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Memorandum

To: Jeff Oliver, City of Golden Valley
From: Greg Wilson, Barr Engineering Co.
Subject: Follow-up on Phase 1 of Twin Lake Alum Treatment and Recommendations for Phase 2
Date: June 13, 2018
Project: 23271420.00 PH1
c: Laura Jester, Bassett Creek Watershed Management Commission (BCWMC)

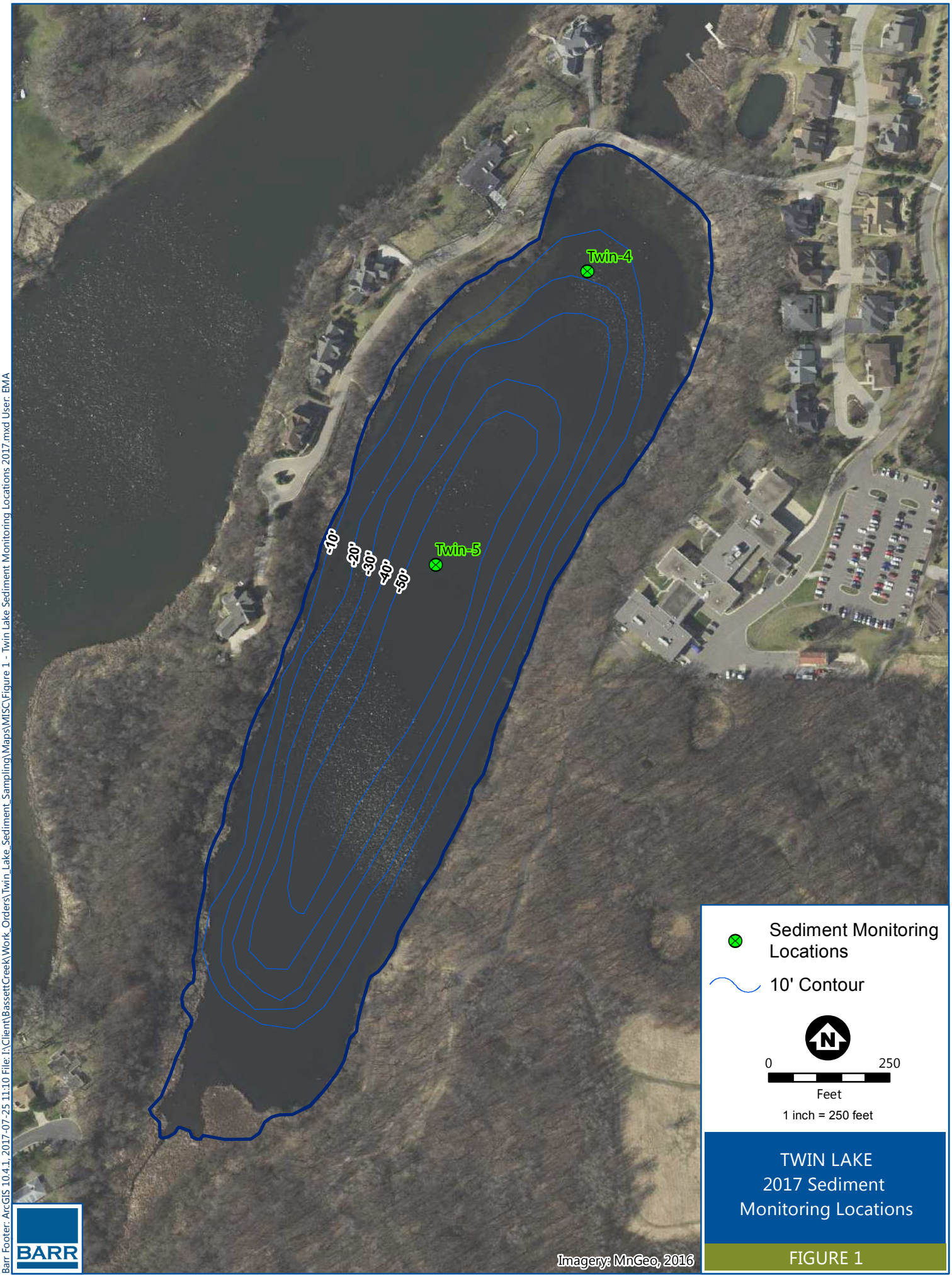
Twin Lake received the first phase of an alum treatment in the spring of 2015 (BCWMC CIP project TW-2). The intent of the first phase was to deliver half of the total dosage of aluminum to immobilize the "releasable" forms of phosphorus in the lake sediments, thereby reducing internal phosphorus loading and protecting the high water quality of the lake. The split dosage serves two purposes: 1) it minimizes the potential impacts on aquatic biota during each phase of treatment, and 2) it improves the overall treatment efficiency and longevity of the alum treatment. More background on the project, and general information about alum treatments, is included in a two-page handout (included as an attachment to this memo).

Approximately $71,000 remains in the BCWMC CIP budget to complete the Twin Lake alum treatment. To further assess the need for the second phase of the alum treatment, Barr collected two new sediment cores from Twin Lake and analyzed the post-treatment lake water quality monitoring data. The locations of the sediment core sampling sites are shown in Figure 1.

Conclusions

Based on our review of the updated monitoring data, the first phase of alum treatment was very successful at controlling internal phosphorus load and we do not feel that it would be beneficial to conduct the second phase of the alum treatment at this time. Our conclusion is based on the following:

1. Figures 2 and 3 show that the alum floc layer (and bound phosphorus) is still very near the surface of the sediment and has not experienced significant sediment accumulation since the first phase of the alum treatment.
2. Figure 4 shows that the bottom water total phosphorus (TP) concentration in 2017 was between 80% and 90% lower than the pretreatment monitoring, when compared to the long-term average TP concentration and the 2014 TP concentration, respectively. This confirms that the first phase of the alum treatment has largely controlled the internal phosphorus load.



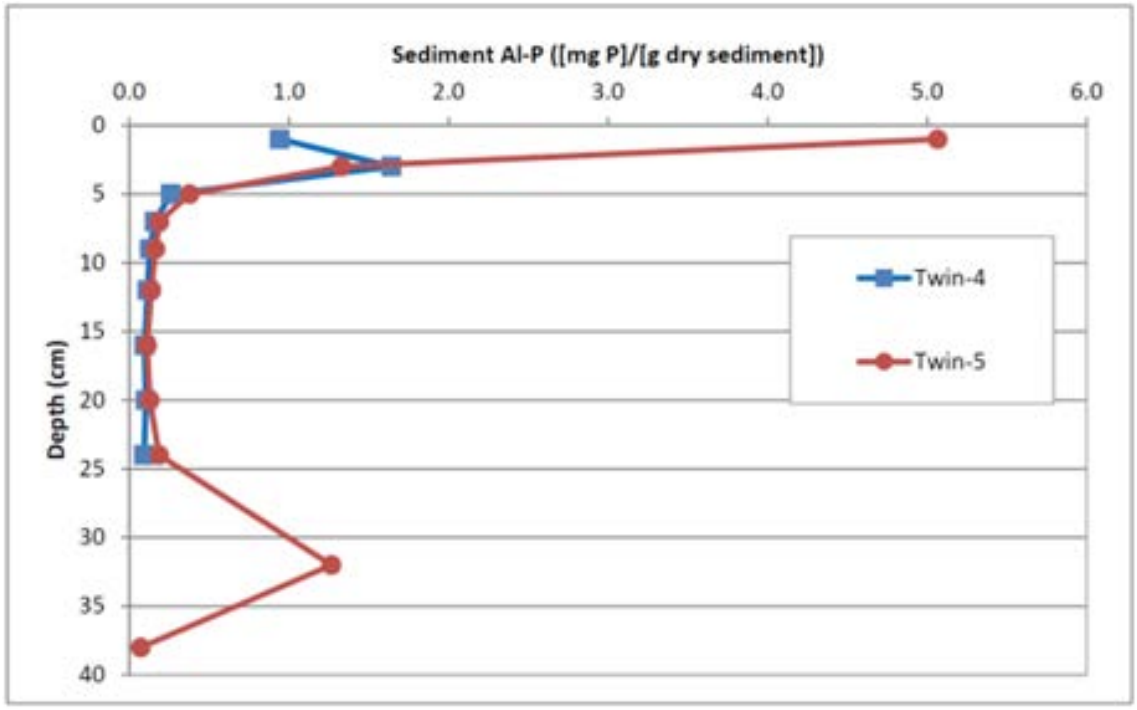


Figure 2 Aluminum-bound phosphorus concentrations throughout the sediment core profile

Figure 3 Photo of sediment core showing alum floc within the top layer

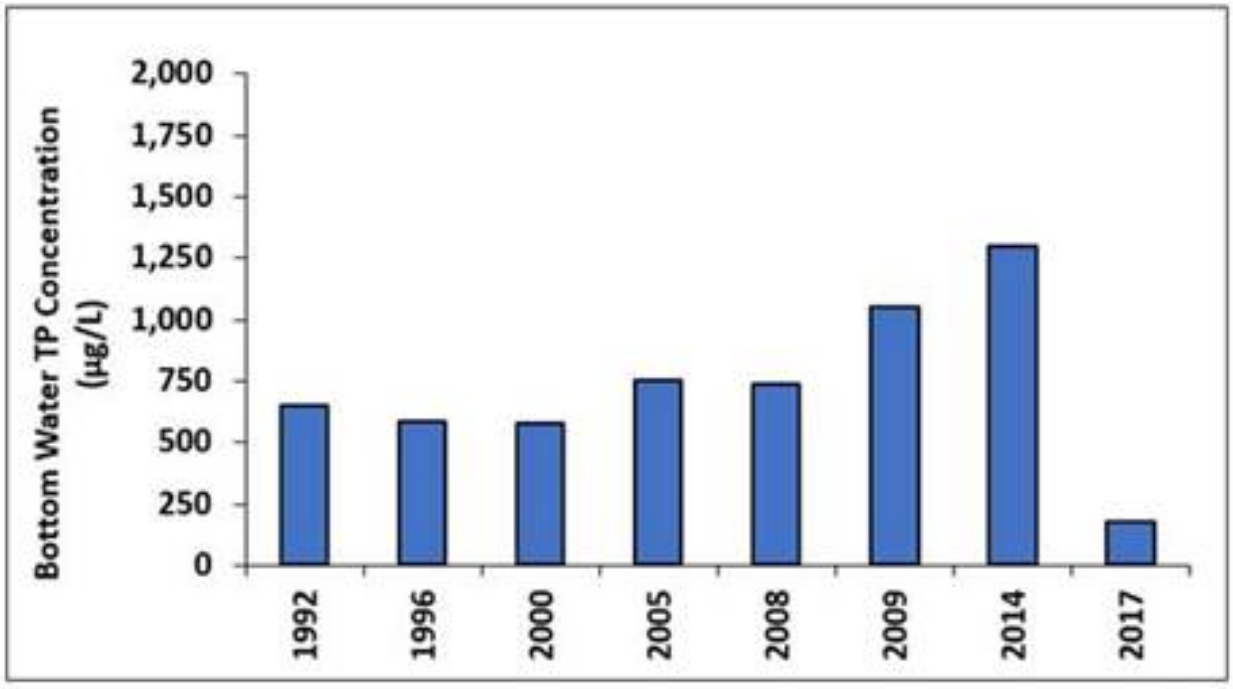


Figure 4 Historical summer average total phosphorus concentrations of Twin Lake bottom water

Recommendations

It is still expected that the second phase of the alum treatment will be needed in the future. It is recommended that the second phase of the alum treatment should be reconsidered after monitoring data (both sediment and lake phosphorus) becomes available, following the 2020 monitoring season. As a result, it is suggested that BCWMC hold CIP budget funds to conduct the second phase of the treatment and associated assessment.

Alum treatment:
Protecting the water quality of Twin Lake

With the goal of improving water quality in Twin Lake, the Bassett Creek Watershed Management Commission and City of Golden Valley plan to treat the lake with aluminum sulfate (alum) in 2015. As a lake-area resident you may have some questions about alum treatment. We hope this information sheet answers those questions. You'll also have an opportunity to learn more at a public meeting scheduled for March 19 (see information box at right).

Alum: frequently asked questions

Why treat the lake with alum?

The alum treatment will provide safe, effective control of algae in Twin Lake for 20–30 years or longer. The result will be cleaner, clearer water for recreation.

What does alum do?

Alum (aluminum sulfate) is derived from aluminum. It has been used in water purification and wastewater treatment for centuries and in lake restoration for decades. The chemical reduces the growth of algae by trapping phosphorus in the lake sediments.

Where does phosphorus come from?

- **From external sources** such as stormwater runoff or groundwater.
- **From internal sources**—phosphorus that has already accumulated in lake-bottom sediments and is periodically re-suspended in the summer.

Project partners have worked to control external sources of phosphorus. But, even when external sources have been reduced, phosphorus that is recycled from the lake's sediments into the overlying waters can support explosive algal growth. This process, frequently referred to as *internal loading*, can be controlled by alum.

How does alum work?

Alum is injected into the lake, several feet below the water's surface. Upon contact with the water it becomes aluminum hydroxide, taking the form of a fluffy substance called *floc*. This floc works to improve water quality in two ways:

1. As it settles to the bottom of the lake, the floc interacts with phosphorus to form aluminum phosphate, an insoluble compound. In this state the phosphorus can no longer be used by algae for food. Other suspended particles are also collected by the floc, leaving the water noticeably clearer.
2. On the bottom of the lake, the floc forms a layer which binds with phosphorus as it is released from the sediment. This produces a "blanket" over the sediment, reducing internal loading.

Public meeting

Alum treatments in Twin Lake

- Date: March 19, 2015
- Time: 6:30–8 p.m.
- Place: Golden Valley City Hall Council Chambers
- Address: 7800 Golden Valley Road

For additional information, please contact Tom Hoffman at 763-593-8044 (thoffman@goldenvalleymn.gov).

How long does it take to complete an alum treatment project?

Alum treatments are generally made either in the late fall or early spring over a period of 7–10 days.

How quickly will results be seen?

Lake transparency will increase dramatically, even within a few hours. Reductions in algae should be noticeable within one year.

How long will the alum treatment last and how can we extend the effectiveness of the treatment?

Since Twin Lake does not receive much phosphorus from *external* sources, the alum treatment is expected to maintain the lake's water quality for 20–30 years, or longer.

We can extend the effectiveness of the treatment by limiting the phosphorus that enters the lake from surface runoff. Leaves, grass clippings, eroded soil, fertilizers, and animal droppings are examples of phosphorus-rich materials carried by surface runoff.

The effectiveness of alum can also be increased by splitting the full alum treatment into multiple applications. Two applications will be used to treat Twin Lake.

Will recreation/aesthetics be affected?

Treatment is planned during times of the year when lake water temperatures would discourage in-lake recreational activities. Swimming, canoeing and boating can continue during treatment; however, direct contact with the alum barge should be avoided.

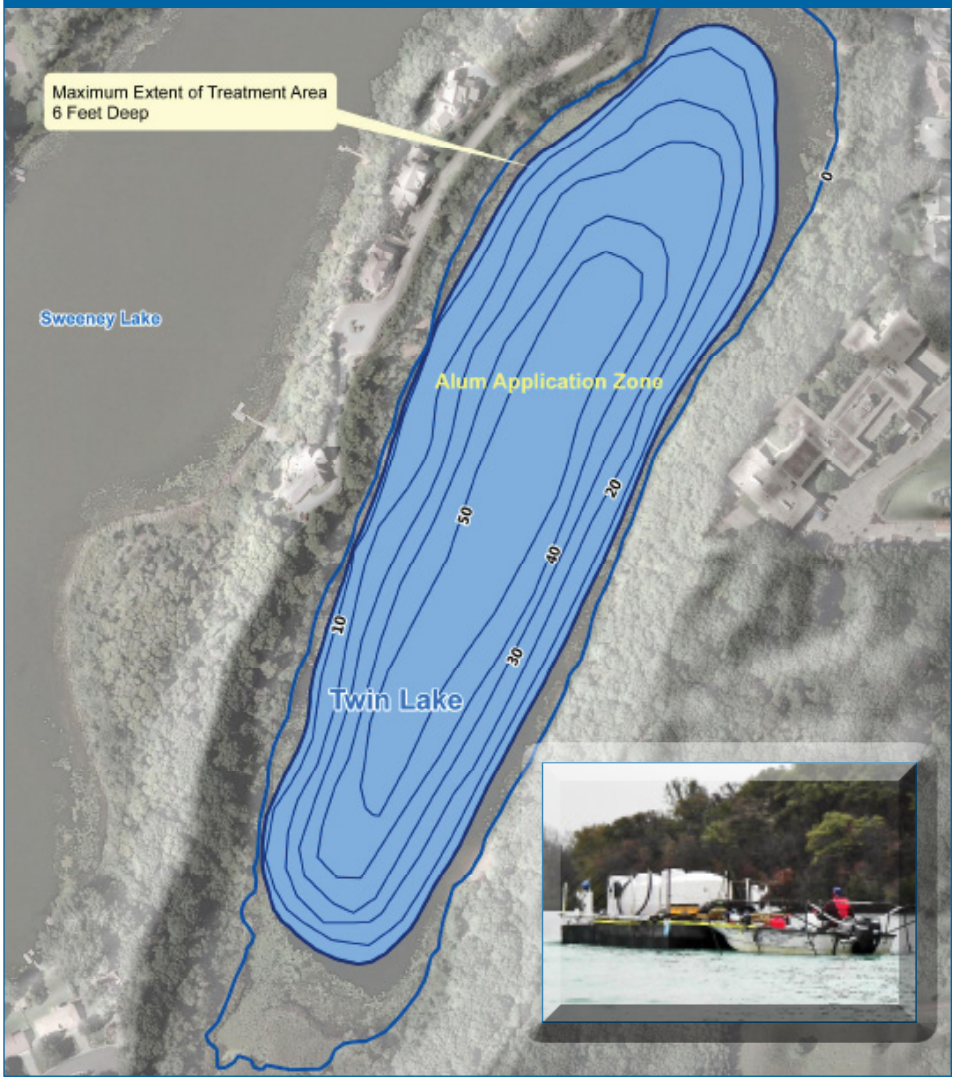
Because application of the alum takes place in relatively deep water (6 or more feet), it is unlikely that the floc would be visible in shallow, recreational areas.

Is alum safe?

Yes. There is no evidence to suggest that aluminum ingested in water poses a health threat. Water treatment plants throughout the United States use hundreds of thousands of tons of alum annually and many municipalities use it for wastewater treatment. The floc is harmless to water creatures and aquatic plants; no adverse effects on spawning habitat have been documented.

The Food and Drug Administration, the U.S. Environmental Protection Agency, and leading medical experts all concur that **aluminum is not a risk factor** for any diseases or health conditions.

Twin Lake alum application zone



Above: The figure shows the extent of the alum treatment area; inset is a photo of an alum treatment barge. Below: Photos of Spring Lake before (left) and after alum treatment (right) by the Prior Lake-Spring Lake Watershed District.