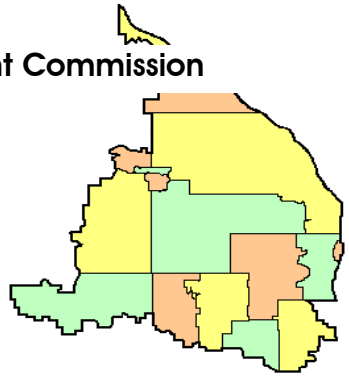
item 01

Shingle Creek Watershed Management Commission

West Mississippi Watershed Management Commission



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September 27, 2019

Commissioners
Shingle Creek and West Mississippi
Watershed Management Commissions
Hennepin County, Minnesota

The agenda and meeting packet are available to all interested parties on the Commission's web site. The direct path is http://www.shinglecreek.org/minutes--meeting-packets.html

Dear Commissioners:

Regular meetings of the Shingle Creek and West Mississippi Watershed Management Commissions will be held **Thursday, October 10, 2019,** at Edinburgh USA, 8700 Edinbrook Crossing, Brooklyn Park, MN. Lunch will be served at 12:00 noon and the meetings will convene concurrently at 12:45.

The Commissions will suspend their meetings at 12:45 p.m. for the purpose of conducting a public meeting on a proposed Minor Amendment to the Shingle Creek/West Mississippi Third Generation Watershed Management Plan. The regular meetings will resume immediately after the public meeting concludes.

Please email me at judie@jass.biz to confirm whether you or your Alternate will be attending the regular meeting.

Your meal choices are:

_____ Grilled Steak Salad, Mixed Greens, Bacon, Blue Cheese, Grilled Scallions, Avocado, Smoked Tomato Vinaigrette (GF) (All Dressing will be served on the side), Freshly Baked Breads

_____ BLT Chicken Sandwich, Bacon, Lettuce, Tomato, Aioli, Onion Roll (DF) Kettle Chips

_____ Sautéed Salmon, Peas, Fingerling Potatoes, Charred Tomato Relish (GF, DF)

_____ I will be attending but DO NOT want a meal.

_____ I will not be attending the regular meeting.

We must make final reservations by **noon Wednesday, October 2, 2018.** Please make a reservation, even if you are not requesting a meal, so we can arrange for sufficient seating and meeting materials. Thank you.

Regards,

Judie A. Anderson
Administrator

cc: Alternate Commissioners, Member Cites, Troy Gilchrist, TAC Members, Metropolitan Council, Wenck Associates

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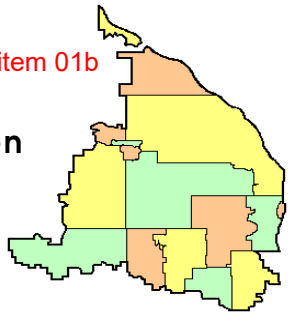
item 01b



Shingle Creek Watershed Management Commission

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A combined regular meeting of the Shingle Creek and West Mississippi Watershed Management Commissions will be convened on Thursday, October 10, 2019, at 12:45 p.m. at Edinburgh USA, 8700 Edinbrook Crossing, Brooklyn Park, MN. The Commissions will suspend their meetings at 12:45 p.m. for the purpose of conducting a public meeting on a proposed Minor Amendment to the Shingle Creek/West Mississippi Third Generation Watershed Management Plan. The regular meetings will resume immediately after the public meeting concludes. Agenda items are available at **http://www.shinglecreek.org/minutes--meeting-packets.html.**

		1.	Call to Order.
	SCWM	a.	Roll Call.
√	SCWM	b.	Approve Agenda.*
√	SCWM	c.	Approve Minutes of Last Meeting.*
		2.	Reports.
√	SC	a.	Treasurer's Report.*
√	SC	b.	Approve Claims* - voice vote.
√	WM	c.	Treasurer's Report.*
√	WM	d.	Approve Claims* - voice vote.

Suspend regular meetings.

	SCWM	3.	Public Meeting for Minor Plan Amendment to SCWM Third Generation Plan.
	SCWM	a.	Staff Report.*
	SCWM	b.	Commission discussion.
	SCWM	c.	Open Public Meeting.
	SCWM	1)	Receive Written Comments.
	SCWM	2)	Receive Comments from Public.
	SCWM	d.	Close Public Meeting.
	SCWM	e.	Commission Discussion.
√	SC	f.	Consider Resolution SC2019-04.*
√	WM	g.	Consider Resolution WM2019-04.*

Resume regular meetings.

	SCWM	4.	Open forum.
		5.	Project Reviews.
√	SC	a.	SC2019-006 Twin Lake North, Crystal.*
√	WM	b.	WM2019-008 North Park Business Center Building 3, Brooklyn Park.*
√	WM	c.	WM2019-009 Coon Rapids Dam Regional Park, Brooklyn Park.*
		6.	Watershed Management Plan.
	SCWM	7.	Water Quality.
√	SC	a.	Twin Lake North Cost Share Application.*
	SCWM	b.	Next TAC meeting – tentatively 8:30 a.m., Thursday, October 24, 2019, Crystal City Hall.
		1)	September 12, 2019 TAC Meeting Minutes* - information only.

(over)

SCWM 8. Education and Public Outreach.
SCWM a. Education and Outreach – update.**
SCWM b. Next WMWA meeting – 8:30 a.m., Tuesday, November 12, 2019, Plymouth City Hall.
9. Grant Opportunities and Updates.
SC a. Twin Lake Carp Removal – final report.*
SCWM b. Biochar/Iron Sand Bacteria Filter Project – final report.*
SCWM c. Hennepin County Good Steward Grants.*
SC d. CWF Grant Applications.*
SC 1) Meadow Lake Management Plan.*
SC 2) Shingle Creek Connections II.
√ SC a) Project Accounting.*
SCWM 10. Communications.
SCWM a. Communications Log.*
SCWM 11. Other Business.
SCWM 12. Adjournment.

Shingle Creek Watershed Management Commission
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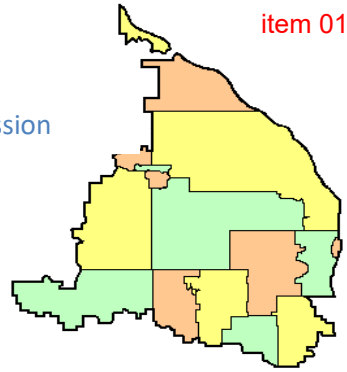


MINUTES
Regular Meeting and Public Hearing
September 12, 2019

(Action by the SCWMC appears in blue, by the WMWMC in green and shared information in black.
*indicates items included in the meeting packet.)

I. A joint meeting of the Shingle Creek Watershed Management Commission and the West Mississippi Watershed Management Commission was called to order by Shingle Creek Chairman Andy Polzin at 12:45 p.m. on Thursday, September 12, 2019, at Edinburgh, USA, 8700 Edinbrook Crossing, Brooklyn Park, MN.

Present for Shingle Creek were: David Vlasin, Brooklyn Center; Steven Chesney, Brooklyn Park; Burton Orred, Jr., Crystal; Karen Jaeger, Maple Grove; Bill Wills, New Hope; Harold E. Johnson, Osseo; Andy Polzin, Plymouth; Wayne Sicora, Robbinsdale; Ed Matthiesen and Diane Spector, Wenck Associates, Inc.; Troy Gilchrist, Kennedy & Graven; and Judie Anderson, JASS.

Not represented: Minneapolis.

Present for West Mississippi were: David Vlasin, Brooklyn Center; Steven Chesney, Brooklyn Park; Karen Jaeger, Maple Grove; Harold E. Johnson, Osseo; Ed Matthiesen and Diane Spector, Wenck Associates, Inc.; Troy Gilchrist, Kennedy & Graven; and Judie Anderson, JASS.

Not represented: Champlin.

Also present were: Andrew Hogg, Brooklyn Center; Mitch Robinson and Alex Prasch, Brooklyn Park; Todd Tuominen, Champlin; Mark Ray, Crystal; Derek Asche, Maple Grove; Liz Stout and Shahram Missaghi, Minneapolis; Bob Grant and Megan Hedstrom, New Hope; Ben Scharenbroich and Leah Gifford, Plymouth; Steve Christopher, Board of Water and Soil Resources (BWSR); and Randy Nelson, Margaret Milner and Vicki Herald, residents, Brooklyn Center.

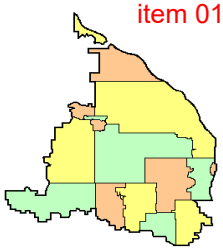
II. Agendas and Minutes.

Motion by Jaeger, second by Chesney to approve the **Shingle Creek agenda.*** *Motion carried unanimously.*

Motion by Johnson, second by Vlasin to approve the **West Mississippi agenda.*** *Motion carried unanimously.*

Motion by Jaeger, second by Chesney to approve the **minutes of the August regular and public meetings.*** *Motion carried unanimously.*

Motion by Johnson, second by Vlasin to approve the **minutes of the August regular and public meetings.*** *Motion carried unanimously.*



III. Finances and Reports.

A. Motion by Chesney, second by Jaeger to approve the Shingle Creek **September Treasurer's Report.*** *Motion carried unanimously*.

Motion by Vlasin, second by Johnson to approve the **Shingle Creek September claims.*** Claims totaling $61,436.17 were *approved by roll call vote:* ayes – Vlasin, Chesney, Orred, Jaeger, Wills, Johnson, Polzin, and Sicora; nays – none; absent – Minneapolis.

B. Motion by Jaeger, second by Chesney to approve the **West Mississippi September Treasurer's Report.*** *Motion carried unanimously*.

Motion by Johnson, second by Jaeger to approve the **West Mississippi September claims.*** Claims totaling $9,832.08 were *approved by roll call vote:* ayes – Vlasin, Chesney, Jaeger, and Johnson; nays – none; absent - Champlin.

[The regular meeting was suspended at 12:49 p.m. in order to conduct a public hearing.]

IV. Public Hearing.*

A. At the August 8, 2019 meeting the Commissions called for a public hearing for today to consider the Crystal Lake Management Plan and the annual City Cost Share and Partnership Cost Share projects for certification to the County for ad valorem levy. The cities and the county have been notified and notice has been duly published. The purpose of the public hearing is to present the proposed projects and proposed financing and to take comment from the member cities and the public.

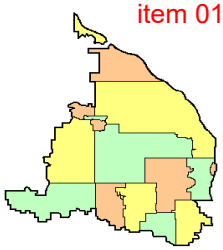
B. Shingle Creek Projects.

1. Commission Fund for Retrofit Cost Share (City Projects). This annual project provides cost sharing to retrofit smaller BMPs. The TAC developed policies and procedures to administer these funds, and makes recommendations to the Commissions on which projects should be funded. Brooklyn Park, Brooklyn Center, Minneapolis, Crystal, Robbinsdale, and New Hope have all received matching funds for small voluntary BMP projects. The annual levy is $100,000, to be matched at least one-to-one by a member city or cities. Applications are open until funds are depleted. Potential cost-share projects for 2020 will be solicited in November-December 2019. The program is open until all funds have been used.

Shingle Creek 2019 CIP Projects (2020 levy).

Project	Total Est Cost	City/Private	Grant	Comm Share	Total Levy
Cost share (city projects)	$200,000	$100,000	0	$100,000	$106,050
Partnership cost share (private projects)	$100,000	$50,000	0	$50,000	$53,025
Crystal Lake Management Plan	$370,506	$0	0*	$370,506	$392,915
Subtotal	**$670,506**	**$150,000**	**$ 0**	**$520,500**	
5% additional for legal/admin costs				**26,025**	
Subtotal				**546,525**	
TOTAL LEVY (101% for uncollectable)				**$551,990**	

2. Priority BMP Retrofits (Private Partnership Projects). Two projects have been funded, Phases 1 and 2 of Autumn Ridge). The annual levy is $50,000 and funding does not require a match. Potential cost-share projects are open year-round until the funds are depleted.



3. Crystal Lake Management Plan. This project is rough fish and aquatic vegetation management, alum treatments applied over two years, and lake monitoring. The Shingle Creek Commission received a Feasibility Study for this project at the time the Section 319 grant application was approved in April 2019. Robbinsdale is the lead city on this project. The MPCA has confirmed that the EPA has since approved this application and that the MPCA is awaiting receipt of funds so a contract can be developed.

C. West Mississippi Projects.

Commission Fund for Retrofit Cost Share (City Projects). Similar to Shingle Creek, this annual project provides cost sharing to retrofit smaller BMPs. No project applications have been received to date.

West Mississippi 2019 CIP Projects (2020 levy).

Project	Total Estimated	City/ Private	Grant	Commission Share	Total Levy
Cost share (city projects)	$100,000	$50,000	0	$50,000	$53,025
Subtotal	**$100,000**	**$50,000**	**$ 0**	**$50,000**	
5% additional for legal/admin costs				**2,500**	
Subtotal				**52,500**	
TOTAL LEVY (101% for uncollectable)				**$53,025**	

D. Open public hearing. The public hearing was opened at 12:54 p.m.

1. No comments on the proposed amendment were received from either the member cities or the public. No one was present from the general public for this hearing.

2. The public hearing was closed at 12:57 p.m.

E. Commission Discussion.

Motion by Wills, second by Chesney to adopt **Resolution 2019-03** Ordering 2019 Improvements ... and Certifying Costs to Hennepin County …. * *Motion carried unanimously.*

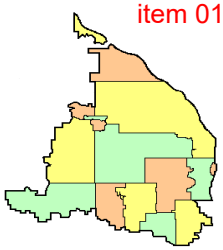
Motion by Johnson, second by Jaeger to adopt **Resolution 2019-03** Ordering 2019 Improvements ... and Certifying Costs to Hennepin County …. * *Motion carried unanimously.*

[The regular meeting resumed at 12:58 p.m.]

V. Open Forum.

VI. Project Reviews.

WM2019-007: Brooklyn Park-Champlin Interceptor Renewal Phase II.* The proposed project is the rehabilitation of sanitary sewer through lining, replacement, and construction of sanitary sewer pipe, and the construction of a city submersible pump station. The site is 14.2 acres. Following development, there will be a negligible increase in impervious surface (i.e., 189 SF of additional impervious surface). The site will have 7.0 acres of impervious surface and will, therefore, be 49.2 percent impervious. A complete project review application was received August 1, 2019.



This is an approximately 17,318-foot linear project located at two sites: Site 2 along West River Road and Riverview Lane N between 83rd and 89th Avenues North and Site 3 along Riverview Lane North and 81st Avenue North. The improvements will include Cured in Place Pipe (CIPP) lining of 5,208 LF of existing 48"-66" diameter sewer pipe, construction of approximately 4,025 LF of 72" Reinforced Plastic Mortar Pipe (RPMP), construction of approximately 8,085 LF of 8" PVC city sanitary sewer, replacement of sewer and watermain in construction areas, temporary conveyance and pumps, and construction of a city submersible pump station. The project will disturb approximately 14.2 acres.

Typically, to comply with the Commission's water quality treatment requirement, the site must provide ponding designed to NURP standards with dead storage volume equal to or greater than the volume of runoff from a 2.5" storm event, or BMPs providing a similar level of treatment - 85% TSS removal and 60% TP removal. However, the increase of impervious surface at this site is negligible, so the applicant meets Commission water quality treatment requirements.

Commission rules require that site runoff is limited to predevelopment rates for the 2-, 10-, and 100-year storm events. Because the increase in impervious surface at this site is negligible, the applicant meets Commission rate control requirements.

Commission rules require the site to infiltrate 1.0 inch of runoff from new impervious area within 48 hours, but, because the increase in impervious area is negligible, the applicant meets Commission volume requirements.

The erosion control plan includes perimeter silt fence, double-row silt fence surrounding wetlands, inlet protection, and native seed specified on pond slopes. The erosion control plan meets Commission requirements.

Wetlands are absent from most of the study area. However, the National Wetlands Inventory identifies three potential and/or probable wetlands in the project area, all of which are in Brooklyn Park. The applicant has submitted a memo to the WCA LGU for Brooklyn Park, i.e., West Mississippi WMC. The applicant believes this information will lead to the conclusion that none of these sites are wetlands. This memo has not yet been reviewed, so it is unknown if the applicant meets Commission wetland requirements.

There are no Public Waters on this site. The applicant meets Commission Public Waters requirements.

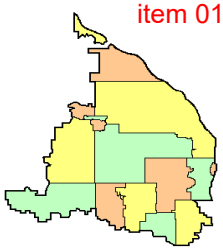
There is FEMA 100-year floodplain in two areas within the project boundaries. The FEMA floodplain on the portion of the site adjacent to County Ditch No. 5 (Mattson Brook) will not be affected by the proposed work. The second FEMA floodplain is at the site of the proposed lift station, adjacent to 8030 Mississippi Lane N. Here, FEMA floodplain elevation of the Mississippi River is 822 ft. and grading associated with the lift station proposes to fill this floodplain with 734 CF. The applicant proposes to provide 766 CF of compensatory storage adjacent to the lift station. The applicant meets Commission floodplain requirements.

There have been several public meetings about this project, including a presentation at National Night Out on August 6, 2019. A neighborhood meeting will be held as construction gets closer. The applicant meets Commission public notice requirements.

Motion by Vlasin, second by Johnson to advise the cities of Brooklyn Park and Champlin that Project WM2019-007 is approved contingent upon resolution of WCA issues at the three potential/probable wetland sites. *Motion carried unanimously.*

VII. Watershed Management Plan.

A proposed Minor Plan Amendment would add two projects to the Capital Improvement Program (CIP). The first is Brooklyn Park's River Park Stormwater Improvements project requested to be added to



the West Mississippi CIP The Technical Advisory Committee reviewed this project at the TAC meeting held just prior to this meeting and recommended to the Commission that this project be added to the CIP. The second is Plymouth's Enhanced Street Sweeper proposed to be added to the Shingle Creek CIP, in accordance with the newly revised and adopted Cost Share Policy.

The Commissions must send a copy of the proposed minor plan amendment to the member cities, Hennepin County, the Met Council, and the state review agencies for review and comment, and must hold a public meeting to explain the amendment. This meeting must be public noticed twice, at least seven and 14 days prior to the meeting. The Minor Plan amendment would then be forwarded to Hennepin County for consideration by the Hennepin County Board. Because it is a joint Management Plan both Commissions must authorize proceeding with the Minor Plan Amendment.

The proposed minor plan revision is shown below as additions (underlined) or deletions (~~strike outs~~).

Table 4.5. Shingle Creek WMC Third Generation Plan Implementation Plan is hereby revised to add as follows:

Action	2018	2019	2020	2021	2022
Plymouth Enhanced Street Sweeper			350,000		
-Commission Contribution			75,000		
-Local Contribution			275,000		

Table 4.6. West Mississippi WMC Third Generation Plan Implementation Plan is hereby revised as follows:

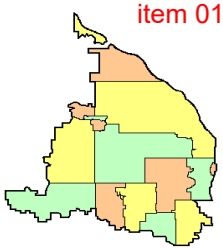
Action	2018	2019	2020	2021	2022
River Park Stormwater Improvements			485,000		
-Commission Contribution			121,250		
-Local Contribution			363,750		

Appendix F, CIP Descriptions is hereby revised to add as follows:

Plymouth Enhanced Street Sweeper
Plymouth will purchase and operate a regenerative air street sweeper to enhance its street sweeping program to four full city sweeps per year. Enhanced street sweeping has been identified in the Bass, Schmidt & Pomerleau TMDL, the Cedar Island, Pike and Eagle Lake TMDL and the Pike Lake Subwatershed Assessment as a cost-effective BMP for nutrient reductions.

River Park Stormwater Improvements
Brooklyn Park's River Park Master Plan includes stormwater improvements that will provide water quality treatment for 250 acres of mixed use lands that currently discharge into the Mississippi River with no treatment. The stormwater improvements are also intended to provide an improved habitat for animals and insects and an educational space for the residents of the community to learn about water quality.

Motion by Chesney, second by Wills to add these projects to the CIP and proceed with the proposed Minor Plan Amendment to a public meeting on October 10, 2019. *Motion carried unanimously.*



Motion by Jaeger, second by Chesney to add these projects to the CIP and proceed with the proposed Minor Plan Amendment to a public meeting on October 10, 2019. *Motion carried unanimously.*

VIII. Water Quality.

The next **Technical Advisory Committee (TAC) meeting** is scheduled for 11:30 a.m., Thursday, October 10, 2019, prior to the regular meetings.

IX. Education and Public Outreach.*

A. At recent WMWA and Commission meetings members have discussed contracting for a part-time project coordinator for WMWA. Given limited staff and volunteer time availability, WMWA has not been able to make meaningful progress towards achieving the goals of this consortium. A coordinator would be able to take on the routine tasks of implementation as well as special projects, allowing WMWA to serve primarily as an oversight and advisory group.

The Steering Committee has drafted a Project Coordinator job description* for consideration by the member commissions. It identifies primary job duties and tasks as well as some additional job duties that are now part of the administrative budget that could be considered for this position in the future. It is estimated that initially the contractor would work 8-10 hours per week or about 30 hours per month on average, at $40/hour, similar to the educators. For the balance of 2019 it is suggested that WMWA and the member Commissions fund the contract coordinator through the Special Projects budget. The four partners each budgeted $2,000 for 2019 for Special Projects, but since there was carryover funding from 2018 sufficient to cover existing 2019 activities, that $8,000 has not yet been invoiced and received. Billing that amount now and adding the $8,000 budgeted in 2020 would cover most of the position for 2019 and 2020.

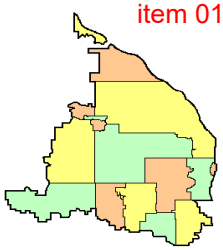
Proposed Project Coordinator funding.

2019 Special Projects unbilled balance	$8,000
3 months * 30 hours * $40	$3,600
Expected special projects carryover to 2020 + 2020 budget	$4,400 + $8,000 = $12,400
12 months * 30 hours * $40 (360 hours)	$14,400
Deficit	$2,000

As part of the 2021 budget process next spring, WMWA and the Commissions can evaluate progress and consider modifying the WMWA budget to fully fund 2020 and beyond, as the existing annual Special Projects budget would be inadequate to fund this contract on an ongoing basis.

The WMWA partner agreement states that uses of the Special Projects funds are required to be reviewed and approved by the four Commissions. The WMWA Steering Committee recommends approval. There is an individual, Catherine Cesnik, who is interested in this position. She currently is the alternate Plymouth Commissioner to both Bassett Creek WMC and Elm Creek WMC and has been actively involved in the WMWA Steering Committee. If the Commissions are in agreement, the Steering Committee will work with the Shingle Creek attorney to draft a contract for services similar to the contract used with the WMWA Educators or WMWA Social Media/Outreach Consultant.

Motion by Jaeger, second by Sicora to approve the WMWA Project Coordinator position description, authorize the Shingle Creek Commission, acting as fiscal agent, to contract with a part-time Project Coordinator to be funded from the WMWA Special Projects 2019 and 2020 budgets, and authorize the Commission's attorney to prepare the contract. *Motion carried unanimously.*



Motion by Johnson, second by Chesney to approve the actions cited above. *Motion carried unanimously.*

B. The **next WMWA meeting** is scheduled for 8:30 a.m., Tuesday, October 8, 2019, at Plymouth City Hall.

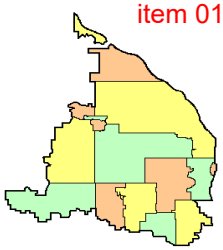
X. Grant Opportunities and Updates.

A. Meadow Lake Management Plan. (Staff memo dated August 7, 2019* and Project Summary dated September 6, 2019*) Meadow Lake is a shallow eutrophic lake located in New Hope that discharges through storm sewer to Bass Creek, a tributary of Shingle Creek. In 2002 the Minnesota Pollution Control Agency (MPCA) listed the lake as impaired for excess nutrients. In 2010, Wenck completed a TMDL and Implementation Plan to assess nutrient loading concerns and provide strategies to reduce excess nutrient loading.

In 2019 the Commission completed a TMDL Five-Year Review, summarizing progress to date and updating the nutrient budgets and targets using more recent and complete monitoring data. The 5-Year Review concluded with updated Implementation Plan activities for the coming 5-10 years to reduce both watershed and internal loading to Meadow Lake. Those activities are identified in Staff's memo.

Since significant progress has been made in reducing watershed load, it is appropriate at this time to start to manage the internal load. The Meadow Lake Management Plan would be completed in two phases: Phase 1 would be completed over 3-5 years and would focus on reestablishing a balanced biology by removing the fathead minnow population and limiting recolonization, reducing curly-leaf pondweed to non-nuisance levels, and restoring a healthy native aquatic vegetation community through a series of temporary drawdowns. Completed over 2-3 years, Phase 2 would focus on reducing phosphorus loading from the sediments. Annual monitoring would be conducted and would guide adaptive management until the desired outcome is achieved.

Task #	Task	Total Hrs.	Staff Costs	Const. Costs	Lab Costs	Expense	TOTAL Cost
1	Project Coordination	64	$12,360	$0	$0	$0	$12,360
2	Construction						
	Drawdown	40	$8,160	$50,000	$0	$0	$58,160
	SAV Treatment	24	$4,896	$6,000	$0	$500	$11,396
	Alum Treatment	36	$7,560	$70,000	$0	$500	$78,060
	Fish Barriers	12	$2,448	$15,000	$0	$0	$17,448
	Fish Treatment	24	$3,076	$5,000	$0	$500	$8,576
3	Monitoring						
	Water Quality	258	$30,897	$0	$16,740	$6,300	$53,937
	Fish Surveys and Permits	172	$20,806	$0	$0	$1,500	$22,306
	SAV Surveys and Permits	216	$13,500	$0	$0	$5,700	$19,200
	Sediment Coring	76	$8,805	$0	$10,000	$1,500	$20,305
4	Report	66	$8,124	$0	$0	$0	$8,124
5	Meetings	96	$16,688	$0	$0	$0	$16,688
6	Grant Reporting	12	$1,728	$0	$0	$0	$1,728
					Subtotal		**$328,288**
					Contingency 10%		$32,830
					TOTAL		$361,118



During Year 1 (spring 2020 to spring 2021, if a grant is awarded) a fall-winter drawdown will be conducted to consolidate sediments, eliminate fathead minnows and prevent recolonization, and reduce curly-leaf pondweed growth. During Years 2-3-4 (beginning spring 2021) the impact of the drawdown will be evaluated and chemical treatment of curly-leaf pondweed and/or fish done as necessary. During Years 4-5-6, alum will be applied in two doses one or two years apart. Between the doses sediment cores will be taken to verify second dose application rates. Total estimated costs are shown in the table above. The cost of undertaking the proposed actions, excluding monitoring and administration, equals approximately $1,318/lb. TP.

At the August meeting the Commission approved a BWSR Clean Water Fund Competitive Grant application be submitted for Phase I of this project using Closed Project funds as the Commission's match. With a project cost of $190,000, the grant request is $152,000 and the Commission's match is $38,000.

B. Shingle Creek Connections II. (Project Summary dated September 4, 2019*) Restoration of the reach of Shingle Creek from Regent/73rd Avenue to Brooklyn Boulevard is on the Commission's CIP for 2020. This is the segment between the restoration project done in conjunction with the Village Creek North development and the more recent Connections project on the east side of Brooklyn Boulevard and is the last significant non-wetland reach of Shingle Creek to be completed outside of the MPRB segments in Minneapolis.

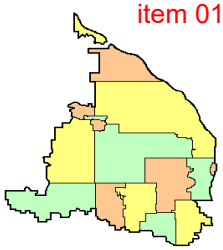
Shingle Creek is an impaired water for excess chloride and *E. coli*, low DO, and biotic integrity (macroinvertebrates). The primary aquatic life stressors are altered habitat, altered flow, low DO, loss of connectedness, and chloride. Contributors to the low DO impairment include the over-widened, flat-bottomed channel that reduces natural reaeration and results in excess sediment oxygen demand. The origin of that sediment oxygen demand is the sediment and nutrients transported to the stream from the watershed and from erosion of the streambanks. These restoration projects are identified in the TMDL Implementation Plan and focus on stabilizing streambanks, adding some roughness and aeration to the streambed, enhancing habitat, and adding or enhancing native buffers in the stream corridor.

In consultation with the cities of Brooklyn Center and Brooklyn Park, Staff developed 30% conceptual plans for the restoration of this segment. They anticipate that the nature of the work will be very similar to the other reaches that have been completed; however, some segments of the reach are experiencing severe erosion that will require more stabilization. Three concepts were considered, including lining the stream with boulder toe; using native vegetation to restore and stabilize the streambanks; and using some riprap and root wads to slightly re-meander the stream within its existing valley. Because these improvements address impairments to the stream, this project would fall under the Commissions' revised cost share policy whereby the Commission would fund the cost of Load Allocation reduction projects 100%. This project is currently on the CIP in 2020 for $400,000.

At the August meeting the Commission approved a Clean Water Fund grant application be submitted for this project. With an updated project cost of $410,000, the grant request is $328,000 and the Commission's match is $82,000.

C. Bass and Pomerleau Lakes Alum Treatment. Good responses from the May alum treatments have been reported.

D. Final reports for the **Twin Lake Carp Management** and **Biochar and Iron-Enhanced Sand Filter** projects will be available at the October meeting.



E. Staff reported that the **Crystal Lake Management Plan** has received EPA approval.

XI. Communications.

A. September Communications Log.* No items required action.

B. Letter of support from the West Mississippi Commission to the City of Brooklyn Park for the River Park project.

XII. Other Business.

The terms of representatives from Champlin and Minneapolis expired January 31, 2019. Staff have not received updated appointments as of this date. The Commissioner positions from the City of Brooklyn Park and Minneapolis have become vacant and new representatives must be appointed by those cities.

XIII. Adjournment. There being no further business before the Commissions, the joint meeting was adjourned at 1:40 p.m.

Respectfully submitted,

Judie A. Anderson
Recording Secretary
JAA:tim

Z:\Shingle Creek\Meetings\09 Regular Meeting_Public Hearing Minutes.doc

item 03a

Technical Memo

WENCK ASSOCIATES

Responsive partner.
Exceptional outcomes.

To: Shingle Creek/West Mississippi WMO Commissioners

From: Ed Matthiesen, P.E.
Diane Spector

Date: October 4, 2019

Subject: Proposed Minor Plan Amendment Public Meeting

Recommended Commission Action	Discuss Minor Plan Amendment. Each Commission should by motion adopt the attached resolution.

The Shingle Creek and West Mississippi Third Generation Watershed Management Plan and Capital Improvement Programs (CIP) are proposed for a Minor Plan Amendment (MPA), the third this year. The proposed Minor Plan Amendment would add two projects to the CIP. The first is Brooklyn Park's proposed River Park Stormwater Improvements project, to be added to the West Mississippi CIP. The second is Plymouth's Enhanced Street Sweeper proposed to be added to the Shingle Creek CIP. The Commissions have discussed each of these proposed improvements at previous meetings.

The Commissions initiated a MPA on September 12, 2019. Notice was sent to the member cities, county, and reviewing agencies, and published as required by statute and the Plan. The purpose of the October 10, 2019 Commission public meeting is to discuss the proposed minor plan amendment and any comments received prior to or at a public meeting. (Note this is not a formal public hearing.) After that discussion, each Commission may consider a resolution adopting the MPA contingent on County Board approval of the Minor Plan Amendment, which will be heard at a County Board hearing in November 2019.

Recommended Commission Action
The proposed minor plan amendment is attached. The Met Council has responded that they have no comments, and Hennepin County has reviewed and approved it. The Commissions should each approve their respective attached resolution adopting the proposed amendment.

Notice of Minor Plan Amendment
Shingle Creek and West Mississippi Watershed Management Commissions

The Shingle Creek and West Mississippi Watershed Management Commissions propose to amend their joint *Third Generation Watershed Management Plan* to add one project to the Shingle Creek CIP and one project to the West Mississippi CIP.

The proposed minor plan revision is shown as additions (underlined) or deletions (~~strike outs~~).

Table 4.5. Shingle Creek WMC Third Generation Plan Implementation Plan is hereby revised to add as follows:

Action	2018	2019	2020	2021	2022
Plymouth Enhanced Street Sweeper			350,000		
-Commission Contribution			75,000		
-Local Contribution			275,000		

Table 4.6. West Mississippi WMC Third Generation Plan Implementation Plan is hereby revised as follows:

Action	2018	2019	2020	2021	2022
River Park Stormwater Improvements			485,000		
-Commission Contribution			121,250		
-Local Contribution			363,750		

Appendix F, CIP Descriptions is hereby revised to add as follows:

Plymouth Enhanced Street Sweeper
Plymouth will purchase and operate a regenerative air street sweeper to enhance its street sweeping program to four full city sweeps per year. Enhanced street sweeping has been identified in the Bass, Schmidt & Pomerleau TMDL, the Cedar Island, Pike and Eagle Lake TMDL and the Pike Lake Subwatershed Assessment as a cost effective BMP for nutrient reductions.

River Park Stormwater Improvements
Brooklyn Park's River Park Master Plan includes stormwater improvements that will provide water quality treatment for 250 acres of mixed use lands that currently discharge into the Mississippi River with no treatment. The stormwater improvements are also intended to provide an improved habitat for animals and insects and an educational space for the residents of the community to learn about water quality.

SHINGLE CREEK WATERSHED MANAGEMENT COMMISSION
STATE OF MINNESOTA

RESOLUTION NO. 2019-04

ADOPTING A MINOR PLAN AMENDMENT TO THE THIRD GENERATION PLAN REVISING THE CAPITAL IMPROVEMENT PROGRAM

WHEREAS, on April 11, 2013, the Commission and the West Mississippi Watershed Management Commission jointly adopted the Shingle Creek and West Mississippi Third Generation Watershed Management Plan (the "Plan"); and

WHEREAS, the Plan includes a Capital Improvement Program ("CIP"); and

WHEREAS, the Commission has proposed a Minor Plan Amendment that would revise the CIP to add one project to the CIP; and

WHEREAS, the proposed Minor Plan Amendment has been reviewed in accordance with the requirements of Minnesota Statutes, Section 103B.231; and

WHEREAS, the Commission has determined that it would be reasonable and appropriate and in the public interest to adopt the Minor Plan Amendment.

NOW, THEREFORE, BE IT RESOLVED, by the Board of Commissioners of the Shingle Creek Watershed Management Commission that:

1. The Minor Plan Amendment is approved and adopted, subject to Hennepin County review.

2. Commission staff is directed to notify appropriate parties of the Amendment to the Plan.

Adopted by the Board of Commissioners of the Shingle Creek Watershed Management Commission this tenth day of October, 2019.

_____
David Vlasin, Vice Chair

ATTEST:

_____
Judie Anderson, Recording Secretary

State of Minnesota
Hennepin County

I, Judie Anderson, do hereby certify that I am the custodian of the minutes of all proceedings had and held by the Board of Commissioners of said Shingle Creek Watershed Management Commission, that I

have compared the above resolution with the original passed and adopted by the Board of Commissioners at a meeting thereof held on the tenth day of October, 2019, at 12:45 pm., that the above constitutes a true and correct copy thereof, that the same has not been amended or rescinded and is in full force and effect.

In witness whereof, I have hereunto placed my hand and signature this tenth day of October, 2019.

Print name: Judie A. Anderson Title: Administrator

Authorized signature: _____ Date: _____

(NO SEAL)

WEST MISSISSIPPI WATERSHED MANAGEMENT COMMISSION
STATE OF MINNESOTA

RESOLUTION NO. 2019-04

ADOPTING A MINOR PLAN AMENDMENT TO THE THIRD GENERATION PLAN REVISING THE CAPITAL IMPROVEMENT PROGRAM

WHEREAS, on April 11, 2013, the Commission and the Shingle Creek Watershed Management Commission jointly adopted the Shingle Creek and West Mississippi Third Generation Watershed Management Plan (the "Plan"); and

WHEREAS, the Plan includes a Capital Improvement Program ("CIP"); and

WHEREAS, the Commission has proposed a Minor Plan Amendment that would revise the CIP to add one project to the CIP; and

WHEREAS, the proposed Minor Plan Amendment has been reviewed in accordance with the requirements of Minnesota Statutes, Section 103B.231; and

WHEREAS, the Commission has determined that it would be reasonable and appropriate and in the public interest to adopt the Minor Plan Amendment.

NOW, THEREFORE, BE IT RESOLVED, by the Board of Commissioners of the West Mississippi Watershed Management Commission that:

1. The Minor Plan Amendment is approved and adopted, subject to Hennepin County review.

2. Commission staff is directed to notify appropriate parties of the Amendment to the Plan.

Adopted by the Board of Commissioners of the West Mississippi Watershed Management Commission this tenth day of October, 2019.

_____
Gerry Butcher, Chair

ATTEST:

_____
Judie Anderson, Recording Secretary

State of Minnesota
Hennepin County

I, Judie Anderson, do hereby certify that I am the custodian of the minutes of all proceedings had and held by the Board of Commissioners of said West Mississippi Watershed Management Commission,

that I have compared the above resolution with the original passed and adopted by the Board of Commissioners at a meeting thereof held on the tenth day of October, 2019, at 12:45 pm., that the above constitutes a true and correct copy thereof, that the same has not been amended or rescinded and is in full force and effect.

In witness whereof, I have hereunto placed my hand and signature this tenth day of October, 2019.

Print name: Judie A. Anderson Title: Administrator

Authorized signature: _____ Date: _____

(NO SEAL)

SHINGLE CREEK WATERSHED MANAGEMENT COMMISSION

PROJECT REVIEW SC2019-006: Twin Lake North Parking Lot

Owner: Twin Lake North Condominium Association
4710 58th Avenue
Crystal, MN 55429

Engineer: Stephen Mastey
Company: Landscape Architecture, Inc.
Address: 2350 Bayless Place
Saint Paul, MN 55114
Phone: (651) 646-1020
Email: stephen@landarcinc.com

Purpose: Removal of entire parking lot, reconstruction of a smaller parking lot, and installation of water quality BMPs (i.e., rain garden and vegetated buffer) on a 4.34-acre site.

Location: 4710 58th Avenue, Crystal, MN 55429 (Figure 1).

Exhibits:

1. Project review application form and project review fee of $1,700, dated 9/27/19, received 9/30/19.

2. Site plan, grading plan (Figure 2), utility plan, erosion control plan, and landscaping plans dated 9/29/19, received 9/30/19.

3. Hydrologic calculations by Brandt Engineering and Surveying LLC, dated 7/3/19, received 9/30/19.

Findings:

1. The proposed project is the removal of parking lot, reconstruction of a smaller parking lot and the installation of water quality BMPs, i.e., a rain garden and vegetated buffer. The site is 4.34 acres. Following development, the site will be 29 percent impervious with 1.26 acres of impervious surface, a decrease of 0.39 acres.

2. The complete project application was received on 9/30/19. To comply with the 60-day review requirement, the Commission must approve or deny this project no later than the 11/14/19 meeting. Sixty calendar-days expires on 11/29/19.

3. To comply with the Commission's water quality treatment requirement, the site must provide ponding designed to NURP standards with dead storage volume equal to or greater than the volume of runoff from a 2.5" storm event, or BMPs providing a similar level of treatment, i.e., 85% TSS removal and 60% TP removal. However, because this project reduces impervious surface area, the project is not held to Commission water quality standards. Still, the applicant proposes to install 1) a rain garden with sediment traps for pretreatment and tire-derived aggregate underneath for additional storage and 2) extensive vegetated buffer where the parking lot is currently. These BMPs likely remove 85% TSS and 60% TP from the site's runoff. The applicant meets Commission water quality treatment requirements.

4. Commission rules require that site runoff is limited to predevelopment rates for the 2-, 10-, and 100-year storm events. Runoff from the site is

routed either to a rain garden or to vegetated buffer to reduce runoff rates. However, because this project reduces impervious surface area, the project is not held to Commission runoff rate standards. The applicant meets Commission rate control requirements.

5. Commission rules require the site to infiltrate 1.0 inch of runoff from new impervious area within 48 hours. However, this project reduces impervious surface area (from 1.65 to 1.26 acres) and is therefore exempt from Commission volume standards. The applicant meets Commission volume control requirements.

6. The National Wetlands Inventory identifies approximately 0.95 acres of probable wetlands in the western portion of the parcel. The City of Crystal is LGU for WCA administration. Wetland buffers a minimum of 20 feet in width and averaging at least 30 feet in width are provided. The applicant meets Commission wetland requirements.

7. There is an unnamed DNR Public Water wetland on the western portion of the site. However, adequate wetland buffer is provided (see above) and the proposed project is not anticipated to negatively impact this wetland. The applicant meets Commission Public Waters requirements.

8. There is no FEMA-regulated floodplain on this site. However, there is a creek adjacent to the site that flows out of the MAC Crystal Wetland (Wetland 639) and into Upper Twin Lake, and although not FEMA-regulated, this creek has floodplain. Because the creek is hydraulically connected to Upper Twin Lake, the 100-year high water level for Upper Twin Lake, 855.5 ft., was assumed to be the 100-year high-water level for the creek (Figure 3). (A memo about this was sent from Wenck to the applicant on January 13, 2016.) Grading occurs below this 100-year high water level, but the net result of floodplain cut and fill is that this project creates 2,298 cubic feet or about 85 cubic yards of floodplain storage. In addition, the rain garden has an emergency overflow at 855.75, which is two feet below the low floor elevation of the building. The applicant meets Commission floodplain requirements.

9. An erosion control plan was submitted with the project review, and includes a rock construction entrance, a double row of straw wattle protecting the adjacent creek, inlet protection and native seed specified on the slope adjacent to the creek. The erosion control plan meets Commission requirements.

10. All residents that live within 300 feet of the project were notified through several Twin Lake North Homeowner Association Board meetings. The most recent Board meeting in which this information was presented was on 3/21/19. The project meets Commission public notice requirements.

11. A draft Operations & Maintenance (O&M) agreement between the owner and the City of Crystal was provided.

12. A Project Review Fee of $1,700 has been received.

SC2019-006: Twin Lake North Parking Lot

Recommendation: Recommend approval subject to the following condition:

1. Provide a complete O&M agreement between the owner and the City of Crystal for the rain garden.

2. Before installation, ensure tire derived aggregate is inspected on site by City of Crystal staff for signs of pollutants.

Wenck Associates, Inc.
Engineers for the Commission

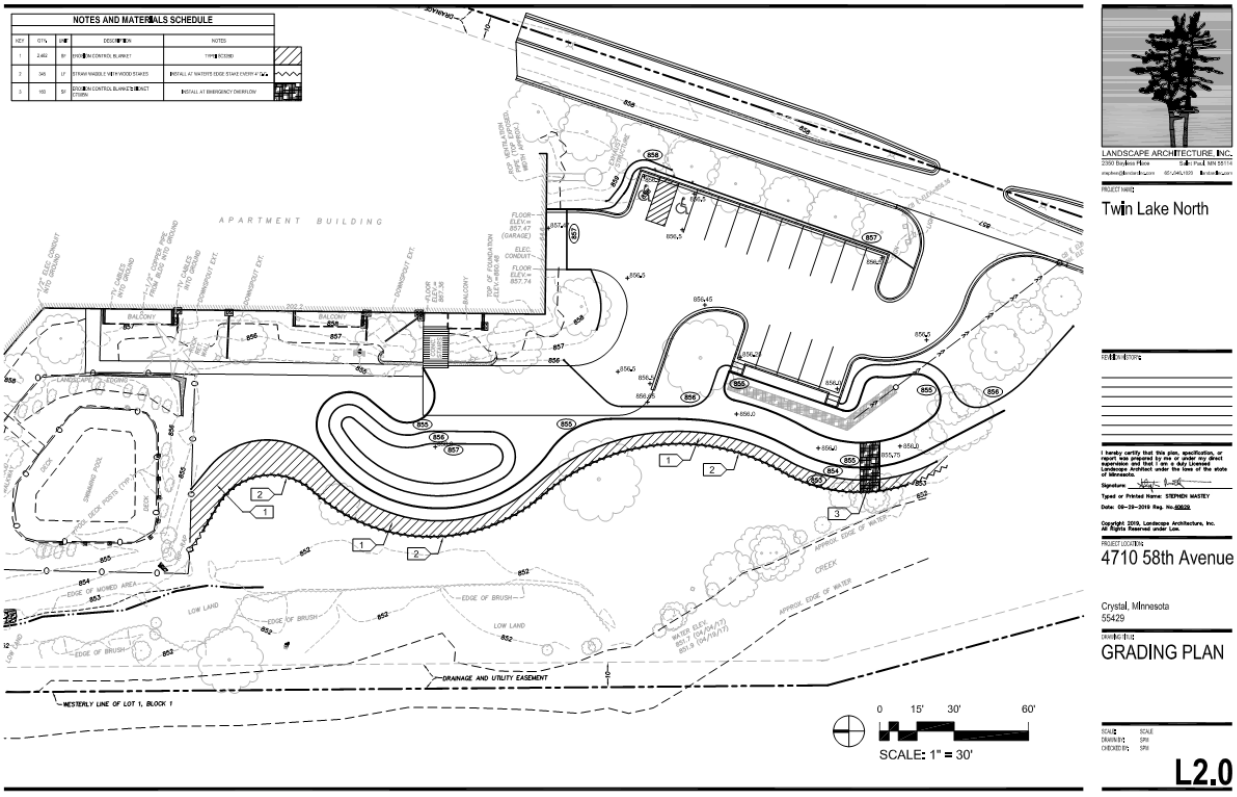
Ed Matthiesen, P.E. Date

SC2019-006: Twin Lake North Parking Lot

Figure 1. Site location.

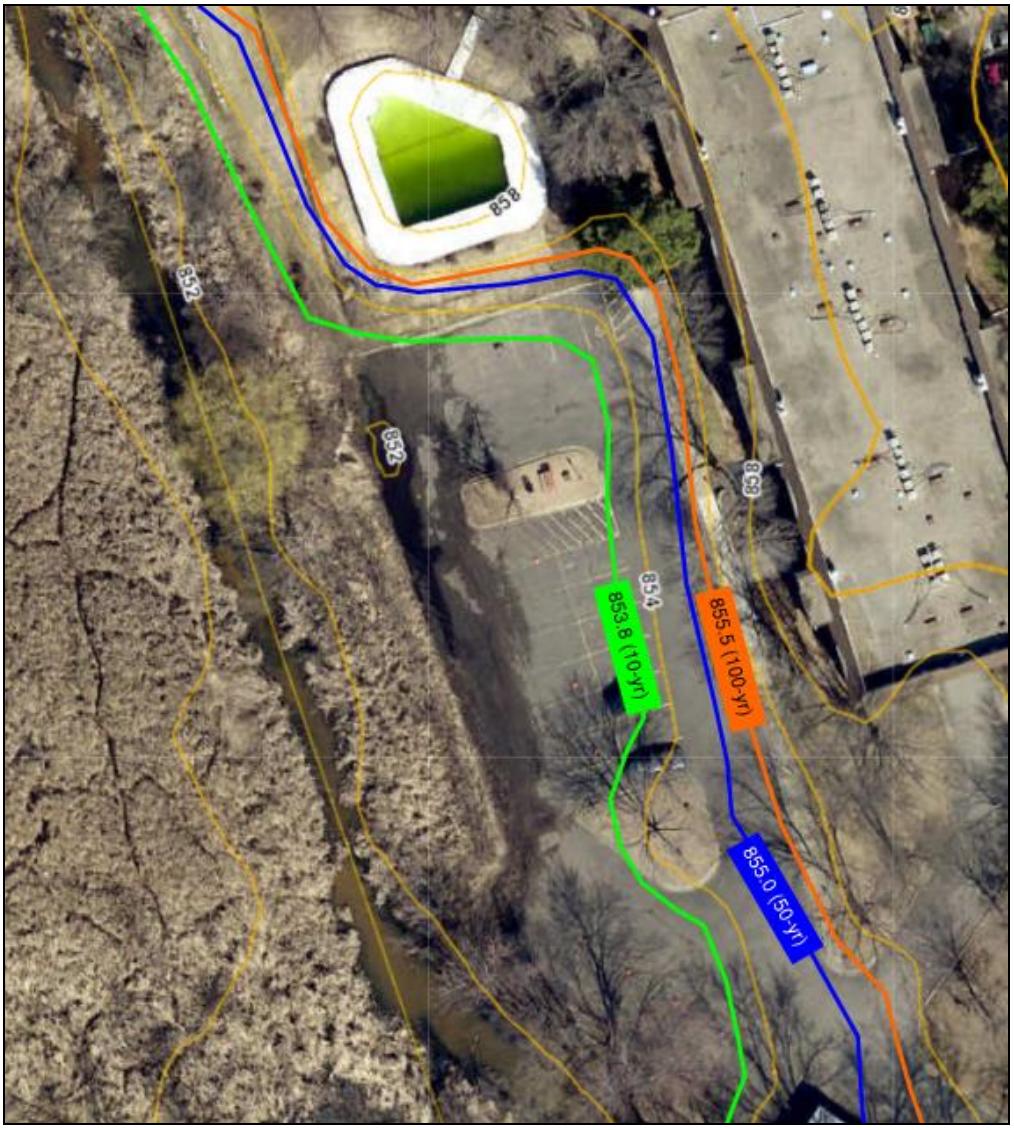
SC2019-006: Twin Lake North Parking Lot

Figure 2. Site grading plan.



SC2019-006: Twin Lake North Parking Lot

Figure 3. Floodplain on site.



WEST MISSISSIPPI WATERSHED MANAGEMENT COMMISSION

PROJECT REVIEW WM2019-008: North Park Business Center- Building 3

Owner: Scannell Properties, LLC
Address: 821 Meander Court
Suite 200
Medina, MN 55340

Engineer: Chuck Plowe
Company: Plowe Engineering, Inc.
Address: 6776 Lake Drive
Lino Lakes, MN 55014
Phone: 651-361-8210
Email: chuck@plowe.com

Purpose: Construction of 204,000 sf building with parking on 14.4 acres.

Location: South of 109th Ave North at Highway 169 (Figure 1).

Exhibits:

1. Project review application and project review fee of $2,200, dated 8/28/19, received 8/30/19.
2. Civil Plan Set dated 5/7/19, received 8/29/19.
3. Updated Grading and Utility Plan dated 10/01/19, received 10/01/19.
4. Master Plan HydroCAD model dated 3/1/19, received 8/29/19.
5. Temporary Pond HydroCAD model dated 9/14/19, received 10/01/19.
6. SHSAM Results dated 9/11/19, received 9/11/19.

Findings:

1. The proposed project is the North Park Business Center Building #3. It is part of a larger site called North Park Business Center that was approved in 2015 (WM 2015-005). The Building 3 site is 14.4 acres. Following development, the site will be 73 percent impervious with 10.55 acres of impervious surface, an increase of 10.45 acres.

2. The complete project application was received on 8/30/19. To comply with the 60-day review requirement, the Commission must approve or deny this project no later than the 10/10/19 meeting. Sixty calendar-days expires on 10/29/19.

3. To comply with the Commission's water quality treatment requirement, the site must provide ponding designed to NURP standards with dead storage volume equal to or greater than the volume of runoff from a 2.5" storm event, or BMPs providing a similar level of treatment, i.e., 85% TSS removal and 60% TP removal. Infiltrating 1.3-inches of runoff, for example, is considered sufficient to provide a similar level of treatment. If a sump is used the MnDOT Road Sand particle size distribution is acceptable for 80% capture.

   Runoff from the site is routed from the south and central portion of the site to an existing stormwater basin to the west which overflows to an infiltration basin on the southwest corner of the North Park Business Center master site. Runoff is pretreated via two sumps and a sediment

forebay. Runoff from the northeast parking lot and the north side of the site is routed to a temporary basin to the north. In the future, the temporary basin will be constructed into a stormwater basin which overflows into an infiltration basin. The master site infiltrates all stormwater, (it does not even discharge in the 100-year back-to-back event), meeting water quality treatment requirements.

4. Commission rules require that site runoff is limited to predevelopment rates for the 2-, 10-, and 100-year storm events. Runoff from the site is directed to a series of sediment ponds and infiltration basins that are a part of the North Park Business Center Master Plan. The sediment basins and infiltration basins were designed to contain the back-to-back 100-year event with no discharge off of the master site. The applicant meets Commission rate control requirements (Table 1).

Table 1. Runoff from site (cfs).

Drainage Area	2-year event		10-year event		100-year event	
	Pre-	Post-	Pre-	Post-	Pre-	Post-
Entire site	0	0	0	0	0	0

5. Commission rules require the site to infiltrate 1.0 inch of runoff from new impervious area within 48 hours. The new impervious area on this site is 10.45 acres, requiring infiltration of 0.87 acre-feet within 48 hours. The stormwater from the site flows to a stormwater basin that outlets into an infiltration basin that has the capacity to infiltrate the required volume within 48 hours. The applicant meets Commission volume control requirements.

6. The erosion control plan includes a rock construction entrance, perimeter silt fence, silt fence surrounding detention ponds/infiltration basins, inlet protection, rip rap at inlets, slope checks, and native seed specified on the pond slopes. The erosion control plan meets Commission requirements.

7. The 2015 review of the master site noted no wetlands on site. The project meets Commission wetland requirements.

8. There are no Public Waters on this site. The applicant meets Commission Public Waters requirements.

9. There is no FEMA-regulated floodplain on this site. The low floor elevations of the buildings are at least two feet higher than the high-water elevation of the detention ponds according to Atlas 14 precipitation. The applicant meets Commission floodplain requirements.

10. The site is not located in a Drinking Water Management Area (DWSMA). The applicant meets Commission drinking water protection requirements.

11. A public hearing for the project was conducted on March 13, 2019 as part of Planning Commission and City Council review of this project, meeting Commission public notice requirements.

12. An Operations & Maintenance (O&M) agreement between the applicant and the City of Brooklyn Park is in negotiation.

13. A Project Review Fee of $2,200 has been received.

Recommendation: Recommend approval with one condition:

1. Provide a complete O&M agreement between the applicant and the City of Brooklyn Park for all stormwater facilities on the project site.

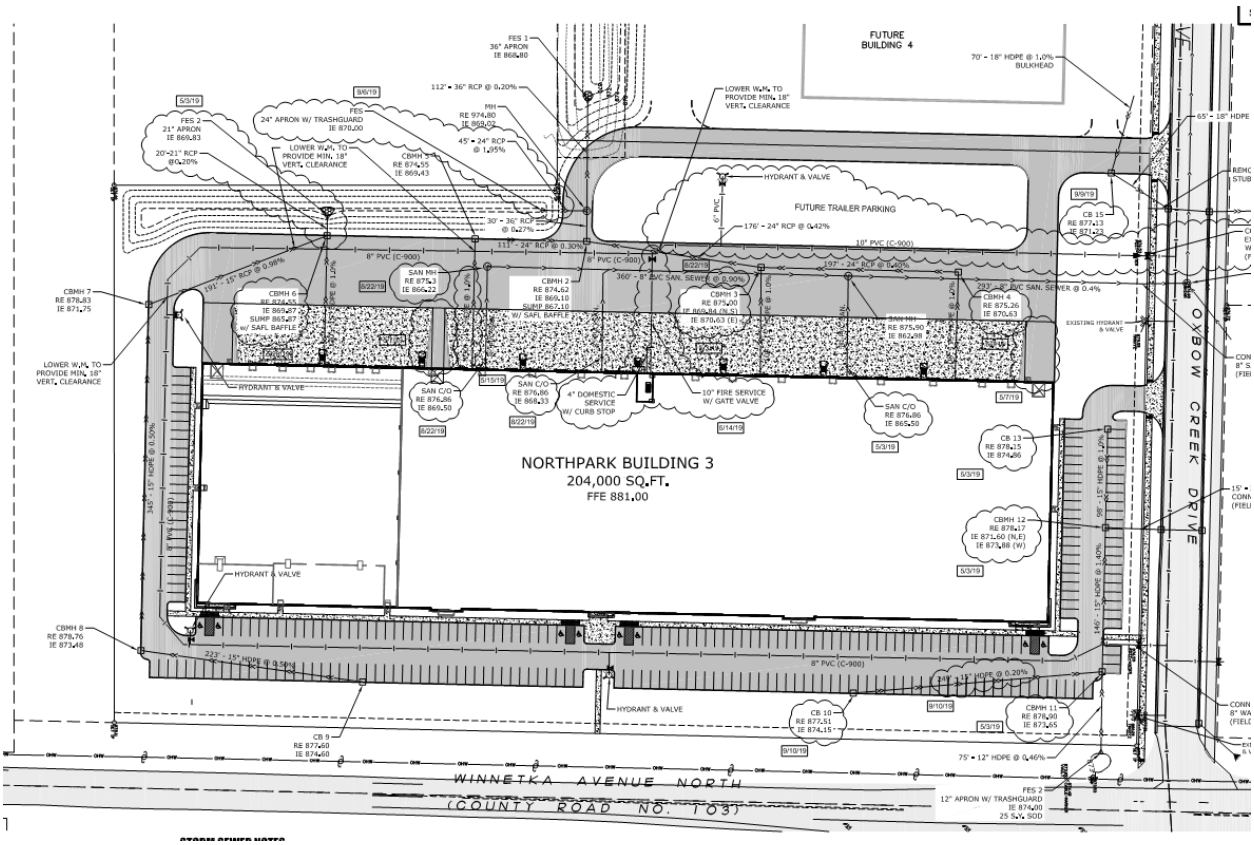
Wenck Associates, Inc.
Engineers for the Commission

Ed Matthiesen, P.E. Date

WM 2019-008: North Park Business Center- Building 3

Figure 1. Site location.

Figure 2. Site grading plan.



WEST MISSISSIPPI WATERSHED MANAGEMENT COMMISSION

PROJECT REVIEW WM2019-009: Coon Rapids Dam Regional Park Phase II

Owner: Katie Warner, PE
Company: Three Rivers Park District
Address: 3000 Xenium Lane North
Plymouth, MN 55441

Engineer: Kevin Kielb, PE
Company: Bolton & Menk, Inc
Address: 7533 Sunwood Drive NW, Suite 206
Ramsey, MN 55303
Phone: 651-968-7760
Fax: 763-427-0833
Email: kevinkl@bolton-menk.com

Purpose: Redevelopment of park facilities on 6.0 acres (park is 130 acres, but disturbed area is 6 acres).

Location: West Coon Rapids Dam Regional Park, Brooklyn Park, MN (Figure 1).

Exhibits:

1. Project review application and project review fee of $2,200, dated 8/29/19, received 8/29/19.

2. Site plan, grading, utility, erosion control, and landscaping plans (90%), received 8/29/19 (plans are undated).

3. Hydrologic calculations by Bolton & Menk, dated 8/8/19, received 8/29/19.

Findings:

1. The proposed project is the redevelopment of park facilities at Coon Rapids Dam Regional Park. The park is approximately 160 acres, 6.0 acres of which will be disturbed. Following redevelopment, the disturbed portion of the site will be 43 percent impervious with 2.6 acres of impervious surface, an increase of 1.6 acres.

2. The complete project application was received on 8/29/19. To comply with the 60-day review requirement, the Commission must approve or deny this project no later than the 10/10/19 meeting. Sixty calendar-days expires on 10/28/19.

3. To comply with the Commission's water quality treatment requirement, the site must provide ponding designed to NURP standards with dead storage volume equal to or greater than the volume of runoff from a 2.5" storm event, or BMPs providing a similar level of treatment - 85% TSS removal and 60% TP removal. Infiltrating 1.3-inches of runoff, for example, is considered sufficient to provide a similar level of treatment. If a sump is used the MnDOT Road Sand particle size distribution is acceptable for 80% capture.

   Runoff from the site is proposed to be routed to both a bioretention basin and vegetated trail buffer (Figure 2). The bioretention basin will receive runoff from the new river access road, and will include a Rain Guardian pretreatment chamber. The vegetated trail buffer will treat runoff from all trails. According to calculations with the Minimum Impacts Design calculator, together these practices remove 95% of TP

and TSS. The applicant meets Commission water quality treatment requirements.

4. Commission rules require that site runoff is limited to predevelopment rates for the 2-, 10-, and 100-year storm events. Runoff from the site is routed to a bioretention basin and to vegetated trail buffer, both of which slow runoff rate. The applicant meets Commission rate control requirements (Table 1).

Table 1. Runoff from site (cfs).

Drainage Area	2-year event		10-year event		100-year event	
	Pre-	Post-	Pre-	Post-	Pre-	Post-
Entire site	2.16	1.76	7.27	7.23	21.83	20.81

5. Commission rules require the site to infiltrate 1.0 inch of runoff from new impervious area within 48 hours. The new impervious area on this site is 2.58 acres, requiring infiltration of 9,365 cubic feet within 48 hours. Infiltration will be accomplished using both the bioretention basin and the vegetated trail buffer. New impervious area draining to the bioretention basin is 0.6 acres, requiring infiltration of 2,178 acres within 48 hours. The bioretention basin has the capacity to infiltrate this required volume within 48 hours. New impervious area draining from the trails to the vegetated trail buffer is 1.98 acres, requiring infiltration of 7,187 cubic feet within 48 hours. The trails will have a 1:1 buffer or 1:4 buffer, depending on whether soils are HSG A or B, respectively, which will provide the required infiltration. The applicant meets Commission volume control requirements.

6. The erosion control plan includes a rock construction entrance, silt fence, sediment control log, erosion control blanket, flotation silt curtain, inlet protection, rip rap at bioretention basin inlets, and native seed specified in the bioretention basin/by the Mississippi River. The erosion control plan meets Commission requirements.

7. There is one wetland on site. The Commission is LGU for WCA administration in Brooklyn Park. The delineation for this wetland was approved by the Commission in November 2018. The wetland will not be impacted during this project. Erosion and sediment controls will protect this wetland during construction and the drainage area contributing to the wetland will not be changed. Buffers a minimum of 20 feet in width and averaging 30 feet in width are provided. The applicant meets Commission wetland requirements.

8. The two Public Waters on this site are the existing wetland mentioned above (#7) and the Mississippi River. The proposed project is not anticipated to negatively impact either of these water bodies. The applicant meets Commission Public Waters requirements.

9. Trail is proposed to be reconstructed in the Mississippi River Zone AE Floodplain. However, there will be no net fill in the floodplain and no new impervious construction in the floodplain. Therefore, there will be no change in the base flood elevation, meeting the requirements of a no-

rise certification. The applicant meets Commission floodplain requirements.

10. Several public meetings have been conducted for the project, beginning in November 2017 and most recently in February 2019. The applicant meets Commission public notice requirements.

11. An Operations & Maintenance (O&M) plan was provided.

12. A Project Review Fee of $2,200 has been received.

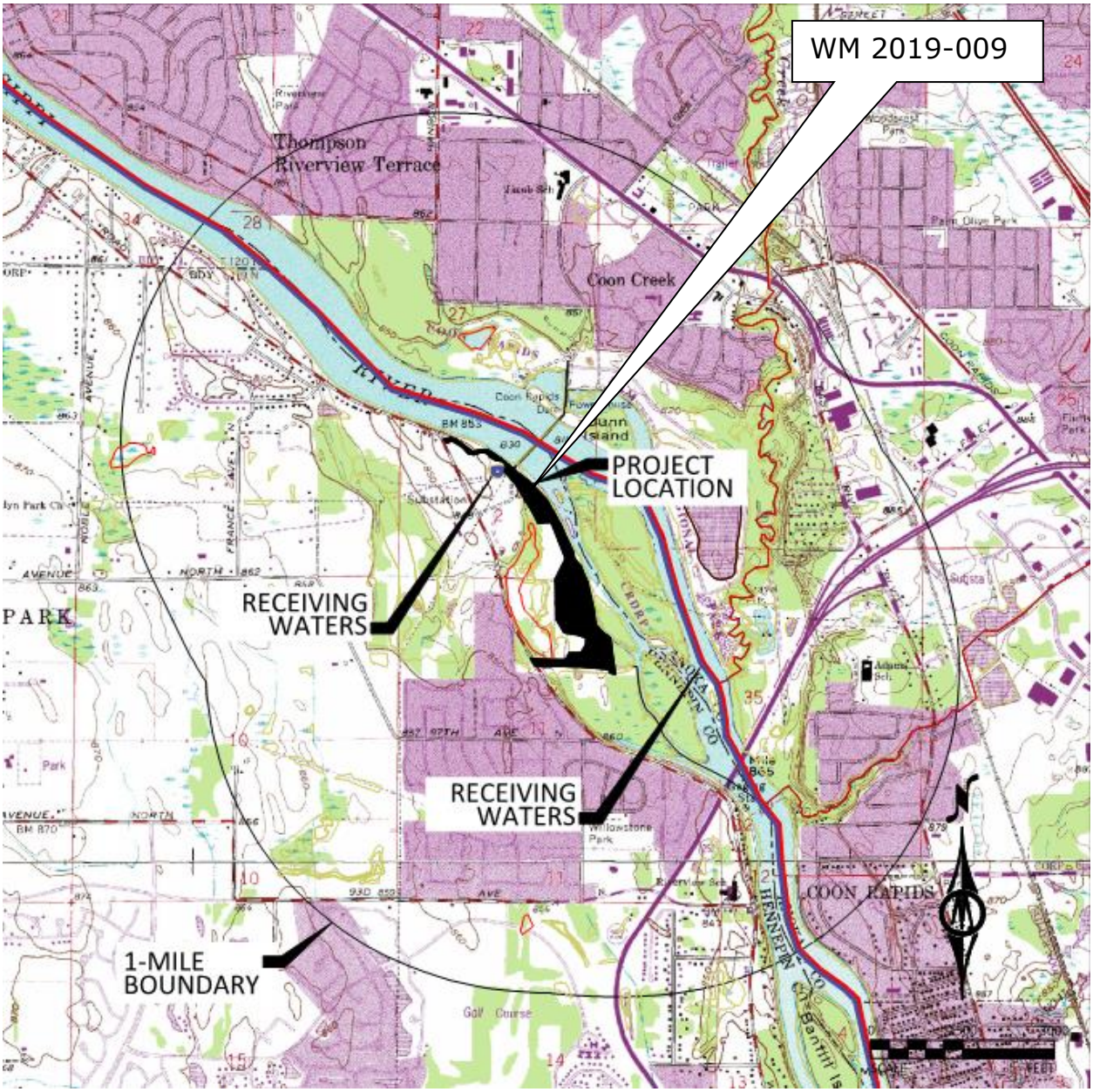
Recommendation: Recommend approval with no conditions.

Wenck Associates, Inc.
Engineers for the Commission

Ed Matthiesen, P.E. Date

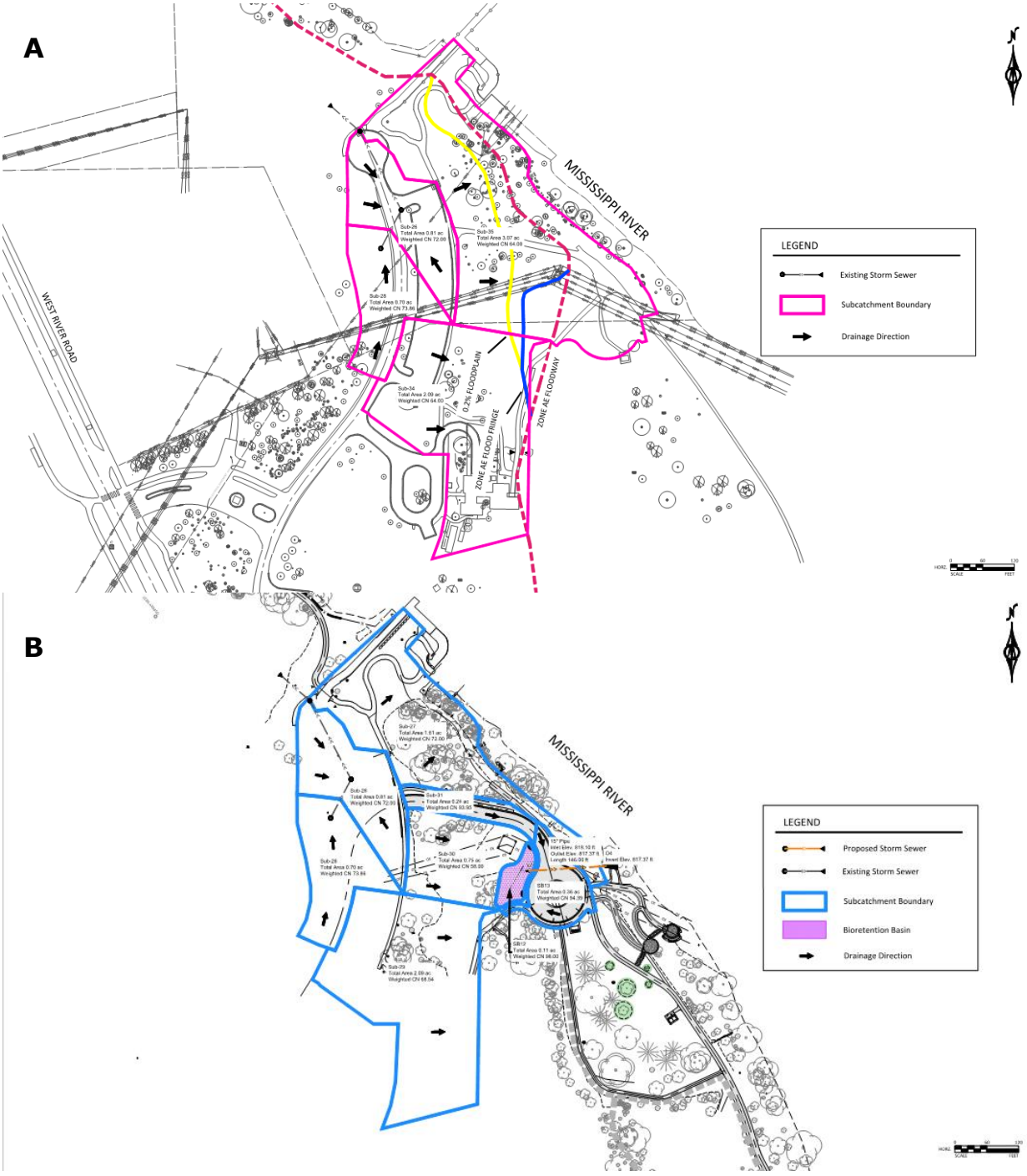
WM 2019-009: Coon Rapids Dam Regional Park Phase II

Figure 1. Site location.



WM 2019-009: Coon Rapids Dam Regional Park Phase II

Figure 2. (A) Existing drainage map. (B) Proposed drainage map.



Technical Memo

WENCK ASSOCIATES

Responsive partner.
Exceptional outcomes.

To: Shingle Creek/West Mississippi WMO TAC

From: Ed Matthiesen, P.E.
Diane Spector

Date: October 4, 2019

Subject: Partnership Cost Share Application
Twin Lake North

Recommended TAC/ Commission Action	Staff recommends approving the Partnership Cost Share request for $43,510.

The City of Crystal has received a Partnership Cost Share Application for improvements at the Twin Lake North Condominiums adjacent to Wetland 639W. This is on the Commission's agenda as Project review SC2019-006. A parking lot on site is partly within the floodplain and when Twin Creek and Upper Twin Lake is high, it can become inundated with water (Figure 1).

The proposed Parking Lot Relocation Project will move that existing parking lot out of the floodplain and restore the area with a diverse native plant community. The project is also reducing the amount of impervious on-site by .39 acres and treating runoff from the relocated parking lot. Currently, runoff from the parking lot drains directly into Twin Creek untreated.

The request is for $43,510 to fund the proposed rain garden and TDA Infiltration System (Figure 2), including rain garden plantings and native buffer (Figure 3) to restore area that once was a parking lot to a high quality water filtration system and pollinator habitat along Twin Creek. A 100-year event of 7.33 inches will be infiltrated on site.

Staff recommends approval of the request for $43,510. The Partnership Cost Share account currently has an unencumbered balance of just over $100,000.

Z:\Shingle Creek\Cost Share Program\Twin Lake North\M-oct partnership twin lk north.docx

Figure 1. Existing conditions. The channel is the outlet of Wetland 639W, which discharges directly into Upper Twin Lake.

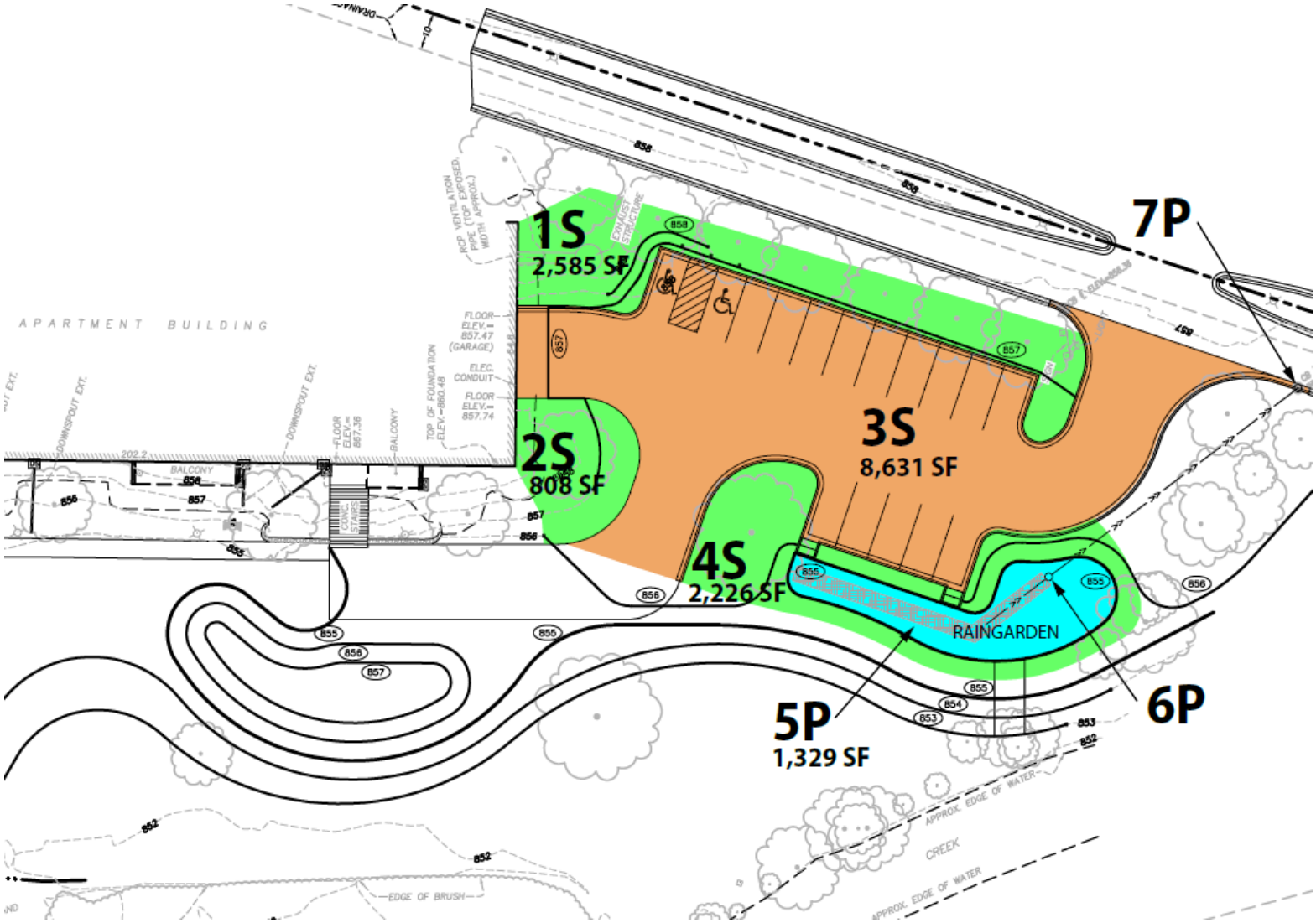


Figure 2. The existing parking lot will removed and a new parking lot will be constructed closer to Bass Lake Road. Runoff is directed to the new rain garden with a TDA underdrain system.

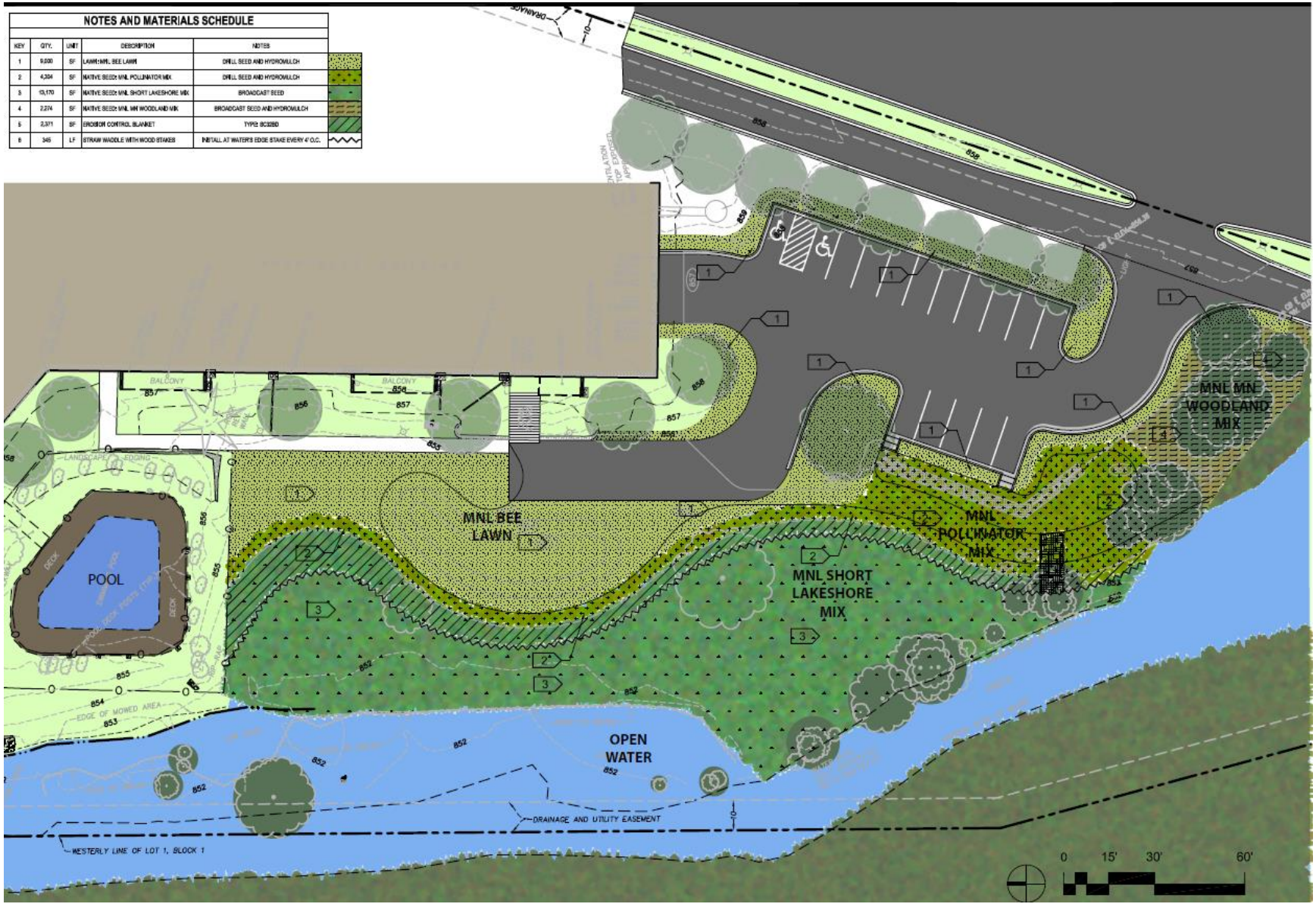


Figure 3. The old parking lot area will be restored with native plantings and a bee lawn.

Shingle Creek Watershed Management Commission

3235 Fernbrook Lane N • Plymouth, MN 55447
Phone (763) 553-1144 • Fax (763) 553-9326

www.shinglecreek.org

Shingle Creek
Watershed Management Commissions
Partnership Cost-Share Program Guidelines

The Shingle Creek Watershed Management Commission will from time to time make funds available to its member cities to help fund the cost of Best Management Practices (BMPs) partnership projects with private landowners. The following are the guidelines for the award of cost-share grants from this program:

1. Projects on private property must be for water quality improvement, and must be for improvement above and beyond what would be required to meet Commission rules. Only the incremental cost of "upsizing" a BMP above and beyond is eligible.
2. Priority is given to projects in a priority area identified in a subwatershed assessment or TMDL.
3. Commission funds may reimburse up to 100% of the cost of the qualifying BMP.
4. The minimum cost-share per project is $10,000 and the maximum is $50,000.
5. Projects must be reviewed by the Technical Advisory Committee (TAC) and recommended to the Commissions for funding.
6. Cost-share is on a reimbursable basis following completion of project.
7. The TAC has discretion on a case-by-case basis to consider and recommend to the Commissions projects that do not meet the letter of these guidelines.
8. Unallocated funds will carry over from year to year and be maintained in a designated fund account. Any balance in said account in excess of $100,000 will be transferred to the City Cost Share Program Account.
9. The property owner must dedicate a public easement or equivalent sufficient to install and maintain the BMP.
10. The Member City must obtain a recordable maintenance agreement from the property owner that specifies maintenance requirements and schedule; authorizes the City to inspect the BMP and order maintenance and improvement; and authorizes the City to undertake ordered maintenance and improvement not completed by the property owner, and assess the cost that work to the property.
11. The standard Commission/Member Cooperative Agreement will executed prior to project construction.

Adopted November 2015
Revised February 2017

Shingle Creek Watershed Management Commission

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Shingle Creek Watershed Management Commissions
Partnership Cost-Share Program Application

City:	CRYSTAL
Contact Name:	Stephen Mastey, Landscape Architect
Contact Phone:	651.646.1020 Office / 651.246.1151 Mobile
Contact Email:	Stephen@landarcinc.com
Project Name:	Twin Lake North Parking Lot Relocation out of Floodplain Project
Total Project Cost:	Total Installation Costs (not including design process & permits) = **$171,862**
Amount Requested:	$23,102 (Stormwater Systems) + $20,408 (Plantings/Restoration) = **$43,510**
Project Location:	4710 58th Avenue North, Crystal, MN
Owner:	Twin Lake North Condominium Association
Address:	4710 58th Avenue North
City, State, Zip:	Crystal, MN 55429
Phone:	Ann Gaasch – HOA Board Member / Mobile 612.802.2746
Email:	agaasch@familywiseservices.org

1. Describe the BMP(s) proposed in your project. Describe the current condition and how the BMP(s) will reduce pollutant loading and/or runoff volume. Note the estimated annual load and volume reduction by parameter, if known, and how they were calculated. Attach figures showing project location and BMP details including drainage area to the BMP(s).

Parking Lot Relocation Project to move an existing parking lot that is mostly within the 100 year floodplain out of the floodplain and restore the remaining area with a diverse native plant community. The project is also reducing the amount of impervious on-site by .39 acres and treating the proposed impervious to the level of a 100 year 7.44 inch rainfall event per attached project drawings and hydrocad model.

2. If this request is for cost share in "upsizing" a BMP, explain how the upsize cost and benefit were computed.

We are requesting for funds to help with the creation of the Stormwater Treatment Systems (Raingarden and innovative TDA infiltration System) including Raingarden Plantings and Native Buffer to Restore area that once was a parking lot to a high quality water filtration system and pollinator habitat along the Existing Creek.

3. Show total project cost and the amount of cost share requested.

See also Land Logic Installation Proposal Attached

Total Installation Costs (not including design process & permits) = **$171,862**
$23,102 (Stormwater Systems) + $20,408 (Plantings/Restoration) = **$43,510**

Shingle Creek Watershed Management Commission

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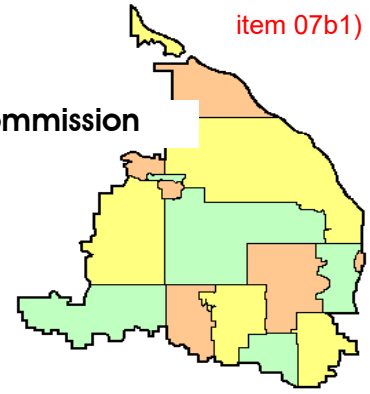
4. What is the project schedule, when will work on the BMP(s) commence and when will work be complete?
Work is scheduled to begin Fall of 2019 as soon as approvals are completed and completing the project as weather allows either Fall of 2019 or Early in the 2020 Construction Season.

The member City must verify that a public easement (or equivalent) is dedicated and that an Operations and Maintenance Agreement has been executed and recorded prior to release of any funds.

Shingle Creek Watershed Management Commission
West Mississippi Watershed Management Commission

3235 Fernbrook Lane N • Plymouth, MN 55447
Tel: 763.553.1144 • Fax: 763.553.9326
Email: judie@jass.biz • Website: www.shinglecreek.org



MINUTES
September 12, 2019

A meeting of the Technical Advisory Committee (TAC) of the Shingle Creek and West Mississippi Watershed Management Commissions was called to order by Vice Chairman Mark Ray at 11:33 a.m., Thursday, September 12, 2019, at Edinburgh USA, 8700 Edinbrook Crossing, Brooklyn Park, MN.

Present were: Andrew Hogg, Brooklyn Center; Mitchell Robinson, Brooklyn Park; Mark Ray, Crystal; Derek Asche, Maple Grove; Liz Stout, Minneapolis; Megan Hedstrom, New Hope; Ben Scharenbroich, Plymouth; Ed Matthiesen and Diane Spector, Wenck Associates, Inc.; and Judie Anderson, JASS.

Also present: Burt Orred, Jr., Crystal; Shahram Missaghi, Minneapolis; and Steve Christopher, Board of Water and Soil Resources (BWSR).

Not represented: Champlin, Osseo, and Robbinsdale.

I. Motion by Asche, second by Scharenbroich to **approve the agenda.*** *Motion carried unanimously.*

II. Motion by Robinson, second by Hogg to **approve the minutes*** of the July 25, 2019 meeting. *Motion carried unanimously.*

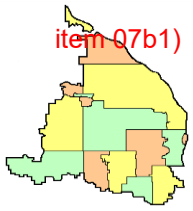
III. River Park Stormwater Improvement.*

The River Park Master Plan establishes a vision for the park and provides guidelines for its further development to accommodate an increased natural experience while providing more opportunity to view and access the Mississippi River. Stormwater improvements are included in the proposed updates to River Park as part of the Master Plan. The proposed stormwater improvements are intended to provide an improved habitat for animals and insects and an educational space for the residents of the community to learn about water quality.

Roughly 300 acres within the City of Brooklyn Park drain to the existing stormwater outlet to the Mississippi River at the southern end of the park. The current outlet is a 60" concrete pipe connected to a concrete spillway which slopes down to the river's edge. There is currently no water quality treatment provided prior to the discharge into the Mississippi River for much of the 300 acres that drain through the park outlet. There are two stormwater ponds upstream which treat roadway drainage from Trunk Highway 252. However, about 250 acres remain untreated prior to discharge.

The City wishes to incorporate water quality treatment into the design of River Park both to reduce the loads on the impaired Mississippi River and to provide an educational space for residents to learn about water quality treatment. The stormwater best management practice (BMP) will contribute to the overall natural feel of the park while adding additional benefit for the residents, animals and insects.

A stormwater pond is proposed near the exiting 60" piped outlet to the river. The pond would be designed to have a natural feel, with slight drops in elevation from one cell of the pond to the next and slowly sloping to the river. A diversion structure would be placed upstream of the ponds with the primary outlet



routed to the pond and the secondary outlet routed directly to the river. During low flow storm events the majority of the water would be routed through the pond and treated prior to discharge into the river. During larger storm events, high flows would bypass the stormwater pond and discharge directly to the river, similar to existing conditions. This would provide water quality treatment during small events while reducing the risk of washing out of the stormwater pond during larger events.

This section of the Mississippi River is listed as impaired for nutrients, fecal coliform and PCB in fish by the Minnesota Pollution Control Agency (MPCA). The proposed stormwater pond would address the nutrient portion of the impairment by reducing phosphorous while also reducing the turbidity. A pretreatment device consisting of a sump manhole with a SAFL baffle will be placed downstream of the diversion device and upstream of the pond to provide additional treatment and to reduce the maintenance requirements for the stormwater pond. The existing 60" concrete pipe/spillway outlet would be relocated to accommodate the proposed stormwater pond. The pipe would be extended towards the river, under the proposed island feature in the park to conceal the outlet to visitors of the park and to enhance the natural feel of park.

Funding from this project will come from the City of Brooklyn Park storm sewer funds and is identified in the Capital Improvement Plan. For this project, the City of Brooklyn Park will be requesting a 25% cost-share from the West Mississippi Watershed Management Commission. The estimated cost-share for this project is approximately $121,250.00.

Motion by Asche, second by Scharenbroich to proceed with a Minor Plan Amendment to add this project to the SCWM CIP. *Motion carried unanimously.*

IV. The City of Brooklyn Center has been discussing options regarding an ongoing water quality issue in the private channel/pond system at **Mallard Creek Townhomes** in the northwest corner of the city, just south of the upcoming Connections II project.

In the late 1970s a developer excavated an old agricultural ditch through a wetland and built townhomes and ponds on the high ground. The ponds were ornamental and not intended to provide stormwater treatment. Prior to this construction the ditch received stormwater from nearby streets and development, which continues today. The volume into the ditch/pond system is not sufficient to flush the system and the ponds can get very stagnant and algae-covered. There are multiple townhome associations, and they mostly maintain turf grass to the edge of the ponds, although they are now leaving a fringe unmowed. Water quality has been an issue for decades.

The City recently received a request from one of the associations as to whether a proposed aeration system would qualify for any cost-share funds. They forwarded quotes from an equipment supplier and an electrician to install a series of aerators in the channel in the southern part of the development. These total about $78,000. The association also submitted a quote for algaecide at $3,800. Some academic research was also provided. Staff have reviewed the literature and the proposal and believe that such an aeration system may help reduce algal growth and muck, but it will not improve water quality or decrease any nutrient load being discharged into Shingle Creek downstream. It is their opinion that sharing in the cost of this system would not be consistent with the Partnership Cost Share guidelines, but would be happy to discuss further.

Motion by Ray, second by Scharenbroich to deny this request. *Motion carried unanimously.* The members indicated they would be willing to reconsider this request should the applicant return with a revised proposal that would show water quality improvement above and beyond what is proposed.

V. The members queried whether **Ryan-Twin Lakes** should be added to the HUC8 modeling. Staff will bring back a scope of work and project costs. The Commission's attorney indicated this could be considered a watershed benefit.

item 07b1)

VI. Other Business.

A. The **next meeting** of the Technical Advisory Committee is scheduled for 11:30 a.m., Thursday, October 10, 2019, prior to the Commission's regular meeting.

B. The meeting was adjourned at 11:58 a.m.

Respectfully submitted,

Judie A. Anderson
Recording Secretary

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Technical Memo

WENCK ASSOCIATES

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To: Shingle Creek WMO Commissioners

From: Ed Matthiesen, P.E.
Diane Spector

Date: October 5, 2019

Subject: Twin Lake Carp Management Project Final Report

Recommended Commission Action	Review and accept the final report. Authorize retaining the balance of levy funds in the project account and reallocate the audited balance from the Biochar project (approximately $6,051.95) in the Closed Projects Account to this project.

The Section 319 grant funding the Twin Lake Carp Management Project expired on August 30, and work is now complete.

Attached is the project final report. This project was intended to reduce the biomass of carp in the Twin and Ryan chain of lakes, limit future recruitment, and manage lake submersed aquatic vegetation (SAV) response to reduce internal phosphorus loads and increase water clarity. Project objectives were:

- Assess the carp population and estimate current densities;
- Track seasonal movement and migrations of carp within the chain of lakes;
- Locate and evaluate carp overwintering, spawning and nursery habitats;
- Implement controls to reduce recruitment and movement of carp into the system;
- Reduce carp biomass in the system; and
- Develop aquatic vegetation management response strategies.

Population estimates confirmed a large abundance of common carp and densities above critical impairment thresholds within the system. Radio telemetry tracking demonstrated high mobility of the carp populations among the lakes suggesting that carp are able to move easily among the lakes and into/out of the system during seasonal high water levels. Tracking also located over wintering habitats and aided in identifying potential spawning and nursery habitats.

An estimated 14,450 ponds pounds of carp were removed from the system, or about 44% of the overall removal goal, and about 15,000 pounds of black bullhead, another bottom-feeding fish. Permanent carp barriers were installed in two locations to prevent the fish from moving upstream from Shingle Creek into the lake system, and to prevent access to a nursery location in a wetland connected to Upper Twin Lake via a road culvert. Curly-leaf pondweed was treated in year one; year two density did not warrant treatment.

Water quality monitoring has not yet identified any significant improvement in water quality or clarity. However, shallow lakes such as Upper Twin typically exist in one of two conditions: a clear-water state and a turbid water state. These lakes can "flip" rapidly between these states when certain tipping points are achieved. As carp continue to be removed, that tipping point eventually will be met and the lake should flip to a clear water condition.

Final Project Cost

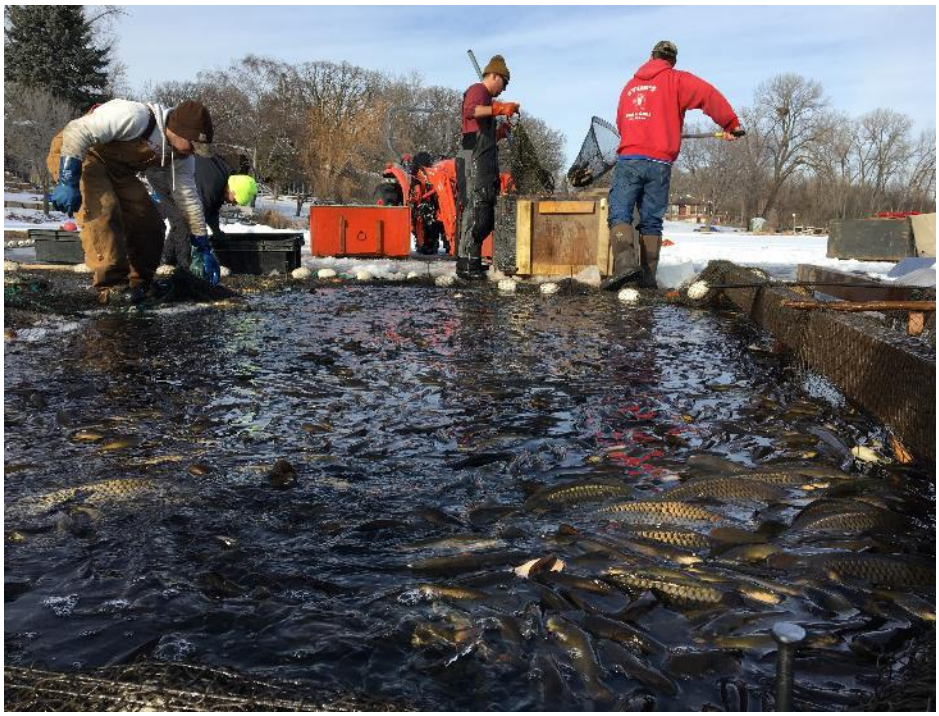
Table 1 below shows the final project cost and the funding sources. Note that the final cost and match is not the same as what was reported in the final project report because some additional expenses occurred after August 30. The original amount granted was $100,000, of which $99,992.26 was expended and reimbursed (final reimbursement is pending). The Commission received levy funds of $125,184.32, of which $118,024.58 was expended (the final accounting is pending audit). There is an approximate balance of $7,159.74. Staff recommends retaining the full amount in the project account to fund ongoing carp removals and SAV maintenance. Staff also recommends that the Commission reallocate the approximate $6,051.95 returned to the Closed Projects Account from the Biochar project to the carp management project to continue to fund these efforts.

Table 1. Final project cost and funding.

Total project cost	$218,016.84
Total grant expenses	$99,992.26
Total match (levy) expenses*	$118,024.58
Total levy received	$125,184.32
Total levy remaining*	$7,159.74
Recommended retention*	$7,159.74
Release to closed projects account	$ 0
Reallocation from closed projects account*	$6,051.95
Total available for future carp management*	$13,211.69

*The final amount is pending audit.

Twin Lake Carp Management Project Summary Final Report



Prepared for:

SHINGLE CREEK
WATERSHED MANAGEMENT COMMISSION
MINNESOTA POLLUTION CONTROL AGENCY
SEPTEMBER 2019

Prepared by:
WENCK ASSOCIATES, INC.
7500 Olson Memorial Hwy
Suite 300
Golden Valley, Minnesota
55427
(763) 252-6800

Wenck File #1240-0162

Shingle Creek

Minnesota Pollution Control Agency

WENCK
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Acknowledgments

Funding for this study was provided by the Minnesota Pollution Control Agency through a grant from the United States Environmental Protection Agency Section 319 Nonpoint Source Management Fund. Additional funding was provided by the Shingle Creek Watershed Management Commission. In-kind services were provided by the city of Robbinsdale, Minnesota.

Ed Matthiesen, P.E., Wenck Associates, Project Engineer and Principle Investigator
Diane Spector, Wenck Associates, Project Manager
For more information: ematthiesen@wenck.com (763)-252-6851
dspector@wenck.com (763)-252-6880

Photo: Carp tracking on the Twin Lake chain of lakes, Crystal, Robbinsdale, and Brooklyn Center, Minnesota, April 2017.

Cover: Harvesting common carp on Middle Twin Lake, Crystal, Minnesota, January 2018.

All photos and graphics: Wenck Associates, Inc., unless noted.

Table of Contents

TABLES

FIGURES

Executive Summary

The Twin Lake chain of four lakes located in suburban Hennepin County, Minnesota in the Twin Cities Metro Area are impaired by excess nutrients. All four – Upper, Middle, and Lower Twin Lakes and Ryan Lake – were listed as Impaired Waters in 2002 with two of the four – Lower Twin and Ryan – subsequently removed from the Impaired Waters list due to improved water quality. Upper Twin Lake, a very shallow lake, remains hypereutrophic and turbid, and is one of the largest sources of phosphorus to Middle Twin. TMDLs were completed on all the lakes and substantial effort has occurred to date targeting and reducing watershed sources of nutrients. Management efforts are now turning to addressing internal loading sources within the lakes.

Common carp (*Cyprinus carpio*) are a widespread aquatic invasive species that can have direct and indirect deleterious effects on lake ecosystems and were known to be present in high numbers in the chain of lakes. Common carp uproot and displace aquatic macrophytes, reduce habitat structure, and increase sediment resuspension in lake ecosystems which result in increased turbidity, sediment phosphorus release, and poor water quality conditions. A growing body of research shows that reducing carp densities within a waterbody below a critical threshold and preventing successful recruitment have the potential to benefit water quality conditions and aide in lake restoration efforts.

This project was intended to reduce the biomass of carp in the chain of lakes, limit future recruitment, and manage lake submersed aquatic vegetation (SAV) response to reduce internal phosphorus loads and increase water clarity. Project objectives were:

- Assess the carp population and estimate current densities;
- Track seasonal movement and migrations of carp within the chain of lakes;
- Locate and evaluate carp overwintering, spawning and nursery habitats;
- Implement controls to reduce recruitment and movement of carp into the system;
- Reduce carp biomass in the system; and
- Develop aquatic vegetation management response strategies.

Population estimates confirmed a large abundance of common carp and densities above critical impairment thresholds within the system. Radio telemetry tracking demonstrated high mobility of the carp populations among the lakes suggesting that carp are able to move easily among the waterbodies and into/out of the system during seasonal high water levels. Tracking also located over wintering habitats and aided in identifying potential spawning and nursery habitats within the Twin Lakes watershed. An estimated 14,450 ponds pounds of carp were removed from the system, or about 44% of the overall removal goal, and about 15,000 pounds of black bullhead, another bottom-feeding fish. Permanent carp barriers were installed in two locations to prevent the fish from moving upstream from Shingle Creek into the lake system, and to prevent access to a nursery location in a wetland connected to Upper Twin Lake via a road culvert. Curly-leaf pondweed was treated in year one; year two density did not warrant treatment.

Water quality monitoring has not yet identified any significant improvement in water quality or clarity. However, shallow lakes such as Upper Twin typically exist in one of two conditions: a clear-water state and a turbid water state. These lakes can "flip" rapidly between these states when certain tipping points are achieved. As carp continue to be removed, that tipping point eventually will be met and the lake should flip to a clear water condition.

1.0 Section 319 Final Report

1.1 GRANT SUMMARY REPORT

Grant project summary

Project title: Twin Lake Carp Management Project

Organization (Grantee): Shingle Creek Watershed Management Commission

Project start date: 12/1/2015 Project end date: 8/30/2019 Report submittal date: 9/27/19

Grantee contact name: Judie Anderson Title: Administrator

Address: 3235 Fernbrook Lane N

City: Plymouth State: MN Zip: 55447

Phone number: 763-553-1144 Fax: 763-553-9326 Email: judie@jass.biz

Basin (Red, Minnesota, St. Croix, etc.)
/Watershed & 8 digit HUC:: Upper Mississippi 07010206 County: Hennepin

Project type (check one):

- ☐ Clean Water Partnership
- ☐ Total Maximum Daily Load (TMDL)/Watershed Restoration or Protection Strategy (WRAPS) Development
- ☒ 319 Implementation
- ☐ 319 Demonstration, Education, Research
- ☐ TMDL/WRAPS Implementation

Grant funding

Final grant amount: $99,992.26 Final total project costs: $210,091.93

Matching funds: Final cash: $110,099.67 Final in-kind: $ Final Loan: $

MPCA project manager: Karen Evens

Executive summary of project (300 words or less)

This summary will help us prepare the Watershed Achievements Report to the Environmental Protection Agency. (Include any specific project history, purpose, and timeline.)

Problem (one paragraph)

The purpose of the project was to reduce and manage the common carp population in the Twin Lake chain of lakes to reduce internal phosphorus load and increase water clarity. The Twin and Ryan Lakes chain of four lakes is located in the highly urbanized Shingle Creek watershed in Hennepin County, Minnesota. The chain starts with Upper Twin, which is connected to Middle Twin by a short channel through a wetland. Middle Twin and Lower Twin are two bays of a single lake separated by a narrow throat. Lower Twin outlets into Ryan Creek and then into Ryan Lake, which ultimately outlets into Shingle Creek and then the Mississippi River. The lakes are impaired by excess nutrients conveyed from urban stormwater and from internal load from sediment, aquatic vegetation, and rough fish. A Total Maximum Daily Load (TMDL) study and Implementation Plan for excess nutrients were completed and approved in 2007 and significant external total phosphorus (TP) load reductions have been achieved. Lower Twin and Ryan have since been delisted due to improved water quality. However, Upper Twin continues to have poor water quality and clarity, and its outflow continues to be the largest source of phosphorus to Middle Twin. Shallow Upper Twin is impacted by an excessive population of common carp.

Waterbody improved (one paragraph)

This project removed nearly half the estimated biomass of common carp in the four lake chain of Upper (North), Middle, and Lower (South) Twin Lakes and Ryan Lake, and fish barriers were installed to prevent recolonization from Shingle Creek. Additional removels will be completed in the future to meet the goal of reducing the biomass density below the desired 100 kg/ha. Curly-leaf pondweed was chemically treated on Upper Twin in year one, but a cold and snowy winter limited its growth and no teatment was necessary in year two. Residents reported improvements in water clarity early in the season in year two, but a combination of unusual precipitation and temperature patterns in late spring led to filementous algae growth. Water quality will continue to be routinely monitored post-project.

Project highlights (one paragraph)

Carp tagging and radio tracking successfully located breeding and overwintering locations and allowed for winter seining to remove about one-third the target biomass. With additonal removals from spawning and shoaling areas, about 14,450 pounds have been removed, or 44% of the goal biomass. The tracking also verified the suspicion that carp were moving freely between the lakes and Shingle Creek downstream. Carp barriers were installed to limit access to spawning areas in upstream wetlands and prevent recolonization from Shingle Creek, downstream of Ryan Lake. The project also successfully raised lakeshore owners' awareness about shallow lake ecology and the importance of managing rough fish and invasive vegetation.

Results.

Removed 14,450 ponds pounds of carp, or about 44% of the overall removal goal, and about 15,000 pounds of black bullhead from the lake system. Permanent fish barriers were installed to prevent recolonization from outside the lake system and to limit access to a spawning area. Curly-leaf pondweed was treated in year one; year two density did not warrant treatment.

Partnerships (Name all partners and indicate relationship to project)

Shingle Creek Watershed Management Commission: lead partner
City of Crystal: host partner
City of Brooklyn Center: host partner
City of Robbinsdale: host partner
City of Minneapolis: host partner
Minnesota Pollution Control Agency: funding partner
Minnesota DNR: permitting and technical review partner

Pictures

Incorporated into report

1.2 WORK PLAN REVIEW

1.2.1 Approved Work Plan Changes

None made.

1.2.2 Report by Activity/Task

The overarching goal of this project was to reduce and manage the common carp population in the Twin and Ryan Lake chain of lakes to reduce internal phosphorus load and increase water clarity. More specifically goals were: 1) Understand the estimated number and biomass of common carp in the lake system; 2) Understand immigration/migration in the lake system; 3) Determine locations where spawning and overwintering occur; 4) Significantly reduce the numbers and biomass of common carp in the lake system; 5) Prevent or limit reproduction of common carp in the lake system; and 6) Identify potential aquatic vegetation response to improved water clarity and options for future aquatic vegetation management needs.

Objective 1: Understand life history of carp within the study system

Task A: Population/biomass Estimate

Two mark and recapture surveys were conducted in September 2016 using electrofishing techniques to determine a population estimate and carp biomass within the lake system. A follow up survey was completed in July 2017, and a fourth was completed in July 2018 after the first round of carp harvesting. The population assessment was completed using the mark and recapture/electrofishing technique. The linear regression model and procedure outlined in Bajer and Sorenson (2012) was used to estimate the current population and biomass. The estimated total biomass pre-harvest was just over 25,800 kg (56,800 lbs). Literature and lake management experience suggest that carp and other rough fish can have negative impacts to water quality and the ecosystem when the biomass of the carp exceeds 100 kilograms per hectare (kg/ha). Both Upper and Middle Twin are estimated to be well above the critical biomass threshold. Lower Twin was estimated to be below the critical threshold, but because the lakes are interconnected and fish can migrate easily, all three basins are likely being impacted by carp.

To set a removal goal, it was assumed that the current biomass would double over time, to account for growth and maturation of the younger fish. The difference between twice the current biomass and the target biomass at 100 kg/ha was set as the removal goal. That goal is 33,100 pounds.

Task B: Carp Migration Tracking
During mark and recapture surveying activities, 40 carp were tagged with radio transmitter markers. Efforts to tag equal proportions of fish per lake were attempted, however, fish capture and size ultimately affected how many fish could be tagged for a given lake. Relatively equal males to females were tagged within the system and fish of various sizes were tagged. An automated reader was installed at the outflow of the lake system to track immigration/emigration. The tagged carp were periodically tracked (monthly during the non-spawning season and biweekly to weekly during spawning season) using both automated and portable trackers to identify spawning and overwintering locations and to better understand emigration and immigration.

Objective 2 Control reproduction and immigration and emigration of the carp population.

Task A: Aeration system installation
Research conducted by Dr. Peter Sorensen at the University of Minnesota suggests that carp can reproduce very successfully in shallow lakes that experience severe hypoxia. Upper Twin is shallow (max depth <10 feet) and experiences frequent winter kills. To help protect the vulnerable pan fish during winter hypoxia, the intent of the project was to install an aeration system in Upper Twin Lake. After resolving various logistical difficulties and lakeshore property owner concerns, ultimately the host City of Brooklyn Center declined to take on the legal liability for the aerator. The aeration system was not installed.

Task B: Installation of fish barriers
The carp tracking verified the suspicion that carp were moving into and out of the lake system via Ryan Creek. A fish barrier was installed on the weir of Ryan Creek as it flows under France Avenue North. Ryan Creek is the outlet of the Twin chain, and flows in and out of Ryan Lake downstream to Shingle Creek. Tracking also indicated that carp were moving into a connected wetland upstream of Upper Twin Lake, potentially to spawn. Another barrier was installed at the street culvert that connects the wetland to the lake.

Objective 3 Carp removal from the system.

Task A: Remove carp from the system.
The Commission worked with the commercial fishermen assigned to this area to undertake a winter seine. Tracking indicated a dense school of fish on the west side of Middle Twin Lake. The seine haul occurred on 1/18/2018. Two large holes were cut in the ice (one on the east shoreline and the other on the west shoreline areas) on Middle Twin Lake. The net was deployed under the ice on the east side of the lake at 9:00 am and was pulled westward where it began to surface through around 10:30 am. The initial 100-150 feet of the seine was damaged and did not fish properly. A rusted steel drum and barb wire fencing were tangled in the net and likely cut part of the net, suggesting that debris impacted the seine haul. However, an estimated 10,643 pounds of carp were removed, along with about 15,000 pounds of black bullhead, another common bottom feeder that can also have negative effects on water quality.

An additional seine was attempted in January 2019, but due to equipment problems the fisherman was unable to get set up before the fish dispersed. As an alternative, it had been previously noted that carp tended to congregate in Ryan Creek at the outlet of Lower Twin Lake, waiting for the water to be high enough to get over the outlet weir. This weir, where Ryan Creek passes under France Avenue in a culvert, was one of the locations where a carp barrier was installed as part of this project. Commission consulting staff devised a method using block nets and seines and made several hauls, removing an estimated 3,800 pounds of carp. Between the winter seining and the creek removals, about 14,450 pounds have been removed, or 44% of the goal biomass. The Commission will continue to remove carp form Ryan Creek and other congregation areas until the goal is met.

Objective 4 Vegetation management plan.

Task A: Water quality monitoring.
Biweekly water quality monitoring was completed in 2018 on all three basins of Twin Lake as well as Ryan Lake. Monthly sampling was completed on the three basins in 2019. Parameters that were measured were total phosphorus (TP), soluble reactive phosphorus (ortho-P), total suspended solids (TSS), and chlorophyll-a (chl-a). In the deeper Middle Twin and Ryan Lakes hypolimnetic (deep) water

samples were collected and tested for TP and ortho-P. In addition to these chemical parameters, the physical profile of the lakes were assessed in the deepest part of the lake. A profile typically consisted of taking measurements starting at the water's surface and continuing every meter (or half meter in shallow lakes) throughout the entire water column. A multimeter probe was used to collect dissolved oxygen (DO; mg/L), DO %, temperature, pH, oxidation reduction potential (ORP) and specific conductivity at each step in the profile. Additionally, a Secchi disk reading was taken during every assessment to relate the relative level of water transparency. The data were compiled and reported in the Commission's annual Water Quality Report.

Task B: Vegetation survey and management plan.
Prior to undertaking the carp removal project, previous SAV point-intercept surveys were evaluated to better understand the existing issues with aquatic invasive species (AIS). Survey results demonstrate a biological impaired vegetation community across all three basins. Species richness, abundance and spatial coverage all decrease across the growing season due to decreased water clarity over the growing season. Currently, curlyleaf pondweed (CLP) is the only dominant vegetative AIS species in Twin Lake system (most notable in the Upper Twin basin). Point-intercept surveys were conducted in 2016 (Upper) and 2012 (Middle & Lower). These were used to develop an Aquatic Vegetation Management Plan (AVMP) for review and approval by the DNR. The AVMP documents current conditions and potential future management actions depending on the aquatic vegetation response as water clarity improves. The DNR approved the AVMP, and issued a variance for Upper Twin Lake allowing the Commission to treat more than the state limit of 15% of the lake surface area if necessary. In spring 2018, the DNR and Commission staff delineated a 9.4 acre CLP stand on Upper Twin Lake that was subsequently treated with endothall, In spring 2019 the DNR and Commission staff conducted an invasive plant survey and found very sparse stands of CLP as well as some stands that were dead. Harsh conditions during the 2018-2019 winter, including a significant and long-lasting snowpack on the lake surface limited light penetration, which inhibited CLP growth under the ice. No treatment was performed. Another survey will be completed in spring 2020 to determine if additional CLP treatment is necessary.

Task C: Submit data to EQuIS.
Water quality monitoring data was submitted to EQuIS on a timely basis.

Task D: Prepare QAPP.
Commission and MPCA staff prepared a QAPP, which was approved.

Objective 5: Community engagement and meetings.

Task A: Outreach activities to inform and engage community.
There was a considerable amount of communication with lakeshore residents as well as the communities at large. Owners of all properties on the lake were invited to a public meeting on December 13, 2017, held at the Crystal Community Center and which was well attended. Commission staff regularly sent out project update emails to the lake association chairs, who forwarded them on to their association members and posted on their association Facebook and websites. A number of lakeshore residents walked out on the frozen lake to observe the winter seining. The seining event was highlighted on local cable channel 12, which provides cable television service to northwestern Hennepin County suburbs. https://ccxmedia.org/news/water-quality-project-targets-carp-on-middle-twin-lake/. The Commission also created and maintained two project pages on its website. http://www.shinglecreek.org/twin-lake-carp-management.html.

Objective 6: Administration/Semiannual and Final Reports.

Task A: Administration/Semiannual and Final Reports.
Quarterly invoices, semiannual reports, and the final report were prepared and submitted in a timely manner.

1.3 GRANT RESULTS

1.3.1 Measurements

Between the winter seining and the creek removals, about 14,450 pounds of carp have been removed, or 44% of the goal biomass. Results of monitoring data are presented in the following sections of this report. However, none of the lakes showed any statistically significant improvement in water quality as measured by TP or chl-a concentration, or in water clarity as measured by Secchi depth.

1.3.2 Products

Project products were installed BMPs, the Aquatic Vegetation Management Plan, monitoring data, a final report, and presentations.

1.3.3 Public Outreach and Education

There was a considerable amount of communication with lakeshore residents as well as the communities at large. Owners of all

properties on the lake were invited to a public meeting on December 13, 2017, held at the Crystal Community Center and which was well attended. Commission staff regularly sent out project update emails to the lake association chairs, who forwarded them on to their association members and posted on their association Facebook and websites. A number of lakeshore residents walked out on the frozen lake to observe the winter seining. The seining event was highlighted on local cable channel 12, which provides cable television service to northwestern Hennepin County suburbs. https://ccxmedia.org/news/water-quality-project-targets-carp-on-middle-twin-lake/. The Commission also created and maintained two project pages on its website. http://www.shinglecreek.org/twin-lake-carp-management.html.

1.3.4 Long-term Results

Capacity-Building. The Commission developed a method to continue to harvest carp from the lake system from Ryan Creek that can be completed annually at low cost. Lakeshore property owners are now more aware of carp management benefits, and have contacted Commission staff when they observe carp shoaling or spawning.

Partnerships. Good relationships with the lake associations were created.

Dissemination of Project Results. Results have been shared with the Commission and cities, the lake associations, and the DNR. Results have been posted on the Commission's website.

Applicability to Other Audiences/Locations. Control of rough fish is an important component of shallow lake management. Commission staff have shared findings and strategies with other lake managers, as well as learned from their experiences.

Lessons Learned. For logistical reasons, winter seining can be complicated. By the time a commercial fisherman can get mobilized, the fish may have dispersed from the congregation. The market for carp is seasonal, and does not necessarily coincide with optimal winter seining times.

1.4 FINAL EXPENDITURES

Funding Source	Cost
Section 319 Grant	$99,992.26
Shingle Creek WMC	110,099.67
TOTAL	$210,091.93

2.0 Carp Management

2.1 BACKGROUND

The goal of this project was to reduce and manage the common carp population in the Twin and Ryan Lake chain of lakes to reduce internal phosphorus load and increase water clarity. More specifically goals were: 1) Understand the number and biomass of common carp in the lake system; 2) Understand immigration/ migration in the lake system; 3) Determine locations where spawning and overwintering occur; 4) Significantly reduce the number and biomass of common carp; 5) Prevent or limit reproduction of common carp in the lake system; and 6) Identify potential aquatic vegetation response to improved water clarity and options for future aquatic vegetation management needs.

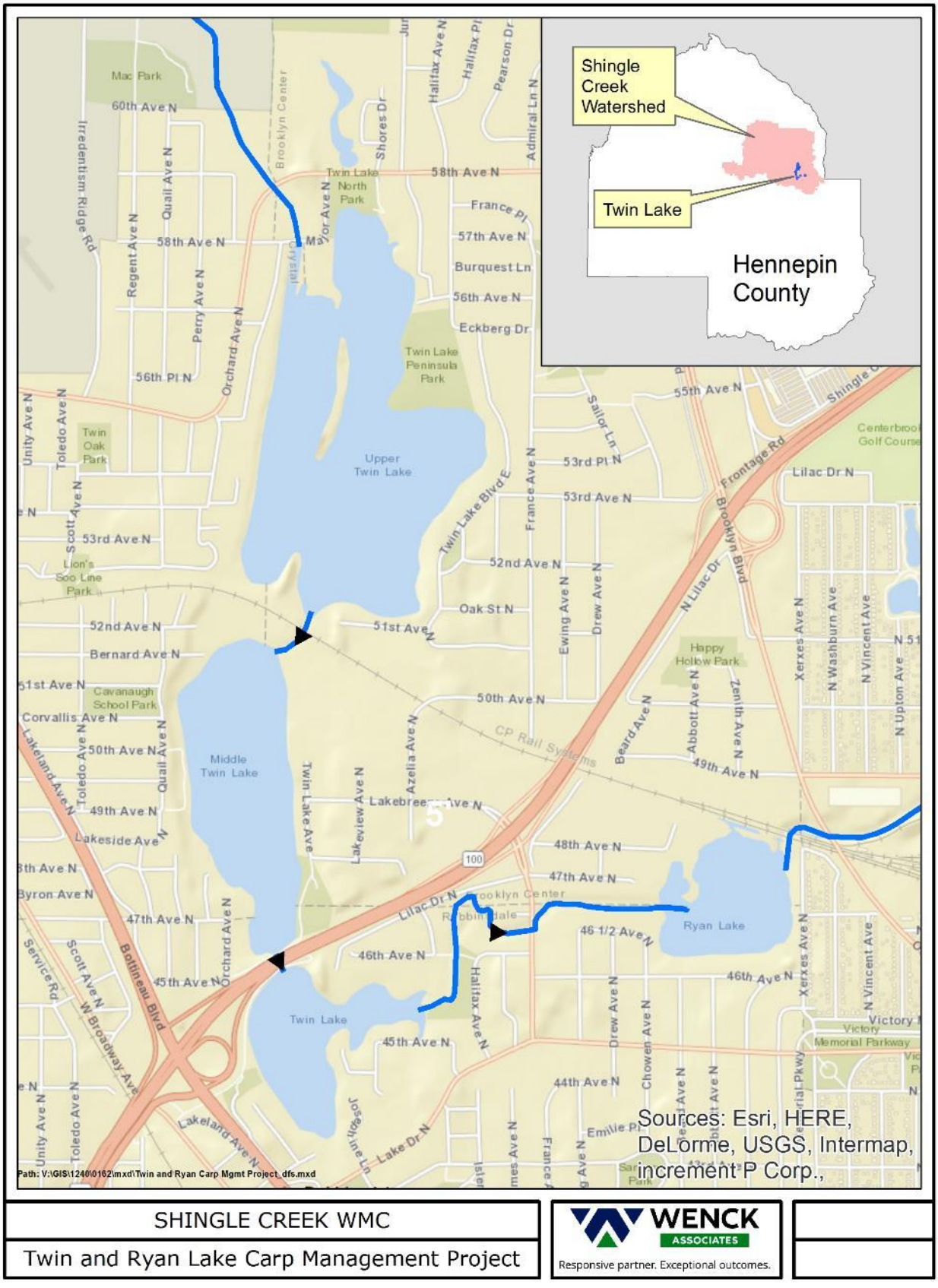
2.2 POPULATION ESTIMATE

2.2.1 Method

The common carp (*Cyprinus carpio*) is among the most widespread and damaging aquatic invasive species in North America (Sorensen and Bajer 2011, Weber and Brown 2009) with the ability to rapidly colonize a waterbody (Koehn 2004) and significantly alter habitat, water quality conditions and nutrient dynamics within a lake (Huser et al. 2016, Bajer et al. 2009). Due to their ecological impact, recent efforts have focused on determining ecological density thresholds (Bajer et al. 2009) in which vegetation and improved water quality conditions return. Bajer et al. suggest that significant impacts of common carp are observed at densities of about 100kg/ha (89 lbs/acre), therefore, populations persisting at or above this threshold would benefit from population reductions.

Determining the number and density of carp has been difficult using standard sampling protocols. Recent techniques using a standardized boat electrofishing survey methodology have proven effective at determining the abundance and density of common carp with lake ecosystems (Bajer et al. 2012). Comparing lake population estimates to the critical threshold quantifies the need for active carp management while allowing targeted removal goals to be established to ensure populations are reduced below critical thresholds.

Initial population estimates began on September 2, 2016 with electro-boat shocking on Lower Twin Lake (Figure 2.1). Fisheries information and shocking time were recorded. The left pelvic fin was clipped on all captured Lower Twin common carp. Boat shocking continued September 9, 2016 on Middle and Upper Twin Lakes. The right pelvic fin was clipped on Upper Twin carp and the right pectoral fin on Middle Twin carp. The second assessment was conducted on September 29 and coincided with radio tag implanting on select carp. Only one fish initially fin-clipped on Middle Twin was recaptured on Middle Twin. A third sample session was completed in July 2017 and a fourth in July 2018 after the first round of carp harvesting. Fisheries and shocking related information are shown in Table 2.1.



SHINGLE CREEK WMC

Twin and Ryan Lake Carp Management Project

WENCK ASSOCIATES
Responsive partner. Exceptional outcomes.

Figure 2.1. Twin Lake carp management project location.

The linear regression model and procedure outlined in Bajer and Sorenson (2012) was used to estimate the current population and biomass. The average of the pre-harvest population assessment surveys estimates a population of about 14,300 common carp, with the largest number of individuals found within the Upper basin. The estimated total biomass pre-harvest was just over 25,800 kg (56,800 lbs) (Table 2.2). Literature and lake management experience suggest that carp and other rough fish can have negative impacts to water quality and the ecosystem when the biomass of the carp exceeds 100 kilograms per hectare (kg/ha). Both Upper and Middle Twin are estimated to be well above the critical biomass threshold. Lower Twin was estimated to be below the critical threshold, but because the lakes are interconnected and fish can migrate easily, all three basins are likely being impacted by carp.

Table 2.1. Population estimate fish sampling results.

Lake	Date	n	Shock Time (hour)	Average Weight (kg)	Estimated Density (carp/ha)	Biomass mean (kg/ha)	Estimated Population Size
Upper	9/9/2016	41	0.9	1.2	217.61	261.8	10,233
Upper	9/29/2016	48	0.8	1.3	285.64	367.5	13,432
Upper	7/27/2017	27	0.88	1.8	147.55	272.3	6,939
Upper	7/30/2018	20	1	1.73	97.24	168.2	4,573
Middle	9/9/2016	24	0.7	1.2	164.53	190.8	3,729
Middle	9/29/2016	23	0.5	1.5	219.70	337.3	4,979
Middle	7/27/2017	13	0.72	1.5	88.08	131.3	1,996
Middle	7/30/2018	12	1	2.03	59.56	120.9	1,350
Lower	7/27/2017	7	0.6	1.6	57.99	91.9	690
Lower	9/2/2016	6	0.9	1.0	34.44	35.6	410
Lower	9/29/2016	5	0.5	1.9	50.14	95.7	597
Lower	7/30/2018	6	0.7	1.47	43.41	63.8	516

Table 2.2. Estimated average carp population, density, and biomass.

Lake	Average Population Size (# carp)	Average Biomass Density (kg/ha)	Average Total Biomass (kg)
Upper	10,201	301	18,362
Middle	3,568	220	6,422
Lower	565	74	1,018
TOTAL	14,334	198	25,802

2.2.2 Setting a Removal Goal

A biomass density goal of 100 kg/ha is used to establish the minimum harvesting goal. Using a cross multiple equation, the minimum target removal goal can be calculated thusly:

$$Individuals\ to\ Remove = \ Current\ Pop.Size - (\frac{Current\ Pop.Size}{Current\ Biomass\ Density} * Biomass\ Density\ Goal\ )$$

Solving the equation:

$$Individuals\ to\ Remove = \ 14{,}334\ individuals - (\frac{14{,}334\ individuals}{198\frac{kg}{ha}} * \ 100\frac{kg}{ha})$$

$$Individuals\ to\ Remove = 7{,}095$$

However, this modeling exercise doesn't account for the annual growth and increase in biomass of individual carp within the system. Data from the DNR Lake Finder (https://www.dnr.state.mn.us/lakefind/index.html) was used to estimate typical average common carp weights at about 10-11 lbs. or 4.5-5.0 kg. Using this same frame of reference, the carp in Twin Lake could be expected on average to at least double in biomass. To account for this growth potential, several removal rate scenarios (Table 2.3) were considered, with the biomass doubles scenario selected as the removal target.

Table 2.3. Minimum target removal goal scenarios.

Average Weight Scenario	Targeted Removal #s			
	Individuals	Biomass (kg)	Biomass (lbs)	% of population
Current	7,095	9,933	28,191	49%
Biomass Doubles	10,715	15,000	33,069	75%
Biomass Triples	11,921	16,690	36,795	83%

2.3 CARP TRACKING

Common carp are a relatively long-lived species suggesting that population reduction and control may need a removal component to reverse the deleterious impacts once recruitment areas have been blocked. Large congregations of carp have been observed during spawning migrations and overwintering shoals and are behaviors that make carp vulnerable to targeted removals. To successfully remove large aggregations of carp researchers have utilized a Judas technique. This technique implants radio tags into a few individuals in the population that can be followed to determine where aggregations form to better target removal operations. In carp management, the Judas technique is often paired with winter seining events to remove target goals of carp (Bajer et al. 2011).

We implanted radio tags in select individuals within each of the three basins to conduct tracking to 1) locate potential overwintering habitats, 2) locate potential spawning and nursery locations and 3) understand seasonal movements among the three basins and the watershed. Radio tag implanting (Figure 2.2) coincided with the second mark and recapture assessment on 9/29/2016. A total of 40 fish were implanted with radio tags. Efforts to tag equal proportions of fish per lake were attempted, however, fish capture and size ultimately affected how many fish could be tagged for a given lake. Relatively equal males to females were tagged within the system and fish of various sizes were tagged. Each transmitter was uniquely coded for individual tracking and was implanted inside the body cavity near the pelvic fin with an external antenna to assist with transmitter detection. Carp were temporarily anesthetized prior to implanting radio tags, revived after implantation was complete and held in holding tanks until carp had recovered. They were then released back into the lake in which they were initially collected. A unique radio frequency was assigned to each fish and length, weight, sex information was recorded.

The initial tracking effort began on 9/30/2016. The primary objective of this tracking event was to determine any initial mortality post-surgery and to test out tracking equipment and methods. Three of the four fish tagged from Lower Twin lake were located. One was located in Lower Twin and the other two fish were located in the outlet channel or downstream wetland complex. Therefore, two fish left the system and it is possible the remaining Lower Twin tagged fish that was not located also had left the system.

Figure 2.2. Implanting radio tags in anesthetized carp.

Sixteen of 17 Middle Twin carp were located. Eleven of the 16 were tracked to be within Middle Twin with most fish moving back to areas where carp were captured the day before. Five of the 16 carp had relocated into Upper Twin Lake. Ten of 19 Upper Twin carp were found to be within Upper Twin. Logistic constraints limited the tracking effort on Upper Twin and the status of the other 9 fish was unknown, however, since these fish were not located in Middle or Lower Twin lakes it is likely that they were other areas of Upper Twin Lake not assessed.

Following the initial tracking event, tracking was completed monthly, and increased to weekly or even daily during perceived spawning and overwintering timeframes and in the leadup to winter seining removal events. There are two open water wetland systems on the north end of Upper Twin that are connected to the lake by culverts and channels. No carp were observed to move into these wetlands, and no tagged carp were located in these wetlands. Lower Twin outlets into Ryan Creek, which flows to Ryan Lake. Ryan Lake discharges into the lower branch of Ryan Creek, and flows though that channel and then into storm sewer to Shingle Creek, where there is a known population of common carp. Tagged carp were found periodically in Ryan Lake. A single stationary tracking unit was placed along Ryan Creek to track carp out of and back into the Twin Lake system. Data from this unit was downloaded during every mobile tracking event and reviewed for possible movements.

For tracking events where not all the tagged fish were found or otherwise accounted for, tracking was also conducted along Ryan Creek, Ryan Lake and in a few instances, locations along Shingle Creek, Palmer Lake, Eagle Lake and Pike Lake. Radio tags not located within the Twin Lakes were fish that either 1) were simply not detected during a tracking event, 2) left the system through the outlet, or 3) were harvested by fisherman or natural predators (i.e. eagles). Fish that were not located during a tracking event but then were observed during subsequent events were likely missed by trackers. Fish repeatedly not found and not observed at the completion of the project were logged as having left the system. Where a radio tag was logged in a single, unmoving location multiple events in a row was taken to indicate that the radio tag was either 1) rejected by the fish, 2) the fish died, or 3) the tag was removed by a fisherman or predator.

Figure 2.3 shows how the carp tend to school during the winter and spring months. In January, the tagged carp tended to congregate at the deepest parts of Upper and especially the deeper Middle Twin Lake. The large gathering in Middle Twin on the January panel on Figure 2.2 is the location where the January 2018 winter seining event occurred. By February and March, when there are periodic snow melt events, the fish tended to congregate around the outfalls of the large storm sewers discharging warmer, more oxygenated water into the lake. By April they were more dispersed, and the tagged fish were frequenting the shallow margins of Upper Twin Lake where there may be new vegetative growth and where spawning may occur.

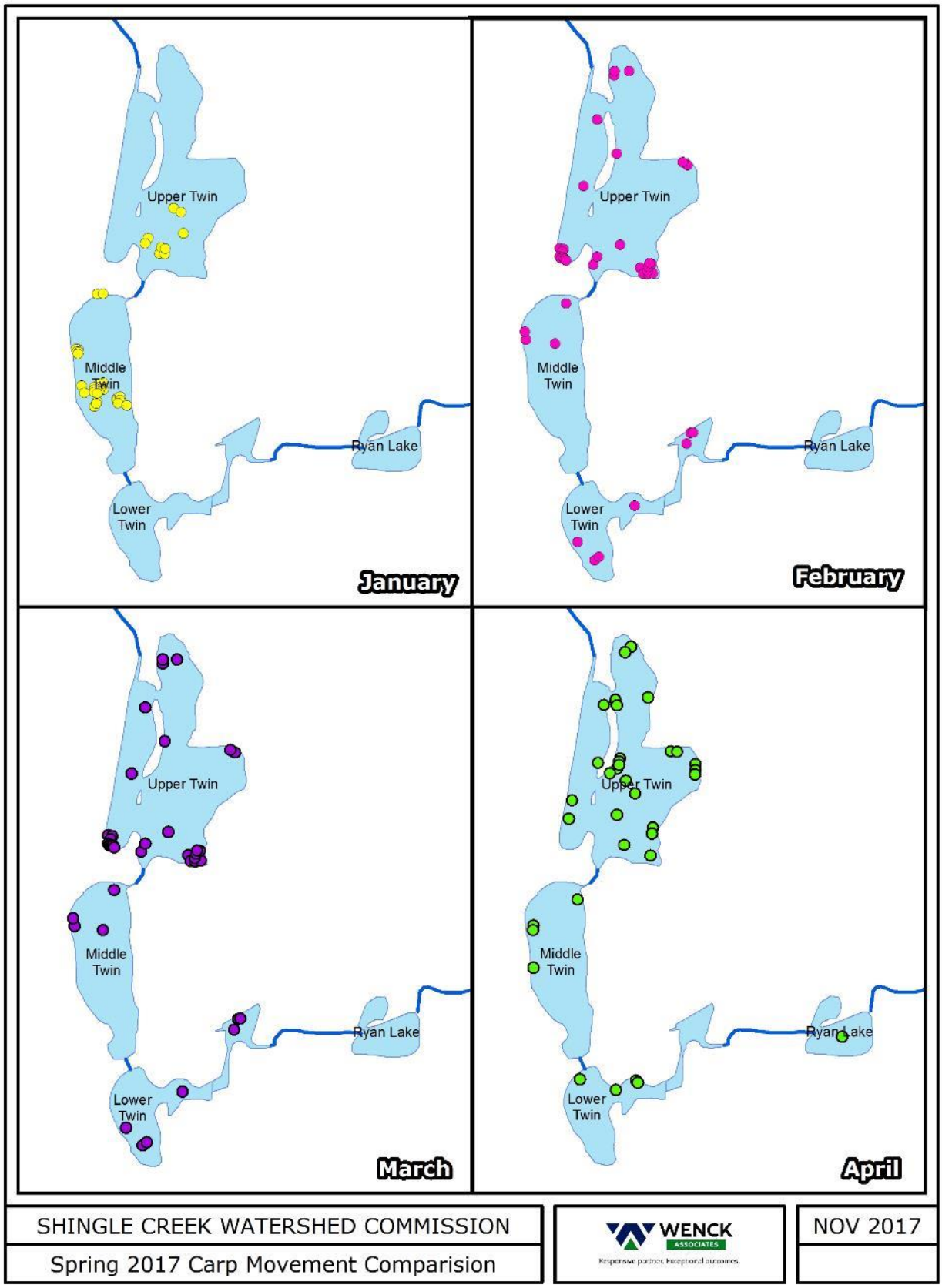


Figure 2.3. Spring 2017 carp movement by month.

2.4 CARP REMOVALS

2.4.1 Removals

Radio tracking identified a dense aggregation in Middle Twin Lake in January 2018. Arrangements were made with the commercial fishermen assigned to this territory to complete a winter seining. The seine haul occurred on 1/18/2019. Two large holes were cut in the ice (one on the east shoreline and the other on the west shoreline areas) on Middle Twin Lake. The net was deployed under the ice on the east side of the lake at 9:00 am and was pulled westward where it began to surface through around 10:30 am. The initial 100-150 feet of the seine was damaged and did not fish properly. A rusted steel drum and barb wire fencing was tangled in the net and likely cut part of the net, suggesting that debris impacted the seine haul. It is also possible that the net lifted off the bottom of the lake and allow fish to escape the seine haul. A sharp bathymetry change or debris can cause the net to lift from the bottom.

Ten fish species were observed during the seine haul: black bullhead, common carp, bluegill, black crappie, northern pike, largemouth bass, walleye, white sucker, yellow perch and bowfin. Black bullhead and common carp were removed, and all other fish were returned to the water (Figure 2.4). Carp were measured to estimate weight and the total biomass removed. A handful of larger carp were observed in the seine haul than was predicted in population modeling, thus it is likely that the biomass of carp in the system was underpredicted. An estimated 10,643 pounds of carp were removed, and an estimated 15,000 pounds of black bullhead, another bottom feeder. A second winter seine was planned in January 2019. While the carp schooled in the same location as January 2018, the commercial fisherman had equipment issues and was unable to mobilize before the school dispersed during a sudden warm snap.

Two alternate methods were used in spring 2019 to accomplish additional removals. The first capitalized on the propensity of carp to assemble in the Lower Twin Lake outlet channel, Highway 100 wetland, and Ryan Creek just upstream of the France Avenue outlet weir where a fish barrier was installed in fall 2018 (Figures 2.5 and 2.6). It is theorized that the fish are waiting for spring high water levels to make it easier to swim over the weir and through Ryan Creek to Ryan Lake to spawn. Commission staff devised a method to trap the carp in the channel just upstream of the barrier using a block net, then to use a seine to net the trapped carp. This was successfully completed twice. An additional effort was thwarted when a large spring storm the night before the removal increased the volume and velocity of lake outflow, which undermined the barrier footing. The trapped carp were able to slip under the footing and over the weir. Their estimated biomass was counted as removed as they can no longer return to the Twin Lake system, and the barrier footing has been reinforced.

The second method was simply trolling the shallows of Upper and Lower Twin Lake with an electrofishing boat in the areas where tracking had suggested they congregate during the spawning season. Some of the females caught during these removals were dissected and were found to be laden with eggs.

While the biomass removed during these alternate methods was less than winter seining, this method can be much more responsive to school movements and be completed at lower cost per effort. The Commission intends to continue these methods to bring down the carp population to a much more manageable density.

Figure 2.4. Winter seining.

Figure 2.5. Sorting fish netted from Ryan Creek.

Table 2.4. Carp removals to date.

Removal Date	# Carp Individuals	Average Weight (lbs)	Total Weight (lbs)	Method
1/19/2018	2661	4	10,643	Winter seine
3/4/2019	0	0	0	Winter seine
4/18/2019	200	4	800	Under barrier
4/26/2019	89	3.98	354	E-boat
5/2/2019	162	4.71	763	E-boat
5/16/2019	206	4.5	927	Ryan Creek
5/23/2019	211	4.5	950	Ryan Creek
TOTAL	3,529 (38%)		14,437 (44%)	
Goal	10,715		33,069	

Figure 2.6. The outlet of Lower Twin Lake.

2.5 CONTROL REPRODUCTION AND MIGRATION

2.5.1 Carp Barriers

The carp tracking verified the suspicion that carp were moving into and out of the lake system via Ryan Creek. A fish barrier (Figure 2.7) was installed on the weir of Ryan Creek as it flows under France Avenue North. Ryan Creek is the outlet of the Twin chain, and flows in and out of Ryan Lake downstream to Shingle Creek. Tracking also indicated that carp were moving into a connected wetland across Bass Lake Road, upstream of Upper Twin Lake, potentially to spawn. Another barrier was installed in the channel just downstream of the Bass Lake Road culvert (Figure 2.8).

2.5.2 Aeration

Research conducted by Dr. Peter Sorensen at the University of Minnesota suggests that carp can reproduce very successfully in shallow lakes that experience severe hypoxia. Upper Twin is shallow (max depth <10 feet) and experiences frequent winter kills. To help protect the vulnerable pan fish during winter hypoxia, the intent of the project was to install an aeration system in Upper Twin Lake. After resolving various logistical difficulties and lakeshore property owner concerns, ultimately the host City of Brooklyn Center declined to take on the legal liability of the aeration system. The aerator was not installed.

Figure 2.7. The fish barrier on Ryan Creek at France Avenue.

Figure 2.8. The fish barrier at Bass Lake Road.

3.0 Lake Response

3.1 VEGETATION MONITORING

It was expected that improvements in lake clarity may drive a response in submersed aquatic vegetation (SAV), including aquatic invasive species (AIS) known to be present in the lakes. The exact nature of that response was unpredictable, so the project included surveys of existing SAV conditions and the preparation of an Aquatic Vegetation Management Plan.

Baseline surveys for the three basins of Twin Lake are shown in Figures 3.1, 3.2, and 3.3. These surveys were done by both point-intercept transects and by continuous sonar readings. Computer software is used to overlay a grid of points across the entire lake that are the predetermined sampling locations. At each survey location a double sided weighted 14 tine rake is thrown from the boat, allowed to sink, and then retrieved across the lake bottom to represent approximately 1 m^2 of vegetation sampling. For each rake toss, vegetation is removed from the rake, identified to the species level, placed in a perforated bucket, weighed and assigned a proportion of the total biomass based on visual approximation (e.g. 80% of total weight was curly-leaf pondweed (CLP) and 20% of total weight was coontail). All biomass values are reported in wet weights (kg). The continuous sonar data was processed using CiBioBase software (cibiobase.com) to map water depth and vegetation biovolume. Biovolume differs from biomass in that it provides context to vegetation water column saturation. The higher the biovolume the more saturated the water column is with vegetation.

Surveys were done in late spring and then again in early fall, after senescence of any curly-leaf pondweed. Survey points where CLP was detected are shown in yellow, with the size of the symbol indicating estimated biomass. Biovolume of SAV is illustrated by a color ramp.

The survey results demonstrate a biologically-impaired vegetation community across all three basins. Species richness, abundance and spatial coverage all decrease across the growing season due to decreased water clarity over the growing season. Currently, CLP is the only dominant vegetative AIS species in Twin Lake system, most notable in the Upper Twin basin. The surveys were used to develop an Aquatic Vegetation Management Plan (AVMP) for review and approval by the DNR. The AVMP documents current conditions and potential future management actions depending on the aquatic vegetation response as water clarity improves. The DNR approved the AVMP, and issued a variance for Upper Twin Lake allowing the Commission to if necessary treat more than the state limit of 15% of the 117 acre lake surface area.

In spring 2018, the DNR and Commission staff delineated a 9.4 acre area of CLP on Upper Twin Lake that was subsequently treated with endothall, In spring 2019 the DNR and Commission staff conducted an invasive plant survey and found very sparse stands of CLP as well as some stands that were dead. Harsh conditions during the 2018-2019 winter, including a significant and long-lasting snowpack on the lake surface limited light penetration, which inhibited CLP growth under the ice. No treatment was performed. Another survey will be completed in spring 2020 to determine if additional CLP treatment is necessary.

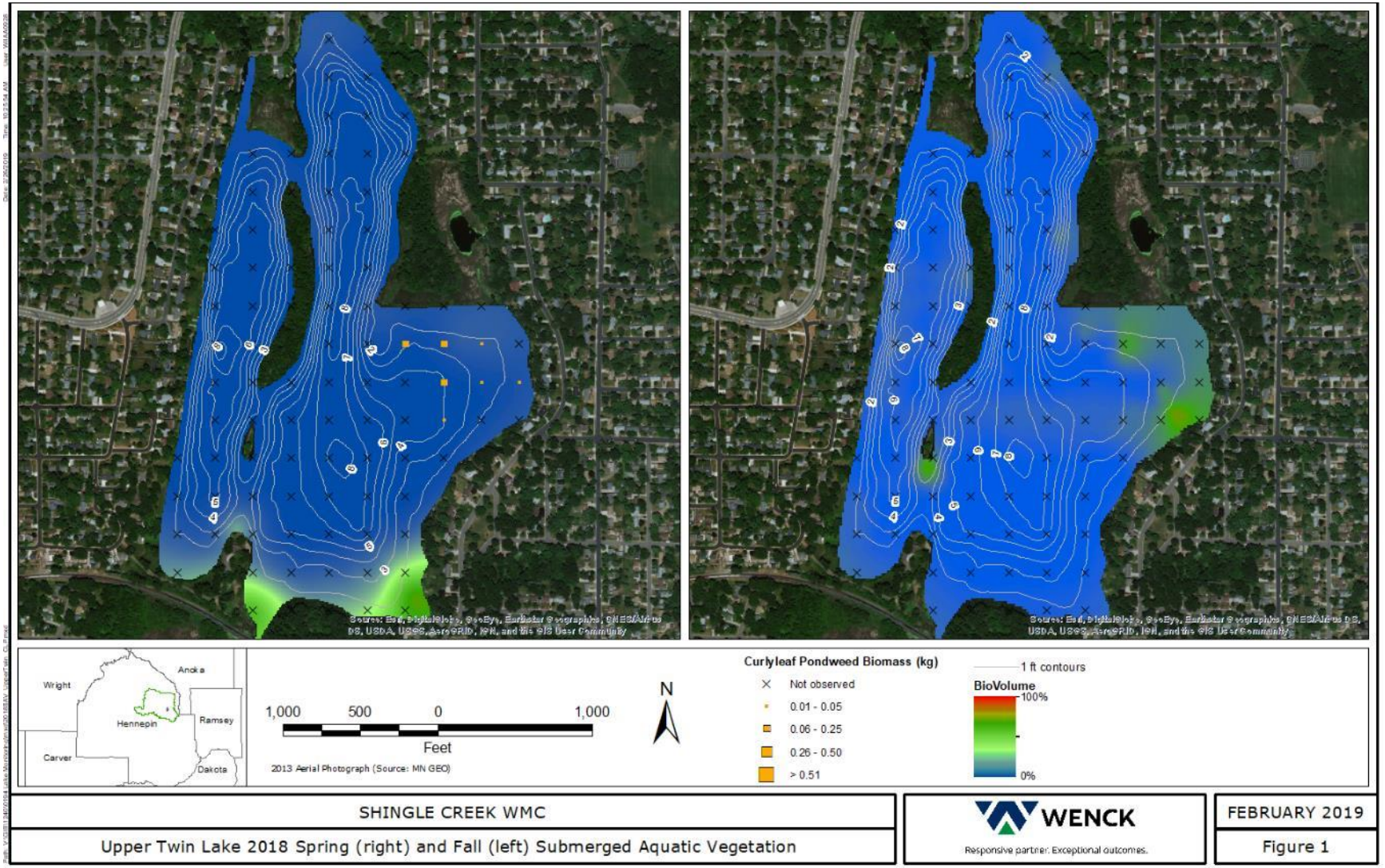


Figure 3.1. Upper Twin Lake SAV survey results.

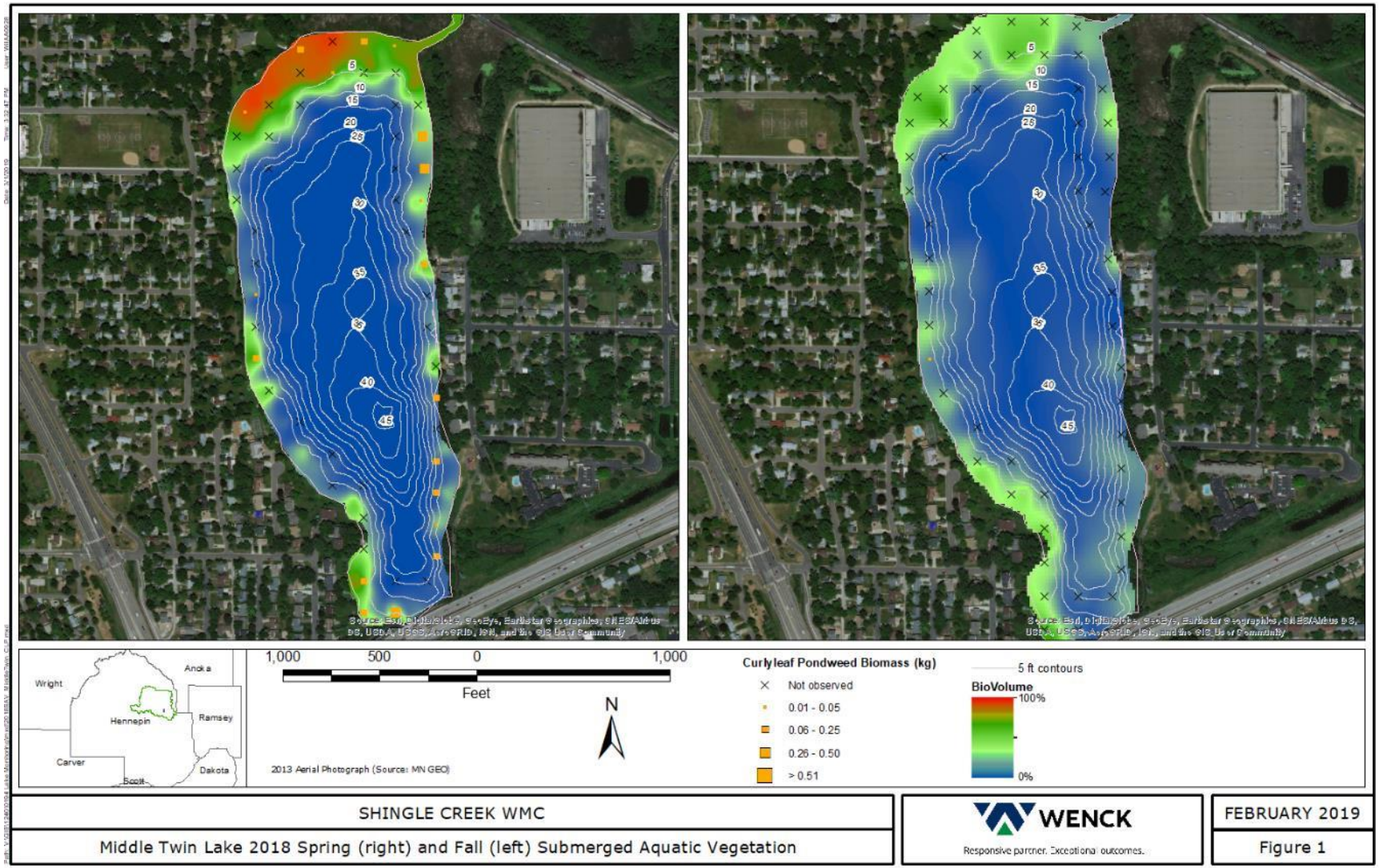


Figure 3.2. Middle Twin Lake SAV survey results.

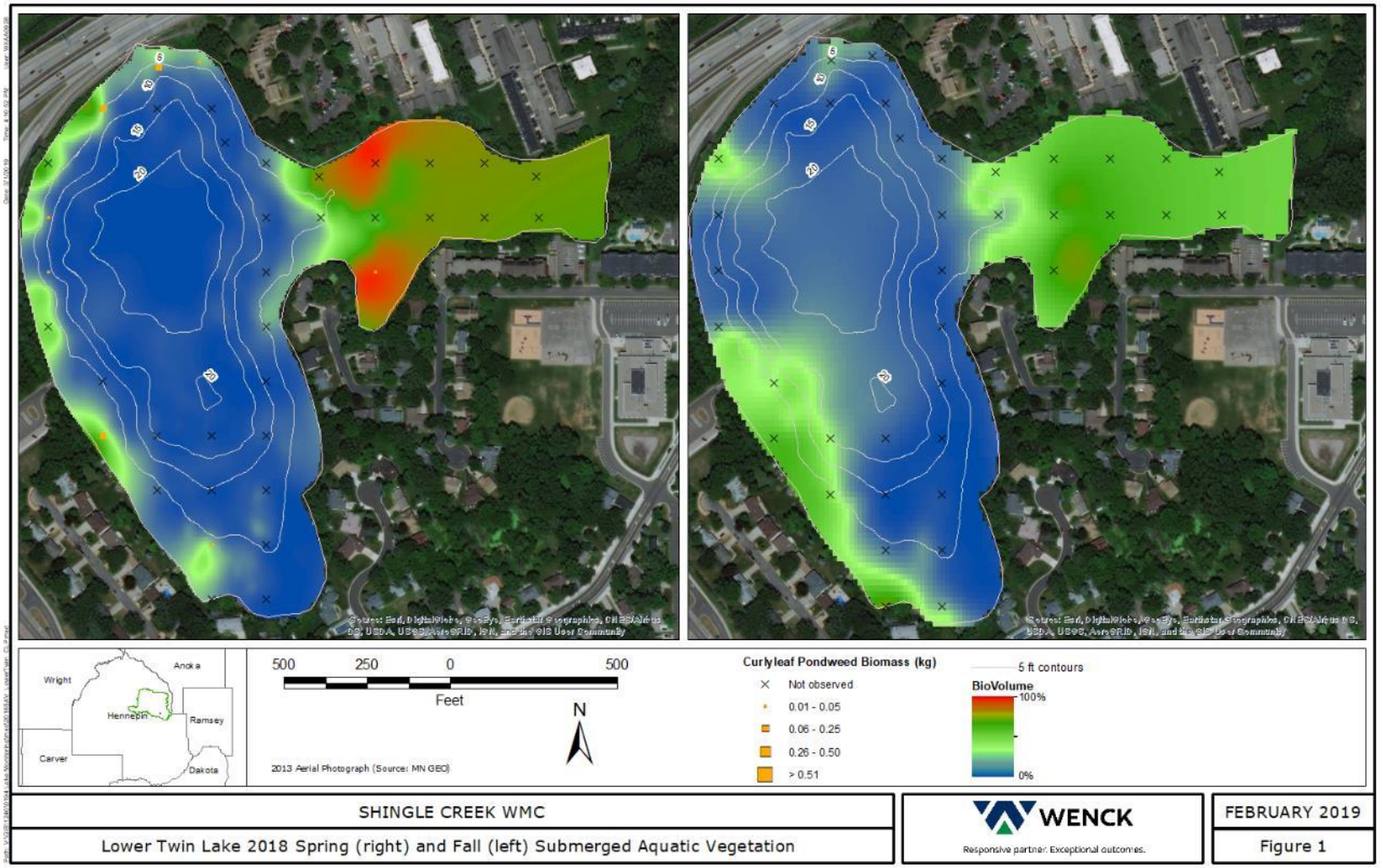


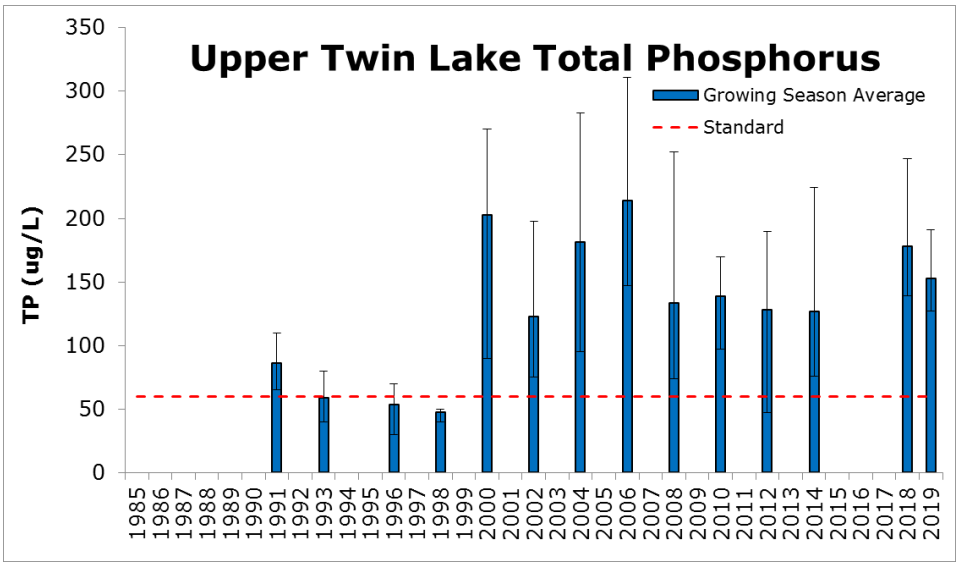
Figure 3.3. Lower Twin Lake SAV survey.

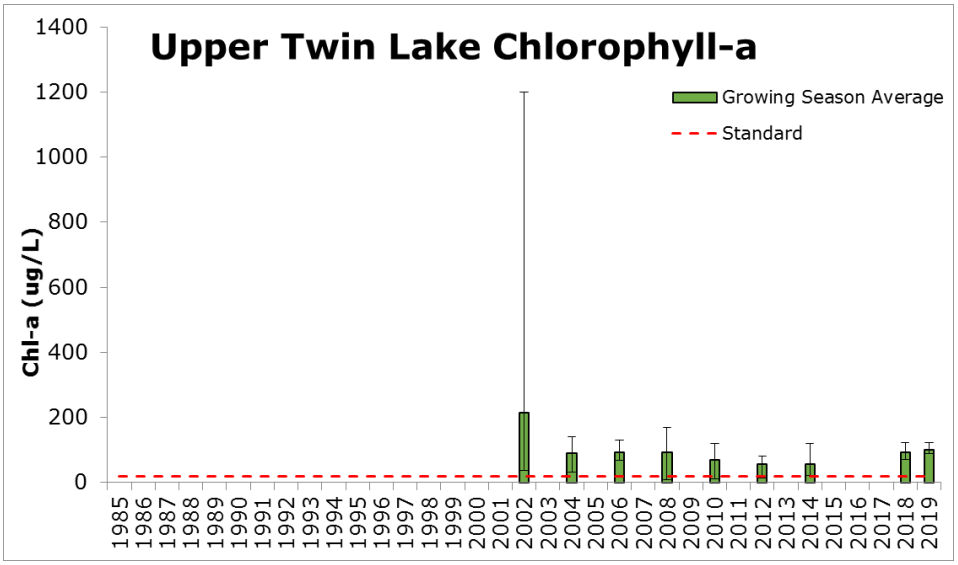
3.2 WATER QUALITY MONITORING

Biweekly water quality monitoring was completed in 2018 on all three basins of Twin Lake as well as Ryan Lake. Monthly sampling was completed on the three basins in 2019. Parameters that were measured were total phosphorus (TP), soluble reactive phosphorus (ortho-P), total suspended solids (TSS), and chlorophyll-a (chl-a). In the deeper Middle Twin and Ryan Lakes hypolimnetic (deep) water samples were collected and tested for TP and ortho-P. In addition to these chemical parameters, the physical profile of the lakes were assessed in the deepest part of the lake. A profile typically consisted of taking measurements starting at the water's surface and continuing every meter (or half meter in shallow lakes) throughout the entire water column. A multimeter probe was used to collect dissolved oxygen (DO; mg/L), DO%, temperature, pH, oxidation reduction potential (ORP) and specific conductivity at each step in the profile. Additionally, a Secchi disk reading was taken during every assessment to relate the relative level of water transparency. The data were compiled and reported in the Commission's annual Water Quality Report.

Figures 3.4 through 3.6 show historic water quality in the three basins of Twin Lake. The data are summer growing season averages, May 1 to September 30. The whiskers on each bar show the range of data, with the top of the whisker representing the highest recorded concentration that year. For Secchi depth, the X-axis is flipped to be on top rather than on the bottom. The axis represents the surface water level, and the bars represent the depth of clarity. The whiskers again show the range of data, and the bottom of the whisker indicates the best water clarity recorded that year.

No significant immediate water quality response was noted in any of the lakes. Because of annual variability more years of data will be necessary to determine whether there is a trend for improvement.





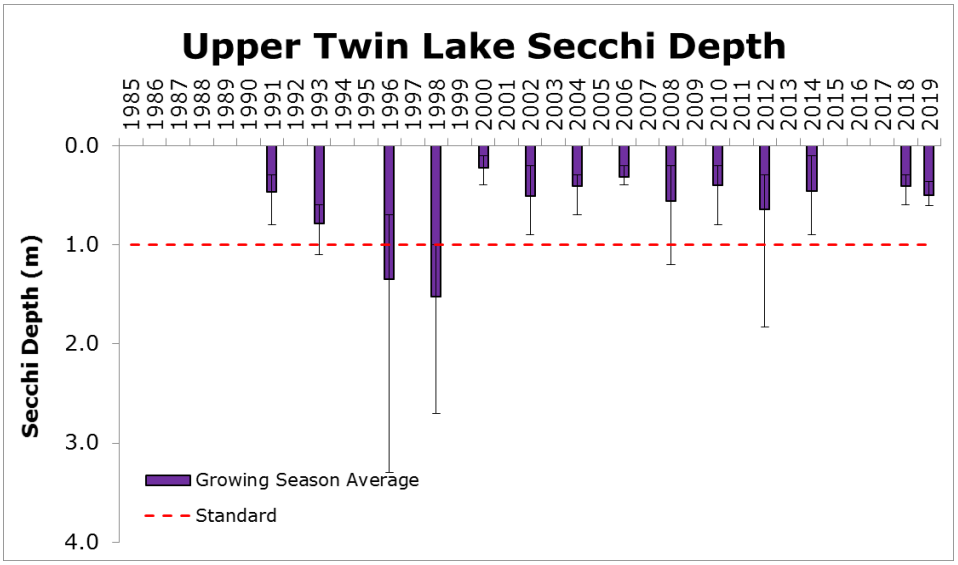
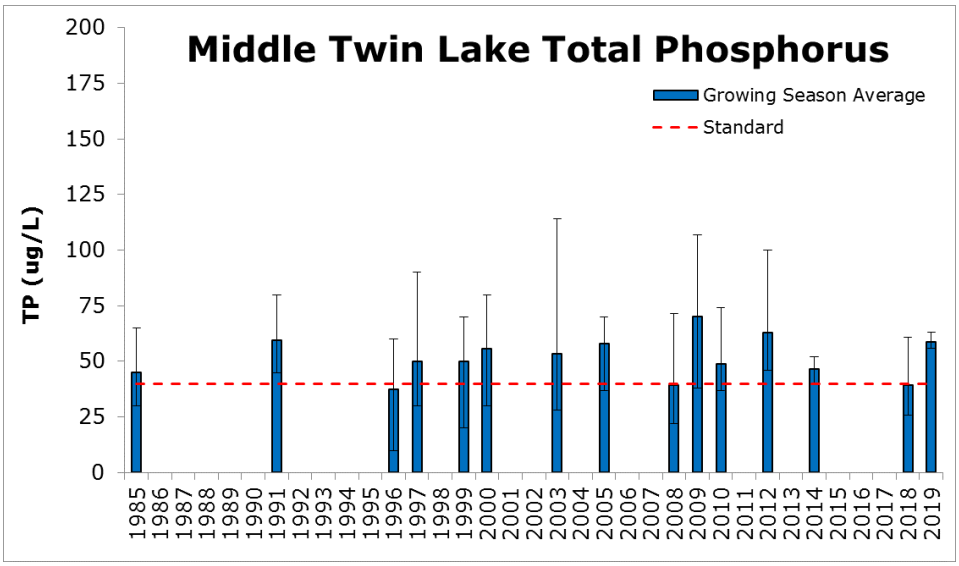
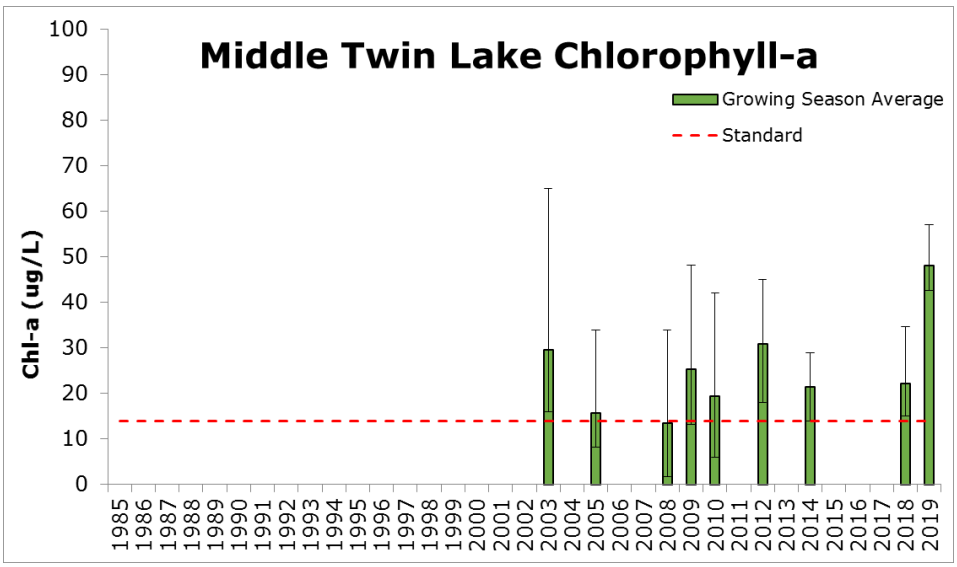


Figure 3.4. Upper Twin Lake historic water quality.





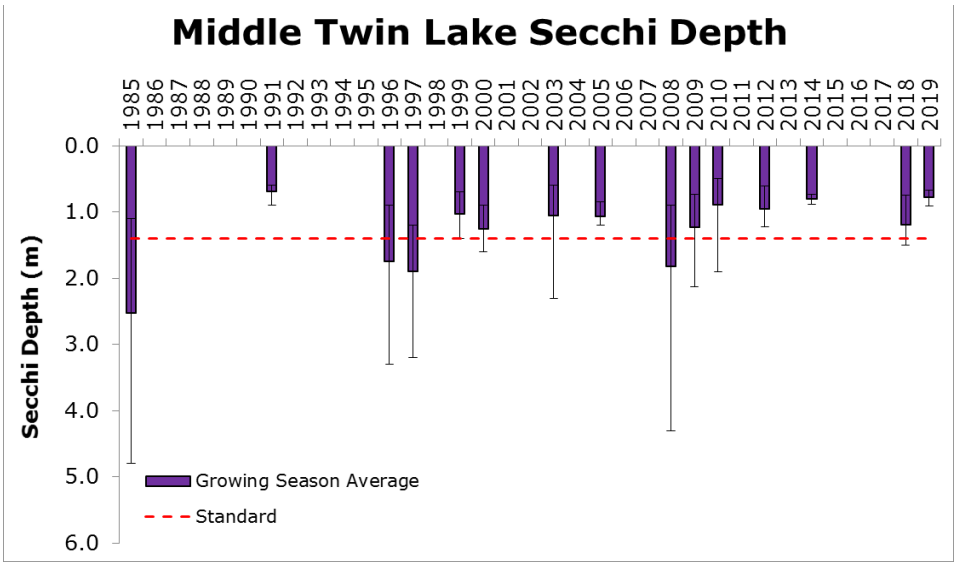
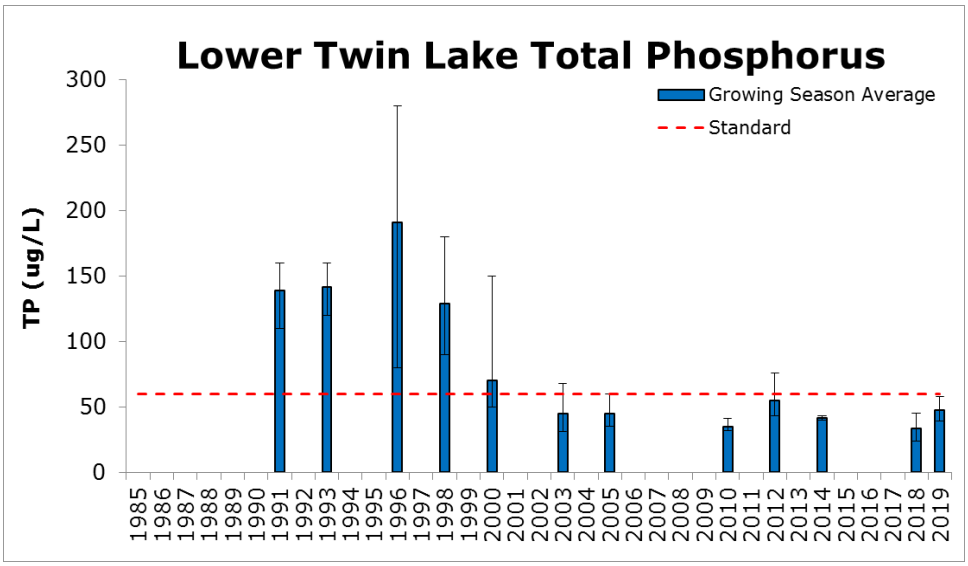
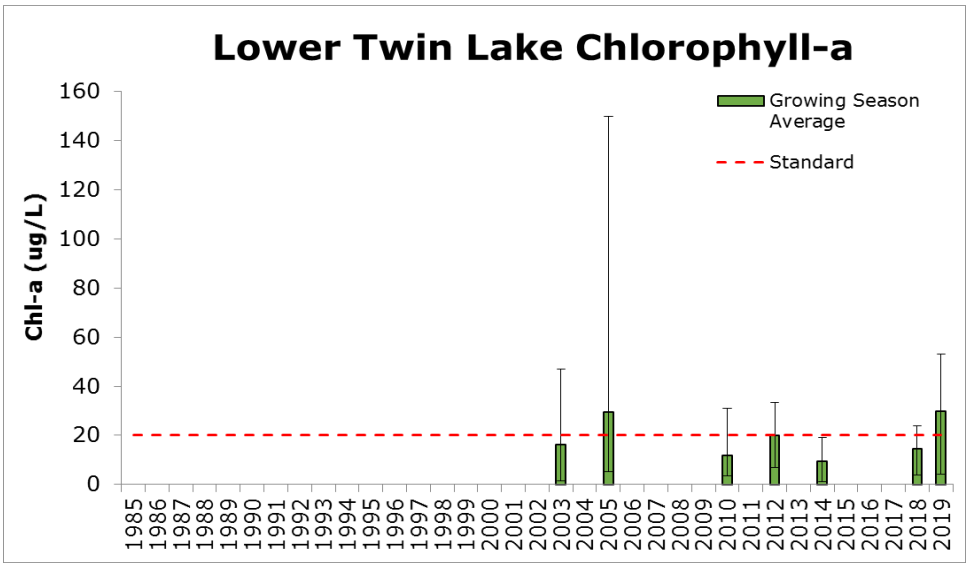


Figure 3.5. Middle Twin Lake historic water quality.





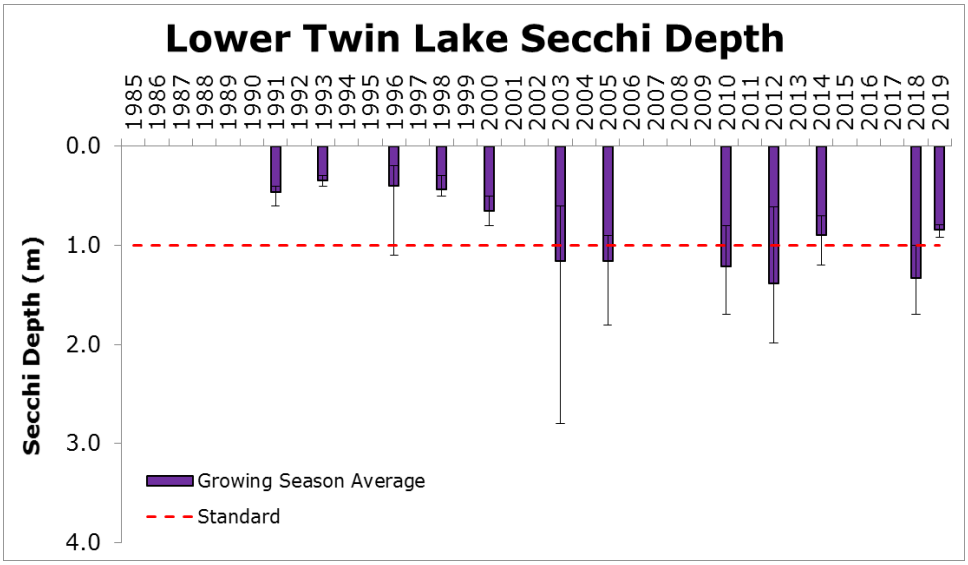


Figure 3.6. Lower Twin Lake historic water quality.

4.0 References

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Technical Memo

WENCK ASSOCIATES

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To: Shingle Creek/West Mississippi WMO Commissioners

From: Ed Matthiesen, P.E.
Diane Spector

Date: October 5, 2019

Subject: Biochar-Enhanced Sand Filters Project Final Report

Recommended Commission Action	Review and accept the final report. Authorize retaining $5,000 of levy funds in the project account and return of the audited balance (approximately $6,051.95) to the Closed Projects Account.

The Section 319 grant funding the Shingle Creek Biochar/Iron Enhanced Sand Filters Project expired on August 30, and work is now complete. The filter box at Webber Park Falls and the inserts from the catch basins in New Hope and Robbinsdale have been removed. The pond filter benches will remain in place, but the monitoring instrumentation has been removed.

Attached is the project final report. In summary, we found that the creek diversion filter box reduced *E. coli* concentration by an average 90%, the stormwater pond filter benches averaged 73% reduction, and the catch basin skimmer box filters averaged 81%. The filter box very reliably reduced TP concentrations, averaging 79% reduction. The pond filters were less reliable and lower efficiency (Champlin 40% and Crystal 61%), with some samples showing an increase in TP concentration in filtered outflow. There did not appear to be any pattern that might explain why these occasional increases were seen. At both catch basin sites, TP actually increased in filtered outflow in all samples but one.

Similar to TP performance, the filter box significantly reduced OP (dissolved P) by an average 83%. The pond filter benches performed slightly better than the TP results. The Crystal site averaged 77% OP reduction while the Champlin site averaged 52%. The Champlin site was frequently inundated for long periods of time. Previous research and observation have shown that iron-enhanced filters are better at capturing OP in stormwater when they are allowed to dry out between rain events. Similar to their TP performance, the catch basin filters very rarely reduced OP, and for most samples actually showed increased OP in filtered stormwater.

We also took samples of the pond filter media and had them tested for phosphorus sorption capacity. The Minneapolis Olson Pond media, which were never inundated, showed 0.27% saturation. The Crystal filter media showed 1.1% saturation and the Champlin pond 14.4% saturation. These results confirm that the iron-enhanced sand sorbs (binds) phosphorus over time, and the more the media is inundated with stormwater, the more phosphorus it sorbs. The results also suggest that these filters have a lot of binding capacity remaining—even the Champlin filter media, which has been inundated continuously, is only 14.4% saturated with phosphorus, meaning 85% of its phosphorus-binding sites remain.

The study results show that biochar has a very promising potential in removing *E. coli* from stormwater. The modification to the Minnesota iron-enhanced sand filter design not only reduced *E.* coli concentrations but also provided additional benefit in the form of phosphorus removal. However, the mechanism of *E. coli* removal by biochar is still unclear and the longevity of iron- and biochar-enhanced sand filters in the field must still be determined. While the filters have been in place only a few years, we have not yet observed any significant reduction in effectiveness. We have also not observed any breakdown of the biochar during the winter-spring freeze-thaw cycles. These knowledge gaps should be investigated now that this study has determined the potential of biochar- and iron-enhanced sand filters in removing *E. coli* and phosphorus from stormwater.

All three types of field designs tested can be useful in different scenarios. A particularly useful application would be installing such filters to treat concentrated flow from a site with high bacterial contamination potential, such as runoff from a dog park, a location with excessive populations of waterfowl such as Canada geese, or a storm sewer outfall near a swimming beach.

Final Project Cost

Table 1 below shows the final project cost and the funding sources. Note that the final cost and match is not the same as what was reported in the final project report because some additional expenses occurred after August 30. The original amount granted was $199,375, of which $197,160.28 was expended and reimbursed (final reimbursement is pending). The two Commissions received a total levy of $296,252.91, of which $285,200.95 was expended (the final accounting is pending audit). There is an approximate balance of $11,051.96. Staff recommends retaining $5,000 of that in the project account for any maintenance or other issues that come up with the pond filters, and designating the balance to be returned to the Closed Projects Account to be available for other projects.

Table 1. Final project cost and funding.

Total project cost	$482,361.23
Total grant expenses	$197,160.28
Total match (levy) expenses*	$285,200.95
Total levy received	$296,252.91
Total levy remaining*	$ 11,051.96
Recommended retention	$ 5,000.00
Release to closed projects account*	$ 6,051.96

*The final amount is pending audit.

Shingle Creek Biochar/Iron Enhanced Sand Filters Project

Prepared for:

SHINGLE CREEK AND WEST MISSISSIPPI WATERSHED MANAGEMENT COMMISSIONS
MINNESOTA POLLUTION CONTROL AGENCY

September 2019

Prepared by:
WENCK ASSOCIATES, INC.
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Wenck File #1240-0163

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Acknowledgments

Funding for this study was provided by the Minnesota Pollution Control Agency through a grant from the United States Environmental Protection Agency Section 319 Nonpoint Source Management Fund. Additional funding was provided by the Shingle Creek and West Mississippi Watershed Management Commissions. In-kind services were provided by the Cities of Crystal, Minneapolis, and Champlin, Minnesota and the Minneapolis Park and Recreation Board. Dr. Sanjay Mohanty, UCLA, provided strategic guidance and assistance.

Additional guidance and specialty monitoring were provided by Dr. Andy Erickson and Dr. John Gulliver at the University of Minnesota Saint Anthony Falls Laboratory; Dr. Josh Feinberg and Dr. Beth Fisher at the University of Minnesota Institute for Rock Magnetism; and Bill James, University of Wisconsin-Stout.

Ed Matthiesen, P.E., Wenck Associates, Project Engineer and Principle Investigator
Diane Spector, Project Manager
For more information: ematthiesen@wenck.com (763) 252-6851
dspector@wenck.com (763) 252-6880

Photo: Iron-enhanced sand filter, North Lions Park pond, Crystal, Minnesota, June 2017.

Cover: Shingle Creek Filter Box at Webber Falls, Webber Park, Minneapolis, Minnesota, October, 2017.

All photos and graphics: Wenck Associates, Inc., unless noted.

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Executive Summary

The Shingle Creek watershed is a 44-square mile highly urbanized watershed in Hennepin County, Minnesota in the Twin Cities Metropolitan Area. Lack of adequate treatment of non-point source stormwater runoff has resulted in Shingle Creek, a Mississippi River tributary, to be listed as and Impaired Water for chloride (1998), dissolved oxygen (2004), *E.coli* (2014), and biotic integrity (macroinvertebrates) (2006). Its "sister" watershed, the West Mississippi watershed, drains primarily by storm sewer directly to the Mississippi River, which is also impaired by excess fecal coliform concentrations (2006).

High concentrations of *Escherichia coli (E. coli)* bacteria in urban stormwater and natural waters is a public health concern. Ingestion of *E. coli* can cause various diseases, such as gastroenteritis, urinary tract infections and neonatal meningitis. Excess phosphorus in stormwater and natural waters is also a concern because high phosphorus levels cause algae blooms that can inhibit recreation and harm aquatic organisms. High levels of phosphorus load to Shingle Creek is one of the sources of excess sediment oxygen demand, one of the causes of low DO in the stream, and one of the primary stressors to the macroinvertebrate community. The 2017 Upper Mississippi Bacteria TMDL requires a reduction in bacteria concentrations in Shingle Creek, while the 2011 Shingle and Bass Creeks Biota and DO TMDL calls for reducing phosphorus loading to the stream to reduce sediment oxygen demand.

This study was a field trial of a practice to reduce *E. coli* in stormwater runoff that has shown great promise in the lab. We modified iron-enhanced sand filters, a stormwater treatment practice more typically used for phosphorus removal, to provide additional *E. coli* removal using a biochar amendment. We tested this iron- and biochar-enhanced sand filter concept in three different applications: filters in catch basin skimmer boxes; stormwater pond filter benches, and a creek diversion filter box. This study found that biochar has good capability in *E. coli* removal. The creek diversion filter box reduced *E. coli* concentration by an average 90%, regardless of short hydraulic residence time. The stormwater pond filter benches averaged 73% reduction, and the catch basin skimmer box filters averaged 81%. Phosphorus removal was reliable as expected at the pond filter benches when filters were properly maintained.

As the first test of using biochar amended iron-sand filters outside the lab, the study showed that this relatively simple technology can also work in the field. As there are few options to reduce *E. coli* in urban stormwater runoff, this will be a valuable tool for watershed managers. Study results have been presented in Minnesota and nationally, and there is high interest from practictioners in learning from these findings.

1.0 Section 319 Final report

1.1 GRANT SUMMARY REPORT

Grant project summary

Project title: Shingle Creek Biochar/Iron Sand Bacteria Filters

Organization (Grantee): Shingle Creek Watershed Management Commission

Project start date: 12/24/2015 Project end date: 8/30/2019 Report submittal date: 9/30/2019

Grantee contact name: Judie Anderson Title: Administrator

Address: 3235 Fernbrook Lane N

City: Plymouth State: MN Zip: 55447

Phone number: 763-553-1144 Fax: 763-553-9326 Email: judie@jass.biz

Basin (Red, Minnesota, St. Croix, etc.)
/Watershed & 8 digit HUC:: Upper Mississippi 07010206 County: Hennepin

Project type (check one):

- ☐ Clean Water Partnership
- ☐ Total Maximum Daily Load (TMDL)/Watershed Restoration or Protection Strategy (WRAPS) Development
- ☒ 319 Implementation
- ☐ 319 Demonstration, Education, Research
- ☐ TMDL/WRAPS Implementation

Grant funding

Final grant amount: $197,160.28 Final total project costs: $473,181.04

Matching funds: Final cash: $276,020.76 Final in-kind: $ Final Loan: $

MPCA project manager: Deepa deAlwis

Executive summary of project (300 words or less)

This summary will help us prepare the Watershed Achievements Report to the Environmental Protection Agency. (Include any specific project history, purpose, and timeline.)

Problem (one paragraph)

Stormwater conveys bacteria such as *E. coli* to receiving waters, where contact can be a human health risk. In urban areas bacteria sources are diffuse –pet and wildlife waste, sanitary overflows and leakages - and options for reducing loads are limited. How can bacteria being conveyed to impaired waters or swimming beaches be most effectively addressed? The Shingle Creek watershed in northwestern Hennepin County, Minnesota is 44 square miles of urban and suburban development. Both Shingle Creek and the Mississippi River to which it discharges, are impaired by excess concentrations of *E. coli* and other bacteria. Existing development reduces opportunities to add new ponds or biofiltration and infiltration practices. Academic research is evaluating the efficiency of various filter media in removing nutrients, bacteria, metals, and other pollutants in urban stormwater. An exciting new finding is that adding biochar to iron-enhanced sand filters removed up to 99% of bacteria from synthetic stormwater in the lab. There is great interest in field-testing this relatively simple BMP to determine the expected removal rate in real-world conditions. This research project proposes to construct three different applications of biochar- and iron- enhanced filters in different parts of the watershed and conduct pre- and post-construction monitoring to determine effectiveness at removing *E. coli* and phosphorus from stormwater runoff.

Waterbody improved (one paragraph)

Shingle Creek (MPCA AUID 07010206-506) and the Mississipi River (MPCA AUID 07010206-805, Crow R to Upper St Anthony Falls).

Project highlights (one paragraph)

In a first of its kind field application of research previously only conducted in the lab, the Shingle Creek Watershed Management Commission has successfully achieved reductions of 70 to 90 percent of *E. coli* from stormwater, even when incoming bacteria concentrations were extremely high. This is an exciting finding with great potential. We installed biochar- and iron-enhanced sand filters in storm sewer catch basin inserts, stormwater pond sand filter benches, and an creek diversion filter box on Shingle Creek to reduce bacteria and nutrients in stormwater runoff. Three years of inflow and outflow monitoring data document the results. In addition, we identified lessons learned about designing and maintaining these types of filters. Demonstrating that biochar- and iron-enhanced sand filters can be added to existing stormwater infrastructure or as standalone practices adds a powerful new tool to the urban stormwater toolbox.

Results

The project demonstrated that adding biochar to three types of iron-enhanced sand filters reduced *E. coli* bacteria concentrations in stormwater by 70 to 90 percent. Because these were small-scale demonstration projects, the impacts to downstream water quality were not measurable.

Partnerships (Name all partners and indicate relationship to project)

Shingle Creek Watershed Management Commission: lead partner
City of Crystal: host partner
City of Champlin: host partner
City of Minneapolis: host partner
City of Robbinsdale: host partner
City of New Hope: host partner
Minneapolis Park and Recreation Board: host partner
Drs. John Gulliver and Andy Erickson, University of Minnesota Saint Anthony Falls Lab: research partners
Drs. Joshua Feinberg and Beth Fisher, University of Minnesota: research partners
Dr. Sanjay Mohanty, Stanford University and UCLA: research partner
Minnesota Pollution Control Agency: funding partner

Pictures

Included

1.2 WORK PLAN REVIEW

1.2.1 Approved Work Plan Changes

Amendment #1 revised the contract to clarify language regarding the QAPP. Amendment #2 reallocated budget and hours between tasks but did not change the overall cost or schedule. Amendment #3 reallocated budget and hours between tasks for additional specialty monitoring within the pond filters and at the surface-water interface but did not change the overall cost or schedule.

1.2.2 Report by Activity/Task

Objective 1: Design and Install iron- and biochar- enhanced filters.
Task A: Confirm appropriate site locations for filters.

The Commission identified eight existing ponds in the Shingle Creek and West Mississippi watersheds that could be potential pond retrofit sites. *E. coli*, total phosphorus (TP), and orthophosphorus (OP) samples were taken to evaluate existing water quality in the ponds. Ponds with elevated effluent *E. coli* concentrations are the best candidates for application of this BMP. Those eight were narrowed down to four. During the design phase, it was determined that site constraints meant that it would be extremely expensive to modify one of the ponds, leaving three ponds for retrofit.

Task B: Design iron- and biochar- infrastructure.

The Commission's engineer designed three biochar- and iron-enhanced sand filter benches using the Minnesota Filter https://stormwater.pca.state.mn.us/index.php/Iron_enhanced_sand_filter_(Minnesota_Filter) developed by the University of Minnesota St. Anthony Falls Lab. Each filter was slightly modified to fit specific site constraints. The engineer also designed sampling ports into the perforated pipe drain tile at the bottom of the filter so samples of treated stormwater could be taken and compared to pond inflow water quality.

Standard catch basin inserts used for temporary sedimentation control were modified to incorporate sample collection bottles at the bottom of the filter. Finally, the engineer and a fabrication specialist designed a pipe system to withdraw streamflow from Shingle Creek convey that flow to a steel box on the streambank containing filter media, and then return the filtered water back to the stream.

Task C: Construct iron- and biochar- infrastructure

The pond filters were publicly bid and constructed by the low bidder under the oversight of the Commission's engineer. During construction, the contractor was unable to obtain enough biochar to incorporate into all three filters, so the project manager decided to construct one of the filters with iron-enhanced sand only as a comparison. At a later date, biochar will be added to that filter and subsequent monitoring will be completed.

Post construction, it was apparent that the bench on one pond was very rarely inundated. Investigation found that outflow weir was "leaky," allowing the pond to discharge when the pond was actually lower than the weir elevation. The weir was repaired, but the pond still did not rise to the bench level. Further analysis showed that the pond as-builts incorrectly stated the outlet weir elevation and thus the bench was constructed at too high an elevation. Some monitoring occurred by pumping pond water through the filter.

The filter box was installed on a viewing platform overlooking Shingle Creek Falls in Webber Park, which is a nine foot artificial drop structure. A pipe was extended out to the lip of the drop structure to withdraw streamflow and send it to the filter box. The flow then percolated through the filter box, and an outflow pipe at the bottom extended over the edge of the viewing platform to discharge the flow back into the Creek. Sampling ports were added to both the inflow and outflow pipes.

Objective 2: Monitoring and Evaluation
Task A: Pre- and post-construction BMP monitoring.

Post-construction water quality monitoring was completed on the Crystal Pond 12 times between June 2017 and July 2019. Analytes included total phosphorus (TP), orthophosphorus (OP), total suspended solids (TSS), and *E. coli*. For some samples, lab pH, nitrate+nitrate, and dissolved organic carbon (DOC) were analyzed.

The Champlin Pond was monitored 19 times between September 2017 and July 2019. The Crystal Pond was monitored 15 times. The Minneapolis Pond was monitored two times. Each pond's outlet was monitored in addition to the filter media outlet. The pond outlet is considered the control since it is not being treated by the filter media. The New Hope catch basin was monitored nine times, and the Robbinsdale catch basin 13 times. At each catch basin, samples were taken of gutter flow and from a collection bottle fixed to the bottom of the catch basin insert, below the filter media. The creek diversion filter box was sampled 23 times, with both inflow and outflow monitored. Data was compiled in an Excel database.

To characterize the initial binding capacity of filter media, filter core samples were analyzed by Bill James at the University of Wisconsin Stout. The iron-bound phosphorus in the sample as well as the phosphorus sorption capacity were analyzed. These results confirm that the iron-enhanced sand sorbs phosphorus over time, and the more the media is inundated with stormwater, the more phosphorus it sorbs. The results also suggest that these filters have a lot of binding capacity remaining

During the project, the Commission became acquainted with the work of Drs. Beth Fisher and Joshua Feinberg of the University of Minnesota, who are researching the iron-phosphorus binding mechanism and the ability to predict the chemical conditions that favor the formation of the specific iron oxide types that most successfully trap phosphates. The Commission contracted with them to supplement the water quality monitoring with more detailed monitoring of conditions at the filter/ water interface and within the filter itself. Monitoring was conducted real-time using in-situ sensors, including: water level, which indicates how long the filter drains; conductivity before and after filtration to log the total ionic activity in the water; redox in the filter at various depths, which relates to the oxidation state of iron and the iron forming conditions in the filter; and DO before, in-filter, and after filtration to estimate microbial oxygen consumption/demand throughout the system. In addition, Drs. Fisher and Feinberg analyzed core samples taken from the filters to characterize iron mineral makeup within filter media to determine which iron minerals are bonding with phosphorous. Their findings suggest that these filters are least successful in low DO conditions, or where pH is consistently above neutral.

Task B: Evaluation.

All iron- and biochar-enhanced sand filter applications demonstrated average *E. coli* removal efficiencies of 63% or greater (Table 4-1).

The Champlin stormwater pond, which was the only monitored stormwater pond containing a biochar-enhanced filter, had a 73% removal efficiency. The creek flow diversion filter box had a 90% removal efficiency. The two catch basin filter inserts had removal efficiencies of 63% and 92%, respectively. Results of monitoring data are presented in more detail later in this report

Task C: Submit data to EQuIS.

The data has been formatted for EQuIS and will be submitted in November 2019 with the Commission's annual upload to EQuIS.

Task D: Prepare QAPP.

The Commission collaborated with MPCA staff to prepare a QAPP for the project.

Objective 3 Reporting and Information Sharing
Task A: Reporting and Information Sharing

Results of monitoring data and general findings and conclusions are presented in the following sections of this report. The interim and results were (or will be) presented at numerous local, regional, and national conferences, including the following:

Table 1.1. Presentations of study interim and final results.

Conference	Date	Location
2018 IECA Annual Conference	2/13/18	Long Beach, CA
2018 IECA Great Connections Great Rivers/Great Lakes Chapter	4/26/18	Dubuque, IA
2018 StormCon	8/15/18	Denver, CO
2018 MN Water Resources Conference	10/16/18	St. Paul, MN
2019 Minnesota Pollution Control Agency Staff	1/24/19	St. Paul, MN
2019 Minnesota Board of Water and Soil Resources Staff	5/22/19	Golden Valley, MN
2019 Biochar and Bioenergy Conference	7/21/19	Fort Collins, CO
2019 MN Water Resources Conference	10/15-10/16/19	St. Paul, MN
2020 IECA Annual Conference	2/20-2/16/20	Raleigh, NC

IECA = International Erosion Control Association

Objective 4 Administration/ Semiannual and Final Reporting
Task A: Administration/ Semiannual and Final Reporting

The Commission submitted timely quarterly invoices and semiannual reports as required and prepared this final report.

1.3 GRANT RESULTS

1.3.1 Measurements

Results of monitoring data are presented in more detail in the following sections of this report. All iron- and biochar-enhanced sand filter applications demonstrated average *E. coli* removal efficiencies of 63% or greater. The Champlin stormwater pond, which was the only monitored stormwater pond containing a biochar-enhanced filter, had a 73% removal efficiency. The creek flow diversion filter box had a 90% removal efficiency. The two catch basin filter inserts had removal efficiencies of 63% and 92%, respectively. Phosphorus removal efficiencies ranged from 0 to 81%.

1.3.2 Products

Project products were installed BMPs, monitoring data, a final report, and numerous presentations.

1.3.3 Public Outreach and Education

This project did not include a specific public outreach and education component. However, the project has been presented at conferences locally, regionally, and nationally (see Table 1.1). In addition, temporary interpretive signage was placed at each pond and at the Webber Park Shingle Creek Falls filter box site. The filter box application was also featured on the local nightly news and the Minneapolis Pond was the focus of an Olson Middle School sixth grade field trip (which included a presentation by Commission staff).

1.3.4 Long-term Results

Capacity-Building. This research project raised awareness about the use of biochar in iron-enhanced sand filters as a new method of reducing bacteria in stormwater runoff. The final presentation and report includes a "lessons learned" section which will be helpful to other practitioners as they choose to implement this new technology. It is estimated that several hundred water resources, engineers and other professionals have seen a presentation on this project.

Partnerships. The project forged partnerships between cities, watersheds, and the biochar industry, and all parties shared information and expertise as well as learned from the results. The biochar industry was not aware of this potential use, as biochar is primarily used for soil amendments.

Dissemination of Project Results. The primary form of dissemination was presentations at various conferences, which are detailed in Table 1.1, and which included Minnesota, Midwestern regional, and national conferences as well as one international conference.

Applicability to Other Audiences/Locations. The intent of the project was to field test a technology that had previously only been studied in the lab. Urban bacteria impairments are very common and the current suite of available BMPs is limited. Demonstrating that the technology works well in the field will encourage other practitioners to devise creative uses of biochar and iron-enhanced sand filters.

Lessons Learned. While biochar does appear to have utility at reducing *E. coli* and other bacteria concentrations in stormwater runoff when added to iron-enhanced sand filters, there are still obstacles to general use. For the stormwater pond filter application, not all existing ponds are physically good candidates for retrofit. They may be limited by available space, outlet configuration, or hydrology, or the incoming bacteria concentrations may not be high enough to justify an expensive retrofit. Iron-enhanced sand filters, whether or not they are amended with biochar, are not maintenance-free. Fines and organics tend to collect on the surface, leaving a crust that needs to be raked fairly frequently. The catch basin inserts performed well at bacteria reduction, but when leaf and other organic litter collected in the sump, nutrients were more able to leach from the material into the stormwater. This actually increased the phosphorus being discharged into the storm sewer system. The filter box application performed the best, but the volume of streamflow treated was miniscule compared to the stream discharge. Such an offline filter might be better suited for smaller channels conveying smaller volumes. There is limited data available on the useful life of the biochar. It is expected that at some point the filters would need to be recharged with biochar and potentially iron, but it is unknown whether that is after 5 years or 25 years.

1.4 FINAL EXPENDITURES

Funding Source	Cost
Section 319 Grant	$197,160.28
Shingle Creek WMC	$276,020.76
TOTAL	$473,181.04

2.0 Implementation

2.1 BACKGROUND

The Shingle Creek watershed is a 44-square mile highly urbanized watershed in Hennepin County, Minnesota in the Twin Cities Metropolitan Area (Figure 2-2). Shingle Creek (AUID: 07010206-506), a Mississippi River tributary, is listed as an Impaired Water for chloride (1998), dissolved oxygen (2004), biotic integrity (macroinvertebrates)(2006), and *E.coli* (2014), partly as a result of inadequate treatment of non-point source stormwater runoff. Shingle Creek's "sister" watershed, the West Mississippi watershed, drains primarily by storm sewer to the Mississippi River, which is also listed as Impaired (2006) by excess *E. coli* concentrations (AUID:07010206-805).

The Minnesota Pollution Control Agency (MPCA) has an acute standard for *E. coli* of 1,260 cfu/100ml and a chronic standard of 126 cfu/100ml. In Shingle Creek, the *E. coli* levels have been historically high. From 2007 to 2012, *E. coli* levels ranged from 10 cfu/100 ml to 27,000 cfu/100ml, averaging 1,091 cfu/100 ml (Figure 2-1). Monitoring station SC-0 is located at the downstream end of Shingle Creek before the creek outlets into the Mississippi River. Figure 2-1 is a boxplot summarizing all historical *E. coli* data. The blue line in the figure represents the median of the data and is well above the chronic standard.

High concentrations of *E. coli* bacteria in urban stormwater and natural waters is a public health concern. Ingestion of *E. coli* can cause various diseases, such as gastroenteritis, urinary tract infections and neonatal meningitis. In the Shingle Creek watershed, a suburban-urban watershed, *E. coli* comes primarily from pet and wildlife waste.

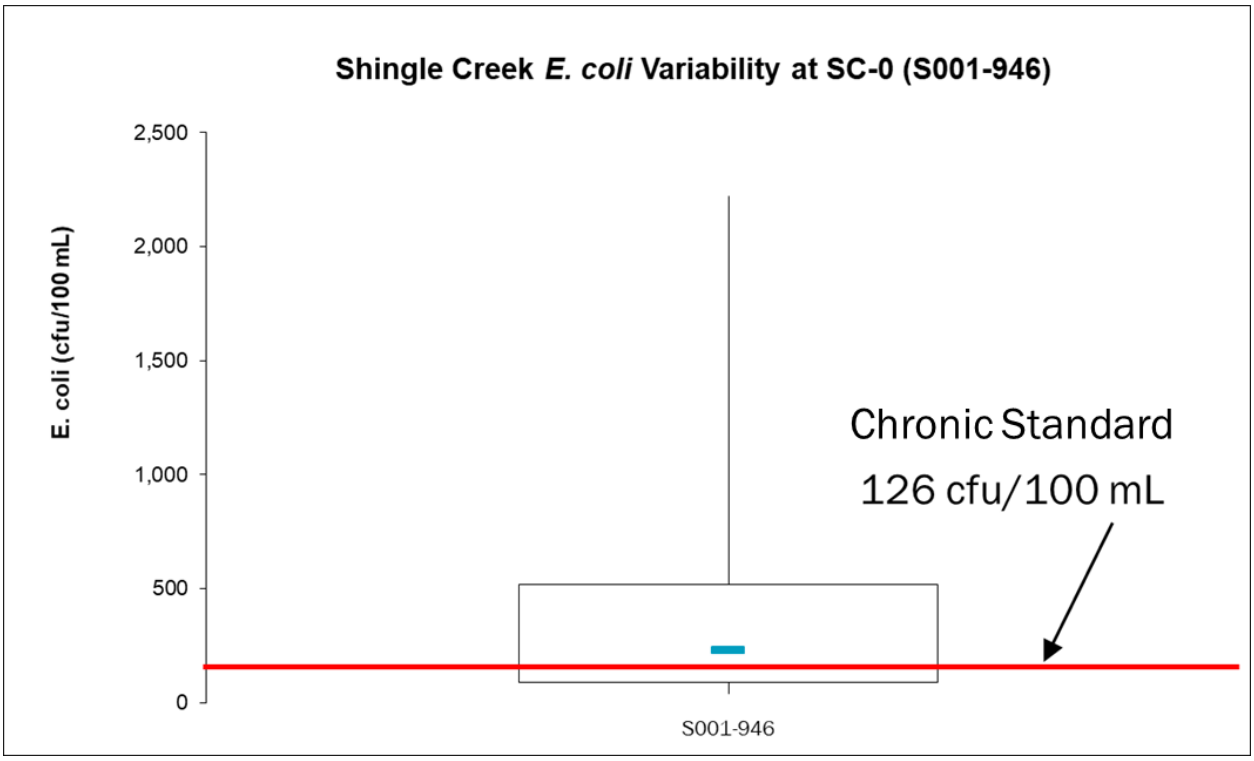


Figure 2.1. Shingle Creek E. coli variability at monitoring station SC-0.

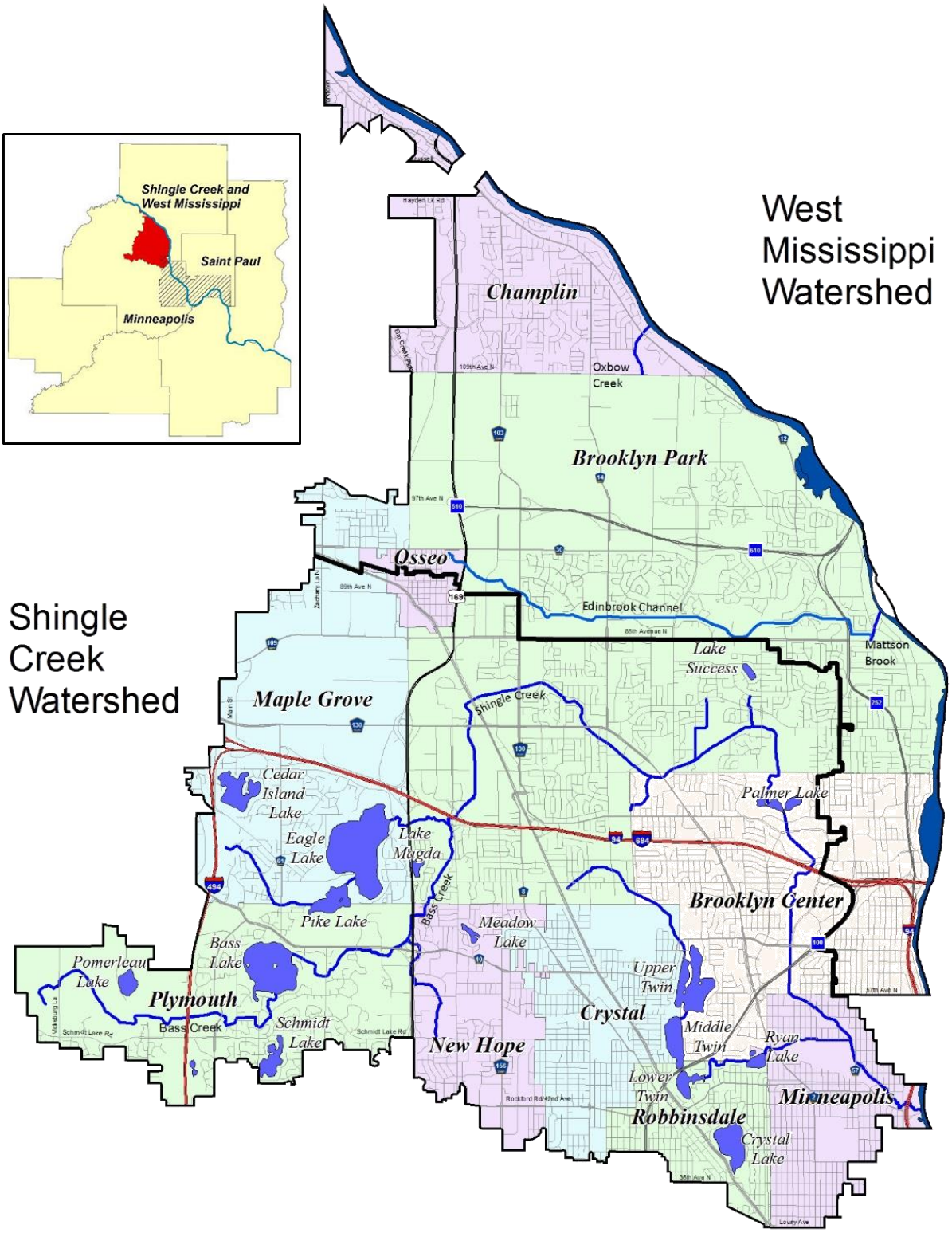


Figure 2.2. The Shingle Creek and West Mississippi watersheds.

Excess phosphorus in stormwater and natural waters is also a concern because high phosphorus levels cause algae blooms, which inhibit recreation, degrade habitat, and sometimes produce toxins. Like *E. coli* levels, phosphorus levels in the Shingle Creek watershed are also high. Shingle Creek summer total phosphorus (TP) measurement for the past 10 years averaged 164 ug/L and 151 ug/L at two different monitoring locations, respectively, well above the standard of 100 ug/L. In addition, ten of the 16 lakes in the watershed are impaired for excess phosphorus. Common sources of phosphorus include plant and leaf litter, soil particles, pet waste and fertilizers. Because sources of both *E. coli* and phosphorus are diffuse, it can be more practical to remove *E. coli* and phosphorus downstream than it is to reduce the sources of these pollutants.

2.2 PURPOSE

The purpose of this project was to evaluate the effectiveness of using biochar and iron-enhanced sand filters to remove *Escherichia coli* (*E. coli*) and phosphorus from urban stormwater runoff. Biochar has been effective in removing *E. coli* in the lab, but the intent of this project was to determine if these positive lab results can be replicated in the field. The basic research question was: Are biochar and iron-enhanced sand filters cost-effective BMPs for removing bacteria and phosphorus from stormwater in urban watersheds?

In this project, we modified iron-enhanced sand filters, a stormwater treatment practice used for phosphorus removal, to provide additional *E. coli* removal using a biochar amendment. Over the last decade, the iron-enhanced sand filter (IESF) has become a commonly used best management practice (BMP) to remove phosphorus in Minnesota, and a design called the Minnesota Filter has been included in the Minnesota Stormwater Manual. IESFs can be added to a stormwater pond as a filter bench, or can be a stand-alone BMP. The media is composed of iron filings and sand (5- 8% iron by weight) and removes phosphorus by binding phosphorus to iron oxides. This project amended iron-enhanced sand media with biochar. Biochar is produced by heating woody material under oxygen-free conditions, known as pyrolysis. Pyrolysis largely preserves the carbon content of woody material but creates a charred chip with a more complex structure and more surface area. This biochar used in these filters was reduced to sand grain-sized particles to avoid creating hydraulic barriers.

Biochar has been effective in removing *E. coli* in the laboratory. Mohanty et al. (2014) conducted research in which *E. coli*-laden water was passed through a column of iron- and biochar-enhanced sand media. The study concluded that by adding 30% biochar by volume to iron-enhanced sand, the media was able to remove 97% of *E. coli* on average. However, biochar's effectiveness in removing *E. coli* from water has not been tested in the field. This study aimed to evaluate the feasibility and effectiveness of using iron- and biochar-enhanced sand filters in the field to remove both *E. coli* and phosphorus from surface water. Three field applications of this technology were investigated: a stormwater pond filter bench, a filter box through which creek flow was diverted, and a catch basin skimmer box insert.

3.0 Implementation

Iron- and biochar-enhanced filters were constructed and installed in the Shingle Creek watershed using three different applications of this technology (Figure 3.1).

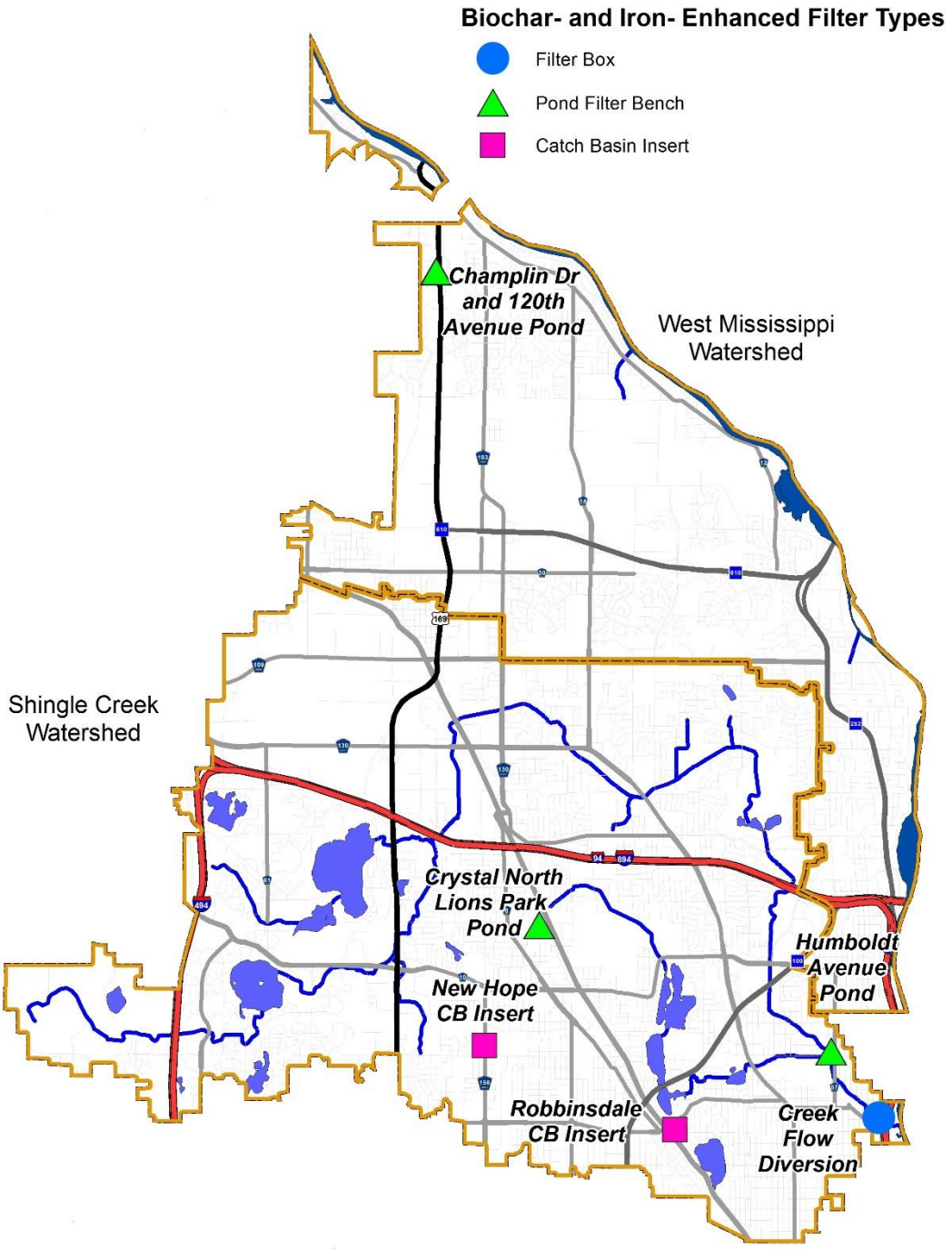


Figure 3.1. Biochar- and iron-enhanced sand filter locations.

3.1 CATCH BASIN INSERTS

The first application was to intercept *E. coli* when it enters the collection system. Two catch basin skimmer boxes of a type typically used during construction projects for temporary sediment capture and control were modified to incorporate a sand filter (Figure 3.2). The two inserts were deployed in the cities of New Hope and Robbinsdale. The New Hope location was a storm sewer catch basin along a well-travelled street while the Robbinsdale catch basin was in a parking lot at City Hall. Filter media filled about half of the skimmer box, allowing storm water draining into the catch basin to percolate through and into the storm sewer below. The media consisted of a mix of biochar and iron-enhanced sand at a ratio of 1:2 by volume. Biochar was placed in between two sand layers to prevent floating, clogging, and loss. A hole drilled into the bottom of the insert was fitted with a collection bottle to allow for sampling of filtered storm water (Figure 3-3).

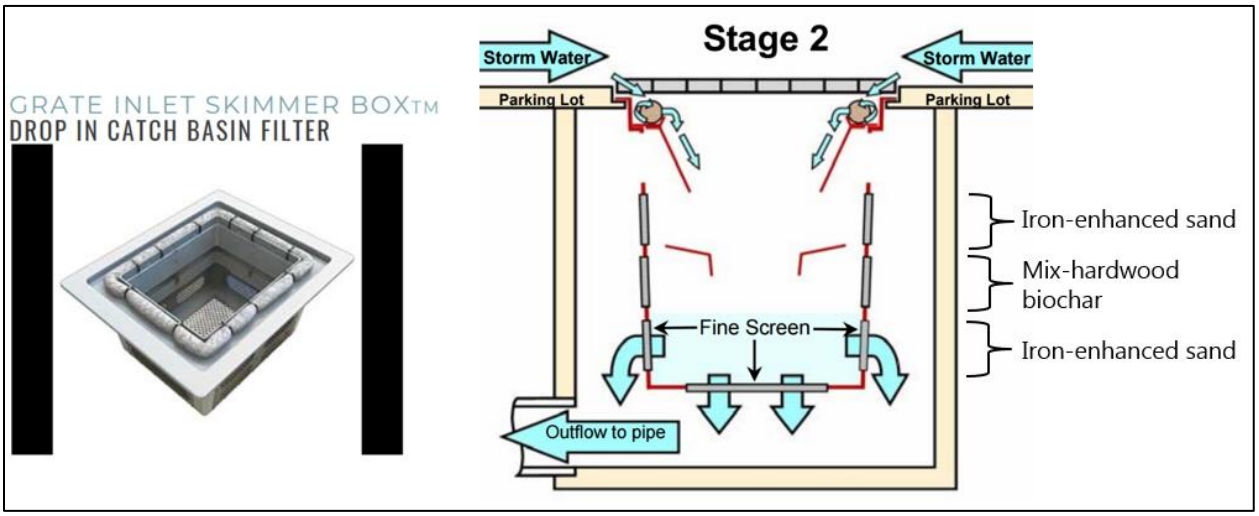


Figure 3.2. Catch basin filter conceptual design.

Figure 3.3. A sample bottle attached to the bottom of the insert.
(The insert is laying on its side in this photo.)

3.2 POND FILTER BENCHES

The second application was the retrofit of biochar- and iron-enhanced sand benches on three existing storm water ponds in the cities of Champlin, Crystal and Minneapolis. The Minnesota Filter (MPCA 2019) (Figure 3.4) is based on research conducted at the University of Minnesota St. Anthony Falls Lab and elsewhere. Stormwater retention basins, or "wet ponds," provide stormwater quality treatment by storing runoff until the particulate pollutants such as sediment settle to the bottom. They are designed with a deeper, permanent pool below a normal water elevation, and have capacity to hold an additional volume of stormwater runoff that is slowly discharged downstream following a rain event. Retention ponds can be quite effective at reducing particulate pollutants, but minimally remove dissolved constituents, leaving dissolved phosphorus to be released downstream as the pond discharges. This is especially problematic because the dissolved fraction of phosphorus is the most biologically available to algae.

The St. Anthony Falls Lab and others determined that mixing iron into a sand filter can remove dissolved phosphorus from stormwater. The filters can be deployed as stand-alone infiltration or filtration basins, or they may be incorporated into traditional stormwater retention ponds as benches around the perimeter. When water levels rise in the pond during a rain event, the bench is overtopped (Figure 3.5), allowing water to flow through into perforated drain tile that routes filtered water to the pond outlet.

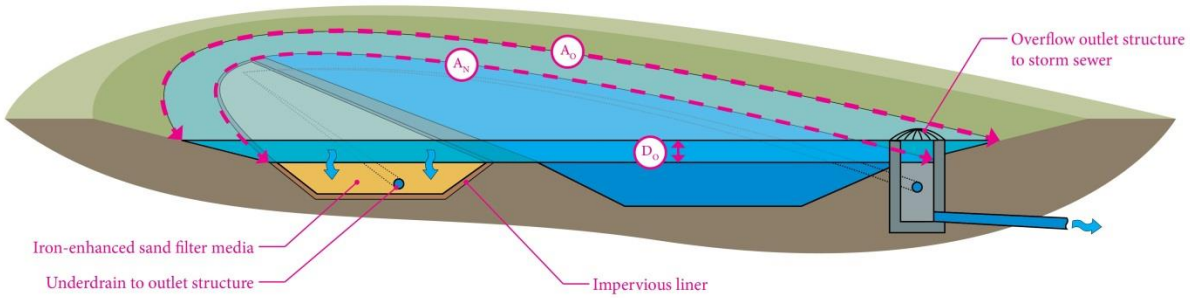


Figure 3.4. A typical Minnesota Filter pond filter bench.
Source: Minnesota Stormwater Manual

Each of the three ponds were retrofitted with these benches and variable amounts of biochar were added to the iron-enhanced sand. The Champlin pond contained both biochar and iron-enhanced sand; the Crystal pond filter bench contained just iron-enhanced sand with no biochar; and the Minneapolis pond only contained biochar on the upstream half of the filter. This application tests the efficiency of treating *E. coli* at regional collection systems.

Figure 3.5. The Crystal pond filter under inundation.

Figure 3.6. The Crystal pond filter at normal water level.
Note: The PVC pipe risers provide access to the underdrain for sampling.

3.3 FILTER BOX

The third application tests whether streamflow in Shingle Creek can be treated directly by withdrawing water from the creek, passing it through a filter, then returning it to the creek. The filter takes advantage of Webber Park Falls in Minneapolis, using gravity alone to move water through the filter. The falls are an eight foot artificial drop structure and were constructed decades ago when Shingle Creek was realigned due to highway construction.

The filter is contained within a 4x4x6 ft. steel utility box placed on the viewing platform next to the falls (Figure 3.7). A pipe intercepts flow from the creek at the top of the falls, and routes it into the filter, where it percolates through two layers of iron-enhanced sand with biochar in between. Then the flow is piped back to the creek at the bottom of the falls. Valves in the utility box allow sample collection from inflow and outflow pipes (Figures 3.8 to 3.10). This application is a field version of the lab column experiment referenced earlier (Mohanty et al. 2014). An interpretive sign educates park users about the project (Figure 3.11).

Figure 3.7. The utility box in place overlooking Webber Falls.
Note: The inlet pipe on the right bends along the wing wall to the top of the falls to convey flow to the box. The middle pipe is an overflow while the left pipe is the filter box outlet.

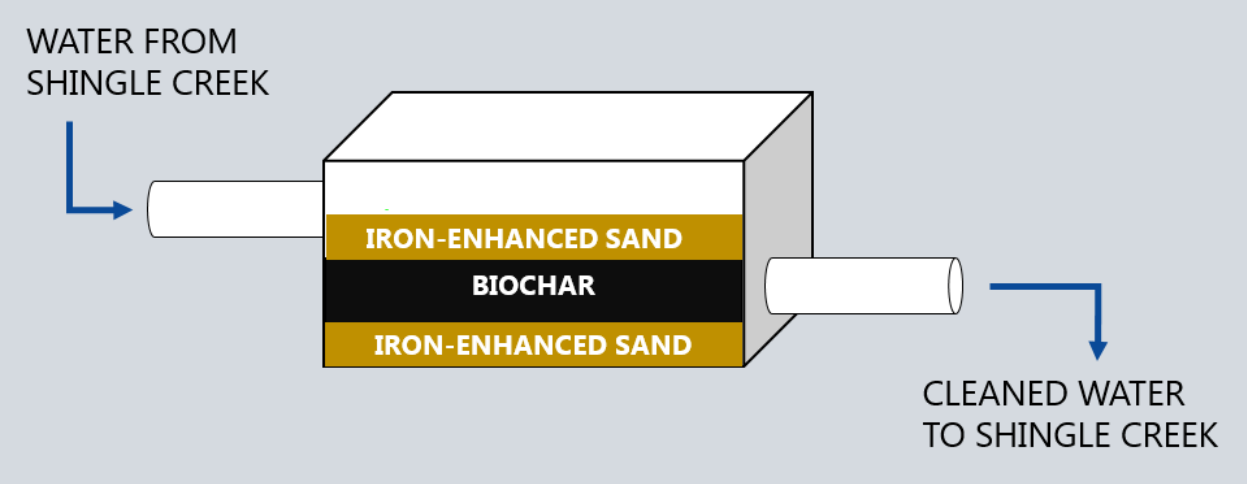


Figure 3.8. Utility box conceptual design.

Figure 3.9. Layer of biochar sandwiched between iron-enhanced sand layers.
Note: The gasket to the left is the inflow pipe and the gasket on the right is the overflow pipe. The outlet pipe is to the right at the bottom of the box, under the biochar.

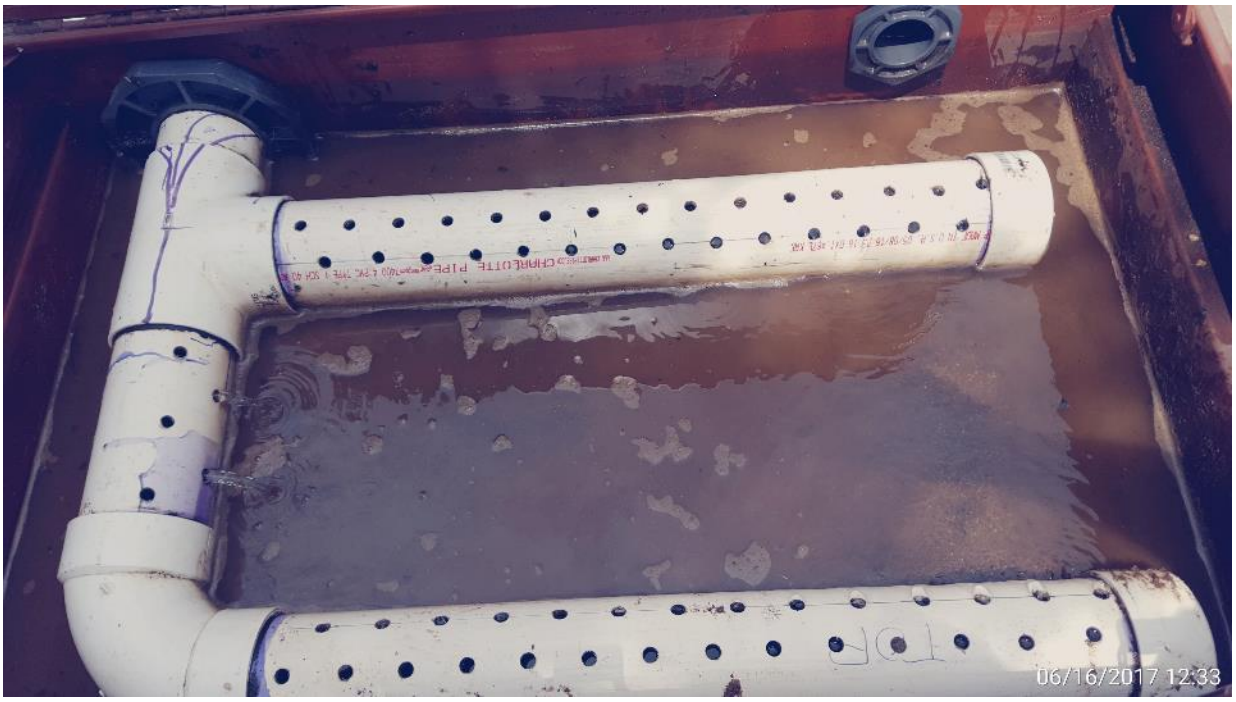


Figure 3.10. Streamflow percolates down through the filter.

Figure 3.11. Interpretive sign educates park visitors.

4.0 Monitoring Results

The monitoring program at the start of the project was intended to be limited to pre- and post-treatment water quality via periodic grab samples. During the project the Commission became acquainted with the work of researchers at the University of Minnesota Institute of Rock Magnetism, who are researching the iron-phosphorus binding mechanism and the ability to predict the chemical conditions that favor the formation of the specific iron oxide types that most successfully trap phosphates. Mid-project the monitoring program was amended to include collection of continuous parameters at the filter media-water interface and within the media itself. Finally, filter media core samples were analyzed to determine initial binding capacity and phosphorus sorption capability.

4.1 WATER QUALITY TREATMENT RESULTS

Pre- and post- treatment water samples were collected from the various filter applications and analyzed for TP, orthophosphorus, and *E. coli*. For some samples, lab pH, inorganic nitrogen (nitrite and nitrate), and dissolved organic carbon (DOC) were analyzed.

Stormwater ponds were sampled from the summer of 2017 to the summer of 2019. Sampling at the Champlin stormwater pond took place every other week. Sampling at the Crystal Pond took place when the water level was high enough to flow through the filter, roughly monthly. The Minneapolis pond had a leaky outlet weir and the water level was too low to allow flow onto the filter bench, so no meaningful samples were collected throughout the study period. The creek flow diversion filter box was sampled from October 2016 to the August 2019, and samples were taken every other week. Catch basin inserts were sampled during storm events.

While the capability of biochar in removing *E. coli* was reliable, most of the sites experienced instances when phosphorus was released. Table 4.1 summarizes the sampling results of all the sites for *E. coli*, total phosphorus, and orthophosphorus. The creek diversion utility box was under the most controlled environment and had the least number of instances of P release.

4.1.1 *E. coli* Removal Efficiencies

All iron- and biochar-enhanced sand filter applications demonstrated average *E. coli* removal efficiencies of 63% or greater (Table 4.1). The Champlin stormwater pond, which was the only monitored stormwater pond containing a biochar-enhanced filter, had a 73% removal efficiency. The creek flow diversion filter box had an 89% removal efficiency. The two catch basin filter inserts had removal efficiencies of 63% and 92%, respectively. The Crystal stormwater pond filter bench, which served as a negative control and did not contain any biochar, had only 3 out of 15 sampling events where *E. coli* was being removed, indicating the biochar and not something else in the filter bench is responsible for *E. coli* removal. Figure 4-1 summarizes the average *E. coli* concentrations coming in and going out of the devices. T-tests indicate that the filter box reductions were statistically significant ($p < 0.05$) but the other filter performance was not.

Table 4.1. Summary of all devices' performance.

Device	Parameter	Sample Size	No. of Samples Showing Pollutant Removal	Average % Removal*	Average Concentration Going In	Average Concentration Going Out	Unit	T-test p-value
Catch Basin Skimmer Box New Hope	*E. coli*	8	4	63%	7,625	985	CFU/100 ml	0.323
	TP	7	1	42%	0.24	0.14	mg/L	-
	Ortho-P	3	1	13%	0.32	0.28	mg/L	-
Catch Basin Skimmer Box Robbinsdale	*E. coli*	13	7	92%	2,711	110	CFU /100 ml	0.139
	TP	11	1	18%	0.26	0.22	mg/L	-
	Ortho -P	7	2	37%	0.14	0.08	mg/L	0.401
Stormwater Pond Filter Bench Champlin	*E. coli*	22	20	73%	2,119	138	CFU /100 ml	0.119
	TP	22	13	40%	0.23	0.11	mg/L	0.019
	Ortho -P	22	12	52%	0.16	0.07	mg/L	0.007
Stormwater Pond Filter Bench Crystal (no biochar)	*E. coli*	15	3	71%	6,385	5,052	CFU /100 ml	0.303
	TP	15	13	61%	0.31	0.10	mg/L	<0.001
	Ortho -P	15	13	77%	0.18	0.02	mg/L	0.005
Creek Diversion Utility Box	*E. coli*	26	26	89%	749	18	CFU /100 ml	0.027
	TP	26	26	79%	0.08	0.02	mg/L	<0.001
	Ortho -P	26	25	83%	0.05	0.01	mg/L	<0.001

*Note: Average % removal is computed only for the sample pairs showing a reduction.

Figures 4.2 and 4.3 are boxplots of *E. coli* concentrations when *E. coli* was being removed. The boxplot is a good way to show how data is distributed. The Crystal site in 2017 had some high *E. coli* concentrations coming in. Other sites also had some extreme events. The variation in the outflow concentrations was not very much other than Crystal site where there was no removal.

The exact mechanism of biochar *E. coli* removal is still unknown, but one possible mechanism is trapping on the surface and killing *E. coli* cells. The concern with trapping is that *E. coli* could establish colonies on the biochar surface and be released into the water later. However, only an occasional outflow sample was higher in *E. coli* concentration than a paired inflow sample, suggesting that *E. coli* colonies were not established to any extent on the biochar media.

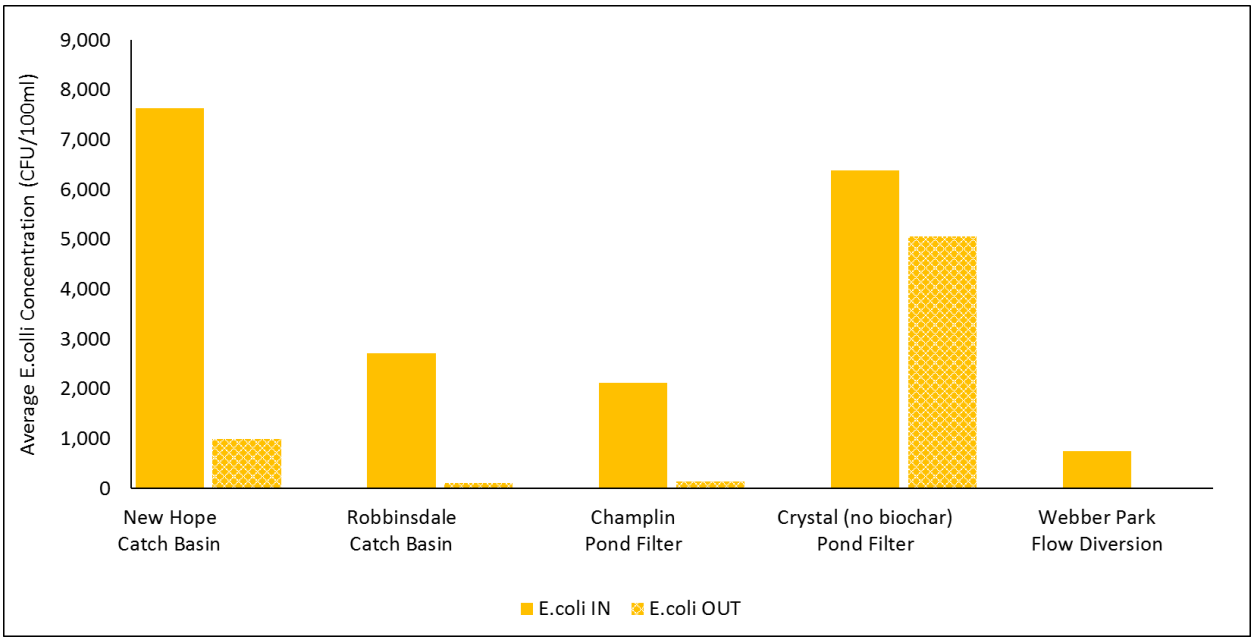


Figure 4.1. Average *E. coli* inflow and outflow concentrations by site.
Note: Average outflow concentration for the Webber Park Flow Diversion box was 18 CFU/100 mL, which is too low to be seen on this figure.

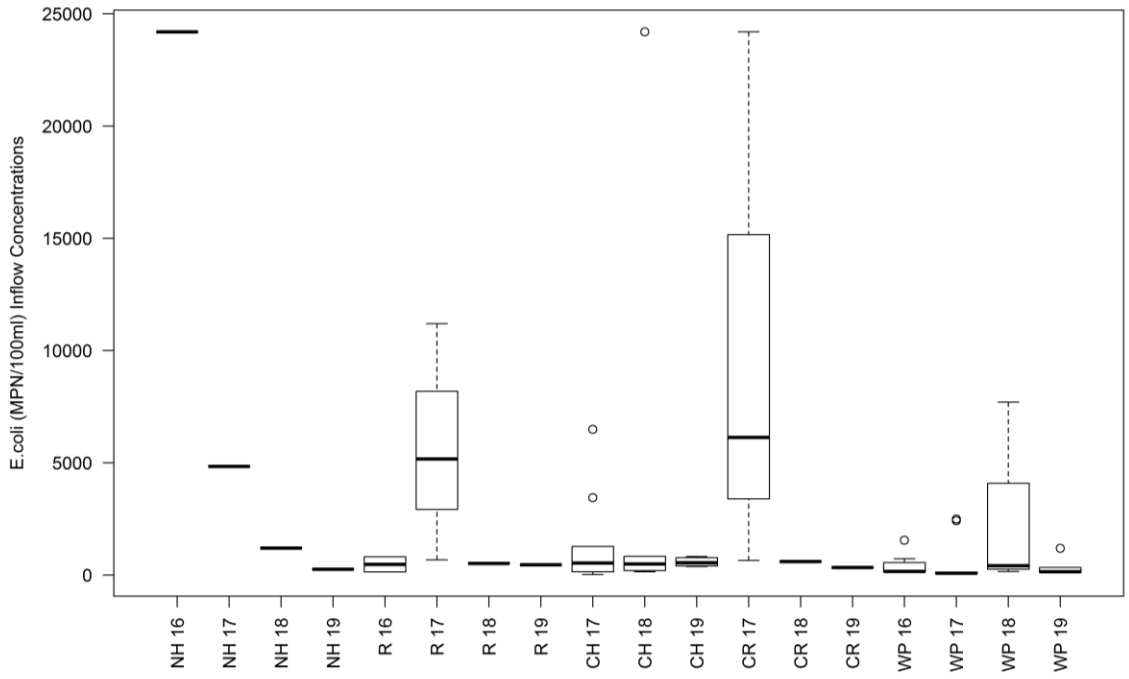


Figure 4.2. *E. coli* inflow concentration boxplots by site and by year.
Note: NH represents New Hope catch basin; R represents Robbinsdale catch basin; CH represents Champlin filter; CR represents Crystal filter; WP represents Webber Park flow diversion. 16, 17, 18 and 19 represent 2016-2019, respectively.

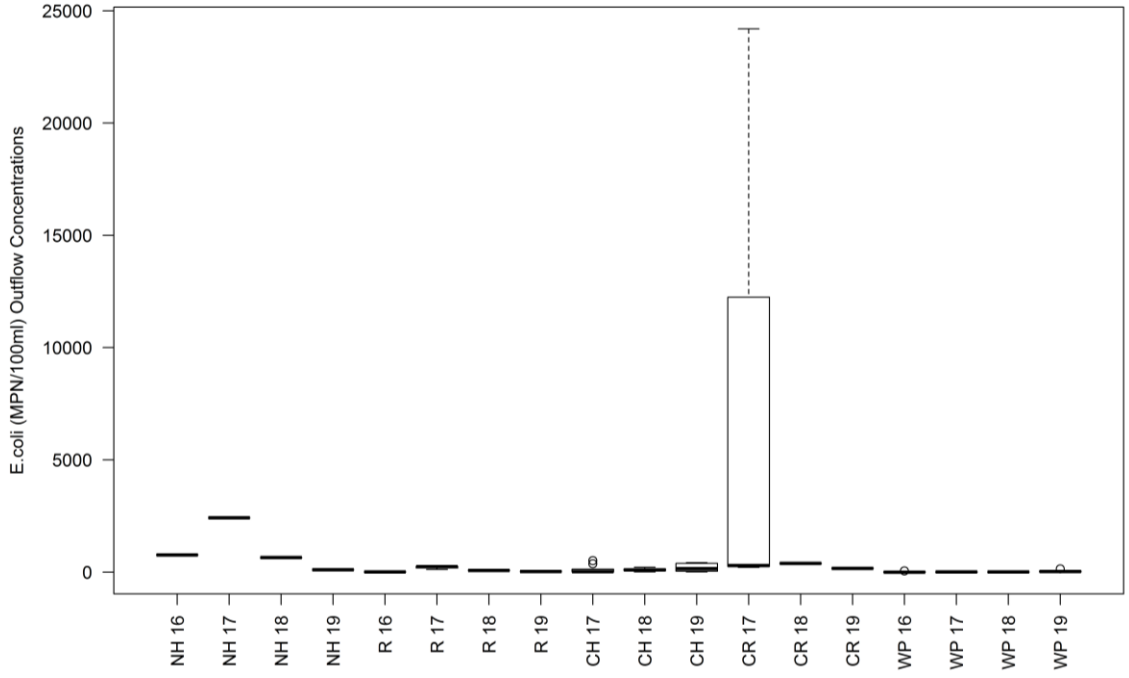


Figure 4.3. *E. coli* outflow concentration boxplots by site and by year.
Note: NH represents New Hope catch basin; R represents Robbinsdale catch basin; CH represents Champlin filter; CR represents Crystal filter; WP represents Webber Park flow diversion. 16, 17, 18 and 19 represent 2016-2019, respectively.

4.1.2 Phosphorus Removal Efficiencies

Phosphorus removal efficiencies ranged from 0 to 83%. Figure 4.4 summarizes the average TP concentration in the inflow and outflow at each device. In most cases, iron-enhanced sand is expected to remove phosphorus. The creek diversion box very reliably reduced TP concentrations, averaging 79% reduction. The pond filters were less reliable and lower efficiency (Champlin 40% and Crystal 61%), with some samples showing an increase in TP concentration in filtered outflow. There did not appear to be any pattern that might explain why these occasional increases were seen. At both catch basin sites, TP actually increased in filtered outflow in all samples but one. It is possible that the media in the catch basins bound phosphorus and other constituents (such as organic matter) and became clogged, losing the ability to convey water. Preferential flow therefore bypassed the media matrix and did not get treated. This does not seem to be plausible since *E. coli* did get reduced. Additional phosphorus released from the broken-down leaves could get flushed out during the rainfall event, thus contributing TP to the outflow.

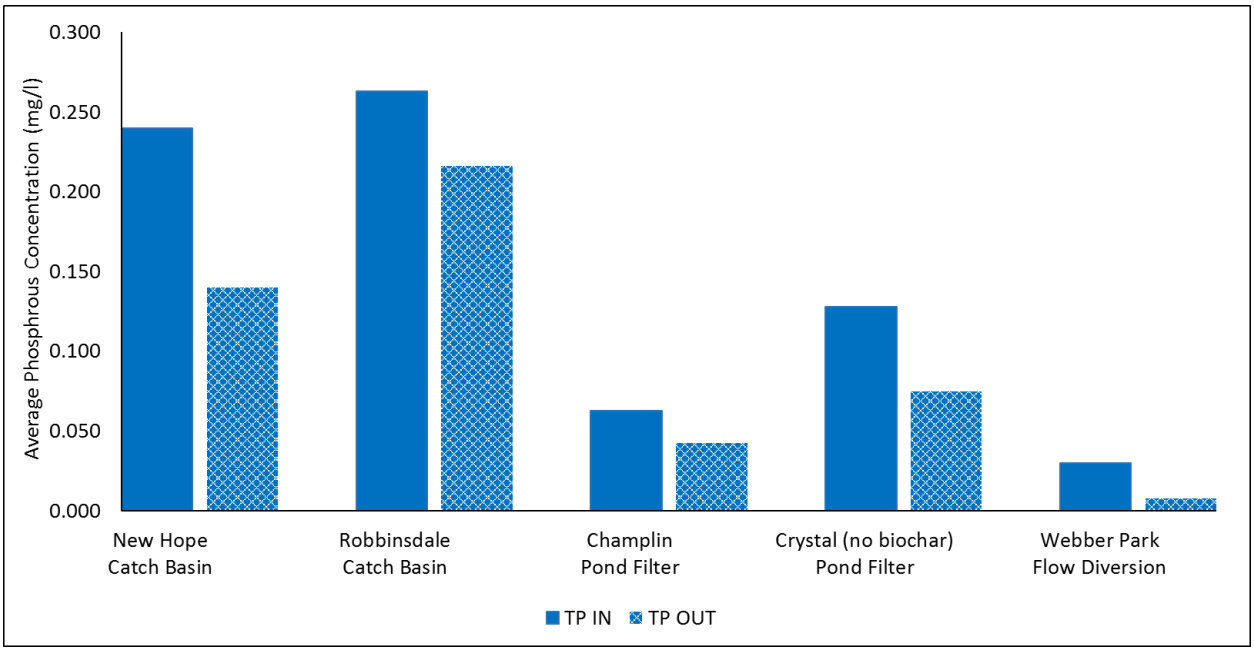


Figure 4.4. Average TP inflow and outflow concentrations by site.
Note: Only one sample event for each catch basin showed a reduction, so n=1 for those sites.

Figure 4.5 summarizes the average OP concentration in the inflow and outflow at each device. Similar to TP performance, the creek diversion box significantly reduced OP by an average 83%. The pond filter benches performed slightly better than the TP results. The Crystal site averaged 77% OP reduction while the Champlin site averaged 52%. The Champlin site was frequently inundated for longer periods of time. Previous research and observation have shown that iron-enhanced filters are better at capturing OP in stormwater when they are allowed to dry out between rain events. Similar to their TP performance, the catch basin filters very rarely reduced OP, and for most samples actually showed increased OP in filtered stormwater. It is likely that P is leaching from the accumulated organic matter (such as plant litter) on the media surface.

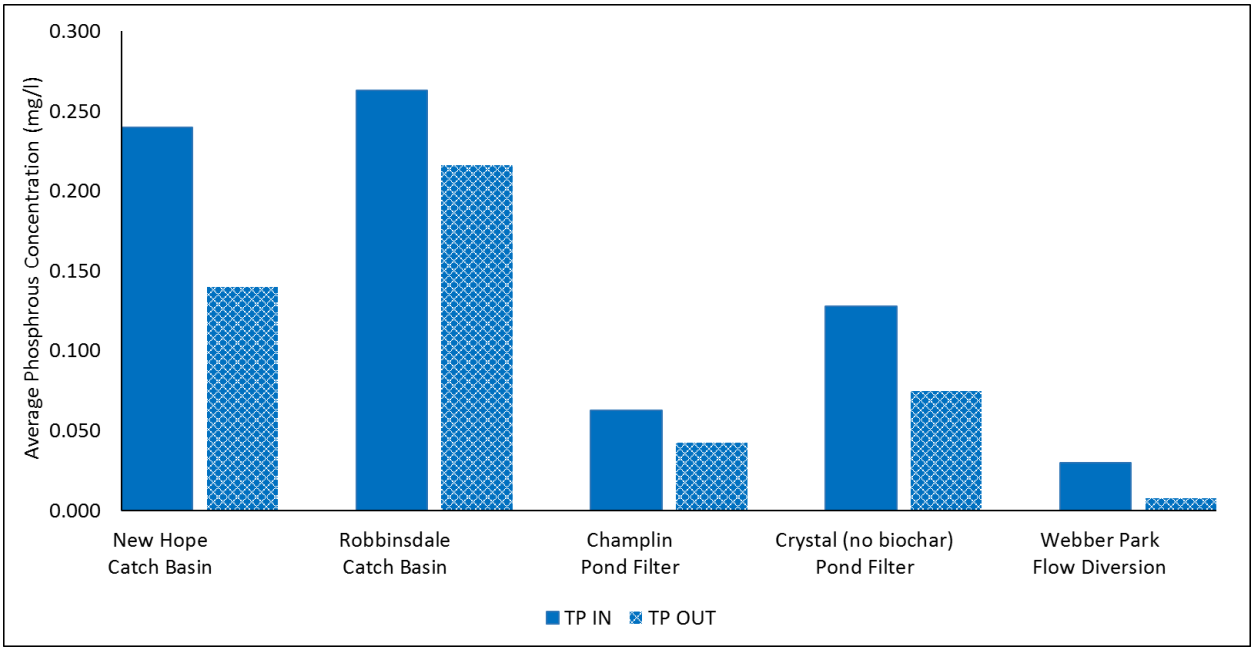


Figure 4.5. Average OP inflow and outflow concentrations by site.
Note: N=2 for the New Hope site and N=1 for the Robbinsdale site.

The flow diversion filter box had the best results overall, likely because it was the most controlled device. It received relatively consistent flow and it experienced the least mixing at the outlet. At both ponds, phosphorus had reasonable reduction. Champlin had constant flow throughout the flowing season. But Crystal had a significant amount of dry period when the water surface elevation was lower than the filter bench and no flow was being treated. Mixing occurred at the outlets of both pond filter benches when water level rose above the bench outlets after a major storm event. This could increase phosphorus concentration in the outflow samples.

TSS was also monitored at the flow diversion filter box. An 83% average reduction was measured. The amount of TSS removed was limited by flow rate and TSS inflow concentration. The average TSS inflow concentration measured during sampling time was 8.12 mg/l. This agrees with the long-term monitoring data for Shingle Creek where 65% of measurements during flow season are between 0.5 and 15.5 mg/l.

4.2 FILTER PHOSPHOROUS SORPTION CAPACITY

To gain information on phosphorus binding capacity and potential lifespan of the iron-enhanced sand filters, we analyzed fresh iron-enhanced sand and compared it to cores from each of the three filter benches: Olson, Crystal and Champlin. Cores of the filters were taken in May 2019 (Figure 4.6). Fresh sand was purchased from the manufacturer in June 2019.

Samples of fresh iron-enhanced sand and iron-enhanced sand from the three filter benches were analyzed for phosphate-sorption capacity (single-point isotherm), iron-bound phosphorus, total iron, and total phosphorus. Three cores from each of the filters were taken and analyzed separately for each of these parameters. Just one sample of fresh iron-enhanced sand was analyzed. Professor Bill James at the University of Wisconsin-Stout performed the sorption capacity assay and the iron-bound phosphorus analysis.

Figure 4.6. Coring the Crystal filter bench.

Results showed that the more exposure to stormwater the iron-enhanced sand had experienced, the more total and iron-bound phosphorus was present in the sand and the more the sand's phosphorus-binding sites were saturated (Figure 4.7). Fresh iron-enhanced sand contained the least total phosphorus (35 mg/kg; 5.6% saturated) and the least iron-bound phosphorus (1.6 mg/kg; 0.27% saturated), while the Champlin filter's iron-enhanced sand, which had been continuously inundated with stormwater for two years, contained the most total phosphorus (97.7 mg/kg; 3.4% saturated) and the most iron-bound phosphorus (20.3 mg/kg; 14.4% saturated). The Olson and Crystal filters' iron-enhanced sand fell in the middle of these two extremes. The Olson filter media, which had been weathered for two years but was never inundated with stormwater, had just a little more iron-bound phosphorus than the fresh sand (2.8 mg/kg; 0.92 saturated), and the Crystal filter media, which had been inundated during storm events but experienced dry periods, had a little more iron-bound phosphorus than the Olson media (7.3 mg/kg mg/kg; 1.1% saturated).

As previously discussed, the Olson filter bench had a leaky weir and as a result, was never inundated. Although this was not the intended design, the media in this filter bench serendipitously made for a great experimental control, in that it came from the same batch of iron-enhanced sand as the other filters and had been weathered for the same amount of time, but was never inundated with stormwater.

These results confirm that the iron-enhanced sand sorbs phosphorus over time, and the more the media is inundated with stormwater, the more phosphorus it sorbs. The results also suggest that these filters have a lot of binding capacity remaining—even the Champlin filter media, which has been inundated continuously, is only 14.4% saturated with phosphorus, meaning 85% of its phosphorus-binding sites remain.

Theoretical phosphorus sorption capacity was variable with no clear trend between treatment, ranging between 0.314 mg/kg and 0.694 mg/kg (Figure 4.8). Total iron ranged from 19,600 mg/kg to 55,900 mg/kg and also did not show any clear patterns (Figure 4.9). However, the fact that the Olson media had the lowest total iron of all the treatments likely explains why it also had the lowest sorption capacity of all the treatments.

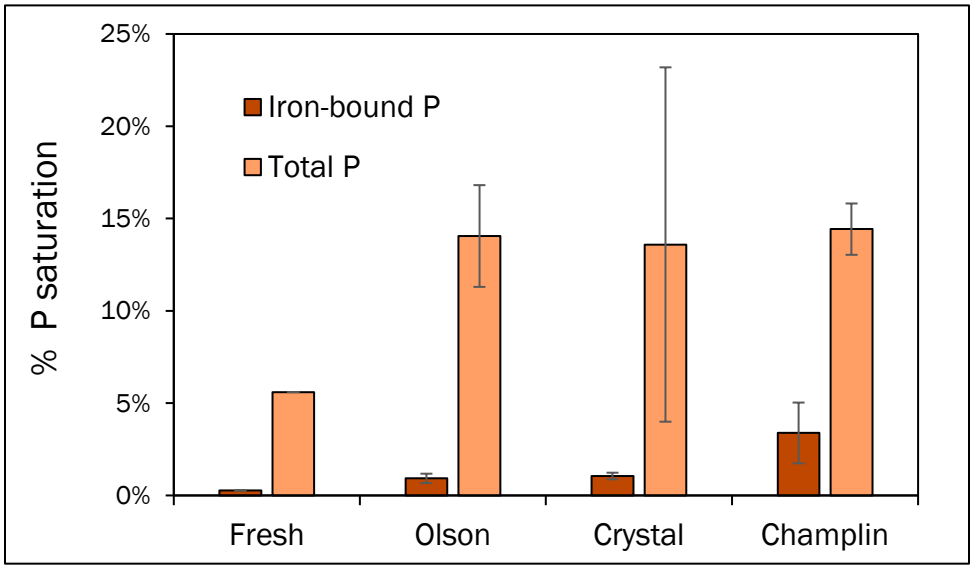


Figure 4.7. Phosphorus saturation of iron-enhanced sand.
Note: % saturation as a concentration of maximum sorption capacity of iron-enhanced sand that is fresh, from the Olson filter (never inundated), from the Crystal filter (periodically inundated) and from the Champlin filter (always inundated). Error bars represent standard deviation of three samples. Only one sample of fresh media was analyzed, which is why there is no error bar.

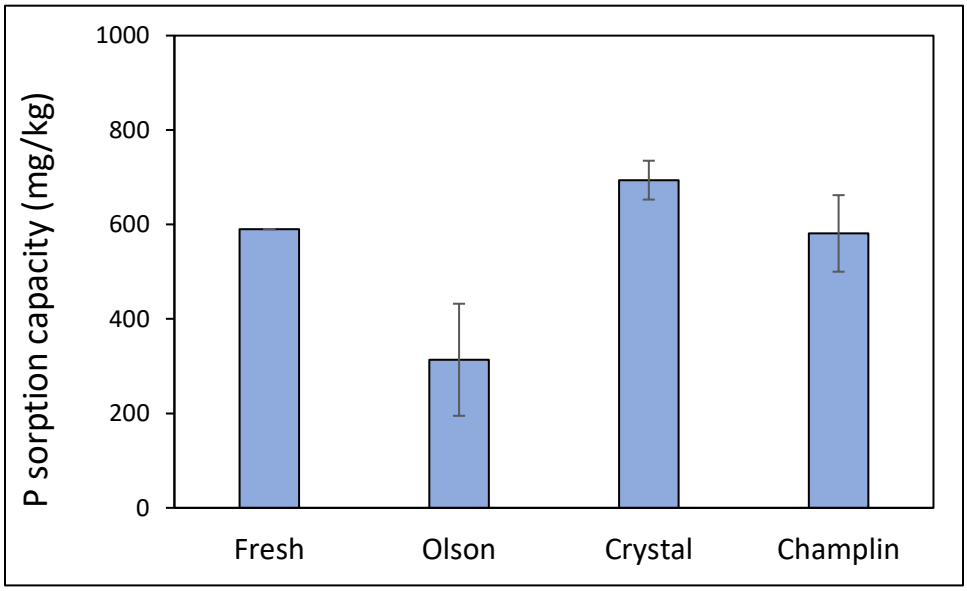


Figure 4.8. Total P sorption capacity in the four treatments.
Error bars represent averages of three samples. Only one sample of fresh media was analyzed, which is why there is no error bar.

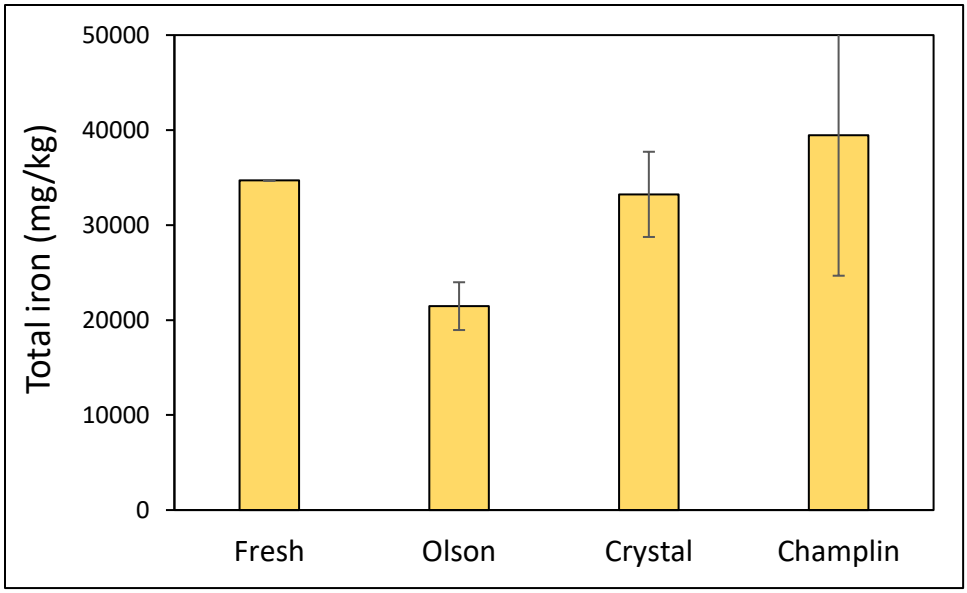


Figure 4.9. Total iron in the four treatments.
Error bars represent averages of three samples. Only one sample of fresh media was analyzed, which is why there is no error bar.

4.3 PREDICTING THE IRON-PHOSPHORUS BINDING MECHANISM

During the project, the Commission became acquainted with the work of Dr. Beth Fisher and Dr. Joshua Feinberg of the University of Minnesota, who are researching the iron-phosphorus binding mechanism and the ability to predict the chemical conditions in iron-sand filters (IESFs) that favor the formation of the specific iron oxide types that most successfully trap phosphates. The Commission contracted with Dr. Fisher and Dr. Feinberg to supplement the water quality monitoring with more detailed monitoring of conditions at the filter-water interface and within the filter itself.

Dr. Fisher and Dr. Feinberg took core samples from the Champlin and Crystal filter benches (and six other filter benches in the Twin Cities Metropolitan Area) and analyzed them using electron microscopy and magnetic measurements. With these measurements, they found that metallic iron, which is the form of iron found originally in the iron-enhanced sand filters, undergoes corrosion as it ages, and this corrosion occurs in a sequence that was common among all of the sites studied (Figure 4.10). The corrosion progression ultimately turns metallic iron to hematite, goethite, lepidocrocite, and akagenéite.

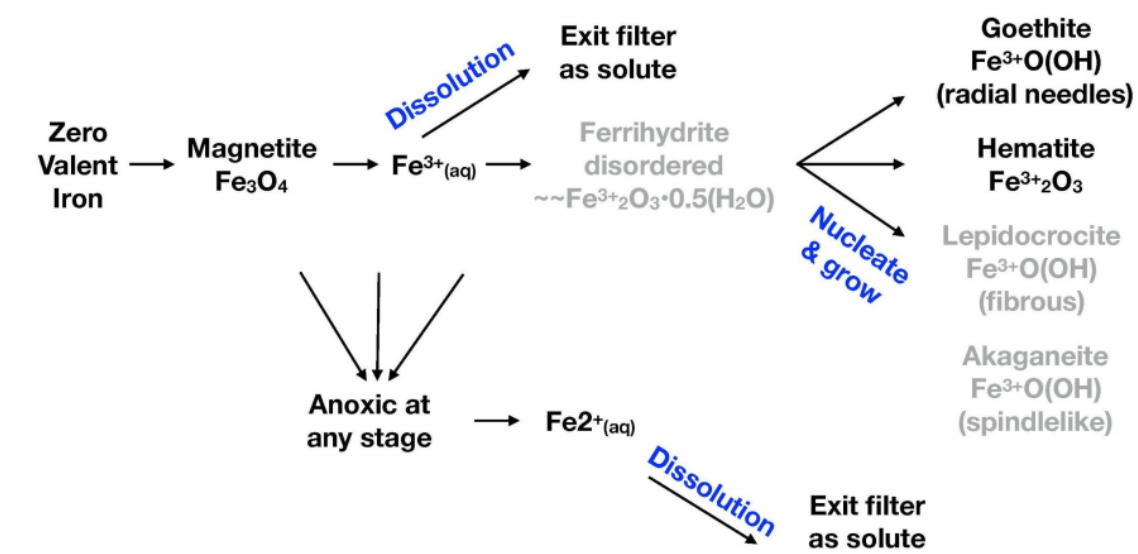


Figure 4.10. Sequence of metallic iron (i.e., zero valent iron) corrosion.
Note: This sequence was found to be common among all 8 sites studied**.**

Where sites had a record of successful phosphate removal, Dr. Fisher and Dr. Feinberg identified the presence of goethite and hematite, in addition to magnetite and zero valent iron (Figure 4.11). Hematite occurred in abundance in successful sand filters, and interestingly, geothite and hematite were not present in media from failing filters (i.e., filters that did not remove phosphorus according to water quality monitoring).

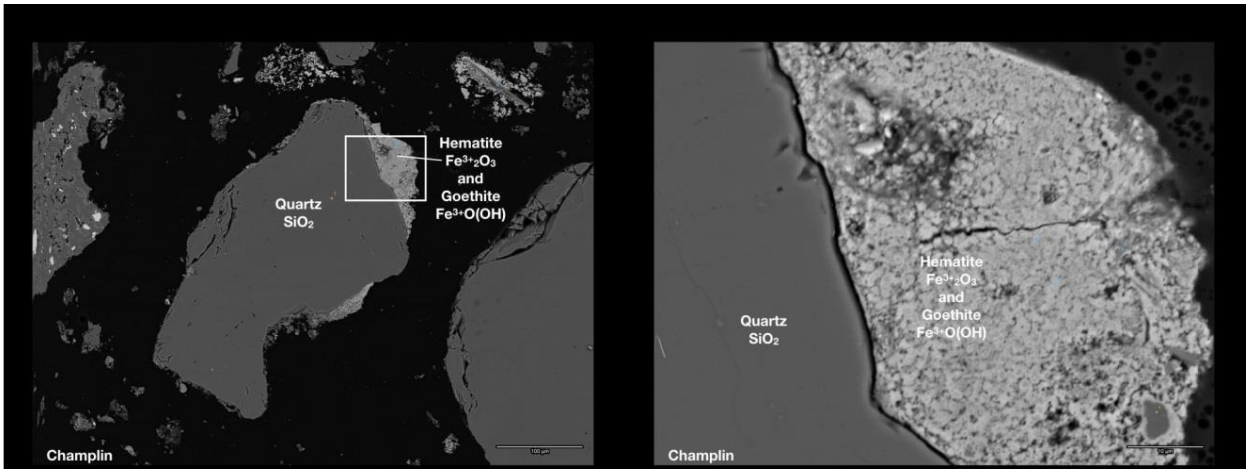


Figure 4.11. Electron micrograph of hematite and goethite adhered to a grain of quartz.
These minerals formed through oxidation of metallic iron, followed by sorption to quartz. The right image is a closer view of the content inside the box in the left image.

Using custom-built Arduino-framework data loggers, Dr. Fisher also monitored several water quality parameters in real time at the Champlin and Crystal filter benches. The following parameters were measured:

a. Water level, which indicates how long the filter drains.
b. Conductivity before and after filtration to log the total ionic activity in the water, which is a proxy for nutrients, salts, and metals, all of with could be iron-forming

factors in filter and reveal when nutrient pulses occur (early, mid, late hydrograph) and the conditions when the filter is being required to remove phosphorous.

c. Redox in filter at various depths. Reducing (Fe^{2+}) or oxidizing (Fe^{3+}) conditions of the filter are directly related to the oxidation state of iron and the iron forming conditions in the filter. This monitoring indicates if organic matter buildup in the filter media is creating anoxic conditions. If anoxic conditions exist, the iron filter media may begin to release phosphorus instead of adsorb phosphorus.
d. Dissolved oxygen before, in-filter, and after filtration to estimate microbial oxygen consumption/demand throughout the system

Table 4.2 shows conductivity and dissolved oxygen ranges in the Champlin and Crystal filter benches and in the ponds (just below the water's surface).

Table 4.2. Conductivity and dissolved oxygen ranges measured using continuous custom data loggers.

Pond	Location	Conductivity (uS/cm)	Dissolved Oxygen (mg/L)
Champlin	Pond	250- 1500	0- 6
	Filter	200- 800	<0.3
Crystal	Pond	250- 500	0- 3
	Filter	100- 200	0- 3

Dr. Fisher and Dr. Feinberg do not believe their study is extensive enough to yield immediate recommendations to practitioners, but their results and their correspondence with practitioners have allowed them to make the following recommendations thus far:

1) The mechanism for trapping phosphorus in IESFs is by adsorption on the surfaces of iron oxide and oxyhydroxide minerals, not through precipitation of iron-phosphate minerals. This strength of this mechanism changes with pH and mineral surface area.

2) Using magnets to pull "used-up" iron out of filter media to reclaim iron and phosphorus is not a realistic option for renewal of IESFs. Most of the "used-up" iron occurs as goethite and hematite, which are weakly magnetic and will not be attracted to common magnets.

3) Chemical evaluation of sites needs to be included in pre-IESF feasibility studies. We recommend evaluation of dissolved oxygen and pH of incoming waters. If dissolved oxygen is too low, the conditions would not favor the formation of oxide minerals, or inundation could shift the filter media chemistry to anoxic conditions that could result in soluble iron (Fe2+) and export of trapped phosphate. If pH is consistently above neutral (such as in carbonate bedrock areas, or from dissolution of concrete), the site may not be ideal for adsorption of phosphate with iron minerals.

4) IESFs would benefit from pre-filtration of particles and organic matter, possibly in addition to the pretreatment that wet ponds provide. Organic debris, fine sediment, and fine organic matter create layers on top of IESFs that inhibit the penetration of oxygen into filter media. Anoxia creates an opportunity for iron and phosphorus export.

5.0 Conclusions

5.1 CONCLUSIONS

The study results show that biochar has a very promising potential in removing *E. coli* from stormwater. The modification to the Minnesota iron-enhanced sand filter design not only reduced *E.* coli concentrations but also provided additional benefit in the form of phosphorus removal. However, the mechanism of *E. coli* removal by biochar is still unclear and the longevity of iron- and biochar-enhanced sand filters in the field must still be determined. While the filters have been in place only a few years, we have not yet observed any significant reduction in effectiveness. We have also not observed any breakdown of the biochar during the winter-spring freeze-thaw cycles. These knowledge gaps should be investigated now that this study has determined the potential of biochar- and iron-enhanced sand filters in removing *E. coli* and phosphorus from stormwater.

All three types of field designs tested here can be useful in different scenarios. A particularly useful application would be installing such filters to treat concentrated flow from a site with high bacterial contamination potential, such as runoff from a dog park, a location with excessive populations of waterfowl such as Canada geese, or a storm sewer outfall near a swimming beach.

5.2 LESSONS LEARNED

5.2.1 Design Issues

Retrofitting Sand Filters. Not every stormwater pond is suitable for retrofitting with biochar- and iron-enhanced sand filters. There may be spatial constraints such as proximity to other infrastructure or steep pond slopes. The outlet structure may be unsuitable or need to be replaced or otherwise adjusted, increasing the cost of the project. It is much simpler to incorporate such filters into a new pond.

Biochar Amendment. The biochar used on the project was approximately the size of a grain of sand. This size did not appear to be a hydraulic restriction, was easy to handle, and resists biologic and freeze-thaw breakdown. However, biochar appears to have a specific gravity slightly below 1.0, making it susceptible to scour and transport. It is important to be sure that the biochar is well incorporated into the filter. Our design sandwiched the biochar layer between layers of iron-enhanced sand. This seemed to be sufficient to keep the biochar from mobilizing.

Socked Pipe. The initial design for the pond filter bench underdrain specified a 6” perforated PVC pipe with a fabric sock to prevent silt from entering and clogging the pipe. However, the fabric sock also prevents gasses in the pipe from being adequately vented. There also is the possibility of biofilm developing on the outside surface, which could restrict flow of water in and gasses out. The benches are fairly shallow, with only about 12 inches of cover. During extended inundation periods, some of the underdrains began to break free of the filter and floated to the top. In cases where the filter is shallow and the underdrain has minimal cover, a vent pipe can help to relieve this gas buildup.

5.2.2 Maintenance Issues

Catch Basin Inserts. As with catch basins, sumps, grit chambers, and manufactured treatment devices, inserts must be regularly maintained to preserve pollutant removal efficiency. Of particular concern with the catch basin inserts was the ease with which they were filled with accumulating leaf litter, which can overwhelm the phosphorus-removal capacity. However, the inserts are relatively easy to observe and access through a storm sewer grate and would be most useful in locations that are regularly trafficked and inspected.

Pond Filter Crusting. As noted on other projects with iron-enhanced sand filters, over time a thin crust can form on top that inhibits the hydraulic capacity of the filter. Whether it is from a chemical reaction with the iron-enhanced sand or from fine particles that settle out of the stormwater, there is also often organic material that may sprout on the filter. Periodic raking and de-clumping is required to restore filtering capacity.

6.0 References

Minnesota Pollution Control Agency (MPCA). 2019. Iron Enhanced Sand Filter (Minnesota Filter). Minnesota Stormwater Manual. stormwater.pca.state.mn.us/index.php/Iron_enhanced_sand_filter_(Minnesota_Filter)

Mohanty, SK and AB Boehm. 2014. Escherichia coli removal in biochar-augmented biofilter: Effect of infiltration rate, initial bacterial concentration, biochar particle size, and presence of compost. *Environmental Science & Technology*. 48 (19), 11535-11542.

HENNEPIN COUNTY

Natural Resources Grants

Hennepin County offers grants to landowners for projects that preserve and restore the county's natural resources.

This grant program has two options	**Good Steward grant** Primarily for smaller projects that improve surface or ground water quality or quantity, enhance natural areas and promote environmental stewardship to the community.	**Opportunity grant** Primarily to help partners take advantage of opportunities to implement larger projects that improve surface or ground water quality or quantity, or preserve, establish or restore natural areas.
Eligible recipients	Landowners, including individuals, non-governmental organizations, local government agencies, non-profit organizations and businesses in Hennepin County.	
Guidelines	• Ideal for smaller community-based or single applicant projects. • Typical projects include constructing rain gardens, stabilizing stream banks, restoring native vegetation installing vegetated filter strips and other best management practices. • While these grants may fund removal of invasive plants as part of a larger overall project, most invasive plant removal is not eligible unless it is part of a comprehensive habitat and restoration plan.	• Ideal for larger scale projects seeking to leverage multiple funding sources from more than one partner. • Ideal for projects documented as priorities in the applicant's managements plans (e.g. comprehensive plan, watershed management plan). • Applicants are encouraged to seek design and engineering assistance to help scope a project prior to the application period.
Eligible expenses	Environmental or engineering consulting fees, materials, supplies, labor and inspection fees.	
Application timeline	• Apply once per year in the fall. • Successful applicants are determined through a competitive selection process.	• Applications are accepted at any time; however, funds are limited and awarded on a first-come, first-served basis. • A pre-application meeting to discuss project details is highly recommended.
Amount of funding available per grant	• Maximum of $25,000 per project. • Typical awards range from $5,000 to $15,000.	• Up to $100,000 per project. • Typical projects range from $25,000 to $50,000.
Matching funds	• Grant funding can cover up to 75% of total eligible project costs. • The landowner is responsible for contributing the remaining 25% of the project costs, which can be cash or in-kind.	• No match is required. • Funds are often used for required match for other leveraged funds.
Project timeline	• 12 to 24 months to complete project. • All practices must be designed and maintained for at least 10 years.	
Reporting requirements	• Each project must enter into a formal project agreement with the county. • Submit a project work plan with budget and design, operation and maintenance plans. • Submit final report with invoices and project outcomes.	

Contact us today

Our staff is available to answer questions and offer resources to:

- Evaluate the natural resources on your property with Hennepin County's natural recourses interactive map
- Provide technical assistance on water quality and erosion control issues
- Help develop a suitable project
- Provide follow-up and ongoing assistance

For more information:

- Visit **hennepin.us** – search natural resources grants
- Contact Jim Kujawa at 612-348-7338 or **James.Kujawa@hennepin.us**

Hennepin County
Environment and Energy

34-108-02-19

item 09d

Technical Memo

WENCK ASSOCIATES

Responsive partner.
Exceptional outcomes.

To: Shingle Creek WMC Commissioners

From: Ed Matthiesen, P.E.
Diane Spector

Date: October 5, 2019

Subject: Clean Water Fund Grants

Attached for your information are the final Clean Water Fund (CWF) grant applications as submitted for the Meadow Lake Management Plan and Shingle Creek Connections II projects.

Meadow Lake Management Plan. The estimated cost of the Meadow Lake Management Plan is $190,000. The grant request is $152,000 and the Commission's share is $38,000. The project is on the 2020 CIP for levy certification next year.

Shingle Creek Connections II. The estimated cost of this stream restoration project is $410,000. The grant request is for $328,000 and the Commission's share is $82,000. The project is on the 2020 CIP for levy certification next year.

This is the Board of Water and Soil Resources (BWSR) schedule for consideration:

- July 1, 2019 Application period begins
- September 9, 2019 Application deadline at 4:30 p.m.
- January 22, 2020 BWSR Board authorizes grant awards (proposed)
- February 2020 BWSR grant agreements sent to recipients (proposed)
- April 15, 2020 Work plan submittal deadline
- May 15, 2020 Grant execution deadline

Wenck Associates, Inc. | 7500 Olson Memorial Highway | Suite 300 | Plymouth, MN 55427
Toll Free 800-472-2232 Main 763-252-6800 Email wenckmp@wenck.com Web wenck.com

BWSR

Projects and Practices Application

Grant Name - Meadow Lake Management Plan Phase 1
Grant ID - C20-7194
Organization - Shingle Creek WMC

Allocation	**Projects and Practices 2020**	**Grant Contact**	**Diane Spector**
Total Grant Amount Requested	$152,000.00	**County(s)**	Hennepin
Grant Match Amount	$38,000	**12 Digit HUC(s)**	070102060402
Required Match %	25%	**Applicant Organization**	Shingle Creek WMC
Calculated Match %	25%	**Application Submitted Date**	
Other Amount			
Project Abstract	The purpose of the Meadow Lake Management Plan is to improve water quality and biotic integrity in Meadow Lake in the City of New Hope, an Impaired Water for excess nutrients that also suffers from nuisance curly-leaf pondweed and fathead minnow infestations. This application is for phase one of this project, which includes one or more whole-lake drawdowns to control the invasive fish and vegetation, consolidate sediments, and regenerate the native seed bank; installation of fish barriers; and development and implementation of education and outreach and maintenance practices to help protect future water quality. Phase two, not included in this application, is an alum application to seal the lake sediments.		
Proposed Measurable Outcomes	-Improve water clarity and chl-a to meet the NCHF shallow lake standard -Eliminate the fathead minnows -Reduce curly-leaf pondweed restore native vegetation -Consolidate sediments -Prepare for alum application in Phase 2		

Narrative

Questions & Answers
Does your organization have any active competitive CWF grants? If so, specify FY and percentage spent. Also, explain your organization's capacity (including available FTEs or contracted resources) to effectively implement additional Clean Water Fund grant dollars.
Yes, the Crystal Becker Park Infiltration Project. Commission as grantee has expended 52%, but the City of Crystal as project lead has expended 100% and is awaiting reimbursement from the Commission. The funds will be fully expended by 12/31/19. The Commission has no employees but contracts with Wenck Associates (300+ FTEs) to provide ongoing technical and engineering services and JASS for administrative services. The project would be implemented by Wenck as Watershed Engineer in cooperation with the City of New Hope.
Water Resource: Identify the water resource the application is targeting for water quality protection or restoration.
Meadow Lake, 27-0057-00, in the City of New Hope in Hennepin County.
Question 1 (17 points): (A) Describe why the water resource was identified in the plan as a priority resource. For the proposed project, identify the specific water management plan reference by plan organization (if different from the applicant), plan title, section, and page number. (B) In addition to the plan citation, provide a brief narrative description that explains whether this application fully or partially accomplishes the referenced activity. (C) Provide weblinks to all referenced plans.
A) 13 of the 16 lakes in the watershed were designated Impaired Waters for excess nutrients, and TMDLs were completed 2007-2010. Stakeholders have focused on reducing TP from the watershed, and 3 lakes have since been delisted with improved water quality. Internal load management has been completed or is in progress on 5 of the remaining 10 lakes. The City of New Hope and the Meadow Lake Watershed Association (MLWA) have been active in reducing watershed load and are ready to start addressing internal load. The Commission's Watershed Management Plan established as its number one priority for the period 2013-2022: "Work aggressively toward achieving TMDL lake and stream goals (p. 4-4)." Furthermore, in addition to establishing a stretch goal to achieve delisting of four additional lakes (Goal B.2.), Goal B.3. of the Plan is to "Improve water clarity in the balance of the lakes by 10% over the average of the previous ten years (p. 4-6)." As a shallow lake currently in a turbid state, internal load control is necessary to flip Meadow Lake to a clear water state to achieve the clarity goal. The Meadow Lake Drawdown Project was identified as a potential project in the Management Plan (p. 4-21) but was not specifically programmed pending additional study. That work has now been completed and the project has been added to the current CIP via a 2019 minor plan amendment. B) This is the first phase of what will be a series of actions over 6 or more years, and will focus on improving the biology of this very shallow lake, preparing it to flip to a clear-water state. This will take 3 to 4 years. The second phase will address internal load by chemically treating the sediments, and will take an additional 3 or more years. Future maintenance actions may be necessary to keep invasive vegetation and fish in check. http://www.shinglecreek.org/management-plan.html

Questions & Answers
https://www.pca.state.mn.us/water/tmdl/meadow-lake-excess-nutrients-tmdl-project http://www.shinglecreek.org/tmdls.htm
Question 2 (3 points): (A) Describe how the resource of concern aligns with at least one of the statewide priorities referenced in the Nonpoint Priority Funding Plan. (also referenced in the "Projects and Practices" section of the RFP). (B) Describe the public benefits resulting from this proposal from both a local and state perspective.
A) The project aligns with the statewide priority "Restore and protect water resources for public use and public health, including drinking water." Phase one of the Meadow Lake Management Plan is the restoration of a balanced lake ecology. Water quality in shallow lakes is as dependent on a balanced fish/invertebrate/vegetation community as on the phosphorus load to the lake. Reducing the watershed load to zero would still result in a hypereutrophic lake with excessive algae blooms simply due to the presence of an unchecked minnow population and excessive curly-leaf pondweed infestation. B) In its current condition the public cannot recreate in the lake and its aesthetics are unpleasing. It is not capable of sustaining a balanced ecology. The Meadow Lake Management Plan would restore the lake's Aquatic Recreation beneficial use.
Question 3. (15 points) Describe the methods used to identify, inventory, and target the root cause (most critical pollution source(s) or threat(s)). Describe any related additional targeting efforts that will be completed prior to installing the projects or practices identified in this proposal.
Periodic water quality monitoring has been conducted on Meadow Lake since the original TMDL study. Much of the data was collected by volunteers through the Met Council's CAMP and the MPCA's CLMP. The Commission monitored water quality on Meadow Lake in 2016 through its Intensive Lake Monitoring Program in preparation for completing a TMDL Five Year Review of progress. The Commission systematically reviews every TMDL in the watershed every 5-7 years to update data, assess progress, and update implementation priorities. In addition to water quality monitoring, the Commission also collected sediment cores, undertook fish and aquatic vegetation surveys, and assembled information about BMPs completed in the lakeshed. This data was used to update HydroCAD, P8, and lake response modeling, and review and revise implementation priorities. The 2016 fish survey as well as previous surveys completed by academic researchers documented the fathead minnow population and its potential role in degrading water quality. The fish and curly-leaf pondweed surveys and sediment core results as well as the lack of any improvement in the lake even with reducing the watershed load by nearly half suggested that internal load control would be necessary to make any water quality gains. Prior to undertaking a winter drawdown, the Commission would monitor water quality and repeat the fish and aquatic vegetation surveys. Another set of sediment cores would be taken to document bulk density and organic content as well as to refine the phosphorus fractionation data. That monitoring would be repeated after the lake refills to assess progress. The Meadow Lake Feasibility Report (attached) includes a decision tree that will guide how the Commission and City would proceed in years two and three based on the monitoring results. Only when monitoring indicates the fish and CLP populations have ben controlled would the Commission proceed to phase 2, an alum treatment.

Questions & Answers
Question 4. (10 points): How does this proposal fit with complimentary work that you and your partners are implementing to achieve the goal(s) for the priority water resource(s) of concern? Describe the comprehensive management approach to this water resource(s) with examples such as: other financial assistance or incentive programs, easements, regulatory enforcement, or community engagement activities that are directly or indirectly related to this proposal.
The Meadow Lake Watershed Association (MLWA) (www.meadowlakematters.org) in partnership with the City of New Hope and the Commission recently updated its Lake Management Plan. This Plan includes both short- and long-term goals and strategies that have been in active implementation since its inception in 2009. The Commission awarded MLWA three education grants to support community education including the publication of a series of newsletters and the Meadow Lake Watershed Guide. MLWA designed and purchased "Welcome to the Meadow Lake Watershed" street signs, worked with the City to place them throughout the watershed, and routinely displays yard signs informing residents that "Every curb is a shoreline" and "Our street connects to Meadow Lake." The Association received a grant from the MN DNR to sponsor a series of three educational workshops on shoreline restoration, and several lakeshore property owners restored their shorelines with native plant buffers. The Association partnered with Meadow Lake Elementary School to plant a 10,000 square foot rain garden, and the Association and City have collaborated with volunteers to adopt and restore over 200 feet of shoreline in Meadow Lake Park. The City also maintains grit chambers and provides enhanced street sweeping in the lakeshed throughout the growing season. Concurrent with this project, the City, Association, and Commission will develop a written maintenance plan that will include schedules for street sweeping, grit chamber and outlet cleaning; best practices for road salt usage and golf course turf management to limit impacts to the lake; and plans for ongoing management of stormwater in the lakeshed.
Question 5. (10 points): (A) What is the primary pollutant(s) will this application specifically address? (B) Has a pollutant reduction goal been set (via TMDL or other study) in relation to the pollutant(s) or the water resource that is the subject of this application? If so, please state that goal (as both an annual pollution reduction AND overall percentage reduction, not as an in-stream or in-lake concentration number). (C) If no pollutant reduction goal has been set, describe the water quality trends or risks associated with the water resource or other management goals that have been established. (D) For protection projects, indicate measurable outputs such as acres of protected land, number of potential contaminant sources removed or managed, etc.
A) The primary pollutant addressed is nutrients, specifically total phosphorus. B) The Meadow Lake Nutrient TMDL requires an 83%, 96 lb/yr reduction from the watershed and 85%, 62 pound reduction from internal load. Lake response modeling completed for the TMDL 5 Year Review using a longer and more recent data set and measured release rates from sediment cores suggests a 71%, 62 pound reduction from the watershed and a 93%, 110 pound reduction from internal load. An analysis conducted for the TMDL 5 Year Review estimates that about 42 pounds of TP are removed annually by BMPs installed since the TMDL and by annual enhanced street sweeping. C) The Phase 1 goal is to achieve the NCHF shallow lake standards for clarity (<1 meter) and chl-a (≤20 µg/L).

Questions & Answers
Question 6. (10 points): (A) What portion of the water quality goal will be achieved through this application? Where applicable, identify the annual reduction in pollutant(s) that will be achieved or avoided for the water resource if this project is completed. (B) Describe the effects this application will have on the root cause of the issue it will address (most critical pollution source(s) or threat(s)).
A) The project restores the biology of the lake to improve water clarity and chl-a concentrations. The metrics to evaluate success will be Floristic Quality Index (FQI), Secchi depth, chl-a concentration, presence/absence of fathead minnows, sediment consolidation (bulk density), and CLP abundance. While it is hard to say with certainty what the numeric TP benefit would be, lake response modeling estimates a residual annual load of 20-25 pounds TP that cannot be accounted for from watershed load or from sediment release based on the measured release rate. This may be the load attributable to resuspension from minnows foraging in the sediments, and from wind resuspension, and would be the estimated load reduction from Phase 1. Based on experience from other shallow lake drawdowns (for example Cleary Lake in Carver County), the initial lake response is likely a decrease in chl-a concentration and improvement in transparency. Phase 2 of the project, in year 4-6, will reduce P from sediment release though an alum application. B) The project restores the biology of the lake to improve water clarity and chl-a concentrations. The metrics to evaluate success will be Floristic Quality Index (FQI), Secchi depth, chl-a concentration, presence/absence of fathead minnows, sediment consolidation (bulk density), and CLP abundance. While it is hard to say with certainty what the numeric TP benefit would be, lake response modeling estimates a residual annual load of 20-25 pounds TP that cannot be accounted for from watershed load or from sediment release based on the measured release rate. This may be the load attributable to resuspension from minnows foraging in the sediments, and from wind resuspension. Based on experience from other shallow lake drawdowns (for example Cleary Lake in Carver County), the initial lake response is likely a decrease in chl-a concentration and improvement in transparency. Phase 2 of the project, in year 4-6, will reduce P from sediment release though a
Question 7. (5 points): If the project will have secondary benefits, specifically describe, (quantify if possible), those benefits. Examples: hydrologic benefits, enhancement of aquatic and terrestrial wildlife species, groundwater protection, enhancement of pollinator populations, or protection of rare and/or native species.
The City and Association will be conducting education and outreach activities throughout the project and will work with the local newspaper, Sun Post, and the cable access provider CCX Media to publicize the project on its daily newscast. Ongoing publicity about the project will create the opportunity to increase community awareness about Meadow Lake and other waterbodies. The City and Association will leverage this publicity as a vehicle to educate the community on how individual practices can make a difference in protecting and improving water quality and ecological integrity.

Questions & Answers
Question 8. (15 points): A) Describe why the proposed project(s) in this application are considered to be the most cost effective and feasible means to attain water quality improvement or protection benefits to achieve or maintain water quality goals. Has any analysis been conducted to help substantiate this determination? Discuss why alternative practices were not selected. Factors to consider include, but are not limited to: BMP effectiveness, timing, site feasibility, practicality, and public acceptance. Note: For in-lake projects such as alum treatments or carp management, please refer to the feasibility study or series of studies that accompanies the grant application to assess alternatives and relative cost effectiveness. You will also need to attach a copy of this study within the Attachments tab. (B) If your application is proposing to use incentives above and beyond payments for practice costs, please describe rates, duration of payments and the rationale for the incentives' cost effectiveness. Note: For in-lake projects such as alum treatments or carp management, please refer to the feasibility study or series of studies that accompanies the grant application to assess alternatives and relative cost effectiveness. Please attach feasibility study to your application in eLINK.
A) Meadow Lake has a small (88 acres), fully developed watershed. A City improvement project several years ago installed grit chambers and a large boulevard rain garden to provide treatment of runoff prior to discharge into the lake. The City also undertakes enhanced street sweeping in the lakeshed. These actions have achieved about 2/3 the required watershed load reduction. Several homeowners have planted native buffers on their shoreline, and the MLWA sponsors shoreline buffer plots at Meadow Lake Park. There are few opportunities left in the small lakeshed to make additional watershed load reductions. Shallow lakes are different than deep lakes, in that achieving a biotic balance is as crucial to achieving a clear water state as is managing nutrients. Even if the watershed load was reduced to zero, the lake would not significantly improve because it does not currently have a balanced biology. The fish community is almost exclusively fathead minnows, and the aquatic vegetation community is dominated by curly-leaf pondweed. Fathead minnows are opportunistic feeders, rooting in the bottom sediments as well as consuming zooplankton that would ordinarily keep algae growth in check. The proposed drawdown would target eliminating as many of the minnows as possible, and barriers installed on outfalls and the lake outlet should prevent colonization from connected waters. The drawdown would also help control the curly-leaf pondweed, allowing native vegetation an opportunity to establish. The City of New Hope had previously undertaken a partial drawdown to excavate sediment at outfalls, and the nextyear water clarity was good and native vegetation did grow, confirming that the seedbank is still present and viable. This first phase will focus on reestablishing biology in the lake. Once the biology is restored, which will take 3-5 years Phase 2 of the project will be chemical control of sediment release, such as an alum treatment. B) A Feasibility Study is attached.
Question 9. (8 points): What steps have been taken or are expected to ensure that project implementation can begin soon after the grant award? Describe general environmental review and permitting needs required by the project (list if needed). Also, describe any discussions with landowners, status of agreements/contracts, contingency plans, and other elements essential to project implementation.
The Commission has completed water quality monitoring and aquatic vegetation and fish surveys as well as taken a sediment core to measure the phosphorus release rate. The City of New Hope and Meadow Lake Watershed Association have been partners in developing the proposed Meadow Lake Management Plan and have held public meetings to discuss the proposed improvements, including an Open House to which all residents in the lakeshed were invited. A DNR Work in Public Waters permit will be required to conduct temporary drawdowns, and the

Questions & Answers
Commission has been in contact with the Area Hydrologist to be sure all permit procedures are followed. MLWA has updated its membership several times, and will assist in obtaining the required riparian property owner approvals.
Question 10. (2 points): What activities, if any proposed, will accompany your project(s) that will communicate the need, benefits, and long term impacts to your local community? This should go above and beyond the standard newsletters, signs and press releases.
The City of New Hope and the MLWA are partners in this project. This project will be publicized on the Commission and City website, and we will also work with CCX Media to provide ongoing , local cable-access TV coverage over the life of the project.
Question 11. (0 points). All project applications for feedlots must include a work sheet with supplemental questions being answered. This worksheet is found on the BWSR webpage "Apply for Grants." Have you attached this worksheet?
N/A
The Constitutional Amendment requires that Amendment funding must not substitute traditional state funding. Briefly describe how this project will provide water quality benefits to the State of Minnesota without substituting existing funding.
The grant funds will allow the Commission to undertake a suite of activities that together will restore Meadow Lake to a clear-water state.

Application Budget

Activity Name	Activity Description	Category	State Grant $ Requested	Activity Lifespan (yrs)
Construction	Lake drawdowns, fish barriers, SAV management	NON-STRUCTURAL MANAGEMENT PRACTICES	$85,600.00	20
Monitoring	Water quality, fish and zooplankton monitoring, sediment cores	MONITORING/DATA COLLECTION	$48,800.00	5
Engineering and Outreach	Design engineering and construction observation, public outreach	TECHNICAL/ENGINEERING ASSISTANCE	$17,600.00	20

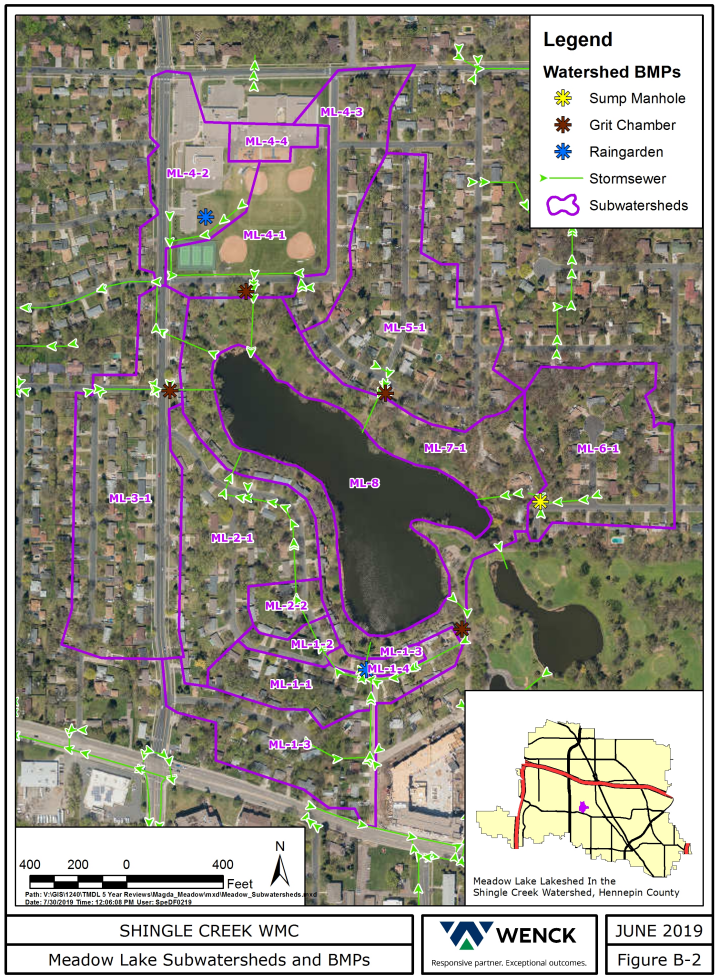
Proposed Activity Indicators

Activity Name	Indicator Name	Value & Units	Waterbody	Calculation Tool	Comments
Construction	PHOSPHORUS (EST. REDUCTION)	25 LBS/YR	Meadow Lake	Other	Lake response modeling using BATHTUB

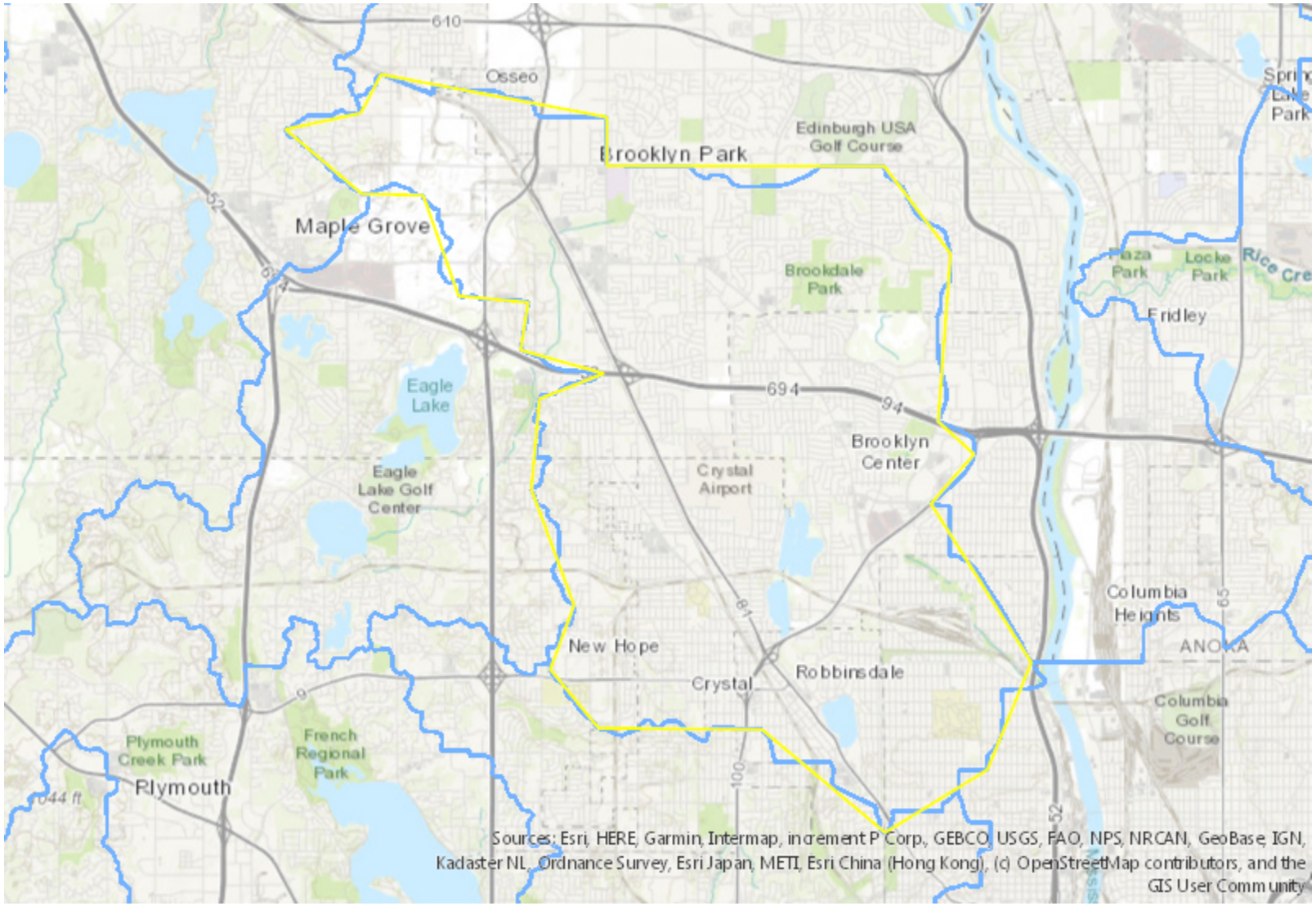
Activity Details

Activity Name	Question	Answer
Construction	Dollar amount requested for Ag BMP Loan Program:	0
Construction	Dollar amount requested for CWP Loans:	0
Monitoring	Dollar amount requested for Ag BMP Loan Program:	0
Monitoring	Dollar amount requested for CWP Loans:	0
Engineering and Outreach	Dollar amount requested for Ag BMP Loan Program:	0
Engineering and Outreach	Dollar amount requested for CWP Loans:	0

Application Image



Map Image


610
Osseo
Brooklyn Park
Edinburgh USA
Golf Course
Maple Grove
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694
Brookdale
Park
Fridley
Eagle
Lake
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Brooklyn
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Lake Golf
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Crystal
Airport
Columbia
Heights
65
ANOKA
New Hope
81
Crystal
Robbinsdale
Columbia
Golf
Course
Plymouth
Creek Park
French
Regional
Park
Plymouth
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52
Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN,
Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the
GIS User Community

BWSR

Projects and Practices Application

Grant Name - Shingle Creek Connections II
Grant ID - C20-7280
Organization - Shingle Creek WMC

Allocation	**Projects and Practices 2020**	**Grant Contact**	**Diane Spector**
Total Grant Amount Requested	$328,000.00	**County(s)**	Hennepin
Grant Match Amount	$82,000	**12 Digit HUC(s)**	070102060402
Required Match %	25%	**Applicant Organization**	Shingle Creek WMC
Calculated Match %	25%	**Application Submitted Date**	
Other Amount	$0		
Project Abstract	The purpose of the Shingle Creek Connections II stream restoration project is to improve water quality and biotic integrity in Shingle Creek in the cities of Brooklyn Park and Brooklyn Center. Shingle Creek is an Impaired Water for low dissolved oxygen, excess E. coli, and an impaired macroinvertebrate community. Approximately 1,750 linear feet between Regent/73rd Avenues N and Brooklyn Boulevard will be improved by thinning trees, establishing native vegetation in the buffer and on the banks, enhancing habitat, and introducing low-flow sinuosity and reaeration opportunities with rock vanes and root wads. This is a “missing link” segment that will result a continuous 2.5 mile corridor of urban stream restoration in the Shingle Creek watershed.		
Proposed Measurable Outcomes	-Reduce annual soil loss from 26.8 to 6.3 tons/year and TP from 5.4 to 1.3 lbs/year -Increase reaeration to minimize time that streamflow DO concentration falls below 5 mg/L. -Improve MSHA score from 39.7 (Poor) to at least 50 points (Fair)		

Narrative

Questions & Answers
Does your organization have any active competitive CWF grants? If so, specify FY and percentage spent. Also, explain your organization's capacity (including available FTEs or contracted resources) to effectively implement additional Clean Water Fund grant dollars.
Yes, the Crystal Becker Park Infiltration Project. Commission as grantee has expended 52%, but the City of Crystal as project lead has expended 100% and is awaiting reimbursement from the Commission, which will be complete by December 31, 2019. The Commission has no employees but contracts with Wenck Associates (300+ FTEs) to provide ongoing technical and engineering services and JASS for administrative services. The project would be implemented by Wenck as Watershed Engineer in cooperation with the cities of Brooklyn Park and Brooklyn Center.
Water Resource: Identify the water resource the application is targeting for water quality protection or restoration.
Shingle Creek, 07010206-506, from Regent/73rd Avenues N to Brooklyn Boulevard in the cities of Brooklyn Park and Brooklyn Center in Hennepin County
Question 1 (17 points): (A) Describe why the water resource was identified in the plan as a priority resource. For the proposed project, identify the specific water management plan reference by plan organization (if different from the applicant), plan title, section, and page number. (B) In addition to the plan citation, provide a brief narrative description that explains whether this application fully or partially accomplishes the referenced activity. (C) Provide weblinks to all referenced plans.
A) The Commission's Third Generation Watershed Management Plan in its Executive Summary and Implementation Plan established as its number one priority for the period 2013-2022: "Work aggressively toward achieving TMDL lake and stream goals (p. 4-4)." Furthermore, Goal B.4. of the Plan is to "Improve at least 30% of the length of Shingle Creek to meet Corridor Study and TMDL design standards (p. 4-6)." As of 2019, 3.09 miles, or 27% of the 11.15 miles have been restored. Initial assessment of stream physical and biotic conditions was completed in 2005 for the Shingle Creek Corridor Study, and included a physical inventory and Rapid Bioassessment Protocol condition assessment as well as a macroinvertebrate collection and assessment. Work completed in 2009 and 2010 for the Shingle and Bass Creeks Biota and DO TMDL included a Rosgen Level III and BEHI assessment of stream morphology. Additional monitoring for the TMDL included 72-hour diurnal DO measurements, two synoptic surveys of water quality and flow, two dye studies under high and low flow, and QUAL2K modeling of water quality and DO dynamics. The QUAL2K models were used to test various improvement scenarios to determine which combination of improvements was most effective at achieving the state water quality standard, and where those improvements should be located. B) This application will fully accomplish the proposed restoration. Shingle Creek upstream and downstream of the site has been restored. Completing this reach will create a continuous 13,000 feet (almost 2.5 miles) of restored urban stream corridor. C) Watershed Management Plan: http://www.shinglecreek.org/management-plan.html Shingle Creek Biota and Dissolved Oxygen TMDL and Implementation Plan: https://www.pca.state.mn.us/sites/default/files/wq-iw11-11e.pdf , https://www.pca.state.mn.us/sites/default/files/wq-iw11-11c.pdf Shingle Creek Corridor Study: http://weebly-file/5/7/7/6/57762663/final_2005_shingle_creek_corridor_report.pdf

Questions & Answers
Question 2 (3 points): (A) Describe how the resource of concern aligns with at least one of the statewide priorities referenced in the Nonpoint Priority Funding Plan. (also referenced in the "Projects and Practices" section of the RFP). (B) Describe the public benefits resulting from this proposal from both a local and state perspective.
A) The project aligns with the statewide priority "Restore and protect water resources for public use and public health, including drinking water." Shingle Creek is a wadable stream, and there are public parks upstream and downstream of this segment. Just downstream is Park Center High School, which has an outdoor classroom directly adjacent to the stream. The classroom is used for, among other things, hands-on aquatic ecology and water quality education. Restoring and enhancing the Connections II segment will improve water quality and enhance habitat, improving the learning experience for the students and the general public. B) The public benefit is stabilized streambanks, a native vegetation buffer, enhanced habitat, improvements in reaeration to reduce periods of low dissolved oxygen, reduced sedimentation and nutrients to improve water quality, and an improved fish and macroinvertebrate community.
Question 3. (15 points) Describe the methods used to identify, inventory, and target the root cause (most critical pollution source(s) or threat(s)). Describe any related additional targeting efforts that will be completed prior to installing the projects or practices identified in this proposal.
The 2005 Shingle Creek Corridor Study was a thorough assessment of physical and biological conditions in Shingle Creek and was used to inform the 2011 Bass and Shingle Creeks Biota and DO TMDL and the Stressor ID and Implementation Plan. The Rapid Bioassessment Protocol and the Steam Visual Assessment Protocol were used to assess stream conditions and the M-IBI to assess biotic conditions. This reach scored the worst of all reaches of Shingle Creek on the SVAP (score of 4.09, poor) and M-IBI (score 13.5, impairment threshold=54) and the second worst on the RBP (score of 83, marginal). The Stressor ID repeated the RBP assessment with similar findings, and completed Rosgen Level II and Pfankuch Stability Analyses, to identify stream reaches at higher potential for instability. This reach was assessed as poor, at a higher risk. The Stressor ID concluded that altered hydrology was the primary cause of impairment, followed closely by low DO and lack of habitat. The DO TMDL concluded that the primary cause of low DO was excess sediment oxygen demand caused by an overwidened stream, and the legacy impacts of nutrient and sediment loading from the watershed and streambank erosion. This stream segment was surveyed in 2018 and the MPCA's MSHA tool was used to evaluate stream conditions, scoring 39.7 or poor. The survey found that about 14% of the bank linear footage was experiencing severe erosion; 68% moderate erosion; and 18% slight erosion. This erosion contributes an estimated 20.5 tons of sediment and 4.1 pounds of total phosphorus to the stream each year. The degree of streambank degradation, altered channels, sediment deposition and aggradation, lack of quality habitat, and the lack of streambank vegetative protection led to the reach being designated as a high priority for restoration. Just prior to restoration the Connections II segment will be re- assessed using the MSHA and inverts collected to establish baseline conditions for comparison post restoration.

Questions & Answers
Question 4. (10 points): How does this proposal fit with complimentary work that you and your partners are implementing to achieve the goal(s) for the priority water resource(s) of concern? Describe the comprehensive management approach to this water resource(s) with examples such as: other financial assistance or incentive programs, easements, regulatory enforcement, or community engagement activities that are directly or indirectly related to this proposal.
The Commission's Third Generation Plan includes a goal to "Improve at least 30% of the length of Shingle Creek to meet Corridor Study and TMDL design standards." (p. 4-6) To date 3.09 miles, or 27% of the 11.15 miles have been restored. This project would complete another 0.33 miles, increasing the total to 3.42 miles, or 31%. More importantly, completing this segment will create a continuous 13,000 feet (almost 2.5 miles) of restored stream corridor. The stakeholders in the watershed have also focused on reducing pollutant loading to Shingle Creek, through installation of Best Management Practices (BMPs) as part of street, highway, and park projects; strengthened standards for development and redevelopment projects that require enhanced stormwater management; strict enforcement of erosion control standards; and enhanced street sweeping. The Commission has identified "directly connected untreated areas" throughout the watershed where stormwater is discharged into lakes and streams with no interim treatment from ponds, wetlands, or BMPs. These are areas of focus for enhanced sweeping and for siting new BMPs. The Commission's annual monitoring program has detected a statistically significant reduction in TP and TSS concentrations in streamflow at the outlet to the Mississippi River.
Question 5. (10 points): (A) What is the primary pollutant(s) will this application specifically address? (B) Has a pollutant reduction goal been set (via TMDL or other study) in relation to the pollutant(s) or the water resource that is the subject of this application? If so, please state that goal (as both an annual pollution reduction AND overall percentage reduction, not as an in-stream or in-lake concentration number). (C) If no pollutant reduction goal has been set, describe the water quality trends or risks associated with the water resource or other management goals that have been established. (D) For protection projects, indicate measurable outputs such as acres of protected land, number of potential contaminant sources removed or managed, etc.
A) The primary pollutants addressed are DO and sediment, as well as the non-numerical TMDL parameter of habitat. B) The Shingle Creek DO TMDL requires a 99.3% reduction in sediment oxygen demand in this segment, primarily through stream restoration to create a low-flow channel to reduce exposure to sediments and oxygen demand during periods of low-velocity, low-reaeration flow. C) Although not considered a pollutant, the biotic TMDL established restoration strategies to improve habitat, including rock vanes to provide aeration and varied substrate and to encourage the formation of deeper pools; root wads to introduce woody substrate, provide cover and refuge, and provide lurking areas for aquatic organisms; native streambank vegetation and installation of live stakes to stabilize streambanks and provide opportunities for overhanging vegetation; low-flow channels meandering through a planted point bar; native buffers to reduce runoff and provide upland habitat; and introduction of cobble and boulders to provide additional varied substrate. Most of these design elements are incorporated into the Connections II design.
Question 6. (10 points): (A) What portion of the water quality goal will be achieved through this application? Where applicable, identify the annual reduction in pollutant(s) that will be achieved or avoided for the water resource if this project is completed. (B) Describe the effects this application will have on the root cause of the issue it will address (most critical pollution source(s) or threat(s)).
A) Aside from sediment loss it is difficult to quantify specific reductions. The project is intended to create the conditions in which improvements

Questions & Answers
will occur. In other words, increasing habitat complexity should result in the stream being more able to support a wider variety of aquatic life; "If you build it they will come." Because this is the "missing link" of restored stream segments, the proposed improvements will create a continuous corridor that will promote recolonization. Sediment oxygen demand is not measured directly, but creating a low-flow channel within the wider channel will reduce the wetted width during those critical low-flow periods and thus reduce streamflow exposure to oxygen demand. Again, because the project is the last segment to be restored, the design elements that are intended to enhance reaeration will help maintain or even increase dissolved oxygen levels rather than sag as it does now, as the creek flows through this reach. B)Stabilizing and restoring the streambanks and enhancing stream buffers will reduce sediment and nutrients delivered to the stream, which will improve water quality, reduce embeddedness, and improve clarity, allowing beneficial aquatic vegetation to thrive. Increased habitat complexity will support a wider variety of organisms. Design elements that promote reaeration will help to sustain dissolved oxygen concentrations and reduce sediment oxygen demand. Finally, completing this segment will result in an almost 2.5 miles corridor of restored urban stream.
Question 7. (5 points): If the project will have secondary benefits, specifically describe, (quantify if possible), those benefits. Examples: hydrologic benefits, enhancement of aquatic and terrestrial wildlife species, groundwater protection, enhancement of pollinator populations, or protection of rare and/or native species.
The project will include enhancements to the stream buffer, which currently is comprised of unmowed turf and field grass, invasive undergrowth, and excessive tree canopy. Thinning the trees to remove leaners and undercut trees and open up the canopy will allow a wider variety of slope stabilizing understory and pollinator-friendly forbs and grasses to thrive and will create a more varied terrestrial habitat. Completion of the continuous 2.5 mile restored corridor will provide a protected natural passage for wildlife and organisms to move through the urban landscape. Finally, opening up the stream, restoring it and planting the buffer and banks with native vegetation creates a more aesthetically pleasing public space.
Question 8. (15 points): A) Describe why the proposed project(s) in this application are considered to be the most cost effective and feasible means to attain water quality improvement or protection benefits to achieve or maintain water quality goals. Has any analysis been conducted to help substantiate this determination? Discuss why alternative practices were not selected. Factors to consider include, but are not limited to: BMP effectiveness, timing, site feasibility, practicality, and public acceptance. Note: For in-lake projects such as alum treatments or carp management, please refer to the feasibility study or series of studies that accompanies the grant application to assess alternatives and relative cost effectiveness. You will also need to attach a copy of this study within the Attachments tab. (B) If your application is proposing to use incentives above and beyond payments for practice costs, please describe rates, duration of payments and the rationale for the incentives' cost effectiveness. Note: For in-lake projects such as alum treatments or carp management, please refer to the feasibility study or series of studies that accompanies the grant application to assess alternatives and relative cost effectiveness. Please attach feasibility study to your application in eLINK.
A) Previous restoration projects completed by the Commission have shown the proposed work to be cost effective in bringing measurable water quality benefits while also obtaining acceptance from residents for the stream appearance. Most of the stream segments along Shingle Creek that have been restored have been located in public parks or residential back or side yards. Based on 20 years of restoration experience

Questions & Answers
we have identified the design elements that are the most acceptable and the most successful for achieving our water quality and habitat enhancement goals, and we have incorporated those into this proposed project. B) N/A
Question 9. (8 points): What steps have been taken or are expected to ensure that project implementation can begin soon after the grant award? Describe general environmental review and permitting needs required by the project (list if needed). Also, describe any discussions with landowners, status of agreements/contracts, contingency plans, and other elements essential to project implementation.
Survey work has been completed, and three design concepts have been developed to the 30% level. The Commission and cities have selected their preferred option, so final design work can proceed as soon the grant is awarded. The project will require a DNR Work in Public Waters permit and a FEMA No Rise Certificate assessment, both of which the Commission has successfully obtained on other stream restoration projects. The Commission will hold a public Open House for residents and property owners riparian to the stream prior to finalization of the plans.
Question 10. (2 points): What activities, if any proposed, will accompany your project(s) that will communicate the need, benefits, and long term impacts to your local community? This should go above and beyond the standard newsletters, signs and press releases.
The cities of Brooklyn Park and Brooklyn Center are partners in this project. This project will be publicized on the Commission and cities' websites, and we will also work with CCX Media to provide ongoing , local cable-access TV coverage over the life of the project
Question 11. (0 points). All project applications for feedlots must include a work sheet with supplemental questions being answered. This worksheet is found on the BWSR webpage "Apply for Grants." Have you attached this worksheet?
N/A
The Constitutional Amendment requires that Amendment funding must not substitute traditional state funding. Briefly describe how this project will provide water quality benefits to the State of Minnesota without substituting existing funding.
The grant funds will allow the Commission to increase the number of habitat features to create better habitat complexity.

Application Budget

Activity Name	Activity Description	Category	State Grant $ Requested	Activity Lifespan (yrs)
Construction	Construction contract	STREAMBANK OR SHORELINE PROTECTION	$288,000.00	20

Activity Name	Activity Description	Category	State Grant $ Requested	Activity Lifespan (yrs)
Professional Services	Engieering design and construction observation, public outreach	TECHNICAL/ENGINEERING ASSISTANCE	$40,000.00	20

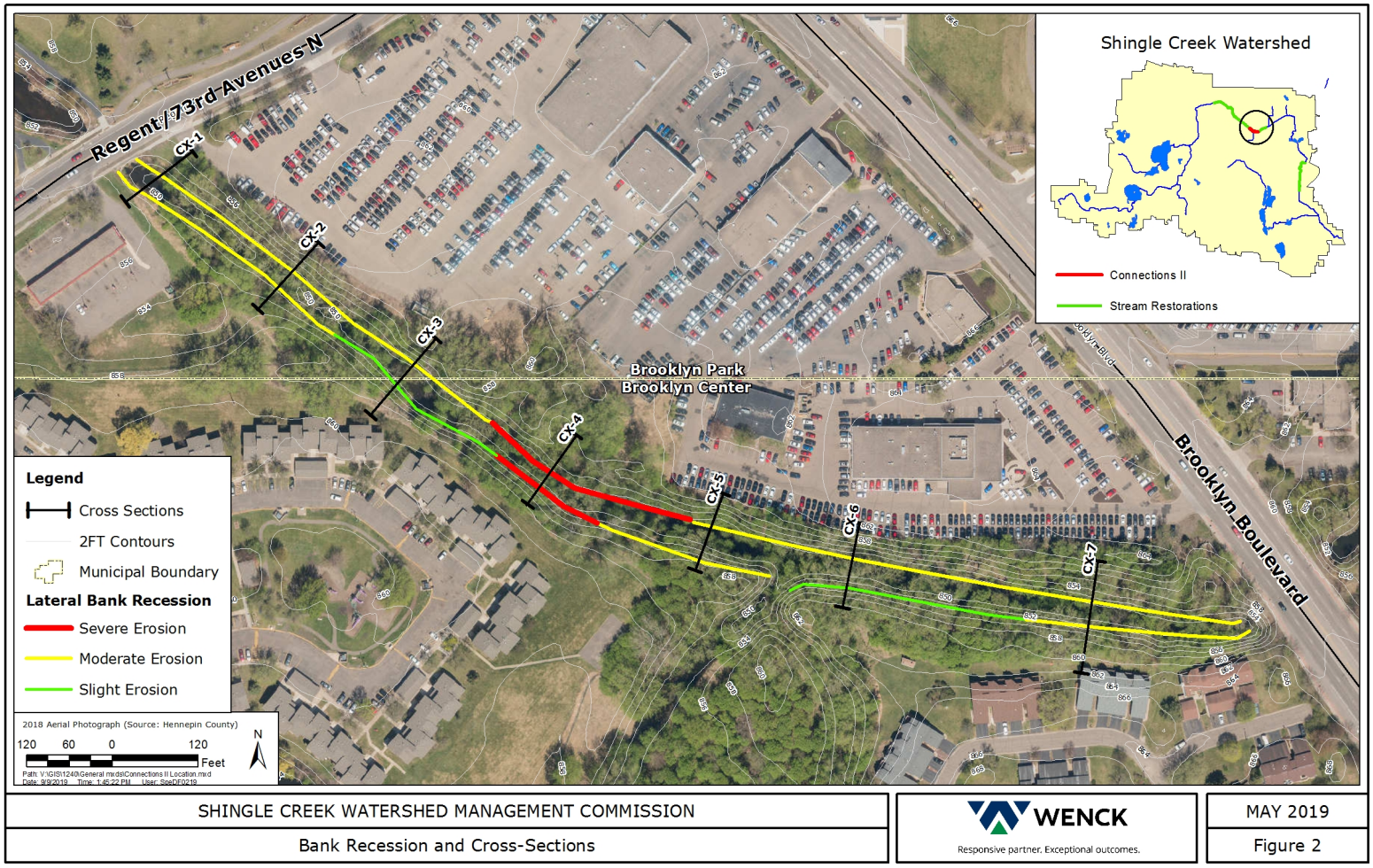
Proposed Activity Indicators

Activity Name	Indicator Name	Value & Units	Waterbody	Calculation Tool	Comments
Construction	PHOSPHORUS (EST. REDUCTION)	4.1 LBS/YR	Shingle Creek	Literature Value	
Construction	SEDIMENT (TSS)	20.5 TONS/YR	Shingle Creek	Other	NRCS Direct Volume Method

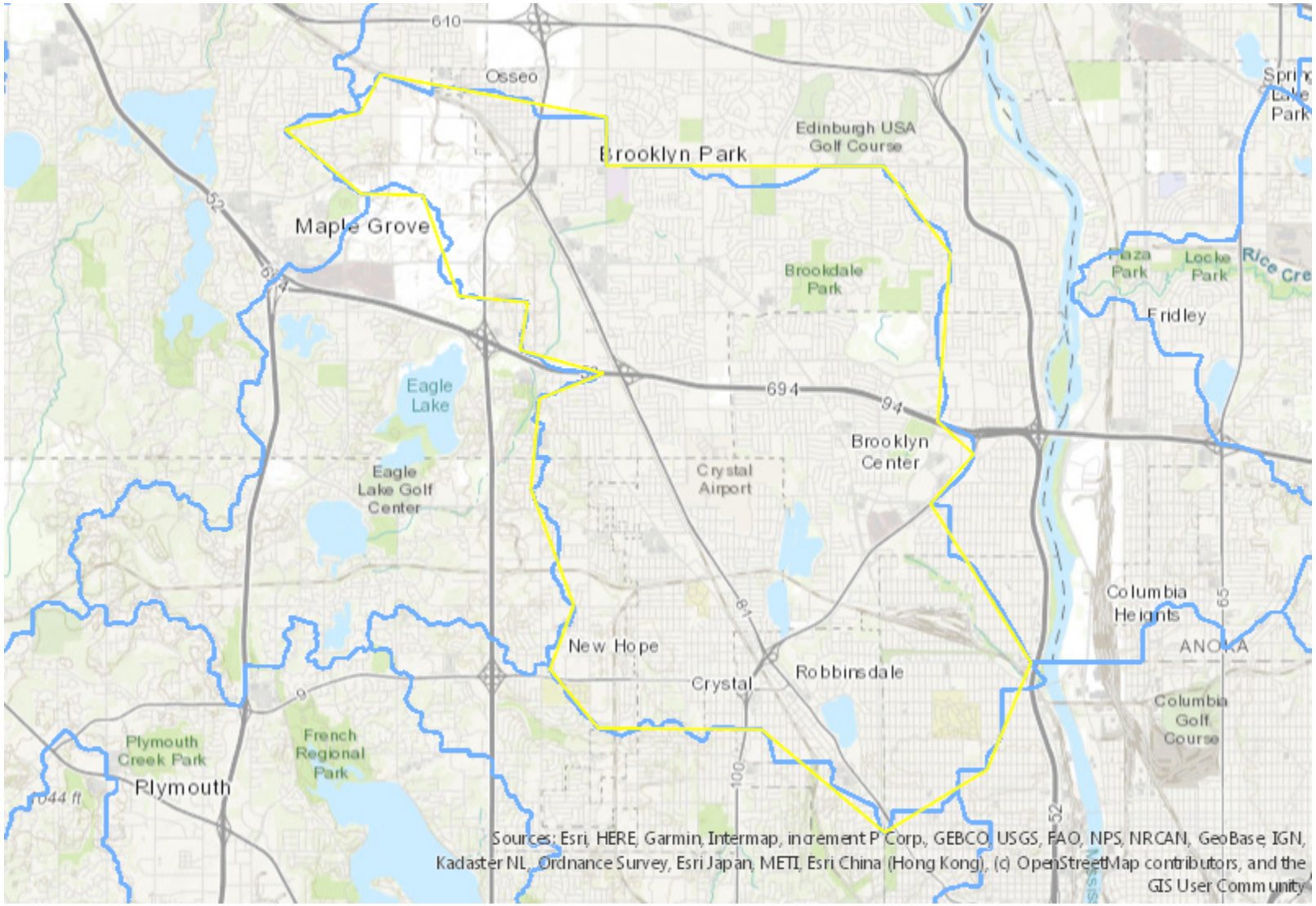
Activity Details

Activity Name	Question	Answer
Construction	Dollar amount requested for Ag BMP Loan Program:	0
Construction	Dollar amount requested for CWP Loans:	0
Professional Services	Dollar amount requested for Ag BMP Loan Program:	0
Professional Services	Dollar amount requested for CWP Loans:	0

Application Image



Map Image


610
Osseo
Brooklyn Park
Edinburgh USA
Golf Course
Maple Grove
52
694
Brookdale
Park
Fridley
Eagle
Lake
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Lake Golf
Center
Crystal
Airport
Brooklyn
Center
94
Columbia
Heights
ANOKA
New Hope
Crystal
Robbinsdale
Columbia
Golf
Course
Plymouth
Creek Park
Plymouth
French
Regional
Park
Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN,
Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the
GIS User Community

item 09d2)a)

Technical Memo

WENCK ASSOCIATES

Responsive partner.
Exceptional outcomes.

To: Shingle Creek WMO Commissioners

From: Ed Matthiesen, P.E.
Diane Spector

Date: October 5, 2019

Subject: Connections II Project Accounting

Recommended Commission Action	Authorize the creation of a Connections II Feasibility Study project to be funded by the Closed Project Account, and authorize the reallocation of $9,392.44 expended from the General Engineering budget line item to the new Feasibility Study project.

Earlier this year we worked with the cities of Brooklyn Park and Brooklyn Center to conceptualize and prepare 30% plans and a cost estimate for the Shingle Creek Connections II. The feasibility study and findings were used to prepare a Clean Water Fund grant application that was submitted to BWSR last month. This is similar to what was done for the Meadow Lake Feasibility Study.

The Meadow Lake work was funded from the Closed Projects Account. That was not the case for the Connections II work, which was funded from the General Engineering budget.

We recommend that the Commission establish a project called the Connections II Feasibility Report project, funded from the Closed Projects Account. We further recommend that the Commission authorize the reallocation of $9,392.44 of expense charged to General Engineering to that project. In 2020, when the project is ordered, the expense of the feasibility report will be included in the overall project cost, and will be included in the levy certified for the overall project, thus “reimbursing” the Closed Projects Account for this cost.

As of 12/31/18, the Closed Projects Account had a balance of just under $80,000. $5,000 of that was expended on the preparation of the Meadow Lake Feasibility Study.

item 10a

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SHINGLE CREEK / WEST MISSISSIPPI WATERSHED MANAGEMENT COMMISSION
MONTHLY COMMUNICATION LOG
September 2019

Date	From	To	SC	WM	Description
9-3-19	Rachel Olmanson, BWSR	Diane S, Jeff S	X		Request for shapefiles associated with past TMDLs
9-4-19	Eric Alms, MPCA	Diane S	X		Reminder to submit final reports for the 319 projects by the end of September
9-5-19	Tom Dillon, McSharry Real Estate	Ed M.	X		2019-009 Lake Road Apartments Robbinsdale Planning Commission meeting
9-5-19	Jodi Taitt, Meadow Lake Association	Diane S	X		Comments on the draft Meadow Lake Management Plan grant application
9-9-19	Diane S	BWSR eLink	X		Submitted CWF applications for the Meadow Lake and Connections II projects
9-10-19	Claire Bleser, RPBWD	SCWM WMC	X	X	Update on progress re: the Hennepin County Chloride Group. "Our interviews are completed and we are currently analyzing the data. We are also hoping to launch a survey for applicators by the end of this month to complement the qualitative research (I will update the group when the survey is live). I am hoping that we will get the findings presented to the group this Fall. "
9-12-19	Nick Phelps, MAISRC	SC WMC	X		Request for Commission participation in a project researching the effectiveness of common carp management as a strategy for water quality restoration
9-13-19	David Knaeble, Civil Site Group	Sarah N.	X		Questions about new project in Shingle Creek and SC requirements
9-17-19	Bob Masser @ L&R Landscaping	Ed M.	X		Retaining wall replacement on Bass Lake in Plymouth
9-17-19	Sarah Piket @ Maple Grove Arbor Committee	Ed M.	X	X	Adding trees to hard surfaces
9-17-19	Judie A	Karen Galles, HCEE	X	X	Letters and resolutions certifying levies
9-20-19	Daniel Bovitz @ Hennepin County	Ed M.	X	X	Hennepin County Emergency Management Quarterly Meeting
9-20-19	Laura Jester @ Bassett Creek WMC	Ed M., Diane S.	X	X	Manufactured Treatment Devices testing protocol
9-20-19	Jason Staebell @ Hennepin County	Ed M., Sarah N.		X	CSAH 152 design review meeting
9-23-19	Jeff S	Lower Twin Lake HOA	X		Gave update on Lower Twin water quality and carp mgmt results to lake assn
9-26-19	Karen Galles, HCEE	Diane S	X		Information regarding two applicants for Master Water Stewards program form Shingle Creek watershed
9-27-19	Dustin Simonson	Diane S., Ed M.		X	Brooklyn Park River Park pre application meeting
9-27-19	MPCA	SC WMC	X		Final report and invoice for the Twin Lake Carp Management Project
9-27-19	Kasey Rundquist, MAISRC	Diane S., Ed M.	X		Phone interview regarding carp management strategies in the watershed
9-30-19	MPCA	SC WMC	X		Final report and invoice for the Biochar-Enhanced Sand Filters Project