised at most of the sites. Additional outreach and education events this year included storm drain marking in the City of Ashland and participating in events with the City of Columbia stormwater educator.

A land management workshop was held in the watershed in March of 2019, and it was another great success. The next land management workshop is planned for December 14, 2019. The December workshop will focus on Soil Health and Regenerative Agriculture. Practices discussed will be beneficial to producers from an economic perspective as well as beneficial to water quality.

**9-element plan development.** Boone County stormwater staff continue to work with MDNR to develop a 9-element plan for recovery of stream water quality and protection of outstanding state resource waters in the Greater Bonne Femme Watershed. The plan will be finalized during the 2020 calendar year. A Steering Committee is being assembled that includes policy-makers from local governments and the University of Missouri. The Steering Committee will help draft various portions of the plan that will transition into the implementation phase after the plan is completed. Boone County and partners will be asking for more citizen involvement in the coming months as we begin public meetings to discuss the content of the plan and host additional public education and outreach events. We are excited about the opportunity to engage and work with the many stakeholders that have an interest in water quality in the Greater Bonne Femme Watershed.

## IV. Stream Team #4794

**Streams surveyed in 2019.** The Boone County Stormwater Team actively participates in the Missouri Stream Teams program as Stream Team #4794. In 2019, team #4794 monitored water quality on Bonne Femme Creek, Turkey Creek, Little Bonne Femme Creek, the Devil's Icebox Spring Branch in Rock Bridge Memorial State Park, Silver Fork Creek, Lick Fork Creek, and Cedar Creek, all in Boone County. Streams are typically monitored for chemical constituents (nutrients) four times per year, and macroinvertebrate sampling is conducted twice per year. Due to high precipitation and flooding conditions in 2019, stream water quality data would not have been representative so there were far fewer rounds of sampling. We hope for stream conditions to be relatively normal in the coming water year so that we can resume monitoring on all of our sites and add a few sites as the need arises.

**Moving forward.** The Boone County Stormwater Team continues to welcome suggestions from citizens of Boone County for other waterways that may need a closer look or are currently exhibiting high water quality. Water quality monitoring is not just about restoring impaired waters but also protecting those waters that are in good condition moving into the future.

## V. Concluding Remarks

It has been another exciting and challenging year for water quality in Boone County. As partners in the CAM process we continue to research water quality in Hinkson Creek. New research projects will provide data to inform decision-making to improve water quality in the creek and

reduce the likelihood of future impairments. The 9-element plan in the Greater Bonne Femme Watershed continues to develop, giving us the opportunity to have local input into how the impairments are managed to improve water quality and protect our valuable Outstanding State Resource Waters. The Stormwater Team looks forward to working more closely with citizens of Boone County in 2020 to conserve and protect our natural resources.



The Missouri River from the overlook in Hart Creek Conservation Area, April 5, 2019