National Park Service
U.S. Department of the Interior

Inventory and Monitoring Division
Cumberland Piedmont Network

Water Quality Monitoring, Fiscal Year 2024

Overview

The Cumberland Piedmont Inventory and Monitoring Network (CUPN) began long-term water quality monitoring at Stones River National Battlefield in fiscal year 2003 (FY03). Water quality is measured every month for two years, followed by a five-year hiatus (concordant with the U.S. Geological Survey's national long-term water quality program). Water quality is measured at four sites: the West Fork Stones River at Redoubt Brannan (RBWF) and further downstream at McFadden's Ford (MFWF); and King's Pond Spring (KSKP) which sinks underground and emerges at Battlefield Spring (BSBS) near the river (see map on page 2). Based upon program requirements and findings of the water quality inventory, a set of parameters was chosen for long-term monitoring. These include field measures of water temperature, specific conductance, pH, and dissolved oxygen. Samples were also collected for laboratory analysis of *Escherichia coli* (*E. coli*) and nitrate.

This brief summarizes data collected from November 2002 through September 2024, highlighting October 18, 2023 through September 19, 2024. Water quality data are available upon request to the Cumberland Piedmont Network.

Significant Findings

There were three violations of state water quality standards in fiscal year 2024 (FY24). Dissolved oxygen, corresponding to low flow, was found below the state standard of 5.0 mg/L twice at Battlefield Spring. The depressed dissolved oxygen is likely the result of natural hydrological conditions—the springs are fed mostly through the epikarst, the upper few meters of soil—covered limestone where there is no natural aeration of water (Figure 1).

There was one violation of the state *Echerichia coli* standard of 487 MPN/110mL. This single high value was during higher than normal flow at Kings Pond and is likely the result of wildlife. Most Probable Number (MPN) is a statistical method of estimating bacteria colony density.

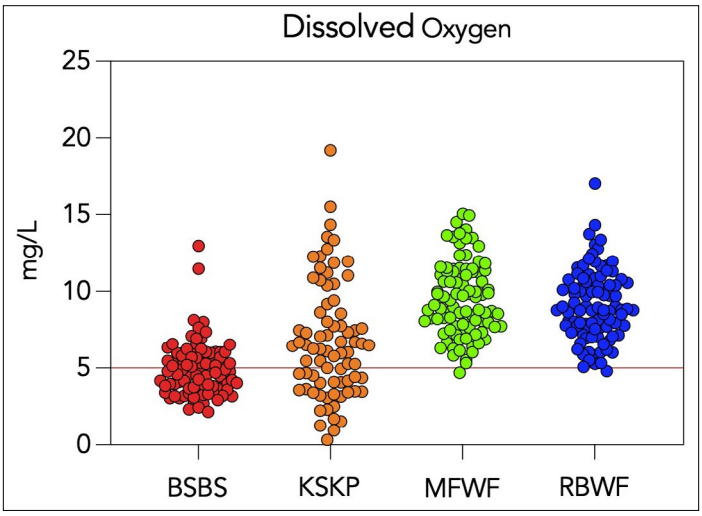


Figure 1. Dissolved oxygen at Stones River NB November 2002 through September 2024. The red line denotes the Tennessee dissolved oxygen standard of 5 mg/L. The West Fork Stones River at McFadden's Ford (MFWF) and Redoubt Brannan (RBWF) are typically well-aerated with oxygen while the shallow groundwater of Battlefield Spring (BSBS) and Kings Pond Spring (KSKP) commonly have low dissolved oxygen. NPS / CUPN

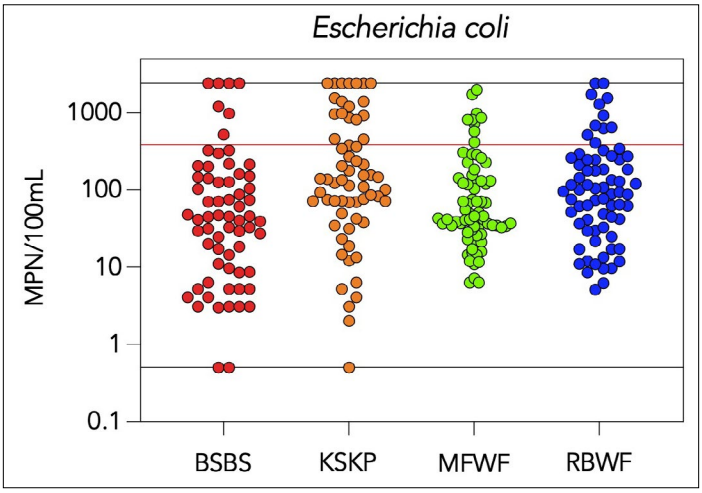


Figure 2. *Escherichia coli* at Stones River NB October 2008 through September 2024. The red line represents the Tennessee standard of 487 MPN/100mL. The lower black line is set at 0.5 and represents values below the detection limit of 1 MPN/100mL. The upper black line is set at 2420 MPN/100mL representing all values above the detection limit. Each site has exceeded the state limit several times. [BSBS= Battlefield Spring; KSKP=Kings Pond Spring; MFWF=West Fork Stones River at McFadden's Ford; RBWF= West Fork Stones River at Redoubt Brannan]. NPS / CUPN

Water Quality Standards

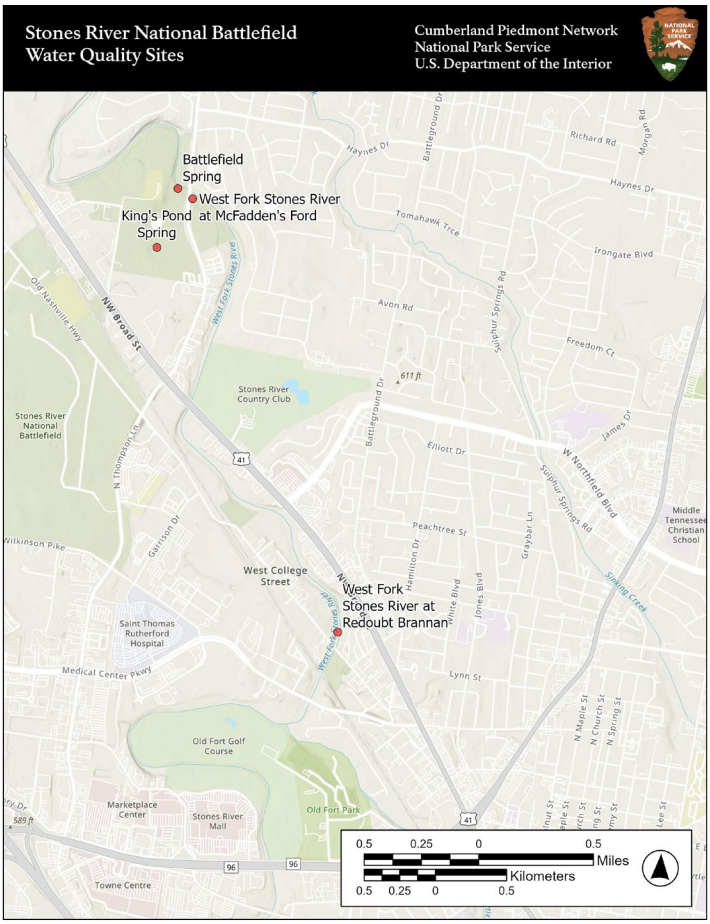
All park waters are considered "Exceptional Tennessee Waters." This designation prohibits discharge and other pollution sources. Criteria are defined as Tennessee's "Fish & Aquatic Life and Recreational" standards, a combination of the highest standards under the Clean Water Act as promulgated by the state. We use the EPA freshwater aquatic life recommended concentration limit for nitrate of 90 mg/L as NO_3.

Table 1. Parameters and Standards.

Parameter	Standard
Water temperature	Less than 31.7°C (89.1°F)
Dissolved oxygen	Greater than 5.0 mg/L
pH	Between 6.0 and 9.0 SU
Escherichia coli	Less than 487 MPN/100 mL
Specific conductance	No standard
Nitrate	Less than 90 mg/L as NO_3

Future Monitoring

Water quality sampling is scheduled to resume in FY30.



Water-quality monitoring sites at Stones River National Battlefield in FY24. NPS / CUPN

West Fork Stones River at Redoubt Brannan (RBWF) on November 15, 2023. The stream is also monitored downstream at West Fork Stones River at McFadden's Ford (MFWF). NPS / Brenda Wells

About the CUPN

In 1999 the National Park Service initiated a long-term ecological inventory and monitoring program in more than 280 National Park Service units. This program monitors fundamental elements and processes in park ecosystems to help indicate the overall health or condition of park resources. Data generated allows us to better understand natural processes and the results of management actions, and help guide parks in the successful protection and use of park resources. Information gathered is shared widely through the production of technical reports, resource briefs, and journal publications.

The Cumberland Piedmont Inventory and Monitoring Network, one of 32 networks across the country, includes 14 parks that share geographic proximity and common natural resources. Parks within each of the networks work together to plan, design, and conduct inventories and long-term monitoring. The Cumberland Piedmont Network provides long-term monitoring for water quality, cave bats, crickets and meteorology, Allegheny woodrats, forest vegetation, ozone foliar damage, and invasive species.

For More Information

CUPN Home Page:
https://www.nps.gov/im/cupn/index.htm

CUPN Reports & Publications:
https://www.nps.gov/im/cupn/reports-publications.htm

About the NPS Inventory & Monitoring Program:
https://www.nps.gov/im/index.htm

Data Downloads via the Natural Resource Information Portal:
https://irma.nps.gov/Portal/

Contact

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Kings Pond (KSKP) on March 20, 2024. This small spring-fed pond commonly has dense algal growth. NPS / Brenda Wells