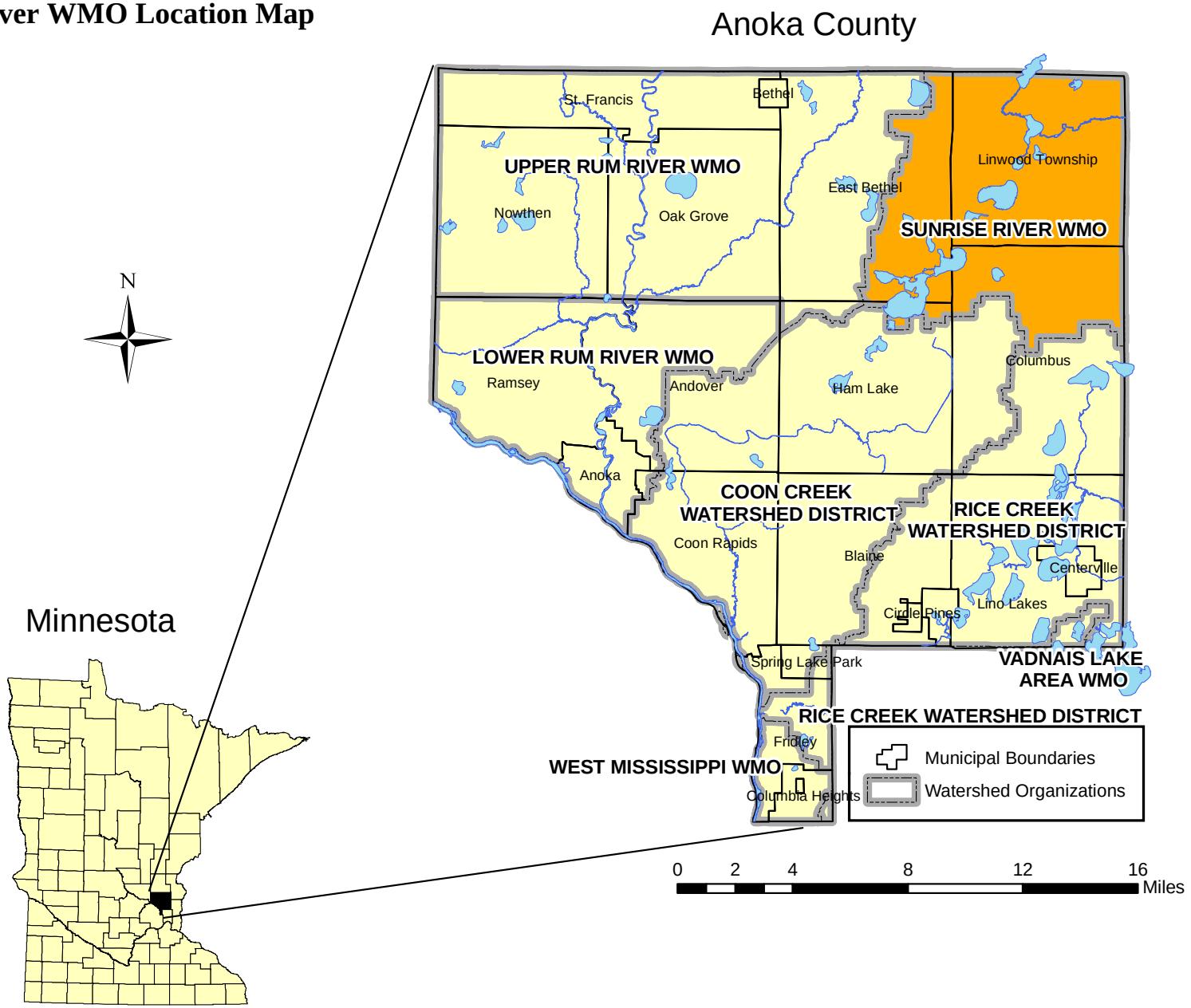
2018 Annual Report

Sunrise River Watershed Management Organization

East Bethel – Ham Lake – Linwood - Columbus

April 11, 2019

Sunrise River WMO Location Map



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I. Introduction to this Report

This report is intended for local and state oversight agencies, as well as interested citizens. At the local level, it is intended to provide member communities, their elected officials, and staff with an activity update. At the state level, this report meets the annual watershed management organization reporting requirements of Minnesota Rules 8410.0150. The report is intended to fulfill 2018 reporting requirements.

II. About the Sunrise River WMO

The Sunrise River Watershed Management Organization (SRWMO) is a special purpose unit of government that operates as a joint powers organization under Minnesota Statutes, Section 471.59. It is comprised of Linwood Township and portions of the Cities of Columbus, Ham Lake, and East Bethel. Board members are appointed by the member communities. Financing is from member communities. The SRWMO's direction is laid out in its watershed management plan and the member municipalities' local water plans.

The SRWMO area is rich in water and natural resources. Approximately 50% of the area is water and wetlands, including 19 lakes. Four are major recreational lakes (Coon, Linwood, Martin, and Typo). 19% of the SRWMO area is high quality natural communities that have undergone little human disturbance since pre-settlement times. Many of these areas have been designated by the State as sites of biodiversity significance or regionally significant ecological areas. 27 plant and animal species that are state endangered, threatened, special concern, or rare are known to occur in the SRWMO. These water and natural resources are at the heart of the character of these north Twin Cities metro communities.


Sunrise River

Despite the overwhelming good quality of the natural resources, there are some areas of concern. Martin, Typo, and Linwood Lakes have been designated as "impaired" by the Minnesota Pollution Control Agency for excess nutrients. Several segments of the Sunrise River in Linwood Township are impaired for pH, turbidity, and the fish community. Coon

and Linwood Lakes are infested with two aquatic invasive species: curly leaf pondweed and Eurasian Water Milfoil. There are questions about the effects that improperly maintained septic systems may be having on water quality. Many of these problems flow across community boundaries and cannot be effectively addressed by any one community alone. This is the reason for this joint powers watershed management organization.

SRWMO Watershed Management

The SRWMO is guided by its 10-year watershed management plan. The plan can be found on the SRWMO website (www.SRWMO.org).

The Sunrise River WMO Board of Managers considers its responsibilities to be overseeing the management of water resources in the watershed. The WMO serves the community by:

- Providing a forum to consider inter-community water problems.
- Collecting data and conducting resource monitoring to guide management.
- Facilitating water quality improvement projects, which often will be cooperative endeavors with others.
- Setting minimum standards for member community ordinances that consider local water resources issues. The SRWMO will not have its own permitting program.
- Providing a linkage between natural resources and land use planning decisions.
- Educating the public about water resources, and enabling or incentivizing individual action.
- Informing and engaging local elected officials about water problems, projecst and the SRWMO.
- Ensuring expenditures result in corresponding benefits to the public.
- Avoiding duplication among government agencies and communities.

The SRWMO operates under the following philosophies:

- Water-related problems are community problems and not individual problems.
- Water resource management is a vital matter that cannot be effectively addressed by individual communities because watersheds cover multiple communities.
- Water resources should be managed on a watershed basis.
- Aquatic and terrestrial areas are integrally linked and cannot be effectively managed separately.

III. Activity Report

a. Current Board Members

CITY OF COLUMBUS

Shelly Logren
16319 Kettle River Blvd
Columbus, MN 55025
651.464.3120
councilslogren@ci.columbus.mn.us

Janet Hegland
16319 Kettle River Blvd
Columbus, MN 55025
651.464.3120
councilsjaneth@ci.columbus.mn.us

CITY OF HAM LAKE

Matt Downing (Treasurer)
16163 Lexington Ave NE
Ham Lake, MN 55304
651.428.6350
Matthewdowning108@gmail.com

Sandy Flaherty
834 181st Ave NE
Cedar, MN 55011
763.226.4127
stevensandy6@q.com

CITY OF EAST BETHEL

Tim Harrington
2241 221st Ave NE
East Bethel, MN 55011
763.413.7851
tim.harrington@ci.east-bethel.mn.us

Leon Mager (Vice Chair)
19511 East Tri Oak Circle NE
Wyoming, MN 55092-8420
763.434.9652
lam3@isd.net

LINWOOD TOWNSHIP

Dan Babineau (Chair)
22275 Martin Lake Road NE
Stacy, MN 55079
763.390.9985
danb@microconsulting.com

Paul Enestvedt
6220 213th Lane NE
Stacy, MN 55092
651.408.0046
paul.enestvedt71@gmail.com

Tim Peterson (Alternate)
23561 Fontana St NE
Stacy, MN 55079
651.233.4151
braveheart51@frontiernet.net

Current SRWMO Managers and contact information can be found at **www.SRWMO.org**

b. Day to Day Contact

The day to day contact person for the SRWMO who can answer questions about the organization is:

Jamie Schurbon, Watershed Projects Manager
Anoka Conservation District
1318 McKay Drive NE, suite 300
Ham Lake, MN 55304
763-434-2030 ext. 12

c. Employees and Consultants

The SRWMO does not employ staff, but does utilize consulting services and enters into cooperative agreements with other government agencies. A description of contracted services is listed below:

SRWMO consultants and partners during the reporting period:

Consultant/ Partner	Contact	Work Description
Anoka Conservation District	Jamie Schurbon Watershed Projects Manager 1318 McKay Drive NW, #300 Ham Lake, MN 55304 763-434-2030 ext. 12 jamie.schurbon@anokaswcd.org	1. **Water Monitoring** – Water quality and hydrology monitoring in lakes, streams and wetlands. 2. **Water Quality Improvement Projects** –Implementation of water quality improvement efforts, including administering the SRWMO water quality grant program. 3. **Education –** Promotion of SRWMO programs. 4. **Website** - Maintain SRWMO website. 5. **Reporting** - Assistance preparing this annual report and State Auditor reporting. 6. **Administration –** Serve as a limited, on-call administrator to address miscellaneous day-to-day operational issues. Reviews local water plans. 7. **Watershed planning –** Updates to the 10-year SRWMO watershed management plan.
Gail Gessner	Gail Gessner 4621 203rd Lane NW Oak Grove, MN 55303 (763) 753-2368 recordwmo@gmail.com	**Recording secretary** for meetings, plus miscellaneous administrative assistance.

Working for the SRWMO, Anoka Conservation District staff monitor water quality at Coon Lake.

d. Highlighted Recent Projects and Accomplishments

Listed below from most to least recent

Friend of Martin Lake Award (April 2019)

The Martin Lakers Association presented SRWMO Chairperson Dan Babineau with their Friend of Martin Lake award at their April 2019 annual meeting. Dan was recognized for his leadership leading to several successful projects including carp barriers, carp harvests and securing funding for upcoming stormwater retrofits. Dan also donated his time and equipment to carp removals in 2018.

SRWMO Chair Dan Babineau assisting with Martin Lake carp harvests (left) and receiving the annual Friend of Martin Lake award from Martin Lakers Association Vice-President Mike Smith.

Martin and Typo Lakes Carp Removal (2017-2019)

This project is a follow-up to the carp barriers project (described below). The purpose is to improve water quality, habitat and the game fishery in Martin and Typo Lakes. To accomplish this Carp Solutions, Inc., a spin-off company from the University of

Minnesota Aquatic Invasive Species Research Lab is conducting carp surveys, radio tracking and harvests. This project is funded by a MN DNR Conservation Partners Legacy grant ($99,000), the Sunrise River WMO ($5,000), Martin Lakers Association ($8,400) and Anoka Conservation District ($5,000). The project will both aim to reduce carp populations below the critical threshold for ecological damage of 100 lbs/ac and craft a plan for maintaining this condition long-term.

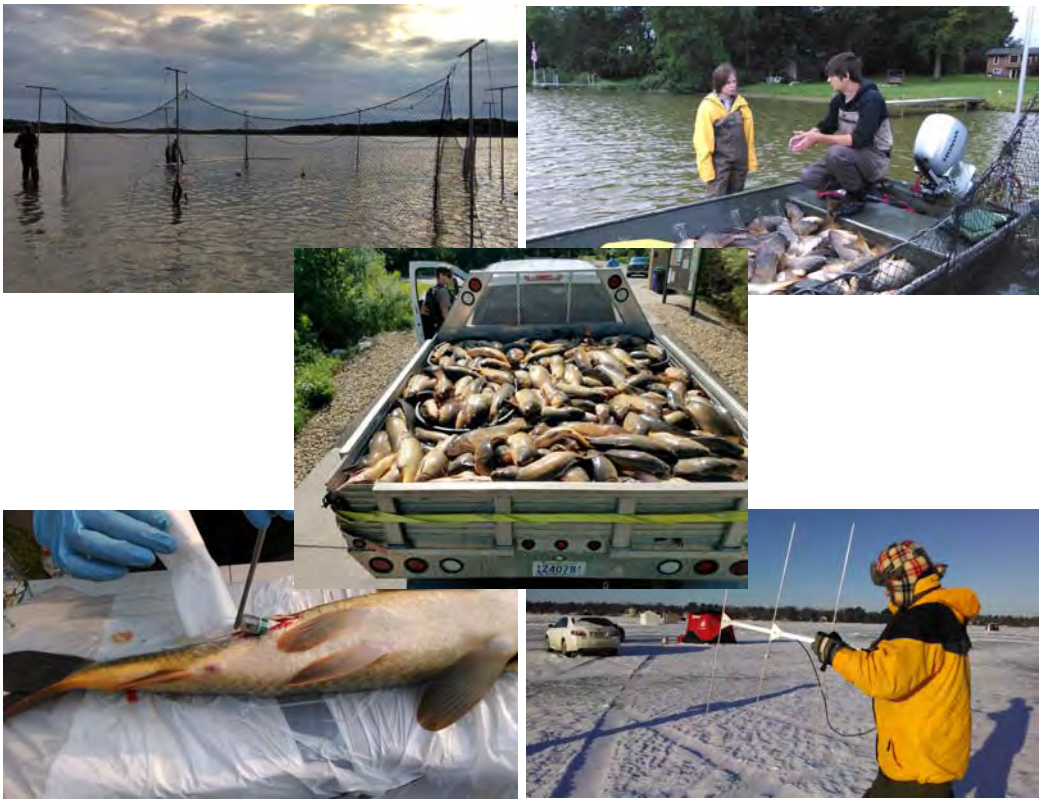
CLEAN WATER LAND & LEGACY AMENDMENT

In 2017 accomplishments:

- Box netted Typo Lake 6 occasions with 2-3 nets each time. 2,100 carp removed.
- Electrofished in Martin Lake as a population survey, and to get carp for mark/recapture and radio tagging.
- Surgically implanted radio tags into 20 carp in each Martin and Typo Lakes.
- Located radio tagged carp monthly and mapped their locations.
- Fin clipped several hundred carp in each lake for mark-recapture study that will result in population estimations.
- Trap netted at 5 satellite waters and wetlands to locate young carp that would indicate the area is used for spawning and be subject to future management.

In 2018 accomplishments:

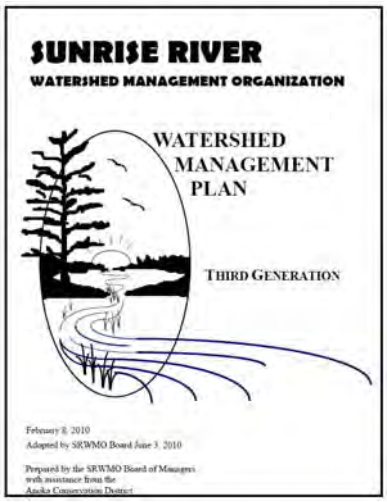
- Located radio tagged carp monthly and mapped their locations.
- Removed 3,552 carp from Typo Lake. Multi-year total removed is 5,652 or 37% of the estimated population.
- Removed 3,369 carp from Martin Lake, or 25% of the estimated population.



Carp Management at Typo and Martin Lakes

Sunrise River WMO Watershed Management Plan Update

The SRWMO is required to update its watershed management plan each 10 years. That plan serves to guide the activity of the organization. The current watershed plan expires December of 2019. The update process began in early 2018 and takes approximately 18 months. Stakeholders including lake groups, elected officials, cities and state agencies will be invited to participate in planning. The SRWMO has contracted with the Anoka Conservation District for planning and plan writing services.



As part of its watershed plan update, the SRWMO hosted a public tour of recent projects and an indoor public input meeting.

Linwood Lake Carp Feasibility Study (2018-2019)

The SRWMO hired Carp Solutions LLC to determine if common carp management was warranted in Linwood Lake to improve water quality, habitat and the fishery.

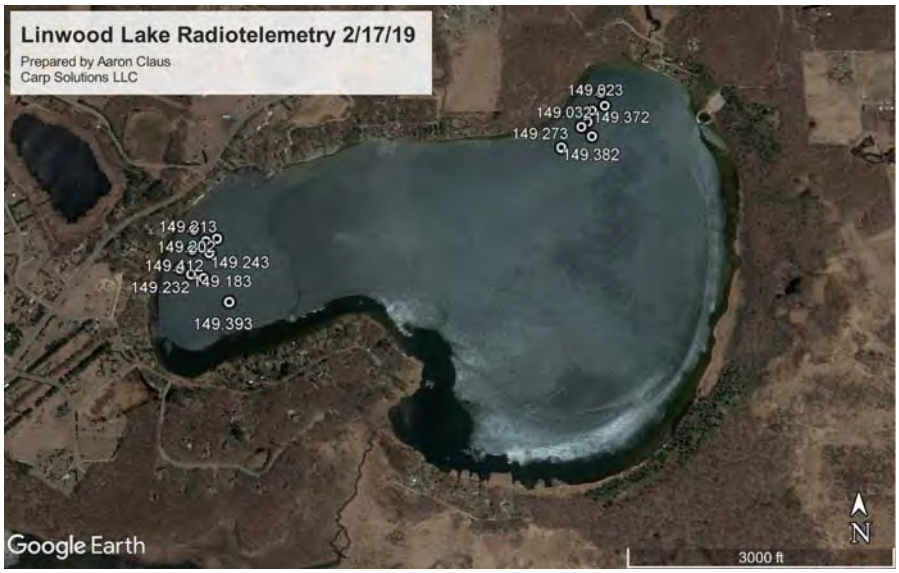
2018 accomplishments:

- Electrofishing survey to estimate carp populations.
- 20 carp were radio tagged and tracked.
- Boot Lake was trap netted to determine if carp spawning occurs in this adjacent lake.
- Approximately 50 carp were aged using their otoliths in order to generate a carp spawning success history.

Preliminary findings indicate that carp biomass in Linwood Lake is 10% over the threshold at which carp are understood to negatively affect water quality and habitat. Carp have reproduced in all of the last eight years, but reproduction before that time was only

CLEAN WATER LAND & LEGACY AMENDMENT

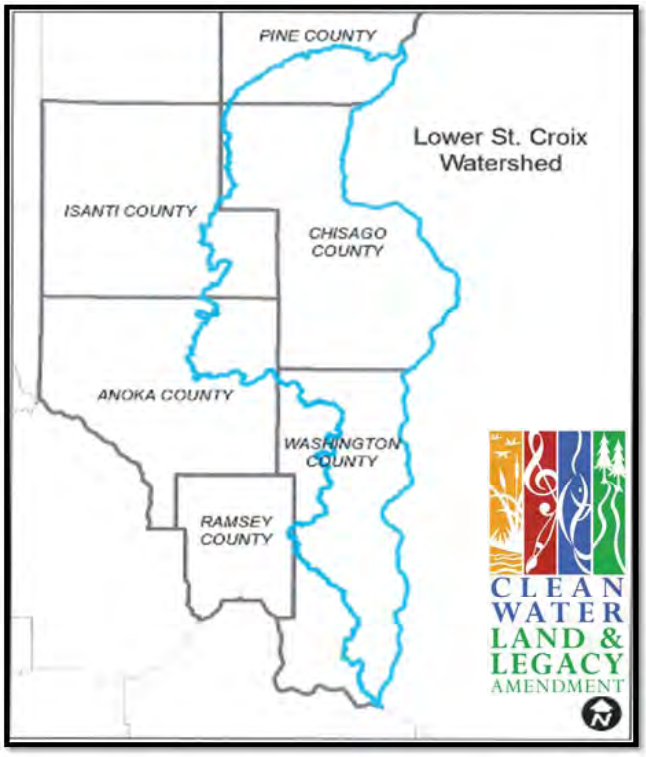
occasional. These results suggest the carp population is only slightly too high, but poised to increase quickly if not controlled.
This study is funded by the SRWMO and a Watershed Based Funding grant from the Clean Water Land and Legacy Amendment.



Locations of Linwood Lake radio tagged carp, revealing the carp's preferred locations in the lake and seasonal spawning movements which can be used in management efforts.

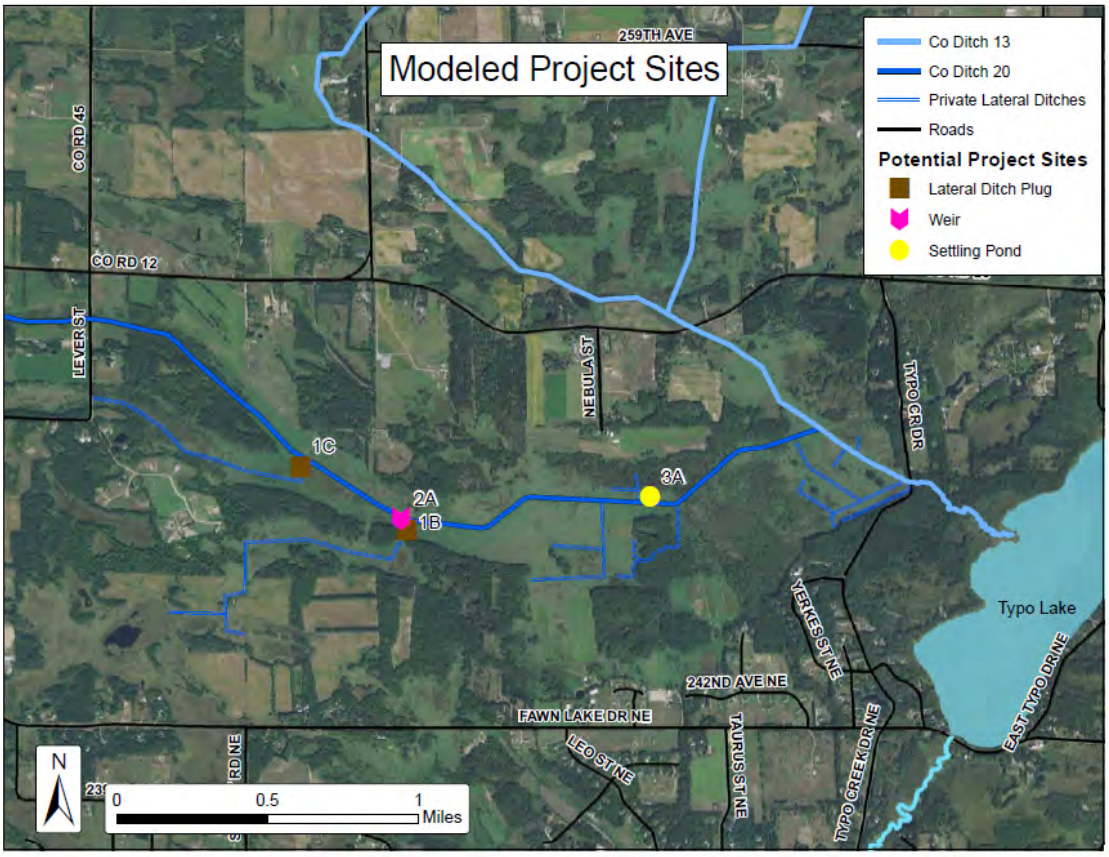
Lower St. Croix One Watershed, One Plan (2018-2019)

The Sunrise River WMO is participating in a regional watershed planning called One Watershed, One Plan (1W1P). The process is in collaboration with 16 other entities including counties, watershed organizations, and soil and water conservation districts. It aims to identify the highest priority regional water resources and ensure they are managed collaboratively. The process complements local water plans. It does not create any new government entities. It does make the area eligible for a new State funding program called Watershed Based Funding (note: the 7-county metro is already eligible without 1W1P). The process is funded by a grant from the MN Board of Water and Soil Resources.



Ditch 20 Feasibility Study (completed 3-2018)

This study identified and calculated cost effectiveness of wetland restoration projects around Ditch 20 to improve water quality in Martin and Typo Lakes downstream. Ditch 20 nutrient export was noted as a problem in a Total Maximum Daily Load (TMDL) study for those lakes. Ditching through broad peat lowlands was a likely cause. This study identified three locations for wetland restoration and one settling pond project, all of which would be highly cost effective at phosphorus reduction, but do have some inherent challenges and uncertainty. Landowners at each site are interested in cooperating in these projects. These projects will be considered by the SRWMO, Anoka Conservation District and Isanti County for future implementation.



Ditch 20 Area Modeled Water Quality Projects

Martin and Typo Lake Carp Barriers (completed 2016)

A series of four barriers has been installed to control carp in Martin and Typo Lakes in order to improve water quality and habitat. This project is funded by $435,753 in MN DNR Conservation Partners Legacy grants, the Sunrise River WMO, Martin Lakers Association and Anoka Conservation District. The same funding partners are teaming to follow this project with a carp removal program in 2017-2019.

Completed carp barriers

Martin Lake Outlet

South Inlet of Martin Lake

North Inlet of Martin Lake

Typo Lake Outlet

Coon Lake Stormwater Retrofits (completed 2016)

Three rain gardens, one stormwater stabilization and three lakeshore restorations were installed in neighborhoods draining to Coon Lake in 2015 and 2016. These were among the most highly cost effective projects at reducing nutrient delivery to the lake, as identified in the 2013 Coon Lake Subwatershed Assessment. These projects are funded by a $42,987 2014 BWSR Clean Water Fund Grant, the SRWMO, Coon Lake Improvement District, Coon Lake Improvement Association and Coon Lake Beach Community Center.

Completed Coon Lake Stormwater Retrofits

Lincoln Drive Stabilization

Mager Lakeshore

Community Center Rain Garden

19303 E Front Blvd Rain Garden

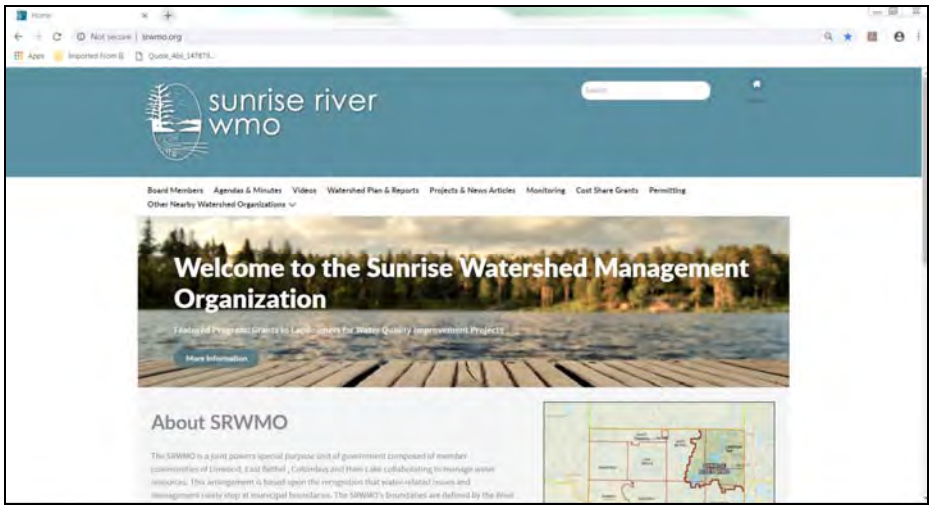
Karger Lakeshore Restoration

Sheffield Lakeshore Restoration

e. Public Outreach

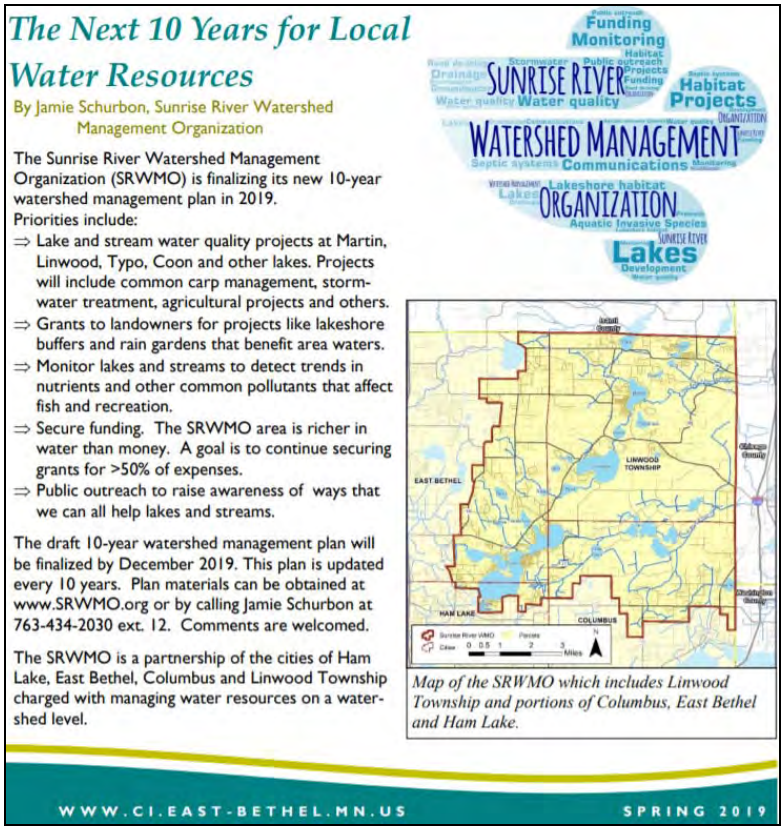
The SRWMO does regular public outreach and education projects, but the SRWMO's website serves as the primary, continuous public outreach tool. Website contents include general information about the organization, meeting agendas and minutes, water monitoring results and profiles of WMO projects. The SRWMO ensures visibility of its website by asking member cities and townships to post the SRWMO website address in their newsletters. Links to the SRWMO website are also provided through each member community's website and the Anoka Conservation District website. The SRWMO website address is http://www.srwmo.org

Sunrise River WMO website homepage



Additional public outreach is accomplished through at least annual newsletter articles. The articles are distributed to member communities for distribution in their newsletters. Periodic larger articles are distributed as press releases to the local newspaper, the Forest Lake Times.

In 2018 the SRWMO's newsletter article was aimed at informing the public of the SRWMO's Watershed Plan update. It was printed in city and township newsletters.



The Next 10 Years for Local Water Resources

By Jamie Schurbon, Sunrise River Watershed Management Organization

The Sunrise River Watershed Management Organization (SRWMO) is finalizing its new 10-year watershed management plan in 2019.
Priorities include:

⇒ Lake and stream water quality projects at Martin, Linwood, Typo, Coon and other lakes. Projects will include common carp management, storm-water treatment, agricultural projects and others.
⇒ Grants to landowners for projects like lakeshore buffers and rain gardens that benefit area waters.
⇒ Monitor lakes and streams to detect trends in nutrients and other common pollutants that affect fish and recreation.
⇒ Secure funding. The SRWMO area is richer in water than money. A goal is to continue securing grants for >50% of expenses.
⇒ Public outreach to raise awareness of ways that we can all help lakes and streams.

The draft 10-year watershed management plan will be finalized by December 2019. This plan is updated every 10 years. Plan materials can be obtained at www.SRWMO.org or by calling Jamie Schurbon at 763-434-2030 ext. 12. Comments are welcomed.

The SRWMO is a partnership of the cities of Ham Lake, East Bethel, Columbus and Linwood Township charged with managing water resources on a water-shed level.

Map of the SRWMO which includes Linwood Township and portions of Columbus, East Bethel and Ham Lake.

WWW.CI.EAST-BETHEL.MN.US SPRING 2019

SRWMO annual newsletter article. Shown as printed in the East Bethel city newsletter. Also printed in the other member communities' newsletters.

f. Water Quality Trends

The SRWMO has a long term water quality monitoring program that includes most larger stream and recreational lakes in the watershed. From 2000-2009 the SRWMO had a robust water monitoring program to establish a baseline of data; little water monitoring had been done previously. From 2010 to the present the amount of monitoring has moderated to a level sufficient to detect trends. Many waterbodies are monitored every 2-3 years. An important part of evaluating implementation of the watershed management plan is looking at water quality trends.

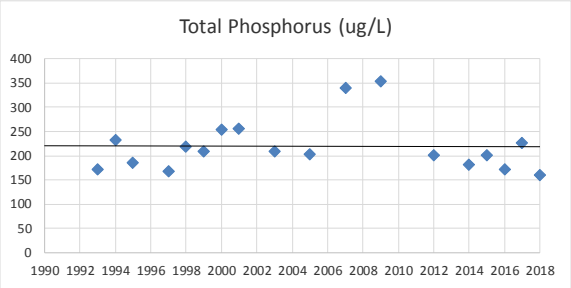
The SRWMO lakes have a range from poor to good water quality (table below). Three of the lakes (Martin, Typo and Linwood) are impaired for excess nutrients. Two of those lakes, Martin and Typo, have been a focus of SRWMO management and are improving (see figures below).

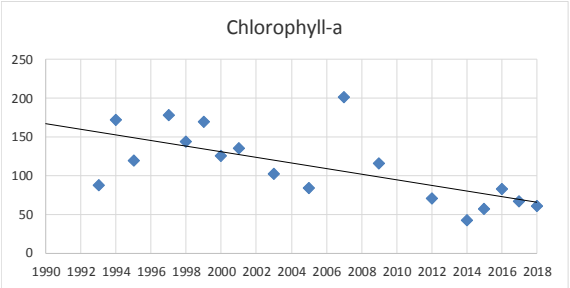
Water quality summary for monitored SRWMO lakes as of 2018*. Data shown are for the most recent year. Trends are based on a MANOVA with response variables of TP, chlorophyll-a and Secchi transparency.*

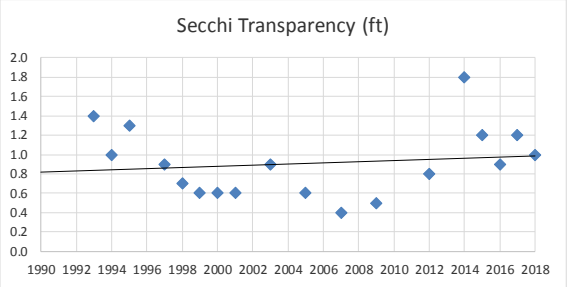
Lake	Letter Grade	Total phosphorus summer average (µg/L)	Chlorophyll-a summer average (µg/L)	Secchi transparency summer average (ft)	Year of most recent data	# years of monitored	Trend
Coon – East Bay	A	19.4	6.7	8.0	2018	22	Improving
Coon – West Bay	A	21.8	6.9	7.3	2018	13 (5 with TP and chlorophyll)	Insufficient data. No evidence of decline.
Boot	C	35.0	11.5	6.5	2018	1	Insufficient data
Linwood	C	34.4	20.2	4.2	2018	18	Stable
Typo	F	160	61.5	1.0	2018	18	Improving
Martin	C	53.1	27.6	3.0	2018	18	Improving
Fawn	A	17.1	4.0	13.7	2018	14	No change
Island	C	33.9	10.6	4.6	2011	9	NA

Typo Lake's water quality improvement appears to be primarily a reduction in algae (as measured by chlorophyll-a). A test that incorporates the correlated factors of total phosphorus, chlorophyll-a and Secchi transparency found statistically significant water quality change (repeated measures MANOVA with response variables TP, Cl-a, and Secchi depth; $F_{2,15}=5.6$, $p=0.02$). If these factors are examined separately with one-way ANOVAs, Cl-a has a statistically significant decline ($p=<0.001$), while total phosphorus and Secchi transparency show no statistically significant change.

Typo Lake Water Quality Data Showing Trend Lines

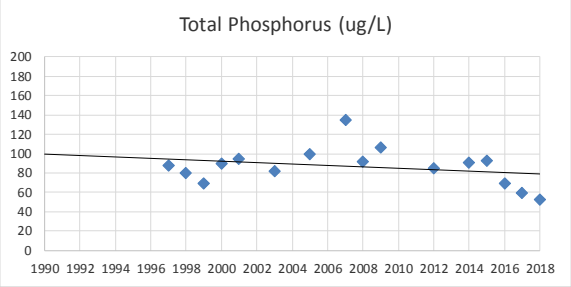


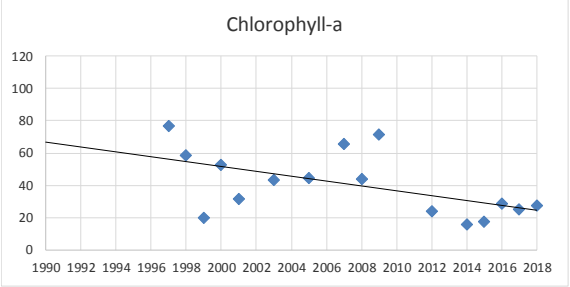


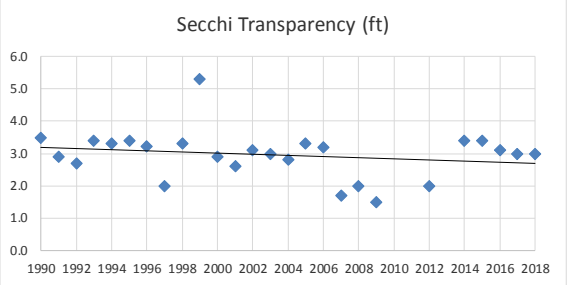


Martin Lake's water quality improvement also appears to be primarily driven by algae reduction. A test that incorporates the correlated factors of total phosphorus, chlorophyll-a and Secchi transparency found statistically significant water quality change (repeated measures MANOVA with response variables TP, Cl-a, and Secchi depth; $F_{2,14}$=5.33, p=<0.05). Further examination of the data (one-way ANOVAs on the individual response variables) shows that while TP and Secchi depth appear to be staying virtually flat, while Cl-a has shown a statistical decrease (p<0.01).

Martin Lake Water Quality Data Showing Trend Lines







More detailed water quality data and analysis can be found in **Appendix B** and online. Additionally, all water quality data collected by the SRWMO is on the MN Pollution Control Agency's EQuIS database, which is accessible through their website.

g. Evaluation of Watershed Management Plan Implementation

The SRWMO Watershed Management Plan contains a schedule of tasks that the WMO should accomplish in order to realize its goals (see table on following page). The tables on the following pages compare work planned and work actually accomplished. There is one table for 2010-2014 and another table for 2015-2019, thereby covering the entire 10 years of the current plan's life.

In 2018 minor deviations from the Watershed Management Plan included:

Change	Excluded lakeshore landscape marketing.
Reason	This longstanding program has not been successful. A new direction is needed. The SRWMO secured $1,750 in Watershed Based Funding to be used in 2019 for lakeshore outreach. Additionally, the SRWMO has a plan to revamp this program in its draft 4th Generation Watershed Management Plan.
Change	Added a Linwood Lake carp management feasibility study and Martin/Coon Lakes stormwater retrofits.
Reason	These projects were highly prioritized by the SRWMO and member communities in 2018 during selection of projects for new State Watershed Based Funding.
Change	Reduced "other water quality projects" from $10,000 to $8,000.
Reason	This reduced funding was believed sufficient during the 2018 budgeting process (which happens in 2017) for upcoming projects. This funding was restored to $10,000 in 2019. 2018 and 2019 funds are being used as match for a State Watershed Based Funding grant.
Change	Added the Martin and Typo Lakes carp harvest program.
Reason	While not a project specifically mentioned in the SRWMO Watershed Management Plan, this type of management in these waterbodies is in the watershed plan. This project is a follow up to the carp barriers project. The financing for this project was <10% from the SRWMO due to a grant and other partners.
Change	Added chloride testing to planned stream water quality monitoring.
Reason	Chloride is a pollutant of growing concern. It has not been monitored in the SRWMO in recent years.
Change	Increased administrative services by $2,000 in October 2018.
Reason	Administrative tasks were greater than anticipated, including proposed watershed management organization boundary changes, participation in One Watershed, One Plan and others.
Change	Reduced water quality cost share grant program funding from $2,000 planned to $0.
Reason	Sufficient funds were carried over from previous years

2010-2014 work planned in the SRWMO Watershed Plan and actually accomplished. Numbers are sites monitored or projects completed.

Task	2010		2011		2012		2013		2014	
	Planned	**Done**	**Planned**	**Done**	**Planned**	**Done**	**Planned**	**Done**	**Planned**	**Done**
Monitoring and Studies										
Lake Levels	5	5	5	5	5	5	5	5	5	5
Lake Water Quality	3	3	Find volunteers	Secured volunteers for 5 recreational lakes	6	6	0	0	2	2
Stream Water Quality	0	0	0	0	2	2	1	0	2	0
Stream Hydrology	2	2	2	2	2	2	2	0	2	0
ReferenceWetland	3	3	3	3	3	3	3	3	3	3
Studies and Investigations										
Typo/Martin Lake TMDL Study	none	MPCA finalizing study	none	none	none	TMDL approved by MPCA				
Fawn Lk curly leaf pondweed assmt			Yes	Prelim review in 2010, work unnecessary						
Linwood Lake TMDL									$20,000	Watershed WRAP/TMDL completed
Water Quality Improvement Projects										
Water Quality Cost Share Grant Fund	$1,840	$1,840 contributions, $0 awarded	$2,000	$2,000 contributions, $0 awarded	$2,000	$2,000, $29.43 awarded, $4,300 diverted to carp barriers	$2,000	$0	$2,000	$2,000
Martin - Typo Lakes Water Quality Projects		Rough fish barrier design.		Grant secured for carp barriers.	$20,000	$20,000 to carp barriers	$15,000	$15,000 to carp barriers		1 constructed, 3 underway
Martin Lake Area Stormwater Retrofit	$5,000	$5,000 Martin Lake area stormwater retrofits.	$10,000	3 rain gardens installed. $7,000 + grants						
Coon Lake Area Stormwater Retrofit						Work started, with no costs until 2013	Subwatershed retrofit study	Subwatershed retrofit study	$20,000	$25,000, projects started
St. Croix Basin Team	Yes	Joined								
Other Water Quality Improvement Projects		E Front Blvd retrofit planned.		E Front retrofit installed by city	$10,000	$10,000 to Martin/Typo Lakes carp barriers				

Continued on next page…

Task	2010		2011		2012		2013		2014	
	Planned	**Done**	**Planned**	**Done**	**Planned**	**Done**	**Planned**	**Done**	**Planned**	**Done**
Education and Public Outreach										
SRWMO Website	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Public Officials Tour										
Lakeshore Landscaping Ed			Yes	Web video. Mailing to 66 Fawn Lake homes. Joined Blue Thumb	Yes	Lake assoc presentation,demo project, SRWMO display banner, web promo	Yes	Created display, handouts and staffed it at 2 community events	Yes	News release about local residents' practices
Aquatic Plant Ed			New sign at Martin Lk access	New sign at Martin Lk access					Yes	Staffed event displays
Other Ed			Annual newsletter article	Annual newsletter article	Annual newsletter article	Annual newsletter article	Annual newsletter article	Annual newsletter article	Annual newsletter article	Annual newsletter article
Other										
Estimate SRWMO P export			Yes	Yes						
Co. Geologic Atlas						Part a done				
Non-Operating Administrative Expenses										
On call admin asst			No	Yes	No	Yes	Yes	Yes	Yes	Yes
Annual Report to BWSR	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Annual Report to State Auditor	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Review municipal local water plans	Yes	Reviewed 2 of 4	Yes	All completed						
Develop member community annual report template	Yes	Yes								
Grant Search/App	No	No	Yes	Matched DNR and BWSR Grants. DNR grant for carp barriers successful.	Yes	Matched for BWSR grants for Coon and Martin Lake stormwater retrofits. Denied.	Yes	Matched BWSR CWF grant for Coon Lake area stormwater retrofits		Matched BWSR CWF grant for Ditch 20 feasibility study
Seek bids for services			Yes	Yes			Yes	Yes		

2015-2019 work planned in the SRWMO Watershed Plan and actually accomplished. Numbers are sites monitored or projects completed.

Task	2015		2016		2017		2018		2019	
	Planned	**Done**	**Planned**	**Done**	**Planned**	**Done**	**Planned**	**Done**	**Planned**	**Ongoing**
Monitoring and Studies										
Lake Levels	5	5	5	5	5	5	5	5	5	5
Lake Water Quality	4	4	2	2	0	0	5	6	0	1
Stream Water Quality	2	2	1	1	1	1	2	2 + chlorides	0	0
Stream Hydrology	2	2	1	0	2	2	2	2	1	0
ReferenceWetland	3	3	3	3	3	3	3	3	3	3
Water quality project effectiveness monitoring	1	2 lake water quality sites, 2 hydrology sites associated with carp barriers	1	2 lake water quality sites, 2 hydrology sites associated with carp barriers	1	2 lake water quality sites, 2 hydrology sites associated with carp barriers	1	0	1	2 lake water quality sites
Studies and Investigations										
Studies and Investigations	Fawn Lk curly leaf pondweed assmt	Fawn Lk curly leaf pondweed assmt, Dt 20 study		Ditch 20 Feasibility study		Ditch 20 Feasibility study completed		Linwood Lk Carp Management Feasibility Study		Linwood Lk Carp Management Feasibility Study
Water Quality Improvement Projects										
Water Quality Cost Share Grant Fund	$2,000	$0, fund has sufficient balance	$2,000	$0, fund has sufficient balance	$2,000	$1,000, fund has strong balance	$2,000	$0	$2,000	$0
Martin - Typo Lakes Water Quality Projects		3 carp barriers being constructed		3 carp barriers completed		Typo Lake carp harvests		Martin and Typo Lake carp harvests		Martin and Typo Lake carp harvests
Coon Lake Area Stormwater Retrofit	$20,000	$15,000, 4 projects constructed		2 lakeshore restorations, 1 rain garden						
Other Water Quality Projects	$10,000	$6,750 used toward Coon Lk retrofits or Ditch 20 study	$10,000	$5,000 Ditch 20 feasibility study	$10,000	$850 Linwood Lk Imp Assoc for veg mgmt plan. $5,000 Martin & Typo Lks carp harvests				Martin/Coon stormwater retrofits (primary funding is Watershed Based Funding)
Education and Public Outreach										
SRWMO Website	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Overhaul website		
Lakeshore Landscaping Ed	Yes	Booklet distribution to 670 homes	Yes	Combined with annual newsletter	Yes	No	Yes	No	Yes	Lakeshore outreach (primary funding is Watershed Based Funding)
Aquatic Plant Ed					Yes	No				
Public officials tour							Yes	Yes		

Continued on next page…

Task	2015		2016		2017		2018		2019	
	Planned	**Done**	**Planned**	**Done**	**Planned**	**Done**	**Planned**	**Done**	**Planned**	**Ongoing**
Other Ed	Annual newsletter article	Annual newsletter article, Display at Linwood Family Fun Day	Annual newsletter article	Annual newsletter article, Display at Linwood Family Fun Day	Annual newsletter article	Annual newsletter article	Annual newsletter article	Annual newsletter article	Annual newsletter article	Annual newsletter article
Other										
Co. Geologic Atlas				Part b completed						
Update SRWMO Watershed Mgmt Plan							Yes	Yes	Yes	Yes
Non-Operating Administrative Expenses										
On call admin asst	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Annual Report to BWSR	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Annual Report to State Auditor	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Grant Search/App	Yes	Searched, but none applied for	Yes	Searched, but none applied for	Yes	Applied for and awarded DNR CPL grant for Martin and Typo Lake carp removal	Yes	Participating in Watershed Based Funding process. $156,750 allocation to SR watershed area.	Yes	Anticipated applications for Martin, Typo and perhaps Linwood Lake carp mgmt
Seek bids for services	Yes	Yes			Yes	Yes	No	Yes – for watershed plan update consultant	Yes	Yes

h. 2019 Work Plan (insurance, secretarial and similar operating expenses are not included)

Task	Purpose	Description	Locations or Action	Cost
Prepare 2018 Annual Report to BWSR and municipalities (this report)	To provide transparency and accountability of organization operations. To improve communication with member communities.	Produce an annual report of SRWMO activities and finances that satisfies Minnesota Rules 8410.0150 and is an effective tool for reporting WMO accomplishments to member city councils. The goal is to allow the city councils to better understand the SRWMO's work.	Secured Anoka Conservation District (ACD) staff to assist with this task.	$800
Prepare Annual Report to State Auditor	To provide transparency and accountability of organization operations.	Online reporting of WMO finances though the State Auditor's SAFES website.	Watershed-wide	$300
Administrator (on-call, limited)	To provide a day-to-day WMO contact for the public and partners. To complete day-to-day miscellaneous operational tasks.	Day-to-day WMO administration.	ACD has been hired to provide this service up to 56 hours.	$4,645
Watershed Mgmt Plan Update	To update the SRWMO Watershed Management Plan in accordance with MN Rules 8410.	Planning includes a variety of steps to set SRWMO goals, policies and activities over a 10 year period. A plan update is due Dec. 31, 2019 and takes 18 mo to complete.	Watershed-wide	$20,000 in 2019
Grant search and applications	Obtain outside funding for water quality improvement projects.	Search for grant opportunities and apply for those that are applicable to SRWMO projects. In 2019 emphasis is on participating in non-competitive Watershed Based Funding and competitive grants for lake carp management.	ACD has been hired to provide this service. Projects for which to pursue grants were selected.	$1,000
Lake Level Monitoring	To understand lake hydrology, including the impact of climate or other water budget changes. These data are useful for regulatory, building/development, and lake management decisions.	Weekly water level monitoring in lakes by volunteers. All are available on the Minnesota DNR website using the "LakeFinder" feature (www.dnr.mn.us.state \lakefind\index.html).	Coon, Linwood, Martin, Fawn, and Typo Lakes	$1,500
Lake Water Quality Monitoring	To detect water quality trends and diagnose the cause of changes.	May through September twice-monthly monitoring of the following parameters: total phosphorus, chlorophyll-a, secchi transparency, dissolved oxygen, turbidity, temperature, conductivity, pH, and salinity.	Boot Lake	$1,825

Task	Purpose	Description	Locations or Action	Cost
Monitoring of Water Quality Improve-ment Project Effective-ness	Determine the effectiveness of practices installed to improve water quality.	Monitoring lakes, streams or discharge after installation of practices aimed at improving water quality to ensure the desired results and direct any management changes.	Typo Lake Martin Lake	$3,650
Stream Water Quality Monitoring	To detect water quality trends and diagnose the cause of changes.	4 baseflow samples, 4 during storms. Parameters: stage, total phosphorus, TSS, Secchi tube, dissolved oxygen, turbidity, chlorides, temperature, conductivity, pH, and salinity.	None in 2019	$0
Reference Wetland Monitoring	To provide understanding of wetland hydrology, including the impact of climate and land use. These data aid in delineation of nearby wetlands by documenting hydrologic trends including the timing, frequency, and duration of saturation.	Continuous groundwater level monitoring at a wetland boundary, to a depth of 40 inches. This is part of a network of 18 wetland hydrology monitoring stations county-wide.	1. Carlos Avery Reference Wetland 2. Carlos 181st Reference Wetland, 3. Tamarack Reference Wetland	$1,950
Cost Share Grants for Water Quality Improve-ment	To improve water quality in lakes, rivers, and streams.	These grants offer cost sharing of the materials needed for a water quality improvement project. The Anoka Conservation District provides grant administration and technical assistance to landowners. SRWMO funds are used only in the SRWMO area.	No planned contribution in 2019 due to strong carryover fund balance.	$0
Martin and Typo Lakes Carp Removal	To improve Martin and Typo Lakes Lake water quality, fishery and ecological health.	Carp management planning and removal including population surveys, radio tracking, and carp removal.	Martin and Typo Lakes	$7,720 + grant and lake assoc funds
Lakeshore Stewardship Outreach	To improve water quality and near-shore ecological health.	Targeted outreach to properties with shoreline erosion. Outreach will encourage lake stewardship projects and offer technical and financial help.	Coon, Linwood, Martin and Typo Lakes	$175 + $1,750 grant funds
Martin and Coon Lakes Stormwater Retrofits	To improve water quality.	Install projects identified and shown to be the most cost effective in recently completed studies.	Coon and Martin Lakes	$13,028 + $133,580 grant funds
SRWMO Website	To increase awareness of the SRWMO and its programs. The website also provides tools and information that helps users better understand water resources issues in the area.	Annually maintain and update the SRWMO website with current information about the organization, meeting minutes and agendas, and watershed plan update information.	http://www.Srwmo.org	$645
Annual Newsletter Article	To increase visibility of the SRWMO name and messaging. To meet State-required outreach.	Newsletter article distributed to member communities for publication in their newsletters.	Throughout watershed	$500

The following deviations from watershed plan are anticipated in 2019:

Change	Deleted water quality cost share grant program funding of $2,000.
Reason	Sufficient funds were carried over from previous years.
Change	Added water quality monitoring at Boot Lake.
Reason	The Linwood Lake Improvement Association requested this monitoring. They are preparing a lake management plan, and realized the lake's only stream inlet which comes from Boot Lake had never been monitored. They suspect it may be a source of some problems. Monitoring the stream inlet was not feasible due to difficult access, so monitoring Boot Lake was selected instead. The lake was monitored in 2018 and will be done in two subsequent years to ensure good baseline data exist. The results should help inform the lake management plan as well as the SRWMO Watershed Plan update.

i. Status of Local Ordinances, Water Plan Adoption and Implementation

All SRWMO member communities are required to have a Local Water Plan that is consistent with the SRWMO Watershed Management Plan. The WMOs have approval authority over these Local Water Plans. Whenever a WMO plan is updated the member municipalities have two years to update their Local Water Plans, ordinances, and other control measures to be consistent with the WMO Plan.

All local water plans have been approved. The following is the status of each city or township's local water plan:

Linwood Township – Linwood Township has adopted the SRWMO Watershed Management Plan by reference.

Ham Lake – Approved in February 2013 by the SRWMO.

East Bethel – Approved in May 2011 by the SRWMO.

Columbus – Approved February 2011 by the SRWMO.

As of late 2018 and early 2019, all of the communities are updating their local water plans. Draft plans from Linwood and Columbus have been reviewed by the SRWMO. All plans will need to be submitted to the SRWMO after completion of the 4th Generation SRWMO Plan in late 2019.

To track member cities' progress on local plan implementation, the SRWMO requires a brief annual report from each city and provides a template for this report. In addition to serving as a reporting tool, the template serves as a "to do" list for our cities. These reports are available upon request, and are summarized in the table below.

Status of city local water plans and some recent accomplishments toward plan implementation.

Linwood Township

Submitted 2018 annual report to SRWMO?	Yes
Status of ordinances and control measures	The Township has the full suite of ordinances required by the SRWMO.
Some Recent Implementation Accomplishments	• Inventory of septic systems around Linwood Lake, identifying potentially troubled systems, and offering technical and financial assistance to fix problems. • Outreach and education reaching 1,800 households on the topics of wetland buffers, water quality monitoring, groundwater protection, controlling invasive species, hazardous waste disposal, yard waste management and activities of the SRWMO.

City of East Bethel

Submitted 2018 annual report to SRWMO?	Yes
Status of ordinances and control measures	The City has the full suite of ordinances required by the SRWMO.
Some Recent Implementation Accomplishments	• Education materials distributed to 11,000 residents on the topics of water quality monitoring, controlling invasive species, and yard waste management. • Completed mapping of stormwater system in 2014. • Annual street sweeping.

City of Ham Lake

Submitted 2018 annual report to SRWMO?	Yes
Status of ordinances and control measures	The City has the full suite of ordinances required by the SRWMO.
Some Recent Implementation Accomplishments	• Ongoing work to complete BMP's in the City's Storm Water Pollution Prevention Plan. • Educational efforts through the City's newsletter, which reaches the entire population of 5,525 households and businesses. Educational article topics in 2018 included groundwater protection, water conservation, hazardous waste disposal, yard waste management, ag BMPs, pet waste disposal, and activities of the SRWMO.

City of Columbus

Submitted 2018 annual report to SRWMO?	Yes
Status of ordinances and control measures	The City has the full suite of ordinances required by the SRWMO.

Some Recent Implementation Accomplishments	• Educational efforts through the City's newsletter, which reaches the entire population of 1,500 households and businesses. Educational article topics in 2018 included wetland buffers, water quality monitoring, groundwater protection, water conservation, yard waste management, pet waste disposal and activities of the SRWMO. • Partially completed mapping of stormwater systems. Completion was required by the WMO by 2014. • Street sweeping. • Inspections of storm water treatment basins.

j. Solicitations for Services

State rules require watershed management organizations to solicit bids for professional services at least once every two years. Most recently the SRWMO solicited bids in early 2018 for work to occur in the same year. Two requests for proposals were made: one for annual water monitoring and management and the other for update of the SRWMO Watershed Management plan.

The SRWMO sought proposals from a variety of firms for these services. To build a list of possible consultants the Chairperson contacted engineering departments of 12 nearby cities, plus Anoka County, to learn who they used for similar work. Requests for proposals were sent to the resulting list. Four firms responded that they would not choose to provide proposals. Only one entity, the Anoka Conservation District, provided proposals, and was selected for both annual water monitoring and management and update of the SRWMO Watershed Management Plan.

k. Permits, Variances, and Enforcement Actions

The SRWMO does not issue permits, variances, or take enforcement actions. These responsibilities are held by the member municipalities, as outlined in each municipality's local water plan, ordinances, and policies.

IV. Financial and Audit Report

a. 2018 Financial Report

See Appendix A – 2018 Financial Report.

b. Financial Audit

An annual financial report is complete. That report is Appendix A.

The SRWMO completed an audit of 2014 finances in 2015. No audit of 2018 is required per MN Statutes, section 6.756. The next anticipated audit should occur after the end of 2019. Per state statute, that audit will be for any one of the previous five years, which the auditor shall choose at random.

c. 2019 Budget

At its May 4, 2017 meeting the SRWMO Board approved a 2019 budget. Budget details are below.

		Linwood	East Bethel	Columbus	Ham Lake
	Cost	46.40%	32.93%	16.72%	3.95%
NON-OPERATING EXPENSES (split by percentages)					
Grant Search and Applications	$1,000.00	$464.00	$329.30	$167.20	$39.50
Lake Level Monitoring	$1,550.00	$719.20	$510.42	$259.16	$61.23
Lake Water Quality Monitoring	$1,825.00	$846.80	$600.97	$305.14	$72.09
Lake Water Quality Monitoring - Improvement Project Effectiveness	$3,650.00	$1,693.60	$1,201.95	$610.28	$144.18
Stream Water Quality Monitoring	$0.00	$0.00	$0.00	$0.00	$0.00
Stream Rating Curve Development	$0.00	$0.00	$0.00	$0.00	$0.00
Stream Hydrology Monitoring	$0.00	$0.00	$0.00	$0.00	$0.00
Reference Wetland Hydrology Monitoring	$1,845.00	$856.08	$607.56	$308.48	$72.88
Fawn Lake curly-leaf pondweed mapping and assess control needs	$0.00	$0.00	$0.00	$0.00	$0.00
Upcoming Water Quality Projects	$10,000.00	$4,640.00	$3,293.00	$1,672.00	$395.00
SRWMO Cost Share Grant Fund	$0.00	$0.00	$0.00	$0.00	$0.00
Website – Annual Operations	$685.00	$317.84	$225.57	$114.53	$27.06
Lakeshore Landscaping Marketing	$700.00	$324.80	$230.51	$117.04	$27.65
SRWMO Annual Education Publication/Newsletter Article	$500.00	$232.00	$164.65	$83.60	$19.75
Legal	$0.00	$0.00	$0.00	$0.00	$0.00
Financial Audit (next req'd in 2020 for 2019)	$0.00	$0.00	$0.00	$0.00	$0.00
Advertise Bids for Pro Services (req'd in odd yrs)	$100.00	$46.40	$32.93	$16.72	$3.95
Watershed Plan Update to begin in 2018	$20,000.00	$9,280.00	$6,586.00	$3,344.00	$790.00
SUBTOTAL	$41,855.00	$19,420.72	$13,782.85	$6,998.16	$1,653.27
		Linwood	East Bethel	Columbus	Ham Lake
	Cost	25.00%	25.00%	25.00%	25.00%
OPERATING EXPENSES (split equally four ways)					
Administrator (on-call, limited)	$3,960.00	$990.00	$990.00	$990.00	$990.00
Annual Report to BWSR and Member Communities	$800.00	$200.00	$200.00	$200.00	$200.00
Annual Financial Report to State Auditor	$300.00	$75.00	$75.00	$75.00	$75.00
Secretarial or Other Administrative	$1,750.00	$437.50	$437.50	$437.50	$437.50
Liability Insurance	$1,850.00	$462.50	$462.50	$462.50	$462.50
Administrative Assistance – City of East Bethel	$300.00	$75.00	$75.00	$75.00	$75.00
SUBTOTAL	$8,960.00	$2,240.00	$2,240.00	$2,240.00	$2,240.00
GRAND TOTAL	$50,815.00	$21,660.72	$16,022.85	$9,238.16	$3,893.27

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Appendix A:

2018 Financial Report

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SUNRISE RIVER WATERSHED MANAGEMENT ORGANIZATION

FINANCIAL REPORT
FOR YEAR ENDED DECEMBER 31, 2018

To the Chairperson, Dan Babineau, of Sunrise River Water Management Organization

The enclosed statement has been prepared after review of the organization's financial records. I have not audited the organization's records and do not express an opinion. The enclosed information fairly reflects the Sunrise River WMO's financial position for the stated year, based on records provided to me by the organization.

April 11, 2019

Prepared by:
Jamie Schurbon
Anoka Conservation District
1318 McKay Drive NE, suite 300
Ham Lake, MN 55304
763-434-2030

SUNRISE RIVER WATERSHED MANAGEMENT ORGANIZATION
2241 - 221st Avenue
Cedar, MN 55011

STATEMENT OF REVENUES AND EXPENSES

For: year beginning January 1, 2018 and ending December 31, 2018

Expenditures	**Amount**
Operating	
Insurance – MN Counties Intergovernmental Trust	$1,362.00
Secretarial services - Gail Gessner	$1,225.00
On-call admin assistance - Anoka Conservation District	$5,200.00
Annual report to BWSR – ACD	$800.00
Annual financial report to State Auditor (ACD)	$300.00
Administrative - City of East Bethel	$0.00
Peterson Co LTD - Audit	$0.00
Checks	$118.03
Other	$0.00
SUBTOTAL	$9,005.03
Non-Operating	
Water Monitoring - Anoka Conservation District (ACD)	$20,700.00
Studies and Investigations - ACD	$0.00
Grant search and applications- ACD	$1,000.00
Education and public outreach - ACD	$4,040.00
Water quality improvement projects - ACD	$8,000.00
Cost share grant fund for water quality projects	$0.00
Watershed plan update	$7,890.90
Other	$0.00
SUBTOTAL	$41,630.90
GRAND TOTAL	**$50,635.93**
Revenues	**Amount**
Linwood Twp	$21,105.14
City of Columbus	$8,636.58
City of Ham Lake	$3,271.90
City of East Bethel	$15,446.40
Insurance dividend	259.00
Transfer funds from water quality cost share at Anoka Conservation District to SRWMO general fund	2,000.00
Other	0.00
GRAND TOTAL	**$50,719.02**
Retained Cash Reserves	**$83.09**
Total Cash Reserves	**$33,124.84**

SUNRISE RIVER WATERSHED MANAGEMENT ORGANIZATION

BALANCE SHEET

For the year beginning January 1, 2018 and ending December 31, 2018

Assets	
Cash	$33,124.84
Accounts Receivable	$0.00
Water quality project grant fund held at the Anoka Conservation District	$3,816.53
Other	$0.00
Other	$0.00
Total Assets	$36,941.37

Liabilities	
Accounts Payable	$0.00
Remaining balance on 2018-19 watershed plan update contract with Anoka Cons. District	$28,244.10
Other	$0.00
Other	$0.00
Total Liabilities	$28,244.10

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Appendix B:

2018 Water Monitoring and Management Work Results

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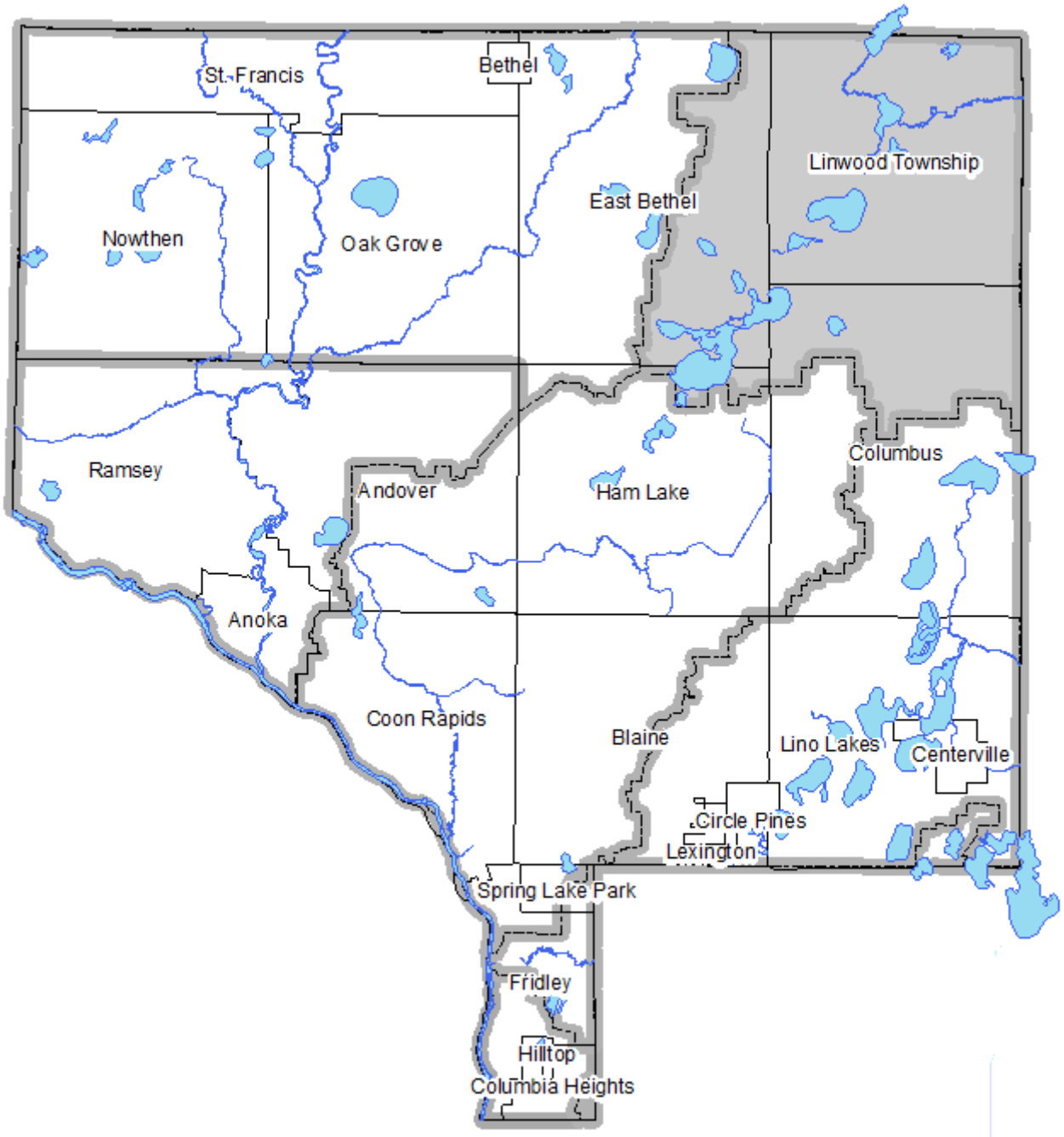
Chapter 2: Sunrise River Watershed



Prepared by the Anoka Conservation District

Sunrise River Watershed

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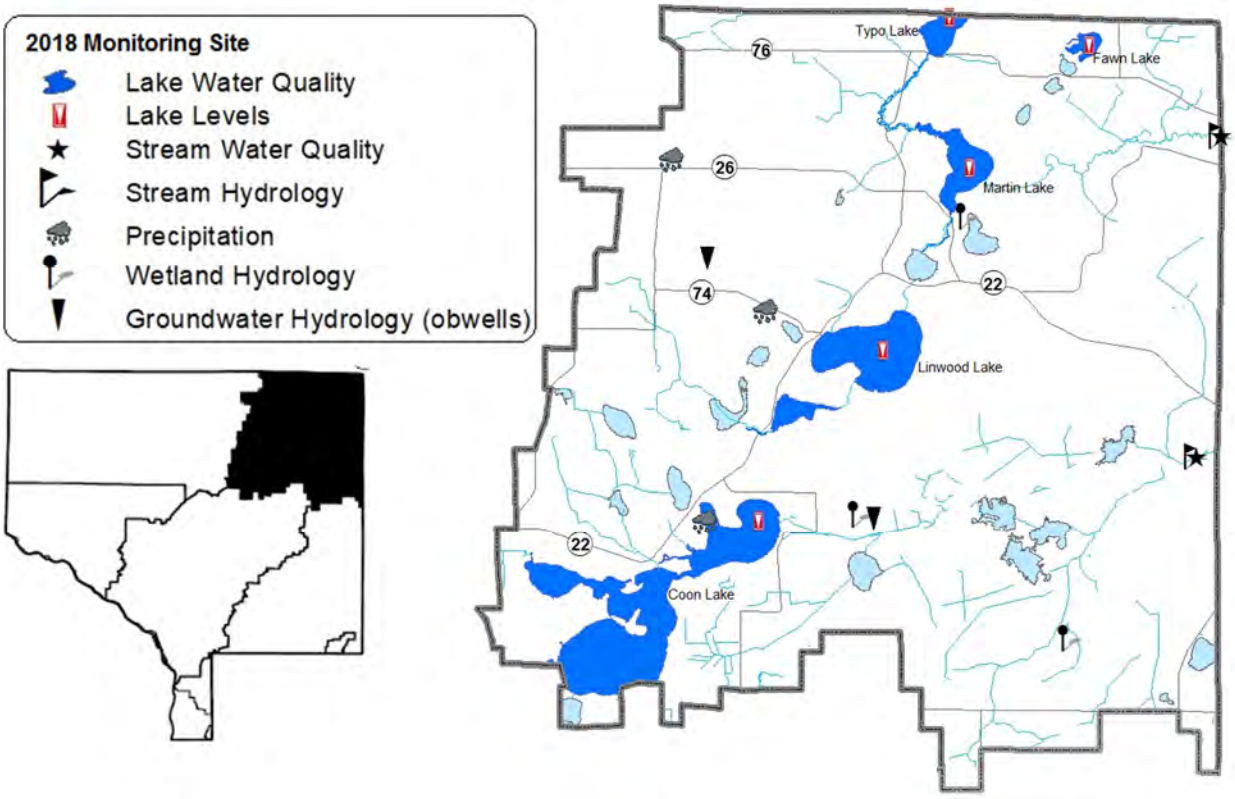


Lake Levels

Partners: SRWMO, ACD, MN DNR, volunteers

Description: Weekly water level monitoring in lakes. The past five and twenty-five years of data for each lake are illustrated below, and all historical data are available on the Minnesota DNR website using the "LakeFinder" feature (www.dnr.mn.us.state\lakefind\index.html).

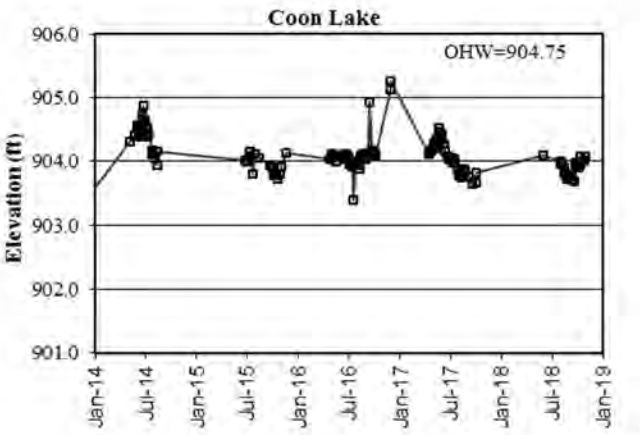
Purpose: To understand lake hydrology, including the impact of climate or other water budget changes. These data are useful for regulatory, building/development, and lake management decisions.

Locations: Coon, Fawn, Linwood, Martin, and Typo Lakes

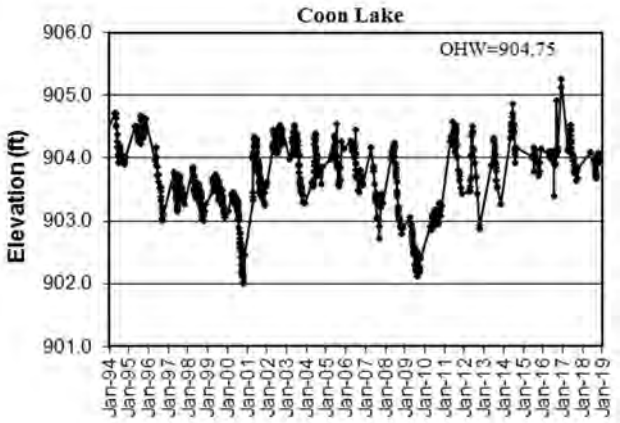
Results: Lake levels were measured by volunteers throughout the 2018 open water season. Lake gauges were installed and surveyed by the Anoka Conservation District and MN DNR. In 2018, there was little data prior to June 1 so the expected pattern of increasing water levels in spring was not documented. By early summer water levels were falling and continued to fall until mid-August when they began to rebound.

All lake level data can be downloaded from the MN DNR website's LakeFinder feature (https://www.dnr.state.mn.us/lakefind/index.html). Ordinary High Water Level (OHW), the elevation below which a DNR permit is needed to perform work, is listed for each lake on the corresponding graphs below.

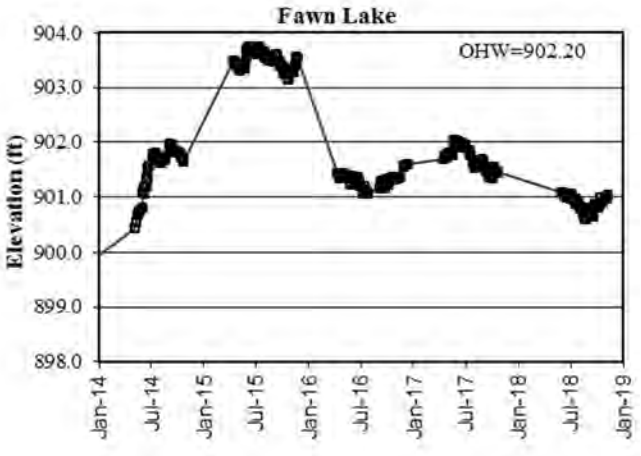
Coon Lake Levels – last 5 years



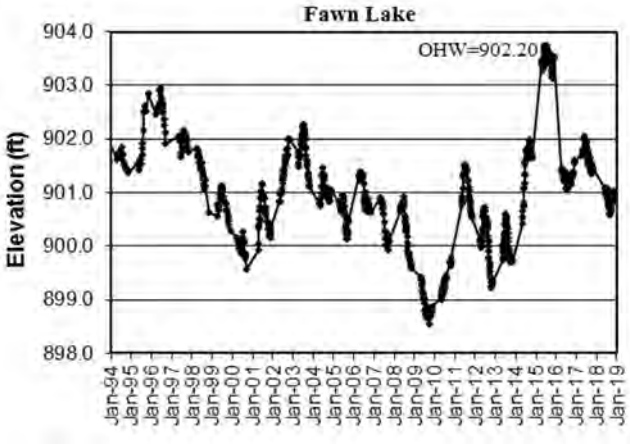
Coon Lake Levels – last 25 years



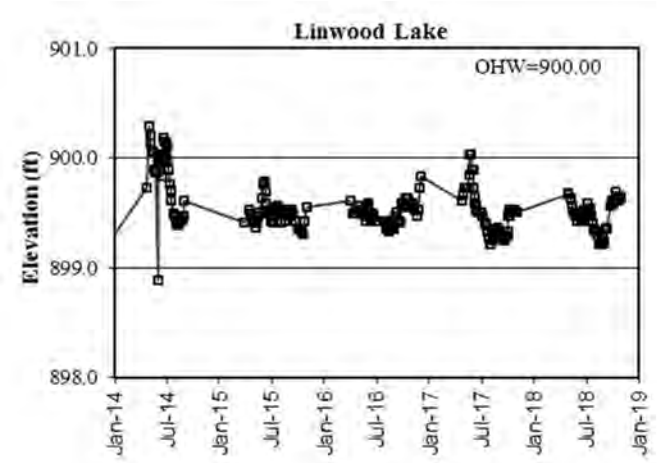
Fawn Lake Levels – last 5 years



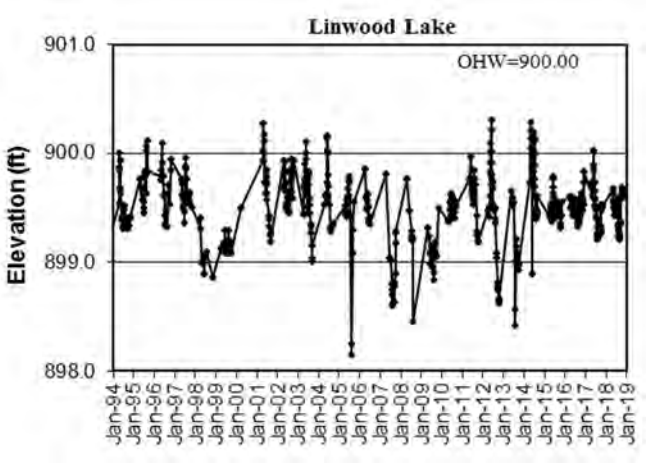
Fawn Lake Levels – last 25 years



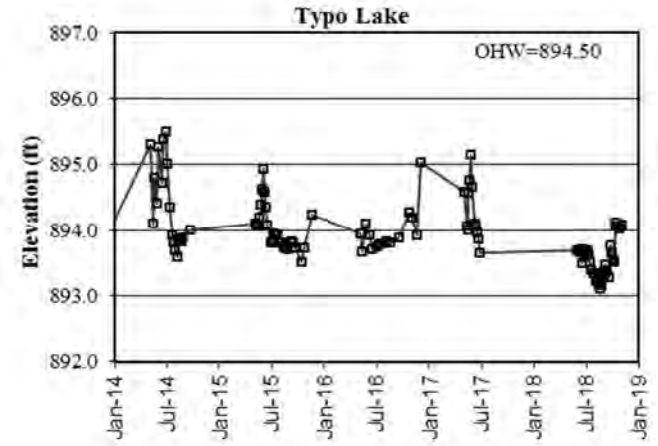
Linwood Lake Levels – last 5 years



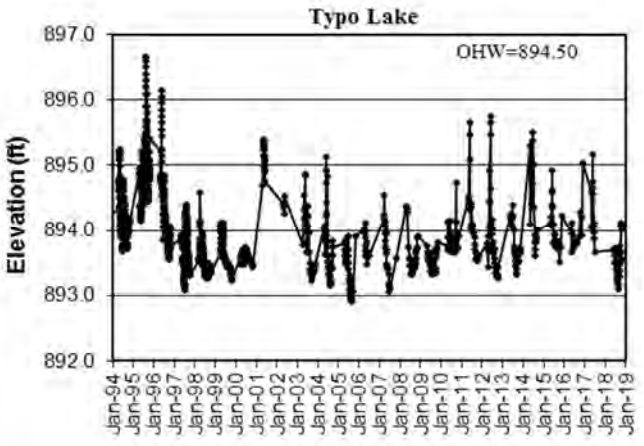
Linwood Lake Levels – last 25 years



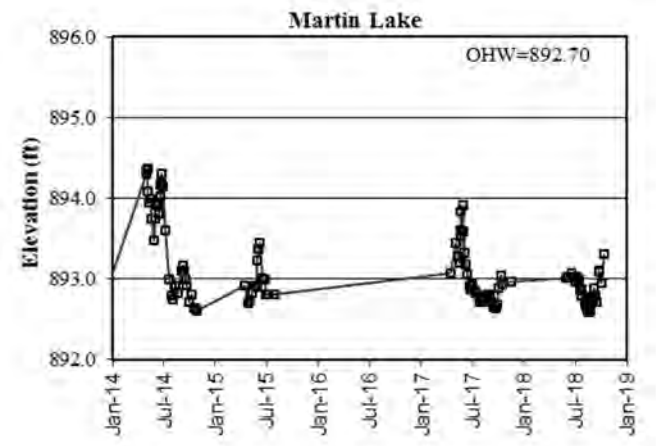
Typo Lake Levels – last 5 years



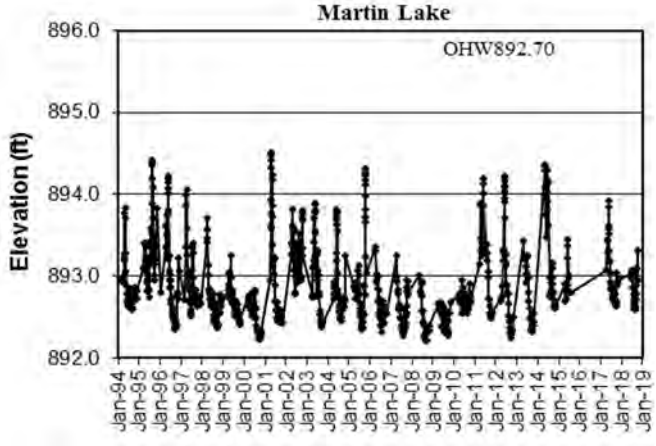
Typo Lake Levels – last 25 years



Martin Lake Levels – last 5 years



Martin Lake Levels – last 25 years



Lake Water Quality

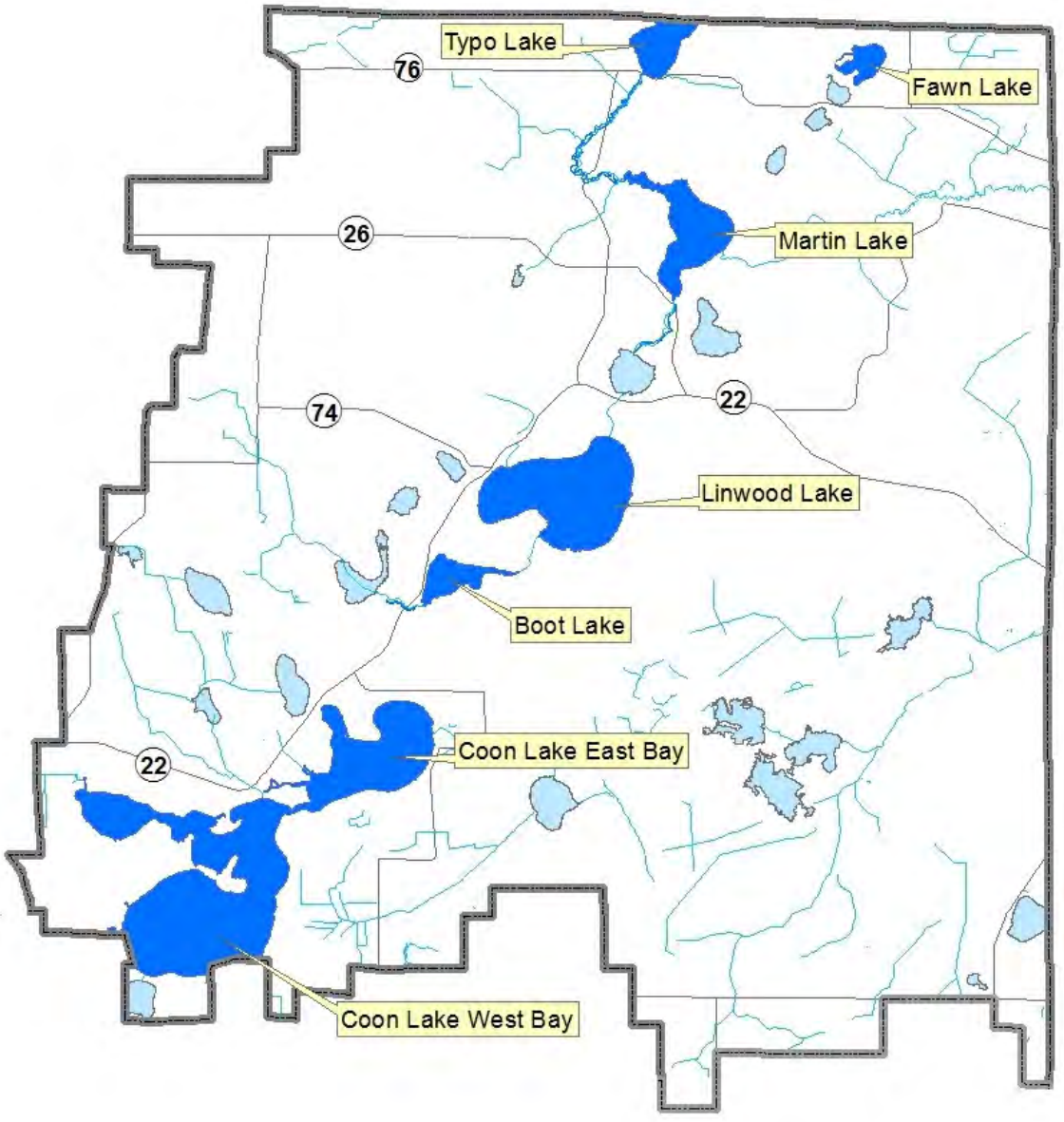
Description: May through September, every-other-week, monitoring is conducted for the following parameters: total phosphorus, chlorophyll-a, Secchi transparency, dissolved oxygen, turbidity, temperature, specific conductivity, pH, and salinity.

Purpose: To detect water quality trends and diagnose the cause of changes.

Locations: Boot, Coon East Bay & West Bay, Fawn, Linwood, Martin & Typo Lakes

Results: Detailed data for each lake are provided on the following pages, including summaries of historical conditions and trend analysis. Previous years' data are available from the Minnesota Pollution Control Agency (MPCA) (https://cf.pca.state.mn.us/water/watershedweb/wdip/search_more.cfm) or from ACD. Refer to Chapter 1 for additional information on lake dynamics and interpreting the data.

Sunrise Watershed Lake Water Quality Monitoring Sites



BOOT LAKE
LINWOOD TOWNSHIP LAKE ID # 02-0028

Background

Boot Lake is located in the northeast portion of Anoka County and has a surface area of 92 acres. While nearly all of the lake is shallow with aquatic vegetation growing to the surface, there is one area with a depth of 23 ft. (7 m) where water quality monitoring occurred.

Boot Lake is within a Scientific and Natural Area (SNA) owned and administered by the Minnesota Department of Natural Resources. The Boot Lake SNA is 660 acres and includes the entire lake as well as the undeveloped shoreline. Access, including water quality monitoring, requires a special permit.

Boot Lake has one primary stream inlet and one outlet. The inlet drains upstream lands that include undeveloped, sod fields and large-lot residential usage. The outlet stream goes to Linwood Lake.

Boot Lake was selected as a new monitoring site in 2018 for two reasons. The first is that Boot Lake is a contributing water source to Linwood Lake which is impaired for excess nutrients. Monitoring Boot Lake water quality allows us to determine whether Boot Lake is degrading Linwood Lake water quality. Secondly, Boot Lake is relatively undisturbed, and it is desirable to see what water quality is like in a rare, undeveloped lake in Anoka County.

2018 Results

Boot Lake's nutrient levels are typical of shallow lakes in the area. Average phosphorus levels in 2018 were 35 µg/L, average chlorophyll-a was 11.5 µg/L, and average Secchi transparency was 6.6 ft. (2.0 m). These are better than the State water quality standard for shallow lakes (total phosphorus <60 µg/L, chlorophyll-a <20 µg/L, Secchi transparency >1m), but only earn Boot Lake an overall C letter grade on Met Council's grading scale for metro area lakes. Boot Lake supports a rich plant community, and the lake attracts abundant waterfowl.

Trend Analysis

This is the first year of water quality monitoring for Boot Lake. Trend analysis is not yet possible.

Discussion

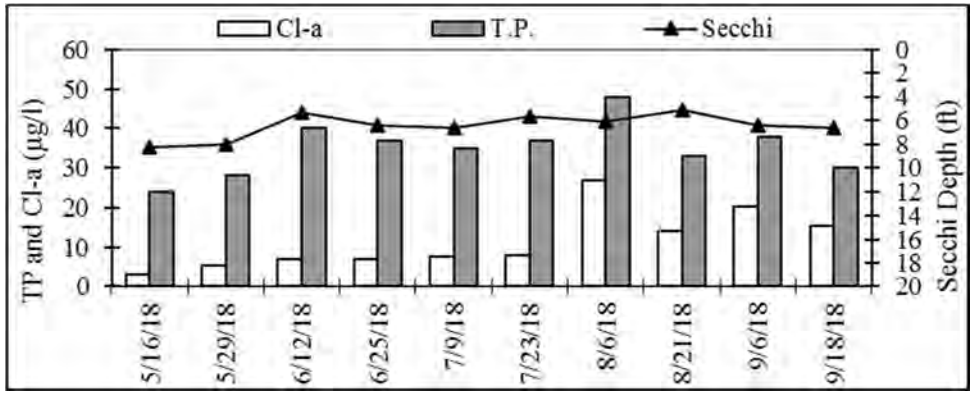
While Boot Lake is not subject to many of the potential negative impacts that occur on unprotected and/or developed lakes, its water quality is far from the pristine condition one might expect. Viking Boulevard runs near the western shore of the lake and may directly contribute pollutants. The contributing subwatershed includes some agriculture and scattered residential housing, which may affect water quality in Boot Lake. Finally, dead common carp were observed when ACD staff was monitoring water quality in Boot Lake. These factors, and likely others, appear to be degrading water quality in Boot Lake to a greater degree than may have been expected given the undisturbed condition of lands immediately surrounding the lake. In 1979 a resource inventory was completed for assessment of the site as a potential Scientific and Natural Area. The inventory did not include water quality monitoring.

Anoka Conservation District has not monitored Boot Lake previously, but in 2001 and 2003 monitored water quality in the Boot Lake inlet at Viking Boulevard. Average total phosphorus in the inlet across both years was 117 µg/L, which is typical for the area but does exceed the state water quality standard of 100 µg/L, and is likely contributing to less than stellar water quality in Boot Lake

Boot Lake's impact on Linwood Lake downstream appears neutral, as its nutrient concentrations are similar. However, efforts to improve impaired Linwood Lake should be made with Boot Lake in mind, despite its surrounding land use. It often makes sense to manage the whole watershed, and especially upstream contributing waters. A 2018-19 study is underway to examine one possible water quality linkage between the lakes – the movement and spawning of common carp.

BOOT LAKE
LINWOOD TOWNSHIP LAKE ID # 02-0028

2018 Results



2018 Median

pH		8.06
Specific Conductivity	mS/cm	0.270
Turbidity	NTU	3.25
D.O.	mg/l	8.12
D.O.	%	0.98
Temp.	°F	74.6
Salinity	%	0.1
Cl-a	µg/L	7.8
T.P.	µg/l	36.0
Secchi	ft	6.4

Historical Report Card

Year	TP	Cl-a	Secchi	**Overall**
2018	C	B	C	**C**
State Standards	60 µg/L	20 µg/L	>3.3 ft	

2018 Water Quality Data

	Units	R.L.*	Date: 5/16/2018 Time: 13:20	5/29/2018 9:30	6/12/2018 10:05	6/25/2018 9:36	7/9/2018 10:12	7/23/2018 9:45	8/6/2018 9:40	8/21/2018 9:35	9/6/2018 9:35	9/18/2018 9:10	Average	Min	Max
pH		0.1	8.21	8.10	8.05	8.64	8.66	8.07	7.73	7.14	7.18	7.38	7.9	7.14	8.66
Specific Conductivity	mS/cm	0.01	0.263	0.282	0.255	0.268	0.264	0.297	0.260	0.271	0.303	0.333	0.3	0.26	0.33
Turbidity	NTU	1	0.40	0.30	0.40	3.50	3.40	4.600	2.60	3.10	31.50	10.70	6.1	0.30	31.50
D.O.	mg/l	0.01	9.01	8.82	7.48	8.84	8.08	8.16	8.71	6.41	5.32	7.34	7.8	5.32	9.01
D.O.	%	100.0%	100.8%	111.2%	86.6%	104.5%	103.4%	94.9%	105.7%	76.6%	58.9%	88.0%	93.1%	58.9%	111.2%
Temp.	°C	0.1	20.77	25.41	21.35	23.78	26.29	24.37	23.50	24.09	21.66	22.35	23.4	20.77	26.29
Temp.	°F	0.1	69.4	77.7	70.4	74.8	79.3	75.9	74.3	75.4	71.0	72.2	74.0	69.39	79.32
Salinity	%	0.01	0.13	0.13	0.12	0.13	0.13	0.14	0.12	0.13	0.15	0.16	0.1	0.12	0.16
Cl-a	µg/L	1	3.12	5.34	7.12	7.1	7.7	8.0	26.7	14.2	20.2	15.4	11.5	3.12	26.70
T.P.	mg/l	0.005	0.024	0.028	0.040	0.037	0.035	0.037	0.048	0.033	0.038	0.030	0.0	0.02	0.05
T.P.	µg/l	5	24	28	40	37	35	37	48	33	38	30	35.0	24.00	48.00
Secchi	ft		8.3	8.0	5.3	6.4	6.7	5.7	6.1	5.1	6.4	6.6	6.5	5.08	8.25
Secchi	m		2.5	2.4	1.6	2.0	2.0	1.7	1.9	1.5	2.0	2.0	2.0	1.55	2.51
Physical			2	2	2	2	1	1	1	1	1	2	2	1	2
Recreational			1	2	2	2	2	2	2	2	2	2	2	1	2

*reporting limit

Coon Lake- East and West Bays

City of East Bethel, City of Ham Lake & City of Columbus, Lake ID # 02-0042

Background

Coon Lake is located in east central Anoka County and is the county's largest lake. Coon Lake has a surface area of 1,498 acres and a maximum depth of 27 feet (9 m). Public access is available at three locations with boat ramps, including one park with a swimming beach. The lake is used extensively by recreational boaters and fishers. Most of the lake is surrounded by private residences. The watershed of 6,616 acres is mostly made up of rural residential land usage. This report includes information individually reported for the East Bay (aka northeast or north bay) and West Bay (aka southwest or south bay) of Coon Lake in 2018. The 2010-18 data is from the Anoka Conservation District (ACD) monitoring at the MN Pollution Control Agency) monitoring site #203 for the East Bay and #206 for the West Bay. Over the years, other sites have been monitored and are included in this report's trend analysis when appropriate. When making comparisons between the two bays, consider that both bays were monitored simultaneously only biennially from 2010 to 2018. Data from other years do not lend themselves well to direct comparisons because monitoring regimes were likely different.

Trend Analysis

To analyze Coon Lake trends we obtained historical monitoring data from the MPCA. Over the years water quality has been monitored at 17 different sites on the lake. For the trend analysis, we pooled data from five East Bay sites (#102, 203, 208, 209, and 401) and four West Bay sites (#101, 105, 206, and 207). These sites were chosen because they were all in the bay of interest, close to each other, and distant from the shoreline. The trend analysis is based on average annual water quality data for each year data was collected. We used data only from years with data from every month May to September, allowing for up to one month of missing data. For years 1998 and after, only data collected by ACD was used for greater comparability. Results appear in each Bays sub-section below.

East Bay

2018 Results

In 2018 the East Bay of Coon Lake was monitored every 2 weeks. Water quality was better than average for this region of the state (NCHF Ecoregion), receiving an A grade, up from the B grade achieved in 2016 (no monitoring occurred in 2017). 2018 results included 19.4 µg/L for total phosphorus, 6.73 µg/L chlorophyll-a, and Secchi transparency of 7.96 feet.

Phosphorus concentrations, chlorophyll-a, and Secchi transparency all improved from 2016 levels and were greatly improved over levels measured before 2010. The decline in total phosphorus that was seen from 2010 (39.0 µg/L) to 2014 (19.0 µg/L) were interrupted in 2016 but may have resumed in 2018 (19.4 µg/L). Secchi transparency in 2018 (7.96 ft.) was amongst the best that has been observed at this lake, with only the 2013 reading of 8.8 ft. exceeding it. Subjective observations of the lake's physical characteristics and recreational suitability by the ACD staff indicated that lake conditions remained excellent for swimming and boating.

Trend Analysis

In the East Bay twenty-two years of water quality data have been collected since 1978. During the most recent 14 years that were monitored (since 1996), data collected included total phosphorus, chlorophyll-a, and Secchi transparency. For most of the other eight years (pre-1997) only Secchi transparency data is available. This provides an adequate dataset for a trend analysis, however, given that most of the data is from the last couple of decades, the analysis is not strong at detecting changes that occurred prior to 1990.

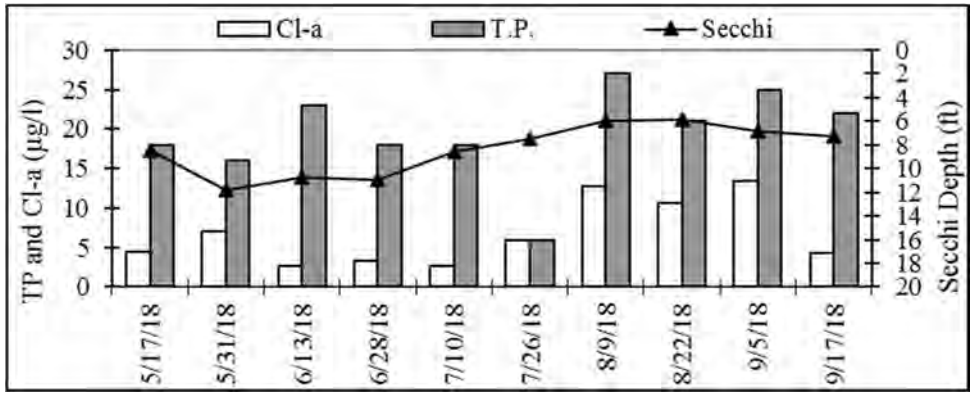
When we examined those years with total phosphorus, chlorophyll-a, and Secchi transparency, excluding the years with only Secchi transparency data, an improving water quality trend did exist. A repeated measures MANOVA with response variables TP, Cl-a, and Secchi depth showed a statistically significant change in water quality over that time period ($F_{2, 16}$=7.27, $p < 0.01$). This is our preferred approach because it examines all three parameters simultaneously.

We also examined variables TP, Cl-a, and Secchi depth across all years of existing data using a one-way ANOVA. Including all years, a significant trend of improving TP ($F_{1, 17}$=10.64, p <0.01), Cl-a ($F_{1, 17}$=12.75, p <0.01), and Secchi transparency ($F_{1, 22}$=25.66, p<0.001) is found. In summary, all three parameters are improving. It is noteworthy that this improvement seems to have primarily occurred since 2010.

Coon Lake- East Bay

City of East Bethel, City of Ham Lake & City of Columbus, Lake ID # 02-0042

2018 Results



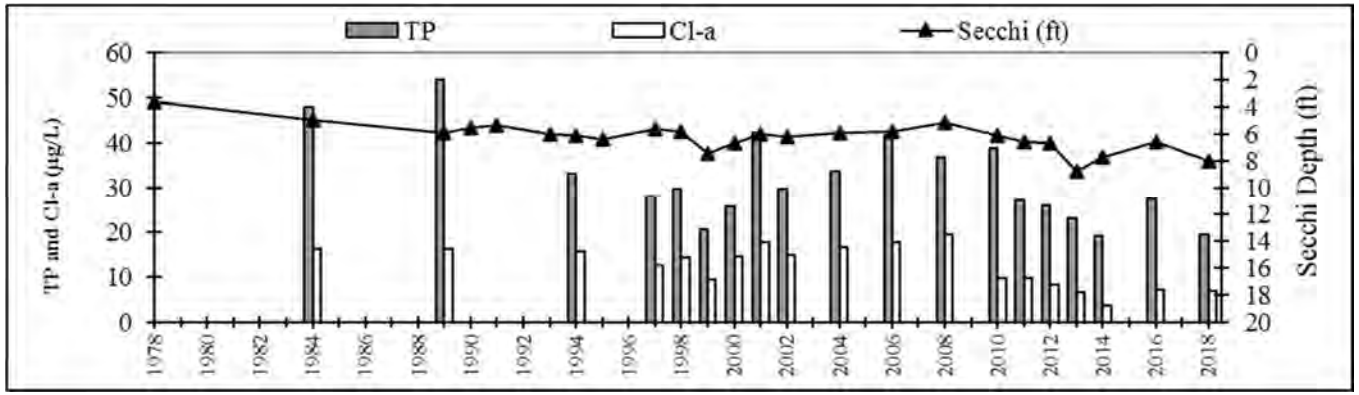
2018 Median Values

pH		8.40
Specific Conductivity	mS/cm	0.229
Turbidity	NTU	2.90
D.O.	mg/l	8.39
D.O.	%	1.05
Temp.	°F	76.3
Salinity	%	0.1
Cl-a	µg/L	5.2
T.P.	µg/l	19.5
Secchi	ft	8.0

Historical Report Card

Year	TP	Chl-A	Secchi	**Overall**
1978			D	D
1984	C	B	C	C
1989	C	B	C	C
1990			C	C
1991			C	C
1993			C	C
1994	C	B	C	**C**
1995			C	**C**
1997	B	B	C	**B**
1998	B	B	C	**B**
1999	A	A	B	**A**
2000	B	B	C	**B**
2001	C	B	C	**C**
2002	B	B	C	**B**
2004	C	B	C	**C**
2006	C	B	C	**C**
2008	C	B	C	**C**
2010	C	A	C	**B-**
2011	B	A	C	**B**
2012	B	A	C	**B**
2013	B	A	B	**B+**
2014	A	A	B	**A**
2016	B	A	C	**B**
2018	A	A	B	**A**
2018	A	A	A	**A**
State Standards	40 µg/L	14 µg/L	>4.6 ft	

Historic Annual Averages



2018 Water Quality Data

	Units	R.L.*	Date:	5/17/2018	5/31/2018	6/13/2018	6/28/2018	7/10/2018	7/26/2018	8/9/2018	8/22/2018	9/5/2018	9/17/2018	Average	Min	Max
			Time:	10:35	15:00	15:35	10:05	10:30	9:45	10:06	14:25	9:25	9:45			
pH		0.1		8.92	7.92	8.42	8.53	8.50	8.37	8.69	7.95	7.59	8.26	8.3	7.59	8.92
Specific Conductivity	mS/cm	0.01		0.247	0.257	0.233	0.219	0.249	0.246	0.217	0.217	0.210	0.225	0.2	0.21	0.26
Turbidity	NTU	1		2.30	0.30	0.0.	0.00	4.30	3.100	3.70	3.90		2.70	2.5	0.00	4.30
D.O.	mg/l	0.01		10.06	8.50	8.29	8.20	8.11	9.47	9.08	7.43	7.11	8.49	8.5	7.11	10.06
D.O.	%	100.0%		111.0%	106.9%	99.5%	98.9%	104.9%	115.4%	115.2%	84.2%	83.6%	104.3%	102.4%	83.6%	115.4%
Temp.	°C	0.1		18.84	24.99	22.97	24.55	26.57	24.65	25.38	24.84	22.71	24.11	24.0	18.84	26.57
Temp.	°F	0.1		65.9	77.0	73.3	76.2	79.8	76.4	77.7	76.7	72.9	75.4	75.1	65.91	79.83
Salinity	%	0.01		0.12	0.12	0.11	0.11	0.12	0.12	0.10	0.10	0.10	0.11	0.1	0.10	0.12
Cl-a	µg/L	1		4.45	7.12	2.67	3.3	2.7	5.9	12.8	10.7	13.4	4.3	6.7	2.67	13.40
T.P.	mg/l	0.005		0.018	0.016	0.023	0.018	0.018	0.006	0.027	0.021	0.025	0.022	0.0	0.01	0.03
T.P.	µg/l	5		18	16	23	18	18	6	27	21	25	22	19.4	6.00	27.00
Secchi	ft			8.4	11.8	10.8	11.0	8.6	7.5	5.9	5.8	6.8	7.3	8.4	5.83	11.83
Secchi	m			2.6	3.6	3.3	3.4	2.6	2.3	1.8	1.8	2.1	2.2	2.6	1.78	3.61
Physical				1	2		2	2	1	2	1	2	1	2	1	2
Recreational				1	1		1	1	1	1	1	1	1	1	1	1

*reporting limit

West Bay

2018 Results

In 2018 the West Bay had better than average water quality for this region of the state (NCHF Ecoregion), receiving an A letter grade. Total phosphorus in 2018 was the second lowest on record at 21.4 µg/L with the lowest being 2016's value of 21.0 µg/L. Phosphorus has been substantially better than state standards (40 µg/L) and low enough to earn B and then A grades since monitoring began in 2010. Chlorophyll-a, on the other hand, was at its highest level on record in 2018 at 6.9 µg/L. Despite nearly doubling since last year chlorophyll-a is still lower than state water quality standards (14 µg/L) and is low enough to earn the lake an A grade for chlorophyll-a. Secchi transparency has been monitored for longer than chlorophyll-a or phosphorus (starting in 1998). Secchi transparency has generally improved over the period of record with the lowest annual average of 3.97 ft. occurring in 1998 and the 2018 average Secchi transparency of 7.3 ft. being the highest. Until this year Secchi transparency has earned a C letter grade. This year it improved just enough to earn a B letter grade. Subjective observation of the lake's physical characteristics and recreational suitability continue to be very high indicating that the lake can be enjoyed for swimming and boating.

Trend Analysis

Thirteen years of data are available for the West Bay with only five of those years including phosphorus and chlorophyll-a data, so meaningful trend analysis is not possible. The dataset for Secchi transparency is longer, but data from 2010 and 2012 must be excluded because a full suite of Secchi measurements is not available due to clarity occasionally exceeding lake depth at the sampling point. Therefore, a statistical analysis would not be highly meaningful.

Instead, we will use a non-analytical look at the data. In 2018, the average Secchi transparency was 7.3 feet. For eight monitored years from 1998-2009, seven of those years had average Secchi transparency of <6 feet. It is notable that in the two most recent years sampled (2016 and 2018), the average Secchi transparency was the best seen since 2002. This suggests that Secchi transparency may be improving, and is at least not declining.

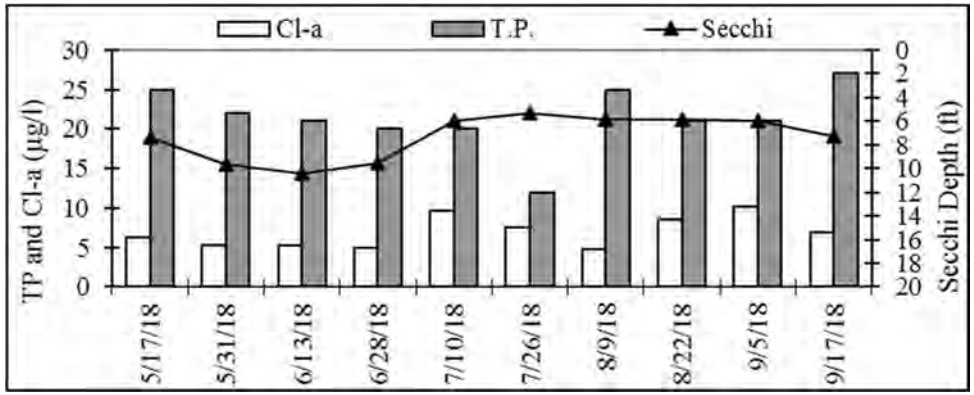
Average total phosphorus, in 2018, was 21.4 µg/L, which is the second lowest on record. Phosphorus has averaged better than 23 µg/L in 2016 and 2018. Prior to that phosphorus ranged from 24 to 28 µg/L. Similar to what is seen in Secchi transparency this may indicate that phosphorus is improving in the West Bay of Coon Lake as well.

Chlorophyll-a concentrations have varied from a low of 3.3 µg/L in 2014 to a high of 6.9 µg/L this year. Unlike phosphorus and transparency, there is no evidence of an improving trend in Chlorophyll-a. The lowest average seen in 2014 is followed by the second highest average in 2012 (5.4 µg/L), another low in 2016 (3.6 µg/L), and then a near doubling in 2018 to 6.9 µg/L. While these may seem like significant changes with average doubling over consecutive sampling years, all years of chlorophyll-a monitoring in Coon Lake have resulted in very low average concentrations when compared to other lakes and State water quality standards.

Coon Lake- West Bay

City of East Bethel, City of Ham Lake & City of Columbus, Lake ID # 02-0042

2018 Results



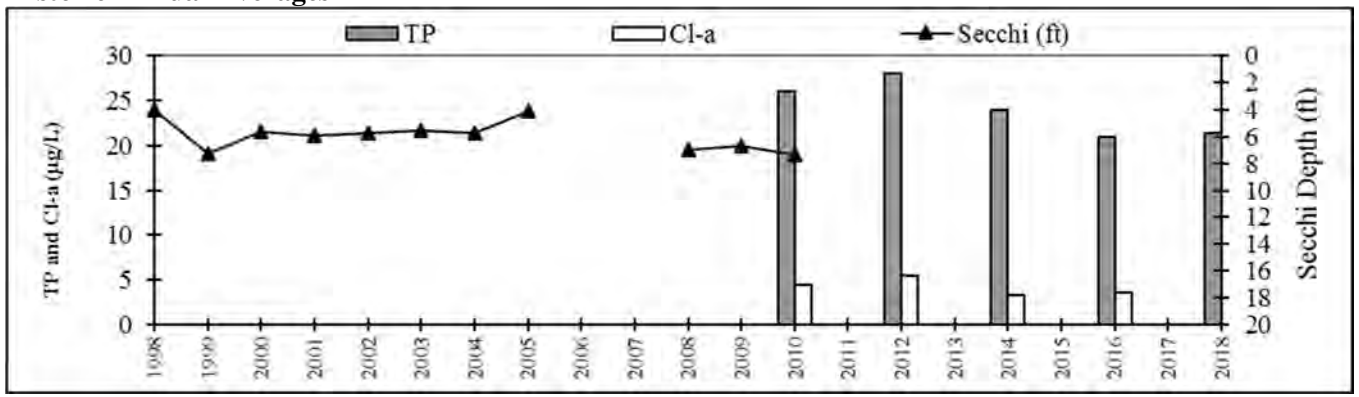
2018 Medians

pH		8.47
Specific Conductivity	mS/cm	0.191
Turbidity	NTU	2.10
D.O.	mg/l	8.04
D.O.	%	0.98
Temp.	°F	75.4
Salinity	%	0.1
Cl-a	µg/L	6.6
T.P.	µg/l	21.0
Secchi	ft	6.6

Historical Report Card

Year	TP	Cl-a	Secchi	Overall
1998			C	
1999			C	
2001			C	
2003			C	
2004			C	
2006			C	
2007			C	
2009			C	
2010	B	A		**A-**
2012	B	A		**A-**
2014	B	A	C	**B**
2016	A	A	C	**A-**
2018	A	A	B	**A**
State Standards	40 µg/L	14 µg/L	>4.6 ft	

Historic Annual Averages



2018 Water Quality Data

	Units	R.L.*	Date: 5/17/2018	5/31/2018	6/13/2018	6/28/2018	7/10/2018	7/26/2018	8/9/2018	8/22/2018	9/5/2018	9/17/2018	Average	Min	Max
			Time: 10:05	14:00	15:07	9:31	10:00	9:13	9:33	14:00	9:01	9:20			
pH		0.1	8.67	7.37	8.45	8.51	8.49	8.60	9.07	8.15	7.73	8.39	8.3	7.37	9.07
Specific Conductivity	mS/cm	0.01	0.231	0.232	0.201	0.182	0.204	0.200	0.166	0.166	0.166	0.176	0.2	0.17	0.23
Turbidity	NTU	1	2.10	0.80	0.00	0.00	8.00	0.056	2.70	3.30		3.70	2.6	0.00	8.00
D.O.	mg/l	0.01	9.82	7.60	8.08	7.82	8.40	8.96	8.81	7.19	7.20	7.99	8.2	7.19	9.82
D.O.	%	100.0%	109.5%	94.0%	97.4%	94.5%	108.0%	109.2%	112.7%	84.1%	84.8%	97.9%	99.2%	84.1%	112.7%
Temp.	°C	0.1	19.60	24.83	22.95	24.31	26.62	24.00	25.41	24.18	22.45	23.77	23.8	19.60	26.62
Temp.	°F	0.1	67.3	76.7	73.3	75.8	79.9	75.2	77.7	75.5	72.4	74.8	74.9	67.28	79.92
Salinity	%	0.01	0.11	0.11	0.10	0.09	0.10	0.10	0.08	0.08	0.08	0.09	0.1	0.08	0.11
Cl-a	µg/L	1	6.23	5.34	5.34	5.0	9.6	7.5	4.8	8.5	10.1	6.9	6.9	4.81	10.10
T.P.	mg/l	0.005	0.025	0.022	0.021	0.020	0.020	0.012	0.025	0.021	0.021	0.027	0.0	0.01	0.03
T.P.	µg/l	5	25	22	21	20	20	12	25	21	21	27	21.4	12.00	27.00
Secchi	ft		7.4	9.7	10.4	9.5	6.0	5.3	5.8	5.8	6.0	7.3	7.3	5.33	10.42
Secchi	m		2.3	3.0	3.2	2.9	1.8	1.6	1.8	1.8	1.8	2.2	2.2	1.62	3.18
Physical			1	1	2	2	2	1	2	1	2	1	2	1	2
Recreational			1	1	1	1	1	1	1	1	1	1	1	1	1

*reporting limit

Coon Lake – East and West Bay

City of East Bethel, City of Ham Lake & City of Columbus, Lake ID # 02-0042

Comparison of the Bays

The East and West Bays of Coon Lake have had noticeably different water quality in the past, but are similar in recent years, especially 2018. In 2010 on every sampling date water quality was better in the West Bay than in the East. In both 2012 and 2014, water quality in the two bays was more similar. In 2016, the West Bay regained its position of higher water quality. However, in 2018 the two bays were again similar. Average total phosphorous, Secchi depth, and chlorophyll-a were all slightly better in the East Bay. However, total phosphorous and chlorophyll-a were lower in the East Bay on only 6 out of 10 sample dates. Secchi showed the most difference between the bays in 2018, with better Secchi transparency in the East Bay on 8 out of 10 sampling dates. When averaged over the summer, Secchi transparency in both bays was very similar (7.3 ft. West Bay, 7.96 ft. East Bay). Historic report cards are shown side by side on the next page.

Discussion

Coon Lake was near State "impaired" status not long ago, but has improved substantially in the last decade. The East Bay has been close to, or exceeded, the state water quality standard of 40 µg/L of total phosphorus from 2001-2010. The West Bay has been well below the state total phosphorous standard in all years on record, except 1989. In recent years, water quality has improved, particularly in the East Bay.

2011 to present has had substantially lower phosphorus than 2001-2010 in the East Bay. Total phosphorus averaged 42 µg/L in 2006, 37 µg/L in 2008, and 39 µg/L in 2010. Phosphorous levels dropped to 27 µg/L in 2011, 26 µg/L in 2012, 23.2 µg/L in 2013, and in 2014 hit an all-time low of 18.8 µg/L. 2016 saw a rebound to 27.3 µg/L, but 2018 saw it drop back down to 19.4 µg/L (second lowest on record). By comparison, the West Bay's highest phosphorus annual average has been 26.0 µg/L in 2010.

The reason for water quality improvement is unknown, but we can speculate on a few contributing factors. The first factor is aquatic invasive species and their treatment, which has been documented to affect water quality in varying ways in other lakes. Best documented and consistently affecting other lakes is curly-leaf pondweed. This species takes up phosphorous from the soil through its root system and dies off in early summer sometimes causing a spike in water-borne phosphorous. Coon Lake has a Eurasian watermilfoil (EWM) and curly-leaf pondweed (CLP) infestation. Treatment of EWM and curly leaf pondweed began in 2009.

Looking back at pre-2010 data we do see a common mid-summer spike in phosphorus that might be at least partially due to CLP. In post-2010 years a mid-summer phosphorus increase is less conspicuous or absent. Herbicide treatment of CLP that is intended to kill the plant when it is small may also result in less phosphorus release compared to decomposition of large plants dying off naturally in mid-summer.

The impact of treating EWM is less clear. This species does not die off in mid-summer, so mass decomposition is not known as an important phosphorus source. Still, it is speculated to have varying effects on lake water quality. It may do so through abundant growth that protects bottom sediments from wind and boat disturbance, nutrient uptake, or even effects on the fishery. Whether this is happening in Coon Lake is unclear.

Water quality improvement projects are likely also part of the water quality improvement story at Coon Lake. Projects have been constructed, mostly in 2015 with a State Clean Water Fund grant, including two rain gardens, one filtration basin and three lakeshore restorations. Based on pollutant reduction estimates for these projects they are responsible for only some small portion of the improvement in lake conditions.

Future management should focus on the ecological health of the lake, as well as protecting water quality. Removal of native shoreline and aquatic vegetation by homeowners is a specific concern. This vegetation is important habitat for fish and other shoreline wildlife, and helps filter runoff to the lake. Septic system maintenance and replacement is also an area of concern, both from a public health and lake water quality point of view. Finally, additional stormwater treatment projects around the lake have been identified by a 2014 study by the Anoka Conservation District. These projects, including many lakeshore restorations, are prioritized by cost effectiveness.

Coon Lake – East and West Bay

City of East Bethel, City of Ham Lake & City of Columbus, Lake ID # 02-0042

Historical Report Card for Both Bays of Coon Lake

Year	TP	Chl-A	Secchi	**Overall**	Year	TP	Chl-A	Secchi	**Overall**
1978			D	D					
/\/\/\/\/\	/\/\/\/	/\/\/\/	/\/\/\/	/\/\/\/\/	/\/\/\/	/\/\/\/	/\/\/\/	/\/\/\/	/\/\/\/\/
1984	C	B	C	C					
/\/\/\/\/\	/\/\/\/	/\/\/\/	/\/\/\/	/\/\/\/\/	/\/\/\/	/\/\/\/	/\/\/\/	/\/\/\/	/\/\/\/\/
1989	C	B	C	C					
1990			C	C					
1991			C	C					
1992									
1993			C	C					
1994	C	B	C	**C**					
1995			C	**C**					
1996									
1997	B	B	C	**B**					
1998	B	B	C	**B**	1998			C	
1999	A	A	B	**A**	1999			C	
2000	B	B	C	**B**					
2001	C	B	C	**C**	2001			C	
2002	B	B	C	**B**					
2003					2003			C	
2004	C	B	C	**C**	2004			C	
2005									
2006	C	B	C	**C**	2006			C	
2007					2007			C	
2008	C	B	C	**C**					
2009					2009			C	
2010	C	A	C	**B-**	2010	B	A		**A-**
2011	B	A	C	**B**					
2012	B	A	C	**B**	2012	B	A		**A-**
2013	B	A	B	**B+**					
2014	A	A	B	**A**	2014	B	A	C	**B**
2015									
2016	B	A	C	**B**	2016	A	A	C	**A-**
2017									
2018	A	A	B	**A**	2018	A	A	B	**A**
State Standards	40 µg/L	14 µg/L	>4.6 ft						

LINWOOD LAKE

LINWOOD TOWNSHIP, LAKE ID # 02-0026

Background

Linwood Lake is located in the northeast portion of Anoka County. It has a surface area of 559 acres and maximum depth of 42 feet (12.8 m). Public access is available on the north side of the lake at Martin-Island-Linwood Regional Park, and includes a boat landing and fishing areas. The lake's shoreline is about 1/3 developed and 2/3 undeveloped. Most of the undeveloped shoreline is on the eastern shore and is part of a regional park. The lake's watershed is primarily undeveloped with scattered residential plots.

Linwood Lake is on the MPCA's 303(d) list of impaired waters for excess nutrients and this year was added for mercury in fish tissue.

2018 Results

In 2018 Linwood Lake has shown a slight improvement in average total phosphorus and Secchi clarity for three straight monitored years (2012, 2015, 2018). Total phosphorous in 2018 averaged 34.4 µg/L, the first time it has averaged under the state standard of 40 µg/L since the year 2000. Secchi clarity averaged 4.2 ft. in 2018, the best on record since 2005, but still below the state standard for clarity. Chlorophyll-a averaged 20.2 µg/L in 2018, typical for this lake, but exceeding the state standard of 14 µg/L.

Trend Analysis

Eighteen years of water quality data have been collected by the Metropolitan Council (1980, '81, '83, '89, '94, '97, and 2008) and the ACD (1998-2001, 2003, '05, '07, '09, '12, '15, and '18). Water quality has not significantly changed from 1980 to 2018 (repeated measures MANOVA with response variables TP, Cl-a, and Secchi transparency; $F_{2, 15}$=2.74, p=0.10). However, graphing each of these response variables over time shows that total phosphorus, chlorophyll-a and Secchi transparency appear to be better in recent years than each was a decade ago, even if not statistically significant.

Discussion

Linwood Lake is on the MPCA's list of impaired waters for excess nutrients, but it is a borderline case. Linwood Lake was placed on the state impaired waters list because summertime average total phosphorus is routinely over the water quality standard of 40 µg/L for deep lakes. The state has since added separate standards for shallow lakes. Linwood does not technically meet the definition of a shallow lake (maximum depth of <15 ft. or >80% of the lake shallow enough to support aquatic plants) due to a large deep hole in the lake's basin. However, it is very similar to other shallow lake systems and expectations for water quality should perhaps be more in line with shallow lake standards (total phosphorus <60 µg/L, chlorophyll-a <20 µg/L, and Secchi transparency >1m).

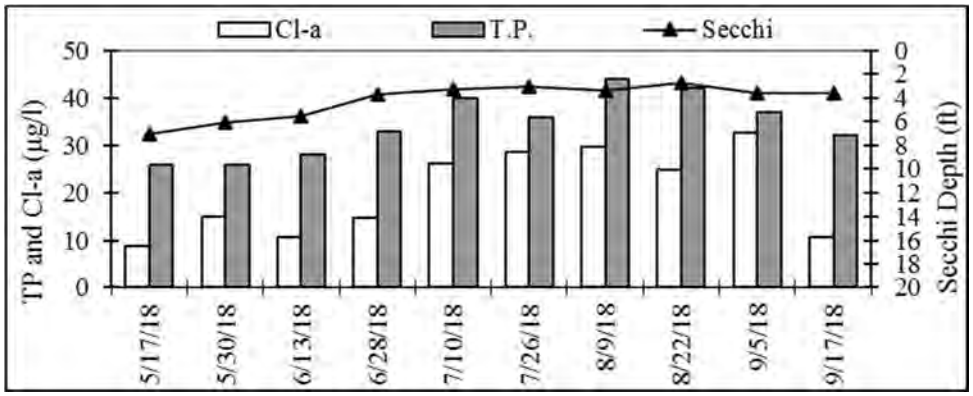
Regardless, water quality improvement is needed. A TMDL impaired waters study has identified the following factors as management targets at Linwood Lake: internal sediments, shoreline management, shoreline septic systems, watershed runoff, agricultural practices, curly-leaf pondweed, and common carp. High powered boats may be impacting water quality by disturbing sediments because the lake is large enough for these boats to get up to full speed, but is mostly shallow. Multi-faceted management is likely needed.

The primary inlet to Linwood Lake comes from Boot Lake. In 2018 Boot Lake was monitored for the first time. It has phosphorus concentrations that are similar to Linwood Lake, and chlorophyll-a concentrations that are lower than Linwood Lake. It appears that while both lakes have similar nutrient levels, those nutrients generate proportionately more algae in Linwood Lake and macrophytes in Boot Lake. In summary, it appears that Boot Lake is neutral in its water quality impact on Linwood Lake, but improvements in or upstream of Boot Lake may be needed to achieve goals at Linwood Lake.

LINWOOD LAKE

LINWOOD TOWNSHIP, LAKE ID # 02-0026

2018 Results



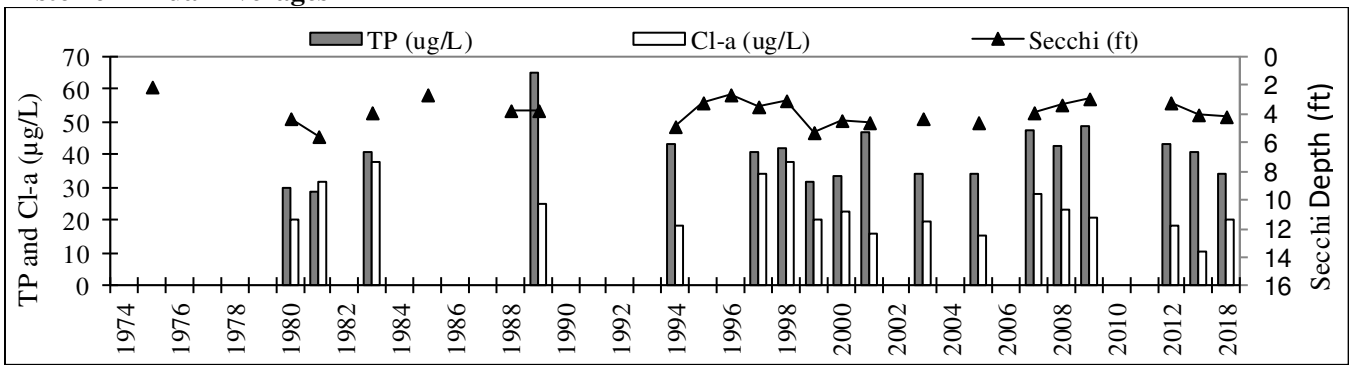
2018 Median Values

pH		8.65
Specific Conductivity	mS/cm	0.314
Turbidity	NTU	11.20
D.O.	mg/l	8.50
D.O.	%	1.07
Temp.	°F	75.3
Salinity	%	0.2
Cl-a	µg/L	20.0
T.P.	µg/l	34.5
Secchi	ft	3.6

Historical Report Card

Year	TP	Cl-a	Secchi	Overall
1975			F	
1980	B	B	C	**B**
1981	B	B	C	**B**
1983	C	C	C	**C**
1985			D	
1988			D	
1989	C	C	D	**C**
1994	C	B	C	**C**
1995			D	
1996			D	
1997	C	C	D	**C**
1998	C	C	D	**C**
1999	C	C	D	**C**
2000	C	C	C	**C**
2001	C	B	C	**C**
2003	C	B	C	**C**
2005	C	B	C	**C**
2007	C	C	D	**C**
2008	C	C	D	**C**
2009	C	C+	D	**C**
2012	C	B	D	**C**
2015	C	B	C	**C**
2018	C	C+	C	**C**
State Standards	40 µg/L	14 µg/L	>4.6 ft	

Historic Annual Averages



2018 Water Quality Data

	Units	R.L.*	Date:	5/17/2018	5/30/2018	6/13/2018	6/28/2018	7/10/2018	7/26/2018	8/9/2018	8/22/2018	9/5/2018	9/17/2018	Average	Min	Max
			Time:	11:45	15:30	14:10	11:03	11:30	10:47	11:00	13:00	10:21	10:45			
pH		0.1		8.80	8.79	8.53	8.85	8.61	8.35	9.10	8.18	8.08	8.68	8.6	8.08	9.10
Specific Conductivity	mS/cm	0.01		0.337	0.346	0.323	0.304	0.345	0.352	0.282	0.271	0.268	0.286	0.3	0.27	0.35
Turbidity	NTU	1		2.90	5.50	3.40	4.30	14.50	16.900	16.40	14.20		11.20	9.9	2.90	16.90
D.O.	mg/l	0.01		10.05	8.02	8.46	8.52	8.47	8.61	10.57	6.56	7.54	9.20	8.6	6.56	10.57
D.O.	%	100.0%		111.9%	103.2%	100.7%	112.2%	109.5%	104.4%	135.0%	78.9%	88.1%	113.6%	105.8%	78.9%	135.0%
Temp.	°C	0.1		19.15	24.43	22.31	23.95	26.65	23.95	25.25	24.53	22.52	24.16	23.7	19.15	26.65
Temp.	°F	0.1		66.5	76.0	72.2	75.1	80.0	75.1	77.5	76.2	72.5	75.5	74.6	66.47	79.97
Salinity	%	0.01		0.16	0.17	0.15	0.15	0.17	0.17	0.14	0.13	0.13	0.14	0.2	0.13	0.17
Cl-a	µg/L	1		8.90	15.10	10.70	14.7	26.2	28.7	29.8	24.9	32.6	10.7	20.2	8.90	32.60
T.P.	mg/l	0.005		0.026	0.026	0.028	0.033	0.040	0.036	0.044	0.042	0.037	0.032	0.0	0.03	0.04
T.P.	µg/l	5		26	26	28	33	40	36	44	42	37	32	34.4	26.00	44.00
Secchi	ft			7.1	6.1	5.5	3.7	3.3	3.1	3.4	2.7	3.6	3.6	4.2	2.67	7.08
Secchi	m			2.2	1.9	1.7	1.1	1.0	0.9	1.0	0.8	1.1	1.1	1.3	0.81	2.16
Physical				2	2	2	2	2	1	2	2	2	3	2	1	3
Recreational				1	1	2	1	1	1	1	1	1	2	1	1	2

*reporting limit

TYPO LAKE

LINWOOD TOWNSHIP, LAKE ID # 30-0009

Background

Typo Lake is located in northeast Anoka County and southeast Isanti County. It has a surface area of 290 acres and maximum depth of 6 feet (1.82 m), though most of the lake is about 3 feet deep. The lake has a mucky, loose, and unconsolidated bottom in some areas, while other areas have a sandy bottom. The public access is located at the south end of the lake along Fawn Lake Drive. The lake is used little for fishing or recreational boating because of the shallow depth and extremely poor water quality. The lake's shoreline is mostly undeveloped, with only 21 homes within 300 feet of the lakeshore. The lake's watershed of 11,520 acres is 3% residential, 33% agricultural, and 28% wetlands, with the remainder being forested or grassland. Typo Lake is on the MPCA's list of impaired waters for excess nutrients.

2018 Results

In 2018 Typo Lake had poor water quality compared to other lakes in this region (NCHF Ecoregion), receiving an overall F letter grade. This overall grade is consistent with previous years monitored except for the D achieved in 2014. Average total phosphorus (TP) was lower than the previous five years monitored at 160.3 µg/L. In fact, 2018 levels are the lowest on record. While total phosphorus levels continue to far exceed the 60 µg/L state standard, average concentrations appear to be staying well below averages from a decade ago.

Chlorophyll-a (Cl-a) levels in 2018 averaged 61.5 µg/L. This is well below the historical average of 115.3 µg/L and lower than the 2017 average of 66.7 µg/L, but still many times higher than the State shallow lakes standard concentration of 20 µg/L.

Average Secchi transparency in 2018 was 1.0 feet. A decade ago transparency was poorer. In 2007 and 2009 a Secchi disk could be seen only 5-6 inches below the surface, on average. In recent years transparency has been better, including 9.6 inches in 2012, 21-22 inches in 2014, and 14 inches in 2017. The State standard for transparency is 3 feet for a shallow lake to not be considered 'impaired.'

Trend Analysis

Eighteen years of water quality monitoring have been conducted by the MPCA (1993, '94, and '95) and the Anoka Conservation District (1997-2001, '03, '05, '07, '09, '12, 2014-2018). Overall, water quality has improved from 1993 to 2018 in a statistically significant way (repeated measures MANOVA with response variables TP, Cl-a, and Secchi depth; $F_{2, 15}$=5.6, p=0.02). When we tested these response variables individually with one-way ANOVAs, TP and Secchi depth still show no significant change across this time period. Cl-a, however, is showing a statistically significant decline (p=0.001). A superficial look at graphs of these parameters suggests that total phosphorus is generally stable between 150 µg/L and 250 µg/L (excluding high outlier years 2007 and 2009) without any sort of long-term trend. Secchi transparency in recent years is similar to averages from the early 1990s, an improvement from the late 1990s-2010. The major driver of improved water quality is decreasing Cl-a concentrations.

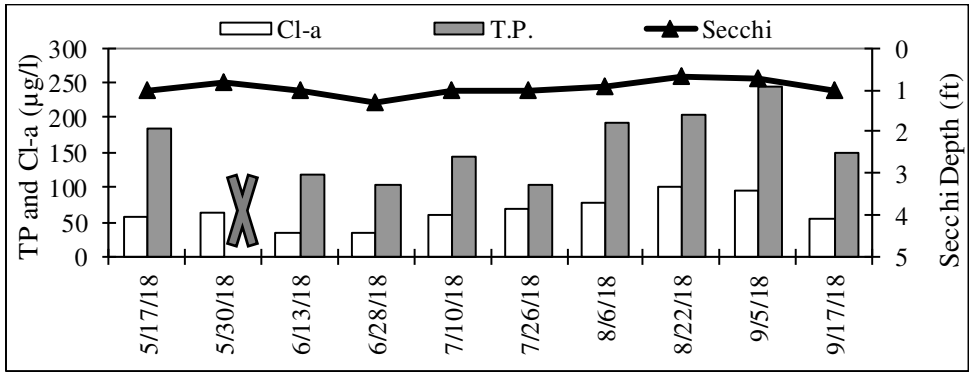
Discussion

Typo Lake, along with Martin Lake downstream, was the subject of a Total Maximum Daily Load (TMDL) study by the Anoka Conservation District, which was approved by the State and EPA in 2012. This study documented the sources of nutrients to the lake, the degree to which each is impacting the lake, and put forth lake rehabilitation strategies. Some factors impacting water quality in Typo Lake include rough fish, high phosphorus inputs from a ditched wetland west of the lake, and lake sediments. Recent work has included installation of carp barriers (completed in 2016), carp removals (2017-18, to be continued in 2019), and a feasibility study of ditched wetland restorations upstream of Typo Lake (2018). The feasibility study was completed in early 2018 and identified 4 potential projects along Ditch 20 upstream of Type Lake. It also recommends that dredging of Ditch 20 not occur. For more information on these projects contact the Anoka Conservation District.

TYPO LAKE

LINWOOD TOWNSHIP, LAKE ID # 30-0009

2018 Results



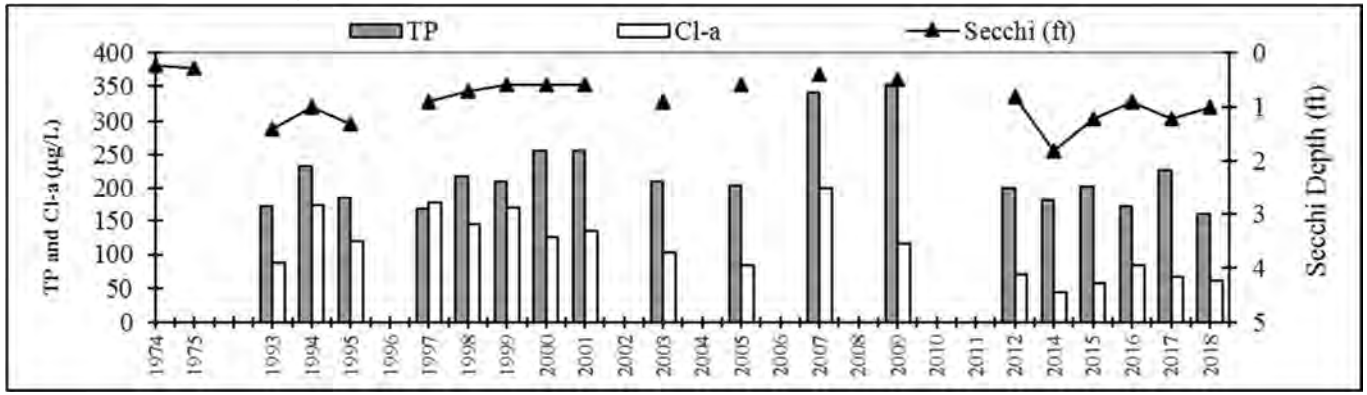
2018 Median Values

pH		8.99
Specific Conductivity	mS/cm	0.275
Turbidity	NTU	82.50
D.O.	mg/l	9.73
D.O.	%	1.15
Temp.	°F	73.3
Salinity	%	0.1
Cl-a	µg/L	61.9
T.P.	µg/l	149.0
Secchi	ft	1.0

Historical Report Card

Year	TP	Cl-a	Secchi	**Overall**
1974			F	
1975			F	
^^^^^	^^^^^	^^^^^	^^^^^	^^^^^
1993	F	F	F	F
1994	F	F	F	F
1995	F	F	F	F
1996				
1997	F	F	F	F
1998	F	F	F	F
1999	F	D	F	F
2000	F	F	F	F
2001	F	F	F	**F**
2002				
2003	F	F	F	**F**
2004				
2005	F	F	F	F
2006				
2007	F	F	F	**F**
2008				
2009	F	F	F	**F**
^^^^^	^^^^^	^^^^^	^^^^^	^^^^^
2012	F	D	F	**F**
2013				
2014	F	C	F	**D-**
2015	F	D	F	**F**
2016	F	F	F	**F**
2017	F	D	F	**F**
2018	C	B	C	**C**
State Standards	60 µg/L	20 µg/L	>3.3 ft	

Historic Annual Averages



2018 Water Quality Data

	Units	R.L.*	Date:	5/17/2018	5/30/2018	6/13/2018	6/28/2018	7/10/2018	7/26/2018	8/6/2018	8/22/2018	9/5/2018	9/17/2018	Average	Min	Max
			Time:	13:20	13:30	12:00	12:22	12:55	12:15	11:08	11:30	11:25	11:55			
pH		0.1		9.23	8.13	8.92	9.01	9.20	9.29	9.10	8.96	8.73	8.69	8.93	8.13	9.29
Specific Conductivity	mS/cm	0.01		0.249	0.320	0.300	0.269	0.309	0.280	0.247	0.233	0.228	0.281	0.272	0.228	0.320
Turbidity	NTU	1		74.50	110.00	50.70	40.00	59.30	99.10	92.40	90.50	140.00	65.30	80	40	140
D.O.	mg/l	0.01		10.19	6.21	9.43	10.64	10.02	10.73	8.92	10.40	7.22	8.57	9.23	6.21	10.73
D.O.	%	100.0%		118%	60%	114%	138%	128%	127%	107%	116%	84%	106%	110%	60%	138%
Temp.	°C	0.1		20.7	24.0	22.2	24.8	27.1	22.5	23.5	21.9	21.9	24.8	23.34	20.71	27.12
Temp.	°F	0.1		69.3	75.3	72.0	76.7	80.8	72.5	74.2	71.3	71.4	76.7	74.0	69.3	80.8
Salinity	%	0.01		0.12	0.15	0.14	0.13	0.15	0.13	0.12	0.11	0.11	0.14	0.1	0.1	0.2
Cl-a	µg/L	1		58.7	64.1	33.4	34.4	59.6	69.4	77.4	101.0	96.1	53.4	61.5	33.4	101.0
T.P.	mg/l	0.005		0.185		0.118	0.103	0.144	0.104	0.192	0.204	0.244	0.149	0.160	0.103	0.244
T.P.	µg/l	5		185		118	103	144	104	192	204	244	149	160	103	244
Secchi	ft			1.0	0.8	1.0	1.3	1.0	1.0	0.9	0.7	0.8	1.0	1.0	0.7	1.3
Secchi	m			0.3	0.3	0.3	0.4	0.3	0.3	0.3	0.2	0.2	0.3	0.3	0.2	0.4
Physical				3	4	3	3	3	2	3	3	3	4	3.1	2.0	4.0
Recreational				4	3	3	3	3	2	2	2	2	4	2.8	2	4

*reporting limit

Martin Lake

Linwood Township, Lake ID # 02-0034

Background

Martin Lake is located in northeast Anoka County. It has a surface area of 223 acres and maximum depth of 20 ft. The public access is located on the southern end of the lake. The lake is used moderately by recreational boaters and fishers, and would likely be used more if water quality improved. Martin Lake is almost entirely surrounded by private residences. The 5,402-acre watershed is 18% developed; the remainder is vacant, agricultural, or wetlands. The non-native, invasive plant curly-leaf pondweed occurs in Martin Lake but not at nuisance levels. Martin is on the MPCA's list of impaired waters for excess nutrients.

2018 Results

In 2018 Martin Lake had typical water quality compared to other recent years, receiving a C letter grade. This compares poorly to other lakes in the North Central Hardwood Forest Ecoregion (NCHF). Martin Lake is quite eutrophic for a lake of its size and depth due to chronically high total phosphorus (TP) and chlorophyll-a (Cl-a). In 2018 total phosphorus levels, however, continued a four-year improvement averaging 53.1 µg/L. This is the lowest average on record, though it remains above the impairment threshold of 40 µg/L. This now marks three consecutive monitoring years with lowest average total phosphorus on record for Martin Lake following the previous record low average of 59.3 µg/L in 2017. These averages are half, or less than half, of averages from a decade ago (135.0 µg/L in 2007).

Chlorophyll-a rose slightly from the previous year to 27.6 µg/L in 2018. While the 5-year average since 2014 (22.8 µg/L) has been much lower than the 2005-2009 average (108.3 µg/L), this average still remains above the impairment standard of 14 µg/L. Average Secchi transparency was 3.0 feet in 2018, exactly matching its historical average. This average remains about 30% below the State impairment threshold of 4.6 feet. The ACD staff continues to note green water during late summer months.

Trend Analysis

Eighteen years of water quality data have been collected by the MPCA (1983), Metropolitan Council (1998, 2008), and the ACD (1997, 1999-2001, 2003, 2005, 2007, 2009, 2012-2018). Citizens monitored Secchi transparency 17 other years. Anecdotal notes from DNR fisheries data indicate poor water quality dating back to at least 1954. Although still pretty poor, water quality in Martin Lake has shown an improvement from 1983 to 2018 that is statistically significant (repeated measures MANOVA with response variables TP, Cl-a, and Secchi depth; $F_{2, 14}=5.33$, $p < 0.05$). This is especially true for the last decade. Further examination of the data shows that while TP and Secchi transparency have not changed in the long-term since 1983, chlorophyll-a has shown a statistical decrease ($p < 0.01$) over this time. Water quality in Martin Lake declined through the late 1990's and reached its worst in 2007. In nine years sampled since 2007, all three parameters have improved on a statistically significant basis (TP $p < 0.01$, Cl-a $p < 0.05$, Secchi $p < 0.01$).

Discussion

Martin Lake, along with Typo Lake upstream, was the subject of a TMDL study by the Anoka Conservation District that was approved by the State and EPA in 2012. This study documented the source of nutrients to the lake, the degree to which each is impacting the lake, and put forward lake rehabilitation strategies. Water from Typo Lake and internal loading (carp, septic systems, sediments, etc.) are two of the largest negative impacts on Martin Lake water quality.

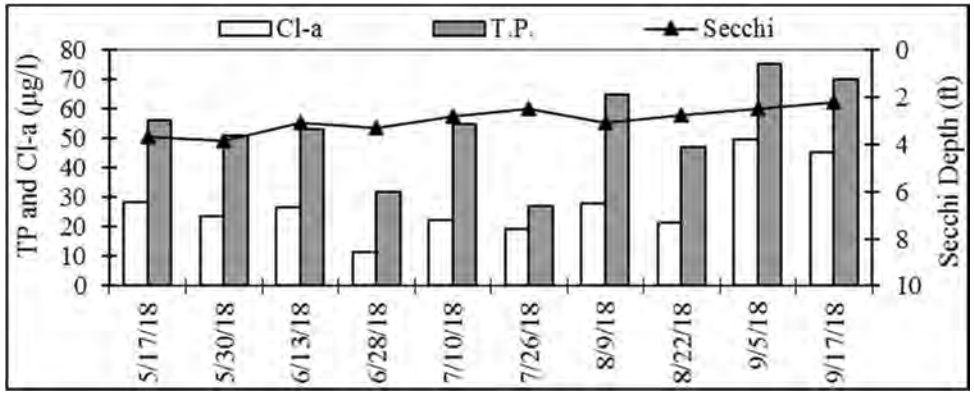
Installation of carp barriers was completed in 2016. Carp removals and other management efforts are taking place in 2017-19. Upstream of Typo Lake, a feasibility study was completed in early 2018 regarding restoration of ditched wetlands (Ditch 20). This study identified 4 potential projects and also recommends that dredging of Ditch 20 not occur. For more information on these projects contact the Anoka Conservation District.

In the neighborhoods adjacent to Martin Lake three rain gardens were installed in 2011and more stormwater retrofits are anticipated in 2020-2021. Recent water quality monitoring results suggest these management approaches are improving conditions in these lakes, but reaching goals will require additional efforts and time.

Martin Lake

Linwood Township, Lake ID # 02-0034

2018 Results



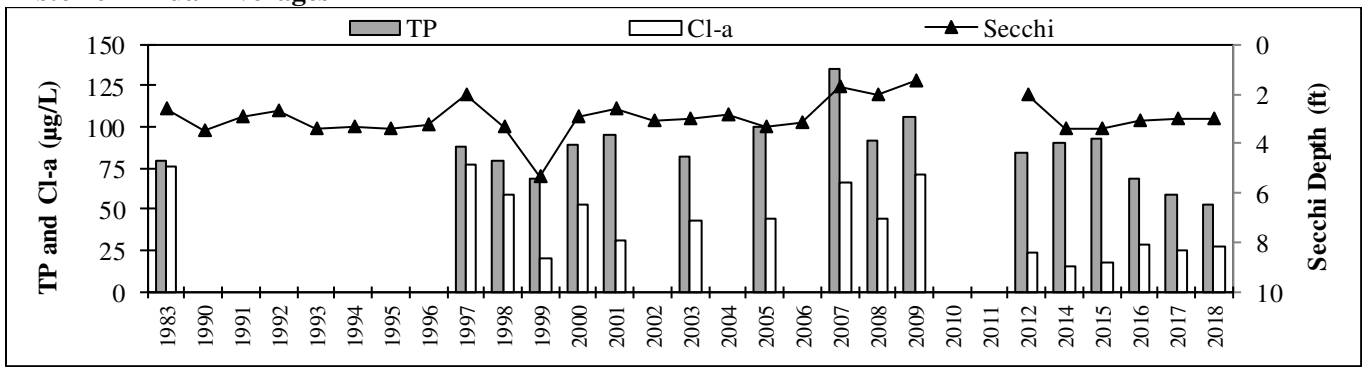
2018 Median Values

pH		8.80
Specific Conductivity	mS/cm	0.309
Turbidity	NTU	15.80
D.O.	mg/l	9.53
D.O.	%	1.19
Temp.	°F	75.4
Salinity	%	0.2
Cl-a	µg/L	25.1
T.P.	µg/l	54.0
Secchi	ft	3.0

Historical Report Card

Year	TP	Cl-a	Secchi	Overall
1996			D	
1997	D	D	F	**D**
1998	D	D	D	D
1999	C	B	C	**C**
2000	D	C	D	**D**
2001	D	C	D	**D**
2002			D	
2003	D	C	D	**D**
2004			D	
2005	D	C	D	**D**
2006			D	
2007	D	D	F	**D**
2008	D	C	F	**D**
2009	D	D	F	**D**
2012	D	C	F	**D**
2014	D	B	D	**C**
2015	D	B	D	**C**
2016	C	C	D	**C**
2017	C	C	D	**C**
2018	C	C	D	**C**
State Standards	40 µg/L	14 µg/L	>4.6 ft	

Historic Annual Averages



2018 Water Quality Data

	Date:	5/17/2018	5/30/2018	6/13/2018	6/28/2018	7/10/2018	7/26/2018	8/9/2018	8/22/2018	9/5/2018	9/17/2018			
	Time:	14:00	14:20	13:14	11:03	12:22	11:30	11:41	12:10	10:55	11:25			
	Units	R.L.*										Average	Min	Max
pH		0.1	9.59	8.69	8.95	9.04	8.44	8.36	9.12	8.04	7.94	8.90	8.7	7.94	9.59
Specific Conductivity	mS/cm	0.01	0.322	0.336	0.307	0.299	0.350	0.369	0.310	0.302	0.301	0.307	0.3	0.30	0.37
Turbidity	NTU	1	15.80	14.30	12.50	4.60	17.90	23.100	20.50	12.40		22.40	15.9	4.60	75.20
D.O.	mg/l	0.01	12.02	9.29	10.02	9.59	9.22	9.46	12.45	6.67	7.34	11.30	9.7	6.67	12.45
D.O.	%	100.0%	131.9%	N/A	119.1%	118.8%	114.0%	116.5%	157.0%	80.1%	86.9%	138.4%	118.1%	80.1%	157.0%
Temp.	°C	0.1	18.56	24.50	22.62	24.82	26.78	24.04	25.60	24.19	22.47	24.03	23.8	18.56	26.78
Temp.	°F	0.1	65.4	76.1	72.7	76.7	80.2	75.3	78.1	75.5	72.4	75.3	74.8	65.41	80.20
Salinity	%	0.01	0.15	0.16	0.15	0.15	0.17	0.18	0.15	0.15	0.14	0.15	0.2	0.14	0.18
Cl-a	µg/L	1	28.30	23.50	26.70	11.3	22.4	19.4	27.8	21.4	49.6	45.4	27.6	11.30	49.60
T.P.	mg/l	0.005	0.056	0.051	0.053	0.032	0.055	0.027	0.065	0.047	0.075	0.070	0.1	0.03	0.08
T.P.	µg/l	5	56	51	53	32	55	27	65	47	75	70	53.1	27.00	75.00
Secchi	ft		3.7	3.8	3.1	3.3	2.8	2.5	3.1	2.8	2.5	2.3	3.0	2.25	3.83
Secchi	m		1.1	1.2	0.9	1.0	0.9	0.8	0.9	0.8	0.8	0.7	0.9	0.69	1.17
Physical			3	3	3	3	2	2	3	3	3	4	3	2	4
Recreational			1	2	2	1	1	1	1	1	1	2	1	1	2

*reporting limit

Fawn Lake

Linwood Township Lake ID # 02-0035

Background

Fawn Lake is located in the northeast corner of Anoka County. It has a surface area of 57 acres and a maximum depth of 30 feet (9.1 m). There is no public access to this lake and no boat landing. A neighborhood association has established a small park and swimming beach for the homeowners. Most of the lake is surrounded by private residences, with the densest housing on the southern and western shores. The watershed for this lake is quite small, consisting mostly of the area within ¼ mile of the basin.

Fawn is one of the clearest lakes in the county. Groundwater likely feeds this lake to a large extent. Vegetation in the lake is healthy, but not so prolific as to be a nuisance, and contributes to high water quality. In 2008 and 2010 an invasive plant species, curly-leaf pondweed, was noticed in a few locations, although it may have been present for some time. It does not appear to occur in high densities. Another aquatic invasive species survey was conducted in 2015 by the Anoka Conservation District. Curly-leaf pondweed was still not a nuisance and no new species were identified. Once again a great variety of healthy-native vegetation was identified.

2018 Results

Fawn Lake is classified as mesotrophic and has some of the clearest water in Anoka County. In 2018, Fawn Lake continued its trend of excellent water quality for this region of the state (NCHF Ecoregion) receiving an overall A grade. Water clarity was high while total phosphorus and chlorophyll-a were low throughout the 2018 sampling season. Water clarity averaged 13.7 ft. from May through September. Chlorophyll-a and phosphorus averaged 4.0 µg/L and 17.0 µg/l, respectively. The subjective observations of the lake's physical characteristics and recreational suitability by the ACD staff indicated that lake conditions were excellent for swimming and boating throughout the summer, although an occasional and slight greenish tint to the water was noted.

Trend Analysis

Fourteen years of water quality data have been collected by the MPCA (1988) and the Anoka Conservation District (between 1997 and 2018). If we examine all years, there is not a statistically significant trend of improving or declining water quality. The first year of monitoring (1988) has notably worse water quality than all years since. Excluding 1988, the trophic state index (TSI) score for Fawn Lake has only varied from 40-47 with the controlling variable appearing to be changes in phosphorus (low of 13.6 µg/L, high of 41.6 µg/L).

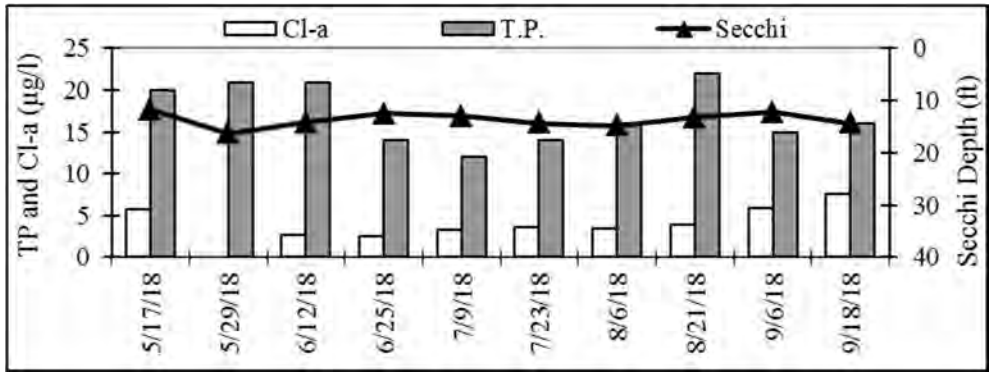
Discussion

This lake's water quality future lies with the actions of the lakeshore homeowners. Because the lake has such a small watershed each lakeshore lot comprises a significant portion of the watershed. Poor practices on a few lots could result in noticeable changes to the lake. Some ways to protect the lake include lakeshore buffers of native vegetation, keeping yard waste out of the lake, and eliminating or minimizing the use of fertilizer. Soil testing on nearby lakes and throughout the metro has found that soil phosphorus fertility is high, and lawns do not benefit from additional phosphorus. Additionally, lakeshore homeowners should refrain from disturbing or removing lake vegetation. This lake's exceptionally high water quality is likely in part due to its healthy plant community. Moreover, curly-leaf pondweed, an invasive species only recently noticed in the lake, readily colonizes disturbed areas and can affect both water quality and recreation.

Fawn Lake

Linwood Township Lake ID # 02-0035

2018 Results



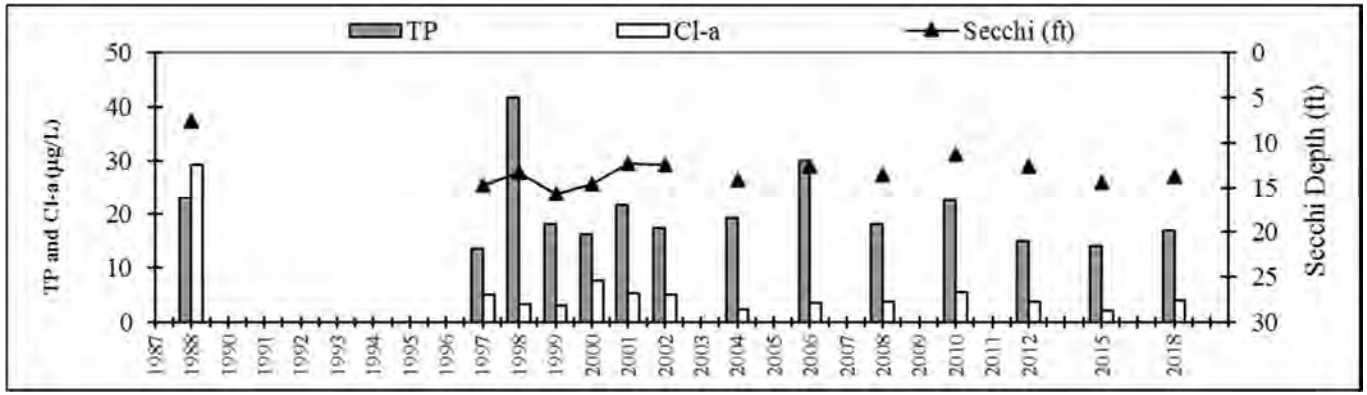
2018 Median Values

pH		8.37
Specific Conductivity	mS/cm	0.234
Turbidity	NTU	0.30
D.O.	mg/l	8.69
D.O.	%	1.08
Temp.	°F	75.9
Salinity	%	0.1
Cl-a	µg/L	3.7
T.P.	µg/l	16.0
Secchi	ft	13.7

Historical Report Card

Year	TP	Chl-A	Secchi	Overall
1988	B	C	A	**B**
1997	A	A	A	**A**
1998	C	A	A	B
1999	A	A	A	**A**
2000	A	A	A	**A**
2001	A	A	A	**A**
2002	A	A	A	**A**
2004	A	A	A	**A**
2006	B	A	A	**A**
2008	A	A	A	**A**
2010	A	A	A	**A**
2012	A	A	A	**A**
2015	A	A	A	**A**
2018	A	A	A	**A**
State Standards	40 µg/L	14 µg/L	>4.6 ft	

Historic Annual Averages



2018 Water Quality Data

	Units	R.L.*	Date:	5/17/2018	5/29/2018	6/12/2018	6/25/2018	7/9/2018	7/23/2018	8/6/2018	8/21/2018	9/6/2018	9/18/2018	Average	Min	Max
			Time:	14:00	10:30	11:00	10:41	12:45	10:40	10:30	10:25	10:35	10:00			
pH		0.1		9.09	8.37	8.37	8.55	8.41	8.24	8.46	7.88	7.68	7.72	8.3	7.68	9.09
Specific Conductivity	mS/cm	0.01		0.267	0.270	0.232	0.240	0.236	0.238	0.200	0.198	0.214	0.222	0.2	0.20	0.27
Turbidity	NTU	1		2.10	0.00	0.00	1.00	0.00	0.600	0.00	0.30		10.70	1.6	0.00	29.70
D.O.	mg/l	0.01		9.60	8.58	8.75	9.00	8.40	8.70	8.96	8.68	7.03	8.10	8.6	7.03	9.60
D.O.	%	100.0%		109.6%	111.7%	104.0%	109.1%	107.8%	108.9%	107.0%	109.2%	81.7%	93.7%	104.3%	81.7%	111.7%
Temp.	°C	0.1		20.37	25.36	22.22	24.57	27.04	25.51	24.25	25.44	22.41	22.85	24.0	20.37	27.04
Temp.	°F	0.1		68.7	77.6	72.0	76.2	80.7	77.9	75.7	77.8	72.3	73.1	75.2	68.67	80.67
Salinity	%	0.01		0.13	0.13	0.11	0.12	0.11	0.12	0.10	0.10	0.10	0.11	0.1	0.10	0.13
Cl-a	µg/L	1		5.78	<1	2.67	2.5	3.3	3.7	3.4	3.9	5.9	7.6	4.0	<1	7.59
T.P.	mg/l	0.005		0.020	0.021	0.021	0.014	0.012	0.014	0.016	0.022	0.015	0.016	0.0	0.01	0.02
T.P.	µg/l	5		20	21	21	14	12	14	16	22	15	16	17.1	12.00	22.00
Secchi	ft			11.8	16.3	14.2	12.5	13.0	14.3	14.8	13.3	12.3	14.3	13.7	11.75	16.25
Secchi	m			3.6	5.0	4.3	3.8	4.0	4.4	4.5	4.0	3.7	4.4	4.2	3.58	4.95
Physical				1	1	2	1	2	2	1	1	1	1	1	1	2
Recreational				1	1	1	1	1	1	1	1	1	1	1	1	1

*reporting limit

Stream Hydrology Monitoring

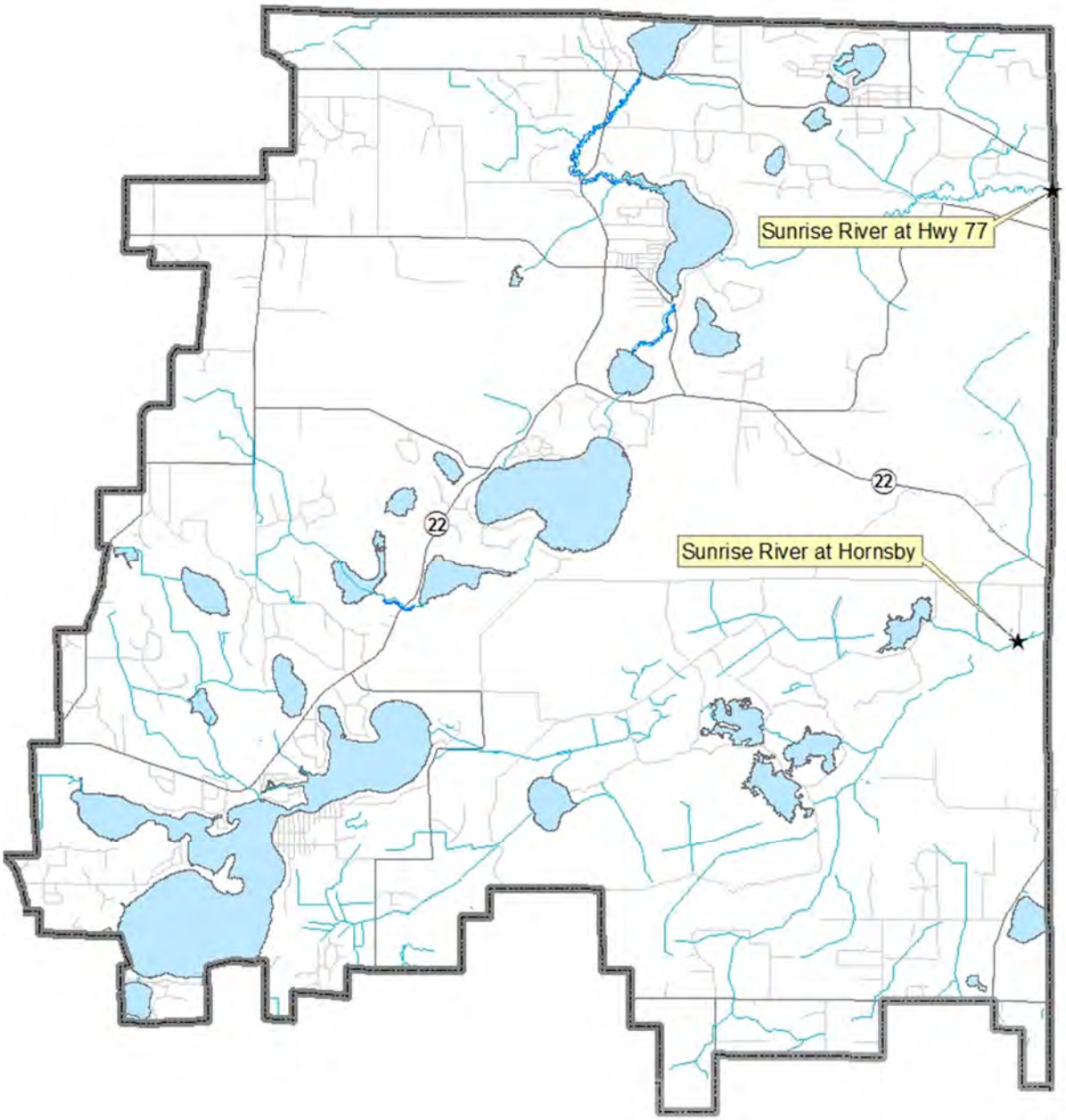
Description: Continuous water level monitoring in streams.

Purpose: To provide understanding of stream hydrology, including the impact of climate, land use, or discharge changes. These data also facilitate calculation of pollutant loads, use of computer models for developing management strategies, and water appropriations permit decisions.

Locations: Sunrise River at Co Rd 77
Sunrise River at Hornsby Rd.

Results: Results are presented on the following pages

2018 Sunrise River Watershed Stream Hydrology Monitoring Sites



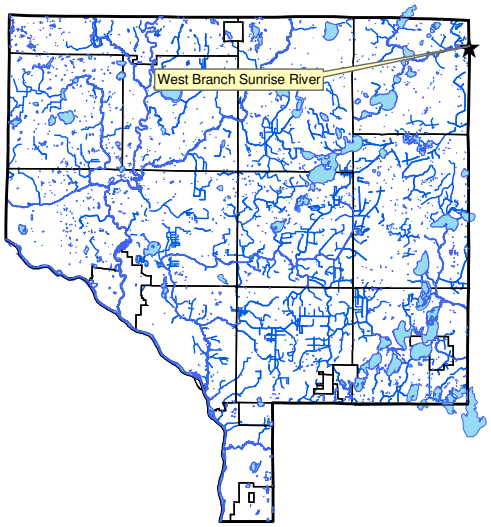
Stream Hydrology Monitoring

WEST BRANCH OF SUNRISE RIVER

At Co Rd 77, Linwood Township

Years Monitored: 2002-2006, 2008, 2010-2012, 2015, 2018

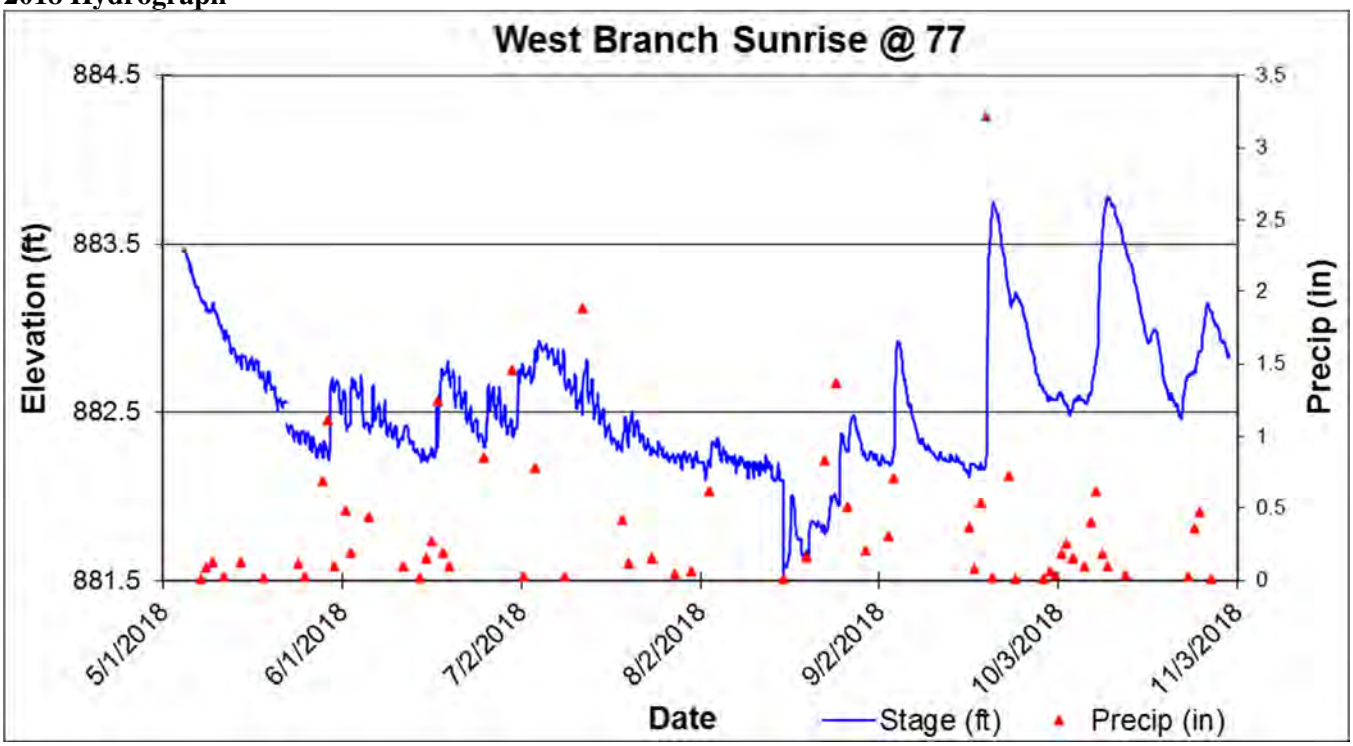
Background: This site is at the bottom of the Sunrise River watershed in Anoka County, at the Chisago County border. This site is monitored to develop an understadning of water quality and quantity in this stream when it leaves Anoka County. Upstream, this river drains through Linwood, Island, Martin, and Typo Lakes. The SRWMO has done water quality monitoring at this site and created a rating curve to estimate flow volumes from continuous water level measurements. In 2008 and 2009 this site was also monitored to collect data for a computer model of the entire Sunrise River watershed being done by the US Army Corps of Engineers, Chisago County, and other partners. A rating curve was developed in 2002 and updated in 2008-2009, however, it does not cover the full range of stages measured in 2018.



Summary of All Monitored Years

In the last 2 years when data was collected stream levels were substantially lower. The cause of this change is unclear, although there are a number of potential causes.

2018 Hydrograph

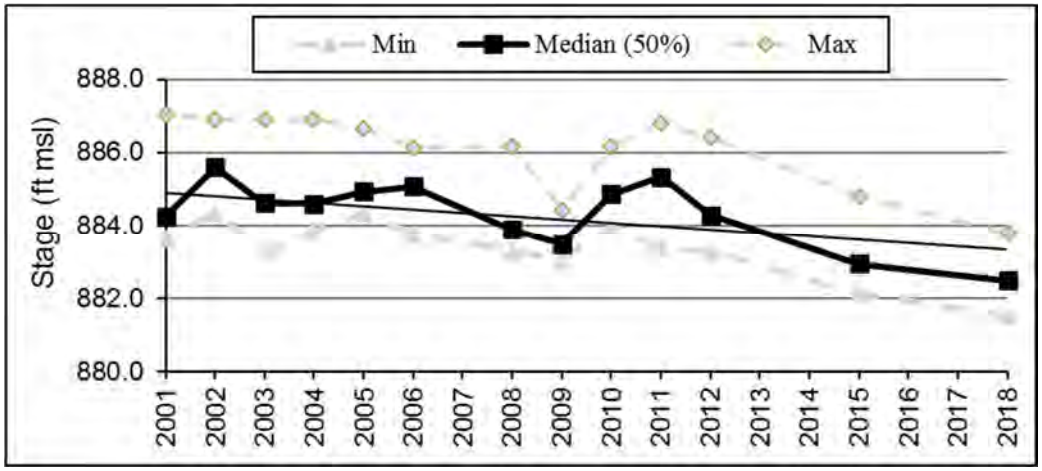


WEST BRANCH OF SUNRISE RIVER

At Co Rd 77, Linwood Township

Summary of All Monitored Years

Percentiles	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2008	2009	2010	2011	2012	2015	2018
Min	883.78	884.25	885.25	884.06	883.41	883.65	884.36	883.28	883.84	884.33	883.76	883.31	883.02	883.96	883.39	883.28	882.13	881.52
2.5%	884.00	884.31	885.35	884.12	883.50	883.76	884.50	883.64	883.93	884.44	883.87	883.40	883.17	884.03	883.45	883.31	882.27	881.81
10.0%	884.14	884.48	885.42	884.22	883.52	883.81	884.63	883.73	884.02	884.58	884.04	883.51	883.21	884.21	883.69	883.35	882.41	882.19
25.0%	884.48	884.79	885.71	884.58	883.55	883.91	885.13	883.83	884.31	884.69	884.50	883.64	883.30	884.48	884.62	883.50	882.60	882.25
Median (50%)	884.77	885.51	886.06	884.80	883.68	884.25	885.59	884.62	884.59	884.93	885.06	883.89	883.48	884.86	885.33	884.28	882.93	882.49
75.0%	885.39	886.03	886.46	884.99	884.21	885.60	886.18	885.66	885.10	885.29	885.27	884.99	883.83	885.14	885.78	884.92	883.33	882.75
90.0%	885.88	886.58	887.10	885.21	884.42	886.69	886.48	886.12	886.03	885.61	885.59	885.74	884.12	885.37	886.42	885.80	883.59	883.12
97.5%	886.90	886.82	887.61	885.65	885.75	887.05	886.84	886.74	886.82	885.92	886.06	886.04	884.31	885.94	886.76	886.36	884.15	883.61
Max	887.13	887.14	887.81	885.77	886.02	887.05	886.89	886.91	886.89	886.67	886.14	886.17	884.42	886.18	886.79	886.41	884.80	883.79



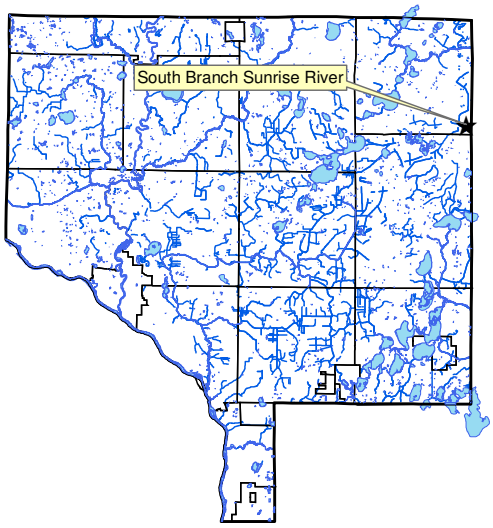
Stream Hydrology Monitoring

SOUTH BRANCH OF SUNRISE RIVER AT HORNSBY

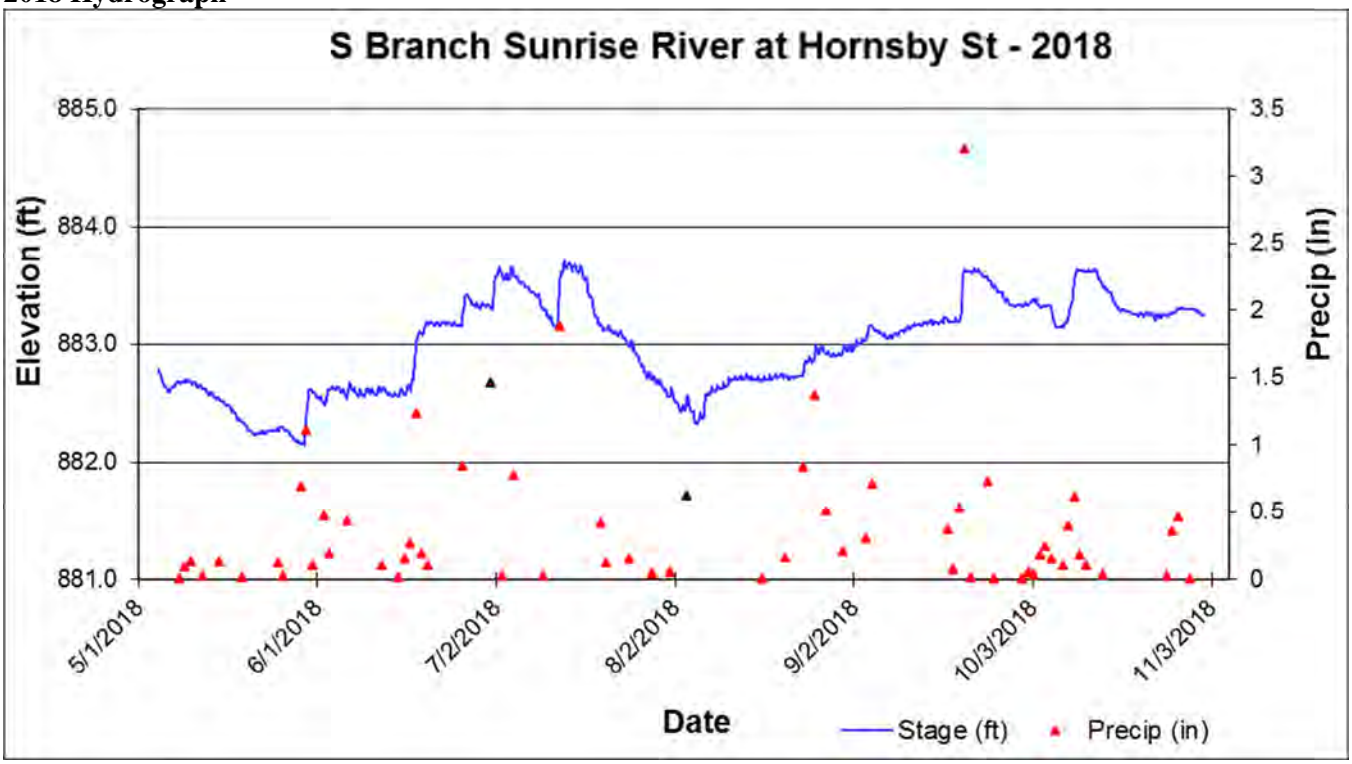
At Hornsby St, Linwood Township

Years Monitored: 2009-2012, 2015, 2018

Background: This monitoring site is the also at the bottom of this watershed in Anoka County, at the closest accessible point to the Anoka-Chisago County boundary. Upstream, this river drains from Coon Lake and through the Carlos Avery Wildlife Management Area. The Sunrise River Watershed Management Organization monitors this site because it is at the bottom of their jurisdictional area. This site was first monitored in 2009 to collect data for a computer model of the entire Sunrise River watershed being done by the US Army Corps of Engineers, Chisago County, and other partners. Water quality monitoring has occurred in some years at this site. A rating curve has not been developed to estimate flow volumes from the water level measurements.



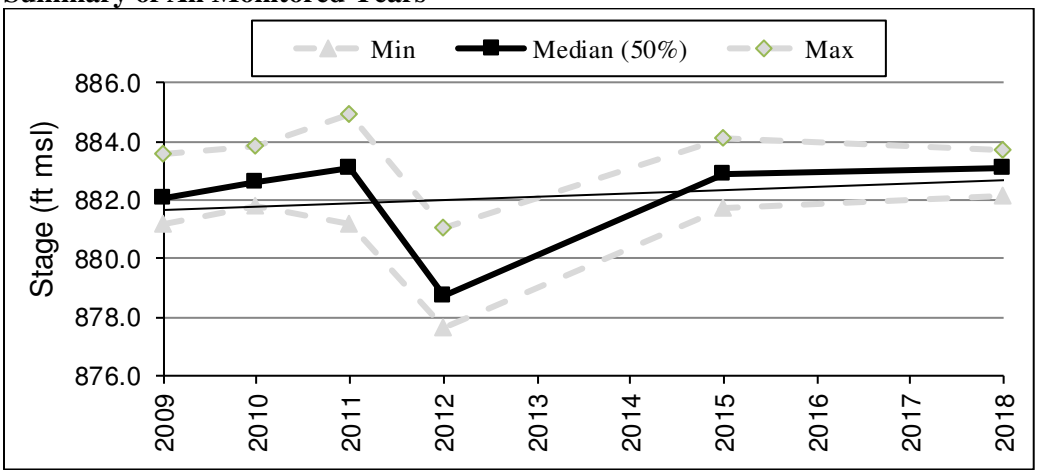
2018 Hydrograph



SOUTH BRANCH OF SUNRISE RIVER AT HORNSBY

At Hornsby St, Linwood Township

Summary of All Monitored Years



Percentiles	2009	2010	2011	2012	2015	2018
Min	881.20	881.77	881.16	877.64	881.75	882.14
2.5%	881.34	881.91	881.28	877.90	882.01	882.24
10.0%	881.57	882.02	881.57	878.10	882.25	882.49
25.0%	881.74	882.17	882.46	878.43	882.62	882.63
Median (50%)	882.09	882.59	883.12	878.70	882.92	883.08
75.0%	883.01	883.02	883.59	879.31	883.22	883.30
90.0%	883.34	883.58	884.04	880.14	883.61	883.54
97.5%	883.52	883.79	884.47	880.64	884.01	883.63
Max	883.56	883.85	884.94	881.05	884.12	883.71

Stream Water Quality

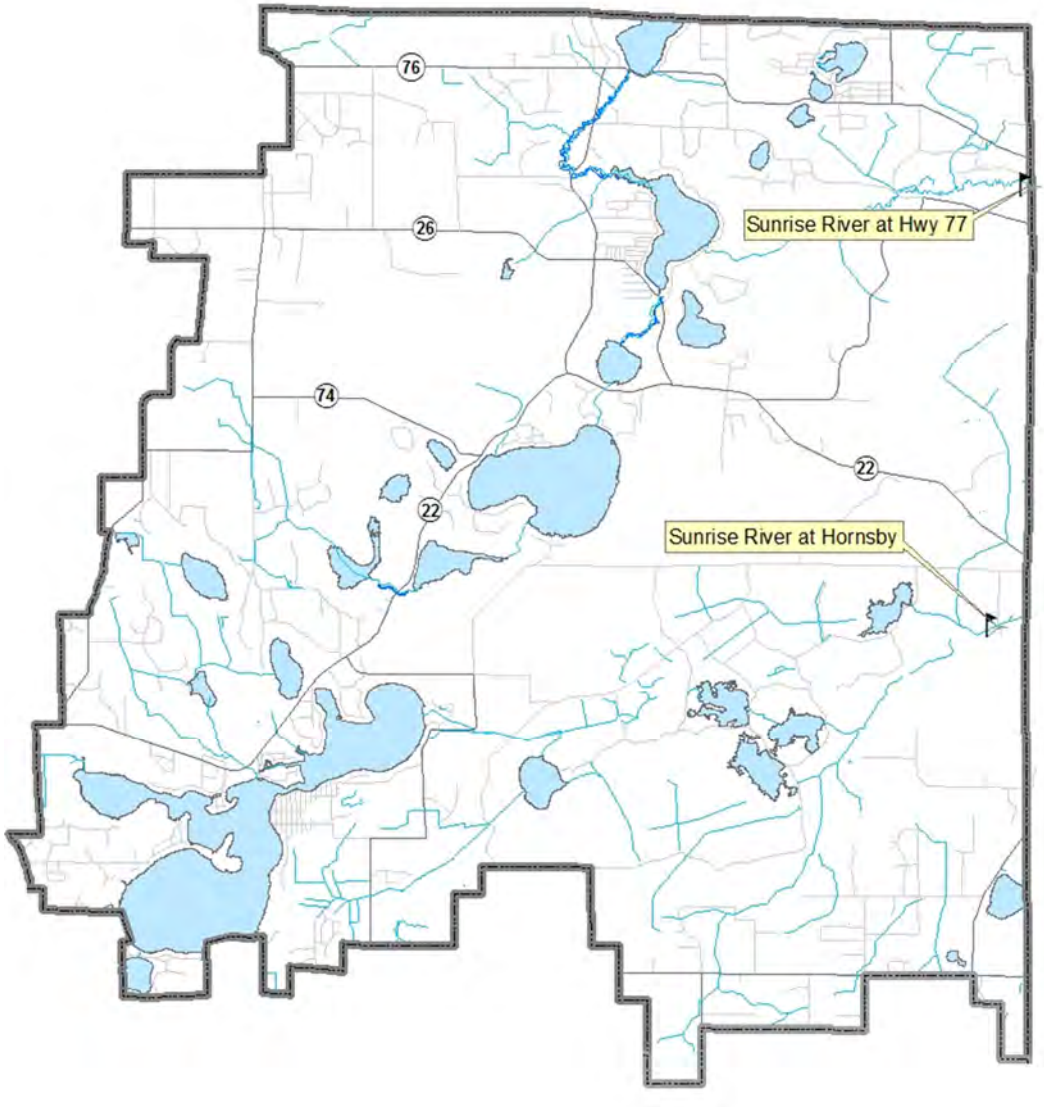
Description: Stream water quality is monitored with grab samples on eight occasions throughout the open water season, including four times immediately following a storm (1" of rain within a 24 hr. period) and four times during baseflow conditions. The selected sites are the farthest downstream limits of the Sunrise River Watershed Management Organization's jurisdictional area. Parameters monitored include water level, pH, specific conductivity, turbidity, transparency, dissolved oxygen, total phosphorus, and total suspended solids. This data can be paired with stream hydrology monitoring to do pollutant-loading calculations.

Purpose: To detect water quality trends and problems, and diagnose the source of problems.

Location: Sunrise River at Co Rd 77
Sunrise River at Hornsby Rd.

Results: Results are presented on the following pages.

2018 Sunrise River Watershed Stream Water Quality Monitoring Sites



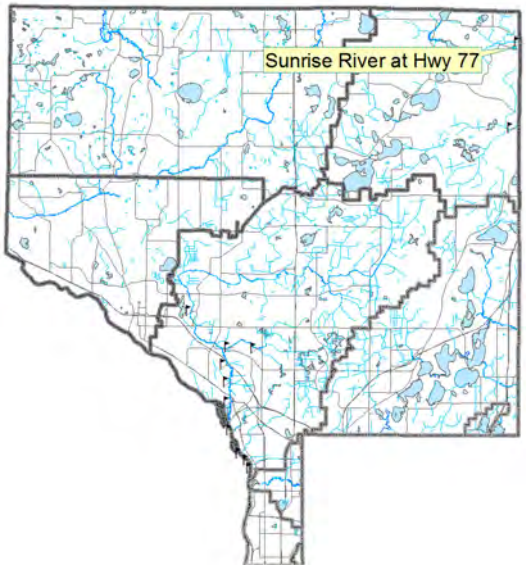
SUNRISE RIVER AT HWY 77

Near Fawn Lake Dr. NE, Linwood Township

STORET SiteID = S001-424

Years Monitored

2001, 2003, 2006, 2012, 2015, 2018



Background

This monitoring site is the bottom of this watershed in Anoka County, at the Chisago County border. Upstream, this river drains through Boot, Linwood, Island, Martin, and Typo Lakes. The Sunrise River Watershed Management Organization monitors this site because it is where the river leaves their jurisdiction. Additionally, monitoring is considered important because this portion of the river is impaired for aquatic life with turbidity identified as a stressor. A TMDL study was completed in 2013.

Methods

The river was monitored by grab samples. Eight water quality samples were taken each year; half during baseflow and half following storms. Storms were generally defined as one-inch or more of rainfall in 24 hours or a significant snowmelt event combined with rainfall. Parameters tested with portable meters included pH, specific conductivity, turbidity, temperature, dissolved oxygen, and salinity. Parameters tested by water samples sent to a state-certified lab included total phosphorus, chlorides, and total suspended solids. Continuous water level monitoring occurred in the open water season.

Summarized Results

Summarized water quality monitoring findings and management implications include:

- Specific conductivity was below the county median of 0.420 mS/cm. The median specific conductivity was 0.311 mS/cm. The median specific conductivity for all years at this site is 0.297 mS/cm. For management considerations see chlorides.
- Chlorides were measured at this site in all years, except 2015. In 2018 the median chloride concentration was 17.95 mg/L. The median for all years at this site is 15.2 mg/L and the countywide median is 13.29 mg/L.
  Management discussion: Road deicing salts are a concern region-wide. They are measurable in area streams year-round, including in the Sunrise River. While they may be low now, excessive use should be avoided.
- Suspended solids and turbidity levels were similar in 2018 to other years monitored, excluding 2015. The 2018 median TSS concentration was 20.1 mg/L, up from 5.5 mg/L in 2015. The median for all years at this site is 18 mg/L. These levels are higher than most other Anoka County streams, but still below the state standard of 30 mg/L TSS.
  Management discussion: Efforts to reduce suspended material in upstream lakes will help decrease turbidity and suspended solids throughout the Sunrise River.
- Phosphorus has fluctuated above and below the water quality standard for the Central River Nutrient Region of ≤100 µg/L. In 2015, the last year monitored, Average phosphorus concentrations were 63.5 µg/L, much lower than other years tested. This year the median phosphorus was up to 101.5 µg/L. The median TP for all years at this site is 88 µg/L.
  Management discussion: Management in upstream lakes will help reduce phosphorus in the river.
- pH was within the range considered normal and healthy for streams in this area. The median pH was 7.69.
- Dissolved oxygen (DO) was typically within the range considered normal and healthy.

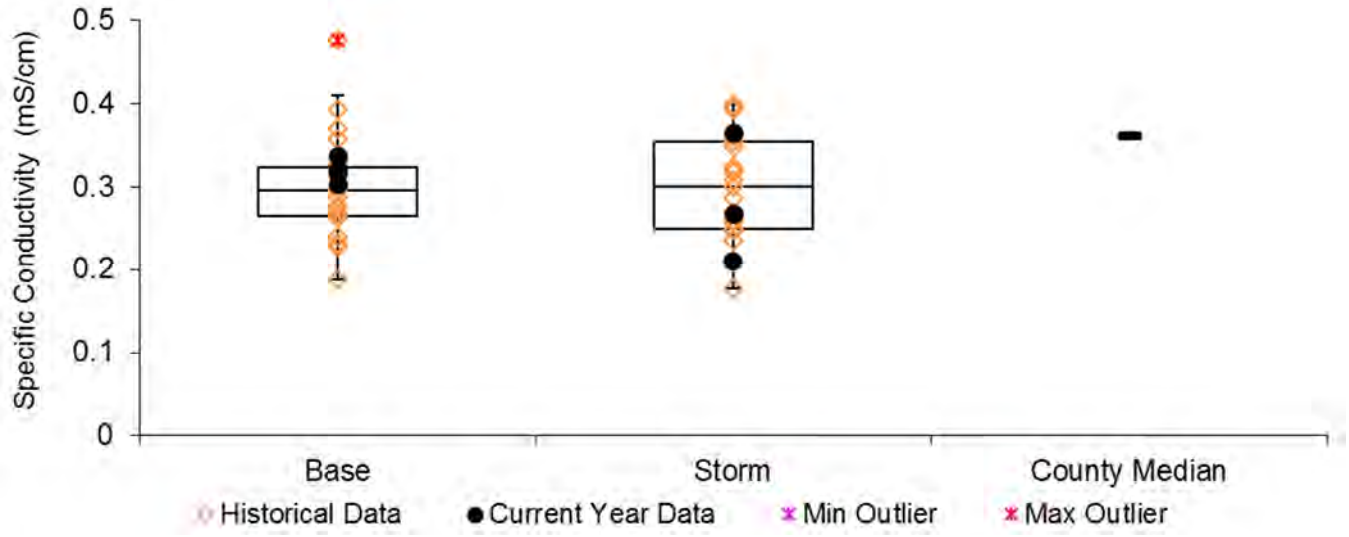
Below the data are presented and discussed for each parameter in greater detail. Management recommendations will be included at the conclusion of this report.

Specific conductivity

Specific conductivity and chlorides are measures of dissolved pollutants. Dissolved pollutant sources include urban road runoff, industrial chemicals, and others. Metals, hydrocarbons, road salts, and others are often of concern in a suburban environment. Specific conductivity is the broadest measure of dissolved pollutants we use. It measures electrical conductivity of water standardized for temperature; pure water with no dissolved constituents has zero specific conductivity.

Specific conductivity was acceptably low in the West Branch of the Sunrise River. Median specific conductivity this year was 0.311 mS/cm. This is notably lower than the median for 49 Anoka County streams of 0.420 mS/cm. Specific conductivity was lower during storms (baseflow median 0.319 mS/cm, stormflow median 0.240 mS/cm), suggesting that stormwater runoff contains fewer dissolved pollutants than the surficial water table that feeds the river during baseflow. High baseflow specific conductivity has been observed in many other area streams too. This has been studied extensively leading to the determination that the largest cause is road salts that have infiltrated into the shallow aquifer.

Specific conductivity during baseflow and storm conditions. Orange diamonds are historical data from previous years and black circles are 2018 readings. Box plots show the median (middle line), 25th and 75th percentile (ends of box), and 10th and 90th percentiles (floating outer lines).

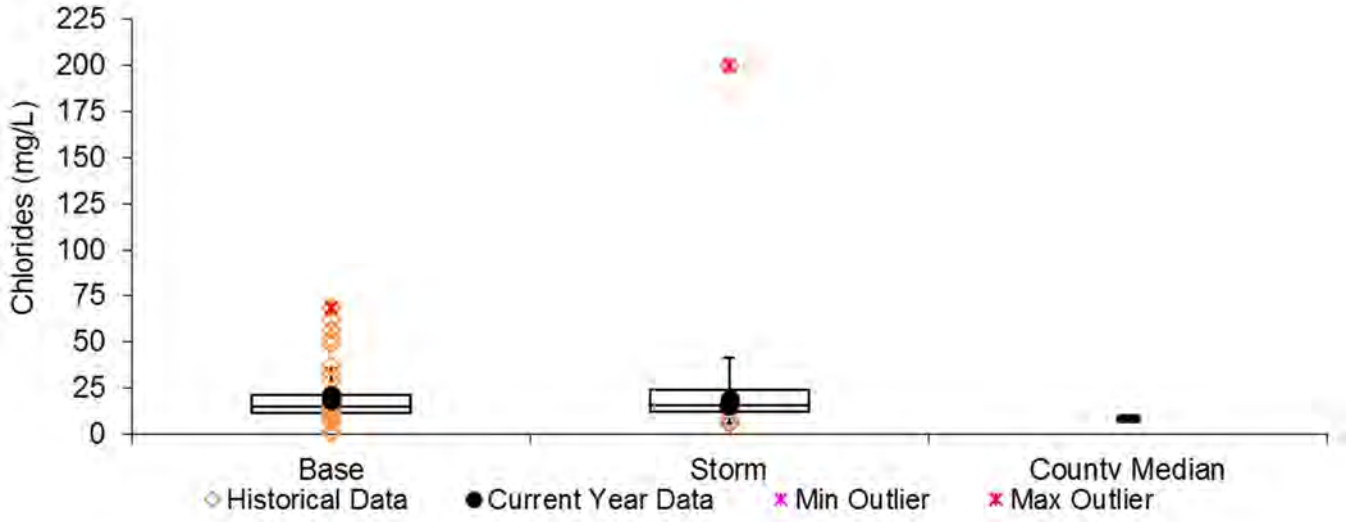


Chlorides

Chlorides are the measure of chloride salts, the most common of which are road de-icing chemicals and those used in water softening. Chlorides can also be present in other pollutant types, such as wastewater. These pollutants are of greatest concern because of the effect they can have on the stream's biological community. Specific Conductivity data, reported above, is partially a reflection of chlorides with higher specific conductivity corresponding to higher chlorides, generally.

Chlorides in the West Branch of the Sunrise River are higher than the median for Anoka county. This year median chlorides were 21.0 and 15.9 mg/L during base and stormflows, respectively, well below the state standard of 230 mg/L. This mirrors the pattern seen in specific conductivity of higher readings during baseflow and further supports the finding that road salts seeping into the shallow aquifer is a primary cause of higher baseflow chloride and high specific conductivity readings.

Chlorides during baseflow and storm conditions. Orange diamonds are historical data from previous years and black circles are 2018 readings. Box plots show the median (middle line), 25th and 75th percentile (ends of box), and 10th and 90th percentiles (floating outer lines).



Turbidity and Total Suspended Solids (TSS)

Turbidity and total suspended solids (TSS) are two different measurements of solid material suspended in the water. Turbidity is measured by refraction of a light beam passed through a water sample. It is most sensitive to large particles. Total suspended solids are measured by filtering solids from a water sample and weighing the filtered material. The amount of suspended material is important because it effects transparency and aquatic life, and because many other pollutants are attached to particles. Many stormwater treatment practices such as street sweeping, sumps, and stormwater settling ponds target sediment and attached pollutants.

It is important to note that suspended solids can come from sources within the river itself or outside of the river from the contributing watershed. Sources from the watershed include soil erosion, road sanding, and others. In-stream sources of TSS include riverbank erosion and movement of the river bottom. Finally, algae from the river and upstream lakes contribute to suspended solids.

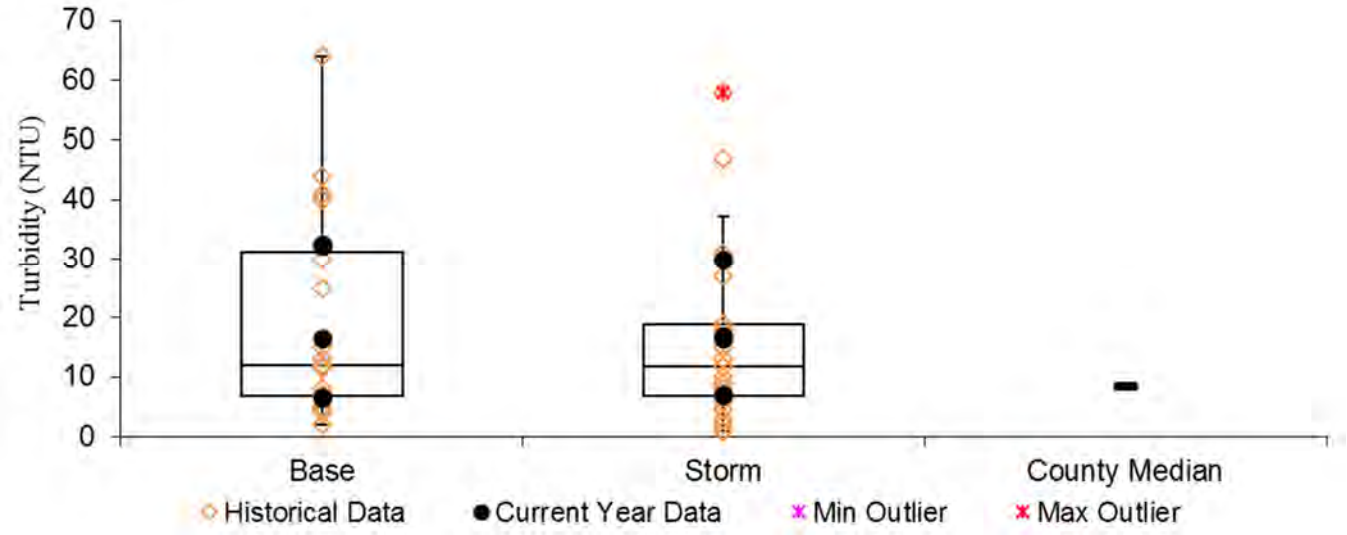
In the past the West Branch of the Sunrise River has been listed as "impaired" for excess turbidity by the MPCA. Their threshold is 25 NTU. If a river exceeds this value on three occasions and at least 10% of all sampling events, it is impaired for turbidity. Based on all years of data, the West Branch of the Sunrise River has exceeded 25 NTU on 13 of 48 sampling occasions (27%). Turbidity decreased markedly in the last year sampled (2015), with the highest turbidity sample being less than half the standard (11.7 NTU). In 2018 turbidity once again often surpassed the standard with 3 of 8 samples (37.5%) above 25 NTU.

The most obvious source of turbidity is algae from upstream lakes. Three of the four immediately upstream lakes are impaired for excess nutrients and high algae. They include Linwood, Martin, and Typo Lakes. The river sampling site is 3 miles downstream from Martin Lake. The area between the lake and sampling site is wide floodplain fringe and forests with little human impact that wouldn't be expected to add much sediment to the river. Therefore, efforts to reduce suspended material in the river should focus on the upstream lakes. It is also worth noting that this section of the river has unconsolidated bottom material which can re-suspend and contribute to turbidity.

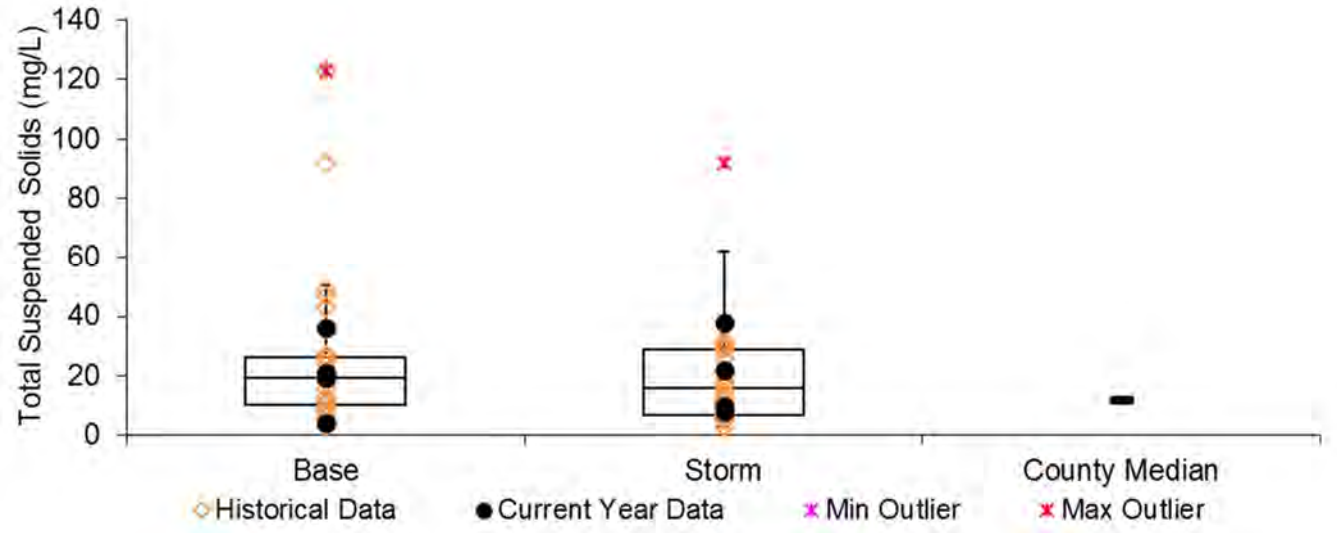
Total suspended solids in the West Branch of the Sunrise River frequently exceed the regional standard. The standard is no more than 10% of samples exceeding 30 mg/L during April 1-September 30. In 2018 the standard was exceeded on 2 of 6 sampling occasions during that period (33%), and over all years monitored the West Branch exceeded the standard on 18% of sampling occasions (7 of 39). The exceedance of the TSS standard suggests that it may be more than algae driving high turbidity and TSS readings as TSS does not reflect algae presence as much as turbidity does. However, it is still likely that the upstream impaired lakes are a leading cause

of high TSS in the river due to both algae and abundant common carp disturbing the lake bottom sediments. Additionally, the unconsolidated river bottom likely contributes to high TSS, especially during times of higher flow.

Turbidity during baseflow and storm conditions Orange diamonds are historical data from previous years and black circles are 2018 readings. Box plots show the median (middle line), 25th and 75th percentile (ends of box), and 10th and 90th percentiles (floating outer lines).



Total suspended solids during baseflow and storm conditions Orange diamonds are historical data from previous years and black circles are 2018 readings. Box plots show the median (middle line), 25th and 75th percentile (ends of box), and 10th and 90th percentiles (floating outer lines).



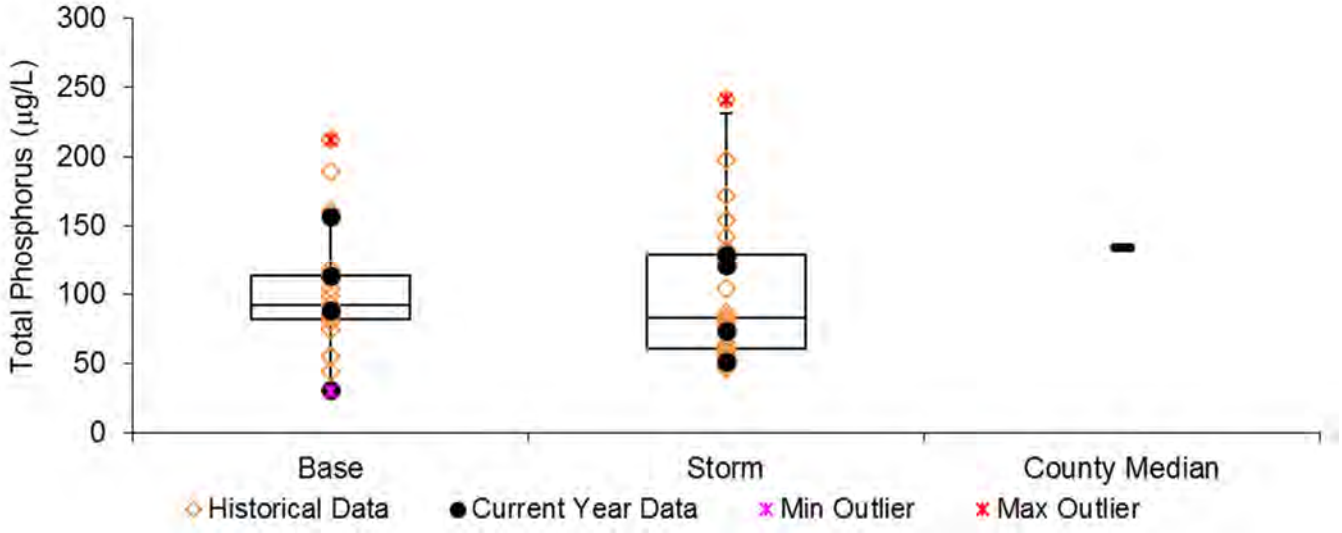
Total Phosphorus

The nutrient phosphorus is one of the most common pollutants in our region, and can be associated with urban runoff, agricultural runoff, wastewater, and many other sources. Total phosphorus (TP) in the West Branch of the Sunrise River often exceeds the state standard of 100 µg/L. In 2018 this level was exceeded on 4 of 8 sampling occasions representing both storm and baseflow conditions. The median phosphorus concentration in the West Branch of the Sunrise River across all years monitored is 88.0 µg/L, and in 2018 was 101.5 µg/L. Over all years sampled 21 of 48 samples have exceeded the standard. There is not a large difference between storm and base

flow median or average total phosphorus at this site (medians 94 µg/L and 97.8 µg/L, average 97.5 µg/L and 101.5 µg/L, respectively).

These phosphorus levels are common for the area. In the case of the West Branch of the Sunrise River phosphorus levels are, at least in part, reflective of conditions of Martin Lake about 3 miles upstream from the sampling site. Martin Lake is impaired for excess phosphorus, with a summertime average of 93.4 µg/L during the last 10 years. Water quality improvements to Martin Lake will benefit the river downstream. Recent upstream projects including carp barriers, carp harvests, and stormwater retrofits coincide with improved conditions in upstream lakes, but those benefits are not yet apparent in the West Branch of the Sunrise River.

Total phosphorus during baseflow and storm conditions. Orange diamonds are historical data from previous years and black circles are 2018 readings. Box plots show the median (middle line), 25th and 75th percentile (ends of box), and 10th and 90th percentiles (floating outer lines).

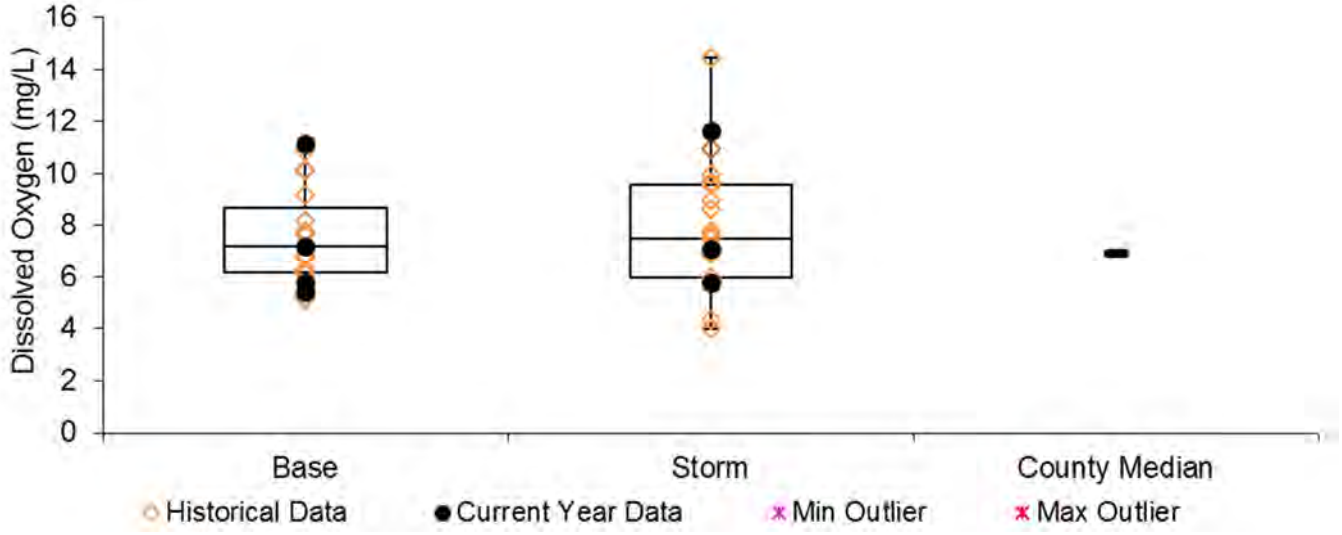


Dissolved Oxygen

Dissolved oxygen is necessary for aquatic life, including fish. Organic pollution causes oxygen consumption when it decomposes. If oxygen levels fall below 5 mg/L aquatic life begins to suffer, therefore the state water quality standard is a daily minimum of 5 mg/L. The stream is impaired if 10% of observations are below this level in the last 10 years. Dissolved oxygen levels are typically lowest in the early morning because of decomposition consuming oxygen at night without offsetting oxygen production by photosynthesis.

For the West Branch of the Sunrise River there are two datasets to consider. First, spot measurements were taken with the other water quality monitoring described in this report. Dissolved oxygen has been found at less than 5 mg/L on three different occasions. All were during storm events, occurring in 2003, 2012 and 2015. In 2018 there were no instances of DO dipping below 5 mg/L but sampling did not occur in early morning. Secondly, MPCA took around-the-clock DO measurements for eight days in 2012. They found DO dipped below 5 mg/L every morning. The river has been designated as impaired for poor fish and invertebrate communities although it is not listed as impaired for DO.

Dissolved oxygen results during baseflow and storm conditions Orange diamonds are historical data from previous years and black circles are 2018 readings. Box plots show the median (middle line), 25th and 75th percentile (ends of box), and 10th and 90th percentiles (floating outer lines).

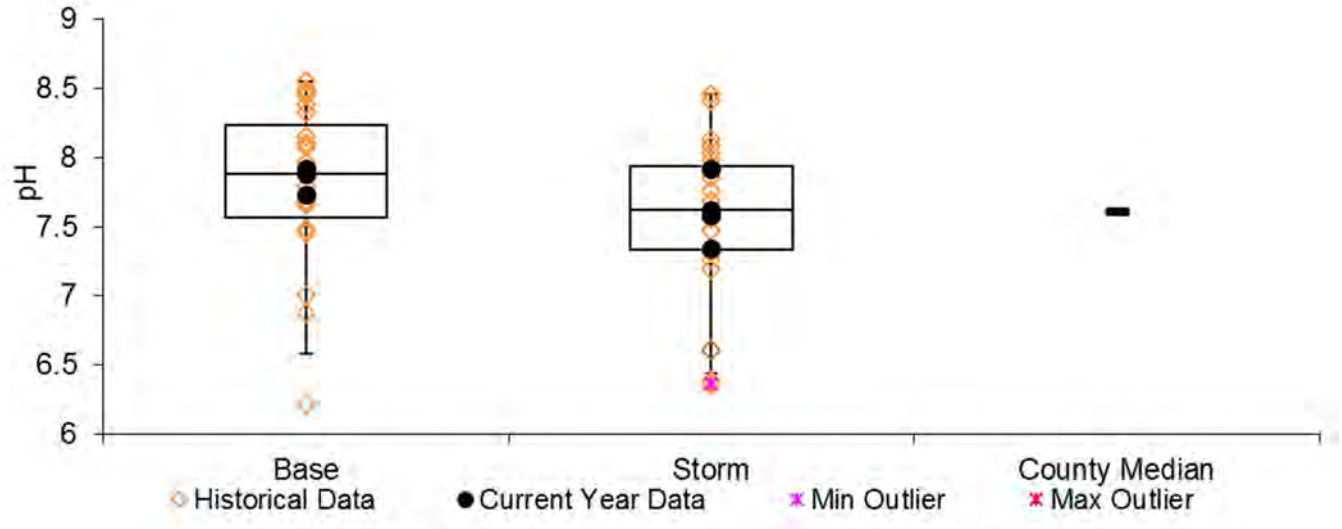


pH

pH refers to the acidity of the water. The MPCA's water quality standard is for pH to be between 6.5 and 8.5. The West Branch of the Sunrise River is regularly within this range (see figure below). It often has slightly higher pH than other streams because of the impact of algal production in upstream lakes.

It is interesting to note that pH is generally lower during storms than during baseflow. This is because the pH of rain is typically lower (more acidic). While acid rain is a longstanding problem, its effect on this aquatic system is small. In 2018 there was one occurrence of sub-standard pH in October when pH was 5.66. This is not concerning. At all other times pH was at the high end of the normal range (7.35 to 7.92).

pH results during baseflow and storm conditions Orange diamonds are historical data from previous years and black circles are 2018 readings. Box plots show the median (middle line), 25th and 75th percentile (ends of box), and 10th and 90th percentiles (floating outer lines).



Recommendations

Water quality in the West Branch of the Sunrise River is lower than ideal. A Total Maximum Daily Load (TMDL) study was completed in 2013 to determine impairments of this river. The study found that aquatic life in this river was struggling with turbidity identified as the main stressor. Low dissolved oxygen may also be a stressor contributing to aquatic life impairment. At this time, it appears that many of the issues in the river would be best addressed with water quality improvement projects targeted at upstream lakes. These lakes are likely the main sources of nutrients and suspended solids in this river.

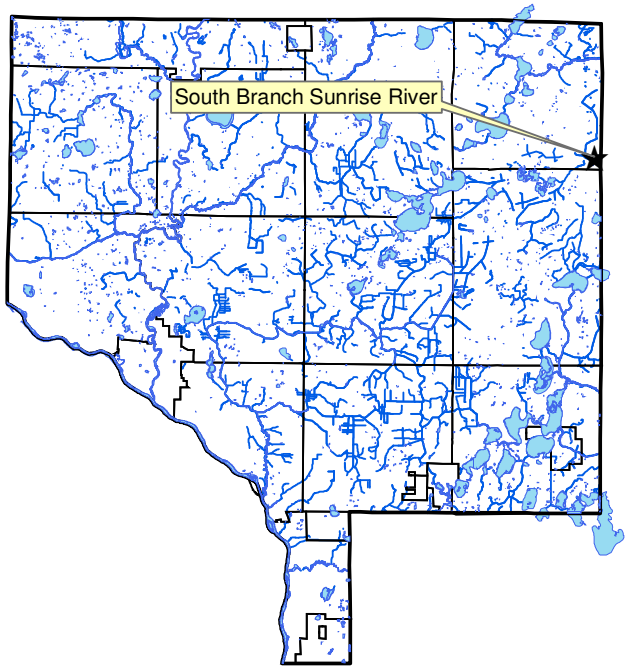
Dissolved oxygen is not low in the lakes however, and low nighttime levels in the river may be related to decomposition occurring in the large wetland floodplain. With regards to water quality improvements in the lakes there are a number of ongoing projects including carp removals in Typo and Linwood lakes. For more information, see the Martin and Typo Lake Carp Removal section.

SOUTH BRANCH SUNRISE RIVER

at Hornsby Street, Linwood Township

STORET SiteID = S005-640

Years Monitored
2012, 2015, 2018



Background

This monitoring site is the bottom of this watershed in Anoka County, at the closest accessible point to the Anoka-Chisago County boundary. Upstream, this river drains from Coon Lake and through the Carlos Avery Wildlife Management Area. The Sunrise River Watershed Management Organization monitors this site because it is at the bottom of their jurisdictional area.

The MPCA has designated this site as "impaired" due to low dissolved oxygen. A TMDL study was completed in 2013. Since that time MPCA has determined that this stream's low oxygen is primarily from decomposition in the vast upstream Carlos Avery Wildlife Management Area wetlands. Because of this, it is not a high priority for corrective action or future monitoring.

Methods

Water quality was monitored by grab samples and a portable meter. Eight water quality samples were taken each year; half during baseflow and half following storms. Storms were generally defined as one-inch or more of rainfall in 24 hours or a significant snowmelt event combined with rainfall. Parameters tested with portable meters included pH, specific conductivity, turbidity, temperature, salinity, and dissolved oxygen. Parameters tested by water samples sent to a state-certified lab included total phosphorus, chlorides, and total suspended solids. Water level was monitored continuously in the open water season. A rating curve has not been developed at this site so flows and thus loading cannot be calculated.

Summarized Results

Water quality in the South Branch of the Sunrise River has several problems which appear linked. The river has already been designated as impaired by the MN Pollution Control Agency for low dissolved oxygen. Our monitoring also found high turbidity and phosphorus during periods with low oxygen.

High turbidity and phosphorus coincide with low oxygen at baseflow. At times the water also has a reddish color, consistent with iron reduction during low oxygen conditions. Iron reduction is not harmful, but simply serves as a visible indicator of low oxygen conditions when phosphorus might also be released from soils through chemical processes.

Low oxygen is likely due to decomposition in upstream wetlands, which might be described as "natural." Understanding this, corrective action is a low priority. The MN Pollution Control Agency has elected not to monitor the stream in 2019-2020 for this reason. Other entities may similarly reduce activity.

Summarized water quality monitoring findings and management implications include:

- Specific conductivity was below the county median of 0.420 mS/cm. The median specific conductivity in 2018 was 0.284 mS/cm. The median specific conductivity for all years at this site is 0.277 mS/cm.
- Chloride was measured at this site in 2012 and 2018. In 2018 the median chloride concentration was 12.8 mg/L. The median for all years at this site is 10.1 mg/L and the countywide median is 13.29 mg/L.

- Phosphorus was high and comparable to 2012 values after being relatively low in 2015. Average phosphorus this year was 131.1 µg/L after dipping to 90 µg/L in 2015. Phosphorus exceeded the state standard of ≤100 µg/L on half of all sampling occasions, with a maximum of 277 µg/L occurring on July 12th during baseflow conditions.
- Suspended solids and turbidity averaged 11.6 mg/L and 18.3 NTU, respectively in 2018. Turbidity was high during midsummer and low during spring and fall, regardless of storm or baseflow conditions. Suspended solids (TSS) also peaked in summer (20.5 mg/L on July 12) but was not as consistently high as turbidity during midsummer. Twenty measurements are required to determine if a stream fails to meet state water quality standards. This year we reached 23 measurements and at this time the stream was above the turbidity standard (25 NTU) on 13 of 23 occasions. The stream has not, on the other hand, exceeded the TSS standard (30 mg/L) at any time.
- pH was within the range considered normal and healthy for streams in this area. pH was similar during both storm and base flows though the highest pH, 8.21, occurred during baseflow conditions.
- Dissolved oxygen was low, as expected. Six out of eight reading recorded DO levels below the state standard of 5 mg/L. This river reach is already listed by the State as "impaired" for low dissolved oxygen. Interestingly, the samples taken in October had much higher DO levels (8.29 and 9.25 mg/L). These are the highest DO measurements on record. As colder water can hold more oxygen, temperature may be most responsible for this positive result.

Management Summary:

Water quality in the South Branch of the Sunrise River has several problems which appear linked. The river has already been designated as "impaired" by the MN Pollution Control Agency for low dissolved oxygen. Our monitoring also found high turbidity and phosphorus during periods with low oxygen.

The issues of low oxygen, turbidity, and phosphorus appear to be related. High turbidity and phosphorus coincide with low oxygen at baseflow. At times the water also has a reddish color, consistent with iron reduction during low oxygen. Iron reduction is not harmful, but simply serves as a visible indicator of low oxygen conditions when phosphorus might also be released form soils through chemical processes.

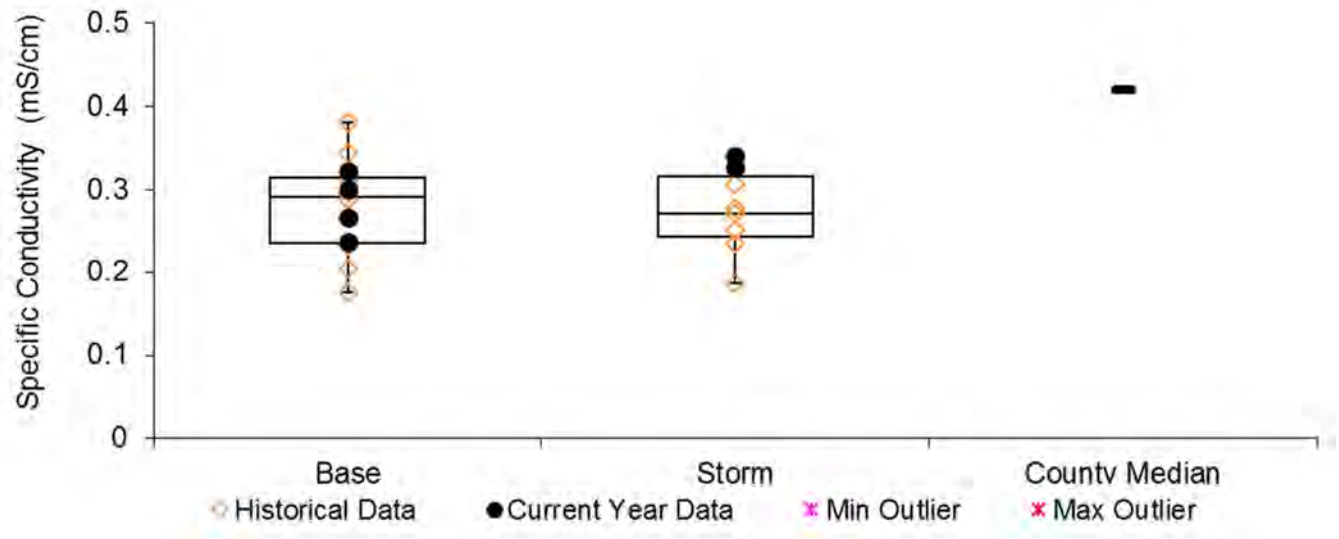
Results and Discussion

Specific Conductivity

Specific conductivity measures dissolved pollutants. Dissolved pollutant sources include urban road runoff, industrial chemicals, and others. Specific conductivity is the broadest measure of dissolved pollutants we use. It measures electrical conductivity of water standardized for temperature; pure water with no dissolved constituents has zero specific conductivity.

Specific conductivity is low in the South branch of the Sunrise River (2018 median 0.284 mS/cm). Specific conductivity was generally lower during storms, suggesting that stormwater runoff contains fewer dissolved pollutants than the surficial water table that feeds the river during baseflow. Higher specific conductivity during baseflow suggests that road deicing salts have infiltrated to the shallow groundwater that feeds the stream during baseflow (see graph on next page).

Specific conductivity during baseflow and storm conditions Orange diamonds are historical data from previous years and black circles are 2018 readings. Box plots show the median (middle line), 25th and 75th percentile (ends of box), and 10th and 90th percentiles (floating outer lines).

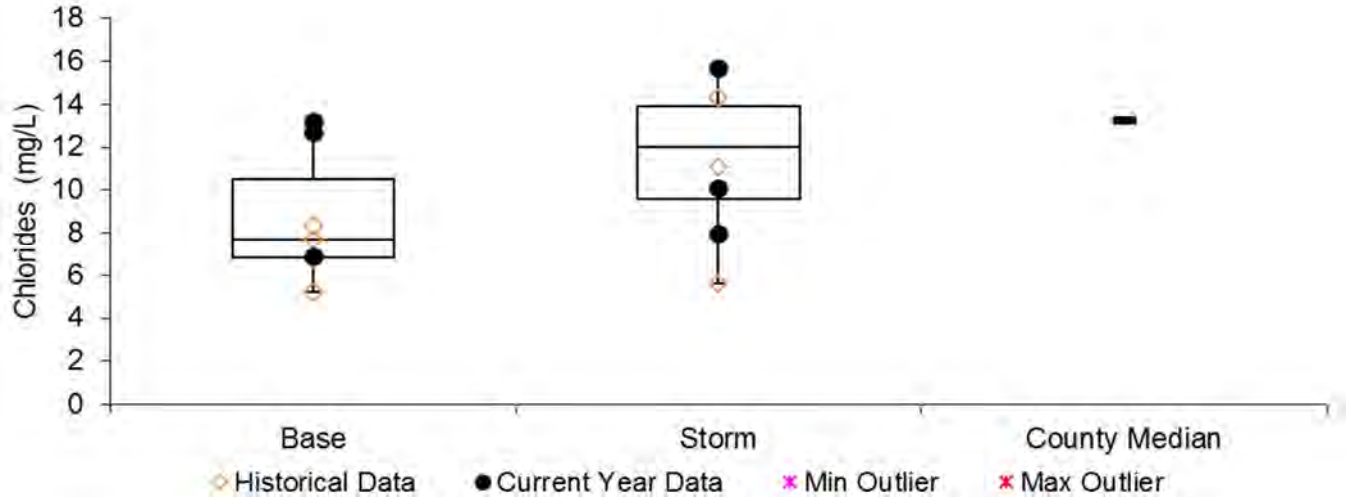


Chlorides

Chlorides tests for chloride salts, the most common of which are road de-icing chemicals. Chlorides can also be present in other pollutant types, such as wastewater. These pollutants are of greatest concern because of the effect they can have on the stream's biological community.

Chlorides have been monitored at this site in 2012 and again this year. The levels observed are much lower than the MPCA's chronic standard for aquatic life of 230 mg/L. Chlorides ranged from 6.9 to 15.7 mg/L this year and were highest in the spring and during storms. The relatively low chlorides are likely because of low road densities (and therefore deicing salt use) in the watershed. However, the higher levels in the spring may relate to winter salt use. Because of large expanses of public natural areas in the watershed, future increases in chlorides should be minimal.

Chlorides during baseflow and storm conditions Orange diamonds are historical data from previous years and black circles are 2018 readings. Box plots show the median (middle line), 25th and 75th percentile (ends of box), and 10th and 90th percentiles (floating outer lines).

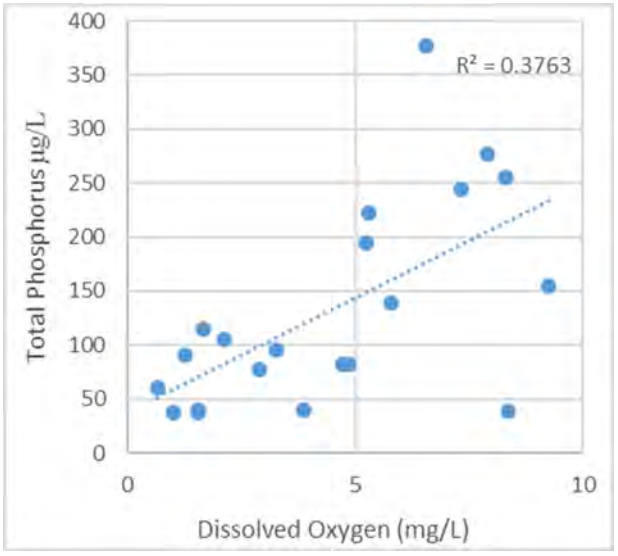


Total Phosphorus

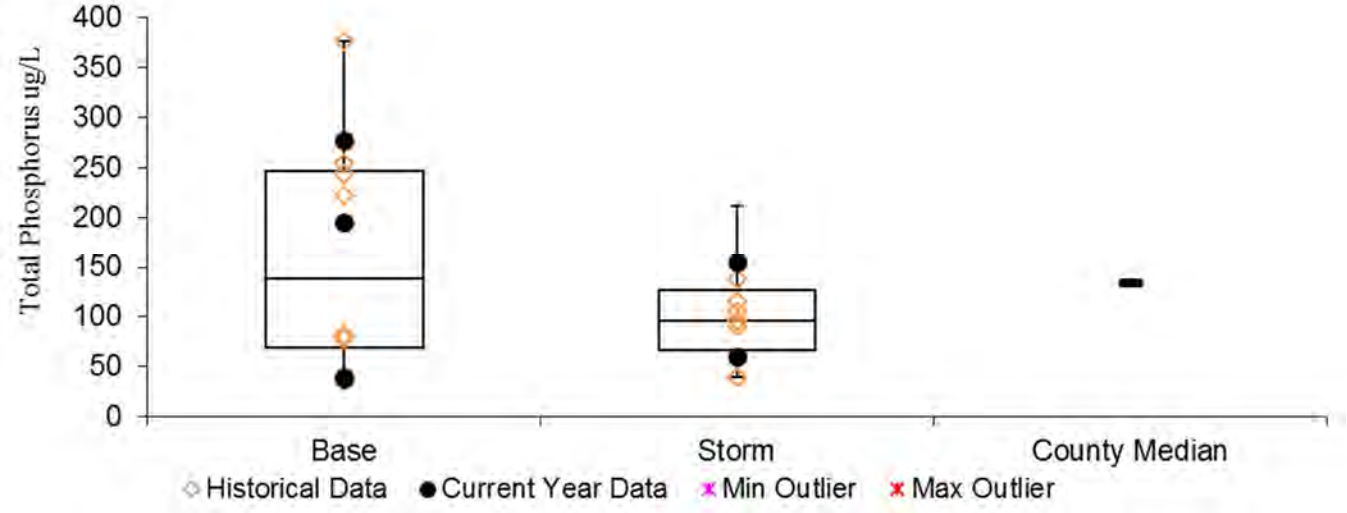
Total phosphorus (TP) in 2018 was higher during baseflow (average 137.5 µg/L) and lower during storms (average 124.8 µg/L). This is unusual as most streams experience high phosphorus as a result of storm runoff. As described earlier, we have hypothesized that an important source of phosphorus and turbidity in this river is native soils and low oxygen. During baseflow conditions the water is occasionally red tinted, dissolved oxygen is low, and phosphorus is high. When oxygen is low, the iron in soils becomes reduced. Reduced iron is less able to bind phosphorus. Dissolved oxygen and total phosphorus in the stream are loosely correlated (R^2=0.38) (see graph to right).

A management implication of these findings is that if dissolved oxygen is kept higher, then turbidity and phosphorus should fall as well. However, there will likely be challenges to achieving higher oxygen. Decomposition within the vast wetlands and pools of the Carlos Avery Wildlife Management Area upstream is likely the cause of low oxygen and it is not desirable to change the natural processes in these wetlands.

Total phosphorus as a function of dissolved oxygen showing that higher phosphorus occurs with lower dissolved oxygen.



Total phosphorus during baseflow and storm conditions Orange diamonds are historical data from previous years and black circles are 2018 readings. Box plots show the median (middle line), 25th and 75th percentile (ends of box), and 10th and 90th percentiles (floating outer lines).



Turbidity and Total Suspended Solids (TSS)

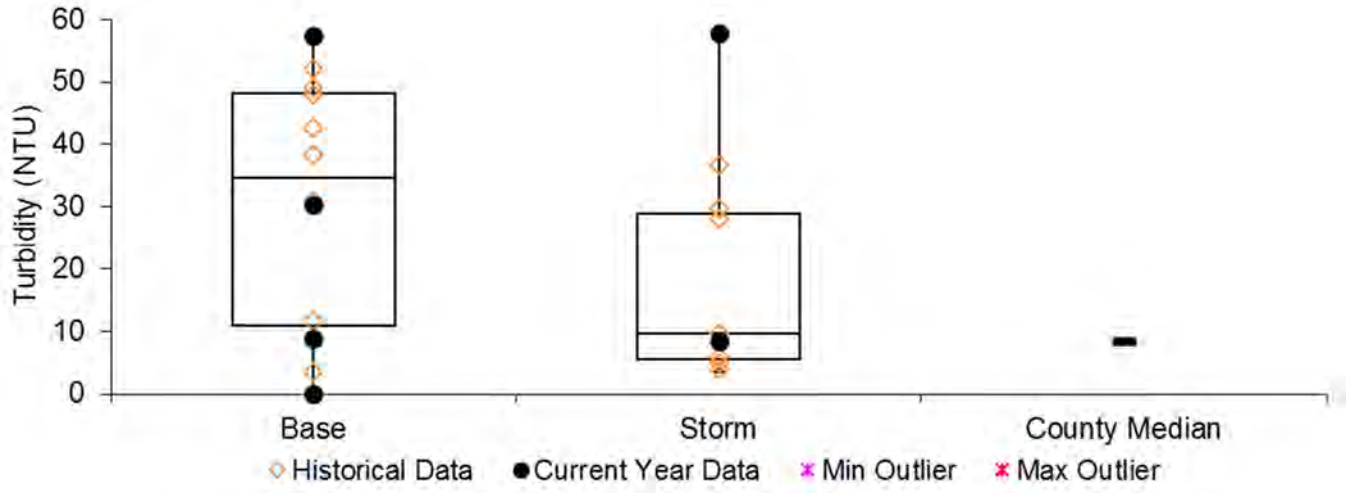
Turbidity and total suspended solids (TSS) are two different measurements of solid material suspended in the water. Turbidity is measured by refraction of a light beam passed through a water sample. It is most sensitive to large particles. Total suspended solids is measured by filtering solids from a water sample and weighing the filtered material. The amount of suspended material is important because it affects transparency and aquatic life, and because many other pollutants are attached to particles. Many stormwater treatment practices such as street sweeping, sumps, and stormwater settling ponds target sediment and attached pollutants.

Turbidity was similar during baseflow and stormflow samples, averaging 24.13 NTU and 24.43 NTU respectively. The state turbidity standard is no more than 10% of samples exceeding 25 NTU from April 1-September 30. In order to establish a standard impairment there needs to be at least 20 readings taken. So far, 19 readings have been taken during the required period and, of those, 11 exceeded the standard. As a result the South Branch of the Sunrise River could be designated as "impaired" for turbidity when more data exists.

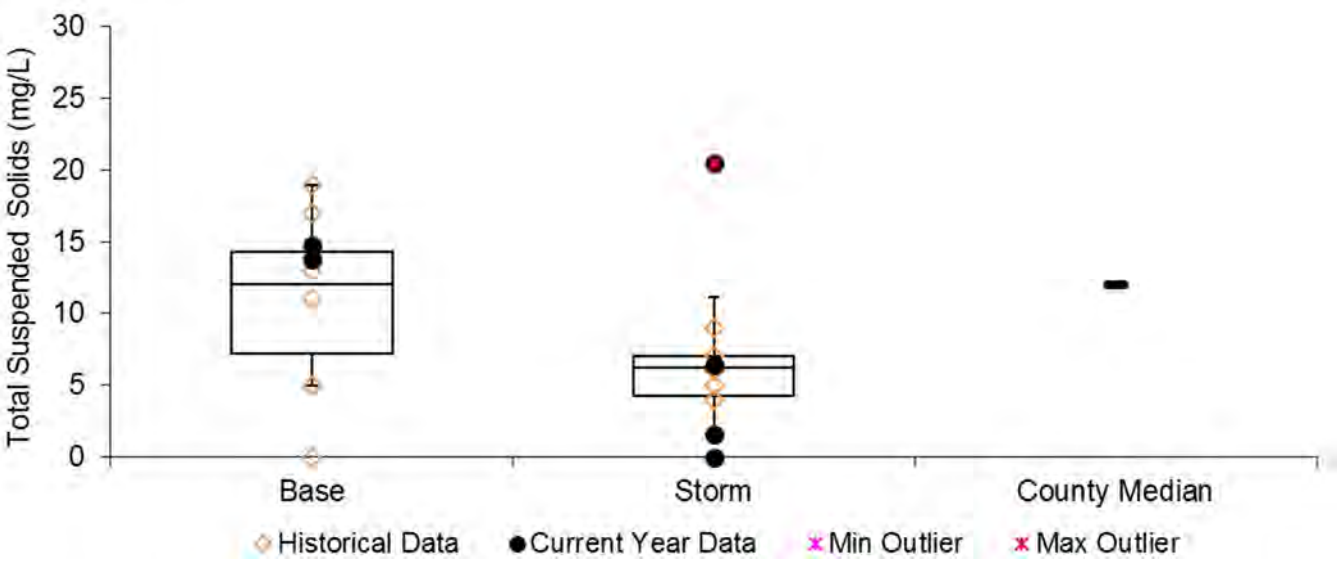
TSS concentrations were higher during baseflow than stormflow samples, averaging 13.1 mg/L and 10.2 mg/L, respectively. These concentrations remain below the state standard of 30 mg/L.

The cause of high turbidity, like high phosphorus, is likely iron-rich native soils in low oxygen conditions. Reduced iron is mobile. Another cause of turbidity may be the nature of the peat soils through which the river flows. Peat-soils when dried can be susceptible to crumbling easily. These snowflake-like particles stay suspended in the water column.

Turbidity during baseflow and storm conditions. Orange diamonds are historical data from previous years and black circles are 2018 readings. Box plots show the median (middle line), 25th and 75th percentile (ends of box), and 10th and 90th percentiles (floating outer lines).



Total suspended solids during baseflow and storm conditions. Orange Diamonds are historical data from previous years and black circles are 2018 readings. Box plots show the median (middle line), 25th and 75th percentile (ends of box), and 10th and 90th percentiles (floating outer lines).

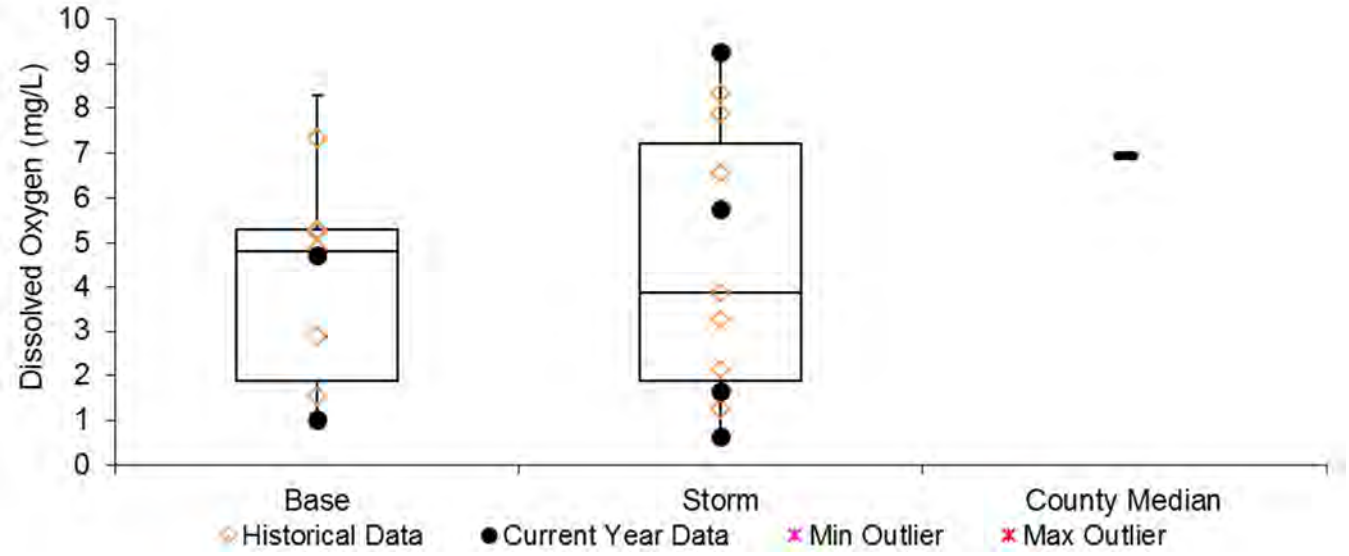


Dissolved Oxygen (DO)

Dissolved oxygen is necessary for aquatic life, including fish. Organic pollution consumes oxygen when it decomposes. If oxygen levels fall below 5 mg/L aquatic life begins to suffer, therefore the state water quality standard is a daily minimum of 5 mg/L. The stream is impaired if 10% of observations are below this level in the last 10 years. Dissolved oxygen levels are typically lowest in the early morning because of decomposition consuming oxygen at night without offsetting oxygen productions by photosynthesis.

The South Branch of the Sunrise River is already designated as "impaired" for low dissolved oxygen. In 2018, 5 out of 8 readings were below the state standard. The lowest measurement was 0.65 mg/L during a storm sample while the lowest baseflow reading was 1.01 mg/L. All readings from July through September were below 2.0 mg/L. Decomposition in the vast wetlands and pools of the Carlos Avery Wildlife Management Area upstream are the likely cause of low oxygen. While these very low levels of dissolved oxygen are not conducive to supporting aquatic life in the stream, they are attributed to natural processes.

Dissolved oxygen results during baseflow and storm conditions. Orange diamonds are historical data from previous years and black circles are 2018 readings. Box plots show the median (middle line), 25th and 75th percentile (ends of box), and 10th and 90th percentiles (floating outer lines).

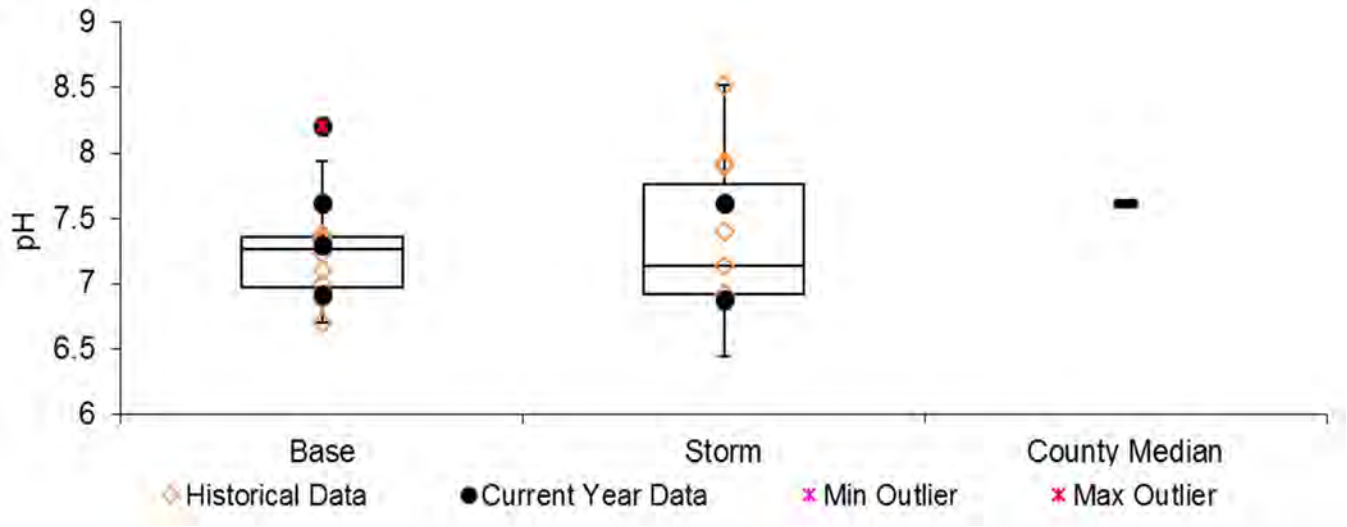


pH

pH refers to the acidity of the water. The MPCA's water quality standard is for pH to be between 6.5 and 8.5.

pH in the South Branch of the Sunrise River is within the acceptable range, however the results between storm and baseflow are the opposite of most streams. In most streams, pH lowers during storms due to the acidity of rainfall. At this river pH was higher during storms, although the variation was not large. During baseflow pH ranged from 6.92-8.21, during storms pH ranged from 6.44-7.62. The reason for this may simply be the small number of samples collected during each condition. A graph of all years of pH data is presented on the next page.

pH results during baseflow and storm conditions. Orange diamonds are historical data from previous years and black circles are 2018 readings. Box plots show the median (middle line), 25th and 75th percentile (ends of box), and 10th and 90th percentiles (floating outer lines).



Recommendations

A Total Maximum Daily Load (TMDL) study was completed in 2013 to determine the causes of impairments of this river. While presently this river's only impairment is dissolved oxygen, we suggest that a focus should also be improving turbidity and total phosphorus. These improvements should be low priorities for managers as the cause is natural decomposition in large upstream wetlands.

Wetland Hydrology

Description: Continuous groundwater level monitoring at a wetland boundary. Countywide, the ACD maintains a network of 23 wetland hydrology monitoring stations.

Purpose: To provide understanding of wetland hydrology, including the impacts of climate and land use. These data aid in delineation of nearby wetlands by documenting hydrologic trends including the timing, frequency, and duration of saturation.

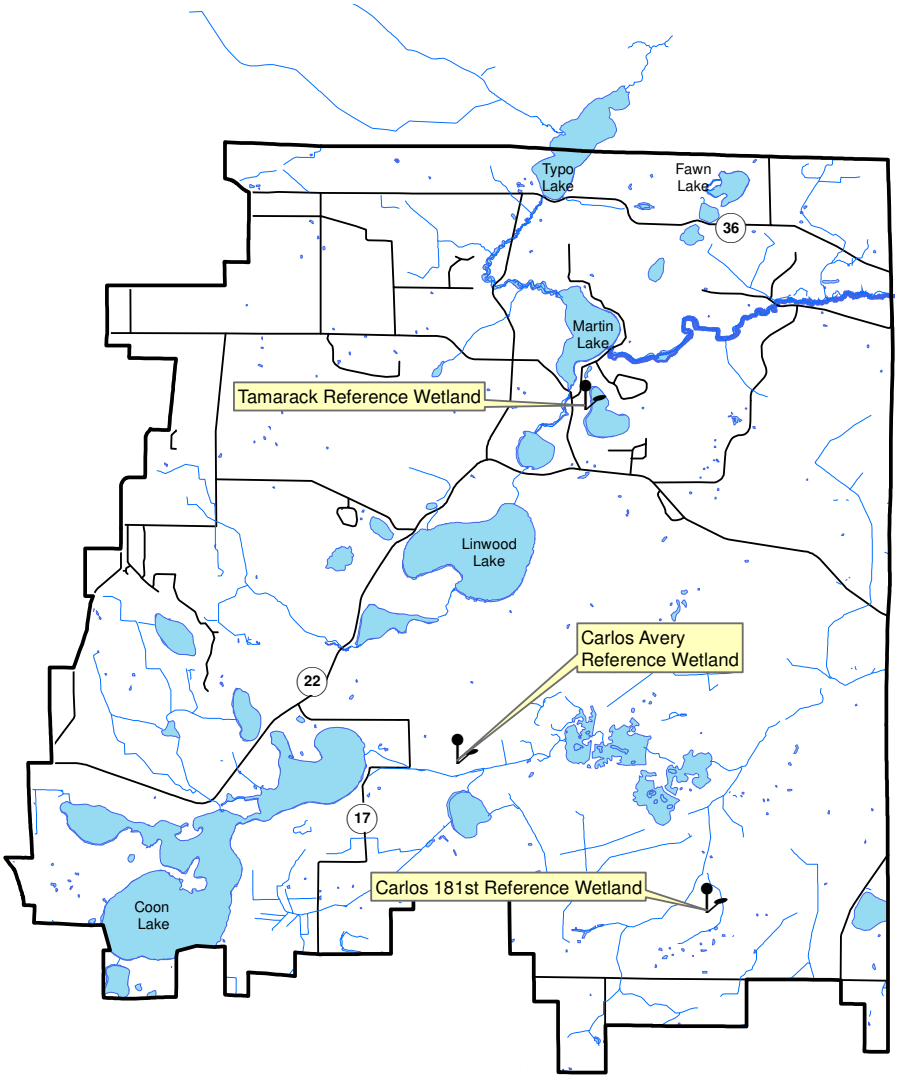
Locations: Carlos Avery Reference Wetland, Carlos Avery Wildlife Management Area, City of Columbus

Carlos 181st Reference Wetland, Carlos Avery Wildlife Management Area, City of Columbus

Tamarack Reference Wetland, Linwood Township

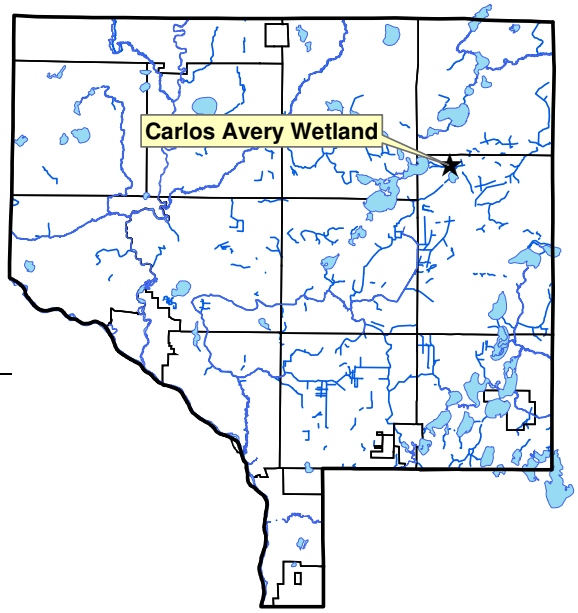
Results: See the following pages.

Sunrise Watershed Wetland Hydrology Monitoring Sites



CARLOS AVERY REFERENCE WETLAND

Carlos Avery Wildlife Management Area, City of Columbus



Site Information

Monitored Since: 1997

Wetland Type: 3

Wetland Size: >300 acres

Isolated Basin? No

Connected to a Ditch? Yes

Soils at Well Location:

Horizon	Depth	Color	Texture	Redox
Oa	0-4	N2/0	Organic	-
Bg	4-25	10yr 5/2	Sandy Loam	25% 10yr 5/6 with organic streaking

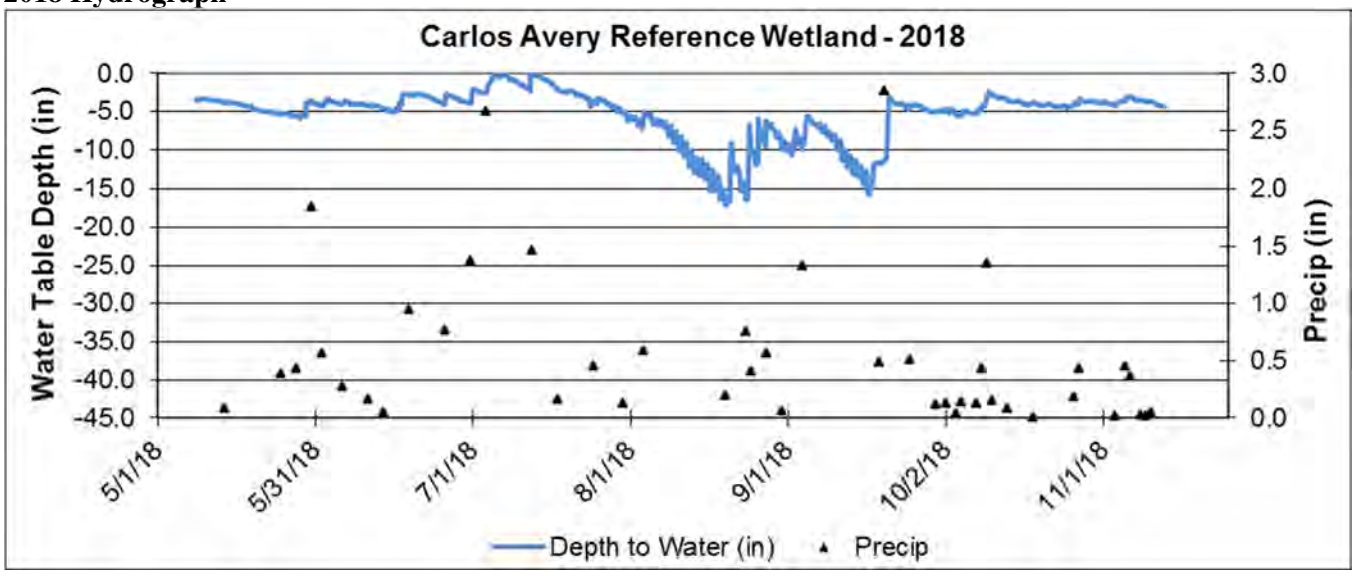
Surrounding Soils: Lino loamy fine sand

Vegetation at Well Location:

Scientific	Common	% Coverage
Phalaris arundinacea	Reed Canary Grass	80
Carex Spp	Sedge undiff.	40
Quercus macrocarpa	Bur Oak	40
Sagitaria latifolia	Broad-leaf Arrowhead	20
Cornus stolonifera	Red-osier Dogwood	20

Other Notes: This is a broad, expansive wetland within a state-owned wildlife management area. Cattails dominate within the wetland.

2018 Hydrograph



CARLOS 181ST REFERENCE WETLAND

Carlos Avery Wildlife Management Area, City of Columbus

Site Information

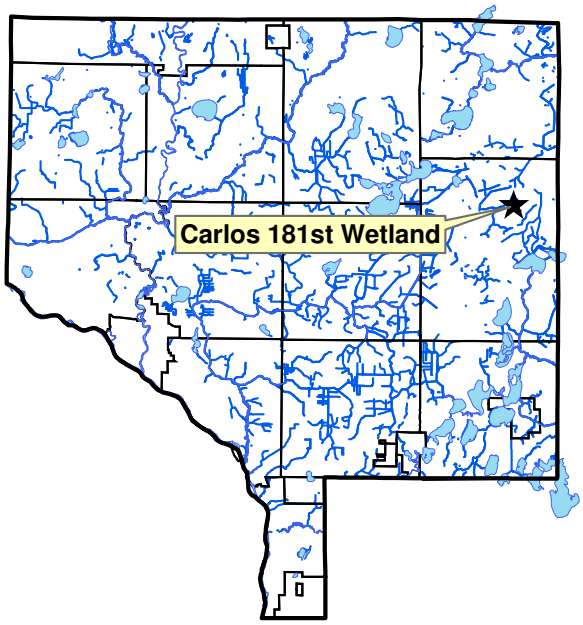
Monitored Since: 2006

Wetland Type: 2-3

Wetland Size: 3.9 acres (approx.)

Isolated Basin? Yes

Connected to a Ditch? Roadside swale only



Soils at Well Location:

Surrounding Soils: Soderville fine sand

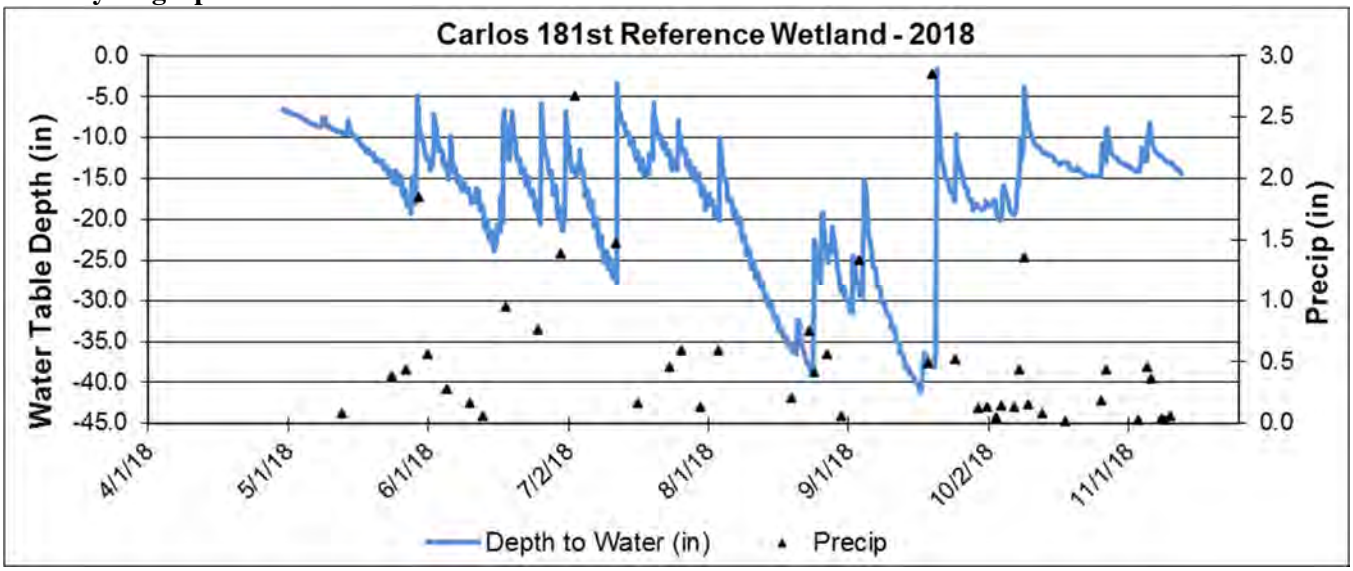
Horizon	Depth	Color	Texture	Redox
Oa	0-3	N2/0	Sapric	-
A	3-10	N2/0	Mucky Fine Sandy Loam	-
Bg1	10-14	10yr 3/1	Fine Sandy Loam	-
Bg2	14-27	5Y 4/2	Fine Sandy Loam	-
Bg3	27-40	5y 4/2	Fine Sandy Loam	-

Vegetation at Well Location:

Scientific	Common	% Coverage
Phalaris arundinacea	Reed Canary Grass	100
Rhamnus frangula (S)	Glossy Buckthorn	40
Ulmus american (S)	American Elm	15
Populus tremulodies (T)	Quaking Aspen	10
Acer saccharum (T)	Silver Maple	10

Other Notes: The site is owned and managed by the MN DNR. Access is from 181st Avenue.

2018 Hydrograph



Wetland Hydrology Monitoring

TAMARACK REFERENCE WETLAND

Martin-Island-Linwood Regional Park, Linwood Township

Site Information

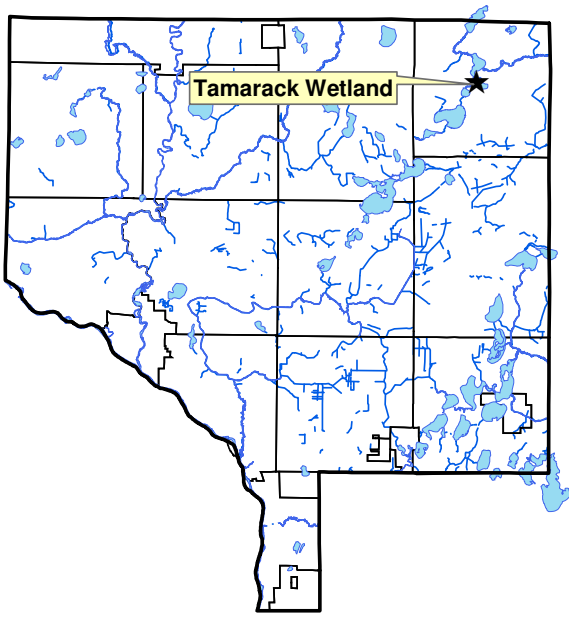
Monitored Since: 1999

Wetland Type: 6

Wetland Size: 1.9 acres (approx.)

Isolated Basin? Yes

Connected to a Ditch? No



Soils at Well Location:

Surrounding Soils:

Horizon	Depth	Color	Texture	Redox
A	0-6	N2/0	Mucky Sandy Loam	-
A2	6-21	10yr 2/1	Sandy Loam	-
AB	21-29	10yr3/2	Sandy Loam	-
Bg	29-40	2.5y5/3	Medium Sand	-

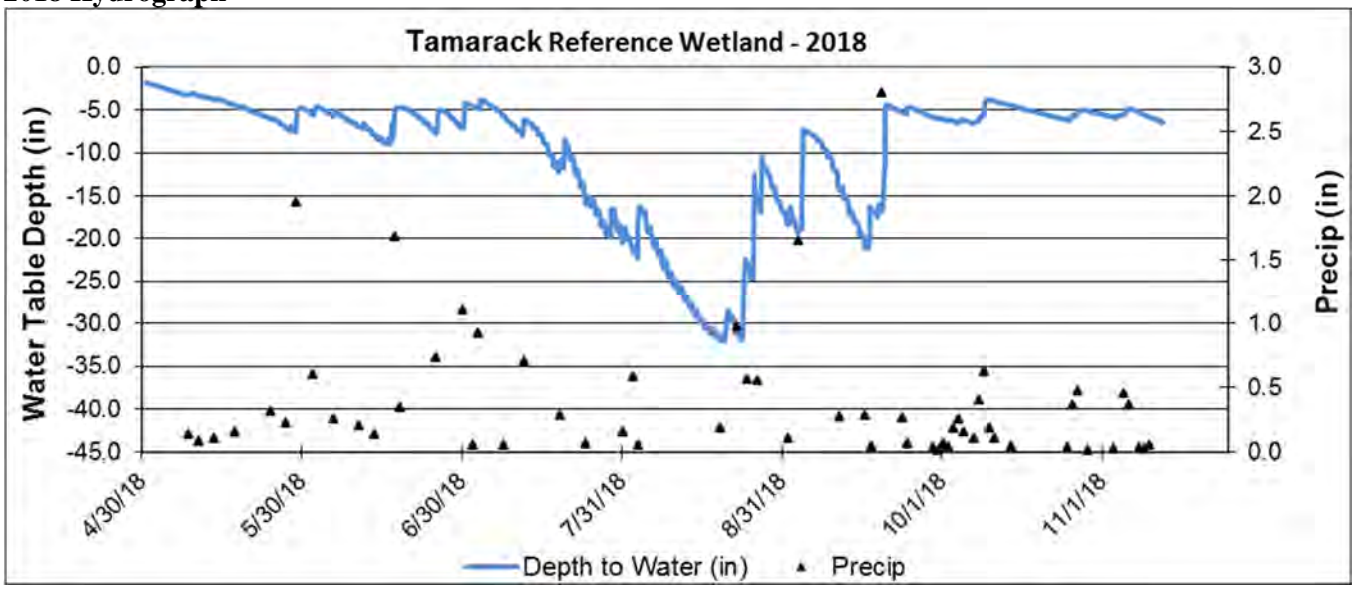
Sandy fine sand

Vegetation at Well Location:

Scientific	Common	% Coverage
Rhamnus frangula	Common Buckthorn	70
Betula alleghaniensis	Yellow Birch	40
Impatiens capensis	Jewelweed	40
Phalaris arundinacea	Reed Canary Grass	40

Other Notes: The site is owned and managed by Anoka County Parks.

2018 Hydrograph



Water Quality Grant Fund

Description: The Sunrise River Watershed Management Organization (SRWMO) offers cost share grants to encourage projects that will benefit lake and stream water quality. These projects include lakeshore restorations, rain gardens, erosion correction, and others. These grants, administered by the ACD, offer cost sharing of the materials needed for a project. The landowner is responsible for some expenses. The ACD assists interested landowners with design, materials acquisition, installation, and maintenance.

Purpose: To improve water quality in area lakes, streams, and rivers.

Locations: Throughout the watershed.

Results: Projects reported in the year they are installed.

SRWMO Cost Share Fund Summary

2005 SRWMO Contribution	+	$1,000.00
2006 SRWMO Contribution	+	$1,000.00
2006 Expense - Coon Lake, Rogers Property Project	-	$ 570.57
2007 – no expenses or contributions		$ 0.00
2008 SRWMO Contribution	+	$2,000.00
2008 Expense - Martin Lake, Moos Property Project	-	$1,091.26
2009 SRWMO Contribution	+	$2,000.00
2010 SRWMO Contribution	+	$1,840.00
2011 SRWMO Contribution	+	$2,000.00
2012 SRWMO Contribution	+	$2,000.00
2012 Expense – Linwood Lake, Gustafson Property Project	-	$ 29.43
2012 Expense – Transfer to Martin-Typo Lakes Carp Barriers	-	$4,300.00
2013 – no expenses or contributions		$ 0.00
2014 SRWMO Contribution	+	$2,000.00
2015 SRWMO Contribution		$ 0.00
2016 SRWMO Contribution		$ 0.00
2016 Expense – Voss Rain Garden	-	$1,229.31
2017 Expense – Voss Rain Garden Plants	-	$ 654.50
2017 SRWMO Contribution	+	$1,000.00
2018 Surplus Funds Returned from ACD to SRWMO Gen Fund	-	$2,000.00
2018 Expense – Gunnink Coon Lakeshore	-	$1,148.40
Fund Balance		**$3,816.53**

Gunnink Lakeshore Restoration

Description: A Coon Lake lakeshore restoration was completed on private property using SRWMO water quality cost share funds in 2018.

Purpose: To stabilize minor shoreline erosion, filter runoff to the lake and provide shoreline habitat.

Location: Coon Lake, 3573 Interlachen Drive NE

Results: 102 linear feet of native plant shoreline buffer totaling 1,276 square feet was installed. This included 60-feet of biology at the water's edge to stop minor existing shoreline erosion. The Anoka Conservation District provided the design, permitting assistance and construction oversight. Construction was done by Shoreline Landscaping Inc.

Finances: Expenses

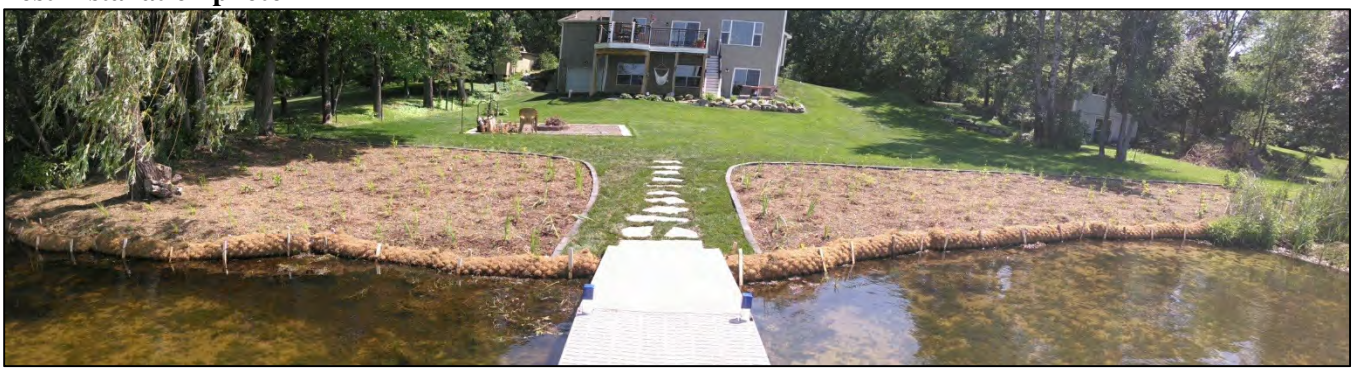
$730.00	Design, permitting and planning assistance
$8,009.30	Installation by contractor
$8,739.30	TOTAL

Funding

$1,148.00	Cost share grant through ACD using SRWMO funds
$7,591.50	Landowner
$8,739.30	TOTAL

Pre-project photo

Post-installation photo



Martin and Typo Lake Carp Removal Project

Description: Martin and Typo Lakes fail to meet state water quality standards due to excessive phosphorus, which fuels algae blooms. As a result, the lakes are often strongly green or brown and the game fishery is depressed. Carp are a major cause of poor water quality in these lakes, diminishing their value for swimming, boating, and fishing. Efforts to manage and reduce carp are being undertaken to improve both water quality and the fishery.

In 2015-2016 carp barriers were installed at four strategic locations near the inlets and outlets of both lakes to prevent carp migration, overwintering, and spawning. In 2017-2019 carp are being removed. Additionally, a detailed assessment of the carp population, age structure, and spawning history is being completed. A long-term management plan for carp will be prepared in 2019.

Purpose: To improve water quality in Typo and Martin Lakes, as well as downstream waterways.

Location: Typo and Martin Lakes

Results: In 2018 the following work was completed:

- Radio telemetry monitoring of carp in Typo and Martin Lakes.
- 209 carp heads were preserved for aging during winter 2017-18. Fish age is determined by internal balance organs called otoliths. The population age structure reveals the spawning history.
- 3,366 carp were removed from Martin Lake and 3,552 carp were removed from Typo Lake

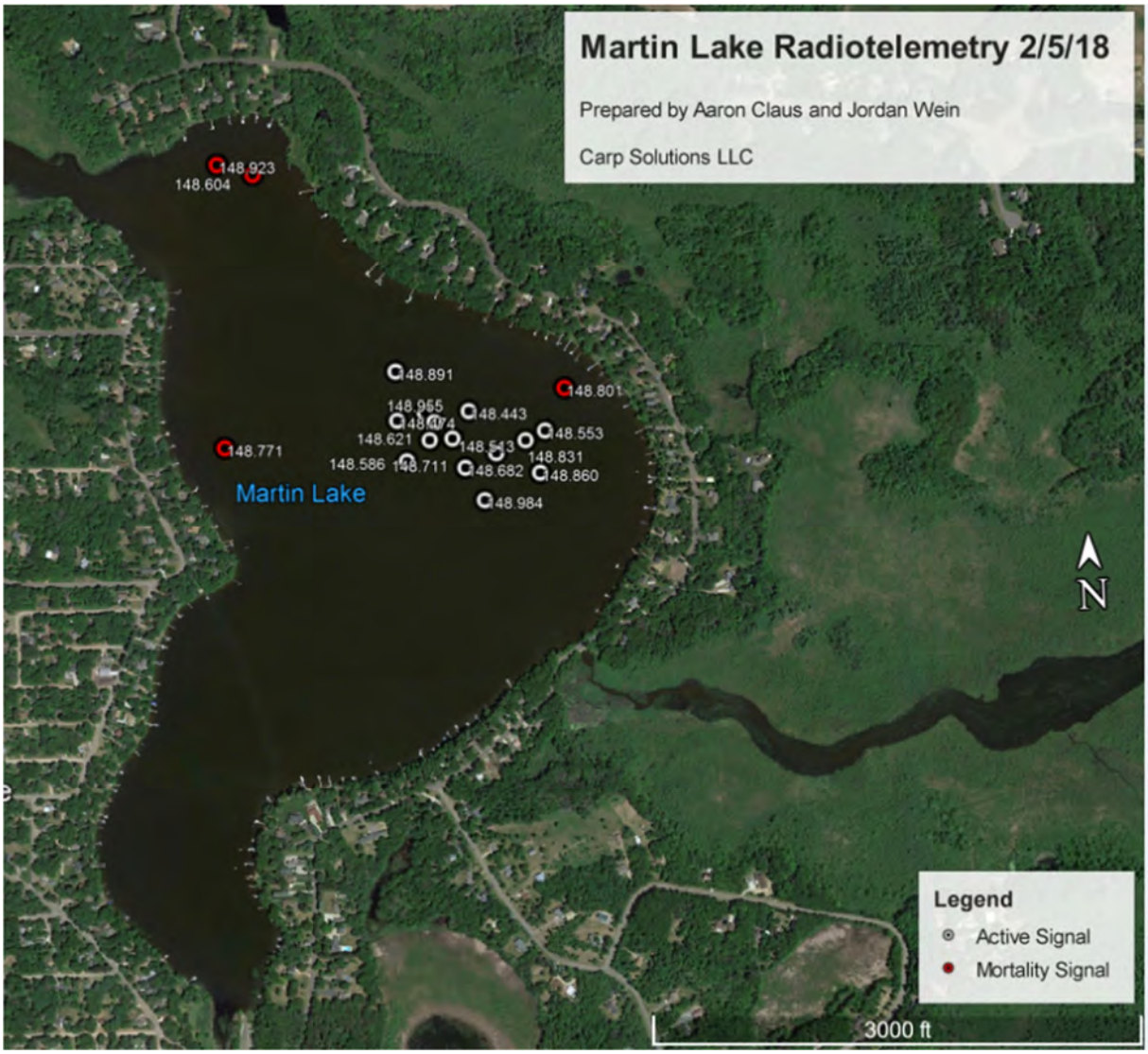
Radio transmitter being surgically implanted in a carp. 40 carp were implanted with radio loggers, 20 each from Typo and Martin Lakes. Radio loggers will help track the schooling, feeding, and movement patterns of the carp to aide in future harvesting efforts.

A sprung box net in Typo Lake. Nets were set, baited, and sprung at four sites each in Typo and Martin Lake for a total of 30 nettings on 8 different days from June through September, 2018.

A boat full of harvested carp. A total of 3,552 carp were removed from Typo Lake during the summer of 2018. 3,366 carp were removed from Martin Lake during August through September 2018. Harvest efforts in both lakes will continue through 2019.

Martin and Typo Lake Carp Removal Project

Telemetry Map from February 5, 2018



Linwood Lake Carp Population Study

Description: Linwood Lake has relatively poor water quality, though not quite as bad as Martin and Typo Lakes. It is close to exceeding the standard for phosphorus, and this year exceeded the standard for chlorophyll-a. As a result, the lake often has a green or brown tinge to it. Carp are a major cause of poor water quality in Typo and Martin Lake, and the goal of this study is to determine how much of a role carp play in causing poor water quality in Linwood Lake.

Purpose: Estimate carp abundance and population age structure; identify likely carp nursery sites; map carp movement using radio telemetry

Location: Linwood Lake

Results: Carp Solutions LLC has completed electrofishing surveys for carp at Linwood Lake, box netting surveys for young carp in Linwood and Boot Lakes, collected otolith samples for determining the carp population's age structure, and implanted radio transmitters in 20 carp.
Initial findings:

- Average sized carp: 7 pounds (3.2 kg). 24.5 inches (627 mm)
- Population estimate: 9,851 individuals
- Biomass estimate: **136 kg/ha**.

The ecological goal of this project is to have a carp population under **100 kg/ha**, so preliminarily Linwood Lake may be marginally over that goal. By comparison, the estimates for Typo Lake were 18,808 carp and 384 kg/ha and for Martin Lake was 13,409 carp and 408 kg/ha.

The next steps for this project include:

- Getting results on the age structure of the carp population. Such as how often do they successfully reproduce? How old are the carp?
- Radio telemetry surveys to find out where carp go during spawning and overwintering. Do any go to Boot Lake?
- Report and management recommendations

Carp Otoliths

Implanting a radio tag

Tour of Water Quality Projects

Description: A tour was given to local officials to highlight recent water quality improvement projects.

Purpose: The purpose of this event was to connect local elected officials, local and state staff, and the SRWMO board with the people, projects, and priorities of the SRWMO. The tour included visits to three large lakes where lake association members provided a brief presentation and recent water quality projects were seen and discussed. This tour was conducted immediately before the SRWMO Watershed Planning Kickoff and Public Input meeting. Nearly all tour attendees stayed for that meeting and provided valuable input on future SRWMO directions.

Location: Voss Residence, Linwood Lake access, Martin Lake access

Results: Sixteen officials representing 11 state and local organizations attended a tour which included rain gardens, water sampling demonstrations, and a carp barrier, amongst others.

Summary of Tour Itinerary

Tour stops included:

1. **Voss residence, Coon Lake**

At this location we were hosted by Steve and Lisa Voss who have installed three rain gardens treating a 4 acre drainage area of the neighborhood and are considering lakeshore landscaping with native plants. Steve is the Mayor of East Bethel and added insights into collaboration, incentive programs and the importance of Coon Lake. During this tour stop Al Beck of the Coon Lake Improvement District and Bruce McEachran of the Coon Lake Improvement Association spoke about the roles of their groups in managing invasive species and improving the lake.

2. **Linwood Lake Public Access**

At this tour stop we were hosted by a group of Linwood Lake Association members. Lake association fundraising leader Elizabeth Kiserow spoke about their recent fundraising successes, collaboration with the SRWMO and ACD on an upcoming carp feasibility study, water monitoring and a vision for improving water quality. Anoka Conservation District staff Jared Wagner provided a dockside demonstration of lake water quality monitoring techniques.

3. **Martin Lake Public Access**

The Martin Lake Association hosted this tour stop. We viewed a carp barrier and discussed water quality improvement efforts including stormwater treatment, carp management and lakeshore restorations. John Matilla and Mike Smith from the lake association discussed their fundraising efforts and their collaboration on these projects.

Annual Education Publication

Description: An annual newsletter article about the SRWMO is required by MN Rules 8410.010 subpart 4, and included in the SRWMO Watershed Management Plan.

Purpose: To improve citizen awareness of the SRWMO, its programs, accomplishments and water quality issues.

Location: Watershed-wide

Results: In 2018 the SRWMO contracted with the ACD to prepare its annual education publication. This year's newsletter was used to announce the SRWMO Watershed Management Plan update process.

Education Material Produced for 2018

Public Invited to Sunrise River Watershed Planning Meeting

The Sunrise River Watershed Management Organization (SRWMO) is beginning a once-every-10-years update of its Watershed Management Plan. To kick off this effort, it is hosting a facilitated meeting to get input from elected officials, lake groups, and the general public on Thursday, May 24 at the Coon Lake Beach Community Center.

The SRWMO is jointly formed by Linwood Township and the Cities of Columbus, Ham Lake and East Bethel. The organization is responsible for water management including lakes and streams, including issues that require management across municipal boundaries. The organization is governed by a board of two appointees from each community.

Recent SRWMO work has focused on improving water quality. Several area lakes do not meet State water quality standards due to excessive nutrients and algae, including Typo, Martin and Linwood Lakes. Coon Lake, the largest recreational lake in Anoka County, is also a high priority. Recent projects have included carp barriers and carp removal, rain gardens, public outreach and water monitoring.

The public meeting will include a brief presentation and facilitated discussion. The presentation will outline SRWMO duties, managed natural resources and recent work. The facilitated discussion will give the public an opportunity to help identify priorities, concerns and SRWMO work in next 10 yrs.

The meeting is Thursday, May 24 from 6:30 to 8:00pm at the Coon Lake Beach Community Center (182 Forest Road Wyoming, MN). More information is available from Jamie Schurbon at 763-434-2030 ext. 12 or at www.SRWMO.org.

SRWMO Website

Description: The Sunrise River Watershed Management Organization (SRWMO) contracts the Anoka Conservation District (ACD) to maintain a website about the SRWMO and the Sunrise River watershed.

Purpose: To increase awareness of the SRWMO and its programs. The website also provides tools and information that helps users better understand water resources issues in the area. The website serves as the SRWMO's alternative to a state-mandated newsletter.

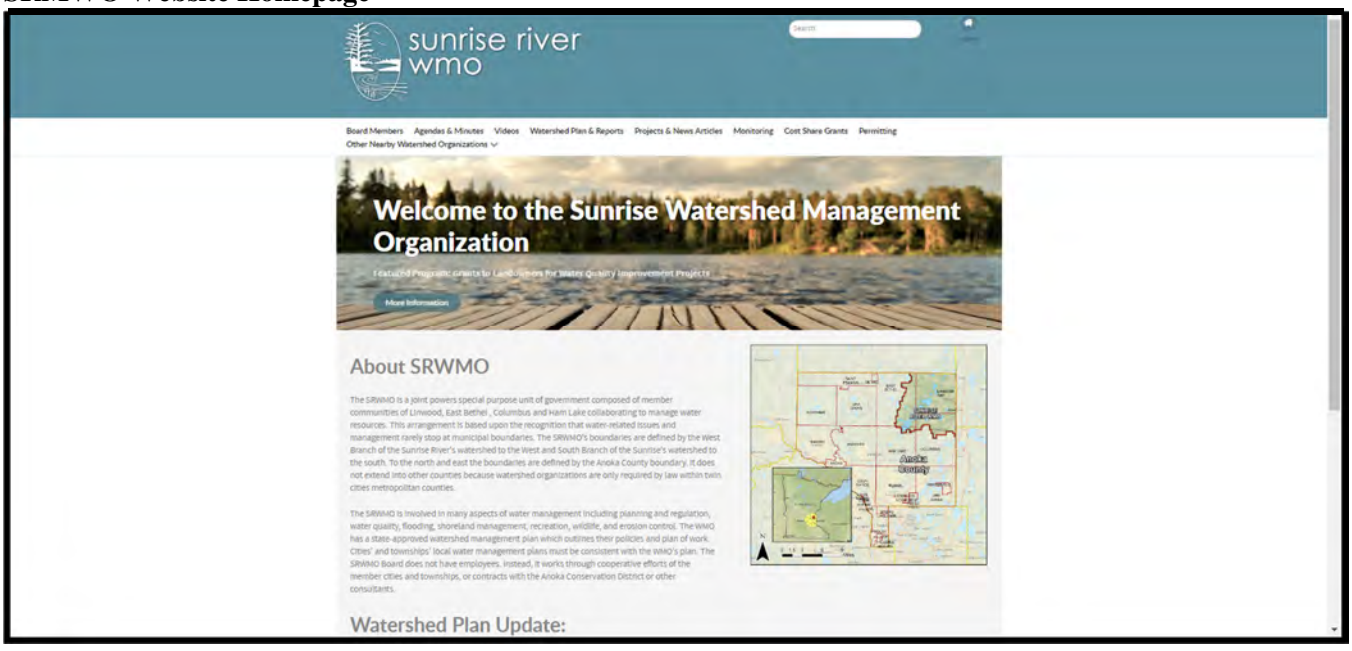
Location: www.SRWMO.org

Results: In 2018 a new SRWMO website was developed. The previous website was outdated and there were security concerns. The Anoka Conservation District developed a template website and finalized it with URRWMO Board input. The new website includes:

- Directory of board members,
- Meeting minutes and agendas,
- Watershed management plan and annual reports,
- Descriptions of work that the organization is directing,
- Highlighted projects,
- Informational videos,
- Maps of the URRWMO.

The website is regularly updated throughout the year.

SRMWO Website Homepage



Grant Searches and Applications

Description: The Anoka Conservation District (ACD) partners with the SRWMO for the preparation of grant applications. Several projects in the SRWMO Watershed Management Plan need outside funding in order to be accomplished.

Purpose: To provide funding for high priority local projects that benefit water resources.

Results: In 2018 the SRWMO pursued a new pot of State Clean Water Funds called Watershed Based Funding. Through a collaborative process with other county-wide agencies, funding allocations were determined, with the SRWMO receiving $156,750. The Anoka Conservation District guided the SRWMO through the process in which SRWMO board members were active participants. After funding allocations were decided, ACD facilitated a process with the SRWMO and its member cities to select projects to fund. Project ideas were generated through a meeting with member communities' staff, SRWMO board discussions, review of completed studies, and review of the SRWMO Watershed Management Plan. The selected projects were:

- Stormwater retrofits around Martin and Coon Lakes, as identified in a previous study.
- Linwood Lake Carp Management Feasibility Study.
- Lakeshore stewardship outreach.

ACD completed BWSR Elink work plans for the SRWMO. Funds were distributed in fall 2018.

Since 2014 the following grants have been secured for SRWMO projects though the assistance of the Anoka Conservation District:

2014 Martin and Typo Lake Carp Barriers, site 2	MN DNR CLP	$ 35,770
2014 Martin and Typo Lake Carp Barriers, sites 1,3,4	MN DNR CLP	$399,983
2014 Coon Lake Area Stormwater Retrofits	BWSR CWF	$ 42,987
2015 Ditch 20 Wetland Restoration Feasibility Study	BWSR CWF	$ 72,400
2017 Martin and Typo Lake Carp Harvests	MN DNR CLP	$ 99,000
2017 Septic System Fix Up Fund*	MPCA	$ 25,931
2018 Watershed Based Funding	BWSR WBF	$156,750
	TOTAL	$832,821

*Septic system fix up funds are available county-wide but the grant application was prompted by septic system inventory work by Linwood Township and the SRMWO.

SRWMO Annual Report to BWSR and State Auditor

Description: The Sunrise River Watershed Management Organization (SRWMO) is required by law to submit an annual report to the Minnesota Board of Water and Soil Resources (BWSR), the state agency with oversight authorities. This report consists of an up-to-date listing of SRWMO Board members, activities related to implementing the SRWMO Watershed Management Plan, the status of municipal water plans, financial summaries, and other work results. The SRWMO bolsters the content of this report beyond the statutory requirements so that it also serves as a comprehensive annual report to SRWMO member communities. The report is due annually 120 days after the end of the SRWMO's fiscal year (April 30th).

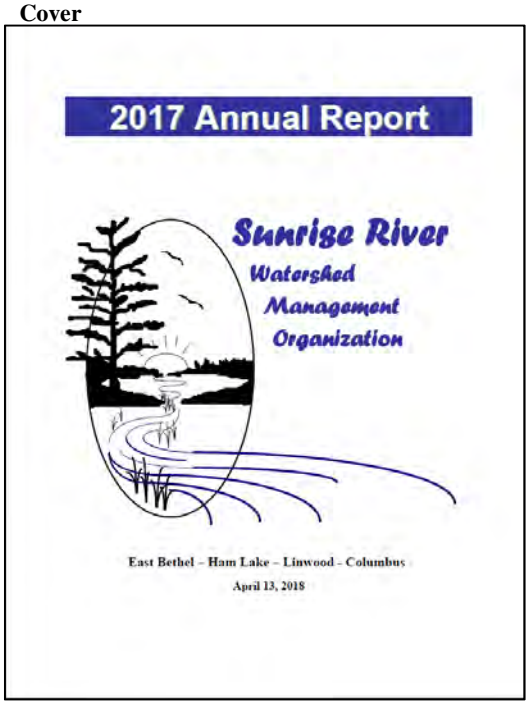
The SRWMO must also submit an annual financial report to the State Auditor. They accept unaudited financial reports for financial districts with annual revenues less than $185,000.

Purpose: To document progress toward implementing the SRWMO Watershed Management Plan and to provide transparency of government operations.

Locations: Watershed-wide

Results: Anoka Conservation District (ACD) assisted the SRWMO with preparation of an annual Sunrise River WMO Annual Report. The ACD drafted the report and cover letter. After SRWMO Board review the final draft was forwarded to BWSR. A sufficient number of copies of the report were sent to each member community to ensure that each city council person and town board member would receive a copy. The report is available to the public on the SRWMO website.

Cover



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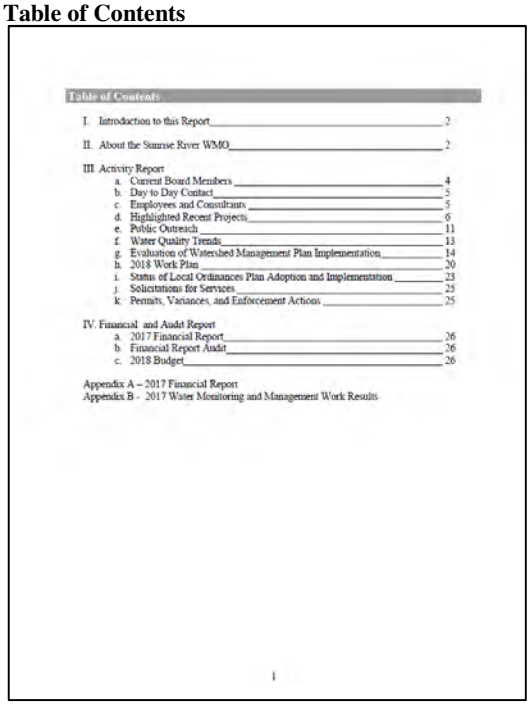

On-call Administrative Services

Description: The Anoka Conservation District Watershed Projects Manager provides limited, on-call administrative assistance to the SRWMO. Tasks are limited to those defined in a contractual agreement.

Purpose: To ensure day-to-day operations of the SRWMO are attended to between regular meetings.

Results: In 2018 a total of 65+ hours of administrative assistance were provided to the SRWMO by the Anoka Conservation District. The following tasks were accomplished:

- Helped the SRWMO come up with priority suggestions for the new county-wide outreach program.
- Coordinated a Linwood Lake Carp Management Feasibility Study with the Linwood Lake Association.
- Prepared a draft 2019 budget for the SRWMO and subsequent revisions.
- Responded to an MPCA request for water monitoring requests. MPCA is planning a once-every-10-years monitoring blitz in the area, and I communicated that the SRWMO would like its watershed outlets to be monitored. This will likely result in a $2,850 savings to the SRWMO, which would have otherwise paid for the monitoring.
- Dealt with a data mining company that submitted a public information request for all of the SRWMO's financial records for the last 5 years. The company uses the information to determine government purchasing trends, which it sells to interested businesses. It required 8 emails to resolve.
- Reviewed the Columbus Local Water Plan and presented findings.
- Prepared requests for proposals for 2018 water monitoring and watershed plan update.
- Fielded permitting questions from the county highway department and builders.
- Determined a planned meeting would not have a quorum, then sent cancellation and rescheduling notices.
- Distributed contact information for two new board members to the rest of the board, and sent welcome emails.
- Presented the county weed management program to the SRWMO Board, which decided to participate.
- Prepared a display for a Linwood Family Fun booth staffed by the SRWMO board.
- Prepared seven meeting agendas and packets of information (some of which was related to projects and paid by other funds).
- Attended seven SRWMO meetings, portions of which were not related to projects paid by other funds.
- Reviewed and edited meeting minutes three times.
- Wrote meeting minutes twice in the absence of the recording secretary.

Financial Summary

The ACD accounting is organized by program and not by customer. This allows us to track all of the labor, materials, and overhead expenses for a program. We do not, however, know specifically which expenses are attributed to monitoring which sites. To enable reporting of expenses for monitoring conducted in a specific watershed, we divide the total program cost by the number of sites monitored to determine an annual cost per site. We then multiply the cost per site by the number of sites monitored for a customer.

Sunrise River Watershed 2018 Financial Summary

		Monitoring							Inventory		Analysis			Planning & Land Protection						Technical Assistance								Resource Improvement Projects									Administrative Assistance		Outreach						
Sunrise River Watershed	Total	Volunteer Precip	DNR Groundwater Wells	Wetland Levels	Lake Levels	Stream Levels	Lake Water Quality	Stream Water Quality	Inventory - Linwood Lake SSTS	Inventory - Lakeshore Photos	Water Resources Almanac	Ditch 20 Analysis	Linwood Lake Carp Mgmt Feasibility Study	Anoka Sandplain Partnership	Sunrise WMO Planning	1W1P St. Croix	Wetland Resto Opportunities	Land Prot/Resto Strategies	Land Protection Outreach	SRWMO Grant Search	Landowner Tech. Asst.	Project Profiles	BMP Maintenance & Inspection	WCA Enforcement	Wetland Consultation	Wetland Restoration and Banking	Buckthorn Boot Lake	Buckthorn Mikkelson	Carp Management	Cooperative Weed Management	BMP Installation	SSTS - Fix-Up	SRWMO Admin/Reporting/Website	WCA Implementation	Watershed Based Funding Coordination	Video Development	Brochures & Displays	Web Blog	Web Story Map	SRWMO Educ/Newsletter	Anoka County Outreach Program
Revenues																																												
SRWMO	62897			1950	1500	1400	13050	2800				3059	409		25920					1000										1148		####							2000	
State - Other	8311		350																											1336			6626							
MPCA	10354																														10354										
DNR OHF	24000																										3410	20590													
DNR CPL	48581																												48581												
BWSR - Service Grant	7998									520				760			770	272			692	217	472						2014					1586	225	428	42			
BWSR - Project Grant	16858											549	14674																											1635
Metro ETA & NPEAP	61																				61																			
Regional/Local	4764						646									4117																								
Anoka Conservationi District	23164									5	3283			110		6051		19	80		711		36	244	2119	181	214	1858	4614	7	916	23		2439	4		43	10	132		63
County Ag Preserves/Projects	16512						1885		3627			1520																			9480									
Service Fees	2567																		262										2000	159	130			16						
TOTAL	226064		350	1950	1500	1400	15581	2800	3627	526	3283	5128	15083	870	25920	10168	770	291	343	1000	1464	217	508	244	2119	181	3624	22448	57209	1501	11675	10377	8660	9080	1590	225	471	53	132	2000	1697
Expenses-																																										
Personnel Salaries/Benefits	######	367	759	1155	974	2178	11622	1401	1627	498	4515	4334	385	730	23175	9118	651	251	290	329	1278	195	407	216	1768	158	3042	16125	7111	1111	9436	1083	5809	5972	1346	53	367	40	121	452	1181
Overhead	14946	47	98	133	111	252	1396	165	218	46	603	666	36	102	2553	1086	98	30	43	46	151	26	50	28	245	22	471	2206	881	124	1025	117	762	667	200	8	53	4	14	58	104
Vehicle/Mileage	2249	7	12	29	24	51	274	28	34	9	35	16	7	6	603	194	4	3	2	7	27	2	8	4	24	1	19	183	155	24	163	24	99	117	16	0	5	1	2	11	21
Project Direct - Supplies	52768	4		20	3	33	2635	730	60	5			3700		419				6				36		36			2942	36965	253	1208		1000	2453	4	163	43	8			42
Project Direct - Capital	636						545	91																																	
Project Direct - Installation	33182												10974															1158	11850			9200									
TOTAL	225410	425	869	1338	1112	2513	16472	2415	1939	558	5153	5016	15103	839	26749	10398	752	284	341	382	1456	222	502	248	2073	181	3532	22614	56962	1512	11831	10424	7670	9209	1566	224	469	53	136	521	1349

Recommendations

- **Continue update of the SRWMO Watershed Management Plan.** The current plan expires December 2019.
- **Continue engaging in the Lower St. Croix One Watershed, One Plan process** to ensure SRMWO priorities are reflected. This is necessary to ensure access to future Watershed Based Funding grants.
- **Continue carp removals at Martin and Typo Lakes.** Attaining goals is feasible.
- **Collaborate with the Anoka County Outreach Coordinator.** This new position in 2018 seeks efficiency and consistent messaging across many cities and natural resources agencies.
- **Conduct Boot Lake water quality monitoring two more years.** 2018 results have been instructive for Linwood Lake management. Three years of data should be sufficient to understand basic year-to-year variability.
- **Support the Linwood Lake Association.** The association has recently become more active and has requested partnerships to manage aquatic invasive species and improve water quality. The SRWMO may be able to help with identifying and promoting projects, or assist with fundraising.
- **Create a new SRWMO display for use at community events.**
- **Continue installation of stormwater retrofits around Coon and Martin Lakes** where completed studies have identified and ranked projects.
- **Promote newly available Septic System Fix Up Grants to landowners,** particularly in shoreland areas.
- **Bolster lakeshore landscaping education efforts.** The SRWMO Watershed Management Plan sets a goal of three lakeshore restorations per year. Few are occurring. Fresh approaches should be welcomed.