

# Indian Ponds Association, Inc.

P. O. Box 383

Marstons Mills, MA 02648

[www.indianponds.org](http://www.indianponds.org)

January 29, 2021

Mr. Mark Ells, Town Manager  
Town of Barnstable  
Town Hall  
367 Main Street  
Hyannis, MA 02601

Dear Mr. Ells,

I am sorry that you were unable to participate in our Zoom meeting with Town staff to discuss how to proceed from the recommendations contained in the recent study done by Dr. Ken Wagner of the current nutrient status of Mystic Lake that was funded by the Indian Ponds Association (IPA).

Your staff was helpful and open regarding their concerns about managing cyanobacteria in the ponds of Barnstable. Our discussion focused on two key issues: 1) what is the best approach to managing the nutrients that cause blooms in Mystic Lake, and 2) why prioritize the treatment of Mystic Lake over several other Town ponds that have considerably worse cyanobacteria problems.

Eichner (2008) found that Mystic Lake had low total nitrogen (N) concentrations relative to many other Cape Cod ponds. More recently, Wagner (2018) found that N and phosphorus (P) levels in the upper waters of Mystic Lake remained low throughout the summer of 2017. Dr. Wagner's 2020 report, which was the impetus for our meeting, found that Mystic Lake has a high internal load of P that likely remains largely in the sediment during winter months or is locked in the deep, anoxic hypolimnion (deeper water layer) during summer months. Presently, it appears that significant P makes its way into the upper water column of Mystic Lake only during the period of spring and fall overturn (late spring or mid-to-late September). That is when Mystic Lake has its highest levels of cyanobacteria.

We discussed some of the complexities and species-dependent dynamics underlying cyanobacteria blooms. However, Dr. Wagner offered that adequate P control is clearly the single most effective means to curb cyanobacteria blooms (Schindler et al. 2008; Wagner et al. 2017; Brattebo et al. 2017). Although Gobler et al. (2016) describe cases in which N input is an important factor contributing to cyanobacteria blooms, N has more qualitative impacts by virtue of its multiple forms and ratio to P. Overall, algal abundance is not determined by nitrate, ammonium, or organic N concentrations. Consider that:

**Mystic Lake**



**Middle Pond**



**Hamblin Pond**

*"To preserve and protect the natural environment and ecological systems of the Indian Ponds and surrounding parcels of land and watershed [and to] participate in studies and work with other agencies, individuals, and groups to educate the public, serve the community, and promote and preserve the Indian Ponds and surrounding areas."*

- 1) N levels in these ponds are at a level considered low (<300 ppb).
- 2) Monitoring efforts in support of the Town's comprehensive wastewater management plan found that N levels exiting Mystic Lake and Middle Pond via the Marstons Mills River were sufficiently low enough that the Town's wastewater management plan excluded Mystic Lake and most of Middle Pond waterfront properties.
- 3) Previous alum treatments that bind up P in the sediments of Hamblin Pond and Mystic Lake have historically suppressed blooms.
- 4) The highest levels of cyanobacteria in Mystic Lake occur during fall overturn when deep, P-rich waters mix with surface waters.
- 5) Many cyanobacteria have specialized cells that allow use of dissolved N gas, plentiful in our atmosphere and surface waters, such that low nitrate or ammonium levels do not prevent bloom formation.

There are several means to reduce adverse effects of internal P loads. The IPA is open to any effective approach, e.g., oxygenation technologies that eliminate anoxic conditions in the lake's hypolimnion, dredging, or various chemical treatments such as alum or Phoslock. Your staff stressed the importance of best management practices (BMPs) to reduce nutrient inputs. IPA supports and advocates via our newsletter that our members should practice BMPs to reduce nutrient inputs to the Indian Ponds. However, a policy of restoring eutrophic or P-impaired lakes that relies primarily on BMPs is typically inadequate, and internal P loading is often a major culprit limiting the effectiveness of such a policy (Osgood 2017). We encourage you to read this latter paper.

With your staff, we discussed the option of another alum treatment for Mystic Lake (see Wagner 2020 for a description of the previous, inadequate alum treatment of Mystic Lake in 2010). Notwithstanding our openness to other means to control P levels, IPA encourages the Town to implement an additional alum treatment in Mystic Lake as soon as possible because:

- 1) It is likely that the internal load of P is causing elevated levels of cyanobacteria that warrant posting, and a proper alum treatment would alleviate that problem.
- 2) An alum treatment would likely be much less expensive than dredging or use of some oxygenation technology.
- 3) Concerns about adverse effects of alum treatments typically involve systems with either excessively low or high pH (<6 or >8), or the result of improperly trained personnel administering the dose (Gensemer and Playle 1999; Nogaro et al. 2013; NALMS 2015). Wagner et al. (2017) provide a 3-level protection system (pH control, dose control, and treatment area control) for preventing significant fish mortality, and they state that

**Mystic Lake**



**Middle Pond**



**Hamblin Pond**

*“To preserve and protect the natural environment and ecological systems of the Indian Ponds and surrounding parcels of land and watershed [and to] participate in studies and work with other agencies, individuals, and groups to educate the public, serve the community, and promote and preserve the Indian Ponds and surrounding areas.”*

documentation of minimal or temporary adverse impacts to biota since 2001 has facilitated and expedited permitting of alum treatments by regulatory agencies.

- 4) Like many kettle hole ponds on Cape Cod, Mystic Lake is an ideal candidate for alum treatment given its relatively long detention time, an infertile sandy bottom overlain in deeper water by organic material that can cause oxygen depletion, and high iron (Fe) concentrations that bind P under oxic conditions (Wagner et al. 2017), and Mystic Lake has a near neutral pH in the upper 8–9 meters (Wagner 2020). Moreover, Mystic Lake is a relatively deep system that thermally stratifies, a condition that substantially extends the longevity of an alum treatment (Huser et al. 2016). [Note that Huser et al. report a mean longevity of only 5.7 years for shallow, polymictic (too shallow to thermally stratify) lakes, which are common in Barnstable.]
- 5) Wagner (2020, p. 17) shows that bottom concentrations of P during late summer have been steadily trending upward since the inadequate treatment in 2010. We are concerned that this trend will continue until cyanobacteria blooms and related health warnings become much more frequent and extended.

We believe that these are, collectively, sound reasons for proceeding with an alum treatment as soon as possible in Mystic Lake. So the question becomes: why should the Town prioritize the treatment of Mystic Lake over ponds that have worse cyanobacteria problems? We believe there are several good reasons, including:

- 1) Supporting the only successful breeding pair of bald eagles on Cape Cod, Mystic Lake is a prominent water body and the second largest lake in the Town of Barnstable.
- 2) Recent lake studies and ongoing monitoring of water quality, sediments, and cyanobacteria done and/or supported/funded by the IPA have appreciably advanced the Town's knowledge about the most effective means to address Mystic Lake water quality issues. The best way to proceed is not as well known for several other (especially shallow polymictic) ponds in the Town.
- 3) We are confident of success that, if done competently, a single year's treatment will yield many years of safe water quality for the Town's second largest lake.
- 4) Given the upward trend of phosphorus during late summer in Mystic Lake, a proactive treatment of this lake will avoid the prospect that most or all of Barnstable's ponds are plagued with harmful cyanobacteria blooms.
- 5) Biodiversity (2018) suggested that Mystic Lake supported an especially diverse assemblage of freshwater mussels, including one of the three best tidewater mucket populations in Massachusetts, and one of the best lake populations of triangle floater. These species are now rare in Mystic Lake and are undergoing recovery following the

**Mystic Lake**



**Middle Pond**



**Hamblin Pond**

*“To preserve and protect the natural environment and ecological systems of the Indian Ponds and surrounding parcels of land and watershed [and to] participate in studies and work with other agencies, individuals, and groups to educate the public, serve the community, and promote and preserve the Indian Ponds and surrounding areas.”*

cyanobacteria bloom that preceded the lake's last, and much delayed, alum treatment. We should try to protect these species.

- 6) Many of the other ponds in Barnstable that are impacted by cyanobacteria are scheduled to benefit from the Town's expenditures for the Sewer Expansion Project, but Mystic Lake is not.

Lastly, towards the end of the meeting with your staff as we pressed them for some indication as to what type of response we might expect from the Town, and when, relative to a treatment for Mystic Lake, Elizabeth Jenkins said or clearly implied that perhaps additional study or data might be needed before any kind of decision would be forthcoming. With all due respect, I must point out that Mystic Lake is probably the best studied lake in the Town, that additional study is not going to reveal anything markedly different from what is already known, and that such a statement or implication is merely an attempt to delay or avoid making a decision. I hope this is not the case.

We hope that you are supportive of our evaluation. We genuinely appreciate your staff's openness and willingness to work with us to address pond management issues in the Town. Thank you for your careful consideration of our request and we look forward to hearing from you.

Sincerely yours,



Emory D. Anderson, PhD  
President, Indian Ponds Association

cc: E. Jenkins, D. Karle, G. Beaudoin, A. Unruh, K. Malkus, B. Hearn, P. Atkinson, K. Wagner

**References:**

- Biodiversity. 2018. Freshwater mussel surveys in Mystic Lake and Middle Pond: 2007-2017, Barnstable, Massachusetts. Prepared for the Town of Barnstable. 13 pp.
- Brattebo, S. K., E. B. Welch, H. L. Gibbons, M. K. Burghdoff, G. N. Williams, and J. L. Oden. 2017. Effectiveness of alum in a hypereutrophic lake with substantial external loading, *Lake and Reservoir Management*, 33(2): 108–118.
- Eichner, E. 2008. Barnstable Ponds: Current Status, Available Data, and Recommendations for Future Activities. School of Marine Science and Technology, University of Massachusetts Dartmouth and Cape Cod Commission. New Bedford and Barnstable, MA.
- Eichner, E., S. Michaud, and T. C. Cambareri. 2006. First Order Assessment of the Indian Ponds (Mystic Lake, Middle Pond, and Hamblin Pond). Final Report. Water Resources Program, Cape Cod Commission. 64 pp.

**Mystic Lake**



**Middle Pond**



**Hamblin Pond**

*“To preserve and protect the natural environment and ecological systems of the Indian Ponds and surrounding parcels of land and watershed [and to] participate in studies and work with other agencies, individuals, and groups to educate the public, serve the community, and promote and preserve the Indian Ponds and surrounding areas.”*

- Gensemer, R. W., and R. C. Playle. 1999. The Bioavailability and Toxicity of Aluminum in Aquatic Environments. *Critical Reviews in Environmental Science and Technology*, 29(4): 315–450.
- Gobler, C. J., J. M. Burkholder, T. W. Davis, M. J. Harke, T. Johengen, C. A. Stow, and D. B. Van de Waal. 2016. The dual role of nitrogen supply in controlling the growth and toxicity of cyanobacterial blooms. *Harmful Algae*, 54: 87–97.
- Huser, B. J., S. Egemose, H. Harper, M. Hupfer, H. Jensen, K. M. Pilgrim, K. Reitzel, E. Rydin, and M. Futter. 2016. Longevity and effectiveness of aluminum addition to reduce sediment phosphorus release and restore lake water quality. *Water Research*, 97: 122–132.
- NALMS. 2015. Lake and Pond Phosphorus Inactivation & Interception Workshop Manual. North American Lake Management Society. Workshop November 17, 2015, Sarasota Springs, NY. 102 pp.
- Nogaro, G., Burgin, A. J., Schoepfer, V. A., Konkler, M. J., Bowman, K. L., and Hammerschmidt, C. R. 2013. Aluminum sulfate (alum) application interactions with coupled metal and nutrient cycling in a hypereutrophic lake ecosystem. *Environmental Pollution*, 176: 267–274.
- Osgood, R. A. 2017. Inadequacy of best management practices for restoring eutrophic lakes in the United States: guidance for policy and practice, *Inland Waters*, DOI: 10.1080/20442041.2017.1368881.
- Schindler, D. W., R. E. Hecky, D. L. Findlay, M. P. Stainton, B. R. Parker, M. J. Paterson, K. G. Beaty, M. Lyng, and S. E. M. Kasian. 2008. Eutrophication of lakes cannot be controlled by reducing nitrogen input: Results of a 37-year whole-ecosystem experiment. *Proceedings of the National Academy of Sciences, USA*, 105: 11254–11258.
- Wagner, K. J. 2017. Preface: Advances in phosphorus inactivation, *Lake and Reservoir Management*, 33(2): 103–107.
- Wagner, K. J., D. Meringolo, D. F. Mitchell, E. Moran, and S. Smith. 2017. Aluminum treatments to control internal phosphorus loading in lakes on Cape Cod, Massachusetts, *Lake and Reservoir Management*, 33(2): 171–186.
- Wagner, K. J. 2018. Monitoring of Mystic Lake and Middle Pond in Barnstable, Massachusetts in 2017. Prepared by Water Resource Services, Inc. for the Town of Barnstable. 42 pp.
- Wagner, K. J. 2020. Mystic Lake status update 2020. Prepared by Water Resource Services, Inc. for the Indian Ponds Association, Marstons Mills, MA. 29 pp.

**Mystic Lake**



**Middle Pond**



**Hamblin Pond**

*“To preserve and protect the natural environment and ecological systems of the Indian Ponds and surrounding parcels of land and watershed [and to] participate in studies and work with other agencies, individuals, and groups to educate the public, serve the community, and promote and preserve the Indian Ponds and surrounding areas.”*