MINNEHAHA CREEK WATERSHED DISTRICT
QUALITY OF WATER, QUALITY OF LIFE

Meeting: Operations and Programs Committee
Meeting date: 5/12/2022
Agenda Item #: 4.1
Item type: Discussion

Title:	Taft-Legion Project Assessment Findings
Prepared by:	Name: Becky Christopher Phone: 952-641-4512 bchristopher@minnehahacreek.org

Purpose:

At the May 12, 2022 Operations and Programs Committee (OPC) Meeting, staff will provide an update on the City of Richfield's 2021 assessment of the Taft-Legion Lake Improvement Project and recommended next steps to address the project's underperformance.

Background:

Project Background

During the 2010 distribution of the District's Capital Improvement Plan, the City of Richfield (City) requested that an improvement project for Taft and Legion Lakes be included. A project proposal was developed that outlined details of a partnership between MCWD and the City to improve water quality in the two lakes through a combination of project elements:

- Infiltration systems that draw water from Taft Lake and the forebay draining to Legion Lake and direct it to underground infiltration systems in the adjacent park land
- A flocculation treatment system that treats water withdrawn from Taft Lake, removing dissolved phosphorus loads, before it is discharged back into the lake
- Native lakeshore buffers established in select areas surrounding Legion Lake
- Pre-treatment of runoff to Legion Lake by redirecting pipes to expanded sedimentation ponds to remove pollutant loads prior to being discharged into Legion Lake

In September 2012, the Board ordered the project and authorized staff to enter into a cooperative agreement with the City under which the City would construct, maintain, and finance the project, and the District would make payments to the City on a 20-year payment schedule to cover the costs of design, construction, bond issuance, and interest totaling $3,466,124. Annual District payments are approximately $165,000 and began on February 1, 2014.

Project Performance

The City completed construction of the project in fall of 2016. Since that time, the City has been operating and monitoring the performance of the systems and providing annual reports to the District by June 30 each year, as required under the cooperative agreement.

To date, the project has been significantly underperforming as compared to the performance standards established in the feasibility report and cooperative agreement. The intended and actual performance metrics are summarized below:

	Intended Performance	2015 Actual*	2016 Actual*	2017 Actual	2018 Actual	2019 Actual	2020 Actual
Volume Reduction (acre-ft/yr)	134-280	16.1	75.4	40.3	12.1	139	150
Phosphorus Reduction (lbs/yr)	167-413	7.2	16.4	22.3	16.0	87.4	82

*Note – The system was not fully operational until September 2016.

In August 2017, District staff initiated discussions with the City about concerns with the project's performance. Since then, the City and District have identified a range of issues affecting the performance of the system, including pre-project assumptions about water quality, capacity of the flocculation system, mechanical issues, and several others. In March 2019, the District sent a letter to the City which outlined in detail the District's understanding of the various issues and requested actions and timelines for evaluating and addressing the issues.

To date, the City has put a substantial amount of effort into optimizing the infiltration and flocculation systems. This has included testing the use of both the deep and shallow Taft Lake intakes, exploring different flocculants and dosing, improving disc filter maintenance practices, optimizing the distribution of pumped volumes between Taft flocculation and infiltration systems, increasing annual days that the systems are operating, and testing the effects of delayed aeration operation on Taft Lake. These efforts have improved performance; however, the project is still not meeting targets.

In November 2020, the District sent another letter to the City concluding that optimization of the current system is unlikely to meet goals and that the performance shortfall appears to be due to underlying design issues. The District requested evaluation of six potential options for system modification. The City contracted with Barr Engineering in June 2021 to complete the requested assessment. The City, District, and Barr met monthly throughout the assessment period to review progress and findings, and the final report was delivered in January 2022 (see Attachment 1).

Summary:

<u>Assessment Findings</u>

Based on the assessment of feasibility and cost-effectiveness of each of the identified alternatives, Barr has recommended that two of the alternatives be implemented:

- Use of a new polymer for the flocculation system which was tested in late 2021 and showed promising results for increasing the flow rate through the system
- Completion of an alum treatment on Taft Lake to reduce sediment phosphorus release

Implementation of these two actions is estimated to increase phosphorus removals by 63 lbs/yr, which would bring the total load reduction for the project to 148 lbs/yr (19 lbs short of the target range). Barr recommends further testing of the new polymer in spring 2022 to determine the maximum flow rate that can be achieved. After approximately 8 weeks of operations data is available, the City and Barr will reassess if the target flow rate is feasible.

It should also be noted that, while the system has not yet met the performance target for pounds of phosphorus removed, water quality within Taft Lake has improved since the project was implemented, as shown on page 12 of the attached memo. If the two recommended alternatives are implemented, Barr anticipates that the lake will consistently meet state water quality standards.

<u>Next Steps</u>

District and City staff will be meeting next week to discuss the work plan for the 2022 operating season. Following assessment of the performance of the new polymer this summer, the City and District will determine whether the system is expected to meet performance targets or if changes to the cooperative agreement should be considered.

Supporting documents:
Taft Lake Alternative Evaluation Summary Memo

resourceful. naturally.
engineering and environmental consultants

BARR

Memorandum

To: City of Richfield and MCWD Project Teams
From: Joe Bischoff, Barr Engineering Co.
Subject: DRAFT Taft Lake Alternative Evaluation Summary
Date: January 7, 2022
Project: Taft Lake Alternative Improvements
c: Michelle Stockness, Barr Engineering Co.

The intent of this document is to further discussion outlined in the report *2020-2022 Work Plan, Taft Lake Flocculation System Evaluation*, and perform a high-level screening of potential water quality improvements to Taft Lake.

1.0 Background

In 2012, the *Taft Lake/Legion Lake Watershed Water Quality Improvement Project Feasibility Report* (WSB, 2010; updated 2012) was developed for the City of Richfield outlining various proposed watershed and in-lake water quality improvement projects for Taft Lake and Legion Lake. The following projects were implemented (Figure 1 and Figure 2):

- 2015/2016: Stormwater re-use infiltration systems adjacent to Taft Lake and Legion Lake
- 2015: Grit chambers and native buffers at Legion Lake
- 2016: Taft Lake flocculation system

In addition to these projects, the City of Richfield installed an aeration system to improve fish habitat in Taft lake.

2.0 Flocculation System Historical Performance

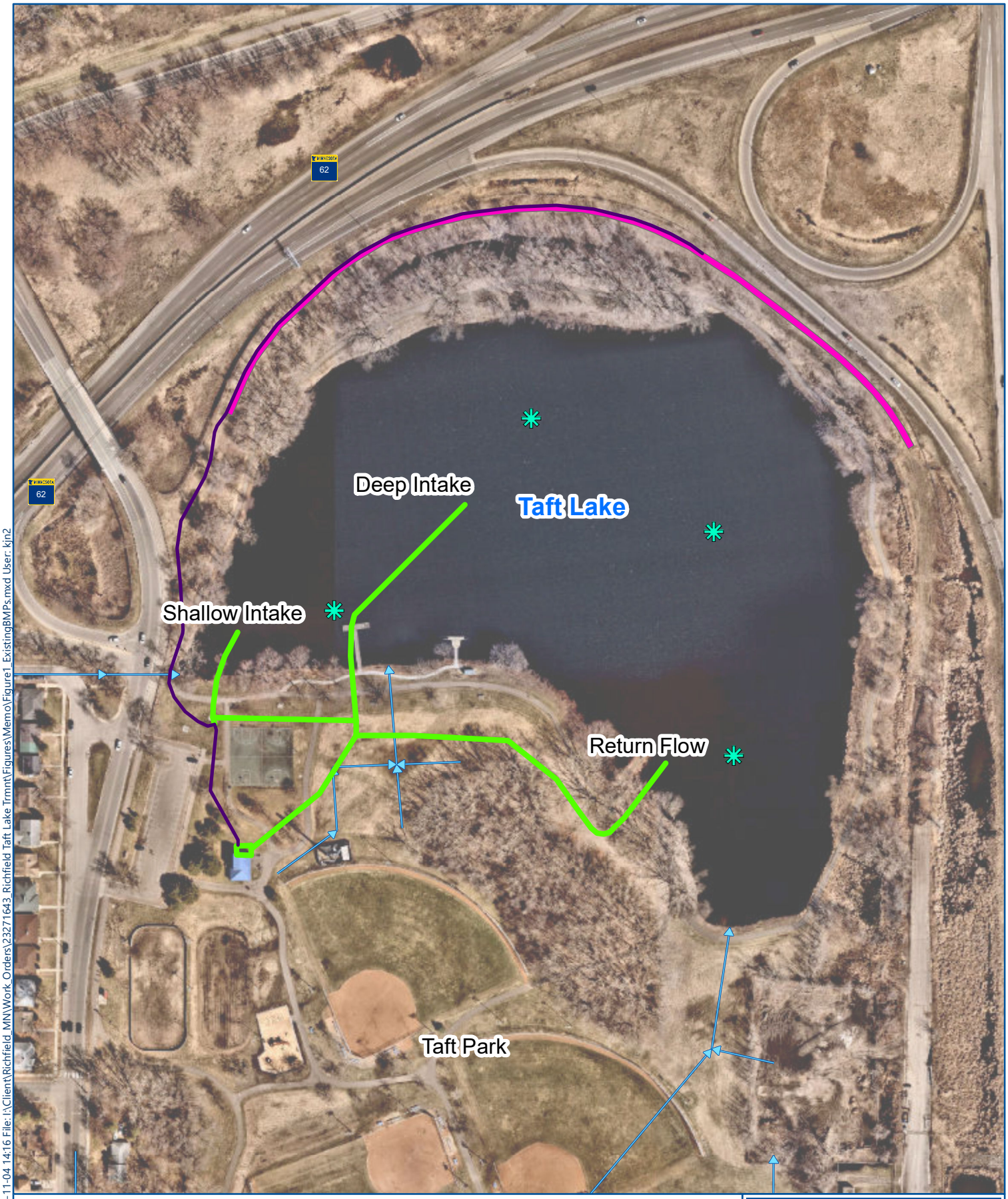
In the 2020 report referenced above, Barr Engineering Co. (Barr) compared flocculation system performance to design assumptions outlined in the original feasibility report (Table 1; WSB, 2010; updated 2012). For the 2016 through 2020 period, a number of factors limited the efficiency of the floc system as compared to the design expectations including:

- Lower inflow phosphorus concentrations than expected due to withdrawals from the epilimnion to avoid impacts from hydrogen sulfide
- Lower hypolimnetic phosphorus concentrations than originally expected
- Lower than expected number of days pumping to the flocculation system
- Lower than expected pumping rates to the flocculation system due to limitations in the disc filter
- Lower than expected phosphorus removal efficiency using alum

The shallow intake was preferentially used in 2018 through 2020 to avoid hydrogen sulfide issues and prevent degradation of surface water quality by returning higher Total Phosphorus (TP) concentrations to the epilimnion. Barr recommended this approach be re-elevated if epilimnion TP concentrations fall below the range of anticipated inflow TP concentration cited in the feasibility study (100 to 200 µg/L) which occurred in all 4 years.

Table 1 Taft Lake Water Quality BMP Performance from 2021 report

	2012 Feasibility Study Assumptions: Low / High Range[1]		Annual Performance Summary				
	LOW	**HIGH**	**2016**	**2017**	**2018**	**2019**	**2020**
	Flocculation System						
Primary Intake Used:	--	--	DEEP	DEEP	DEEP/ SHALLOW	SHALLOW	SHALLOW
Days of Operation (#):	180		23	44	104	174	150
Avg. Pump Rate (gpm):	250	400	31	53	121	106	112
Annual Vol. Treated (ac-ft):	200	320	3	10	56	82	85
Avg. TP Inflow Conc. (µg/L):	100	200	235	482	73	92	74
TP Reduction (lbs):	43	156	2	2	8	15	13
TP Reduction (%):	80%	90%	73%	12%	72%	79%	40%
	Infiltration System						
Volume Reduction (acre-feet)	134	280	76	40	12	139	150
TP Reduction (lbs):	91	257	19	21	8	72	69



Aerators
Infiltration Areas
Flocculation Treatment System
Forcemain
Storm Sewer

N

Feet
0 100 200

BARR

TAFT LAKE
BEST MANAGEMENT
PRACTICES
City of Richfield

FIGURE 1

Forcemain
Flocculation Treatment System
Infiltration Areas
Storm Sewer
Sampling Locations

BARR

N

Feet
0 150 300

LEGION LAKE
BEST MANAGEMENT
PRACTICES
City of Richfield

FIGURE 2

3.0 Infiltration System Performance

The Taft Lake infiltration system has operated since 2016 and removed an estimated 2 to 6 pounds of TP annually (Table 2). Removals in 2016 were likely underestimated since epilimnion TP concentrations were used to calculate TP removal although it was reported that the deep lake intake was used. In August 2018, the City began using the shallow lake intake exclusively due to high hydrogen sulfide concentrations in hypolimnetic water. Since the same intake feeds both the infiltration system and the alum injection facility, lower TP concentrations from the epilimnion were delivered to the infiltration system. The City reports that 2019 and 2020 represent maximum operation of the infiltration system.

Table 2 Taft Lake infiltration basin operation results

Year	Taft Pumped Volume (ac-ft)	Taft Summer Mean TP (µg/L)[1]	Taft TP Removed (lbs)	Water Source	Profile
2016	50	37[2]	5.8	Shallow Intake	Stratified
2017	17	322	2.3	Deep Intake	Stratified; Mixed in August
2018	0	-	0.0	Deep and Shallow Intake	Mixed
2019	28	55	4.0	Shallow Intake	Stratified
2020	27	75	5.9	Shallow Intake	Stratified

[1] Shallow intake summer average total phosphorus (TP) was reported using epilimnion water quality data; however, data is likely under reported since shallow intake is located near Legion Lake discharge pipe, which results in higher total phosphorus concentrations.

[2] Reported using epilimnion data; however, data is likely under reported since data indicates that the deep lake intake was in operation in 2016.

The City of Richfield also operates a subsurface infiltration system west of Legion Lake in Veterans Park where water is pumped from the western basin of Legion Lake. The reported pumping volumes and total phosphorus removals are summarized in Table 3. The Legion Lake infiltration system removed between 8 and 68 pounds of TP over this operational period.

Table 3 Legion Lake infiltration basin operation results

Year	Legion Pumped Volume (ac-ft)	Legion Summer Avg TP (µg/L)	Legion TP Removed (lbs)
2016	26	255	13.9
2017	23	255	18.4
2018	12	184	7.7
2019	111	282	68.1
2020	123	190	63.2

4.0 Study Objectives

To evaluate potential alternatives that could be implemented to further improve TP removal from Taft Lake, the City of Richfield (City) retained Barr to develop a 3-year work plan to continue the TP removal optimization process. The objectives of this 2020-2022 Work Plan include:

- Review background information (e.g., feasibility report, historic water quality, operating data from the TP removal system, etc.) to evaluate system performance and factors limiting system performance
- Optimize performance of the flocculation treatment system disc filter to increase flow rate through the system
- Optimize performance of the infiltration BMPs
- Determine feasibility of a sediment alum treatment in Taft Lake
- Assist with communications between the Minnehaha Creek Watershed District (MCWD) and City throughout the duration of the work plan

5.0 Description of Alternatives and Evaluation Criteria

This study reviewed the water quality best management practices (BMPs) that were constructed for Taft Lake and Legion Lake to assess how the BMPs could be optimized to improve water quality treatment. The 2020 review identified six alternatives to improve the efficiency of the Taft Lake flocculation system and infiltration basins and new BMP. The identified alternatives were:

Alternative 1. Determine Taft Lake flocculation system pumping rates and redesign needs to meet project goals. The goal of this alternative is to maximize the removal efficiency of the Taft Lake flocculation system. Options include the addition of clarification upstream of the Disk Filter to increase pumping rates to the system and the use of the Aqua Hawk RE2 polymer under investigation by the City of Richfield.

Alternative 2. Maximize the use of the Taft Lake deep intake for the flocculation system. This alternative evaluated the potential impacts of maximizing the deep intake to the flocculation system for the removal of phosphorus under aerated and non-aerated conditions.

Alternative 3. Move the flocculation system shallow intake to the outlet of Legion Lake. This alternative evaluated the benefit of moving the Taft Lake flocculation system intake pipe closer to the outlet discharge pipe from Legion Lake. The total phosphorus concentrations in Legion Lake are typically higher than those observed in Taft Lake.

Alternative 4. In-lake alum treatment to inactivate mobile sediment phosphorus in Taft Lake. This alternative evaluated the impact of completing an in-lake alum treatment on Taft Lake to inactivate releasable sediment phosphorus.

Alternative 5. Modify the Taft Lake infiltration system design and operation to maximize phosphorus removal capacity. This alternative evaluated impacts to total phosphorus loading from changes in the Taft Lake infiltration system.

Alternative 6. Modify Legion Lake infiltration system design and operation to maximize phosphorus removal capacity. This alternative evaluated impacts to total phosphorus loading from changes in the Legion Lake infiltration system.

6.0 Summary and Recommendations

6.1 Alternative Review Summary

Review of the Taft and Legion Lake BMPs identified several options to improve overall performance of the system. Areas identified for improvement include:

- Increasing pumping rates and days of operation for the flocculation system
- Increasing TP concentrations to the flocculation system and the Taft Lake infiltration system
- Reducing sediment phosphorus loading

Results of the alternatives analysis are summarized in Table 4. For Alternative 3, moving the shallow intake closer to the Legion Lake outlet, the surface water intake was determined to already be close to the discharge of Legion Lake and there is no benefit to moving it close. The current location of the surface water intake was determined to increase the TP load removal by about 6 pounds when compared to surface water withdrawal from the middle of the lake. Further, the Legion Lake infiltration system was determined to be currently operating at maximum capacity and no further improvements are recommended (Alternative 6). Increasing TP removal in the flocculation system using the Aqua Hawk RE2 polymer is a viable option that can increase the pumping rates to the system improving overall performance (Alternative 1). Pumping from the hypolimnion can increase the overall TP removed from the lake by the flocculation system but managing hydrogen sulfide may prove to be expensive and difficult to accomplish (Alternative 2). Implementing an alum treatment to reduce internal phosphorus loading will achieve similar results to Alterative 2 with a much higher certainty of success and similar costs (Alternative 4). Additional TP removals could be achieved by pumping hypolimnetic water to the Taft Lake infiltration basin, but this option requires constructing an independent intake if the City were to operate the infiltration and flocculation systems independently (Alternative 5). This approach is expensive and assumes a stratified lake which may not occur every year when operating the aeration system.

Following is a summary of the viable alternatives to improve the performance of the Taft Lake flocculation and infiltration systems.

Table 4 Comparison of alternatives evaluated to improve phosphorus removal from Taft Lake.

Evaluation criteria	Alternative 1a	Alternative 1b	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6
Description of alternative	**Taft Lake flocculation system redesign**	**Taft Lake flocculation system redesign**	**Maximize the use of the Taft Lake deep intake for the flocculation system**	**Move the flocculation system intake to the outlet of Legion Lake**	**In-lake alum treatment to inactivate sediment mobile phosphorus in Taft Lake**	**Taft Lake infiltration system optimization**	**Legion Lake infiltration system optimization**
Description	Aqua Hawk RE2 Polymer; Increase flow rate to 360 gpm for 150 days	Alternative Treatment	Enclose alum facility to control H_2S; move return to the hypolimnion	Move the intake close to the Legion Lake outlet	Apply aluminum sulfate and sodium aluminate to inactivate sediment P release	independent deep intake; maintain stratification	No improvements identified
Feasibility	High	Low	Low	High	High	Medium	--
Feasibility Estimated TP removal (pounds)	40 to 160	40 to 160	40 to 160	40 to 160	--	127-253	127-253
Current TP removal (pounds)	14	14	14	8	--	5	66
Enhanced TP removal (pounds)	42	42	Current flow: 22 Alternative 1 flow: 66	Current flow: 14 Alternative 1 flow: 42	35	30	66
Study/Design costs	$15,000	$45,000 to $110,000	$30,000	$0	$15,000	$100,000	--
Capital costs	$0	$450,000 to $1.1M	$93,000 to $198,000	$0	$220,000	$307,000 to $657,000	--
Operations and Maintenance costs	$300,000	Unknown	Unknown	$0	$105,000	$5,000	--
Cost efficiency ($/pound TP)	$7,200	$26,200	Current flow: $9,000 Alternative 1 flow: $3,000	--	$9,300	$26,280	--
Ease of implementation	Easy	Difficult	Difficult	Already implemented	Easy	Difficult	--
Timeline of Implementation (year range)	<1 year	>3 years	>3 years	Complete	4 years (split dose)	2 years	--
Water quality model and P budget required	Simple Lake Response	Simple Lake Response	2-dimensional water quality model	No	Simple Lake Response	Groundwater/Lake Response	Groundwater/Lake Response
Risks	Low	Unknown	High – controlling hydrogen sulfide gas may difficult	None	Low	Moderate – Potential hydrogen sulfide issues near infiltration gallery	None

1 Removals assume a flow rate of 360 gpm for 150 days from the epilimnion

Optimizing the Flocculation System TP Removals

Alternative 1 focused on improving the performance of the alum flocculation facility by replacing the current alum and polymer mix with the Aqua Hawk RE2 polymer or upgrading the filter to improve performance. The City reports that recent testing of the Aqua hawk RE2 polymer was promising and would likely allow pumping rates to increase into the originally designed 250 to 400 gpm without major upgrades to the alum flocculation system. Based on 2019 and 2020 performance and assuming a flow rate around 360 gpm, this would improve performance of the alum flocculation system from an average annual TP removal of 14 to 42 pounds using the surface intake. The City plans to resume operations of the flocculation treatment system in 2022 with Aqua Hawk RE2 polymer addition and to continue optimizing the dose and increasing the operational flow rate to the extent possible. It should be noted that the city has only tested the new polymer at a flow rate of 250 gpm. The city plans to test the new polymer at 400 gpm in 2022.

Optimizing Flocculation System Inflow TP Concentrations and In-lake Alum Treatment

Inflow P concentrations and subsequent P loads were also below expectations outlined in the Feasibility Study. Inflow concentrations were primarily limited by high hydrogen sulfide concentrations in the hypolimnion preventing the use of the bottom intake. Hypolimnetic P concentrations were, on average, more than 3 times higher than epilimnion concentrations. Pumping water from the hypolimnion could increase TP removals by 8 pounds under current flow rates and could increase to a total of 66 pounds TP if the flocculation system flow rates increased to 360 gpm. It should be noted that there is a high level of uncertainty in the hypolimnetic P concentrations due to potential influence of an aerator diffusor on one site. Further, the hypolimnion is extremely high in iron which may be affecting ORP measurements. For this study, we attempted to be conservative and used our best professional judgment to determine the potential removals when withdrawing from the hypolimnion of Taft Lake.

To use the deep lake intake and increase P removal, the flocculation system needs to be modified to control hydrogen sulfide escape to the atmosphere by enclosing the treatment system, adding odor control and safety monitoring to the system building, and returning treated water to the hypolimnion. Controlling hydrogen sulfide release in the flocculation system and building may prove to be difficult and there is a high level of uncertainty for success. Treated water needs to be returned to the hypolimnion to prevent hydrogen sulfide release. The temperature of the return water needs to be monitored continuously to ensure warming is not occurring that may result in upwelling and destratification. Capital costs to enclose the facility could approach $200,000 and may likely be more if hydrogen sulfide leaks from other areas of the system.

This approach requires the lake remain stratified throughout the summer to allow sediment P release and buildup in the hypolimnion. The Taft Lake aeration system would need to be modified to expand the oxygenated areas of the lake without destratifying the lake which may be difficult. To fully develop an operations plan for the aeration system to support hypolimnetic withdrawal, a two-dimensional model would likely need to be developed to understand stratification dynamics throughout the season.

Alternatively, an in-lake alum treatment could be pursued to reduce sediment P release eliminating the need to withdraw from the hypolimnion. The alum treatment could reduce annual TP loading to Taft Lake by 35 pounds at roughly the same cost ($200,000) as enclosing the flocculation system. The alum treatment has a much higher level of certainty for success based on numerous successful alum treatment projects around the Twin Cities Metro Area. This approach allows for continued use of the flocculation system using the shallow intake to avoid hydrogen sulfide gas release.

Optimizing Taft Lake Infiltration System Inflow TP Concentrations

Another option explored to improve TP removal from Taft Lake was increasing the TP concentrations delivered to the Taft lake infiltration system by pumping from the deep intake rather that the surface intake. Pumping the higher concentration bottom water could increase TP removal from the infiltration system by 25 pounds. Because the current intake feeds both the flocculation and infiltration systems, this approach requires a new lift station and withdrawal line so both systems could be operated independently and maximize flow rates to the system. Capital costs to update the system could exceed $600,000 and may require a building addition to house the new lift station. As mentioned above, this approach also requires maintaining stratification throughout the summer season which may prove challenging while operating the aeration system to improve lake habitat.

6.2 Recommended Approach

Based on the review of the alternatives, the most viable approach to improving TP removal for Taft Lake includes:

- Alternative 1: Implementation of the RE2 polymer to increase pumping rates to 360 gpm
- Alternative 4: Completion of an alum treatment on Taft Lake

Implementation of these two actions could increase removals by 63 additional pounds of TP annually from Taft Lake (Table 5). Use of the Aqua Hawk RE2 polymer will allow the flocculation system to perform close to the low end of the removals estimated in the 2012 Feasibility Study using the shallow intake. The alum treatment will eliminate the need to maintain stratified conditions in Taft Lake and manage hydrogen sulfide in the flocculation system while allowing the flocculation system to remove TP from the Taft Lake and Legion Lake discharge. This approach also allows for continued use of the aeration system to improve habitat in the lake.

Table 5 Recommended Options

Action	Current Annual Average TP removal (pounds)	Enhanced Annual Average TP removal (pounds)	Additional TP Removal
Epilimnetic withdrawal with 360 gpm (Aqua Hawk RE2 polymer)	14	42	28
Alum Treatment	--	35	35
Taft Lake Infiltration System (no change)	5	5	--
Legion Lake Infiltration (no change)	66	66	--
TOTAL	85	148	63
Target Removal (pounds TP)	167 to 413		

To further evaluate these two alternatives, the City of Richfield intends to continue testing of the Aqua Hawk RE2 using a flow rate of 400 gpm. The city will maintain this flow rate unless filter backwash rates are too frequent. After approximately 8 weeks of operations data is available, the City and Barr can re-assess if 360 gpm is feasible. Once these tests are completed, the city will discuss next steps with MCWD to determine if the agreement needs to be updated. The City will also discuss the completion of an alum treatment on Taft Lake with MCWD. The city intends to adjust monitoring to ensure the aeration system is not impacting hypolimnetic data and to better describe iron dynamics in Taft Lake.

City of Richfield and Minnehaha Creek Watershed District Cooperative Agreement

The cooperative agreement between the City of Richfield and the Minnehaha Creek Watershed District suggests the installed BMPs should achieve 134 to 280 acre-feet in volume reduction and 167 to 413 pounds of TP reduction (Table 6). In 2019 and 2020, the average removal for these BMPs was a volume of 145 acre-feet and 71 pounds of TP. While the volume reduction was within the agreement range, TP removals were well below the agreement range. Implementation of the Aqua Hawk RE2 polymer and a whole lake alum treatment would increase TP removal to 148 pounds TP annually, within the range outlined in the agreement.

Table 6 Existing Cooperative Agreement Performance Benchmarks

Best Management Practice	Parameter	Range
Alum Flocculation System	TP Load Reduction	40 to 160 pounds
Infiltration	Volume Reduction	134 – 280 acre-feet
	TP Load Reduction	127 to 253pounds

It should be noted that TP concentrations in Taft Lake have improved since 2013 and met the state water quality standard twice between 2016 and 2020 as the BMP projects were implemented (Figure 3). One of the primary goal's of the project is for Taft Lake to consistently meet water quality standards. When Taft Lake meets water quality standards, downstream waters will also be protected. It is likely that once the

flocculation facility can treat 360 gpm and the in-lake alum treatment is completed, the lake will meet water quality standards.

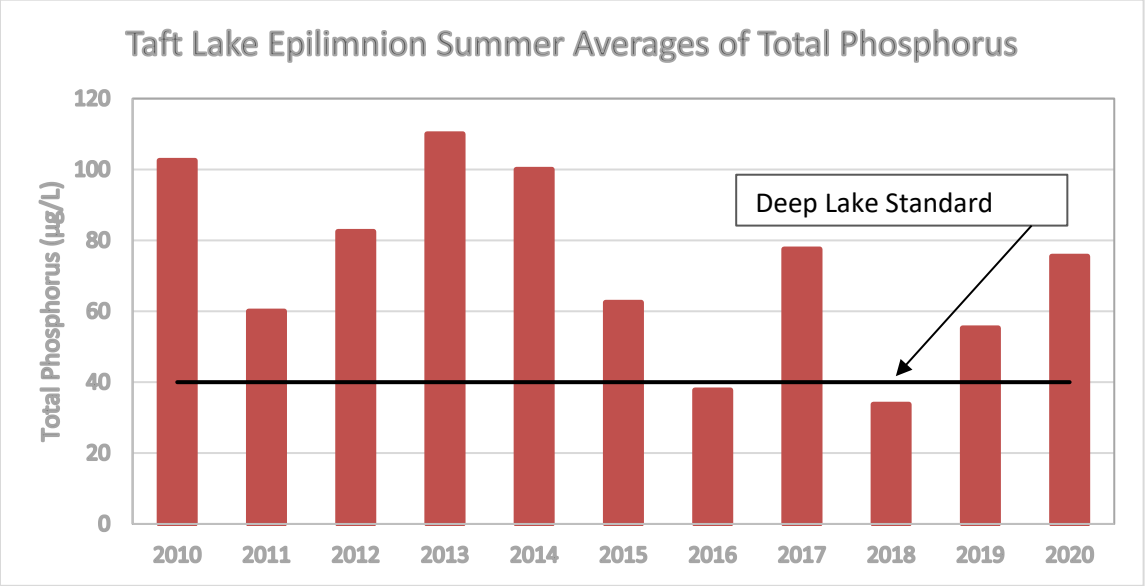


Figure 3 Surface total phosphorus concentrations in Taft Lake

7.0 References

Barr. 2020a. June 2021. *2020 Lake and Pond Water Quality Monitoring. Report* to the City of Richfield.

Barr. 2020b. September 2020. *2020-2022 Work Plan, Taft Lake Flocculation System Evaluation*

Barr. 2022. Alum dose and cost estimate for Taft Lake. Technical memorandum to the City of Richfield. January 2022.

WSB & Associates, Inc., 2010; updated 2012. *Feasibility Report, Taft Lake/Legion Lake Watershed Water Quality Improvement Project*. Prepared for City of Richfield. WSB Project No. 1532-47. May 2010; Updated August 2012.

8.0 Certifications

I hereby certify that this plan, specification, or report was prepared by me or under my direct supervision and that I am a duly Licensed Professional Engineer under the laws of the state of Minnesota.

Michelle Stockness
PE #: 45155

Date