Rivanna River Watershed
2023 Stream Health Report

Monitoring Program Results from 2020-2022

RIVANNA
CONSERVATION ALLIANCE

Our Mission Working with the community to conserve the Rivanna River and its tributaries through monitoring, restoration, education, and advocacy.

Our Vision We envision a healthy Rivanna River and watershed that benefits an engaged community.

Water Quality Monitoring in 2022

As we sit to write this letter, our community is enduring five consecutive days of near 100-degree temperatures, and it's September! This record-breaking heatwave is just one of a growing number of extreme weather events affecting people around the world. The damage caused to human health and productivity by the increasing frequency, duration, and intensity of heatwaves and other extreme weather is easy to observe. Less obvious is the harm caused to the health and productivity of our rivers and streams, and the organisms that live in them.

From 1996 to 2021, the mean number of riverine heatwave days in the U.S. doubled, with the Southeast region experiencing the most heatwave events[1]. Along with rising water temperatures come a cascade of adverse aquatic impacts. Diminished dissolved oxygen levels, increased pollutant toxicity, excessive growth of harmful algae and bacteria, and other water quality changes can severely stress, and even kill, aquatic organisms.

Just like people seeking relief inside on a hot day, aquatic organisms also must find more suitable conditions to survive the heat. For fish, this often means finding areas of deeper, cooler water, and clustering below riffles that help increase oxygen levels. Fish that can move freely up and down streams have access to more varied habitat and will be more successful in finding areas of respite. Those that are confined to small stream reaches due to impassable structures, such as road culverts, are less likely to find the habitat they need to survive and thrive. Open fish passage is also critical for survival of our freshwater mussels, including the endangered James Spinymussel. Freshwater mussels, which are important water filterers, rely on fish as hosts for their development and dispersal into new habitat.

With an eye toward the growing importance of improving fish passage in our waterways, in 2021 and 2022, the Rivanna Conservation Alliance (RCA) partnered with the U.S. Fish and Wildlife Service (USFWS) to evaluate road-stream crossings in the Rivanna River watershed. We are pleased to provide a snapshot of the results on page 2.

American eels (*Anguilla rostrata*) are important migratory fish that serve as hosts to eastern elliptio mussels. *Elliptio complanata* are one of the most common freshwater mussels in the Rivanna watershed. This eel was netted in Ivy Creek during RCA's 2019 fish survey.

Extreme wet weather events are another growing threat to our waterways. In 2018 and 2019, our watershed experienced numerous severe storms and flooding events that altered instream habitat and were associated with lower stream health scores at many biological monitoring sites. Now, with those years behind us, stream health scores have improved slightly, with an 8 percent increase in the number of sites meeting Virginia's water quality standard for aquatic health compared to our 2022 report. Bacteria monitoring results in this report show the opposite, with more sites failing to meet the recreational water quality standard. Details about these results are provided in the monitoring sections of the report.

With climate change increasing the frequency and severity of extreme temperature and rain events, it's more important than ever that we continue to monitor changes within our rivers and streams and find ways to improve the resilience of our freshwater ecosystems.

Lisa Wittenborn, Ph.D.
Executive Director

Claire Sanderson, Ph.D.
Monitoring Program Manager

[1] Tassone, S. J., Besterman, A. F., Buelo, C. D., Ha, D. T., Walter, J. A., & Pace, M. L. (2023). Increasing heatwave frequency in streams and rivers of the United States. Limnology and Oceanography Letters, 8(2), 295-304.

Examples of some of the 248 road-stream crossings RCA evaluated in 2021 and 2022 in the Rivanna River watershed.

River Stewards and Education

River Steward and Education Numbers

- 10 River Steward paddles
- 4 Paddles with a Purpose
- 32 miles of river cleaned
- 59 trash cleanups
- 1,031 volunteers
- 2,036 volunteer hours
- 1,002 students
- 1,834 trees/plugs/live stakes planted

Each year, RCA uses the data we collect to increase the community's understanding of the Rivanna watershed's condition and to guide and evaluate actions to improve it. RCA's River Stewards visually monitor the Rivanna and major tributaries by boat observing changes in the river corridor, and tracking pH, dissolved oxygen, temperature, turbidity, and conductivity to identify water quality anomalies that need further investigation. They also identify and track areas where trash is accumulating, and lead and support cleanup efforts.

RCA focuses native planting activities, including live stake installations, along sections of the Rivanna River that are high priorities for restoration. By working in areas suffering from significant erosion, RCA and our volunteers are helping keep tons of sediment out of the river each year. In 2022, RCA also continued monitoring in conjunction with several large restoration projects to help track their stream health impacts.

RCA engages students in water quality monitoring activities on field trips and provides RCA-collected data to help them understand how stream health conditions are affected by land use. In 2022, RCA continued working with sixth grade students from Albemarle County's Burley Middle School and seventh graders from Charlottesville's Buford Middle School. RCA also hosted several educational field trips in partnership with the Botanical Gardens of the Piedmont. There, RCA led students in collecting basic water quality data and assessing stream and riparian buffer conditions in advance of a stream restoration project taking place on the Garden's property.
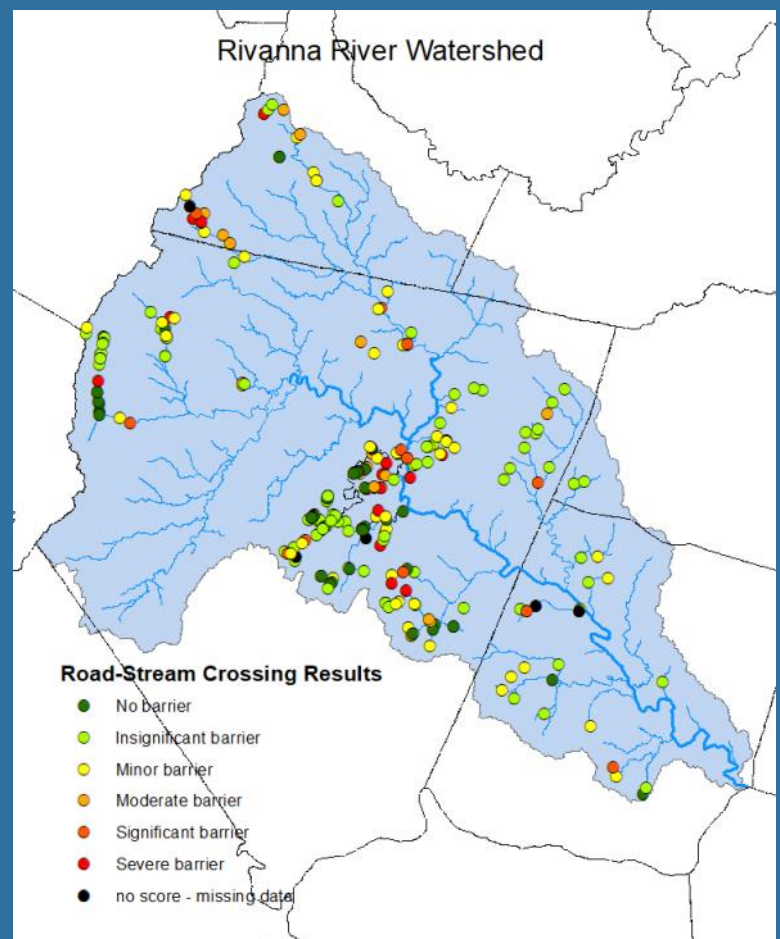
Fish Passage in the Rivanna River Watershed

In 2019, RCA worked with the Virginia Department of Wildlife Resources to complete a survey of fish in 24 locations in the Rivanna River watershed. During that effort, we documented two migratory fish species, sea lamprey and American eel, in multiple locations. We also found other species that serve as important host fish for freshwater mussels. Free movement up and down streams is essential for these species, with the migratory fish needing open access all the way to the ocean.

Following the fish surveys, RCA received a grant from the USFWS to assess road-stream crossings in the Rivanna watershed. The goal was to evaluate places where streams pass underneath roadways, like culverts and bridges, for their potential to impede fish movement. Throughout 2021 and 2022, following training and certification in methods by the North Atlantic Aquatic Connectivity Collaborative (NAACC), RCA staff completed field assessments of 248 different crossings, working in areas prioritized for the likely presence of migratory fish and native trout.

Of the 248 assessments, we found that 32 crossings (13%) are "significant" or "severe" barriers to fish passage. One-hundred, eighty-eight crossings (76%) do not pose a threat to fish passage, with an evaluation of "no barrier," "minor barrier," or "insignificant barrier." The remaining 28 crossings (11%) ranked as "moderate" barriers, or were not scored due to missing information that could not be measured.

The results of this work are publicly available through NAACC. RCA and others will use this information to identify potential restoration projects with the aim of opening up more habitat and passage to fish in our watershed.

Rivanna River Watershed

Road-Stream Crossing Results
- No barrier
- Insignificant barrier
- Minor barrier
- Moderate barrier
- Significant barrier
- Severe barrier
- no score - missing data

How We Evaluate Stream Health Through Biological Monitoring

Volunteer monitors follow strict protocols to collect benthic macroinvertebrates with a net.

Volunteers sort, count, and identify the organisms to the family level.


Photo credit: Warner Granade
Each sample is scored on the number, types, pollution sensitivity, and diversity of organisms.

RCA analyzes three years of data to determine the overall rating for the site.

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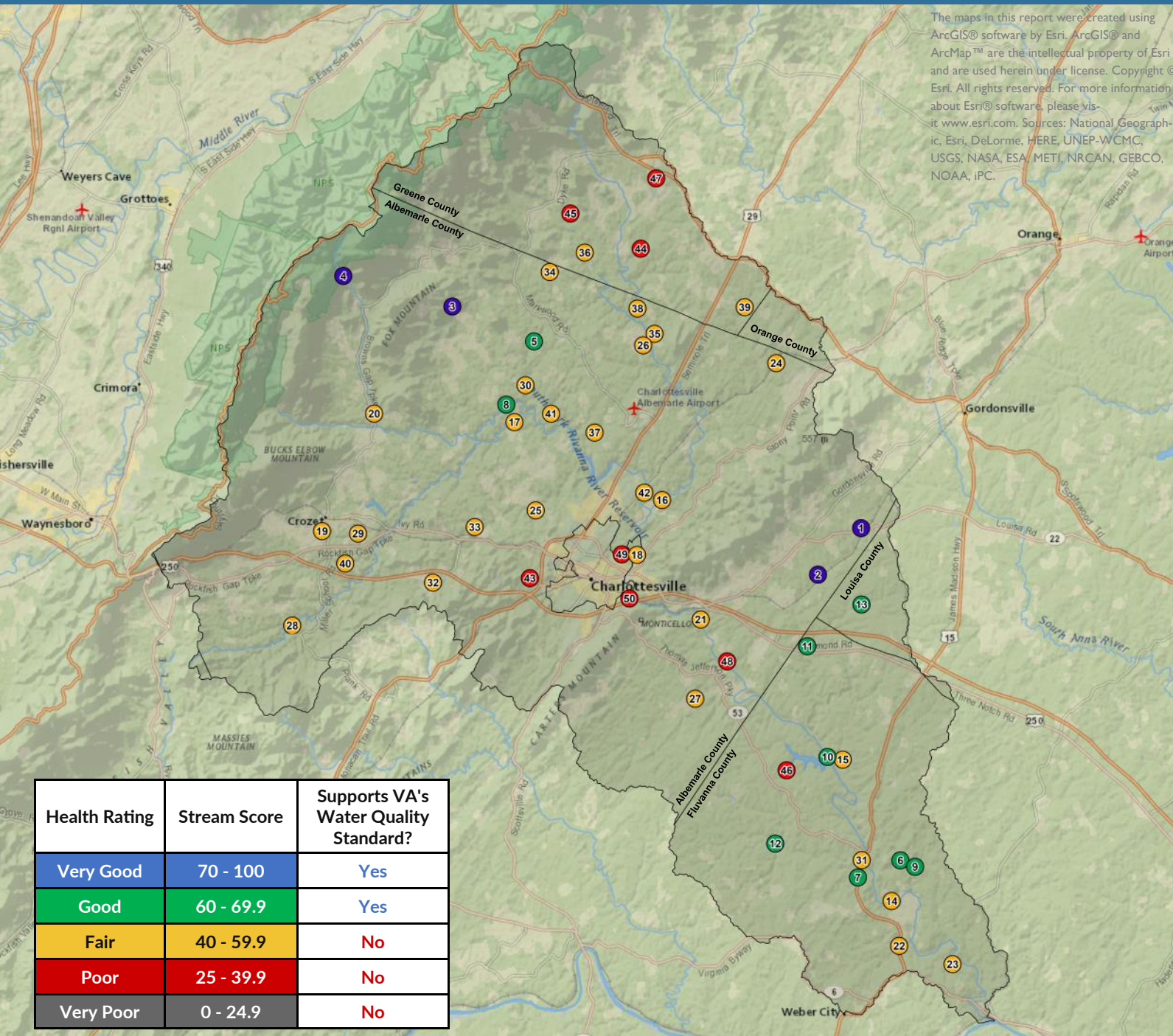
Health Rating	Stream Score	Supports VA's Water Quality Standard?
Very Good	70 - 100	Yes
Good	60 - 69.9	Yes
Fair	40 - 59.9	No
Poor	25 - 39.9	No
Very Poor	0 - 24.9	No

Biological Monitoring Results 2020 - 2022

#	Site Name	Change
1	Turkeysag Creek at 22	▲
2	Mechunk Creek upper at 600	▲
3	Albemarle County reference stream #2	
4	Doyles River upper at National Park Boundary	
5	Buck Mountain Creek upper west of 666 - A	▲
6	Ballinger Creek downstream of 625	
7	Raccoon Creek at 15	
8	Moormans River at 601	
9	Long Island Creek at 601	▲ 🦟
10	Rivanna River at Crofton - A	▲
11	Mechunk Creek at 759	▲ 🦟
12	Cunningham Creek Middle Fork - Bell Farms Ln	▲
13	Beaverdam Creek East Prong	▲
14	Rivanna River downstream of Palmyra	▼
15	Fluvanna County reference stream - A	
16	North Fork at Forks of Rivanna	
17	Mechums River at 601	🦟
18	Rivanna River at Darden Towe	
19	Powells Creek above Lickinghole Creek	
20	Doyles River at 674	🦟
21	Rivanna River at Milton	
22	Carys Creek at 15	
23	Rivanna River at Rivanna Mills	
24	Burnley Branch at Burnley Station Rd	
25	Ivy Creek at 601	
26	North Fork Rivanna River at Advance Mills	
27	Buck Island Creek at 729	
28	Mechums River at 692 - B	
29	Lickinghole Creek near Fairwinds Ln	
30	Buck Mountain Creek at 665 - A	🦟
31	Cunningham Creek at 15	▼
32	Ivy Creek in Rosemont	
33	Little Ivy Creek Trib at Kingston Rd	▲
34	Lynch River at 603	🦟
35	Marsh Run upstream of 641	
36	Roach/Buffalo River north of 648	🦟
37	Naked Creek at 844 - B	▲
38	Swift Run at 605	🦟
39	Preddy Creek west of Rosewood Dr	
40	Stockton Creek at 638 - B	
41	Fishing Creek west of Willwood Dr - B	
42	South Fork at Forks of Rivanna	
43	Morey Creek south of Bellair	
44	Quarter Creek in Twin Lakes	
45	Parker Branch at 633	▼
46	Lake Monticello Trib #1 into Jackson Cove	
47	Stanardsville Run upstream of N Ridge Way	
48	Carroll Creek in Glenmore	▲
49	Meadow Creek west of Locust Lane Ct	
50	Moores Creek near Woolen Mills	▲

Hellgrammites (*Corydalidae*) are the larval stage of dobsonflies. While their pinching mouthparts look intimidating, these critters are shy. Hellgrammites are quite sensitive to pollution and are mostly found in clean, well-oxygenated streams.

RCA's Level III Biological Monitoring Program collects data at 50 long-term monitoring sites twice annually throughout the Rivanna River watershed. Monitors sample benthic macroinvertebrates, the small organisms that live along the bottom of rivers and streams. Because these organisms vary in sensitivity to stressors, their community composition is representative of general stream health at the site. We use a protocol that generates a health score based on diversity, pollution sensitivity, and other characteristics of the community. Three years' worth of these scores are then used to assess water quality and aquatic ecosystem health.

Streams within the Rivanna River watershed primarily score Fair or Good, with sites commonly switching between these two ratings from report to report. While data from 2020-2022 show that the majority of sites are still considered Fair, 11 sites moved to a higher stream health score. This included the progression of two sites from Good to Very Good, six sites from Fair to Good, two sites from Poor to Fair, and one site from Very Poor to Poor. These sites appear to be recovering from the very intense storms and stream scouring events in 2018 and 2019 that correlated with depressed scores during those years.

In contrast, only three sites had lower scores, with two sites moving from Good to Fair and one site from Fair to Poor. All sites that changed scores had a high level of assessment confidence, apart from Sites #14 (Rivanna River downstream of Palmyra) and #31 (Cunningham Creek at 15). These sites lacked data for three seasons, conferring a moderate level of confidence.

Streams rated as Very Good and Good meet Virginia's water quality standard for aquatic life. Those rated as Fair, Poor or Very Poor fail to meet this standard.

From 2020-2022, 74% of streams sampled by RCA failed to meet this important benchmark.

Pie chart: Very Good 8.0%, Good 18.0%, Fair 58.0%, Poor 16.0%
Legend: ● Very Good ● Good ● Fair ● Poor
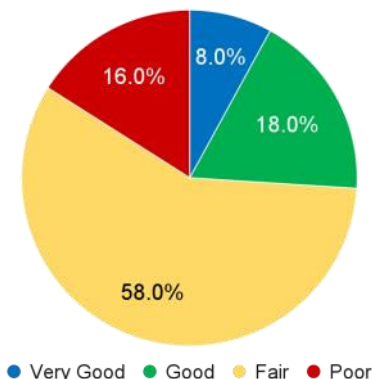
The color and direction of the arrows in the table (▼) show how ratings changed from the previous report. You can find past reports at rivannariver.org. Some 2020 samples were comprised primarily of blackfly larvae resulting in lower scores. These are noted in the table with a black fly icon.

How We Measure Bacteria Levels and 2022 Results
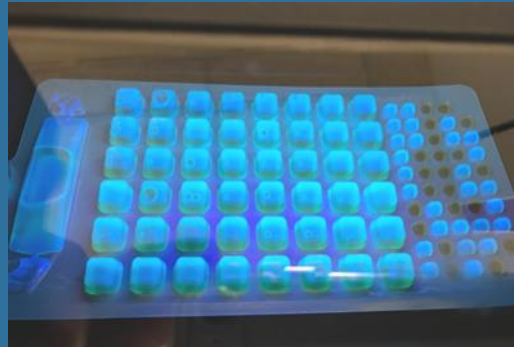
Volunteers collect water samples from the monitoring sites using sterile sample bottles, and return the samples to RCA's certified lab.

Staff then process and analyze the samples. They dissolve a growth medium into the water sample, pour it into a tray, then seal and incubate it.

After 24 hours they read the sample, recording a Most Probable Number (MPN), which is equivalent to the *E. coli* count per 100 mL.

Table 1. Assessments using a 90-day period between April and September 2022					
Site #	Site Name	Samples (#)	Minimum and Maximum* (MPN)	Samples above 410 MPN (#)	Geometric mean (MPN)	Fails to Support WQS
1	Biscuit Run - Biscuit Run State Park†	10	32.7 - 1732.9	10.0% (1)	139.2	Yes
2	Rivanna River - Palmyra#	16	15.8 - 2419.6	12.5% (2)	102.8	Yes
3	Rivanna River - Riverview Park	18	36.9 - 2419.6	16.7% (3)	148.5	Yes
4	Rivanna River - Darden Towe	18	29.5 - 2419.6	16.7% (3)	133.8	Yes
5	Biscuit Run	11	32.7 - 1986.3	27.3% (3)	220.4	Yes
6	Town Branch	10	133.3 - 2419.6	30.0% (3)	365.4	Yes
7	Moores Creek Upper - Azalea Park	11	34.2 - 2419.6	45.5% (5)	314.9	Yes
8	Meadow Creek - Meadowbrook Rd	11	172.3 - 2419.6	54.6% (6)	471.8	Yes
9	Meadow Creek - SE of Brandywine Dr	11	65.7 - 2419.6	54.6% (6)	456.0	Yes
10	Pollocks Branch - Rockland Ave	12	125.0 - 2419.6	83.3% (10)	999.9	Yes
11	Meade Creek - Meade Park	12	410.6 - 2419.6	100% (12)	988.5	Yes

*The upper detection limit for *E. coli* using the Colilert method is 2419.6 MPN per 100 mL of water.
†While only 10% of samples exceeded 410 MPN per 100 mL at this site, the geometric mean exceeded the threshold resulting in a failure of this site to fully support the standard.
#This site had a geometric mean below the threshold of 126 MPN per 100 mL, however, greater than 10% of samples exceeded 410 MPN per 100 mL resulting in a failure of this site to fully support the standard.

Table 2. Assessments using monthly samples collected between March and November 2022				
Site #	Site Name	Samples (#)	Minimum and Maximum* (MPN)	Samples above 410 MPN (#)	Fails to Support WQS
12	Rivanna River - Crofton	9	9.8 - 2419.6	22.2% (2)	Yes
13	Eastern Tributary to Lodge Creek	9	9.8 - 1413.6	22.2% (2)	Yes
14	Rock Creek - Valley Road Extension	9	105.0 - 1986.3	44.4% (4)	Yes
15	Tributary to Rock Creek - Paton St	9	60.2 - 2419.6	44.4% (4)	Yes
16	Lodge Creek - South of JPA	9	101.7 - 2419.6	44.4% (4)	Yes
17	Meadow Creek - Copeley Rd	9	32.3 - 1299.7	55.6% (5)	Yes
18	Western Tributary to Lodge Creek	9	10.9 - 2419.6	44.6% (5)	Yes
19	Lodge Creek - Southeast of 5th St	9	35.5 - 2494.4	55.6% (5)	Yes
20	Schenks Branch near Rescue Station	9	119.8 - 2419.6	55.6% (5)	Yes
21	Rock Creek - Southeast of 5th St	10	26.9 - 2419.6	60.0% (6)	Yes

Virginia's recreational water quality standard

Sites fail to support the revised standard if any of the following hold:

- There are 10 or more samples in a 90-day period and *E. coli* levels exceed 410 counts per 100 mL more than 10% of the time.
- There are 10 or more samples in a 90-day period and the geometric mean of the *E. coli* levels exceeds 126 counts per 100 mL.
- There are fewer than 10 samples in a 90-day period and *E. coli* levels exceed 410 counts per 100 mL in two or more samples.

The Virginia Department of Environmental Quality (VADEQ) uses a six-year period of data to determine if a site is officially "impaired" for *E. coli* but shorter periods of data can be used to evaluate whether a site is failing to meet or "support" the revised water quality standard.

Bacteria Monitoring in 2022

RCA's Level III Bacteria Monitoring Program analyzes *Escherichia coli (E. coli)* levels at 21 locations within the Rivanna River watershed. Samples are collected monthly from March to November, and sites with high recreational use along the Rivanna River are tested weekly throughout the summer. In addition, RCA collected weekly data at 11 sites in the spring to evaluate their compliance with Virginia's revised recreational water quality standard, which requires more frequent sampling (see page 6 for more details).

E. coli are naturally occurring bacteria found in the guts of humans and other animals. They signal the presence of waste pollution and suggest other pathogenic organisms may also be present. Heavy rainfall can temporarily elevate *E. coli* levels. When *E. coli* levels are too high, swimming and wading in the water are considered unsafe.

In an urban area like Charlottesville, sewer overflows, damaged sewer pipes, and animal waste are typically the most significant sources of bacteria contamination. RCA's bacteria monitoring helps protect public health and water quality by identifying these issues in our local waterways.

During the 2022 sampling season, at least ten samples were collected within a 90-day period at RCA's 11 weekly sampling sites (Table 1). All sites failed to meet Virginia's revised water quality standard by having either two or more samples exceed 410 MPN per 100mL within the 90 days or having geometric means greater than 126 MPN per 100 mL. Likewise, all ten monthly sampling sites (Table 2) failed to support the standard due to having two or more samples exceed 410 MPN per 100mL within a 90-day period.

The Rivanna River watershed experienced a wetter than average spring in 2022. The failure of many of these sites to meet the standard may have been influenced by increased rainfall during this time.
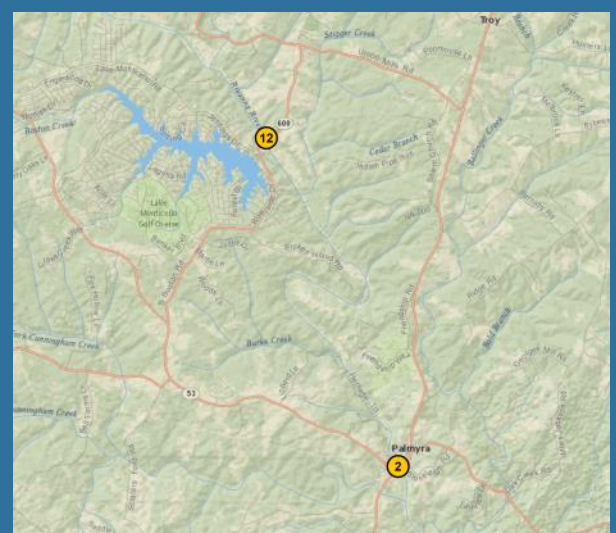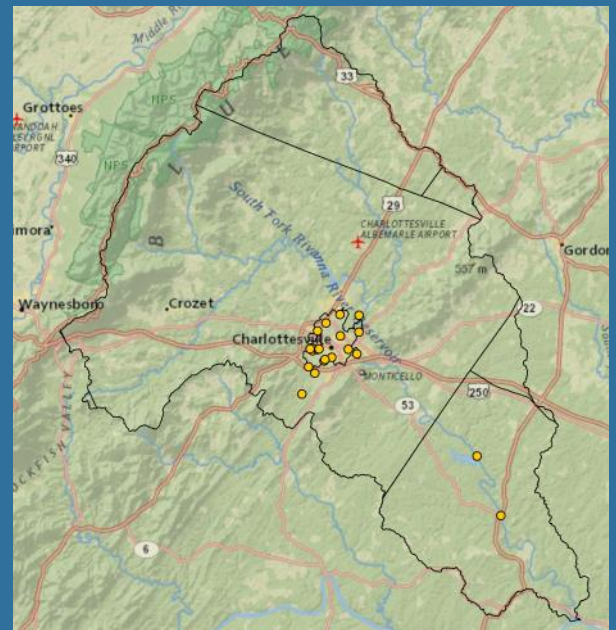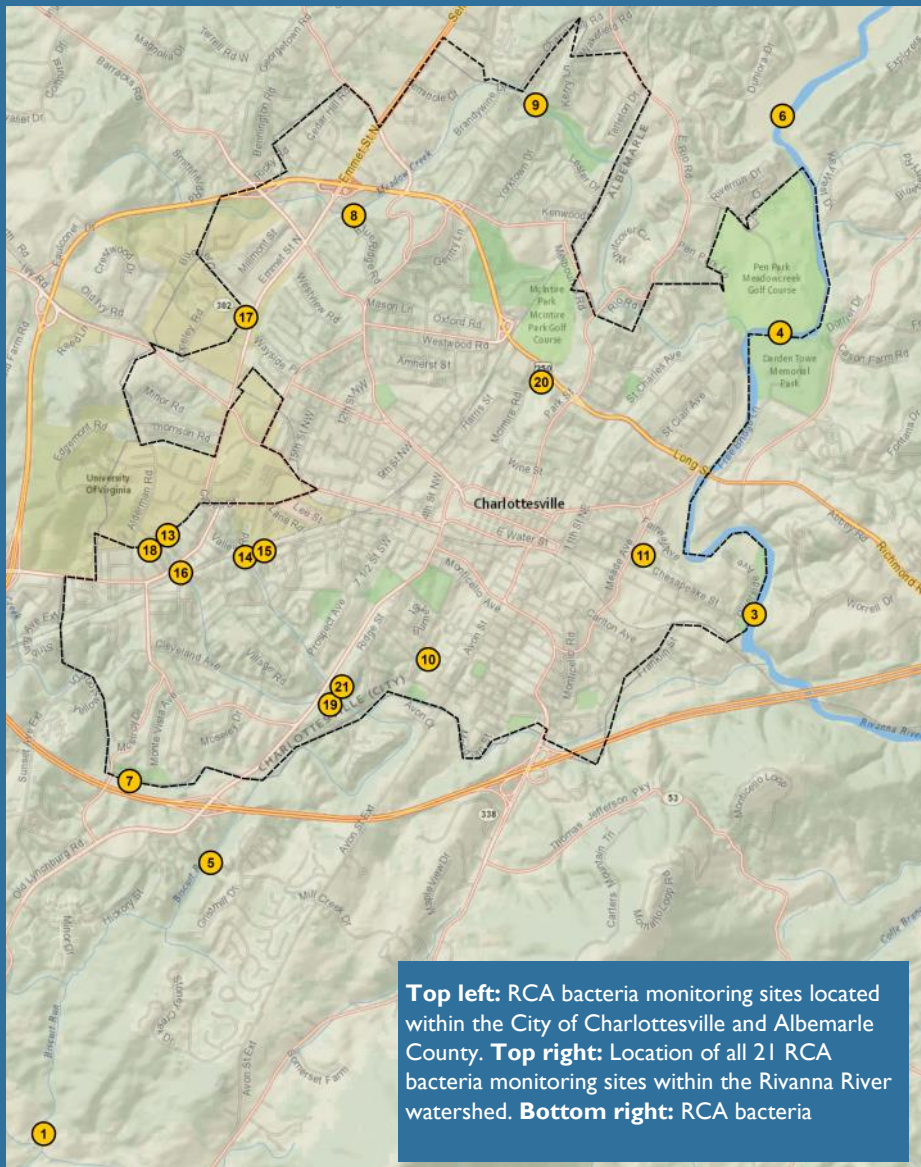
Top left: RCA bacteria monitoring sites located within the City of Charlottesville and Albemarle County. **Top right:** Location of all 21 RCA bacteria monitoring sites within the Rivanna River watershed. **Bottom right:** RCA bacteria

Beaver by John Hines.

RIVANNA CONSERVATION ALLIANCE

1150 River Road, Suite One
Charlottesville, VA 22901
(434) 977-4837, www.rivannariver.org

The Rivanna River watershed drains 769 square miles of land from Shenandoah National Park to the confluence with the James River at Columbia, Virginia. The Rivanna River is an invaluable asset to the communities in the watershed, providing drinking water and contributing to the cultural, recreational, environmental and economic resources of the region. It also has regional importance because the Rivanna River is a tributary to the James River and the Chesapeake Bay.