MEMORANDUM
Comfort Lake-Forest Lake Watershed District

To: Board of Managers **Date:** August 21, 2019

From: Mike Kinney

Subject: Shields Lake Alum Treatment Project Ordering and Bid Solicitation

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Background/Discussion

The purpose of this agenda item is for the Board to consider the project ordering and solicitation of bids for the Shields Lake Alum Treatment Project.

Project Funding

The estimated cost for the Alum Treatment is approximately $185,000. Of this amount, at least $108,000 would be supplied by a Clean Water Fund grant. The District is in the process of requesting a grant work plan and budget amendment which may shift additional grant dollars to the alum treatment. The remainder would be supplied by the CLFLWD through an ad valorem tax levy on real property within the watershed, apportioned between Chisago and Washington Counties in accordance with the net tax capacity of each. In the short-term, the match portion of this project will be funded by the District's Clean Water Partnership loan. As authorized by the Board, Administrator Kinney will request loan disbursements on a schedule appropriate to fund project costs. No further board action is needed concerning the loan disbursements.

The budget line item for this project is 5-226-D – Shields Diagnostic Implementation (SW Harvest & Alum Treatment). The CLFLWD 2019 Budget contains $305,200 for this line item, which also covers other associated project costs such as engineering and any remaining upstream stormwater reuse system construction items that may have remained for 2019.

Project Summary

In many ways this project is similar to the Moody Lake Alum Treatment Project, which was ordered by the board of managers at the August 9, 2018 regular meeting. This project will apply aluminum sulfate (commonly known as alum) to Shields Lake in order to bind suspended phosphorus in the water column and trap it in the lake bottom sediment. Once bound to the alum, the phosphorus will no longer be biologically available for algae, thus improving water clarity. This project is a major component of a systematic, multi-year diagnostic and implementation planning process that the District began in 2015. The approach aims to reduce external pollutant loads first and then in-lake internal loads.

External loading has largely been addressed through the recent implementation of the upstream stormwater harvest and irrigation reuse system project. Other methods for controlling internal loading have either been ongoing in recent years or are underway. These include the retrofit of the tributary stream fish barrier, a proposed fall 2019 carp harvest, ongoing coordination with the City of Forest Lake to operate its winter aeration system, and ongoing springtime curly-leaf pondweed management.

The combination of the alum treatment with these other projects is expected to fully achieve Shields Lake's long-term water quality goal of an in-lake phosphorus concentration of 60 micrograms per liter. This will bring Shields Lake to a clear water state and reduce phosphorus loading to downstream Forest Lake by an estimated 250 pounds per year.

Major project accomplishments to date include: execution of the Clean Water Fund grant agreement, coordination with the City of Forest Lake regarding staging and access, completion of alum dosing plans, project permitting, distribution of informational mailers, a newspaper press release, a neighborhood meeting on the project on May 15, 2018, presentation of alum information at the August 28, 2018 open house, and now the planning for another open house at the District office in September 2019.

The mailers and press release contained several updates on the multiple ongoing projects for Shields Lake. The August 28, 2018 open house was held at the District office and included a presentation on the Shields Lake Stormwater Harvest, Irrigation Reuse System and Alum Treatment project as a whole. The September 2019 open house will focus more specifically on the alum treatment.

Recommended Motion

Proposed Motion: Manager _____ moves to adopt resolution 19-09-01. Seconded by Manager _____. [Roll call vote]

Attached:

1. Resolution 19-09-01 – Project Ordering & Solicitation of Bids
2. Project Basis & Funding Memo

RESOLUTION 19-09-01

COMFORT LAKE-FOREST LAKE WATERSHED DISTRICT
BOARD of MANAGERS

RESOLUTION ORDERING and DIRECTING SOLICITATION OF BIDS for the SHIELDS LAKE WETLAND ALUM TREATMENT PROJECT

Manager _____ offered the following resolution and moved its adoption, seconded by Manager _____:

WHEREAS the District has adopted a watershed management plan (WMP) in accordance with Minnesota Statutes §103B.231, which, in project 5-226-D, identifies, among other projects, an alum treatment to reduce the internal load of phosphorus to Shields Lake (hereafter the "Project");

WHEREAS in accordance with the WMP, the District will address the rough fish population through harvesting in fall 2019 and ongoing winter aeration, and will have addressed watershed loads through implementation of the Shields Lake Stormwater Harvest and Irrigation Reuse Project prior to the alum treatment;

WHEREAS the District has calculated appropriate alum dosing levels using information from the District's deep sediment core study and other available data and resources;

WHEREAS the District applied for and has been awarded a Clean Water Fund grant in the amount of $824,000, for the Project, including the Stormwater Harvest and Irrigation Reuse Project;

WHEREAS Project staging would be located on land riparian to Shields Lake owned by the City of Forest Lake, and the District and City are in the process of executing an access and staging agreement;

WHEREAS the District distributed informational mailers to nearby residents, submitted a press release to its official newspapers, presented on the Project at an open house event on August 28, 2018, and will hold an additional open house in September 2019;

WHEREAS after publication once each week for two successive weeks in the District's legal newspaper, and with mailed notice to cities and townships within the District, as well as Chisago and Washington Counties, the Board of Managers held a duly noticed public hearing on September 5, 2019, at the Comfort Lake-Forest Lake Watershed District offices, at which time all interested parties had the opportunity to speak for and against the Project;

WHEREAS the District engineer has presented the results of its feasibility assessment, its cost estimate and project plans to the Board, and finds that the Project is feasible, and the Board concurs that the Project is feasible and finds that it is a cost-effective element of meeting the District's water quality goals set forth in the WMP; and

WHEREAS the Board has considered the engineer's findings and the comments of interested parties and finds that the Project is feasible and cost-effective, will be conducive to public health

and promote the general welfare, and is in conformance with Minnesota Statutes §§103B.205 to 103B.255 and the WMP;

THEREFORE BE IT RESOLVED that the Project is ordered;

BE IT FURTHER RESOLVED that the District engineer's plans are approved and the District administrator shall solicit sealed bids for performance of the Project, which bids shall be presented to the Board for consideration of contract award; and

The question was on the adoption of the above resolution and there were ____ ayes and _____ nays as follows:

	AYE	**NAY**	**ABSENT**
Jon W. Spence			
Jackie A. Anderson			
Wayne S. Moe			
Stephen Schmaltz			
Jen Oknich			

The President declared the resolution adopted.

Dated: September 5, 2019

_____
Jen Oknich, Secretary

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I, Jen Oknich, Secretary of the Comfort Lake-Forest Lake Watershed District Board of Managers, do hereby certify that the above resolution is a true and correct transcription of an action of the Board taken on the date above indicated.

IN TESTIMONY WHEREOF, I hereunto set my hand this 5th day of September 2019.

_____
Jen Oknich, Secretary

technical memo - forest lmd

Project Name |	Shields Lake Alum Treatment	**Date** |	August 29, 2019
To / Contact info |	CLFLWD Board of Managers		
Cc / Contact info |	Mike Kinney, District Administrator		
From / Contact info |	Meghan Funke, PE, PhD		
Regarding |	Project Basis and Funding		

Background

Forest Lake (82-0159-00) is one of the top recreational lakes in the metro area with a diverse and healthy fishery along with three public accesses; protection of Forest Lake water quality is a high priority for the District. Monitoring of Forest Lake tributaries as part of the Forest Lake CWP Diagnostic Study Update in 2016 identified Shields Lake (82-0162-00), which is impaired for excess nutrients, as the single largest contributor of flows and phosphorus loads to the central basin of Forest Lake. In 2017, the District received a Clean Water Fund to impound water from a tributary to Shields Lake for golf course irrigation reuse, reducing watershed phosphorus loads to Shields Lake by 77 lb/yr, and to complete a whole-lake alum treatment in Shields Lake to reduce internal sediment phosphorus loading to natural background levels. The irrigation reuse system and Shields lake alum treatment, coupled with District permitting of development in the watershed, are expected to achieve the phosphorus reductions needed for Shields Lake to meet its 5-year growing season phosphorus goal of 60 µg/L (or 1,023 lb/yr), and reduce phosphorus loads to Forest Lake by up to 250 lb/yr.

Project Feasibility

Shields Lake is 30 acres with a maximum depth of 27 feet and discharges to the middle basin of Forest Lake. In 2015, the District conducted a feasibility study to monitor flow and phosphorus at 5 sites on 4 tributaries to Shields Lake. The Ditch West tributary site drains 294 acres of agricultural lands (or 35% of the Shields Lake watershed area) and contributes 61 percent (234 lb/yr) of the total monitored phosphorus load to Shields Lake with a flow-weighted mean phosphorus concentration of 450 µg/L – well above the ecoregion background target of 100 µg/L. The feasibility study identified implementation of a stormwater harvest and irrigation reuse project for treatment of the agricultural runoff to achieve the watershed phosphorus load reductions needed for Shields Lake to meet water quality standards, followed by a whole lake alum treatment of Shields Lake sediments to achieve the internal phosphorus load reductions needed for Shields Lake to meet water quality standards.

Other in-lake management activities that were considered but determined to be ineffective included rotenone fish kill, whole lake aeration, and whole lake drawdown. A rotenone fish kill was previously completed in 1994 and the fishery was fairly healthy, despite poor water quality, in the most recent DNR fish survey in July 2018. According to the survey: Bluegills were the most abundant species in the lake and were sampled at high levels, Black Crappies were less abundant but were found in average abundance, Northern Pike were found in above average numbers and above average size, and one 11.5 inch Largemouth Bass was observed during the survey. Other species sampled in low abundance included, Black Bullhead, Brown Bullhead, Pumpkinseed Sunfish and Common Carp. Aeration requires extensive maintenance and is locally effective. Note that a winter aeration system

has been in place in Shields Lake since 1995 and is used to prevent winter fish kills. The dissolved oxygen refuge area provided by the current aeration system is small and located near the City fishing pier. District staff are working with DNR to upgrade this system. A whole lake drawdown is not feasible due to the lack of lake elevation difference between Shields and Forest Lake.

For in-lake management of internal loading in Shields Lake, alum was determined to be the most cost-effective treatment. An alum treatment was previously applied in 1994. Based on discussions with local landowners, the treatment was effective but only for a short period of time. In 1994, watershed loads were not fully addressed and alum treatments at this time were frequently underdosed, likely resulting in a shortened effectiveness of the initial alum treatment. The proposed alum treatment will occur following a significant reduction in the watershed loading and will be based on more advanced dosing methods, which will increase its effectiveness.

The stormwater harvest and irrigation reuse system installation was completed in summer of 2019 and will be on-line for the 2020 growing season. Also in 2019, the District replaced the Shields Lake fish barrier at the outlet of Shields Lake, completed a highly successful curly-leaf pondweed treatment, and has hired a contractor to harvest adult carp from Shields Lake before the end of September. The Shields Lake alum treatment is the final step of implementation and is expected to achieve the internal load reductions needed for Moody Lake to attain the growing season phosphorus goal of 60 μg/L.

Six sediment cores were collected by EOR in October 2018 to measure phosphorus fractions in 2 cm increments from the top 10 cm of sediment in Shields Lake. Three cores were collected from depths greater than 25 feet and 3 cores were collected from depths between 20 and 25 feet. The sediment samples were shipped to Bill James at the University of Wisconsin-Stout for measurement of phosphorus fraction concentrations. The sediment phosphorus fraction data were then analyzed by EOR to determine an appropriate alum dose and treatment area. A dose of approximately 2,000 gallons of liquid aluminum sulfate per acre is needed at all depths greater than 5 feet, or 14.4 acres, to mitigate excess internal sediment phosphorus load in Shields Lake (Figure 1). Due to the high amount of alum that needs to be applied per acre, the treatment will be split over two doses, one year apart (fall 2019 and fall 2020). Low alkalinity levels in Shields Lake also indicate that a buffer agent will need to be applied concurrently with the liquid alum to prevent pH levels from dropping to unsafe levels for fish and other aquatic life (less than pH of 6.0).

Access and staging for the alum treatment will be via the City of Forest Lake park on the east side of Shields Lake. The District spoke with the City of Forest Lake Parks department staff in June 2019 regarding using the park for access and staging of the carp removal and alum treatment. The District recently notified MPCA of the anticipated treatment date in early October 2020, the alum dose, and watershed reduction assurances. To meet the requirements for alum application by MPCA, the District will monitor pH during application to insure that the lake pH does not drop below 6.0, and notify local DNR staff and citizens in advance of the planned treatment to avoid confusion during the application. The District will also maintain the fish barrier, winter aeration system, and annual treatment of curly-leaf pondweed in Shields Lake over the lifespan of the alum treatment.

Project Costs & Funding

The Engineer's estimate for the total cost of the alum treatment is $208,000 with an assumed lifespan of 10 years. Of this total, $185,000 is for Contractor services, including treatment chemicals and mobilization/demobilization; $20,000 for engineering services, including alum dosing, bidding, and application oversight; and $3,000 for project administration by District staff. Implementation of the Shields Lake Alum Treatment will improve water quality in Shields Lake and downstream Forest Lake. The project is expected to reduce internal phosphorus loading to Shields Lake by approximately 913 pounds per year. This equates to roughly $22 per pound of phosphorus reduction to Shields Lake over the project lifespan.

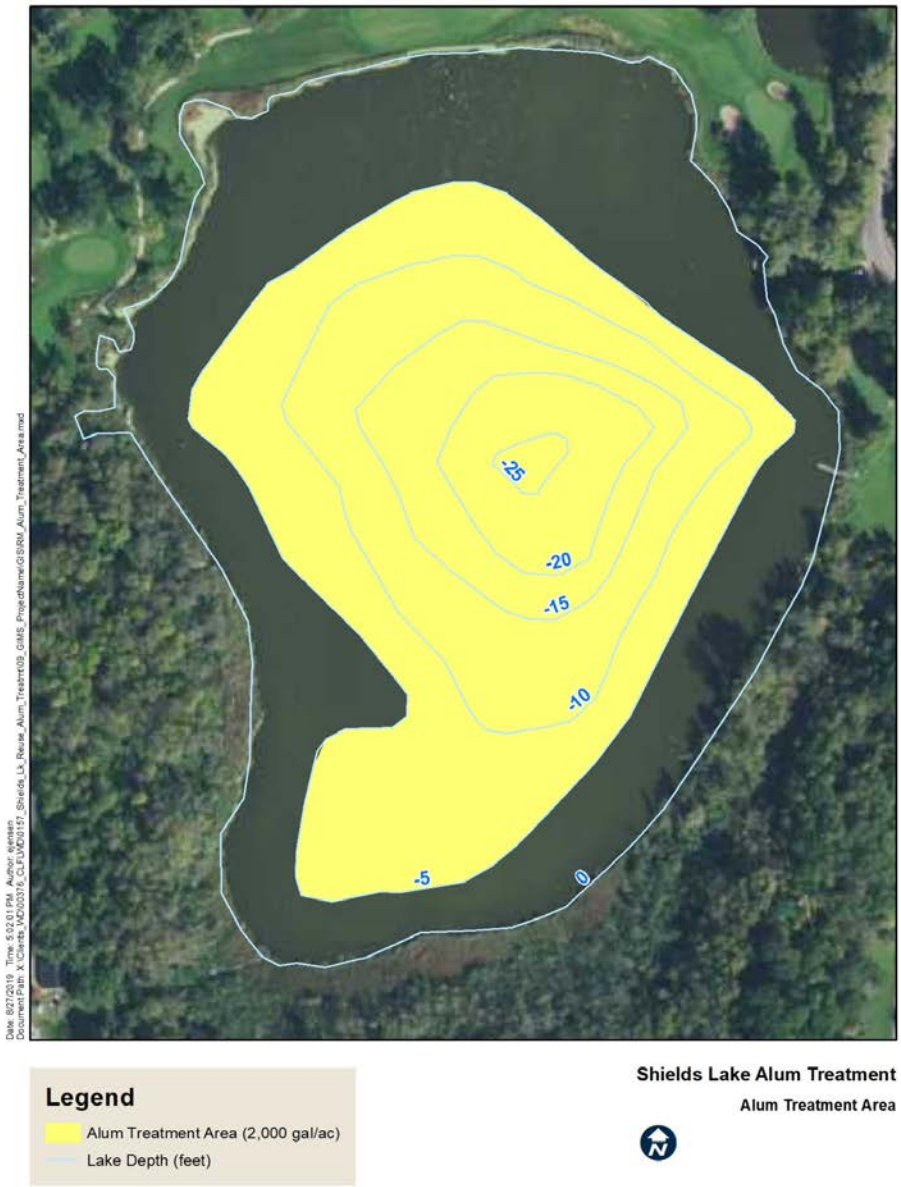

Figure 1. Shields Lake Alum Treatment Area