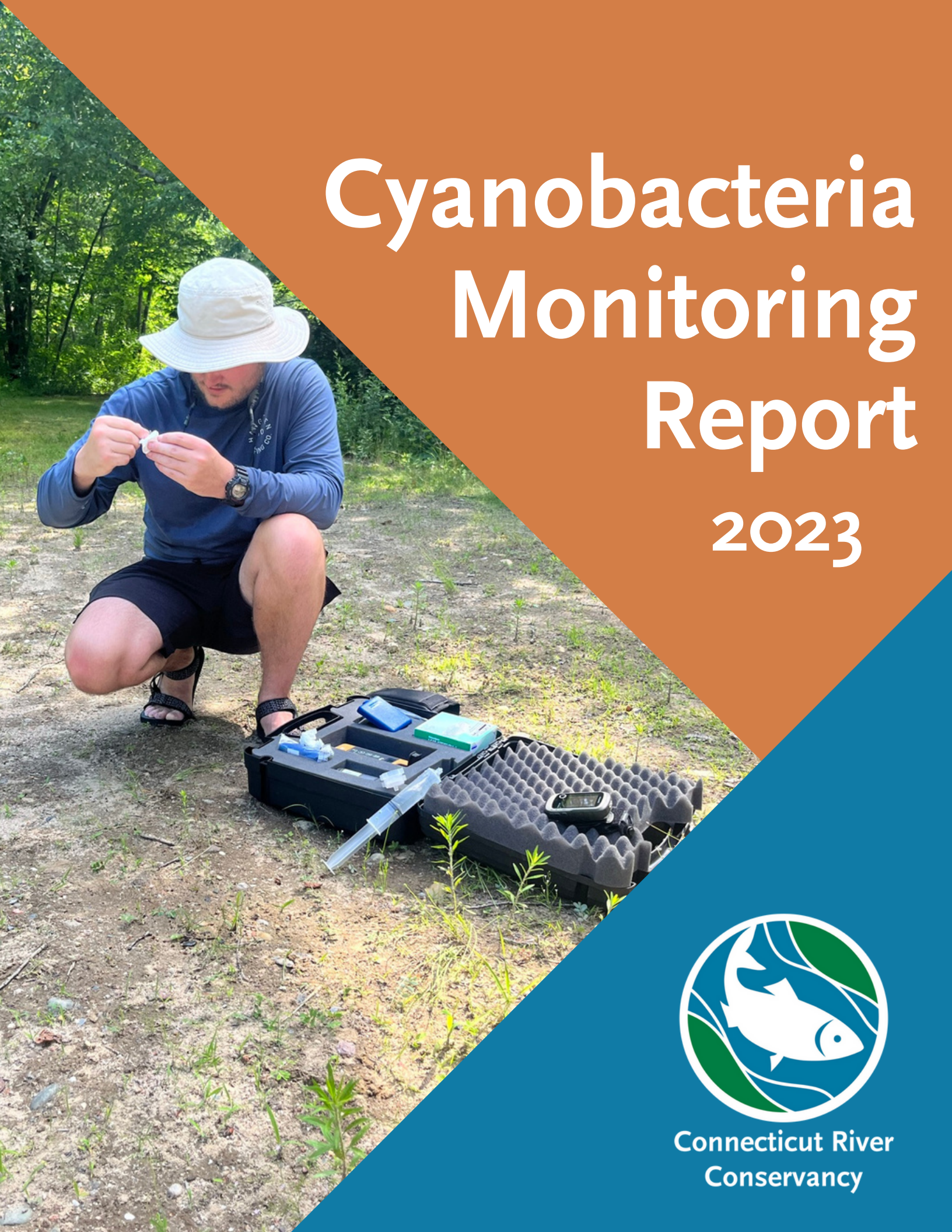


Cyanobacteria Monitoring Report 2023



Connecticut River
Conservancy

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2023 Report

Background

CYANOBACTERIA

Cyanobacteria are naturally found everywhere including fresh water. They grow well in water that has high amounts of nutrients such as nitrogen and phosphorus. Some cyanobacteria produce harmful cyanotoxins¹. Under the right conditions, toxic cyanobacteria can multiply quickly to form dense populations known as Harmful Algae Blooms (HABs).

HABs are toxic to animals (including fish, birds, livestock, humans, and dogs) and are disruptive to healthy ecosystems^{1,2}.

HABs are increasing in frequency globally³, and effects can be observed in the Connecticut River watershed. In response, a group of concerned Stakeholders has taken action to monitor and mitigate HABs in local ponds and lakes in Massachusetts.

Fig.1 | Barley straw bags in Nashawannuck Pond, made with onion bags and recycled bottles for floatation.



HABs - Harmful Algae Blooms

Cyanotoxins - Toxins produced by cyanobacteria

Algistatic - Having the property of inhibiting algal growth.

Fig.2 | CyanoFluor HAB Indicator Kit.



CYANOFLUOR MONITORING

Thanks to the US Fish and Wildlife Services Silvio O. Conte Refuge, our group was able to acquire the CyanoFluor HAB indicator (fig.2). This device allows us to test ponds for cyanobacteria blooms and get results, within 30 seconds⁴.

H.A.B. MITIGATION - BARLEY STRAW

Research demonstrated barley straw, a by-product of cereal crops, is an effective and safe natural resource to mitigate HABs when used according to appropriate protocols. Barley straw does not kill existing cyanobacteria, but rather inhibits their growth by decomposing in a water body and releasing low levels of algistatic chemicals. It does not affect other forms of life. The EPA includes barley straw on its lists for HAB prevention and control⁵.

Barley straw bags (fig.1) are installed in affected ponds early in the year, before the appearance of algae. Barley was first deployed in 2022; HABs were not observed in treated ponds that year. In April 2023, approximately 170 bags of barley straw were deployed in two Massachusetts water bodies affected by HABs; again, HABs were not observed in treated ponds that year. Bags are collected in the fall.

2023 Report Summary

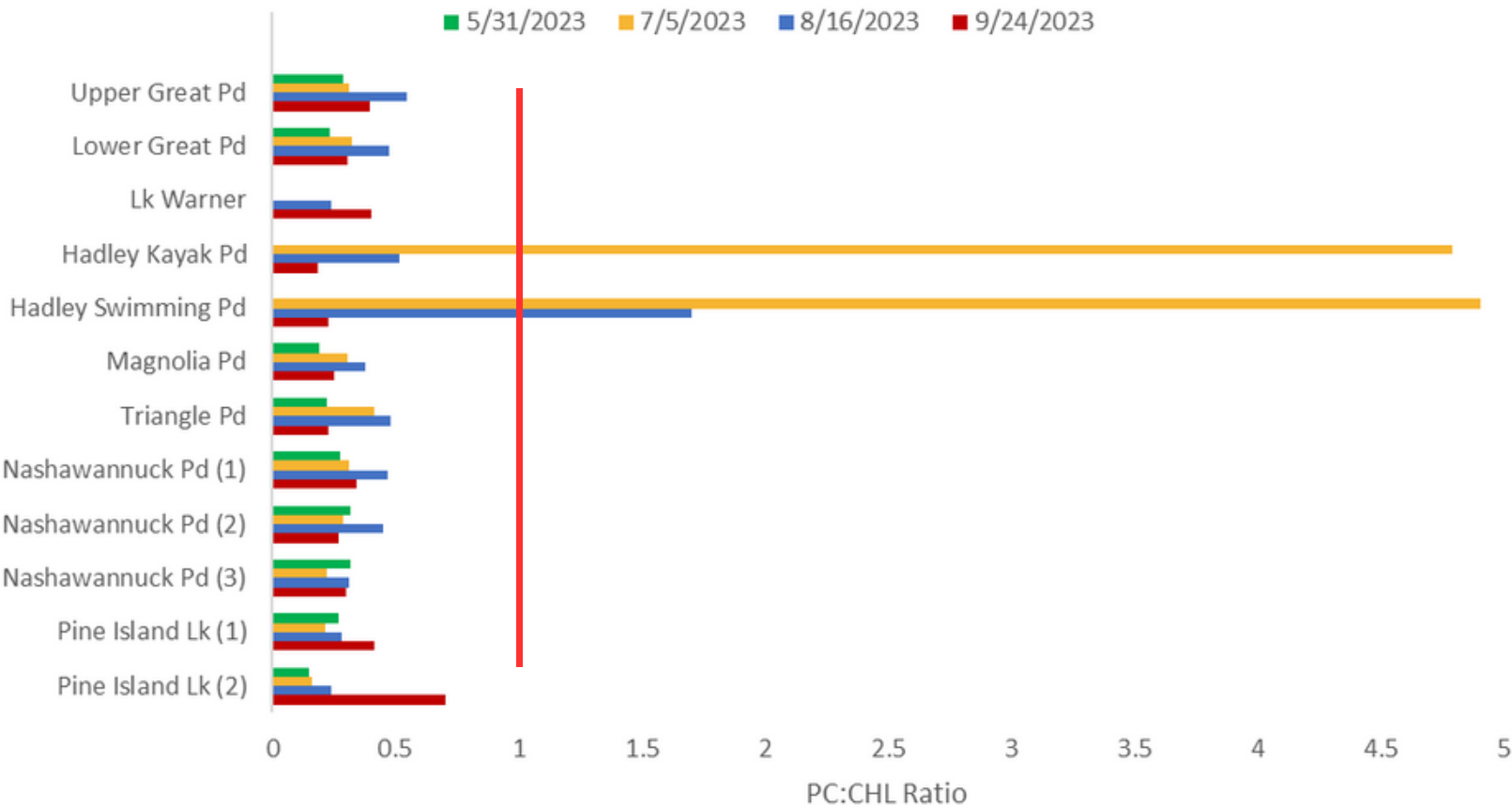
The CyanoFluor HAB Indicator is a field-portable fluorometer that measures the abundance of cyanobacteria in a mixed algal population using phycocyanin (PC) to chlorophyll (CHL) ratios. Just like chlorophyll is the pigment that allows plants to photosynthesize, phycocyanin is what allows cyanobacteria to photosynthesize⁶.



Cyanobacteria is naturally present everywhere⁷, and therefore the device will always detect its presence. When it detects a higher count of PC than CHL (ratio is more than 1), it signifies that the water body in question is experiencing an active cyanobacteria bloom.

The CyanoFluor device does not indicate the species of cyanobacteria in a water body. Not all cyanobacteria produce cyanotoxins. If a test indicates a cyanobacteria bloom, we recommend further testing done at a laboratory to discern the type of bloom and whether it is harmful or not.

Results below compare all sites tested in 2023. The **red line** indicates the threshold of a cyanobacteria bloom; all samples tested higher than that threshold (ratio > 1) are considered in active bloom.



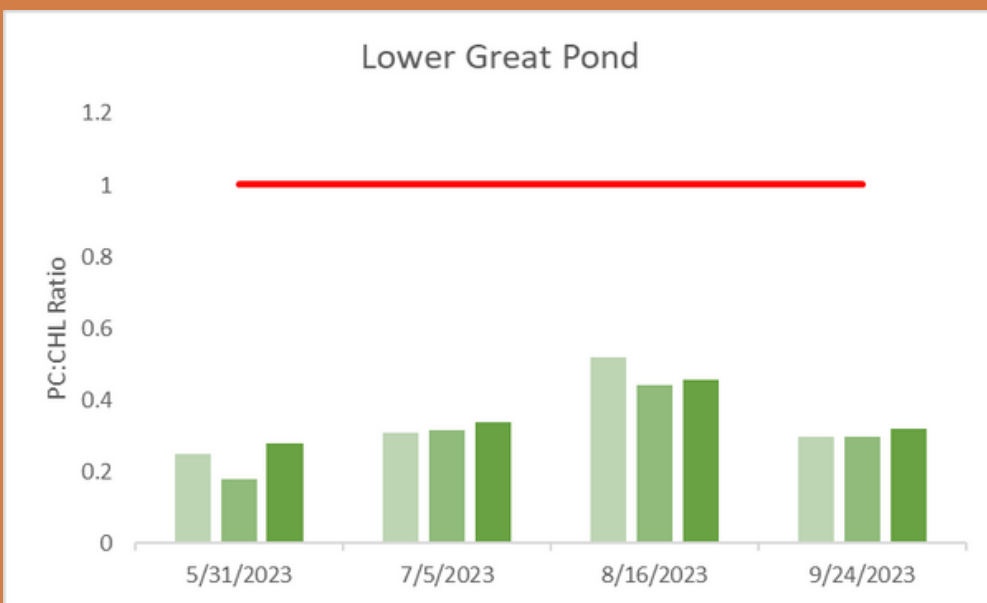
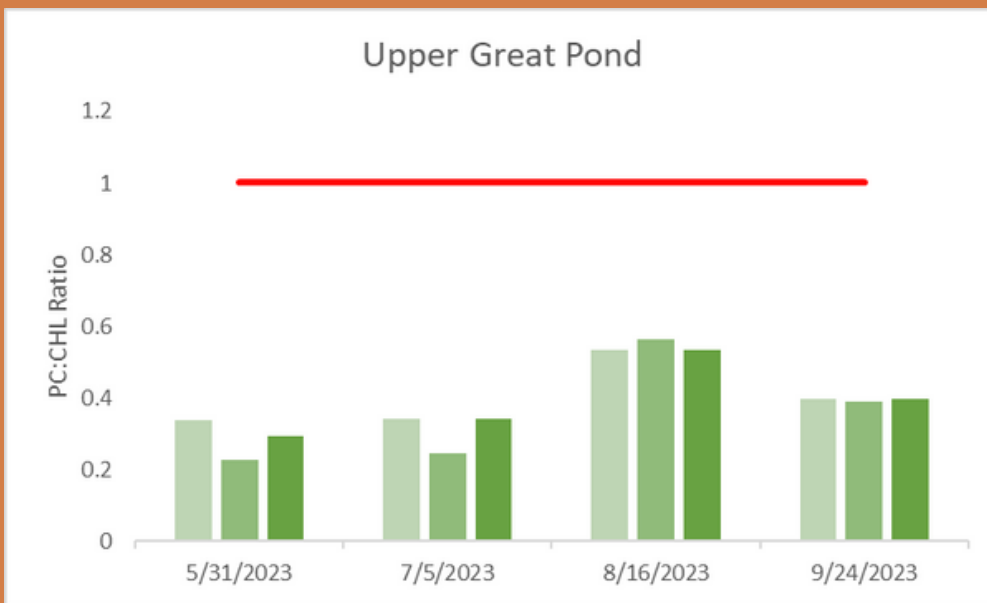
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Great Pond

Great Pond is located in Hatfield, MA. It is surrounded by farm fields on one side, and low-density residences on the other. It flows into the Connecticut River via Cow Bridge Brook. The pond is divided into two sections which we informally refer to as Upper and Lower Great Pond.

In addition to being affected by the invasive aquatic plant water chestnut, Great Pond has previously been affected by HABs. 2022 monitoring results included positive cyanobacteria blooms at Great Pond, which remained untreated. It is a candidate for a barley straw mitigation project but acquiring permits through local governments is a challenge we are still working on.

The results below represent the PC to CHL ratio at both ponds throughout the summer of 2023. The **red line** indicates the threshold of a cyanobacteria bloom; samples that test higher than that threshold (ratio > 1) are considered in active bloom. Great Pond did not test positive for cyanobacteria blooms during our monitoring efforts, though it is still possible a bloom occurred outside of our sampling days.



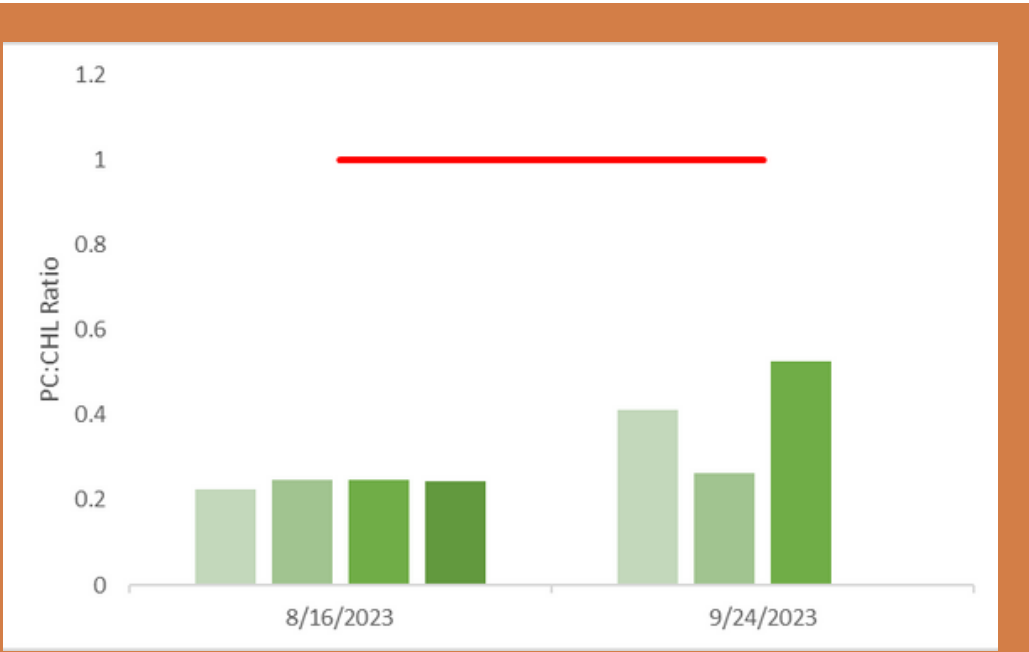
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Lake Warner

Lake Warner is located in Hadley, MA. Surrounded by forests, residences and farm fields, it is one of the great recreational treasures of Western Massachusetts. It is preserved by the Friends of Lake Warner & Mill River Non-profit. The Lake Warner flows into the Connecticut River via the Mill River.

Lake Warner has previously been affected by HABs. A barley straw mitigation project may develop there in the next few years.

The results below represent the PC to CHL ratio at Lake Warner during the monitoring efforts of 2023. The **red line** indicates the threshold of a cyanobacteria bloom; samples that test higher than that threshold (ratio > 1) are considered in active bloom. Lake Warner did not test positive for cyanobacteria blooms during our monitoring efforts, though it is still possible a bloom occurred outside of our sampling days.



“We are dedicated to the preservation, improvement, and responsible use of the Lake Warner and the Mill River in Hadley, Massachusetts.”

www.FriendsofLakeWarner.org

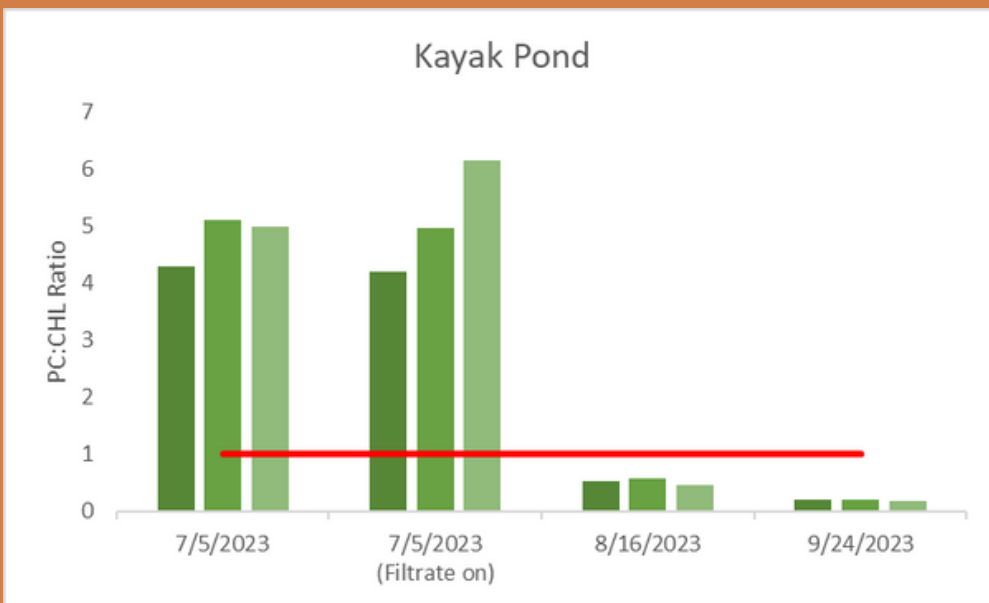
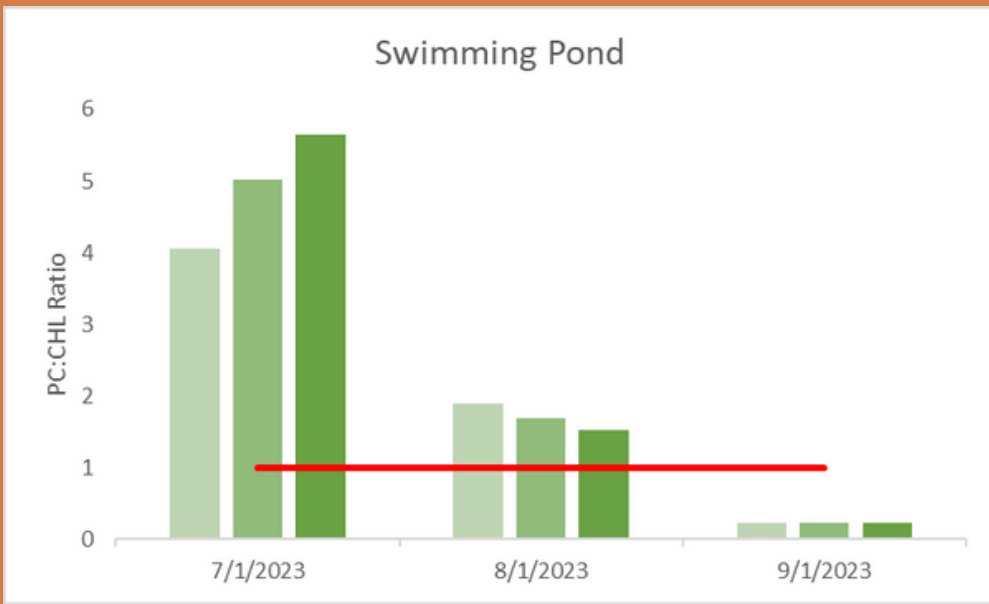
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Hadley Ponds

Two ponds in Hadley were included in the 2023 study. Their details and location will remain undisclosed for the privacy of the landowners.

The ponds had been affected by HABs. A barley straw mitigation project may develop there in the next few years.

The results below represent the PC to CHL ratio at the two ponds during the monitoring efforts of 2023. The **red line** indicates the threshold of a cyanobacteria bloom; samples that test higher than that threshold (ratio > 1) are considered in active bloom. The ponds tested positive for cyanobacteria blooms. A second test was conducted in July on the "Kayak" Pond, using filtered sample water to test without dissolved organic matters which can affect the results. The landowners were informed and were advised to not use the ponds until further tests are done or the opaque green coloration on the ponds as seen in the picture dissipate.

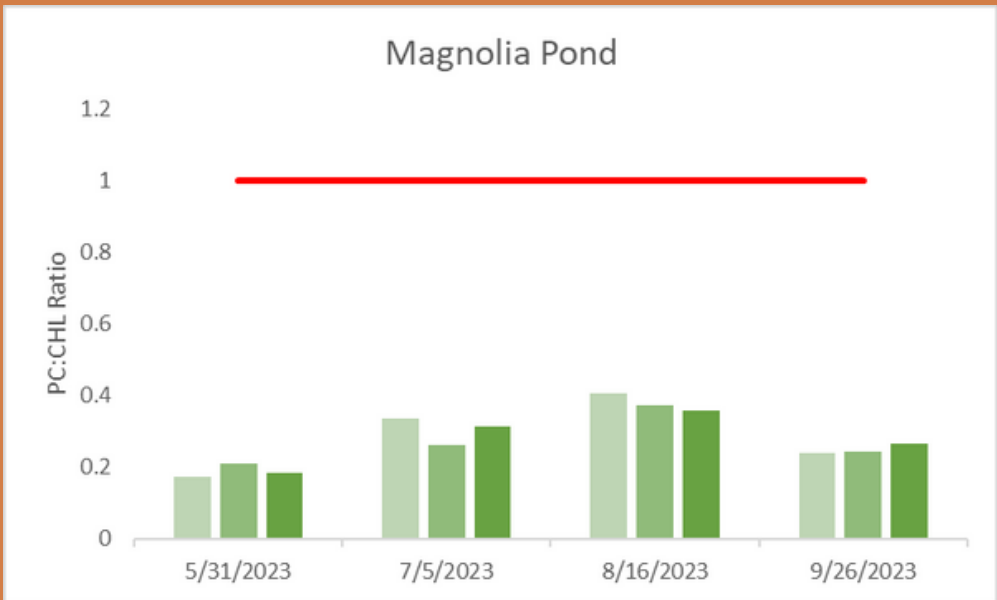
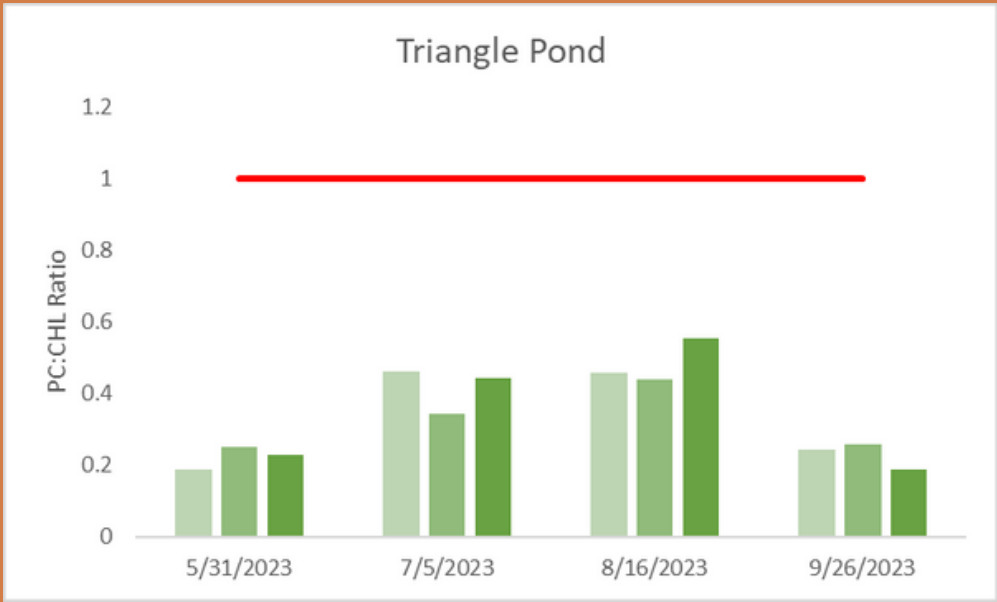


Triangle and Magnolia Ponds

Triangle and Magnolia Ponds are located in Northampton, MA. Just off of the Oxbow and the Connecticut River, the two ponds are within the Silvio O. Conte National Wildlife Refuge. They are often frequented by paddlers and anglers. The ponds flow into the Connecticut River.

Triangle pond had been affected by HABs; 2022 monitoring results included positive cyanobacteria blooms at Triangle Pond, which remained untreated. It is a candidate for a barley straw mitigation project but acquiring permits through local governments is a challenge we are still working on.

The results below represent the PC to CHL ratio at the two ponds during the monitoring efforts of 2023. The **red line** indicates the threshold of a cyanobacteria bloom; samples that test higher than that threshold (ratio > 1) are considered in active bloom. Triangle and Magnolia Ponds did not test positive for cyanobacteria blooms during our monitoring efforts, though it is still possible a bloom occurred outside of our sampling days.



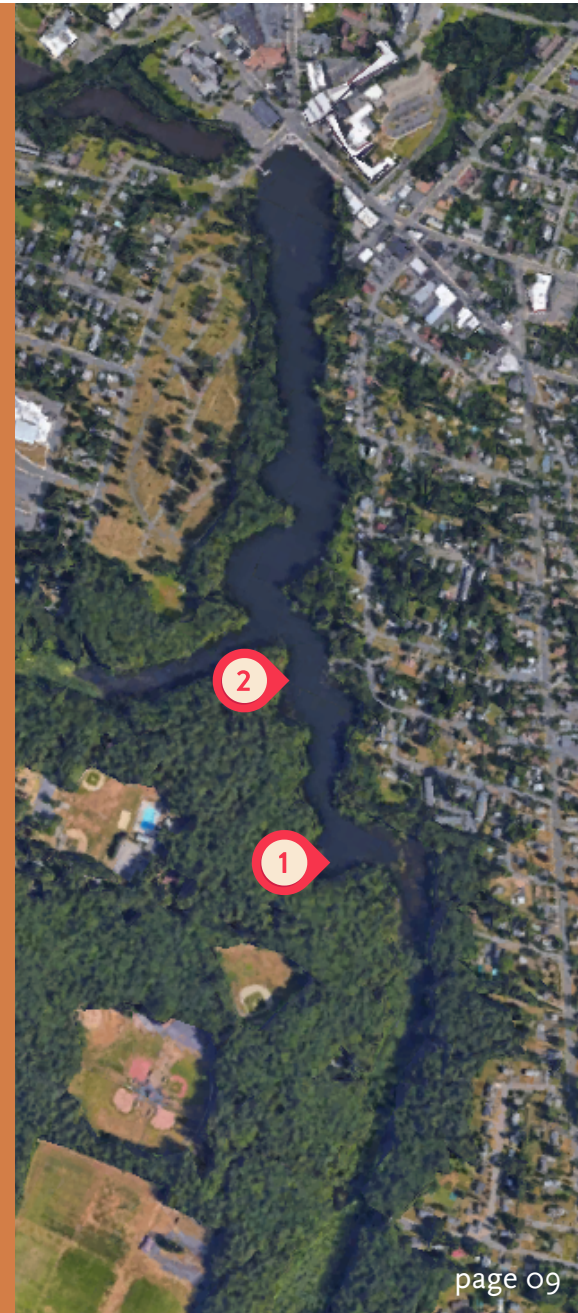
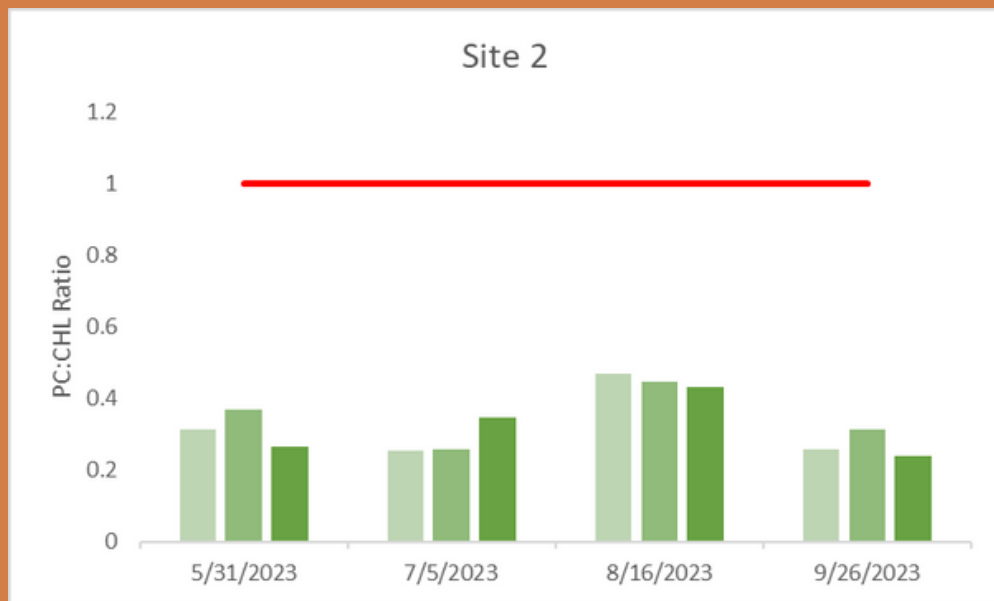
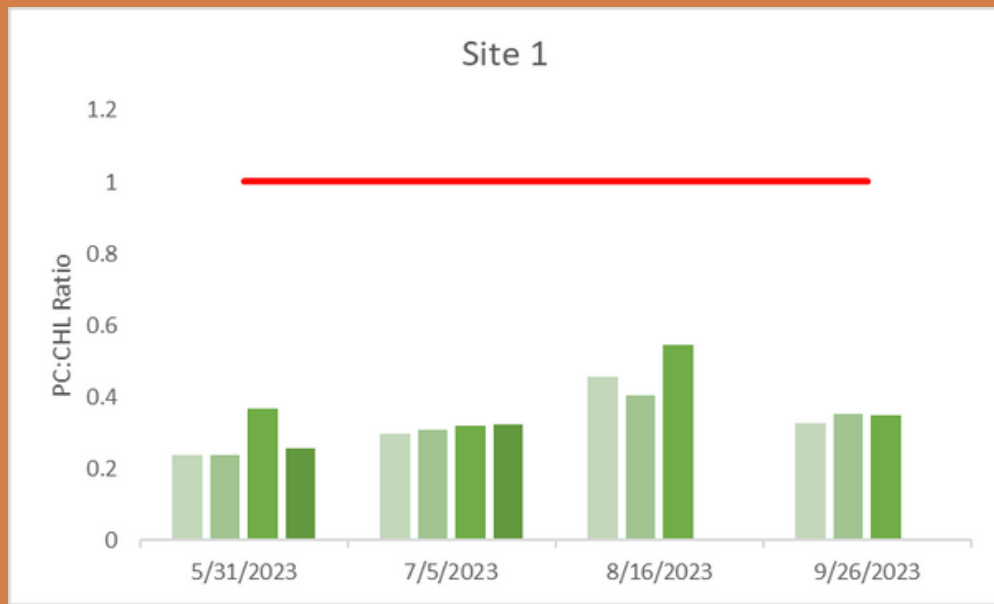
Nashawannuck Pond



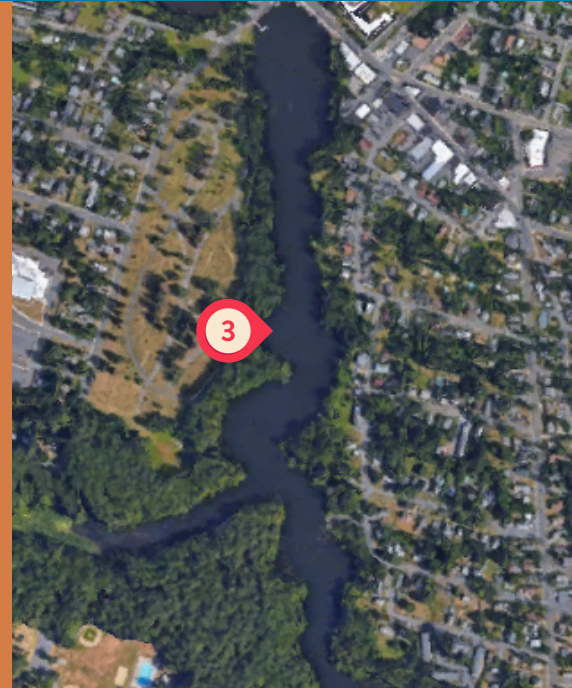
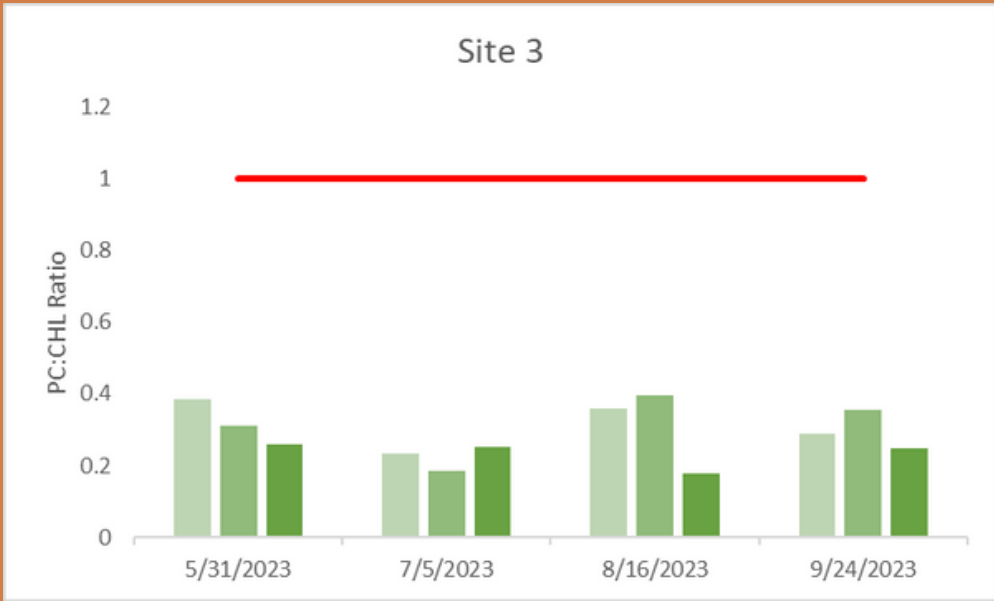
Nashawannuck Pond is located in Easthampton, MA. A cherished recreational resource for the Easthampton communities, it is preserved by the Nashawannuck Pond Steering Committee. The Pond flows into the Connecticut River via the Manhan River.

Nashawannuck Pond had previously been affected by HABs. As a result, the steering committee collaborated with Dr. Allison Ryan to deploy barley straw at various points along the shore of the pond to mitigate the growth of HABs. 2022 was the first year barley straw was deployed at Nashawannuck Pond; the treated pond did not test positive for cyanobacteria blooms in 2022.

The results below represent the PC to CHL ratio at 3 sites on Nashawannuck Pond during the monitoring efforts of 2023. The **red line** indicates the threshold of a cyanobacteria bloom; samples that test higher than that threshold (ratio > 1) are considered in active bloom. Nashawannuck Pond did not test positive for cyanobacteria blooms during our monitoring efforts, though it is still possible a bloom occurred outside of our sampling days.

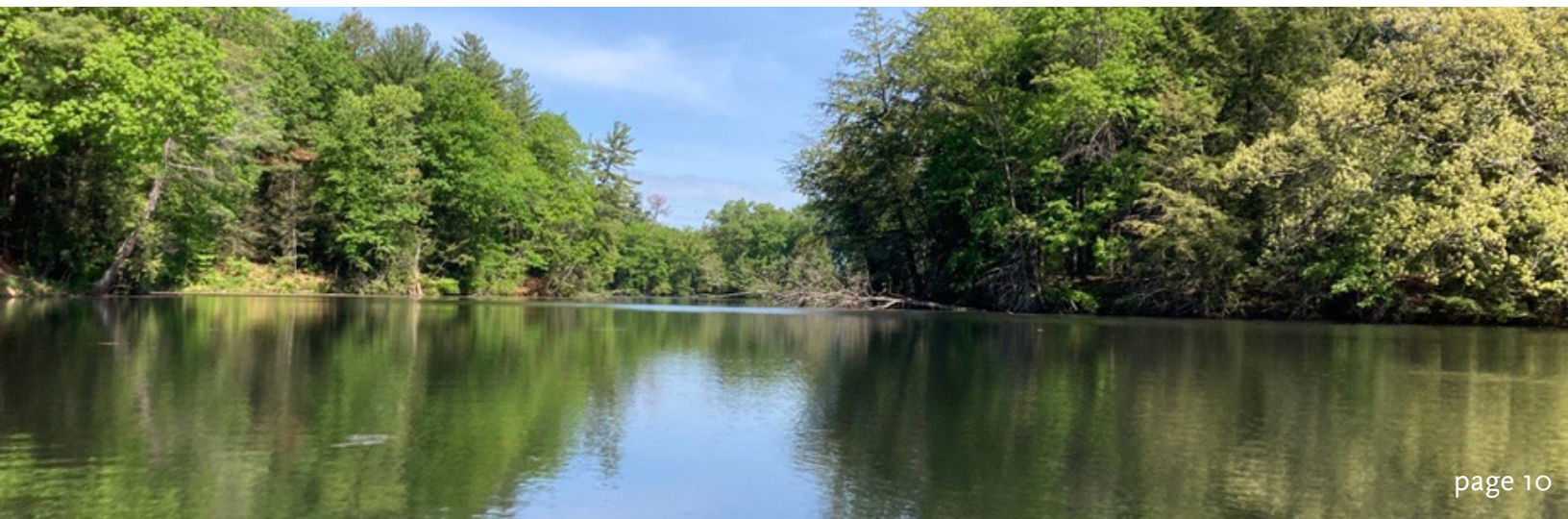


Nashawannuck Pond



“We are an advisory committee to the city, providing guidance on ways to preserve the pond, maintain its health and educate the public about the pond.”

www.NashawannuckPond.org



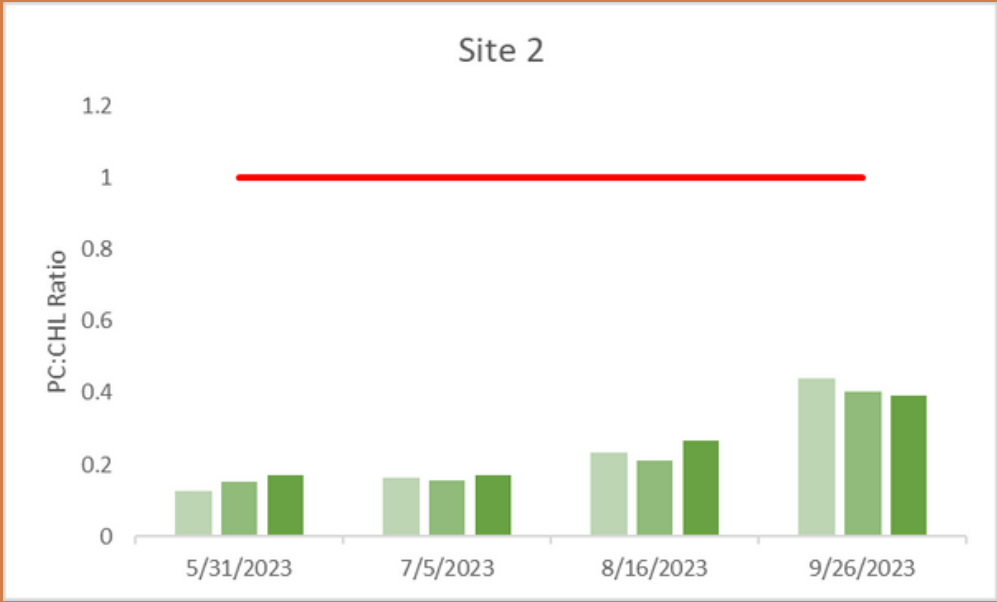
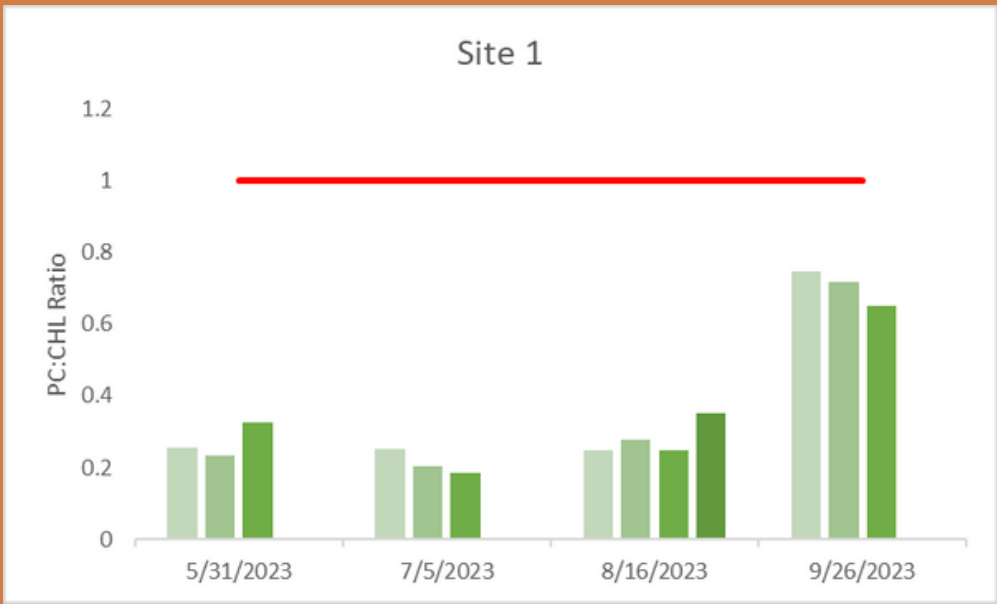
Pine Island Lake



Pine Island Lake is located in Westhampton, MA. It is preserved by the Pine Island Lake Association, comprised of local residents who share a desire to keep the lake in pristine condition. The Lake flows into the Connecticut River via the Manhan River.

Pine Island Lake had previously been affected by HABs. As a result, the Lake Management Committee of the Association collaborated with Dr. Allison Ryan to deploy barley straw at various points along the shore of the pond to mitigate the growth of HABs.

The results below represent the PC to CHL ratio at 2 sites on Pine Island Lake during the monitoring efforts of 2023. The **red line** indicates the threshold of a cyanobacteria bloom; samples that test higher than that threshold (ratio > 1) are considered in active bloom. Pine Island Lake did not test positive for cyanobacteria blooms during our monitoring efforts, though it is still possible a bloom occurred outside of our sampling days.



2023 Report Conclusion

Results highlighted in this report will serve the communities affected by harmful algae blooms through education and awareness. In addition, we rely on the data collected this year to support the barley straw mitigation projects: by collecting results at ponds and lakes that have already worked with barley straw, we can better support the permitting process for other affected water bodies. The Connecticut River Conservancy is not responsible for the public health nor has the jurisdiction to close down waterbodies for suspected HABs. For official recommendations and advisories, please reach out to your local Department of Public Health.

Cyanobacteria monitoring efforts will continue in 2024, hopefully with more capacity added to increase the frequency of tests and communications to affected communities. For more questions about monitoring and sample locations, please contact Aliko Fornier at afornier@ctriver.org.

This project is not possible without the partnerships of several organizations and individuals. In particular, we want to thank retired neurologist Dr. Allison Ryan, and Deputy Refuge Manager Dean Rhine. Dr. Ryan has spearheaded the monitoring and mitigation efforts for cyanobacteria by taking action in gathering a group of concerned stakeholders after witnessing the challenges HABs cause for recreational users and the environment, and the lack of resources offered by local governments. Dean Rhine with the Refuge has provided this effort with invaluable support and assets, to see its success. Thanks to Dr. Ryan and Mr. Rhine, we are beginning the third year of this mitigation and monitoring program!



**Pine Island
Lake
Association**



Image by Beth Tiffany



**Connecticut River
Conservancy**

Report prepared by CRC Staff

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