

# Report on *E. coli* Testing

## Tugaloo Family Park - Tellico Village, TN

Prepared by William Atkinson

Watershed Association of the Tellico Reservoir (WATeR) Board Member

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### Success Story: Green Infrastructure Improvements Mitigate Bacterial Contamination at Tugaloo Family Park

Following the installation of the Rover Run dog park on the hillside next to the parking area for the Tugaloo Swim Beach, the Tellico Village Property Owners Association (TVPOA) consented to support WATeR to undertake a water quality monitoring program to ensure suitability of the lake water at the swim beach for the purpose of recreational swimming, particularly after rainfall events.

According to the U.S. Environmental Protection Agency (EPA), "Water samples are collected to measure *E. coli* to make sure water is safe for public recreation, such as swimming, fishing, or canoeing. *E. coli* is considered an indicator organism, used to identify the possible presence of disease causing bacteria and viruses (pathogens)" (EPA factsheet: *E. coli* [*Escherichia coli*]).

From 2021 through 2025, WATeR conducted regular *E. coli* monitoring at several locations, including Boat Docks B & C, the inlet to Tellico Lake, the Ponded Area near the Pavilion, the Swimming Area, and the Rover Run swale (see attached aerial photo). Results, measured in MPN/100 ml, were compared against Tennessee's revised single-sample recreational water quality standard of 410 CFU/100 ml (effective March 2024). MPN/100 ml and CFU/100 ml are measurements used by laboratories using different test methods but are treated as being equivalent measurements. A summary of results is provided in Table D

During the early years of sampling, elevated *E. coli* levels were frequently recorded at the Inlet to Tellico Lake and the Swimming Area, often exceeding State standards. Major spikes were associated with heavy rainfall events (>1.0 inch), which likely caused runoff carrying bacteria into the swimming area. On several occasions, concentrations exceeded the saturation limit of the lab analysis, raising significant public health concerns. It appeared that the run-off from the dog park and surrounding area, drained onto the parking lot and was then directed into the drainage swale located immediately adjacent to the lake. This run-off contained elevated concentrations of the *E. coli*



organisms. To identify the source of the *E. coli* organisms, WATeR agreed to use DNA speciation methods for water testing, which unfortunately proved inconclusive.

In response, WATeR consulted with Julie Konkel, PhD, a Watershed Scientist & Coordinator with the Blount County Soil & Water Conservation District for the project design and implementation. She was assisted by Madeline Walker, Natural Resources Conservation Intern also with the Blount County Soil & Water Conservation District for the Project Logistics & Implementation aspects dealing with the creation of a riparian garden and drainage swale.

The actual construction of the riparian garden and swales were performed under the direction of Caleb Morris, Properties Manager of the Tellico Village Property Owners Association (TVPOA). The Tellico Village Garden Club also worked in close coordination with the TVPOA for the installation of the riparian plantings.

In addition, this project was supported through a partnership with the Tellico Reservoir Development Agency (TRDA), which provided laboratory analysis at reduced cost. Nick Galloway, Chief Operations Manager, WWTP was essential for completion of the water sample analysis.

These “green infrastructure” improvements were implemented in 2023, and included the installation of a rain-garden and drainage swale upslope from the swimming area and adjacent dog runs. These features were designed to slow, filter, and absorb stormwater, thereby reducing bacterial contamination before it reached recreational waters.

Follow up monitoring in 2025 demonstrated a marked improvement. The *E. coli* concentrations at most sites fell well below the State standard. For example, the Swimming Area showed only 16.9 MPN/100 ml on July 2, 2025. Similar results were noted again after a rainfall event in September 2025, with the Swimming Area showing only very low levels of *E. coli* bacteria, possible evidence of the effectiveness of the new stormwater controls.

## **Conclusion**

Preliminary evidence indicates that the recent construction and installation of green infrastructure have contributed to measurable improvements in water quality at Tugaloo Family Park. However, continued monitoring is required to determine whether the observed reductions in *Escherichia coli* concentrations are directly attributable to these infrastructure interventions or influenced by other factors, such as the relatively moderate rainfall recorded during the monitoring period. Regardless, the downward trend in *E. coli* levels represents a positive development for the protection of public health and recreational water use.

**Table D**  
**Combined E. coli Testing 2021-2025 at Tugaloo Beach Tellico Village, TN (Updated 9/15/25)**

Date	Upstream Sample	Boat Dock B	Boat Dock C	Inlet to Tellico Lake	Ponded area next to Pavilion	Swimming Area	Rover Run swale	State standards for E. Coli Single Sample CFU /100 ml
	MPN 100/ml	MPN 100/ml	MPN 100/ml	MPN 100/ml	MPN 100/ml	MPN 100/ml	MPN 100/ml	TN* (3/17/2024)
4/13/21				4		2		487
4/20/21				6		6		487
4/26/21				6				487
5/5/21				58				487
5/10/21*				240		99		487
5/26/21				13		34		487
6/3/21				40		81		487
6/7/21				2400		2400		487
6/8/21				440		81		487
6/9/21				>2400		390		487
6/11/21				>2400		13		487
7/9/21	170			690				487
7/13/22		261		517		365		487
7/25/22		29		>2419.6		>2419.6		487
11/11/22				1120		10	>2419.6	487
6/19/23				>2419.6		39		487
5/13/25*			157	387	>2419.6	579		410**
5/14/25			86	99		19		410**
5/15/25			86	108		19		410**
5/16/25			39	34		22		410**
5/20/25*						10.9		410**
7/1/25*			52.1	816.4	816.4	83	>2419.6	410**
7/2/25			7.5	27.9		16.9		410**
7/3/25			4.1	6.2		13.4		410**
7/16/25						16		410**
9/3/25*			3	13.4		1		410**
9/4/25			21.8	13.8		8.5		410**
9/5/25			1	1		1		410**
9/7/25			1	4.1		2		410**
9/8/25			1	1		3		410**

**Notes and Comments**

Samples collected by WATeR and analyzed by TRDA lab in Vonore TN or Microbac labs in Maryville, TN

\* denotes substantial rainfall event (>1.0 inches)

In 2023 a rain garden and drainage swale were constructed upslope from the swimming area and in front of the dog runs. Date of rain garden and swale noted by Red border.

\*\*TDEC Chapter 0400-40-03 General Water Quality Criteria ; Criteria for Water Uses 0400-40-03-.03(4)(f). Single sample value for E. coli is 410 cfu/100 ml (revised March 17, 2024)

MPN= Most Probable Number

CFU= Colony Forming Units



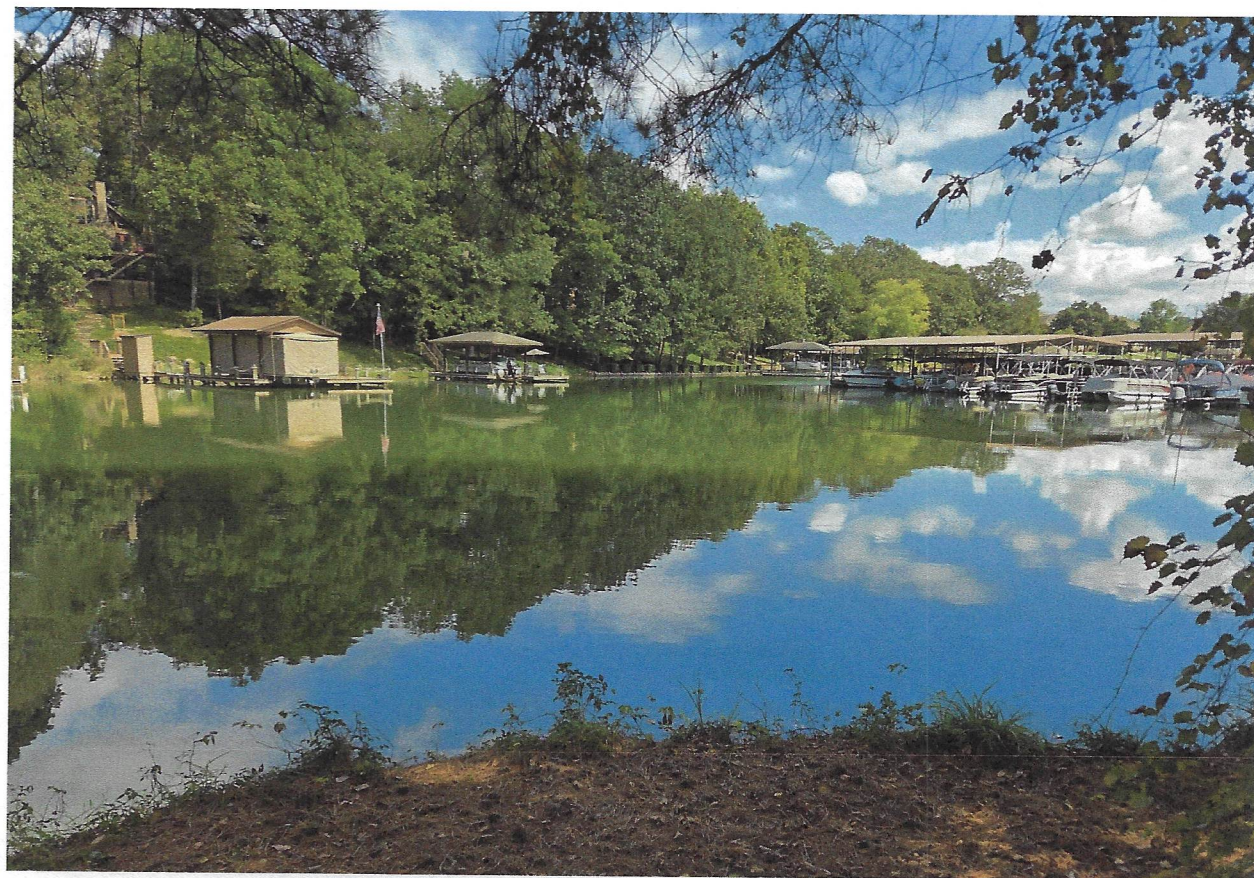
# Aerial View of Tugaloo Beach Family Park Sampling Sites (2021-2025)



1. Upstream sample 2. Rover Run (dog park) 3. Dock B 4. Dock C 5. Pond area pavilion 6. Inlet swale 7. Swimming area



Aerial View Site 1 (Upstream Sampling Site)  
Tugaloo Family Park





**Site 2 Swale in front of Rover Run Dog Park 2025**



**Rover Run Dog Park at Tugaloo Family Park**



## Site 3 Dock B Tugaloo Family Park 2025





## Site 4 Dock C at Tugaloo Family Park





## Site 5 at Tugaloo Family Park (June 2021)



Storm water event prior to installation of Rain Garden and Drainage Swales (2021)



## Site 6 Inlet to Tellico Lake at Tugaloo Family Park 2025





## Site 7 at Tugaloo Family Park (2025)



Swimming Area





**Construction of Rain Garden (drainage swale leading to inlet to lake  
(2023)**





**Rain garden In front of inlet to lake**







# FACTSHEET ON WATER QUALITY PARAMETERS

## *E. coli* (*Escherichia coli*)

*E. coli* (*Escherichia coli*) is a type of bacteria that lives in the intestines of people and animals. *E. coli* is commonly found in human and animal feces. Most strains of *E. coli* are harmless, but some can make people sick.

### Why do we measure *E. coli*?

Water samples are collected to measure *E. coli* (Figure 1) to make sure water is safe for public recreation, such as swimming, fishing or canoeing. *E. coli* is considered an indicator organism, used to identify fecal contamination in freshwater and indicate the possible presence of disease-causing bacteria and viruses (pathogens). Individuals who swim or come in contact with water with elevated levels of *E. coli* and other fecal indicator organisms are at an increased risk of getting sick because of potential exposure to fecal pathogens. Common symptoms of ingesting a pathogenic strain of *E. coli* include vomiting and diarrhea. High numbers of *E. coli* (and other) bacteria may contribute to cloudy water, unpleasant odors, and increased oxygen demand (which may reduce levels of dissolved oxygen in the water).

*E. coli* concentrations may be linked with other parameters such as high total suspended solids (TSS) and turbidity concentrations because the bacteria tend to



Figure 1. *E. coli* under a microscope. Credit: Photo courtesy of National Institute of Allergy and Infectious Diseases

be found with particles. *E. coli* concentrations may also be linked with high phosphorus, nitrate, and biological oxygen demand (BOD) concentrations.

### What affects *E. coli* levels?

*E. coli* is found in the feces of warm-blooded animals. *E. coli* from humans can reach surface water via wastewater treatment plant effluent, broken or leaky sewer pipes, and failing or poorly sited septic systems. *E. coli* from animals can enter waterbodies in stormwater

runoff from feedlots, manure storage areas, or areas where there is wildlife. Livestock that are allowed to get into or near streams can introduce *E. coli* directly into surface water.

For factsheets on other water quality parameters, visit:  
[epa.gov/awma/factsheets-water-quality-parameters](http://epa.gov/awma/factsheets-water-quality-parameters).

For more information about the Clean Water Act Section 106 Grants Program, visit:  
[epa.gov/water-pollution-control-section-106-grants](http://epa.gov/water-pollution-control-section-106-grants).



### What are EPA's recommended criteria for *E. coli*?

*E. coli* criteria are expressed as the number of colony-forming units (cfu) per 100 mL. The two sets of criteria shown in Table 1 were developed using different methods for calculating illness rates from scientific data. They are based on studies that show a link between illness and fecal contamination in recreational waters. Both are considered protective of human health, and either can be used to assess recreational water quality.

**Recommendation 1.** A geometric mean (GM) of 126 cfu per 100 mL and a statistical threshold value (STV) of 410 cfu per 100 mL measured.

**Recommendation 2.** A GM of 100 cfu per 100 mL and an STV of 320 cfu per 100 mL measured.

The GM is a statistic often used for bacterial counts in federal and state water quality standards. The GM of the monitoring samples should not exceed whichever criterion is selected from the two recommendations in any 30-day interval. The STV is similar to a 90th percentile, meaning that no more than 10% of samples should exceed it.

EPA recommends weekly sampling to evaluate the GM and STV over a 30-day period and encourages more frequent sampling at more densely populated beaches.

Table 1. Two sets of *E. coli* criteria based on two different estimated illness rates.

Indicator Organism	Recommendation 1	
	Estimated Illness Rate: 36 per 1,000	
	Geometric Mean (cfu/100 mL)	Statistical Threshold Value (STV- 90 <sup>th</sup> percentile) (cfu/100 mL)
<i>E. coli</i> (freshwater)	126	410

Indicator Organism	Recommendation 2	
	Estimated Illness Rate: 32 per 1,000	
	Geometric Mean (cfu/100 mL)	Statistical Threshold Value (STV- 90 <sup>th</sup> percentile) (cfu/100 mL)
<i>E. coli</i> (freshwater)	100	320

Source: Anderson and Rounds (2003)

### How do we measure *E. coli*?

*E. coli* levels are measured by analyzing bacterial growth in laboratory analyses. This is commonly done by the membrane filter procedure, although color test kits have also been EPA-approved. Care must be taken when

collecting water samples because all of the sampling containers must be sterile. More information on measuring *E. coli* can be found in EPA's *Volunteer Stream Monitoring: A Methods Manual* (1997).

### What are the challenges of using *E. coli* as a water quality parameter?

Bacteria levels in waterbodies can be highly variable. In streams, natural bacteria levels vary and change with

rainfall. This can make it challenging to pinpoint sources of elevated *E. coli* concentrations.



## What if there is an exceedance of the water quality criteria?



Figure 2. Public advisory warns of high bacteria levels in water. Public advisories can include additional information such as the date of the posting and contact information to check on the status of the posting. Credit: Photo courtesy of USEPA

When elevated *E. coli* concentrations are observed, it is important to respond in a timely manner by collecting additional data, posting a public notice (Figure 2), and/or closing the waterbody to recreational activities. Figure 3 summarizes general actions to take when responding to elevated concentrations.

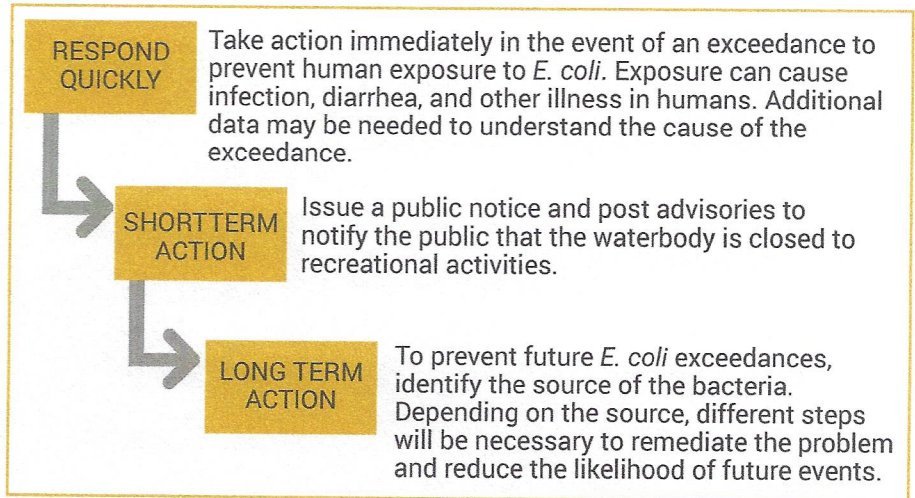


Figure 3. General actions to take when a sampling result shows an elevated concentration of *E. coli*.