



Water Quality Monitoring, Fiscal Year 2025

Overview

The Cumberland Piedmont Network Inventory and Monitoring Program (CUPN) began long-term water quality monitoring at Mammoth Cave National Park in fiscal year 2002 (FY02). Water quality is measured every month over a two-year period followed by a five-year hiatus (concordant with the U. S. Geological Survey's national long-term water quality program). Thirteen sites are monitored at the park (see map on page 2) including: Green (two sites) and Nolin Rivers, Mile 205.7 Spring, Pike Spring, Big Spring, Echo River Spring, Turnhole Spring, Buffalo Creek Spring, Doyle's Ford Spring, and Ugly Creek Spring, plus two cave streams, Hawkins and Logsdon Rivers. Based on findings of the pre-existing monitoring program, parameters were chosen for long-term monitoring, including the field measures of water temperature, specific conductance, (SpC), pH, dissolved oxygen (DO) and turbidity (see Table 1 on page 2). Samples undergo laboratory analysis for *Escherichia coli* (*E. coli*) and nitrate.

This brief summarizes data collected from October 2002 through September 2025, highlighting October 17, 2024, through September 16, 2025. Water quality data are available upon request to the Cumberland Piedmont Network.

Significant Findings

There were 32 violations of state water quality standards in FY25. All violations were samples where *E. coli* exceeded the Kentucky Primary Recreational Contact limit of 298 MPN/100 mL (Figure 1). Most Probable Number (MPN) is a statistical method of estimating bacteria colony density. By far, the most common bacterial source is runoff from private lands. It is worth noting the relationship between *E. coli* and flow condition (Figure 2). Consider the average *E. coli* value during low, normal, and above normal flow categories at each sampling site. It is rare that *E. coli* is elevated during low or normal flow conditions, while it is common to see this limit exceeded during times of high flow. This relationship is due to non-point source contamination (animal waste) becoming entrained in runoff during rainfall events and is more pronounced in watersheds with higher proportions of private lands. There are occasions when small springs like Pike and Mile 205.7 are inundated with river water, causing high bacterial levels.

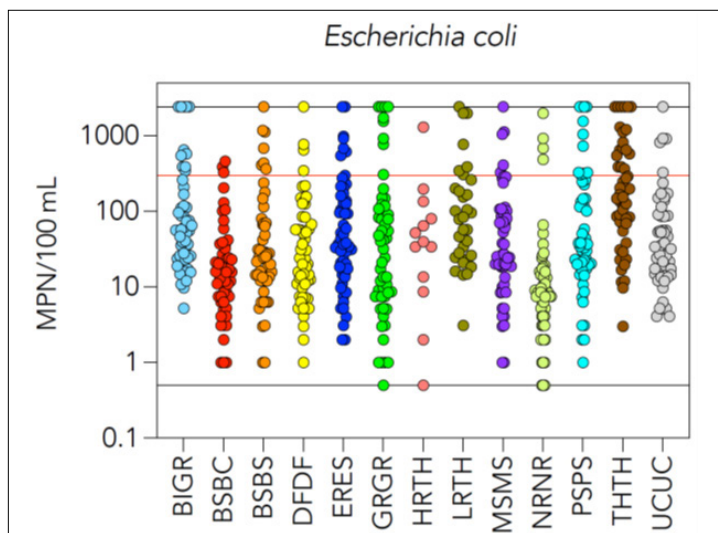


Figure 1. *E. coli* at Mammoth Cave National Park, October 2002 through September 2025. The red line represents the state recreational contact limit of 298 MPN/100 mL. The lower black line is set at 0.5 and represents values below the detection limit of 1 MPN/100 mL. The upper black line is set at 2420 MPN/100 mL representing all values above the detection limit. Every site can exceed the limit at times of high flow [BGR=Green River at Bush Island; BSBC=Buffalo Creek Spring; BSBS=Big Spring; DDFD=Doyle's Ford Spring; ERES=Echo River Spring; GRGR=Green River; HRTH=Hawkings River; LRTH=Logsdon River; MSMS=Mile 205.7 Spring; NRNR=Nolin River; PPS=Pike Spring; THTH=Turnhole Spring; UCUC=Ugly Creek Spring].

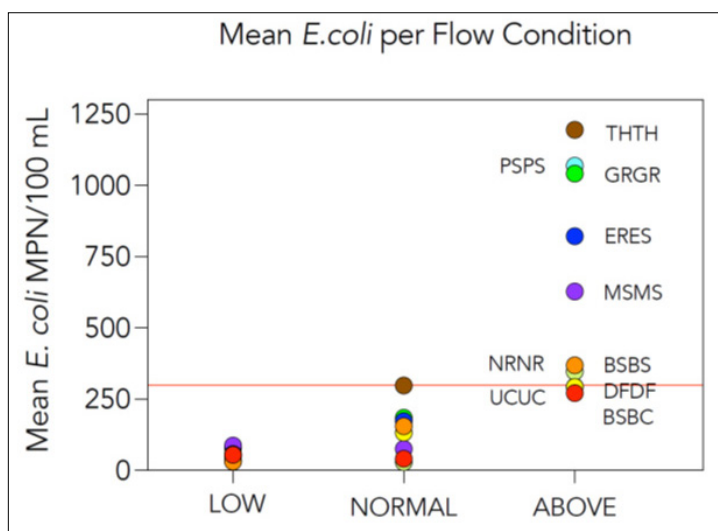


Figure 2. *E. coli* at Mammoth Cave National Park October 2002 through September 2025. The red line represents the state recreational contact limit of 298 MPN/100 mL. This graph shows the relationship between average *E. coli* levels and flow condition.

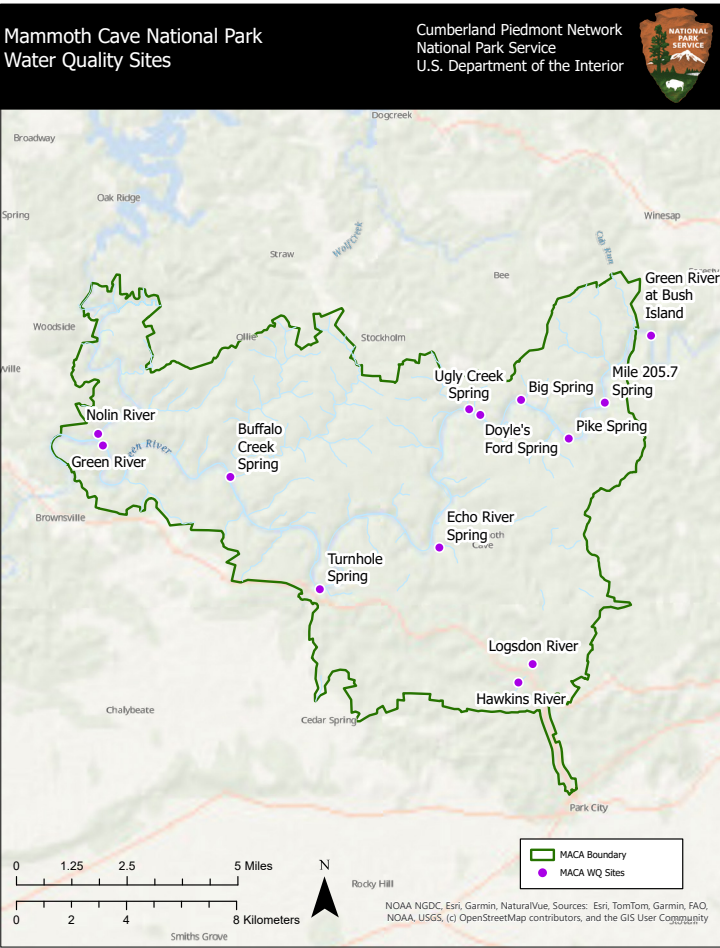
Water Quality Standards

Springs and cave streams are designated as “Cold Water Aquatic Habitat” (CW) under the Clean Water Act as promulgated by the Kentucky. Surface streams are designated as “Warm Water Aquatic Habitat” (WW), as defined in 401 KAR 10:031, Kentucky Administrative Regulations, Surface Water Standards. There is no numerical value for water temperature. The Cumberland Piedmont Network uses the EPA single sample standard for *E. coli*. There are no state or federal standards for nitrate-nitrogen, but we use the EPA freshwater aquatic life recommendation for nitrate results, which are not to exceed 90 mg/L. Specific conductance (SpC) is without a state standard or federal guidelines but is useful for interpreting water quality results. Water quality sampling will resume in FY2032.

Table 1. Parameters and Standards.

Parameter	Standard
Water temperature (CW)	Less than 20°C (68°F)
Water temperature (WW)	Less than 31.7°C (89°F)
Dissolved oxygen (CW)	Greater than 5.0 mg/L
Dissolved oxygen (WW)	Greater than 4.0 mg/L
pH	Between 6.0 and 9.0 SU*
<i>E. coli</i>	Less than 298 MPN/100 mL
Specific conductance	No standard
Nitrate-nitrogen	Drinking water not to exceed 45mg/L

* Standard units (SU) is standardized way to express acidity or alkalinity of water.



WQ monitoring sites at Mammoth Cave National Park in FY 2025.



Echo River Spring on January 17, 2025. Flow condition is considered normal. Photo by Lillian Scoggins

About the Cumberland Piedmont Network

In 1999 the National Park Service initiated a long-term ecological monitoring program in over 280 National Park Service units. This program monitors fundamental elements and processes in park ecosystems that help indicate the overall health or condition of park resources. Data generated from this program allow 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 as Network staff produce technical reports, resource briefs, and journal publications.

The Cumberland Piedmont 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/>

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