



Aeration Project Monitoring Summary Report

2021 Cyanobacteria Testing

In 2021, Buckeye Lake for Tomorrow purchased several bubbling aerator units to introduce dissolved oxygen into selected Buckeye Lake tributaries and canals. The goal of the project is to reduce lake algae and improve water quality through the action of aerator bubbles breaking up algae on the water surface and preventing blooms from forming. Buckeye Lake for Tomorrow commissioned quarterly water testing at the selected tributaries to determine the effectiveness of the aerators. The algae tests were gathered by Perry County Soil and Water Conservation District’s watershed coordinator and were analyzed by the Alloway Environmental Testing Lab in Marion, Ohio. Algae testing began in October 2020, before the aerators were installed, for a base line of pre-aerator water quality. The initial 2021 test sites were Millersport Canal and Heron Bay. An aeration system was installed mid-summer in the Copper Penny canal behind Flip Flops, after the system at Heron Bay was removed due to non-water quality related circumstances within the HOA. Buckeye Beach Park expressed interest in an aerator system, so baseline water samples have been taken there as well. Baseline samples were also taken at Fairfield Beach and Crystal Beach in November 2021 in anticipation of installing aerators through a partnership with ODNR. The test results from the samples collected in October 2020, March 2021, July 2021 and November 2021 are below. Lab analysis was conducted by the Alloway Environmental Testing.

Millersport Canal	<i>Analytical Method</i>	<i>Units reported in gene copies per microliter</i>			
Sample Date	Cyanobacteria, Total (16S)	Microcystins	Cylindrospermopsin	Saxitoxin	Aerator Installed?
10/27/2020	4040	<0.180*	<0.180	3.75	No
03/23/2021	4330	<0.180	<0.180	1.21	Yes
07/27/2021	3170	<0.180	<0.180	<0.180	Yes
11/23/2021	9.49	<0.180	<0.180	<0.180	Yes

*Lowest detectable value

Buckeye Beach Park	<i>Analytical Method</i>	<i>Units reported in gene copies per microliter</i>			
Sample Date	Cyanobacteria, Total (16S)	Microcystins	Cylindrospermopsin	Saxitoxin	Aerator Installed?
10/27/2020	4930	<0.180	<0.180	<0.180	No
03/23/2021	2910	<0.180	<0.180	<0.180	No
07/27/2021	6800	<0.180	<0.180	0.609	No
11/23/2021	5770	<0.180	<0.180	<0.180	No

Heron Bay 1	<i>Analytical Method</i>	<i>Units reported in gene copies per microliter</i>			
Sample Date	Cyanobacteria, Total (16S)	Microcystins	Cylindrospermopsin	Saxitoxin	Aerator Installed?
10/27/2020	5400	0.224	<0.180	<0.180	No
03/23/2021	1160	<0.180	<0.180	<0.180	Yes
07/27/2021	Aerator was installed then subsequently removed due to non-water quality issues within the HOA. Sampling has been discontinued at this site.				
11/23/2021					

Heron Bay 2	<i>Analytical Method</i>	<i>Units reported in gene copies per microliter</i>			
Sample Date	Cyanobacteria, Total (16S)	Microcystins	Cylindrospermopsin	Saxitoxin	Aerator Installed?
10/27/2020	3160	<0.180	<0.180	<0.180	No
03/23/2021	974	<0.180	<0.180	<0.180	Yes
07/27/2021	The aerator system at this control site was also removed and sampling has been discontinued.				
11/23/2021					

Cooper Penny Canal/Flip Flops	<i>Analytical Method</i>	<i>Units reported in gene copies per microliter</i>			
Sample Date	Cyanobacteria, Total (16S)	Microcystins	Cylindrospermopsin	Saxitoxin	Aerator Installed?
10/27/2020	N/A	N/A	N/A	N/A	No
03/23/2021	N/A	N/A	N/A	N/A	No
07/27/2021	5370	<0.180	<0.180	0.906	Yes
11/23/2021	3150	<0.180	<0.180	<0.180	Yes

Fairfield Beach	<i>Analytical Method</i>	<i>Units reported in gene copies per microliter</i>			
Sample Date	Cyanobacteria, Total (16S)	Microcystins	Cylindrospermopsin	Saxitoxin	Aerator Installed?
10/27/2020	N/A	N/A	N/A	N/A	No
03/23/2021	N/A	N/A	N/A	N/A	No
07/27/2021	N/A	N/A	N/A	N/A	No
11/23/2021	8730	4.87	<0.180	<0.180	No

Crystal Beach	Analytical Method	Units reported in gene copies per microliter			
Sample Date	Cyanobacteria, Total (16S)	Microcystins	Cylindrospermopsin	Saxitoxin	Aerator Installed?
10/27/2020	N/A	N/A	N/A	N/A	No
03/23/2021	N/A	N/A	N/A	N/A	No
07/27/2021	N/A	N/A	N/A	N/A	No
11/23/2021	8830	<0.360*	<0.360	<0.360	No

*Sample was diluted in the lab causing the lowest detectable value to double

Interpreting Test Results:

When reading these results, it is important to know that the units presented (gene copies per microliter) measure strands of DNA in a sample but is not a number that can be converted to something like parts per million or milligrams per liter. A representative from Alloway Environmental Testing Lab provided the following explanation:

“Cyanobacteria screening is quite a bit different than most analytical methods; there is no way to convert it to ppm. Gene Copies per microliter (gc/uL) means how many strands of DNA per microliter are in the sample. The DNA strands are capable of producing toxins but it does not guarantee they are. The Ohio EPA has set action levels at 5.0 gc/uL for Cylindrospermopsin, Microcystins and Saxitoxin. When the source water reaches 5.0 gc/uL the Ohio EPA begins monitoring for the toxins. The 16S (total cyanobacteria) does not have an action level. There are over a 100 of variations of cyanobacteria and not all of them are toxic. This metric is used to look at trends for a body of water and look for indicators of an upcoming bloom.”

Summary:

Based on the 2021 test results, there was a very significant decrease in total cyanobacteria and saxitoxins at the Millersport Canal after the aerator system was installed. The March 23 test samples were taken shortly after the aerator system was installed, then test samples were taken again in July and November. In total, the July 27 test results revealed that the cyanobacteria levels dropped in the first four months by 27% and saxitoxins became too low to detect. The November 23 test results revealed that the cyanobacteria levels at the Millersport Canal decreased by 98% compared to the same time period in 2020.

The Copper Penny Canal test results from the water samples collected four months after the aerator was installed revealed a 41% decrease in cyanobacteria and an 80% decrease in saxitoxins. This significant decrease in the first four months is consistent with the Millersport Canal test results. Ongoing testing at the Copper Penny Canal behind Flip Flops is needed to further quantify and understand the benefits of this aerator system.

The test results provide empirical evidence that the aeration systems work to reduce algae producing contaminants. In addition to the quantitative data, eyewitness accounts suggest that the aerator has produced other positive impacts, including clearer water with less visible algae, cleaner water for swimming and better fishing.

While an aeration system has yet to be installed at the Buckeye Beach Park, the test results confirm that high cyanobacteria and saxitoxins levels correspond with the visible increase in algae activity during the summer.

Regarding the water samples taken at the two public ODNR beaches, the baseline results revealed initial cyanobacteria levels that were double the initial levels measured at the Millersport Canal. As two of the areas with historically the highest algae levels on the lake, the cyanobacteria count was over 8700 gene copies per microliter at both locations. At Fairfield Beach the microcystins was 4.87 gene copies per microliter, nearly reaching the Ohio EPA's 5.0 gene copies per microliter threshold that would require toxin monitoring. When considering the successful results already measured at locations where aerators are installed, it is highly likely that algae related toxins at Crystal Beach and Fairfield Beach will be significantly reduced and water quality significantly improved with aeration systems.

Sebastian Teas
Perry County Soil and Water Conservation District
Buckeye Lake Watershed Coordinator