MINNEHAHA CREEK
WATERSHED DISTRICT
QUALITY OF WATER, QUALITY OF LIFE

Meeting: Board of Managers
Meeting date: 3/12/2020
Agenda Item #: 7.2
Board Consent Item

Title:	Authorization to Execute a Grant Agreement for the Wassermann Internal Load Management Project
Resolution number:	20-020
Prepared by:	Name: Anna Brown Phone: 952-641-4522 abrown@minnehahacreek.org
Reviewed by:	Name/Title: Michael Hayman, Project Planning Manager
Recommended action:	Approval of resolution 20-020, authorizing the execution of a grant agreement through BWSR Competitive Grant Program for alum treatment on Wassermann Lake
Schedule:	April/May 2021: First alum treatment Sept/Oct 2022: Second alum treatment
Budget considerations:	Fund name and code: N/A – project to be ordered in 2020 Fund budget: $355,900 (proposed) ($284,720 grant and $71,180 match) Expenditures to date: None Requested amount of funding: Match dollars budgeted through 2021 budget process
Past Board action:	Res #: 19-072 Authorization to apply for BWSR Clean Water Funds Competitive Grant Funding for Wassermann Lake Internal Load Management Project

Summary:
In May 2014, the MCWD Board of Managers formally adopted the Six Mile Creek-Halsted Bay (SMCHB) subwatershed as a geography of strategic planning and implementation focus. In March 2015, the City of Victoria and MCWD executed a memorandum of understanding (MOU) which identifies the mutual value both agencies find in cooperative planning, coordination across agencies on priority water resource issues, and increasing regulatory coordination to support and foster integrated water and natural resources management. One of the priority water resource management areas identified for increased collaboration is Lake Wassermann, an impaired waterbody within the City of Victoria.

From May 2016 through the adoption of MCWD's 2017 Water Management Plan, the District convened staff and policy makers from the geography as the SMCHB Planning Partnership to engage in the proactive development of a subwatershed and implementation plan which integrates identified water resource issues and natural resource areas with local planning and development projects and goals. The SMCHB Subwatershed Plan proposes a fourfold strategy for addressing water resource issues and protecting high-value natural resources through:

- Common carp management
- Shallow lake restoration
- Wetland restoration and protection
- Stormwater management

Since adoption of the 2017 Water Management Plan, MCWD has been systematically applying these strategies, with particular focus in the City of Victoria and Laketown Township, where current land use pressure presents a unique opportunity to implement high impact capital projects concurrent with development. Under this plan, MCWD has invested substantially in the restoration of Wassermann Lake through both watershed and in-lake management activities.

In 2016, MCWD partnered with Lennar Corporation to restore vegetative diversity and predevelopment hydrology in a 22 acre wetland along the upstream segment of Six Mile Creek, improving habitat and nutrient cycling. Since 2018, MCWD has been working on a subwatershed wide carp management program that has effectively reduced the carp population in Wassermann, improving aquatic plant communities and slowing sediment and nutrient resuspension in the water column. In spring 2019, MCWD applied alum in the six acre pond on the Wassermann West property, resulting in a 75 pound per year decrease in phosphorus loading to Wassermann Lake. Finally, MCWD and the City are constructing a 33.5 acre park and habitat restoration project on the west shore of Lake Wassermann which offers an opportunity to showcase the improvements to Wassermann Lake and the SMCHB Subwatershed while creating a unique recreational asset for Victoria residents.

Internal loading is the last remaining significant source of nutrient pollution in Lake Wassermann. The 2013 SMCHB Diagnostic Study estimates an annual internal release rate of 375 pounds per year, the largest nutrient source identified**.** Alum treatment is projected to reduce internal loading by an estimated 90%, for a reduction of 336 pounds per year.

With approval of the grant agreement through the Board of Water a Soil Resources Clean Water Funds Competitive Grant Program, staff will prepare for an initial alum treatment in spring 2020 and a subsequent treatment in 2021. The total budget for this project is $355,900, including $284,720 in grant funds and $71,180 in match. MCWD's match funds will be allocated to feasibility, pre- and post-project sediment analysis, and some of the cost of treatment. The grant dollars will be allocated exclusively to alum treatment.

Supporting documents:

- FY2020 Clean Water Fund Competitive Grants Program Grant Agreement
- Wassermann Internal Load Management Feasibility Study

MINNEHAHA CREEK
WATERSHED DISTRICT
QUALITY OF WATER, QUALITY OF LIFE

RESOLUTION

Resolution number: 20-020

Title: Authorization to Execute a Grant Agreement for Wassermann Internal Load Management Project

WHEREAS, pursuant to Resolution 14-047 the MCWD Board of Managers (Board) has identified the Six Mile Creek-Halsted Bay subwatershed as a priority area for focusing District planning activities and coordination efforts with subwatershed partners;

WHEREAS, March 26, 2015 the Board approved a memorandum of understanding with the City of Victoria outlining opportunities to collaborate and integrate mutual efforts in the realms of coordinated planning of local water and land use plans, assessment of specific water management issues, and coordinated regulatory review of water and land development, and specifically identified a shared interest between the two parties in addressing the impairment of Wassermann Lake;

WHEREAS, the MCWD Watershed Management Plan identifies the Wassermann Lake Internal Load Management Project as a planned capital investment to reduce internal nutrient loading, improve water clarity, and create a more abundant and diverse aquatic vegetation community;

WHEREAS, on August 22, 2019, the Board authorized staff to apply for grant funds the Board of Water and Soil Resources Clean Water Funds Program for the Wassermann Lake Internal Load Management Project;

WHEREAS, In January 2020, MCWD was awarded $284,720 for the Wassermann Internal Load Management Project;

WHEREAS, the grant requires a 25 percent match in the amount of $71,180 which will be included as both work-in-kind and budgeted expenditures in 2021;

WHEREAS, prior to expending grant funds, the project will be ordered pursuant to Minnesota Statutes § 103B.251.

NOW, THEREFORE, BE IT RESOLVED that the Minnehaha Creek Watershed District Board of Managers authorizes the District Administrator to execute a grant agreement with the Board of Water and Soil Resources for the Wassermann internal Load Management project.

Resolution Number 20-020 was moved by Manager _____, seconded by Manager _____. Motion to adopt the resolution ___ ayes, ___ nays, ___abstentions. Date: 3/12/2020

_____ Date: _____
Secretary

BOARD OF WATER AND SOIL RESOURCES

FY 2020 STATE OF MINNESOTA
BOARD OF WATER and SOIL RESOURCES
CLEAN WATER FUND COMPETITIVE GRANTS PROGRAM
GRANT AGREEMENT

Vendor:	0000225729	**VN#:**	
PO#:	3000011694	**Date Paid:**	

This Grant Agreement is between the State of Minnesota, acting through its Board of Water and Soil Resources (Board) and **Minnehaha Creek WD, 8625 Endicott Trail Eden Prairie Minnesota 55347** (Grantee).

This grant is for the following Grant Programs :		
C20-7180	Lake Wassermann Internal Load Management	$284,720

Total Grant Awarded: **$284,720**

Recitals

1. The Laws of Minnesota 2019, 1st Special Session, Chapter 2, Article 2, Section 7(b)&(j), appropriated Clean Water Funds (CWF) to the Board for the FY 2020 Clean Water Fund Projects & Practices Grants.
2. The Board adopted the FY20 Clean Water Fund Competitive Grant Policy and authorized the FY20 Clean Water Fund Program through Board Order #19-32.
3. The Board adopted Board Order #20-05 to allocate funds for the FY 2020 Clean Water Fund Competitive Grants Program.
4. The Grantee has submitted a BWSR approved work plan for this Program, which is incorporated into this Grant Agreement by reference.
5. The Grantee represents that it is duly qualified and agrees to perform all services described in this Grant Agreement to the satisfaction of the State.
6. As a condition of the grant, Grantee agrees to minimize administration costs.

Authorized Representative

The State's Authorized Representative is Marcey Westrick, Clean Water Coordinator, BWSR, 520 Lafayette Road North, Saint Paul, MN 55155, 651-284-4153, or her successor, and has the responsibility to monitor the Grantee's performance and the authority to accept the services and performance provided under this Grant Agreement.

The Grantee's Authorized Representative is:

TITLE
ADDRESS
CITY
TELEPHONE NUMBER

If the Grantee's Authorized Representative changes at any time during this Grant Agreement, the Grantees must immediately notify the Board.

Grant Agreement

1. **Terms of the Grant Agreement.**
   1.1. ***Effective date:*** The date the Board obtains all required signatures under Minn. Stat. § 16B.98, Subd. 5. **The State will notify the Grantee when this Grant Agreement has been executed. The Grantee must not begin work under this Grant Agreement until it is executed.**
   1.2. ***Expiration date: December 31, 2022***, or until all obligations have been satisfactorily fulfilled, whichever comes first.
   1.3. ***Survival of Terms:*** The following clauses survive the expiration date or cancellation of this Grant Agreement: 7. Liability; 8. State Audits; 9. Government Data Practices; 11. Publicity and Endorsement; 12. Governing Law, Jurisdiction, and Venue; 14. Data Disclosure; and 19. Intellectual Property Rights.

2. **Grantee's Duties.**
   2.1. The Grantee will comply with required grants management policies and procedures set forth through Minn. Stat § 16B.97, Subd.4(a)(1). The Grantee is responsible for the specific duties for the Program as follows:
   2.2. ***Implementation:*** The Grantee will implement their work plan, which is incorporated into this Grant Agreement by reference.
   2.3. ***Reporting:*** All data and information provided in a Grantee's report shall be considered public.
      2.3.1. The Grantee will submit an annual progress report to the Board by February 1 of each year on the status of Program implementation by the Grantee. Information provided must conform to the requirements and formats set by the Board. All individual grants over $500,000 will also require a reporting expenditure by June 30 of each year.
      2.3.2. The Grantee will prominently display on its website the Clean Water Legacy Logo and a link to the Legislative Coordinating Commission website.
      2.3.3. Final Progress Report: The Grantee will submit a final progress report to the Board by February 1, 2023 or within 30 days of completion of the project, whichever occurs sooner. Information provided must conform to the requirements and formats set by the Board.
   2.4. ***Match:*** The Grantee will ensure any local match requirement will be provided as stated in Grantee's approved work plan.

3. **Time.**
   The Grantee must comply with all the time requirements described in this Grant Agreement. In the performance of this Grant Agreement, time is of the essence.

4. **Terms of Payment.**
   4.1. Grant funds will be distributed in three installments: 1) The first payment of 50% will be distributed after the execution of the Grant Agreement. 2) The second payment of 40% will be distributed after the first payment of 50% has been expended and reporting requirements have been met. An eLINK Interim Financial Report that summarizes expenditures of the first 50% must be signed by the Grantee and approved by BWSR. Selected grantees may be required at this point to submit documentation of the expenditures reported on the Interim Financial Report for verification. 3) The third payment of 10% will be distributed after the grant has been fully expended and reporting requirements are met. The final, 10% payment must be requested within 30 days of the expiration date of the Grant Agreement. An eLINK Final Financial Report that summarizes final expenditures for the grant must be signed by the Grantee and approved by BWSR.
   4.2. All costs must be incurred within the grant period.
   4.3. All incurred costs must be paid before the amount of unspent funds is determined. Unspent grant funds must be returned within 30 days of the expiration date of the Grant Agreement.
   4.4. The obligation of the State under this Grant Agreement will not exceed the amount listed above.
   4.5. This grant includes an advance payment of 50% of the grant's total amount. Advance payments allow the Grantee to have adequate operating capital for start-up costs, ensure their financial commitment to landowners and contractors, and to better schedule work into the future.

5. **Conditions of Payment.**
   5.1. All services provided by the Grantee under this Grant Agreement must be performed to the State's satisfaction, as set forth in this Grant Agreement and in the BWSR approved work plan for this Program. Compliance will be determined at the sole discretion of the State's Authorized Representative and in accordance with all applicable federal, State, and local laws, policies, ordinances, rules, FY20 Clean Water Fund Competitive Grant Program Policy, and regulations. The Grantee will not receive payment for work found by the State to be unsatisfactory or performed in violation of federal, State or local law.
   5.2. Minnesota Statutes §103C.401 (2018) establishes BWSR's obligation to assure program compliance. If the noncompliance is severe, or if work under the grant agreement is found by BWSR to be unsatisfactory or performed in violation of federal, State, or local law, BWSR has the authority to require the repayment of grant funds or withhold payment on grants from other programs.

6. **Assignment, Amendments, and Waiver**
   6.1. ***Assignment.*** The Grantee may neither assign nor transfer any rights or obligations under this Grant Agreement without the prior consent of the State and a fully executed Assignment Agreement, executed and approved by the same parties who executed and approved this Grant Agreement, or their successors in office.
   6.2. ***Amendments.*** Any amendments to this Grant Agreement must be in writing and will not be effective until it has been approved and executed by the same parties who approved and executed the original Grant Agreement, or their successors in office. Amendments must be executed prior to the expiration of the original Grant Agreement or any amendments thereto.

6.3. ***Waiver.*** If the State fails to enforce any provision of this Grant Agreement, that failure does not waive the provision or its right to enforce it.

7. **Liability.**
The Grantee must indemnify, save, and hold the State, its agents, and employees harmless from any claims or causes of action, including attorney's fees incurred by the State, arising from the performance of this Grant Agreement by the Grantee or the Grantee's agents or employees. This clause will not be construed to bar any legal remedies the Grantee may have for the State's failure to fulfill its obligations under this Grant Agreement.

8. **State Audits.**
Under Minn. Stat. § 16B.98, Subd. 8, the Grantee's books, records, documents, and accounting procedures and practices of the Grantee or other party relevant to this Grant Agreement or transaction are subject to examination by the Board and/or the State Auditor or Legislative Auditor, as appropriate, for a minimum of six years from the end of this Grant Agreement, receipt and approval of all final reports, or the required period of time to satisfy all State and program retention requirements, whichever is later.
8.1. The books, records, documents, accounting procedures and practices of the Grantee and its designated local units of government and contractors relevant to this grant, may be examined at any time by the Board or Board's designee and are subject to verification. The Grantee or delegated local unit of government will maintain records relating to the receipt and expenditure of grant funds.

9. **Government Data Practices.**
The Grantee and State must comply with the Minnesota Government Data Practices Act, Minn. Stat. Ch. 13, as it applies to all data provided by the State under this Grant Agreement, and as it applies to all data created, collected, received, stored, used, maintained, or disseminated by the Grantee under this Grant Agreement. The civil remedies of Minn. Stat. § 13.08 apply to the release of the data referred to in this clause by either the Grantee or the State.

10. **Workers' Compensation.**
The Grantee certifies that it is in compliance with Minn. Stat. § 176.181, Subd. 2, pertaining to workers' compensation insurance coverage. The Grantee's employees and agents will not be considered State employees. Any claims that may arise under the Minnesota Workers' Compensation Act on behalf of these employees and any claims made by any third party as a consequence of any act or omission on the part of these employees are in no way the State's obligation or responsibility.

11. **Publicity and Endorsement.**
11.1. ***Publicity.*** Any publicity regarding the subject matter of this Grant Agreement must identify the Board as the sponsoring agency. For purposes of this provision, publicity includes notices, informational pamphlets, press releases, research, reports, signs, and similar public notices prepared by or for the Grantee individually or jointly with others, or any subcontractors, with respect to the program, publications, or services provided resulting from this Grant Agreement.
11.2. ***Endorsement.*** The Grantee must not claim that the State endorses its products or services

12. **Governing Law, Jurisdiction, and Venue.**
Minnesota law, without regard to its choice-of-law provisions, governs this Grant Agreement. Venue for all legal proceedings out of this Grant Agreement, or its breach, must be in the appropriate State or federal court with competent jurisdiction in Ramsey County, Minnesota.

13. **Termination.**
13.1. The State may cancel this Grant Agreement at any time, with or without cause, upon 30 days' written notice to the Grantee. Upon termination, the Grantee will be entitled to payment, determined on a pro rata basis, for services satisfactorily performed.
13.2. In the event of a lawsuit, an appropriation from a Clean Water Fund is canceled to the extent that a court determines that the appropriation unconstitutionally substitutes for a traditional source of funding.
13.3. The State may immediately terminate this grant contract if the State finds that there has been a failure to comply with the provisions of this grant contract, that reasonable progress has not been made or that the purposes for which the funds were granted have not been or will not be fulfilled. The State may take action to protect the interests of the State of Minnesota, including the refusal to disburse additional funds and requiring the return of all or part of the funds already disbursed.

14. **Data Disclosure.**
Under Minn. Stat. § 270C.65, Subd. 3, and other applicable law, the Grantee consents to disclosure of its social security number, federal employer tax identification number, and/or Minnesota tax identification number, already provided to the State, to federal and State tax agencies and State personnel involved in the payment of State obligations. These identification numbers may be used in the enforcement of federal and State tax laws which could result in action requiring the Grantee to file State tax returns and pay delinquent State tax liabilities, if any.

15. **Prevailing Wage.**
It is the responsibility of the Grantee or contractor to pay prevailing wage for projects that include construction work of $25,000 or more, prevailing wage rules apply per Minn. Stat. §§ 177.41 through 177.44. All laborers and mechanics employed by grant recipients and subcontractors funded in whole or in part with these State funds shall be paid wages at a rate not less than those prevailing on projects of a character similar in the locality. Bid requests must state the project is subject to prevailing wage.

16. **Municipal Contracting Law.**
Per Minn. Stat. § 471.345, grantees that are municipalities as defined in Subd. 1 of this statute must follow the Uniform Municipal Contracting Law. Supporting documentation of the bidding process utilized to contract services must be included in the Grantee's financial records, including support documentation justifying a single/sole source bid, if applicable.

17. **Constitutional Compliance.**
It is the responsibility of the Grantee to comply with requirements of the Minnesota Constitution regarding the use of Clean Water Funds to supplement traditional sources of funding.

18. **Signage.**
It is the responsibility of the Grantee to comply with requirements for project signage as provided in Minnesota Laws 2010, Chapter 361, Article 3, Section 5(b) for Clean Water Fund projects.

19. **Intellectual Property Rights.**
The State owns all rights, title, and interest in all of the intellectual property rights, including copyrights, patents, trade secrets, trademarks, and service marks in the Works and Documents *created and paid for under this grant.* Works means all inventions, improvements, discoveries, (whether or not patentable), databases, computer programs, reports, notes, studies, photographs, negatives, designs, drawings, specifications, materials, tapes, and disks conceived, reduced to practice, created or originated by the Grantee, its employees, agents, and subcontractors, either individually or jointly with others in the performance of this grant. Work includes "Documents." Documents are the originals of any databases, computer programs, reports, notes, studies, photographs, negatives, designs, drawings, specifications, materials, tapes, disks, or other materials, whether in tangible or electronic forms, prepared by the Grantee, its employees, agents or subcontractors, in the performance of this grant. The Documents will be the exclusive property of the State and all such Documents must be immediately returned to the State by the Grantee upon completion or cancellation of this grant at the State's request. To the extent possible, those Works eligible for copyright protection under the United State Copyright Act will be deemed to be "works made for hire." The Grantee assigns all right, title, and interest it may have in the Works and the Documents to the State. The Grantee must, at the request of the State, execute all papers and perform all other acts necessary to transfer or record the State's ownership interest in the Works and Documents.

***IN WITNESS WHEREOF**, the parties have caused this Grant Agreement to be duly executed intending to be bound thereby.*

Approved:

Minnehaha Creek WD	**Board of Water and Soil Resources**
By: _____	**By:** _____
(print)	
_____	
(signature)	
Title: _____	**Title:** _____
Date: _____	**Date:** _____

MEMORANDUM

To: Anna Brown, Minnehaha Creek Watershed District

From: Brian Beck, Minnehaha Creek Watershed District

Date: August 28, 2019

Re: Wassermann Alum Treatment Feasibility Study

Introduction and Background

The Six Mile Creek-Halsted Bay (SMCHB) Subwatershed is a focal priority for the Minnehaha Creek Watershed District (MCWD) over the current 10 year plan cycle due to its abundant and interconnected water and natural resources, existing water resource impairments, and projected growth and development in the area. In 2016, MCWD formed the SMCHB Planning Partnership, which brings together a variety of organizations located in the subwatershed to engage in proactive communication about plans, priorities, and opportunities for collaboration in the region. The implementation strategy for this subwatershed seeks to address legacy pollution issues from long standing agricultural practices and leverage the current growth and development to implement protection and restoration concurrent with land use change.

The City of Victoria is a rapidly growing community whose population increased from 4,025 in 2000 to 7,345 in 2010, and with a current estimated population of 9,820. Fueling Victoria's growth is an orderly annexation agreement between the Cities of Victoria, Waconia, and Chaska governing the land currently in Laketown Township. The annexation agreement results in a majority of Victoria's growth being on land currently in agricultural or rural development. The City's growth trajectory is into an area with substantial water and natural resources. At full build out, the City will include 11 lakes, two of which are impaired, and thousands of acres of wetlands in an area that constitutes the headwaters of the SMCHB Subwatershed, and consequently the headwaters of the greater Minnehaha Creek Watershed.

Recognizing the unique opportunity to protect and improve natural resources in this context of this land use change, MCWD and the City of Victoria entered into a memorandum of understanding in 2015 outlining shared goals and strategies to accommodate growth while preserving the area's unique natural heritage. One of the identified shared priorities is the restoration of Wassermann Lake, an impaired waterbody situated at the southern edge of Victoria's current City boundary. Because Wassermann's impairment and current ecological condition is driven by multiple stressors - degraded wetlands, overabundance of common carp, watershed loading, and internal loading from historic accumulation of nutrients – the District and City have been pursuing a multi-pronged restoration strategy to restore Wassermann Lake. Alum treatment of the Lake is the next phase of work to create substantial progress towards improving water quality and ecological integrity on Wassermann.

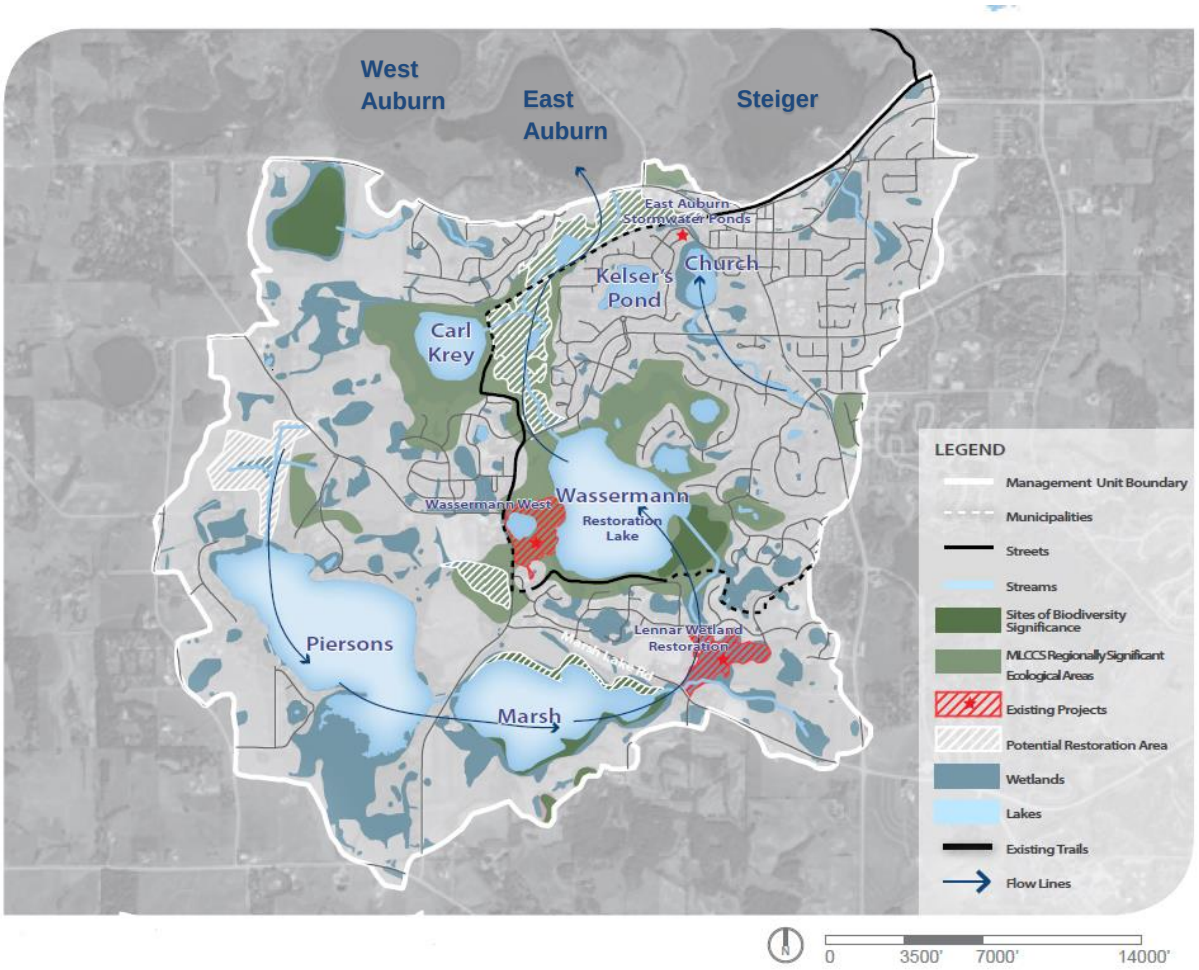

Figure 1. Area map with existing projects

Surface Water Quality of Wassermann Lake

Wassermann Lake is a deep eutrophic lake located in Victoria, MN. In 2012, the Minnesota Pollution Control Agency (MPCA) listed Wassermann Lake as impaired for excess nutrients. Water quality in Wassermann Lake has not met State of Minnesota water quality standards since monitoring efforts began in 2002 (Figure 2). Total phosphorus (TP) and chlorophyll-a (chl-a) appear to be closely related, however, total phosphorus concentrations is the only parameter that has experienced a significant decrease in the past 10 years (Figure 2). Interestingly, water clarity, as measured by secchi depth and chlorophyll-a, have not exhibited a significant trend (Figure 2). These data suggest that phosphorus reduction projects that have been implemented are making an improvement, but the in-lake response to phosphorus reduction is not clear.

The explanation for a poor in-lake response to phosphorus reduction can be explained by common carp and internal phosphorus loading. Common carp have historically been an issue in Wassermann Lake since they resuspended sediment causing poor clarity, contribute to internal phosphorus loading, and reduce the

presence of submerged aquatic vegetation (SAV). The common carp population has been significantly reduced due to management efforts, which should result in better water clarity in the future.

Sediment phosphorus release, or internal loading, is also a major driver of poor water quality in Wassermann Lake. Internal phosphorus loading can cause late season algal blooms due to mixing of high concentration hypolimnion.

Table 1. Physical characteristics of Wassermann Lake

Parameter	Wassermann Lake
Surface Area (acres)	**164**
Maximum Depth (ft)	**41**
Volume (ac-ft)	**1,698**
Residence Time (years)	**0.94**
Littoral Area (%)	**68**
Watershed Size (ac)	**876**

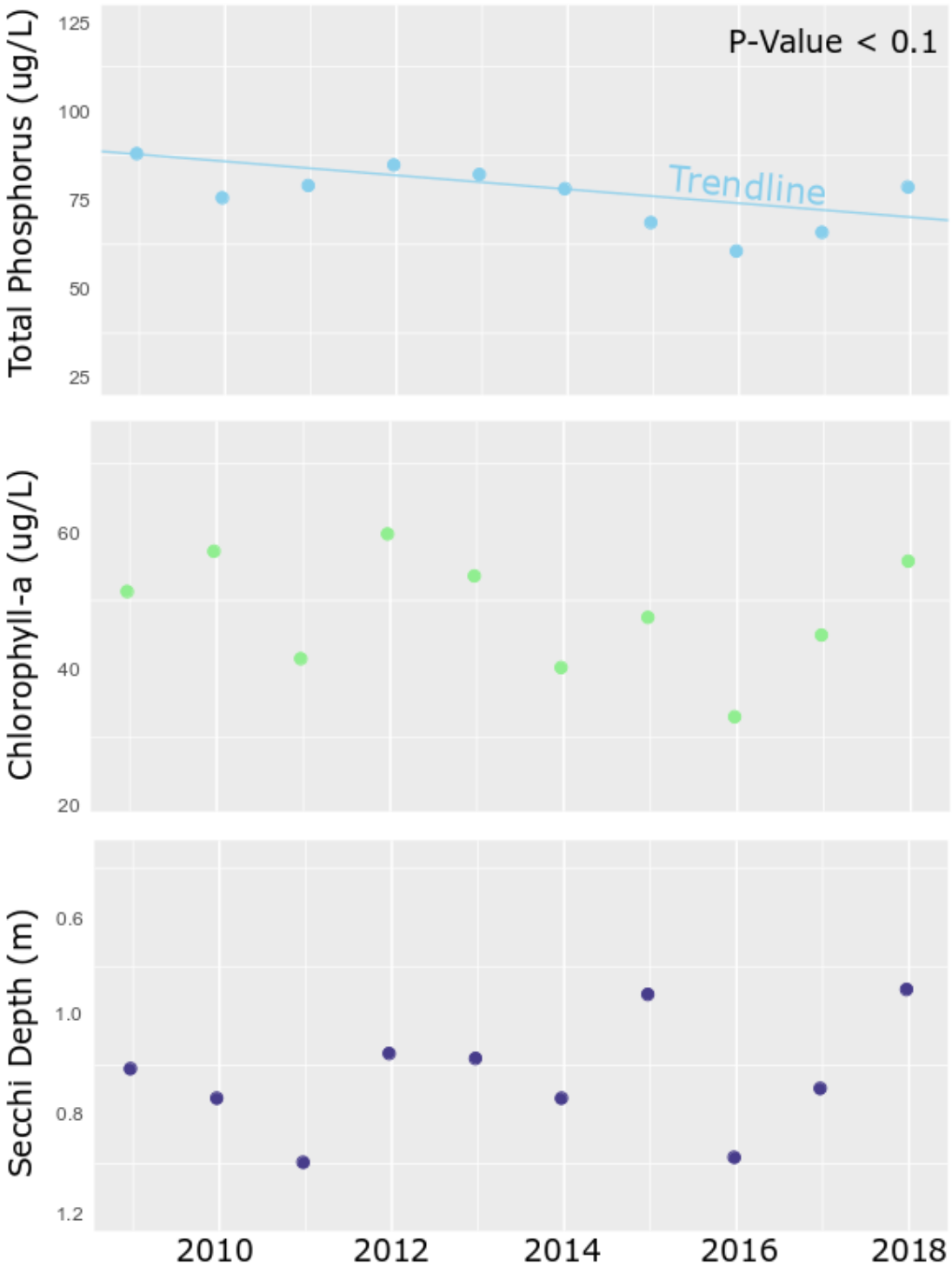

Figure 2. Total phosphorus, chlorophyll-a, and secchi depth in Wassermann Lake. Total phosphorus is the only parameter that has exhibited a significant trend (decrease) in the past ten years.

Wassermann Lake Nutrient Loading Analysis

In 2011, the Minnehaha Creek Watershed District Lakes TMDL study was completed, which outlined the phosphorus loading reductions needed to meet state water quality standards (EOR, 2011). The TMDL indicated that internal phosphorus loading was the primary source of phosphorus and watershed loading was the secondary source of phosphorus. Watershed loading was estimated with a P8 watershed model calibrated with stream water quality data. The internal load was estimated in the TMDL as the sum of sediment phosphorus release, carp sediment resuspension, physical wind mixing, and phosphorus release from decaying curlyleaf pondweed to be 505 lbs P/yr. In 2013, MCWD collected sediment cores were collected in Wasserman Lake to quantify the internal load from sediment phosphorus (374 lbs P/yr). Therefore, the combination of carp sediment resuspension, curlyleaf pondweed, and wind resuspension are responsible for 131 lbs P/yr.

The watershed phosphorus load reduction in the TMDL was approximately 28 lbs P/yr and the internal load reduction (sediment release and other in-lake processes) in the TMDL was 442 lbs P/yr. Specific load reductions below provide an the watershed and in-lake projects that have been implemented since the TMDL and the load reductions associated load reductions.

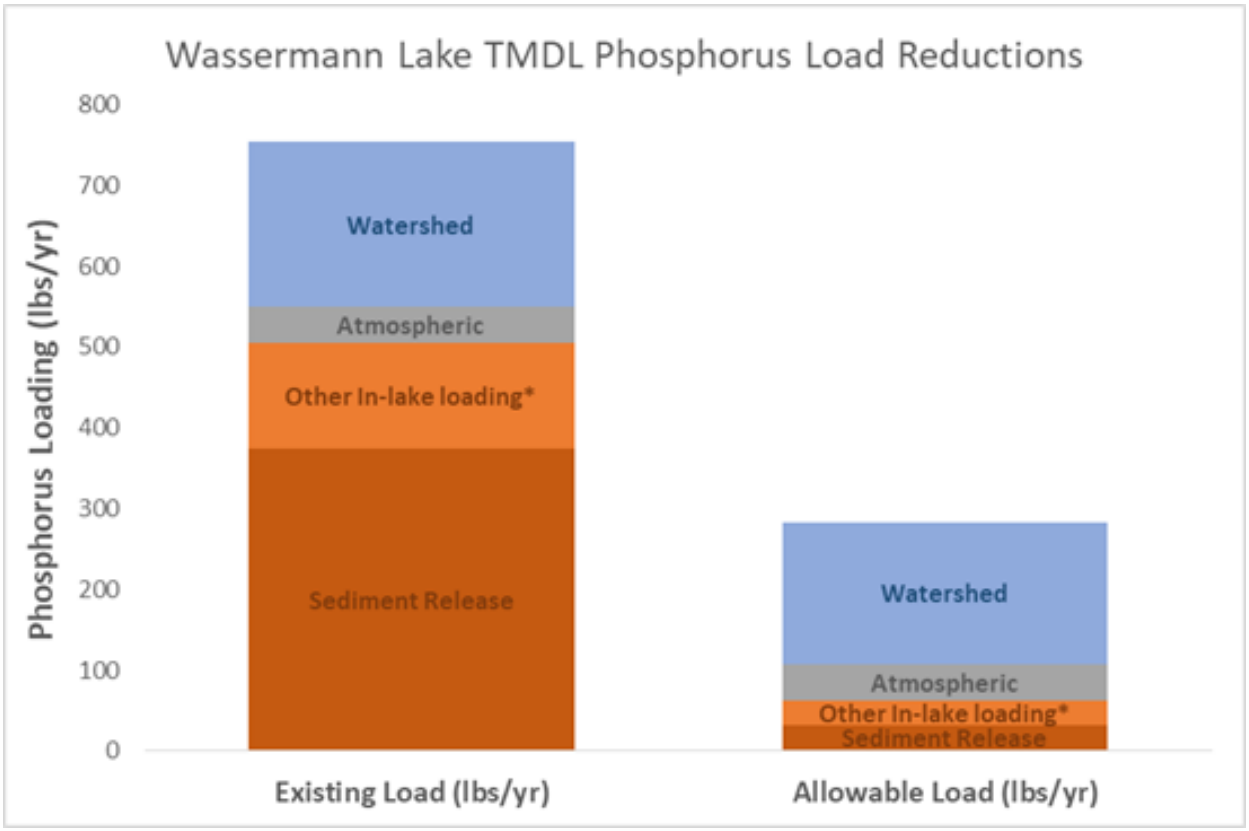

Figure 3. Wassermann Lake Annual Phosphorus Budget. Other in-lake loading represents carp sediment resuspension, wind sediment resuspension, and curlyleaf pondweed phosphorus release.

Downstream Lake Connection to East Auburn

East Auburn Lake is the receiving water body for several lakes including Wassermann Lake. It is currently listed as impaired for excess nutrients and requires a load reduction from upstream lakes of 199 lbs P/yr based on the TMDL reduction requirements (Wenck, 2014). It is important to note that East Auburn Lake would receive a phosphorus load reduction of 161 lbs P/yr if Wassermann Lake were meeting the state phosphorus standard of 40 µg/L.

Description of Nutrient Reduction Projects

Since 2015, MCWD has invested substantially in the restoration of Wassermann Lake through both watershed and in-lake management activities. A brief summary of these activities is provided below:

In-Lake Management Activities

SMCHB Habitat Restoration Program

Beginning in 2018, MCWD commenced the State's most comprehensive program to manage invasive common carp across the SMCHB subwatershed, including Wassermann Lake. This innovative program was developed from a three-year study with the University of Minnesota's AIS Research Center which assessed population concentrations in each of SMCHB's 14 lakes, migratory patterns between lakes, and active reproduction areas. The result is a program that addresses the full lifecycle of common carp through adult biomass removal, aeration of shallow lakes with active carp nurseries, and strategically deployed barriers.

To date, MCWD has successfully achieved a carp biomass of 102 kg/ha through a variety of tactical interventions. MCWD deployed a carp barrier at the outlet of Lake Wassermann, preventing these carp from accessing the North and South Lundsten nursery areas and preventing active migration between the upstream lake system of Pierson-Marsh-Wassermann and downstream East and West Auburn. The barrier was deployed at a time when many of the carp had migrated downstream towards East and West Auburn, limiting the need for active removal. Some removal has been conducted through stream trapping and baited box netting. Monitoring will continue to ensure that no additional reproduction can occur and that the system is maintained at that density.

A detailed description of the carp management program and current common carp assessment results is provided in the *In-Lake Response* section.

Watershed Management Activities

Laketown 9th Wetland Restoration

In 2016, MCWD partnered with Lennar Corporation, one of the largest homebuilders in the US, to restore 12 acres of wetland upstream of Wassermann Lake. The site had been identified in MCWD's 2007 Water Management Plan as a potential project for nutrient reduction and habitat restoration. The 9th Addition of Lennar Corporation's Laketown Development would include a small impact to an adjacent wetland requiring compensatory mitigation. MCWD worked with Lennar to develop a project specific mitigation

that would restore natural hydrology within the upstream wetland system, improving nutrient cycling and the success of native vegetation in this previously cattail dominated system.

Wassermann West Park and Alum Treatment

In 2018, MCWD was awarded funding through the BWSR Watershed Based Funding Pilot Program for alum treatment of a six acre pond west of Lake Wassermann. The pond was an identified source of nutrient pollution to Wassermann Lake, and the single highest identified watershed load in the drainage area. Using a combination of monitoring data and sediment core analysis, it was estimated that alum treatment could achieve a 35 lb/yr phosphorus load reduction. The first of two treatments was conducted in May of 2019, and preliminary analysis shows that the treatment is likely exceeding that reduction target. A second treatment will occur in 2021.

The work to reduce watershed loading to Wassermann Lake through alum treatment of Wassermann West pond is being complimented by a collaborative project between the City of Victoria and MCWD. The six acre pond is located on a 33.5 acre site that includes 16 acres of wetland, 8 acres of upland, and an undisturbed wooded bluff on the shoreline of Lake Wassermann. On a timeline parallel to the pond treatments, the City and District are collaboratively planning a park and site restoration project that will enhance ecosystem function while providing a recreation asset to the City. The site will also feature interpretive elements that highlight the work underway to restore Lake Wassermann.

Stormwater Management Impacts

In addition to District projects undertaken in the watershed to directly manage water resources to correct legacy pollutant issues, a significant amount of land use change in the subwatershed has resulted in an overall reduction in nutrient pollution. Prior to the mid-2000s, the Wassermann drainage area was almost entirely in agricultural land use. A significant amount of the redevelopment has been completed since 2010, when the District's current stormwater rules were adopted that enforce high phosphorus and rate standards on all new development. The net result is that as land has been converted in the subwatershed, Wassermann is experiencing a net reduction in nutrient pollution from routine project permitting on top of the project impacts.

Downstream Lake Strategies

Downtown Stormwater Ponds

The District is currently engaged in a multi-year effort to restore water quality and ecological health across the SMCHB Subwatershed. The work to restore Wassermann Lake not only benefits the Lake itself, but also has cumulative downstream benefits to the whole SMCHB subwatershed. One of the direct beneficiaries of the nutrient load reductions on Wassermann Lake is East Auburn Lake, an impaired water body immediately downstream of Wassermann Lake. Like Wassermann Lake, the restoration of East Auburn Lake will require a multi-pronged strategy that includes stormwater management and wetland restoration.

In 2017, the District leveraged Clean Water Funds to enhance two existing stormwater ponds receiving water from 22 acres of downtown Victoria to enhance treatment of phosphorus from downtown as well as

incorporate treatment of the Church Lake outlet, a lake which routinely fails to meet state water quality standards and contributes to the impairment of East Auburn. The project would exceed regulatory standards for downtown while treating Church Lake, creating a net reduction of approximately 40 lbs P/yr of phosphorus and 4,750 lbs P/yr of TSS. To date, pond construction is complete and the City and District are evaluating additional BMPs to further reduce phosphorus loading from stormwater to East Auburn Lake.

Alum Dosing Recommendations

Alum Treatments for Anoxic Area

The goal of a sediment inactivation treatment is to drive 90% of mobile phosphorus (redox-P) to an inactive form of phosphorus (aluminum bound-P) to reduce phosphorus release rates by 90%. The mass of alum needed to reduce phosphorus loading from anoxic sediments is based on the sediment chemical characteristics in the uppermost 10 cm in Wassermann Lake and the sediment area that is typically exposed to anoxia (dissolved oxygen < 2 mg/L). An application rate of 146 g Al/m^2 is needed to inactivate 90% of the phosphorus available for release in the uppermost 10 cm. The typical anoxic depth in Wassermann Lake is fifteen feet. Therefore, alum will be applied to Wassermann Lake in areas deeper than 15 feet at an application rate of 146 g Al/m^2.

MCWD will avoid causing low pH during alum applications on Wassermann Lake by splitting the dose into two buffered aluminum (sodium aluminate and aluminum sulfate) applications. This option would also be beneficial because two applications of a buffered alum solution would allow more time for the aluminum to react with sediments in Wassermann Lake. MCWD will conduct monitoring after the initial application and final alum application to assess the effectiveness of the treatments. Follow up sediment monitoring is an effective method for tracking the conversion of redox-P to aluminum-bound P.Therefore, follow up monitoring will also inform MCWD if more alum is needed due to the elevated redox-P concentrations. MCWD will also collect sediment data and surface water quality data after the completion of both alum treatments to confirm the estimated load reduction was achieved.

Table 2. Wassermann Lake alum application cost estimate.

Item	Unit	Quantity	Unit Cost	Total Cost
Alum application 1 (half of total dose)				
Aluminum sulfate	Gal $Al_2(SO_4)_3$	27,355	$2.38	$157,950
Sodium aluminate	Gal $NaAlO_2$	13,678	$6.79	
Mobilization	Lump sum	0.5	$5,000	$2,500
Engineer Design	Lump sum	0.5	$5,000	$2,500
Sediment Monitoring	Lump sum	0.5	$30,000	$15,000
Site Observation	Lump sum	0.5	$5,000	$2,500
			Application 1 cost estimate	**$160,450**
Alum application 2 (half of total dose)				
Aluminum sulfate	Gal $Al_2(SO_4)_3$	27,355	$2.38	$157,950
Sodium aluminate	Gal $NaAlO_2$	13,678	$6.79	
Mobilization	Lump sum	0.5	$5,000	$2,500
Engineer Design	Lump sum	0.5	$5,000	$2,500
Sediment Monitoring	Lump sum	0.5	$30,000	$15,000
Site Observation	Lump sum	0.5	$5,000	$2,500
			Application 2 cost estimate	**$160,450**
Total alum application (47.2 acres; top 10 cm; 146 g/m2)				
Aluminum sulfate	Gal $Al_2(SO_4)_3$	54,711	$2.38	$315,900
Sodium aluminate	Gal $NaAlO_2$	27,355	$6.79	
Mobilization	Lump sum	1	$5,000	$5,000
Engineer Design	Lump sum	1	$5,000	$5,000
Sediment Monitoring	Lump sum	1	$30,000	$30,000
Site Observation	Lump sum	1	$5,000	$5,000
			Total application cost estimate	**$355,900**

Estimated Load Reductions and Estimated Effective Life

Sediment phosphorus release in Wassermann Lake, as mentioned earlier, accounts for 374 lbs P/yr of the total annual phosphorus budget (Figure 3). We assume that a 90% reduction in phosphorus release rates will occur in Wassermann Lake since the alum application will reduce mobile phosphorus in sediment (Redox-P) by 90%. We can combine this information with bathymetry and dissolved oxygen profiles to estimate the phosphorus load from sediments is 336 pounds of phosphorus per year.

We also are taking into account the effective life of the alum treatment to ensure that subsequent alum treatments won't be necessary in the future. To estimate the effective life of the treatment we can use the sedimentation term in the BATHTUB model to determine how long it will take to replace inactivated phosphorus in the top 10 cm. We can assume that the watershed and internal load reductions required by the TMDL have been met, which is likely a conservative estimate since the projects that have already been implemented have a load reduction greater than the TMDL watershed load reduction goal (24 lbs P/yr). The effective life of the alum treatment based on this calculation is 50 years. A conservative cost per pound estimate using a 15 year life cycle for the Wassermann Lake is $70/lb P/yr, which makes this project extremely cost effective when compared to watershed BMPs that typically have cost-per pound reductions of ~$1,000/lb P/yr.

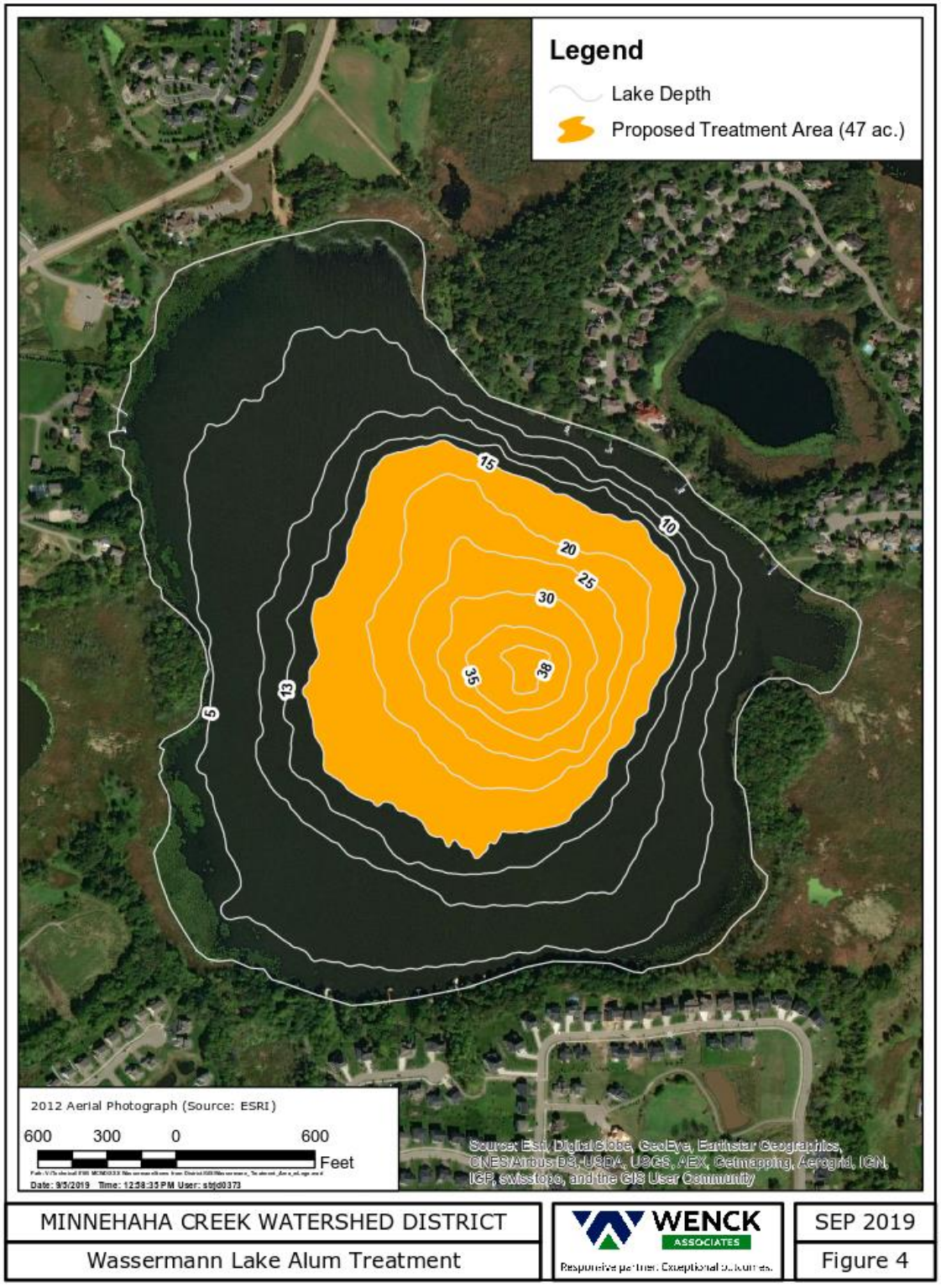

Figure 4. Wassermann Lake alum treatment areas based on anoxic depths.

Alum Treatment Alternatives

There are two primary alternatives to an alum treatment are aeration and sediment dredging. Both aeration and sediment dredging have technical and cost limitations.

Recent studies have found that aeration an effective method to reduce internal phosphorus loading in many cases (Barr, 2018), which makes it predict the effectiveness of an aeration system. Furthermore, aeration systems require annual operations and maintenance (O&M) costs that typically make aeration cost prohibitive even if they meet the load reduction goals. For example, an aeration system in a lake with a similar load reduction area would have a 30 year life cycle cost of $2,000,000 (Wenck, 2018). The uncertainty, cost, and long term O&M requirements indicate that aeration is not a feasible alternative to alum.

In-Lake Response to an Alum Treatment

Fish Community

From 2014-2016, MCWD and the University of Minnesota assessed the abundance and impact of carp throughout the Six Mile Creek Subwatershed. During that study, Wassermann Lake was identified to have a carp population of 10,031±1,182 common carp at a density of 555±145kg/ha, which is well above the 100kg/ha critical threshold (Dauphinais, et al., 2016). As densities of common carp begin to approach 100kg/ha, significant and measurable degradation to both water quality and aquatic vegetation occurs (Bajer & Sorenson 2009).

In 2018, MCWD leveraged the University of Minnesota's common carp study to develop a watershed-wide carp management plan (MCWD, 2018). The management report suggested that a barrier be installed downstream of Wassermann and that approximately 5,000 common carp be removed from Wassermann Lake.

In early 2017 a temporary fish barrier was installed and remained in place until a permanent barrier with a moveable grate was installed in the spring of 2019. The fish barrier(s) were installed along the outlet channel of Wassermann Lake preventing the ability of carp to migrate into or out of the Wassermann Lake watershed from the rest of the Six Mile Creek watershed. The temporary barrier failed in the spring of 2018 and allowed one way movement (determined through carp implanted radio tags) of carp downstream of Wassermann Lake. Since the installation of the permanent barrier, no suspected or observed breaching of the barrier by carp has occurred.

Carp removals began in the winter of 2017 and continued through 2018, with no removal efforts pursued in 2019. Removals consisted of various trapping and netting techniques that removed 3,452 individual carp. Additionally, it was estimated that at ~3,800 carp emigrated from Wassermann Lake downstream during the breach of the temporary fish barrier. In total ~7,252 of the 10,031 carp (72% reduction) have been eliminated from the Wassermann Lake.

In 2018, the District conducted common carp population assessments to verify that the carp biomass was below the 100 kg/ha goal outlined in the management plan. Two population assessments were conducted and resulted in an averaged carp population size of 1,481±628 and a density estimate of 57.3±37 kg/ha,

which demonstrated that carp have been successfully managed within Wassermann Lake. Even with having achieved densities below the critical threshold, the District is continuing efforts within the Lake to further track and reduce the presence of common carp within Wassermann and Six Mile Creek watersheds.

Overall, the management activities focused on common carp within Wassermann Lake have made significant progress in reducing the direct impact common carp have on both water quality and aquatic vegetation. MCWD believes that an alum treatment is the next step in Wassermann Lake's restoration process since common carp biomass densities have been successfully reduced and will continue to be monitored.

Aquatic Plant Community

In healthy lake ecosystems submerged aquatic vegetation will grow throughout the littoral area (≤ 15 feet depth) and consist of a diverse native community. A well vegetated littoral area promotes and facilitates lake's ecosystem health by providing critical spawning, foraging, and nursery habitat for aquatic insects, amphibians, birds, and fishes. The littoral area is also an important area for recreational activities and aesthetic value to lakeshore property owners with diverse communities often causing little to no recreational and aesthetic degradation.

The relative health of the submerged aquatic vegetation (SAV) community can be assessed with the MnDNR's Floristic Quality Index (FQI). The FQI is an assessment tool used to determine the biological health of the SAV community and is a metric in MCWD's E-Grade toolkit (MCWD, 2018). FQI scores are compared to a threshold for context and classification of biological impairment status (MCWD, 2018). Lakes with greater FQI scores and species richness are typically comprised of diverse native communities with abundant plant growth across the entire littoral area. As health begins to deteriorate we typically see a reduction in diversity, an increased presence of invasive species, increasing monodominance, and decreased depth of growth. To assess the presence, abundance and health of the SAV community MCWD has been conducting point intercept surveys during periodically in August over the past decade. Late summer surveys provide the greatest assessment of SAV health, abundance and spatial distribution.

MCWD has assessed the SAV community in 2015, 2017, and 2018, which correspond to pre-carp management, during-carp management, and post-carp management, respectively (Table 2). Across this management period, the SAV community has remained biologically impaired, however, the community has begun showing signs of improved habitat conditions. Specifically, Wassermann Lake has seen a 1.2 foot increase in maximum depth of plant growth and a 20% increase in SAV coverage in the littoral area. These observations were anticipated to occur with carp management activities since carp actively disturb SAV's ability to establish roots.

However, if carp alone were the sole driver of poor water quality and habitat conditions we should have a much larger response in the SAV community since carp have been successfully managed within Wassermann Lake. With carp densities in control and continued to be managed within Wassermann Lake, continued efforts to improve water quality will only further enhance the SAV community with anticipated results of further littoral coverage, deeper maximum growing depths, increased species richness, and increased FQI scores.

Table 2: Wassermann Lake submerged aquatic vegetation survey summary statistics.

	2015	2017	2018
Max Plant Growth (ft)	7.4	5.9	8.6
Littoral Area with SAV (%)	26	32	46
Species richness (count)*	6	6	7
FQI (score)*	11.0	11.0	11.3

*Biological impairment status for FQI is <18.6, and species count is <12.

Alum Treatment Feasibility

MCWD has reduced watershed loading to Wassermann Lake through BMPs and land use conversion with stormwater treatment and volume control under MCWD rules. In addition, MCWD has successfully reduced common carp biomass below 100 kg/ha, which has improved the SAV conditions. The final restoration activity for Wassermann Lake is an internal phosphorus reduction activity and alum is the most cost effective solution.

MCWD expects that an alum treatment will have a minimum 50 year life cycle, however, monitoring by MCWD will help track the effectiveness of the project and help assess if maintenance alum applications are necessary. Based on this information, an alum treatment on Wassermann is feasible and will be cost-effective if dosed properly. Assuming an internal load reduction of 90%, the annual load reduction that could be achieved by alum is estimated as 337 pounds on Wassermann West Pond, which would account for 72% of the watershed phosphorus reduction needed for Wassermann Lake to meet water quality standards.

MCWD will continue to refine the alum dose for Wassermann Lake by collecting sediment cores at a higher spatial resolution in 2020, which will help improve the accuracy of the dose.

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