



Discrete Water Quality Monitoring: Water Year 2022

Background

Water resources within Big South Fork National River and Recreation Area (BISO) include approximately 80 miles (129 kilometers) of the Big South Fork of the Cumberland River along with its two major tributaries, Clear Fork and New River. In addition, there are hundreds of miles of tributaries and headwater streams within the park's 125,000 acres (50,585 hectares).

The BISO rivers and streams sustain nationally important freshwater fauna, including 11 federally-listed mussel species and the only population in existence of the federally-endangered tuxedo darter (*Etheostoma lemniscatum*). Big South Fork National River and Recreation Area supports one of the largest concentrations and some of the most pristine examples remaining of the globally-imperiled Cumberlandian cobble bar or riverside scour prairie. These cobble bar prairies and the rare species that inhabit them thrive in the presence of frequent flood disturbance and are dependent upon natural flood regimes and unpolluted water.

Big South Fork National River and Recreation Area occupies a small, downstream portion of its large (1,120 square mile [2,901 square kilometers]) watershed, and therefore, the health of its aquatic systems is dependent to a large degree on external factors.



Kayakers paddling on the Big South Fork of the Cumberland River at Blue Heron. NPS photos / APHN staff.

Highlights

- In WY2022, 63 water quality samples and seven QA/QC replicates were collected at 14 sites.
- Four sites did not attain state standards for pH.
- Water temperature and dissolved oxygen met state standards.
- There was one violation of *E. coli* state standards.
- Specific conductance was below 200 $\mu\text{S}/\text{cm}$ at all sites.
- Turbidity was generally low.
- Overall, park waters are in good condition.

Issues of Management Concern

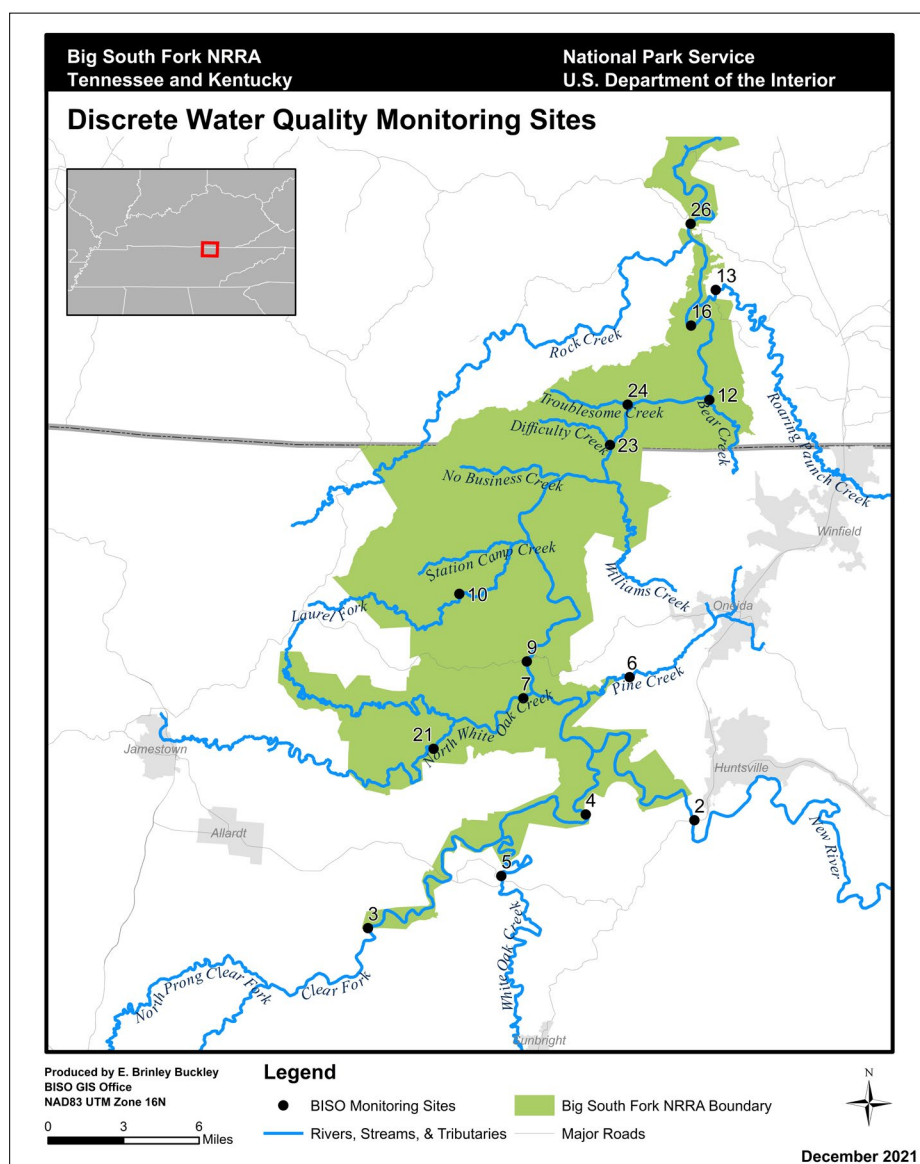
The primary threats to water quality at Big South Fork National River and Recreation Area are related to acid mine drainage from coal mines, sedimentation associated with mining and roads and trails, and impacts from timber harvest, agriculture, water development, and oil and gas activities.

Monitoring and Objectives

The Appalachian Highlands Inventory and Monitoring Network (APHN) monitors water quality at strategic integrator sites to identify water resource conditions. The network monitors core water quality parameters including:

- Streamflow
- Water Temperature
- Dissolved Oxygen
- pH
- Specific Conductance
- ANC (acid neutralizing capacity)
- *Escherichia coli* (*E. coli*)
- Turbidity
- Trace Metals
- Nutrients
- Major Ions

Current conditions are compared to state and federal standards (TDEC 2019), as well as natural reference conditions within Big South Fork National River and Recreation Area (Rikard et al. 1986). For detailed methods, see Hughes et al. 2018.



Map showing discrete water quality monitoring sites in the Big South Fork National River and Recreation Area watershed.

Table showing discrete water quality monitoring site identification numbers, site location names, the number of samples collected during water year 2022 in Big South Fork National River and Recreation Area.

ID	Name	Number of Samples (2022)
02	New River at New River	8
03	Clear Fork at Peters Bridge	3
04	Clear Fork at Burnt Mill Bridge	11
05	White Oak Creek at Rugby	4
06	Pine Creek at Toomey	3
07	North White Oak Creek near mouth	4
09	Big South Fork at Leatherwood Ford	9
10	Laurel Fork at Station Camp Crossing	3
12	Bear Creek at mouth	3
13	Roaring Paunch at Barthell	3
16	Big South Fork at Blue Heron	4
21	North White Oak Creek at Zenith	3
23	Difficulty Creek	2
24	Troublesome Creek	3

Significant Findings

Sampling during water year 2022 (WY22) occurred from October 2021 to September 2022. Including QA/QC, 70 samples were collected from 14 sites.

Six violations of Tennessee State Water Quality Standards were recorded in WY22. There were four violations of the lower pH standard of 6.0 standard units (SU): twice at Troublesome Creek, once at Difficulty Creek, and once at Laurel Fork (Figure 1). There was one violation of the upper pH standard of 9.0 SU, recorded at Pine Creek (9.14 SU). Bear Creek exceeded the *E. coli* single sample standard of 487 cfu/100 ml, recorded at 610 MPN/100 ml.

Water temperature and dissolved oxygen met all water quality criteria, with temperature remaining below 30.5°C (86.9°F) and dissolved oxygen above 5 mg/l. Natural reference conditions for specific conductance, as there are no state standards, are below 100 $\mu\text{S}/\text{cm}$ in the rivers of Big South Fork NRR and below 50 $\mu\text{S}/\text{cm}$ in smaller streams. Specific conductance was below 100 $\mu\text{S}/\text{cm}$ at most sites (mean = 78.22 $\mu\text{S}/\text{cm}$), with the exceptions of New River, Big South Fork at Leatherwood Ford, Roaring Paunch Creek, Bear Creek, and Pine Creek. However, all of these sites were below 200 $\mu\text{S}/\text{cm}$. Turbidity was generally low at all sites (mean = 4.5 FNU). Big South Fork at Leatherwood Ford, Bear Creek, and New River had the highest mean turbidity.

Acid neutralizing capacity is the ability of a stream to buffer or neutralize acid inputs. Streams with ANC below 20 mg/l as CaCO_3 are sensitive to acidification, while streams below 2.5 mg/l as CaCO_3 are highly sensitive. Due to the sandstone dominated geology of the Cumberland Plateau, many streams have low buffering capacity and are considered sensitive to acidification (mean of all streams = 19.29 mg/l CaCO_3). Three streams, Difficulty Creek, Troublesome Creek, and Laurel Fork, are highly sensitive to acidification.

Water quality data are available upon request to the Appalachian Highlands Network. Past water quality reports and briefs are available on the [Appalachian Highlands Network website](https://www.nps.gov/im/aphn/reports-publications.htm) (https://www.nps.gov/im/aphn/reports-publications.htm).

Literature Cited

- Hughes, J., R. Emmott, E. Raskin, and B. Witcher. 2018. Long-term discrete water-quality monitoring at Big South Fork National River and Recreation Area, Blue Ridge Parkway, and Obed Wild and Scenic River: Protocol narrative. Natural Resource Report NPS/APHN/NRR—2018/1840. National Park Service, Fort Collins, Colorado. Available at: <https://irma.nps.gov/DataStore/Reference/Profile/2258269> (last accessed October 2023).
- Rikard, M., S. Kunkle, and J. Wilson. 1986. Big South Fork NRR Water Quality Report, 1982–1984. NPS Water Resources Report No. 86-7. 65pp.
- Tennessee Department of Environment and Conservation (TDEC). 2019. Revised General Water Quality Criteria.

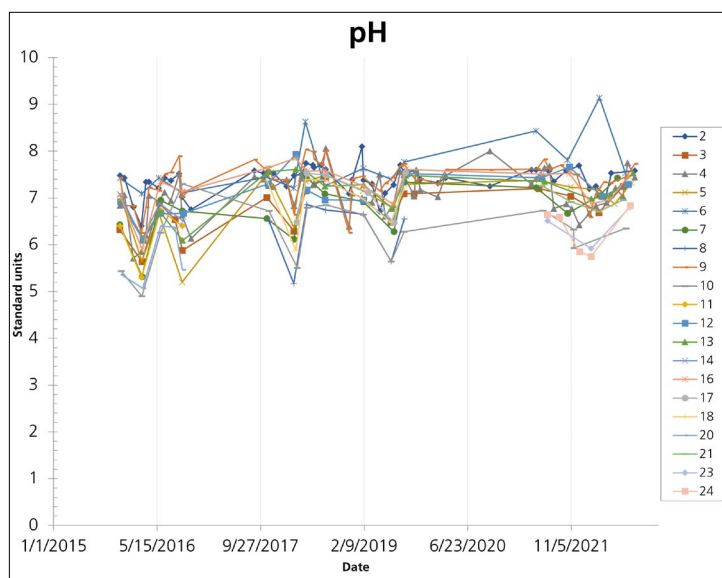
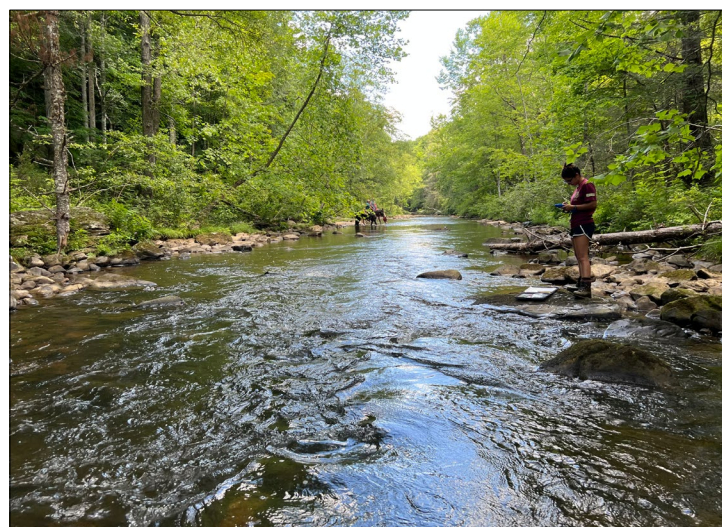


Figure 1. pH from 2015–2022 at BISO monitoring sites.

Appalachian Highlands Network

- Emma Brinley Buckley, Hydrologist
Contact: emma_brinleybuckley@nps.gov
- Amanda Monteverde, Hydrology Intern
- Natalie Stone, Hydrology Intern
- Brian Witcher, Program Manager
- Evan Raskin, Assistant Data Manager/Biologist
- Tim Fotinos, Data Manager

[APHN website](https://www.nps.gov/aphn/index.htm) (https://www.nps.gov/aphn/index.htm)



Recording data upstream from a horse crossing. NPS photos / APHN staff.