



Discrete Water Quality Monitoring: Water Year 2022

Background

Streams and rivers along the Blue Ridge Parkway (BLRI) are important water resources for the park, as well as Southern Appalachia. Approximately 150 headwater streams in the park feed major rivers that provide much of the drinking water for the Southeast (Catlin 1984). The BLRI park boundary also encompasses four state- and nationally-designated Outstanding Resource Waters, 400 streams, five major rivers, and numerous wetlands and lakes.

Blue Ridge Parkway extends 469 miles (754.8 kilometers), connecting Shenandoah National Park and Great Smoky Mountains National Park, and traversing 29 counties, four national forests, one Indian reservation, two state parks, and a dozen municipal watersheds (Emmott et al. 2005). The BLRI streams are driven by heavy precipitation along an elevational gradient ranging from 649 to 6,047 feet (197.8 to 1,843.1 meters). High ridges intercept rain-bearing winds and increase moisture at high-elevation sites, while temperatures drop by approximately 3°F (-16.1°C) for every 1,000 feet (304.8 meters) of elevation gain (Catlin 1984).



Sample bottles at a stream along the parkway. NPS photo / APHN staff.

Issues of Management Concern

Local concerns about park waters include issues related to wastewater treatment systems, facilities development, and campgrounds. However, most threats to park water quality originate outside its approximately 1,000-mile (1,609.3 kilometers) long boundary, including urban and residential development adjacent to Blue Ridge Parkway, agricultural activity, atmospheric deposition, and forest insect or disease infestations. Soils at high-elevation sites typically have low buffering capacity, and streams are highly susceptible to acidification related to atmospheric pollutant deposition. Water resources on the parkway are affected by or affect 149 industrial or municipal discharges, 40 drinking water intakes, and 78 impoundments.

Highlights

- In WY2022, 44 water quality samples and four QA/QC replicates were collected at 22 sites.
- Water temperature and dissolved oxygen attained North Carolina and Virginia state standards.
- There were 14 violations of lower pH state standards.
- *E. coli* state standard was exceeded three times.
- Specific conductance was below 100 $\mu\text{S}/\text{cm}$ except at Bass Lake Creek.

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:

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

For detailed methods, see Hughes et al. 2018.



Measuring flow and collecting a sample. NPS photo / APHN staff.

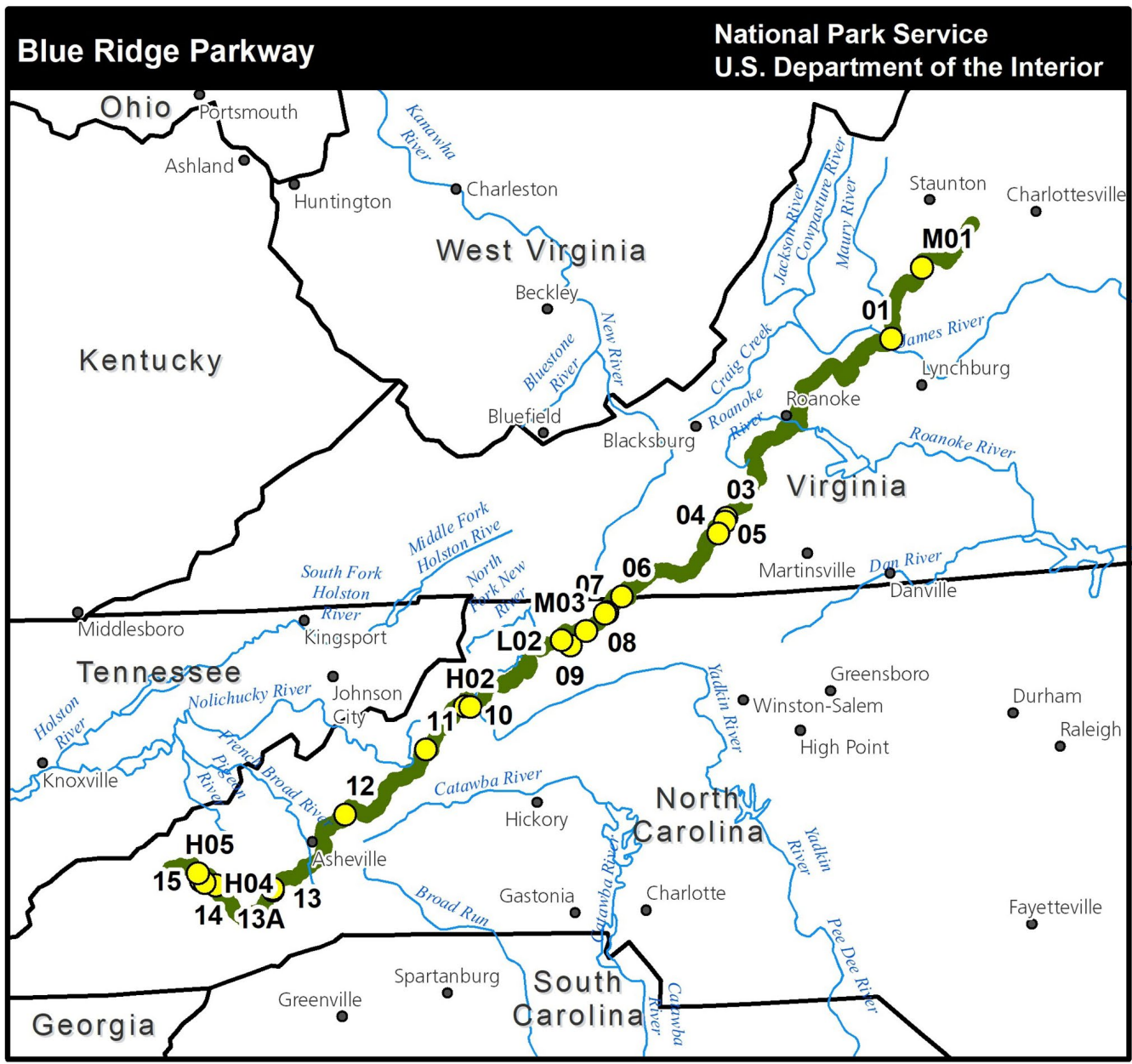


Table listing Water Quality Monitoring Sites at Blue Ridge Parkway.

ID	Name
H05	Soco Creek
15	Yellowface Overlook
H04	Wesner Bald Overlook
14	Redbank Branch
13	Flat Laurel Gap Bog
13A	Pisgah Creek WT (water treatment) Plant
12	Graybeard Mtn Overlook
11	Linville River
10	Simms Creek
H02	Bass Lake
L02	Grassy Gap Fire Rd

ID	Name
L01	Little Rock Castle Creek
09	Basin Creek
M03	Brush Creek
08	Big Pine Creek
07	Big Pine Creek at Saddle Mtn Church NHA
06	Chestnut Creek
05	Rock Castle Creek
04	Coy Wade Bog
03	Dodd Creek
01	Otter Creek
M01	Irish Creek Rd

Significant Findings

During water year 2022 (WY22), two water quality sampling trips were conducted on the Blue Ridge Parkway (February and June 2022). Including four QA/QC replicates, 48 samples were collected from 22 sites.

Prior APHN water quality data from Blue Ridge Parkway were compiled from three sampling trips in 2012, one in 2013, and one in 2019 to compare current and past conditions of field measured parameters. Prior data from December 2019 and January 2020 was compiled to compare lab analyzed parameters. Data were compared to state standards and reference conditions.

Seventeen violations of State Water Quality Standards for North Carolina and Virginia were recorded in WY22. North Carolina does not currently have a regulatory standard for *Escherichia coli* (*E. coli*). Virginia's *E. coli* criteria for recreational waters is a geometric mean (< 126 CFU/100 ml) or a statistical threshold value that approximates the 90th percentile of the water quality distribution (< 410 CFU/100 ml). However, neither of these calculations are achievable with APHN's monitoring framework. We used the Virginia criteria of no more than 10% of total samples shall exceed 1,173 CFU/100 ml to assess WY22 data. *E. coli* concentrations exceeded this value twice at Coy Wade Bog and once at Big Pine Creek at Saddle Mountain Church. Of note, *E. coli* concentrations greater than 410 CFU/100 ml were recorded at Brush Creek, Dodd Creek, and Big Pine Creek.

There were 14 violations of the lower pH standard of 6.0 standard units (SU): twice at Graybeard Mtn Overlook, Yellowface Overlook, Flat Laurel Bog, and Soco Creek, and once at Brush Creek, Bass Lake Creek, Chestnut Creek, Grassy Gap Fire Road Creek, Wesner Bald Overlook, and Pisgah Creek WT (water treatment) plant. Mean pH of all sites for WY22 was 6.25 SU and ranged from 5.14 to 7.2 SU. Low pH is likely a factor of atmospheric deposition, elevation, and geology. However, mean pH in 2021 (6.44 SU) and 2022 (6.25 SU) were higher than at the same sites sampled in 2012 (6.03 SU) and 2013 (5.23 SU), likely reflective of regionally increasing trends in precipitation pH related to declines in atmospheric deposition (<https://www.sciencedirect.com/science/article/pii/S0048969721056291#f0020>).

Many sites on the parkway have low acid neutralizing capacity (ANC), the ability of a stream to buffer against acid inputs. In WY22, ten sites had ANC less than 10 mg/l as CaCO₃, considered sensitive to acidification. Of those, eight had less than 2.5 mg/l as CaCO₃, and considered highly sensitive to acidification.

Water temperature and dissolved oxygen measurements all met state standards. Although there is no standard for specific conductance, all sites were below 100 µS/cm with the exception of Bass Lake Creek (mean = 316 µS/cm).

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>).

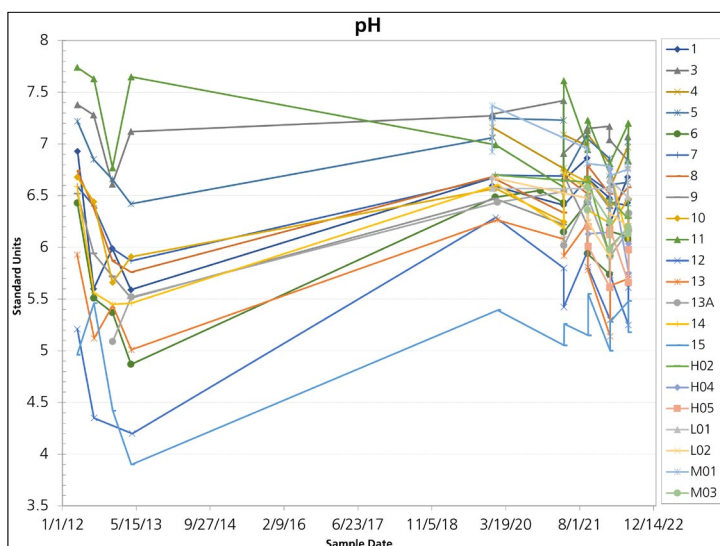
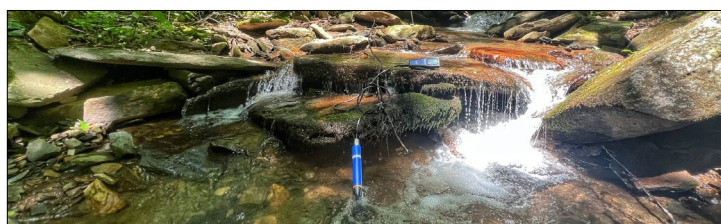


Figure 1. pH on the Blue Ridge Parkway from 2012–2022.



Water quality sonde at a monitoring site. NPS photo / APHN staff.

Literature Cited

- Catlin, D. T. 1984. A Naturalist's Blue Ridge Parkway. University of Tennessee Press, Knoxville, Tennessee. 208 pp.
- Emmott, R. G., N. Murdock, J. Ranney and P. Flaherty. 2005. National Park Service. Appalachian Highlands Inventory and Monitoring Network Vital Signs Monitoring Plan. Asheville, North Carolina. 217 pp. plus Appendices. Available at: <https://irma.nps.gov/DataStore/Reference/Profile/2203943> (last accessed October 2023).
- 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).

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