Proposed Upper Briggs Chain Lakes Alum Treatment Summary and Frequently Asked Questions (FAQ)

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Background

The Sherburne SWCD, Briggs Chain Lake Association, and more recently the Three Lakes Improvement District have been investigating conditions on Julia, Briggs, Rush and Elk Lakes for many years in addition to overseeing conservation projects that aim to improve water quality conditions. These efforts have focused on reducing phosphorus, an important nutrient that drives algae and aquatic plant growth, to the lakes. Currently all lakes are listed as "impaired" waters because of excessive phosphorus.

Phosphorus enters a lake from external sources initially through many sources such as fertilizer runoff, stormwater runoff, eroding streambanks, etc. However, there are internal (within the lake) sources of phosphorous as well. Internal sources may include phosphorous recycling from the bottom sediments and common carp. These are difficult to quantify but can, in some lakes, make up the majority of the phosphorus source in a lake.

Big Elk Lake has a very large watershed so it has been known for some time that the primary source of phosphorus is from external sources. However, only recently has the internal sources been measured directly for Julia, Briggs and Rush Lakes. The recently completed report by consultants at Stantec outlines the sources of phosphorus for these lakes:

Lake	Largest P Source	2nd largest P Source
Julia	Carp	Sediment release
Briggs	Sediment release	Carp
Rush	Upstream lakes	Carp

Proposed actions for the Upper Briggs Chain Lakes (Julia, Briggs, Rush) have been outlined based upon the information obtained from both past studies and this most recent report. This document intends to provide a summary of the Stantec report as well as answer common questions pertaining to the proposed lake management actions.

Alum Treatment FAQ

What is alum?

Aluminum sulfate (alum) is a common mineral found on earth and is one of the most widely used substances in water and wastewater treatment facilities. Alum is also sold as a spice in most grocery stores and is a common ingredient in pickles. In recent decades, alum has been used increasingly as lake management tool in the United States and Europe to control internal sediment phosphorus release.

What does an alum treatment do?

Alum binds with phosphorus in the sediment within the deeper areas of a lake, making it unavailable for algae. It works by forming a fluffy aluminum hydroxide solid called a "floc" when applied to water. As the floc settles, it removes phosphorus and particulates (including algae) from the water column. The floc settles on the sediment where it forms a layer that acts as barrier to phosphorus. The phosphorus released from the sediments binds to the alum and is not released into the water.

Is it safe for humans? Aquatic Life? Pets?

Alum is a safe and effective method for lake management and would not cause any harm to humans, aquatic life, or pets. It is a common ingredient in cosmetics, antiperspirants, toothpaste, bath salts and antacids as well as a common lake treatment. Fish caught in the lake would still be safe to eat. In fact, the application of alum often improves fisheries through reducing excessive algae blooms. A state multi-agency review of internal sediment phosphorus mitigation and alum completed in 2020 and can be viewed here: https://www.pca.state.mn.us/sites/default/files/wq-s1-98.pdf.

What implications would this have for those that use the lake?

An alum treatment would cause very few disruptions to normal lake activities. At the time of treatment, which would last a few days, access to the lake may be limited. Notices would be posted at accesses as well as online or other locations. After application, all lake activities could resume as normal.

Would alum reduce in-lake aquatic plants (weeds)?

The treatment would not reduce lake vegetation. By reducing algae blooms, in fact, water should be clearer. The increased clarity could result in aquatic plant growth in deeper areas of the lake where it hadn't grown previously. This would however increase

habitat structure for fish and other aquatic organisms. Continued management of curly-leaf pondweed would be necessary to keep it from spreading to other areas.

What lakes are proposed for an alum treatment, and why?

The Stantec study aimed to identify if an alum treatment would not only be feasible but also the most efficient and effective phosphorus reduction tool. The study recommends Briggs Lake for an alum treatment due to the amount of phosphorus measured coming from bottom lake sediments, the amount in relation to other sources, and the incredible efficiency of this practice. While sediment phosphorus release is present in Julia and Rush Lakes, it occurs to a lesser extent and so an alum treatment would be less cost-effective and achieve a smaller level of water quality restoration.

What is the cost of an alum treatment? Are there grants available?

The Stantec report recommends an alum treatment on Briggs Lake that would be applied to 122 acres. The estimated cost is $953,862, however with some administrative and project management costs added the end cost could reach $1 million. Currently there this project is eligible for grant funds through the state Clean Water Land and Legacy Amendment. This is a competitive grant program that offers a 90% grant with a 10% local match. If awarded a grant, a $1 million project would require a $100,000 local cash match.

What would the benefit to the individual lakes be?

An alum treatment would have primary benefit to Briggs Lake and could reduce as much as 35%-45% of the phosphorus impacting the lake.

- It is estimated that 2,416 lbs of phosphorus, or 50% of the total phosphorus in Briggs Lake, comes from the sediment. It is difficult to estimate precisely how much phosphorus reduction would occur from an alum treatment, but the Stantec report cites anywhere from 50% to 90% effectiveness, or between 1,208 lbs and 2,174 lbs of phosphorus. A 50% reduction is the minimum we could expect and with proper planning and execution a 75% reduction or greater is likely. A treatment with 75% effectiveness results in a nearly 40% reduction in the total phosphorus budget.

Rush Lake would benefit enormously from a Briggs Lake alum treatment and may experience phosphorus reductions by as much as 25% - 35%.

- Rush Lake would benefit greatly from a Briggs Lake alum treatment. Nearly 50% of the Rush Lake phosphorus budget, which is 1,381 lbs of phosphorus, comes from upstream Briggs Lake. If a Briggs Lake alum treatment reaches 75%

effectiveness, it is very likely Rush Lake's phosphorus budget would reduce by 25%-35%.

Big Elk Lake's largest source of phosphorus is the Elk River watershed. However, a Briggs Lake alum treatment would send cleaner water downstream to Elk Lake and potentially reducing that lake's nutrient budget by 2%-4%.

- The Big Elk Lake phosphorus budget is approximately 20,000 lbs due to its large drainage area, the entire Elk River Watershed. A reduction of 1,208 – 2,174 lbs in Briggs Lake is roughly 5% to 10% of Big Elk Lake's annual phosphorus budget, however as it is further downstream we might expect the overall impact to be less, perhaps 2% - 4%. It is important to note that a reduction of 2% - 4% in Big Elk Lake's phosphorus budget is quite substantial and it would be difficult to achieve through alternative projects (higher expense and perhaps decades of work).

A Briggs Lake alum treatment may not benefit Julia Lake directly.

- Julia Lake residents would enjoy cleaner water on Briggs and Rush Lakes as they boat throughout the chain. It is recommended that Julia, Briggs, and Rush Lake residents work together to manage common carp which impacts all three lakes. Reducing carp populations would increase the longevity of the alum treatment.

What is the longevity of an alum treatment?

Longevity is difficult to measure, the Stantec report estimates seven years but discusses the challenges in calculating this estimate. The estimate does not factor many elements including the impact of complimentary activities. The 2nd largest source of phosphorus, carp, has dedicated grant funding and is planned to begin in summer 2025. Investments towards additional phosphorus reduction through shoreline buffers, stormwater management, and work in the larger watershed have been ongoing and will continue. Reducing phosphorus through other sources, particularly carp, is going to have dramatic positive effects on the longevity of an alum treatment.

How does boating impact an alum treatment?

The alum treatment would occur in depths of 20 feet and greater so smaller and medium sized boats would have no impact on sediment in the deep water. It is unclear as to how much, if at all, larger boats have on sediment and on the effectiveness of an alum treatment. This is an area of emerging research so little is known at this point. Alum treatments that have been completed on lakes shallower than Briggs Lake have developed "Reduce your Wake" marketing and outreach documents to inform the public.

How do carp impact an alum treatment?

Carp are not expected to impact the effectiveness of an alum treatment directly. Carp activity is typically limited to the shallow areas of the lake and not in deeper water, so carp are unable to stir up the sediments that have received alum. Carp do however resuspend sediment from the shallow lake bottoms which can settle in deeper areas and also produce algae. Reducing carp numbers is a critical complimentary action and would result in clearer water for all lakes as well as improve the longevity of an alum treatment.

Are there alternatives to an alum treatment?

Alternatives do exist however they are collectively more expensive, would take decades to complete, and are also largely unrealistic. The proposed alum treatment and carp management are the most realistic and cost-effective ways to achieve measurable and noticeable water quality improvements in the Briggs Chain Lakes. Consider the following:

- The Briggs Lake alum treatment cost:benefit ratio is about 500:1, or $500 per pound of phosphorus reduced assuming a cost of $1 million and a reduction of 2,000 lbs. Carp management for Julia, Briggs and Rush Lakes has a cost:benefit ratio of roughly 215:1 ($75,000 and an estimated 350 lbs of phosphorus reduction).

- There are other conservation projects that can reduce phosphorus and are important complimentary efforts. Examining these project types as alternatives to an alum treatment (removal of 2,000 lbs phosphorus) would require:
    a. 800 rain gardens at $8 million for a cost:benefit of 4,000:1.
    b. 1,333 shoreline buffers at $6 million for a cost:benefit of 3,000:1.
    c. 20,000 acres of farm field cover crops at $1.2 million for a cost:benefit of 600:1. Cover crops must be planted annually so is a reoccurring expense.
    d. The estimates above assume steady and substantial funding and willing landowner participants for several decades. <u>It is impossible to reduce several thousand pounds of phosphorus in Briggs Lake and connected lakes through these alternatives.</u>

What should we expect for maintenance after an alum treatment?

Continuing to reduce sources of phosphorus would be important. Continued water quality monitoring and occasional sediment coring would be necessary to monitor the effectiveness. In future years, another treatment would be necessary. With continued phosphorus reductions and proper monitoring it is likely that any future treatments are many years apart and smaller in scale and price.

Summary

If there is a desire to make a strong and positive impact on the water quality of the Briggs Chain Lakes, the least expensive and most effective way is through an alum treatment and carp management. Alum has been widely used in water treatment projects for decades and there is a great amount of documentation as to its safety and effectiveness. Grant funding exists to assist with the cost of this practice. An alum treatment would result in measurable and observable improvements to the water quality in Julia, Briggs and Rush Lakes and potentially a noticeable improvement to Big Elk Lake's water quality. Continued monitoring and maintenance, just like with any construction or other type of project, would be necessary but a long-term plan for this can ease financial burdens.