Lake & watershed restoration at Georges Pond: **The little lake (association) that could**

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The lake & watershed

Georges Pond is a 358-acre Great Pond located in the Town of Franklin, Maine, approximately 45 minutes north of Bar Harbor and famed Acadia National Park. At its maximum depth, Georges Pond reaches 14 m, has an average depth of 4.3 m and a flushing rate of 0.45 flushes/yr. The lake is fed by several intermittent drainages and has a single outlet on the north end of the lake, Georges Brook (Figure 1).

The Georges Pond watershed is small relative to the size of the lake, covering just 1-square mile of land. Land cover in the watershed is primarily forested (53 percent), consisting mostly of mixed forest, followed by wetlands (19 percent), developed land (15 percent), open green spaces and meadows (7 percent), and agriculture (6 percent) (Figure 2). Logging accounts for approximately 8 percent of the forested area. Residential development accounts for the largest percentage of the developed urban land cover category at 10 percent, with gravel operations and roads making up 5 percent. Development is limited to roads and residential development, with 144 developed shoreline parcels, 92 percent of which are seasonal. Only about a dozen residents live on the shoreline year-round. It is estimated that 23 of the 144 shoreline dwellings meet or exceed the minimum shoreline zoning requirements established in Maine's 1971 Mandatory Shoreland Zoning Act, presumably because the non-conforming properties were built prior to 1971.

Water quality data at Georges Pond has been collected by volunteer monitors and the Maine Department of Environmental Protection (MDEP) since 1977. Georges Pond is on the Maine Department of Environmental Protection's (MDEP) Nonpoint Source Priority List as "Threatened" due to changes in water quality over the past decade, sensitive sediment chemistry that indicates it is susceptible to releasing iron-bound phosphorus when exposed to low levels of dissolved oxygen, and specifically because of nuisance algal blooms that started in 2012.

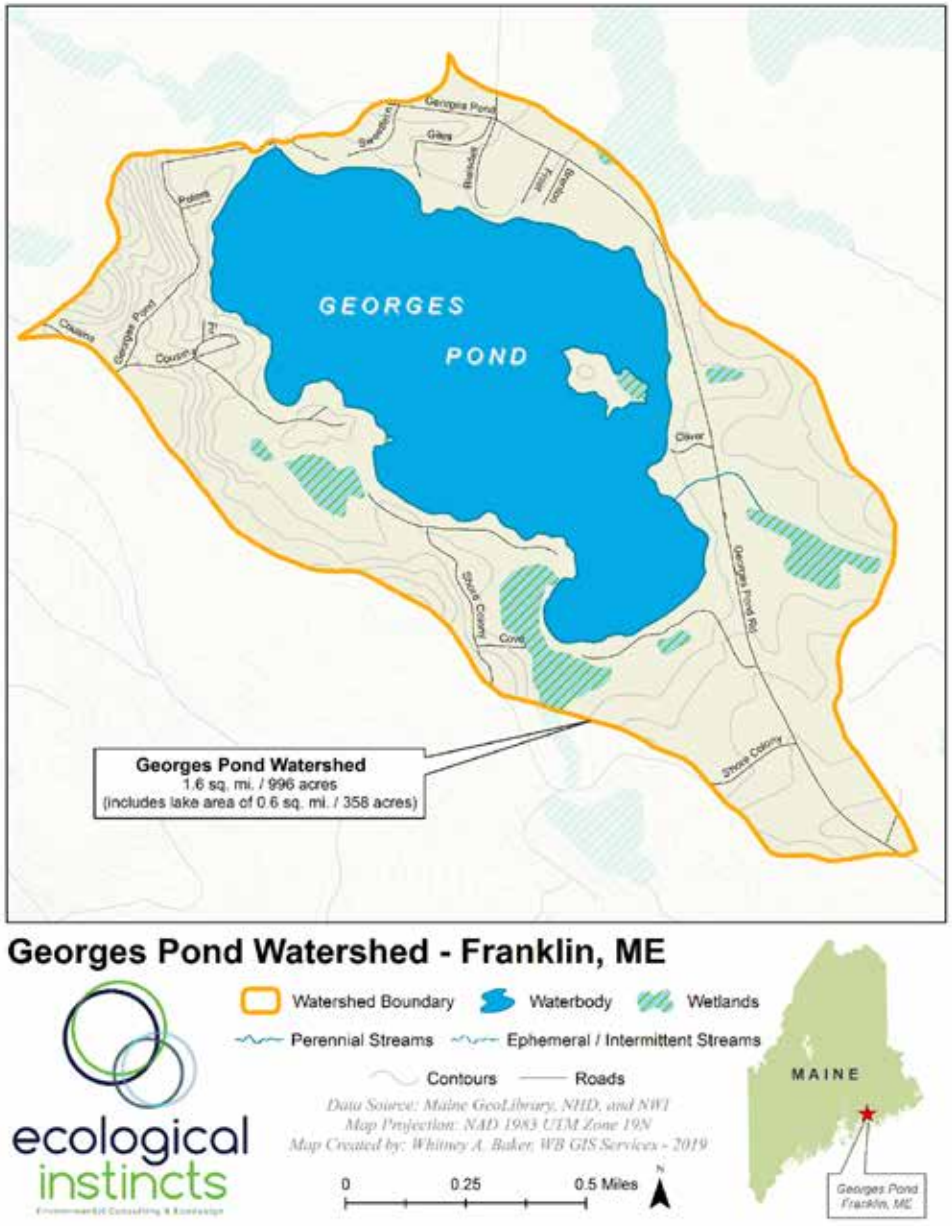

Figure 1. Watershed map.

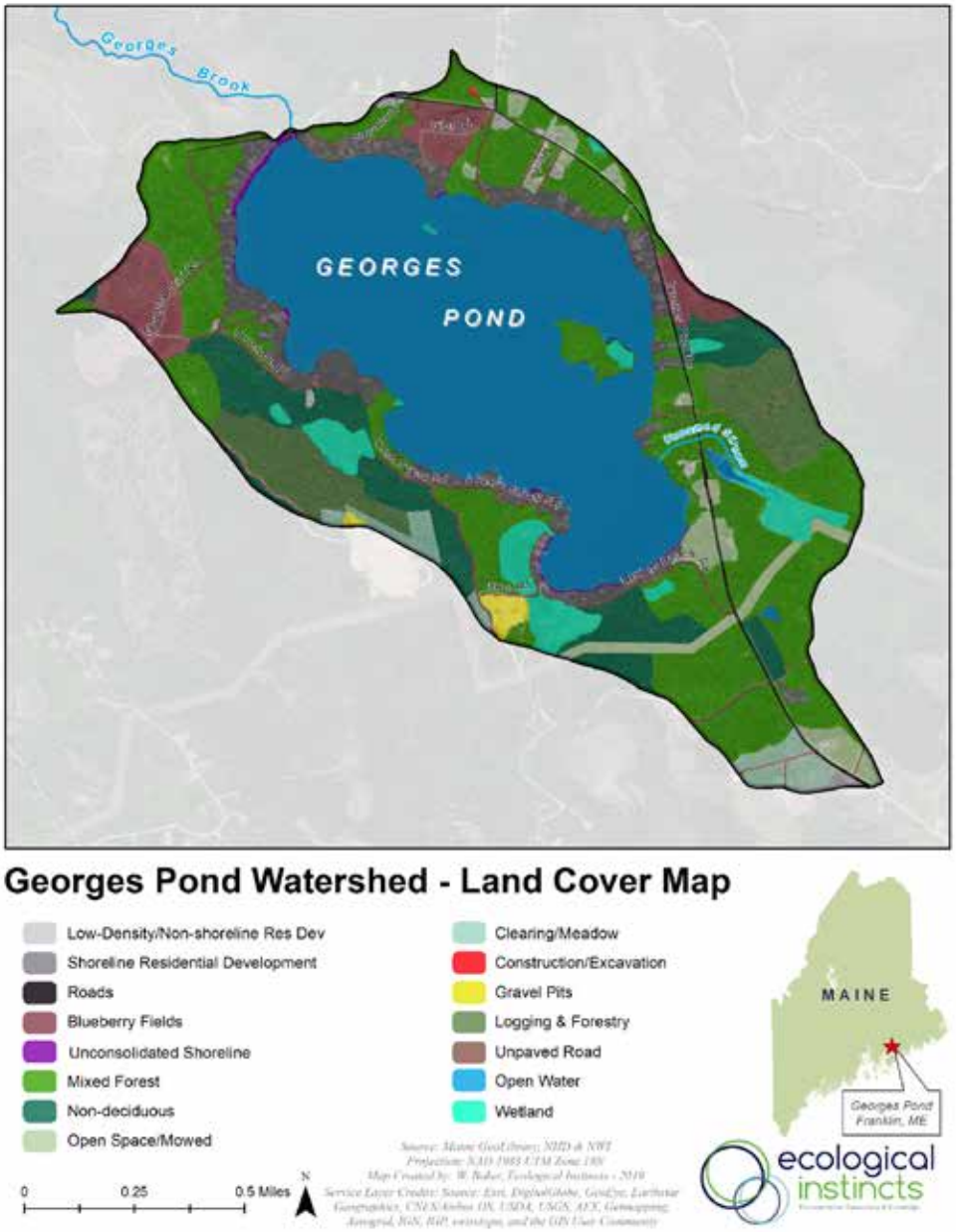

Figure 2. Land cover map.

Figure 3. Pea soup at Georges Pond.

A small lake with a big problem

Prior to 2012, the average total phosphorus concentrations in Georges Pond were 12 ppb and water clarity was 4.6 m. And then, the unthinkable happened. The lake experienced its first significant algal bloom in 2012 the likes of pea soup (Figure 3). Between 2012 and 2019 there were a total of four lake-wide algal blooms that resulted in significant changes in water quality including chlorophyll-a levels 10 times historic levels, an increase in the area of anoxia at the bottom of the lake from 8 m to just 4 m, and total phosphorus concentrations in surface water increased by 10 ppb from pre-bloom conditions. In October 2019, the phosphorus concentration at the bottom of the lake was 980 ppb. The lake community was devastated, disheartened, and avoided spending time with family and friends at their beloved lake, many of which are multi-generational camps. The Georges Pond Association (GPA) needed a plan.

Make a plan

Between 2018-2019, the GPA consulted with professionals from MDEP, Water Resource Services, Inc., and Ecological Instincts to help determine why Georges Pond was experiencing nuisance cyanobacteria blooms and what to do about it. This work resulted in the development of the 2020 Georges Pond Watershed-Based Management Plan, designed to understand the unique factors in the lake and the watershed that were contributing to the algal blooms, and to prevent these blooms from occurring at Georges Pond in the future.

Water quality monitoring was an integral part of this process. The community was upset and pointing fingers to place blame on the problem without any science to back it up. With guidance from MDEP and GPA consultants, GPA trained volunteer monitors embarked on an intensive water quality monitoring program in 2019 to better understand the science behind the problem including the role of internal phosphorus recycling (aka, internal loading). Phosphorus samples were collected every other meter, every two weeks, from the surface to the bottom of the lake from May – October, along with Secchi disk transparency, and dissolved oxygen and temperature profiles. Bathymetric data was collected by GPA volunteers to assist with acquiring more accurate internal loading estimates. Sediment samples were collected from across the lake and analyzed by the University of Maine to gain a better understanding of the sediment chemistry and how Georges Pond sediments would

respond to phosphorus inactivation (Figure 4).

Monitoring is key

Phosphorus inputs from the internal load vary depending on the depth of the thermocline and how much of the lake is anoxic and for how long. Thermal stratification in Georges Pond is typically between 6 and 8 m, and even shallower if mixing is not sufficient as occurred in 2012 when anoxia was as shallow as 4 m. The shallower the depth of anoxia, the greater the area of sediment available to release phosphorus.

Results of the 2019 monitoring and assessment effort confirmed that internal loading was the most significant contributor to the phosphorus load in Georges Pond. Combined with watershed modeling, it was determined that 56 percent of the phosphorus load in Georges Pond is from internal loading (105 kg/yr) compared to 44 percent from external sources such as watershed runoff (32 kg/yr), septic systems (20 kg/yr), atmospheric deposition (22 kg/yr) and wildlife (10 kg/yr) (Figure 5).

The goal

The Georges Pond Watershed-Based Management Plan (WBMP) set a goal of reducing the internal phosphorus load in Georges Pond by 90 percent and reducing the watershed load by 10 percent (90 kg/yr reduction in total load) with an in-lake water quality target of 10 ppb in order to prevent future algal blooms. At greater than 50 percent of the total load, addressing the internal load was determined to be a primary objective in order to restore water quality as well as ramping up water quality protection efforts throughout the watershed to mitigate NPS pollution, and monitoring improvements in water quality.

Fundraising

Well before a scientific analysis recommended an aluminum treatment, GPA assumed that it needed to raise up to $400,000 for restoration. Although the GPA sought additional money from MDEP, the Town of Franklin, and other independent grants, no outside funding was provided, and all funds were raised privately.

GPA adopted a fundraising approach utilized at East Pond (in Smithfield, ME) for their aluminum treatment; to ask all homeowners for a percentage of the value of their property (2 percent) over two years, suggesting that it would be a good return on investment, as property values would increase with cleaner water. People were asked to give what they could afford and were not held to the 2 percent request. First, 100 percent of the Board of Directors were asked to pledge. Then each Board member was asked to personally solicit a handful of potential donors. By the time GPA went public with fundraising requests it had obtained more than 50 percent commitment for its initial goal. Some of the largest donors were friends of the Pond – people with strong connections and memories, but not property owners.

Although meaningful commitments had been made, by early 2020 there were only sufficient funds for half of the total treatment. In addition, Covid was unfolding along with financial hardship and restrictions on contractors. GPA decided to move forward with a partial aluminum treatment. There was some hesitation to proceed with the second treatment, but the GPA moved forward and the success of the first treatment helped to raise the remaining funds.

The aluminum treatments

The goal of the Georges Pond aluminum treatment was to amend the lake's natural chemical balance by increasing the amount of available aluminum in the sediments that could bind to phosphorus. (Whereby increasing the aluminum:iron ratio in the sediments. It is the iron-bound phosphorus that is released during periods of anoxia.)

The multi-year aluminum treatment approach in 2020-2021 was designed to inactivate phosphorus in the top 10 cm of bottom sediment in all areas of the lake subject to anoxia (>5 m), and to knock the internal load down from 105 kg/yr to 10.5 kg/yr. A MDEP General Application for Waste Discharge License (WDL)/Maine Pollutant Discharge Elimination System MEPDES) Permit was required prior to the treatment (Figure 6).

Figure 4. GPA volunteer monitors Lisa Grant and Jim Ashmore.

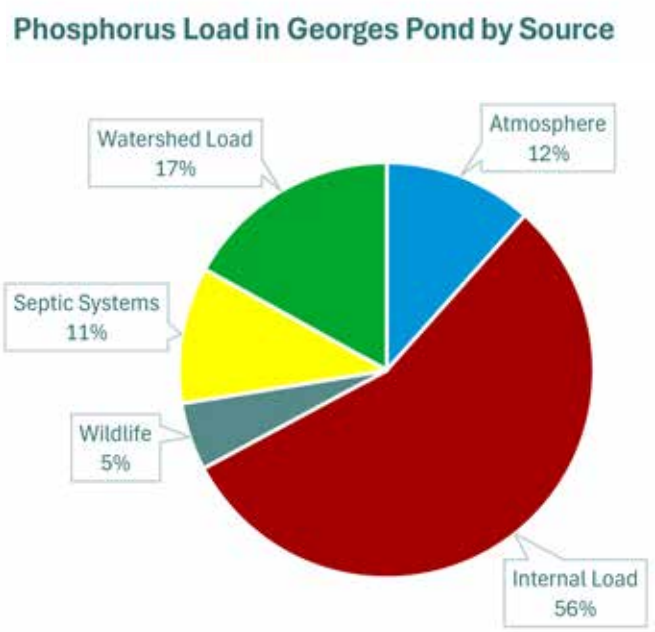

Figure 5. Phosphorus loading to Lake George.

A total of 131 acres, representing all areas deeper than 5 m in Georges Pond, was treated with 45 g/m^2 of aluminum sulfate and sodium aluminate on a barge which was injected below the water surface over the target area. This included a 25g/m^2 treatment in 2020, and a 20 g/m^2 treatment in 2021. The split treatment was partially to ensure funding was in place for the full treatment, but also had the added benefit of stripping phosphorus out of the water column during application each spring (Figure 7).

Monitoring results from 2020-2023 indicate that expected phosphorus reductions in the lake were realized. Secchi disk transparency readings in 2020, 2021 and 2023 exceeded 7.6 m, deeper than historical readings dating back to 1977 (Figure 8). The mass of phosphorus below 5 m was reduced by 81 percent from 32.8 g in 2019 (before aluminum treatments) to 6.1 kg after treatments. In 2021, the in-lake phosphorus concentration was 9.4 ppb, reaching the WBMP goal of 10 ppb.

It is common knowledge that phosphorus inactivation is not a permanent solution and overtime, phosphorus will build up in the sediment again. Preventing phosphorus from getting into the lake is the key to protecting the $300,000 local investment spent on the aluminum treatment.

Figure 6. Aerial image of aluminum treatment.

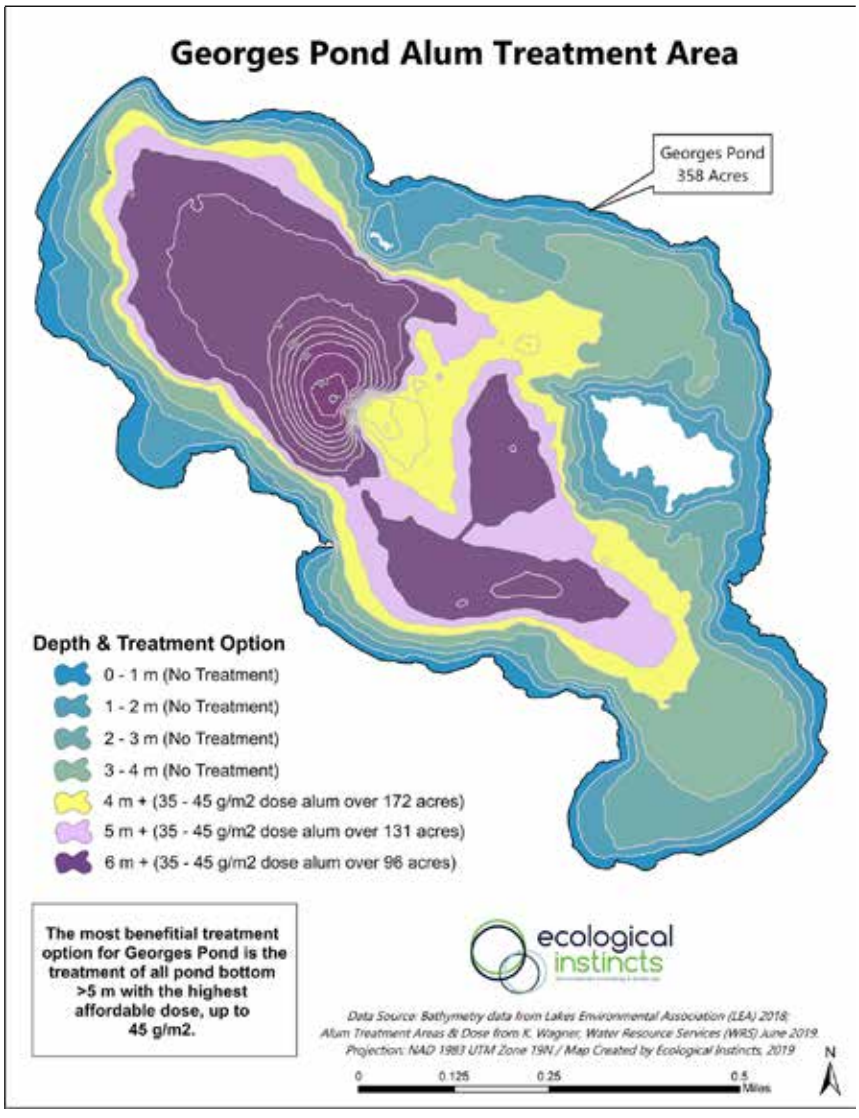

Figure 7. Aluminum treatment area.

Watershed work matters

GPA's two-pronged restoration approach to inactivate phosphorus in the sediments while simultaneously reducing phosphorus inputs from the watershed was realized through two Watershed Protection Grants from the US EPA and MDEP, ramping up GPA's LakeSmart program, and a Septic System Pilot Project and Incentive Program.

LakeSmart

GPA initiated a local LakeSmart program in 2018 with assistance from the statewide umbrella organization, Maine Lakes, who administers the program. Since 2018, trained LakeSmart volunteers from GPA have conducted evaluations for 88 of the 144 properties on the shoreline, helping raise awareness about NPS pollution and lake-friendly landscaping practices that prevent phosphorus from getting into the lake. To date, 28 LakeSmart awards have been issued making GPA one of only a handful of

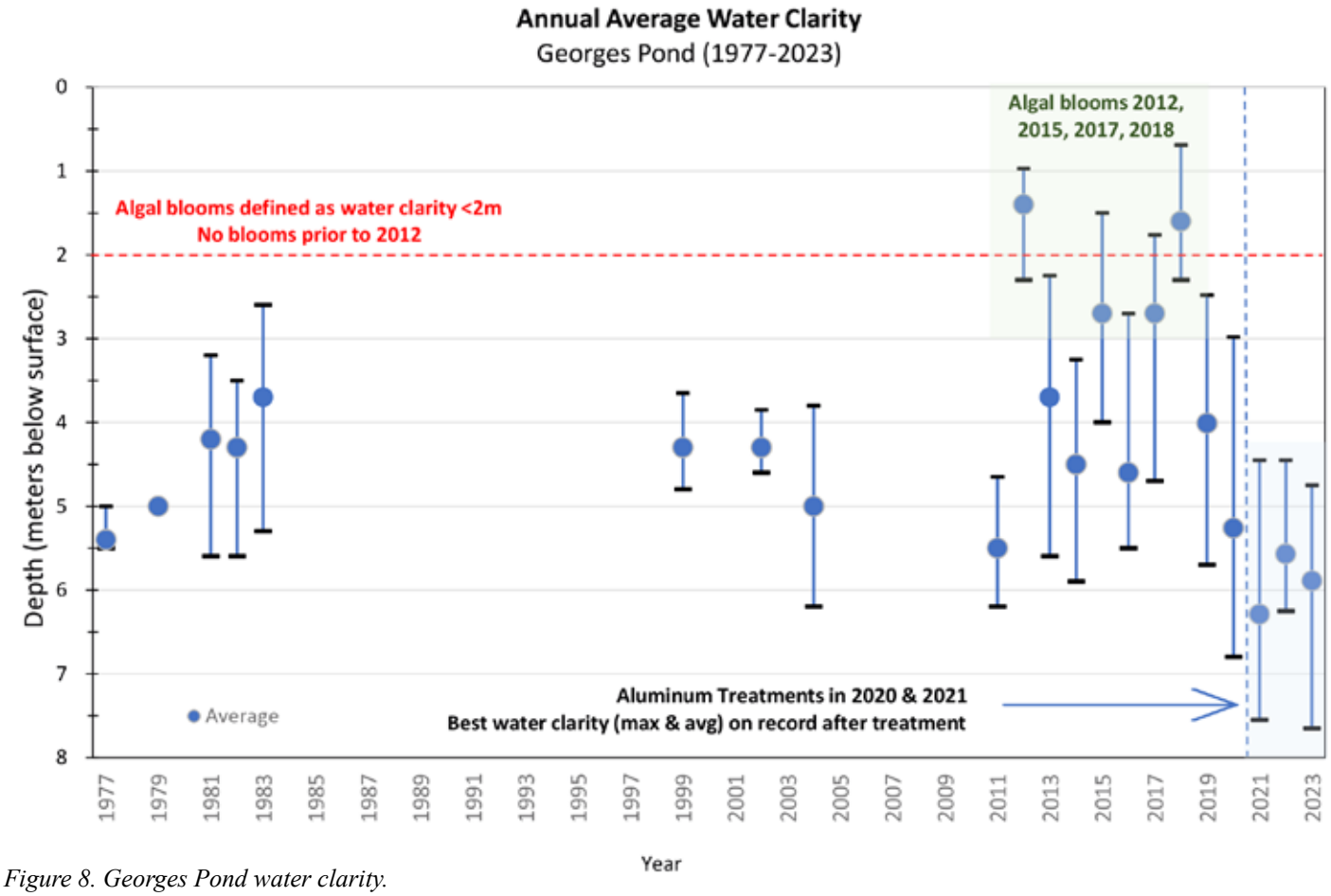

Figure 8. Georges Pond water clarity.

"LakeSmart Gold" lake associations for their LakeSmart efforts (Figure 9).

319 Grants

In Phase I (2020-2021), GPA completed erosion control projects on ten residential projects, two large gravel road projects, and hosted a "Beef Up Your Buffer" workshop to further engage shoreline property owners in the restoration proces. A total of $84,500 was invested in watershed projects including $45,960 in grant funding. To date in Phase II (2022-2024), fifteen residential property evaluations have been completed resulting in completion of nine residential projects (Figures 10a & 10b). Three gravel road projects have been completed, and a large restoration project at the town beach will be completed in the spring of 2024. The Phase II watershed project utilized $56,622 in grant funding and over $80,000 in local matching funds.

Septic Initiative

GPA's Septic System Pilot Project was partially funded by the Phase II grant, which included hosting two septic socials and providing free septic system and

Figure 9. Georges Pond residents with Lake Smart Award.

Figure 10a. Buffer planting workshop – steep slope before planting.

Figure 10b. Steep slope after planting.

biomat inspections for five seasonal and one year-round home on the shoreline which achieved the goal of gaining a better understanding of the possibility of septic systems affecting lake water quality. Only one of the six systems evaluated was found not to have a concern. Two of the older systems were determined to pose a substantial and immediate risk to water quality (Figure 11). This work highlights the need for a more comprehensive study of septic systems in the watershed. In 2023, GPA initiated a Septic System Incentive Program offering free inspections for pre-1974 systems (Maine plumbing code enacted), 50 percent discount for 1974-1995 systems or rentals, and will help schedule and coordinate inspections for post 1995 systems (rules amended to be more protective of systems in sandy soils). In 2023 GPA, helped coordinate four septic system inspections, all of which were well received.

A growing community of lake stewards

Since 2018 when GPA made it their primary mission to restore Georges Pond's water quality, GPA membership has increased from less than 50 to 200 members. GPA has developed an updated website with current information about water quality and watershed programs, completed 88 LakeSmart evaluations, published more than a dozen highly informative and educational newsletters, hosted numerous workshops on buffers and septic systems, started a septic system

Figure 11. Septic system inspection.

incentive program, and oversaw five years of grant-funded watershed work, and a two-year aluminum treatment project. Water quality in Georges Pond is the best on record, and stewardship among lake residents is at an all time high.

The Georges Pond WBMP developed in 2020 is well underway, and the goal of 10 ppb in-lake phosphorus was met early in the process thanks to immediate actions to address internal loading and watershed runoff. Ongoing watershed protection efforts are essential to keep phosphorus out of the lake and to protect the investment that has been spent on restoring the lake over the past 5+ years. One of the greatest challenges is ongoing efforts to change the culture to a "filtered view" of the lake rather than traditional lakeshore activities that clear trees for a view and working with the town to strengthen and enforce mandatory shoreland zoning regulations.

GPA has become a model and provides mentoring for other Maine lake associations facing similar internal loading challenges. The restoration effort at Georges Pond over the past 5 years is a testament to the leadership of the GPA executive board, ongoing landowner participation, and guidance from state agencies, nonprofits, and environmental consultants that helped guide GPA- and who in turn GPA inspired along the way.

Jennifer Jespersen is the owner of Ecological Instincts, a small woman-owned environmental consulting firm located in Manchester, ME. Jen is an ecologist and Certified Lake Manager, assisting lake associations and municipalities with watershed planning and freshwater restoration projects across the State of Maine. Jen is the lead author of the 2020 Georges Pond WBMP and has provided ongoing assistance to GPA for grant writing and project management support for their two recent watershed restoration grants. In her free time, Jen can be found biking the backroads of Maine and enjoying the splendor of all that Maine lakes have to offer.

NATIONAL LAKE BLITZ PROMOTIONAL PACKAGE

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Are you a lake lover who cares about the environment and wants to help track climate and other impacts? Living Lakes Canada [tag us] has the perfect opportunity for you!

Living Lakes Canada's 4th Annual National Lake Blitz is now open for registration! In this citizen science program, volunteers are equipped with simple tools and skills to monitor their chosen lake from May to September.

You have until April 26 to register and join a community of lake stewards this summer! Register today to get your free Lake Blitz Kit: https://livinglakescanada.ca/our-programs/lakes/lake-blitz/

Photo: Heather Benson