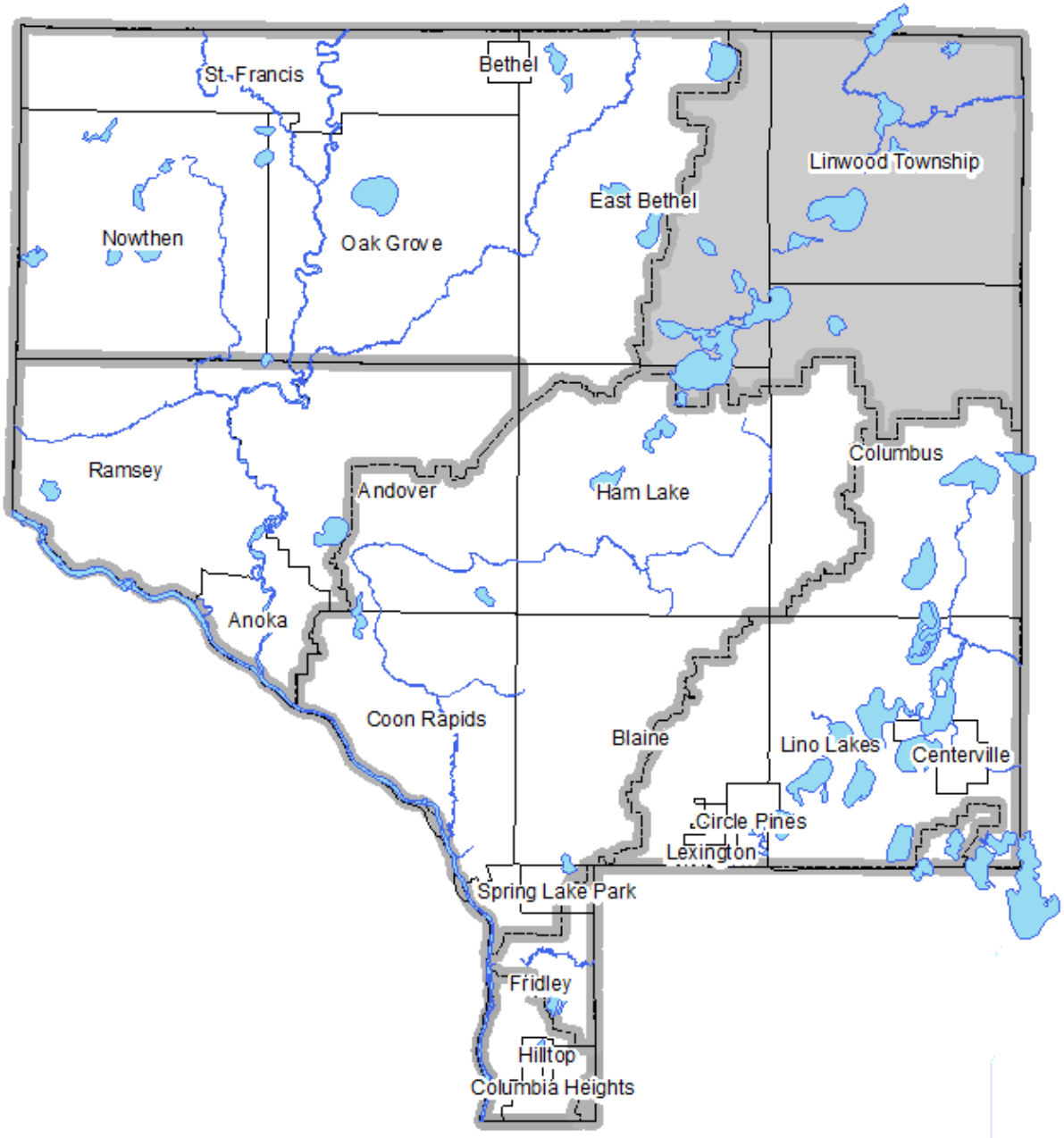
Excerpt from the 2022 Water Almanac

Chapter 2: Sunrise River Watershed



Prepared by the Anoka Conservation District

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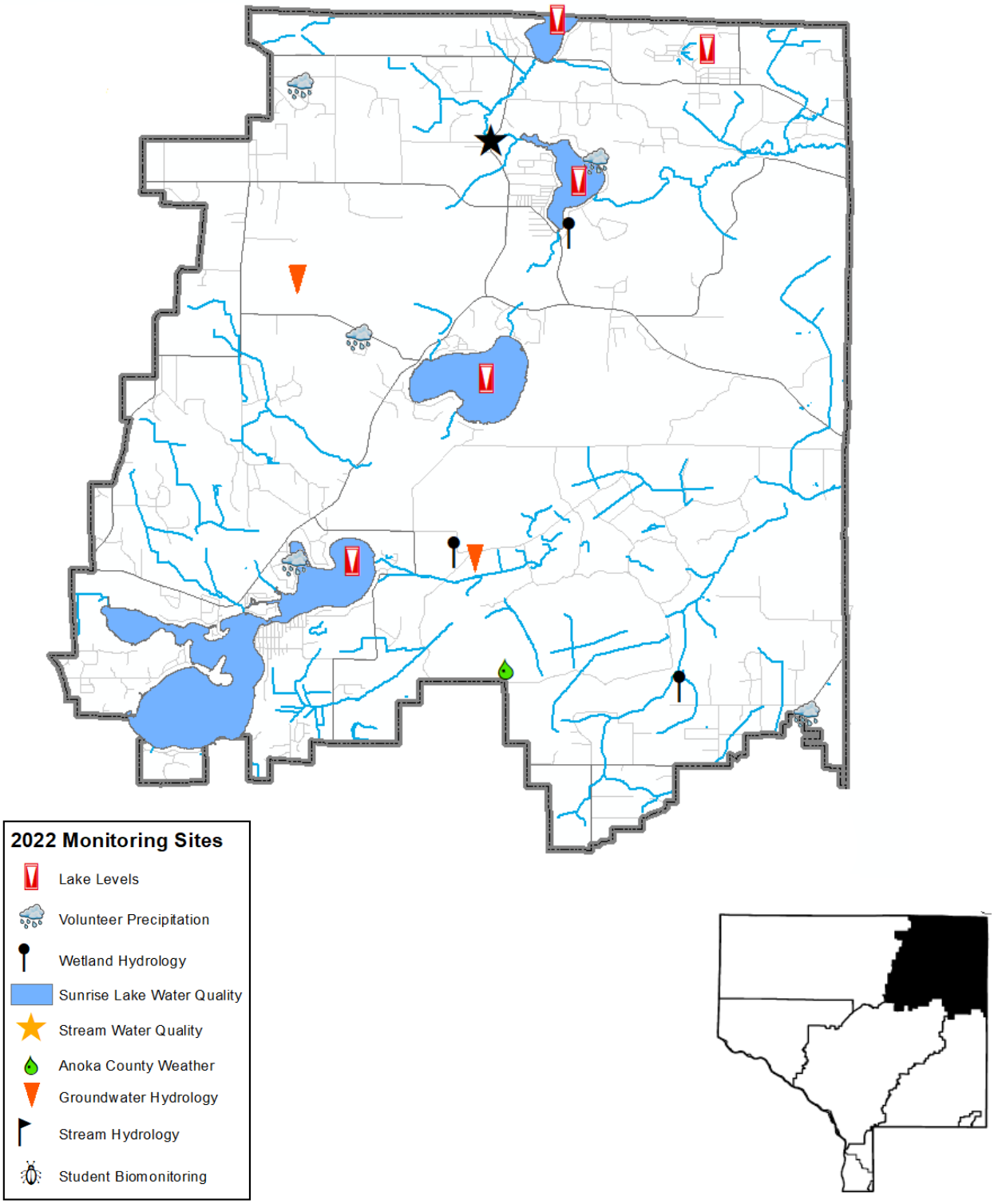
Recommendations

- **Implement the SRWMO Watershed Management Plan that was approved in 2019.** The plan reflects the latest science and includes schedules for various projects.
- **Continue improving Martin Lake water quality towards State standards with the goal of removing its impairment.** Even with water quality in the lake being slightly poorer in 2022, the last five years of data support delisting.
- **Target outreach** to key audiences rather than community-wide messaging. Lakeshore landscaping messaging to lakeshore owners is one priority, particularly given the availability of funding to install lakeshore stewardship projects.
- **Complete shoreline 360-degree photo inventory updates.** Martin Lake is the priority since its last update was in 2019 and there are 2023-25 grant funds that prioritize shoreline projects at this lake. Outreach can target those properties with documented problems. ACD anticipates completing this work.
- **Promote Septic System Fix-up Grants to landowners,** particularly in shoreland areas. Grants are for low income households.
- **Promote Adopt-a-Drain** around Martin, Linwood, Fawn, and Coon Lakes. This began in 2022 at Martin Lake where 11 drains that go to the lake were quickly adopted and are now regularly cleaned by volunteers. Annual reminders for volunteers are recommended.
- **Install the already-designed rain garden on East Front Blvd at Coon Lake as designed in 2021.** The project's cost effectiveness is only moderate, but other means to treat runoff in the neighborhood are not available. Estimated cost is $20,500. Cost effectiveness is $4,848 per pound of phosphorus over a 10-year life.
- **Update the SRWMO joint powers agreement** to address out of date material and other items agreed upon in 2022 by the member communities. Resolve the City of Ham Lake's concerns of being in multiple watersheds and paying and equal share for SRWMO operating expenses despite small area.
- **Continue prioritizing water quality monitoring** to assess baseline conditions, be proactive diagnosing problems and provide quality data to help determine the effectiveness of newly implemented water quality projects. This data helps with strategically implementing grant and local funds.
- **Request Watershed Based Funding from the Lower St. Croix One Watershed, One Plan group.** The most immediate priority project is a Linwood Lake subwatershed assessment study. Other candidates for the future are a wetland restoration at Ditch 20 and internal loading studies for Linwood, Typo, or Martin Lake.

2022 Water Monitoring Sites: Sunrise River Watershed



Lake Level Monitoring

Partners: SRWMO, ACD, MN DNR, Local volunteers

Description: Weekly water level monitoring was conducted with staff gages installed in each lake. 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: Surveillance 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.

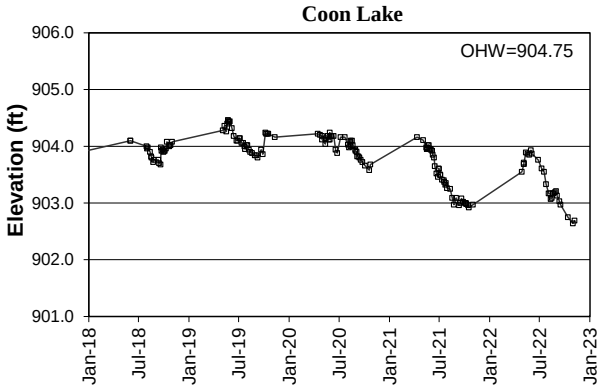
Locations: Coon, Fawn, Linwood, Martin, and Typo Lake

Results: Lake gages were installed by the Anoka Conservation District and surveyed by the MN DNR. With 2021 being the 11th driest season on record, lake levels started below average in 2022 were below average overall when compared to the past 10-years of data. In 2022, another season of infrequent rain events resulted in Anoka County being abnormally dry. The rebound often seen in the fall was not observed.

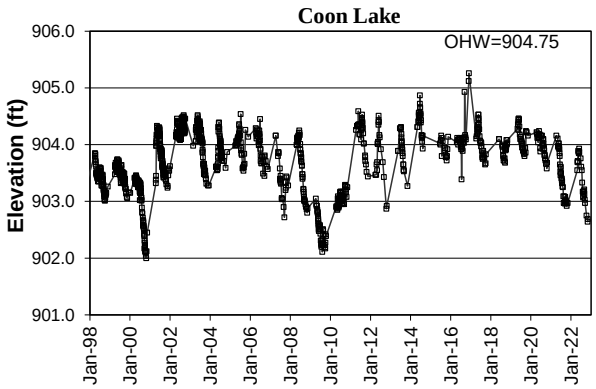
Individual lakes varied. Typo and Martin Lake water levels fluctuated between similar ranges to previous years and had similar averages, with a slight increase compared to the previous 2-years of monitoring. Fawn, Coon and Linwood Lake seemed to be more affected by the drought conditions. Coon Lake observed its lowest water level since 2009 and has only had lower water levels in 1988, 1990 and 2000. Coon Lake also had its lowest average since 2010. Fawn Lake recorded its lowest water level on average since 2013. Linwood Lake water levels averaged higher in 2022 than the previous year but 2021 observed the second lowest recorded water level ever, the record low being observed in 1988.

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.

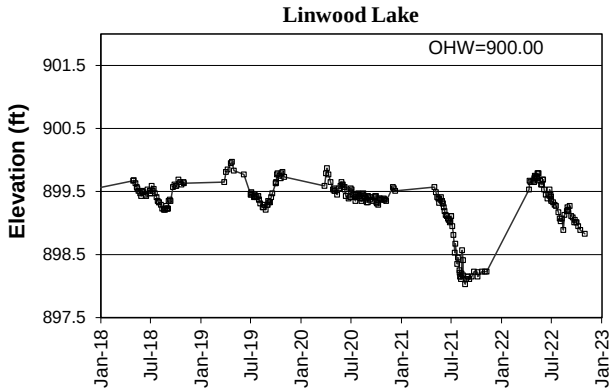
Coon Lake Levels – last 5 years



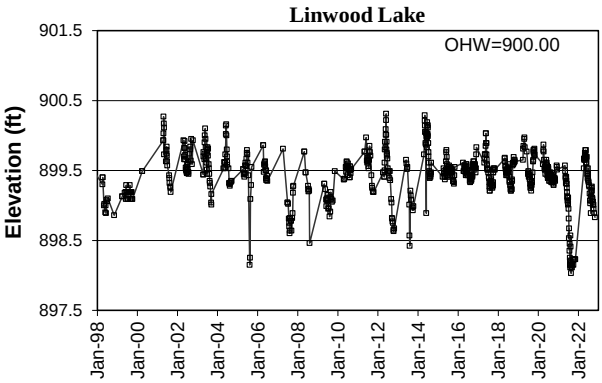
Coon Lake – last 25 years



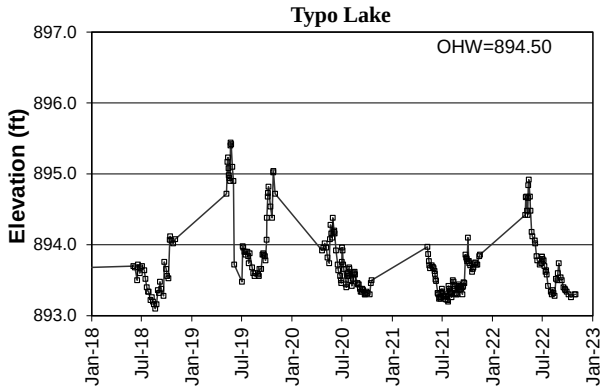
Linwood Lake – last 5 years



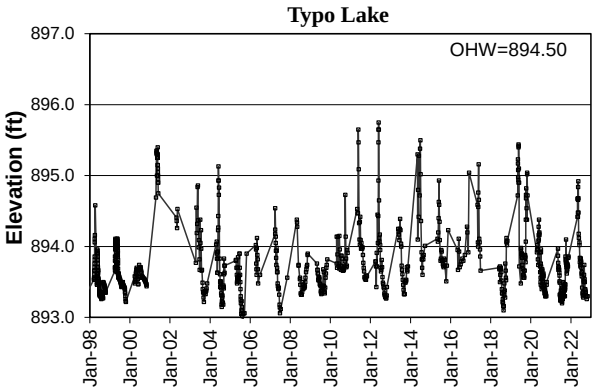
Linwood Lake – last 25 years



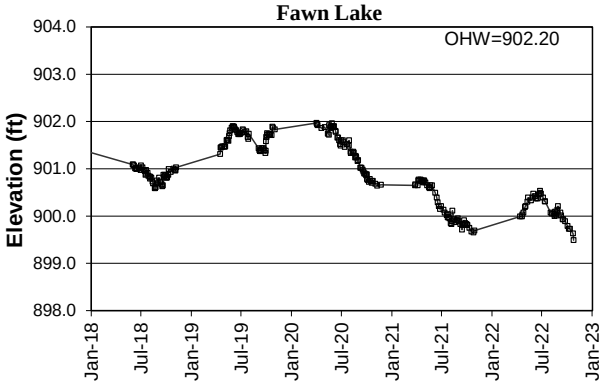
Typo Lake – last 5 years



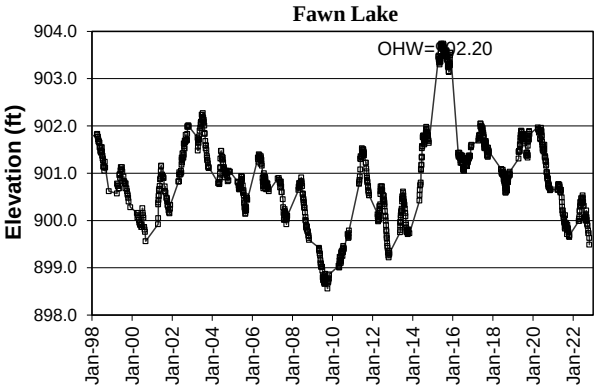
Typo Lake – last 25 years



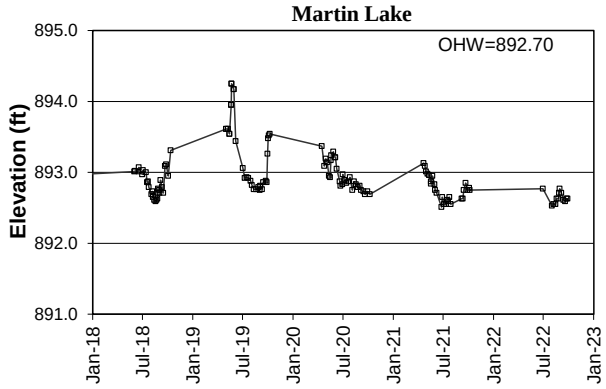
Fawn Lake – last 5 years



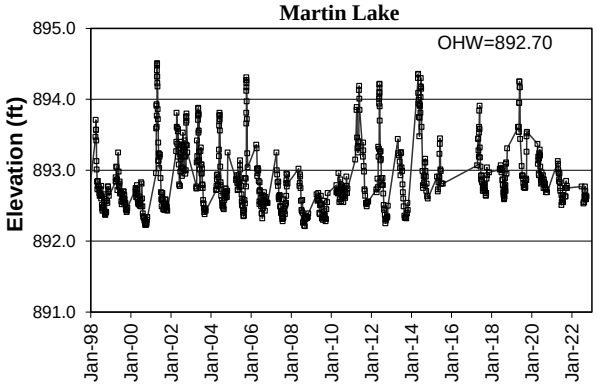
Fawn Lake – last 25 years



Martin Lake – last 5 years



Martin Lake – last 25 years



Lake	Year	Average	Min	Max
Fawn	2018	900.87	900.59	901.09
	2019	901.64	901.31	901.90
	2020	901.35	900.64	901.97
	2021	900.21	899.65	900.77
	2022	900.14	899.49	900.53

Lake	Year	Average	Min	Max
Martin	2018	892.85	892.59	893.31
	2019	893.32	892.75	894.25
	2020	892.95	892.69	893.37
	2021	892.77	892.51	893.13
	2022	892.83	892.53	893.51

Lake	Year	Average	Min	Max
Martin	2018	892.85	892.59	893.31
	2019	893.32	892.75	894.25
	2020	892.95	892.69	893.37
	2021	892.77	892.51	893.13
	2022	892.83	892.53	893.51

Lake	Year	Average	Min	Max
Typo	2018	893.55	893.10	894.12
	2019	894.30	893.48	895.44
	2020	893.66	893.30	894.38
	2021	893.50	893.20	894.10
	2022	893.82	893.26	894.92

Lake	Year	Average	Min	Max
Coon	2018	903.92	903.68	904.10
	2019	904.14	903.80	904.46
	2020	904.01	903.58	904.24
	2021	903.51	902.92	904.16
	2022	903.36	902.64	903.93

Lake Water Quality

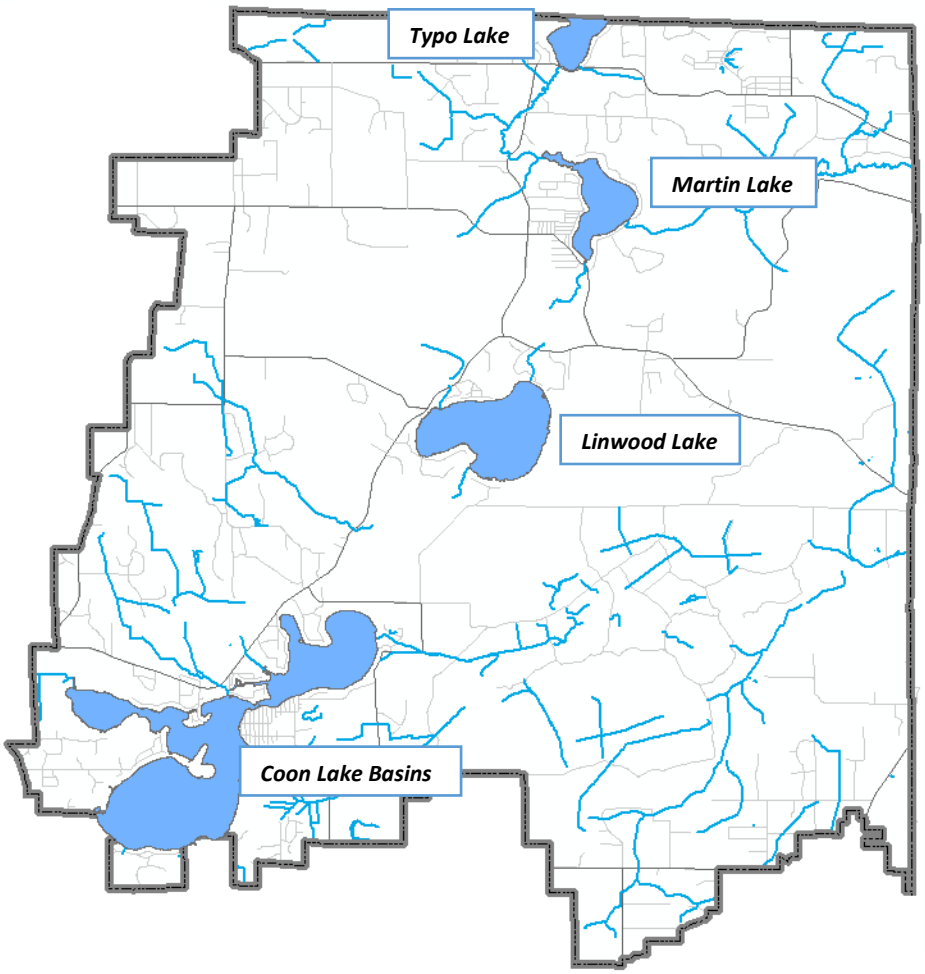
Description: Lake water quality monitoring was conducted ten times between May and September, approximately every two weeks. The monitoring parameters include total phosphorus, chlorophyll-a, secchi transparency, dissolved oxygen, turbidity, temperature, specific conductance, pH, and salinity.

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

Locations: Typo, Martin, Linwood, Coon Lake East Bay and Coon Lake West Bay.

Results: Detailed data for individual lakes is provided on the following pages, including summaries of historical conditions and trend analysis. Previous years' data are available on the Minnesota Pollution Control Agency (MPCA) electronic data access (EDA) website or on ACD's online database (https://maps.barr.com/Anoka/Home/Chart/). Refer to Chapter 1 for additional information on lake dynamics and interpreting the data.

2022 Sunrise River Watershed Lake Water Quality Monitoring Sites



Typo Lake

Lake ID # 30-0009

Background

Typo Lake is located in northeast Anoka County with the north end of the lake in southeast Isanti County. The lake has a surface area of 290 acres and maximum depth of 6 feet (1.82 m). The lake bottom varies from mucky and loose soils to sandy soils. The public access is small, located at the south end of the lake along Fawn Lake Drive. Typo 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 forest or grassland. Typo Lake is listed as impaired for excess nutrients and water quality in the lake is being monitored for best management practice (BMP) effectiveness. The MNDNR conducted a fisheries survey in 2016 which found walleye, black crappie, white crappie, northern pike, and bluegill.

2022 Results

In 2022, Typo Lake had poor water quality compared to other lakes in this region (NCHF Ecoregion), and degraded slightly from 2021, receiving an overall F letter grade. Average total phosphorus (TP) was 175.5 µg/L, which was an increase from the 2021 average of 150.5 µg/L. While TP levels continue to far exceed the 60 µg/L state standard for shallow lakes, average concentrations appear to be improving over the past two decades (average 270 µg/L during 2000-2009, and 174 µg/L 2012-2020). Chlorophyll-a (Cl-a) levels in 2022 averaged 114.26 µg/L. This was an increase from 2021 (72.5 µg/L) and other previous years (average 70 µg/L 2015-2020). In many recent years, Cl-a concentrations have stayed below the historical average for the lake (99 µg/L 1993-2022) but are still many times higher than the state standard for Cl-a in shallow lakes (20 µg/L). Average Secchi transparency in 2022 was 0.9 feet. This was half of the transparency observed in 2021 and the poorest since 2016. While transparency in Typo Lake has shown improvements over the last decade, but remains well below the state standard for transparency in shallow lakes of 1 meter (3.3 feet).

Trend Analysis

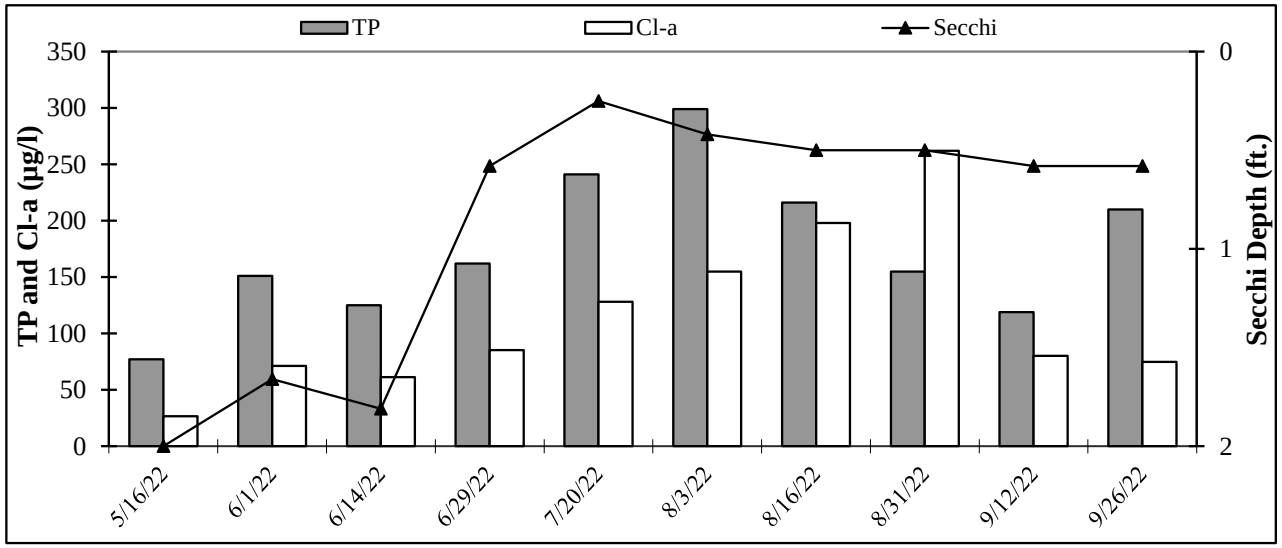
The MPCA (1993 -'95) and the Anoka Conservation District (1997 -'01, '03, '05, '07, '09, '12, '14 -'22) have conducted twenty-two years of water quality monitoring. Overall, water quality has improved since 1993 in a statistically significant way (repeated measures MANOVA with response variables TP, Cl-a, and Secchi depth ($F_{2, 20}=4.28$, $p<0.05$). When these variables are tested individually with one-way ANOVAs, TP shows no significant change across this time period. A superficial look at graphs of this parameter suggests that TP levels are generally stable between 150 µg/L and 250 µg/L with an overall improving trend. Cl-a, however, is showing statistically significant improvement ($p<0.01$). Secchi transparency is also showing a statistically significant improvement ($p<0.05$) when outlier years 2007 and 2009 are excluded. The major driver of statistically improving water quality is decreasing Cl-a concentrations, but improving Seechi transparency is also a positive driving factor.

Discussion

Typo Lake was the subject of a Total Maximum Daily Load (TMDL) study by ACD in 2012. This study documented nutrient input sources to the lake and explored their severity. The results of this study identified some factors affecting water quality in Typo Lake including rough fish, ditched wetlands west of the lake, and internal lake sediment. Recent work has included installation of carp barriers (2016), carp removals (2017-2022), and a feasibility study of ditched wetland restorations upstream of Typo Lake (2018). The feasibility study identified four potential projects along Ditch 20 and recommends that the dredging of Ditch 20 not occur. Shoreline conditions on Typo Lake were inventoried in 2020 and have assisted in identifying potential lakeshore projects. Recent water quality monitoring results suggest these management approaches are improving conditions in Typo Lake but reaching improvement goals will require additional effort and time.

TYPO LAKE

2022 Results

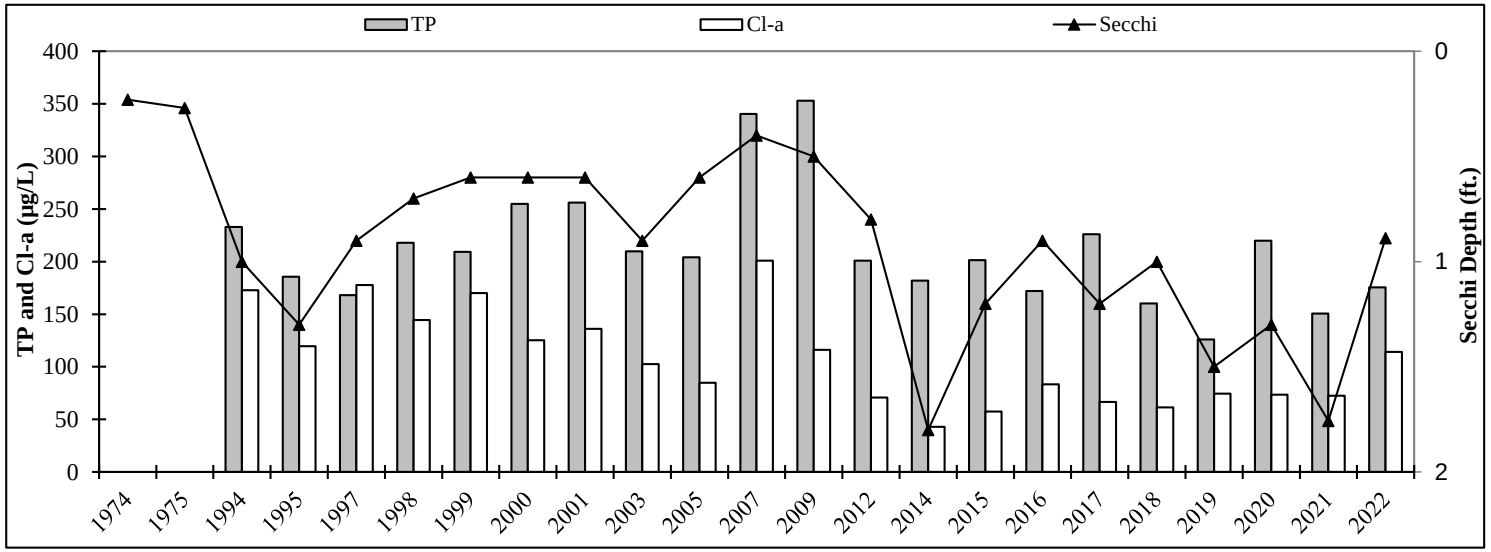


2022 Medians

pH		8.50
Specific Conductivity	mS/cm	0.26
Turbidity	NTU	111.00
D.O.	mg/l	10.48
D.O.	%	117.95
Temp.	°F	71.84
Salinity	%	0.12
Cl-a	µg/L	82.75
T.P.	µg/l	158.50
Secchi	ft	0.58

Typo Lake	30-0009-(Date		5/16/2022	6/1/2022	6/14/2022	6/29/2022	7/20/2022	8/3/2022	8/16/2022	8/31/2022	9/12/2022	9/26/2022			
2022 Water Quality Data	Time		13:40	14:50	10:20	12:00	13:20	11:10	9:00	11:20	11:50	11:10			
	Units	R.L.*											Average	Min	Max
pH		0.1	9.20	8.39	7.84	8.26	8.32	8.60	8.76	8.84	8.81	8.16	8.52	7.84	9.20
Specific Conductivity	mS/cm	0.01	0.220	0.271	0.305	0.266	0.271	0.302	0.241	0.225	0.231	0.260	0.259	0.220	0.305
Turbidity	FNRU	1	23.50	40.90	24.20	149.00	141.00	166.00	124	115.00	100.00	107.00	116	24	166
D.O.	mg/l	0.01	12.99	12.25	9.02	7.19	6.80	7.95	12.17	10.33	12.75	10.62	10.21	6.80	12.99
D.O.	%	1	145.7	142.50	109.2	84.0	93.0	98.4	137.0	126.7	147.5	100.7	118.5	84.0	147.5
Temp.	°C	0.1	19.94	20.87	22.94	22.62	25.89	26.23	21.65	22.98	20.74	14.22	21.81	14.22	26.23
Temp.	°F	0.1	67.9	69.6	73.3	72.7	78.6	79.2	71.0	73.4	69.3	57.6	71.3	57.6	79.2
Salinity	%	0.01	0.11	0.13	0.15	0.13	0.13	0.11	0.12	0.11	0.11	0.12	0.1	0.1	0.2
Cl-a	mg/m³	1	26.70	71.20	61.40	85.40	128.00	155.00	198.00	262.00	80.10	74.80	114.3	26.7	262.0
T.P.	mg/l	0.005	0.077	0.151	0.125	0.162	0.241	0.299	0.216	0.155	0.119	0.210	0.176	0.077	0.299
T.P.	µg/l	5	77	151	125	162	241	299	216	155	119	210	175.5	77	299
Secchi	ft	0.10	2.00	1.66	1.81	0.58	0.25	0.42	0.50	0.50	0.58	0.58	0.9	0.3	2.0
Secchi	m	0.10	0.6	0.5	0.6	0.2	0.1	0.1	0.2	0.2	0.2	0.2	0.3	0.1	0.6
Physical			3.0	2.0	3.0	2.0	2.0	1.00	1.00	1.0	1.0	1.0	1.7	1.0	3.0
Recreational			5.0	2.0	3.0	2.0	3.0	2.00	2.00	3.0	3.0	1.0	2.6	1.0	5.0

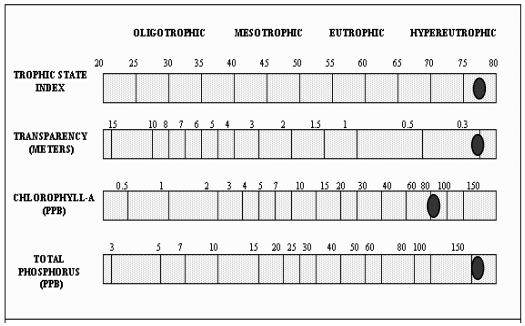
Historical Annual Averages



Historical Report Card

Year	TP	Cl-a	Secchi	**Overall**
1974			F	**F**
1975			F	**F**
1993	F	F	F	**F**
1994	F	F	F	**F**
1995	F	F	F	**F**
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**
2003	F	F	F	**F**
2005	F	F	F	**F**
2007	F	F	F	**F**
2009	F	F	F	**F**
2012	F	D	F	**F**
2014	F	C	F	**D-**
2015	F	D	F	**F**
2016	F	F	F	**F**
2017	F	D	F	**F**
2018	F	D	F	**F**
2019	D	D	D	**D**
2020	F	C	F	**F**
2021	D	D	F	**D**
2022	F	F	F	**F**
State Standards	60 ug/L	20 ug/L	>3.3 ft	

Carlson's Trophic State Index



Grade	Percentile	TP (µg/L)	Cl-a (µg/L)	Secchi Disk (m)
A	< 10	<23	<10	>3.0
B	10 - 30	23 – 32	10 - 20	2.2 - 3.0
C	30 – 70	32 – 68	20 – 48	1.2 – 2.2
D	70 – 90	68 – 152	48 – 77	0.7 – 1.2
F	> 90	> 152	> 77	< 0.7

Martin Lake

Lake ID # 02-0034

Background

Martin Lake is located in northeast Anoka County. The lake has a surface area of 223 acres and a maximum depth of 20 ft. The public access is located on the south end of the lake. The lake is used extensively by recreational boaters and anglers, and has a very active lake association run by residents of the lake. Any water quality improvements on the lake would be largely beneficial to the diverse group of stake-holders who frequent it. Martin Lake is almost entirely surrounded by private residences. The 5,402-acre watershed is 18% developed; the remaining 82% is vacant, agricultural, or wetlands. The invasive aquatic plant, curly-leaf pondweed, is present in the lake but not at nuisance levels. Martin Lake is listed as impaired for excess nutrients and water quality in the lake is being monitored with hopes to get the lake delisted in the future. Water quality is also being monitored for BMP effectiveness. The MNDNR conducted a fisheries survey in 2015, with the lake being managed primarily for walleye and bluegill. An aeration system designed to prevent winter kills was installed in 1993.

2022 Results

In 2022, Martin Lake received an overall D letter grade for water quality. This is a decline from the C letter grade the lake received for 2021, when a record low average for total phosphorus (TP) was observed (47.7 µg/L). 2022 TP averaged 78.4 µg/L. Average TP over the last five years (62.7 µg/L) is close to the state impairment standard (60 µg/L). In 2022, chlorophyll-a averaged 53.04 µg/L, which was more than double the 2021 average of 25.16 µg/L and higher than other monitoring years back until 2009. While the most recent 5-year average for chlorophyll-a (34.0 µg/L) is much lower than the 2005-2009 average (108.3 µg/L), chlorophyll-a remains above the state impairment standard of 20 µg/L. Average Secchi transparency in 2022 was 2.3 feet, a substantial decrease from 4.5 feet in 2021 and below the state standard of 3.3 feet.

Trend Analysis

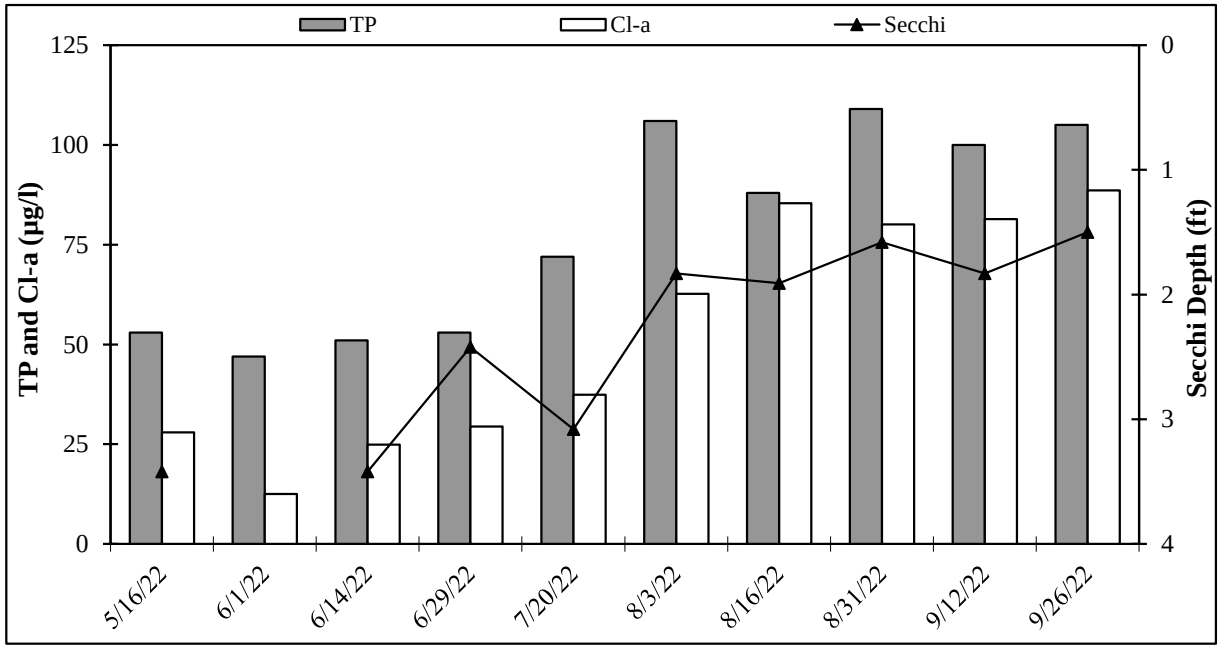
Twenty-two years of water quality data have been collected by the MPCA (1983), Metropolitan Council (1998, ’08), and ACD (’97, 1999-’01, ’03, ’05, ’07, ’09, 2012-’22). Local residents monitored Secchi transparency on the lake 17 other years. Anecdotal notes from DNR fisheries data indicate poor water quality dating back to 1954. Although still poor, water quality in Martin Lake has shown an improvement from 1983 to 2022 that is statistically significant (repeated measures MANOVA with response variables TP, Cl-a, and Secchi; $F_{2, 18}=4.50$, $p < 0.05$). This is especially true for the last decade. Further examination of the data shows that while Secchi transparency has not changed in a statistically significant way since 1983, chlorophyll-a and TP concentrations have both shown a statistically significant improvement ($p < 0.05$) over this time.

Discussion

Martin Lake was the subject of a TMDL study by the Anoka Conservation District in 2012. The study documented nutrient inputs into the lake, and explored their impacts to overall water quality. The study also provided potential lake rehabilitation strategies. Low quality water flowing from Typo Lake and internal loading (carp, septic systems, sediment, etc.) are two of the largest negative impacts on Martin Lake’s water quality. Carp management efforts, septic system replacements, and storm water retrofits have been implemented in recent years. Shoreline conditions on Martin Lake were inventoried during a 2019 shoreline survey, resulting in the implementation of multiple lakeshore restoration projects in 2021 and 2022. Additional funding for projects has been secured, with installation anticipated in 2024. Recent water quality monitoring results suggest these types of management approaches are improving conditions in and around the lake. Results have been positive, and further efforts should be made to continue these improvements. Because many of the most cost-effective watershed projects have been implemented, including various carp management projects, an alum-treatment approach should be considered to continue the restoration of water quality in this lake.

MARTIN LAKE

2022 Results



2022 Medians

pH		8.35
Specific Conductivity	mS/cm	0.31
Turbidity	NTU	19.90
D.O.	mg/l	8.51
D.O.	%	98.20
Temp.	°F	72.08
Salinity	%	0.15
Cl-a	µg/L	50.05
T.P.	µg/l	80.00
Secchi	ft	1.91

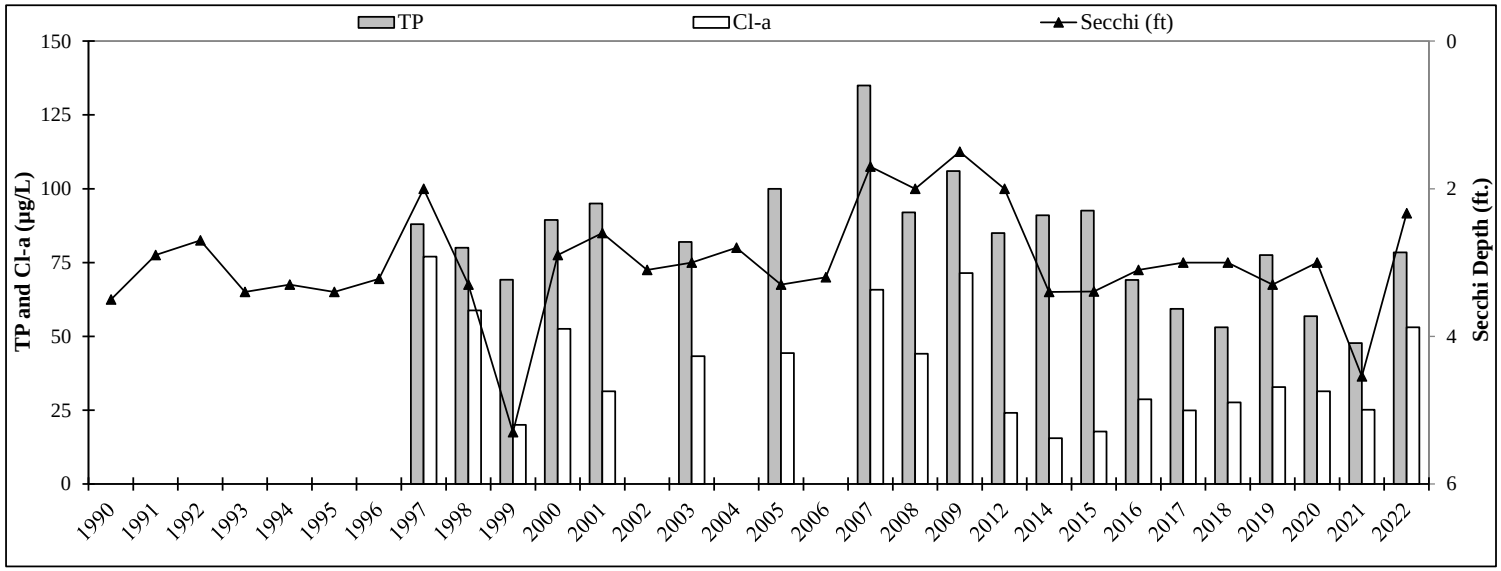
Martin Lake 02-0034-00-202

2022 Water Quality Data

			Date:	5/16/2022	6/1/2022	6/14/2022	6/29/2022	7/20/2022	8/3/2022	8/16/2022	8/31/2022	9/12/2022	9/26/2022			
			Time:	12:50	14:05	11:00	11:15	14:00	11:50	9:30	11:50	12:20	11:40			
	Units	R.L.*												Average	Min	Max
pH		0.1		8.42	7.98	8.02	8.22	8.43	8.60	8.50	8.28	8.52	8.14	8.31	7.98	8.60
Specific Conductivity	mS/cm	0.01		0.262	0.294	0.300	0.300	0.316	0.305	0.331	0.315	0.309	0.316	0.305	0.262	0.331
Turbidity	FNRU	1		6.10	1.90	4.80	13.00	13.10	30.70	26.70	29.70	33.00	48.90	19.43	1.90	48.90
D.O.	mg/l	0.01		11.51	8.12	8.81	8.21	7.32	10.49	10.27	6.54	7.46	8.95	8.77	6.54	11.51
D.O.	%	1		124.6	91.1	106.0		98.2	134.2	128.6	79.7	88.4	95.8	105.2	79.7	134.2
Temp.	°C	0.1		18.2	19.6	22.39	23.97	25.97	25.8	23.17	22.14	21.66	17.24	22.0	17.2	26.0
Temp.	°F	0.1		64.8	67.3	72.3	75.1	78.7	78.4	73.7	71.9	71.0	63.0	71.6	63.0	78.7
Salinity	%	0.01		0.13	0.14	0.14	0.14	0.15	0.15	0.16	0.15	0.15	0.15	0.15	0.13	0.16
Cl-a	mg/m³	1		28.00	12.50	24.90	29.40	37.40	62.70	85.40	80.10	81.400	88.60	53.04	12.5	88.6
T.P.	mg/l	0.005		0.053	0.047	0.051	0.053	0.072	0.106	0.088	0.109	0.100	0.101	0.078	0.047	0.109
T.P.	ug/l	5		53	47	51	53	72	106	88	109	100	105	78.4	47	109
Secchi	ft	0.1		3.42		3.42	2.42	3.08	1.83	1.91	1.6	1.8	1.5	2.3	1.5	3.4
Secchi	m	0.1		1.0	0.0	1.0	0.7	0.9	0.6	0.6	0.5	0.6	0.5	0.7	0.0	1.0
Physical				3.0	3.0	4.0	3.0	4.0	3.0	2.0	2.0	2.0	2.0	2.8	2.0	4.0
Recreational				5.0	4.0	4.0	4.0	4.0	4.0	3.0	4.0	3.0	3.0	3.8	3.0	5.0

*reporting limit

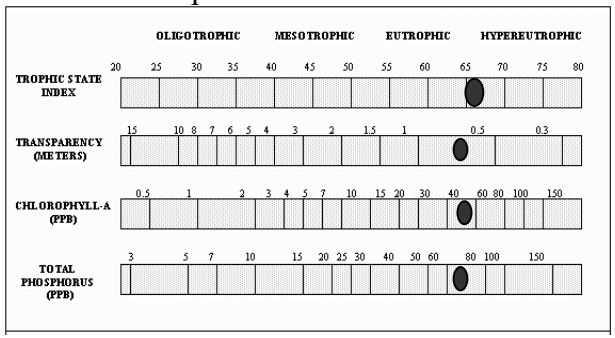
Historical Annual Averages



Historical Report Card

Year	TP	Cl-a	Secchi	Overall
1996			D	**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	**D**
2003	D	C	D	**D**
2004			D	**D**
2005	D	C	D	**D**
2006			D	**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**
2019	D	C	D	**D**
2020	C	C	D	**C**
2021	C	C	C	**C**
2022	D	D	D	**D**
State Standards	40 ug/L	14 ug/L	>4.6 ft	

Carlson's Trophic State Index



Grade	Percentile	TP (µg/L)	Cl-a (µg/L)	Secchi Disk (m)
A	< 10	<23	<10	>3.0
B	10 - 30	23 – 32	10 - 20	2.2 - 3.0
C	30 – 70	32 – 68	20 – 48	1.2 – 2.2
D	70 – 90	68 – 152	48 – 77	0.7 – 1.2
F	> 90	> 152	> 77	< 0.7

Linwood Lake

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 a 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 large boat landing and multiple fishing piers. The lake's shoreline is about 1/3 developed and 2/3 undeveloped. Most of the undeveloped shoreline is on the eastern shore of the lake and is part of a regional park system. The lake's watershed is primarily undeveloped with scattered residential plots. Linwood Lake is listed as impaired waters for excess nutrients and for mercury in fish tissue.

2022 Results

In 2022, Linwood Lake showed similar water quality results compared to other monitoring years, once again scoring an overall C letter grade. Average total phosphorus concentrations and average Secchi transparency degraded from 2018 levels but only slightly. Total phosphorous in 2022 averaged 48.0 µg/L and Secchi clarity averaged 3.2 ft. in 2022, a foot poorer than when last monitored in 2018 and poorer than state standard for Secchi. Chlorophyll-a averaged 26.5 µg/L in 2022, typical for this lake, but exceeding the state standard of 14 µg/L.

Trend Analysis

Nineteen 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, '18, and '22). Water quality has significantly improved from 1980 to 2022 (repeated measures MANOVA with response variables TP, Cl-a, and Secchi transparency; $F_{3, 17}=3.85$, $p<0.05$). However, graphing each of these response variables individually over time does not reveal a statistically significant change in any one of them alone, although Cl-a levels are close to being statistically significant ($p=0.07$). Superficially, the graphs of individual parameters hint toward improvements in recent years compared to a decade ago, even if not statistically significant.

Discussion

Linwood Lake is listed as impaired for excess nutrients, but the impairment is a marginal case. Linwood was placed on the impaired waters list because summertime total phosphorus levels are routinely over the state standard of 40 µg/L for deep lakes. The state has since added separate, less restrictive, water quality standards to be used for shallow lakes. Linwood does not technically meet the definition of a shallow lake (maximum depth of <15 ft. or >80% of the basin is shallow enough to support aquatic plants) due to a deep hole where depths reach 42 feet. However, Linwood Lake is similar to other shallow lake systems and expectations for water quality is perhaps more aligned with the shallow lake standards (total phosphorus <60 µg/L, chlorophyll-a <20 µg/L, and Secchi transparency >1m).

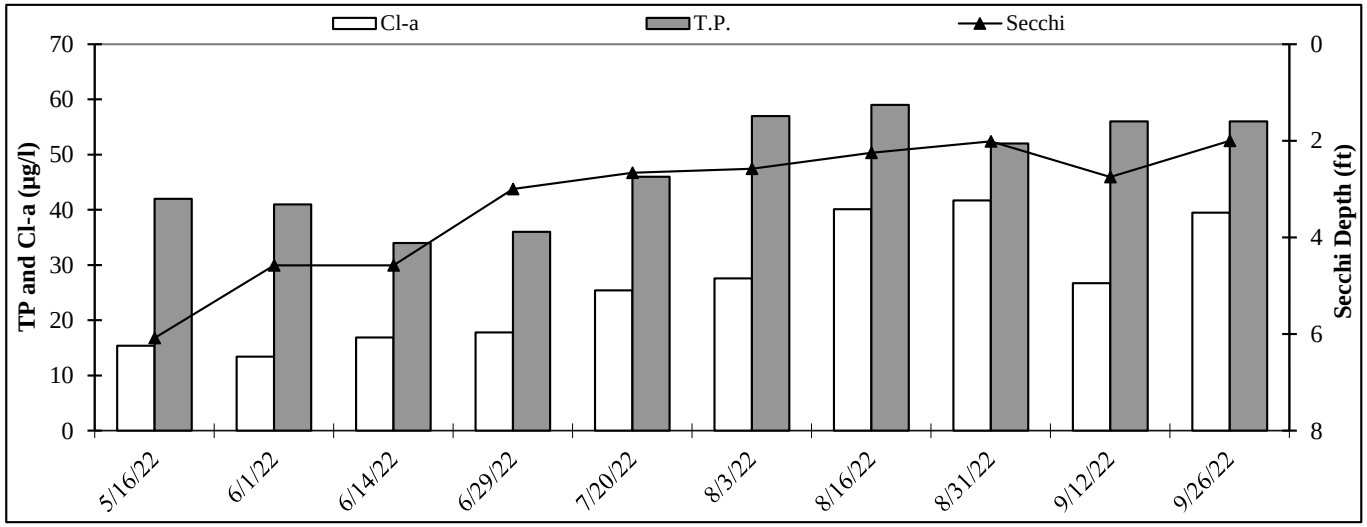
High-powered boats are common on Linwood Lake and may be negatively impacting water quality due to the shallow depth across the majority of the lake. The lake is large enough for these boats to get up to full speed but results in disturbed sediments from the basin bottom continuously mixing into the water column. It may favor propagation of plants that can re-sprout from fragments.

A TMDL impaired waters study has identified several factors as water quality improvement management targets on Linwood Lake including internal sediment loading, shoreline management, replacement of aging septic systems, stormwater runoff, agricultural bmp's, and aquatic invasive species (AIS) management for curly-leaf pondweed and common carp. A holistic lake management approach is likely needed.

The primary inlet into Linwood Lake comes from nearby Boot Lake which has also been monitored by ACD in recent years. Boot Lake has phosphorus concentrations similar to Linwood, 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 more macrophytes in Boot Lake. 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 water quality goals in Linwood Lake.

LINWOOD LAKE

2022 Results



2022 Medians

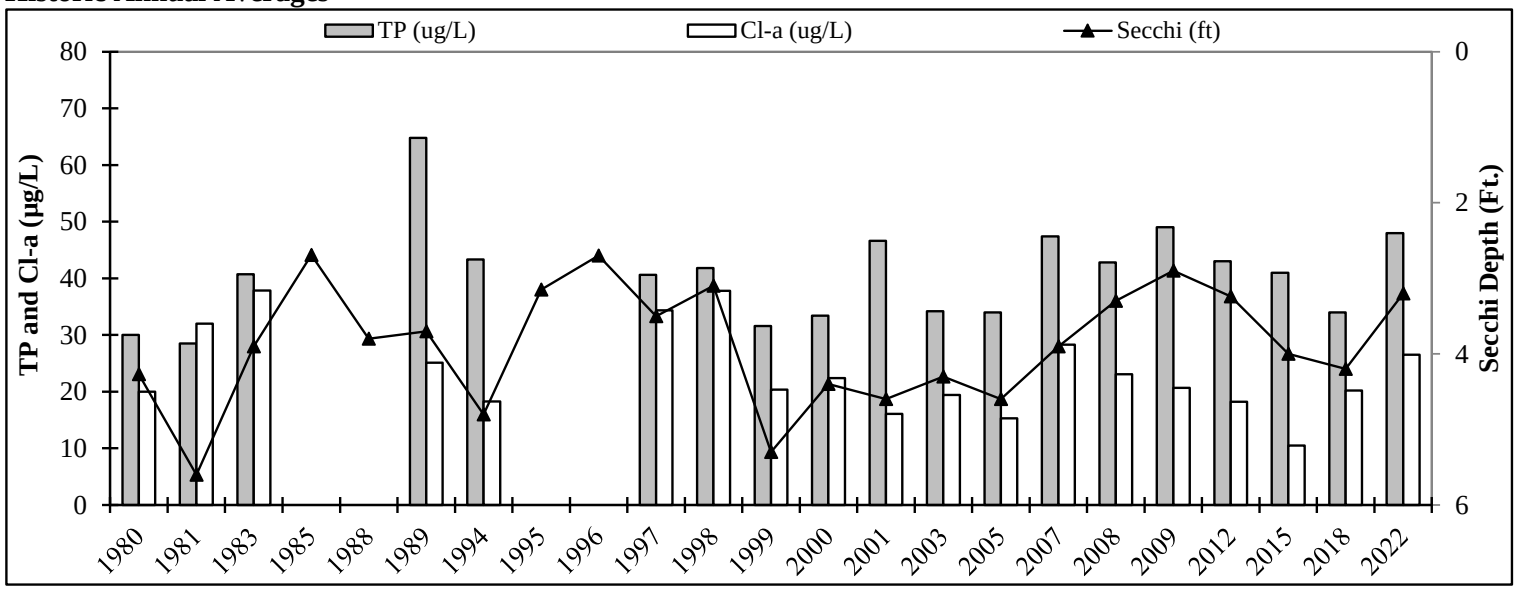
pH		8.35
Specific Conductivity	mS/cm	0.28
Turbidity	NTU	15.55
D.O.	mg/l	8.74
D.O.	%	103.25
Temp.	°F	73.32
Salinity	%	0.14
Cl-a	µg/L	26.05
T.P.	µg/l	49.00
Secchi	ft	2.71

Linwood Lake

2022 Water Quality Data	Date		5/16/2022	6/1/2022	6/14/2022	6/29/2022	7/20/2022	8/3/2022	8/16/2022	8/31/2022	9/12/2022	9/26/2022			
	Time		11:50	13:15	12:10	10:30	14:55	12:45	10:15	12:30	12:55	12:15			
	Units	R.L.*											Average	Min	Max
pH		0.1	8.25	8.01	8.09	8.27	8.46	8.73	8.84	8.43	8.64	8.20	8.39	8.01	8.84
Conductivity	mS/cm	0.01	0.294	0.301	0.296	0.291	0.283	0.274	0.275	0.262	0.251	0.274	0.280	0.251	0.301
Turbidity	FNRU	1	1.3	2.40	7.90	13.80	14.70	16.40	19.10	19.10	21.50	28.60	14	1	29
D.O.	mg/L	0.01	10.73	9.18	8.80	8.58	7.81	9.50	10.36	8.12	7.67	8.67	8.94	7.67	10.73
D.O.	%	1	115.2	102.9	107.0	103.6	97.5	119.8	124	97	89	91	104.6	88.6	123.8
Temp.	°C	0.1	17.5	19.7	22.9	23.5	25.9	25.4	23.2	23.0	21.8	17.3	22.0	17.3	25.9
Temp.	°F	0.1	63.5	67.5	73.2	74.4	78.6	77.8	73.7	73.5	71.3	63.1	71.6	63.1	78.6
Salinity	%	0.01	0.14	0.15	0.14	0.14	0.14	0.13	0.13	0.13	0.13	0.13	0.14	0.13	0.15
Cl-a	mg/m³	1	15.4	13.4	16.9	17.8	25.4	27.6	40.1	41.7	26.7	39.5	26.5	13.4	41.7
T.P.	mg/L	0.005	0.042	0.041	0.034	0.036	0.046	0.057	0.059	0.052	0.056	0.056	0.048	0.034	0.059
T.P.	µg/L	5	42	41	34	36	46	57	59	52	56	56	48	34	59
Secchi	ft	0.1	6.1	4.6	4.6	3.0	2.7	2.6	2.3	2.0	2.8	2.0	3.2	2.0	6.1
Secchi	m	0.10	1.9	1.4	1.4	0.9	0.8	0.8	0.7	0.6	0.8	0.6	1.0	0.6	1.9
Physical			3	3.0	3.0	3.0	4.0	4.0	3.0	3.0	3.0	4.0	3.3	3.0	4.0
Recreational			5	4.0	4.0	3.0	4.0	4.0	4.0	4.0	3.0	4.0	3.9	3.0	5.0

*reporting limit

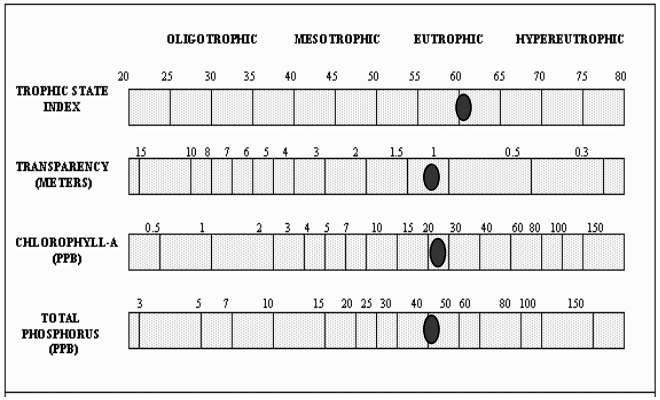
Historic Annual Averages



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**
2022	C	C	D	**C**
State Standards	40 ug/L	14 ug/L	>4.6 ft	

Carlson's Trophic State Index



Grade	Percentile	TP (µg/L)	Cl-a (µg/L)	Secchi Disk (m)
A	< 10	<23	<10	>3.0
B	10 - 30	23 – 32	10 - 20	2.2 - 3.0
C	30 – 70	32 – 68	20 – 48	1.2 – 2.2
D	70 – 90	68 – 152	48 – 77	0.7 – 1.2
F	> 90	> 152	> 77	< 0.7

Coon Lake- East and West Bays

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. Public access is available at three locations with boat ramps, including a large county park with a swimming beach. The lake is used extensively by recreational boaters and fishers. Most of the lake is surrounded by private residences with the watershed of 6,616 acres being mostly rural residential land. Coon Lake is split into two large basins and each basin is monitored as an individual lake. This report includes water quality data that is reported separately for the East Bay and the West Bay of Coon Lake. Data provided from 2010-2022 was collected by the Anoka Conservation District (ACD). Over the years, other sites have been monitored in each of the basins and are included in trend analysis when appropriate. The East and West Bays of Coon Lake have had noticeably different water quality in the past, but have been similar in recent monitoring years. When making comparisons between the two bays, consider that both bays were monitored simultaneously biennially only from 2010 to 2022. Data from other years do not lend themselves well to direct comparisons because monitoring regimes were likely different.

Discussion

Coon Lake was once near state impaired status but has improved substantially in recent decades. Water quality improvements on the lake have likely been driven by several contributing factors. One likely factor is the management and ongoing treatment of aquatic invasive species, which have been documented to affect water quality in negative ways. Certain AIS species absorb phosphorous from the soil through its root system and then plant die-off's in early summer can result in a spike in water-borne phosphorous concentrations. Herbicide treatment of Eurasian watermilfoil (EWM) and curly leaf pondweed (CLP) in the Coon Lake basins began in 2009 and has continued as needed, with treatment being directed by the MNDNR.

Looking back at pre-2010 data, a mid-summer spike in phosphorus is observed 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.

Implementation of water quality improvement projects is also helping to improve the water quality in Coon Lake. Projects have been constructed, including two rain gardens, two stormwater filtration basins and several lakeshore restorations. Based on pollutant reduction estimates for these projects, they are likely only responsible for a small portion of the improvement in lake conditions. Additional funding has been secured by ACD to implement more of these types of projects within the Sunrise River watershed including throughout Coon Lake.

Future management should focus on the ecological health of the lake, as well as protecting the current high-caliber water quality of the lake. Removal of native shoreline and aquatic vegetation by homeowners is a specific concern. This vegetation creates important habitat for fish and other shoreline wildlife, while helping filter stormwater runoff before it reaches the lake. Promoting proper septic system maintenance and replacing failing septic systems is also management target, 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 ACD. These projects, including many lakeshore restorations, are prioritized by cost-effectiveness. A shoreline inventory was completed for each basin in 2021 which assessed lakeshore conditions helped direct outreach efforts. This inventory will continue to aid in prioritizing future lakeshore projects.

Coon Lake East Bay

2022 Results

2022 Coon Lake East Bay water quality was better than average for this region of the state (NCHF Ecoregion), receiving an overall B letter grade, a decline from the A letter grade achieved when the bay was last monitored in 2018. 2022 water quality was better then all state standards and greatly improved when compared to pre-2010 data. Annual averages for 2022 included 29.6 µg/L for total phosphorus, 11.70 µg/L chlorophyll-a, and a Secchi transparency of 5.7 feet.

Even though the East Bay had worsening water quality results in 2022 the overall trend of improving water quality seems to continue when compared to other recent years. It is worth noting that 2018 was the best year on record for total phosphorus levels in the East Bay (19.4 µg/L) and second best on record for Secchi transparency (7.96 ft.), with only the 2013 average 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.

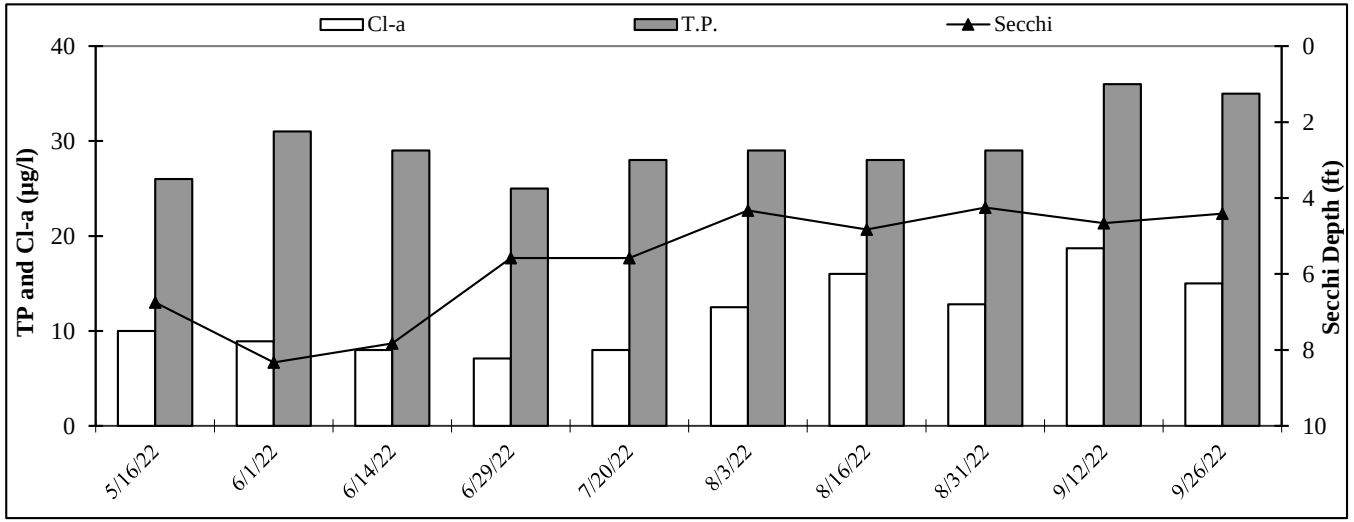
Trend Analysis

In the East Bay, twenty-four years of water quality data have been collected since 1978. Twenty of those monitoring years include total phosphorus, chlorophyll-a, and secchi transparency. 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 ideal for detecting changes that occurred prior to 1990. Monitoring years where only Secchi transparency data is available have been excluded from analysis.

When we examined those years with total phosphorus, chlorophyll-a, and Secchi transparency, 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 ($F_{3, 19}$=4.23, $p < 0.05$). 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. One-way ANOVA results showed a significant trend of improving TP ($F_{1, 19}$=7.25, $p < 0.05$) and Cl-a ($F_{1, 19}$=4.99 $p < 0.05$). Secchi transparency is improving but is not significant. It is noteworthy that this improvement seems to have primarily occurred since 2010.

COON LAKE EAST BAY

2022 Results



2022 Medians

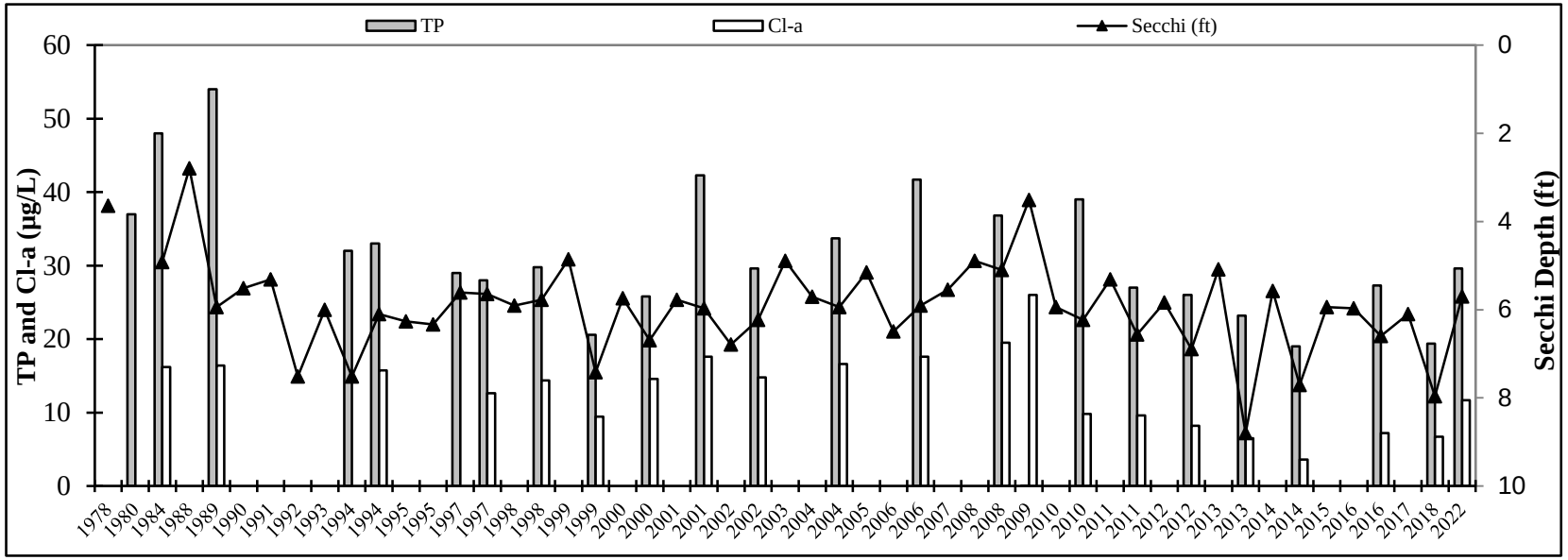
pH		8.30
Specific Conductivity	mS/cm	0.22
Turbidity	NTU	4.60
D.O.	mg/l	8.86
D.O.	%	106.55
Temp.	°F	73.45
Salinity	%	0.11
Cl-a	µg/L	9.45
T.P.	µg/l	28.50
Secchi	ft	5.58

Coon Lake East Bay
2022 Water Quality Data

	Units	R.L.*	Date: 5/16/2022	6/1/2022	6/14/2022	6/29/2022	7/20/2022	8/3/2022	8/16/2022	8/31/2022	9/12/2022	9/26/2022	Average	Min	Max
			Time: 10:55	11:55	13:45	9:20	15:45	13:55	11:15	13:30	13:50	12:50			
pH		0.1	7.92	7.97	8.22	7.88	8.81	8.77	8.38	8.42	8.66	8.21	8.32	7.88	8.81
Conductivity	mS/cm	0.01	0.221	0.229	0.221	0.214	0.218	0.215	0.225	0.210	0.212	0.217	0.218	0.210	0.229
Turbidity	FNRU	1	0.30	0.00	0.60	7.60	4.60	8.20	6.40	3.60	11.20	14.30	6	0	14
D.O.	mg/l	0.01	10.20	8.86	8.86	8.25	8.03	9.12	9.40	9.04	8.68	9.24	8.97	8.03	10.20
D.O.	%	1	110.6	98.3	107.4	100.4	105.7	117.5	112.30	109.40	102.80	98.70	106.3	9830%	11750%
Temp.	°C	0.1	17.6	19.2	22.61	23.93	26.76	25.89	23.45	23.73	22.46	17.63	22.3	17.6	26.8
Temp.	°F	0.1	63.6	66.5	72.7	75.1	80.2	78.6	74.2	74.7	72.4	63.7	72.2	63.6	80.2
Salinity	%	0.01	0.11	0.11	0.11	0.10	0.11	0.10	0.11	0.10	0.10	0.10	0.11	0.10	0.11
Cl-a	mg/m³	1	10.00	8.90	8.00	7.10	8.00	12.50	16.00	12.80	18.70	15.00	11.7	7.10	18.70
T.P.	mg/l	0.005	0.026	0.031	0.029	0.025	0.028	0.029	0.028	0.029	0.036	0.035	0.030	0.025	0.036
T.P.	ug/l	5.00	26.00	31.00	29.00	25.00	28.00	29.00	28.00	29.00	36.00	35.00	29.6	25	36
Secchi	ft		6.8	8.3	7.8	5.6	5.6	4.3	4.8	4.3	4.7	4.4	5.7	4.3	8.3
Secchi	m		2.1	2.5	2.4	1.7	1.7	1.3	1.5	1.3	1.4	1.3	1.7	1.3	2.5
Physical			3	4.0	4.0	4.0	4.0	4.0	3.0	4.0	4.0	4.0	3.8	3.0	4.0
Recreational			5	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.1	4.0	5.0

*reporting limit

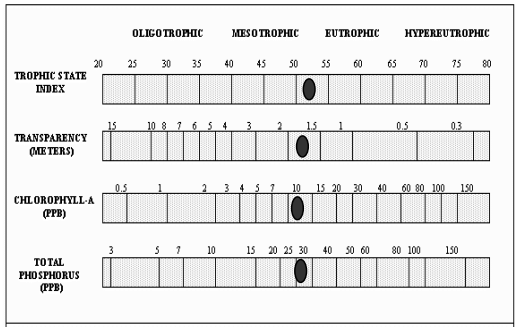
Historical Annual Averages



Historical Report Card

Year	TP	Cl-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**
2022	B	B	C	**B**

Carlson's Trophic State Index



Grade	Percentile	TP (µg/L)	Cl-a (µg/L)	Secchi Disk (m)
A	< 10	<23	<10	>3.0
B	10 - 30	23 – 32	10 - 20	2.2 - 3.0
C	30 – 70	32 – 68	20 – 48	1.2 – 2.2
D	70 – 90	68 – 152	48 – 77	0.7 – 1.2
F	> 90	> 152	> 77	< 0.7

Coon Lake West Bay

2022 Results

In 2022 the West Bay had better than average water quality for this region of the state (NCHF Ecoregion), receiving an overall B letter grade, although this was a decline from the A letter grade the bay received in 2018. Average total phosphorus concentrations in 2022 (24.2 µg/L) were slightly higher than when last monitored in 2018 (21.4 µg/L). The lowest annual TP average was recorded in 2016 (21.0 µg/L). Phosphorus has been substantially better than state standards (40 µg/L) and low enough to earn A or B grades since monitoring began in 2010.

Chlorophyll-a concentrations also increased in 2022 and the highest concentration on record was observed in 2022 (10.5 µg/L), the average for 2018 being 6.9 µg/L. Despite chlorophyll-a levels increasing since 2014 (3.3 µg/L), concentrations are still lower than the state standard (14 µg/L) and earned the West Bay of Coon Lake a B+ grade for the parameter in 2022.

Chlorophyll-a concentrations have varied from a low annual average of 3.3 µg/L in 2014 to a high of 6.9 µg/L in 2022. Unlike phosphorus and Secchi transparency, there is no evidence of an improving trend in chlorophyll-a. The lowest average seen in 2014 followed the second highest annual average in 2012 (5.4 µg/L), followed by another low in 2016 (3.6 µg/L). Cl-a concentration then nearly doubled in 2018 (6.9 µg/L) and then a new record high was recorded in 2022 (10.5 µg/L). While these may seem like significant changes over consecutive sampling years, all years of chlorophyll-a monitoring in the West Bay have resulted in very low average concentrations when compared to other lakes and state water quality standards.

Secchi transparency has been monitored longer than other parameters, 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. 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.

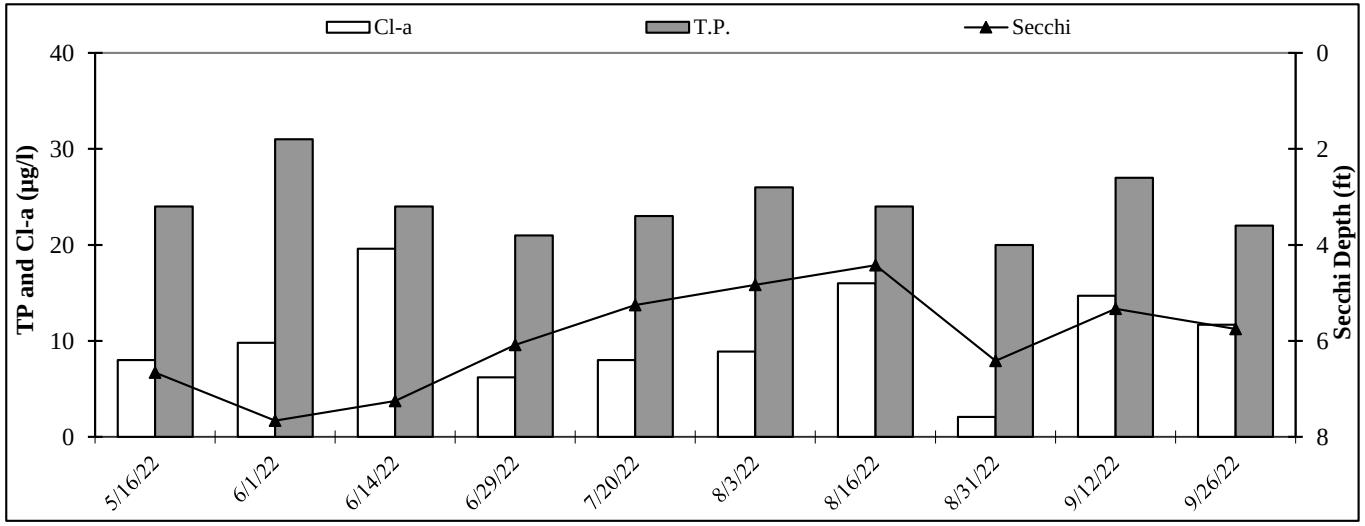
In 2022, the average Secchi transparency was 5.96 feet. This is similar to years monitored before 2010 where seven years between 1998-2010 had average Secchi transparency of <6 feet. It is notable that in other recent sampling years (2014, 2016, 2018), the average Secchi transparency was the best recorded since 2002. This suggests that Secchi transparency may be improving, and is at least not declining.

Trend Analysis

Fourteen years of data are available for the West Bay of Coon Lake but only six of these years include data for total phosphorus, secchi transparency, and chlorophyll-a. This does not provide enough data to generate meaningful trend analysis. The dataset for Secchi transparency is longer, but data from 2010 and 2012 must be excluded because measurements were incomplete due to water clarity occasionally exceeding lake depth at the sampling point. Therefore, a statistical analysis would not be meaningful.

COON LAKE WEST BAY

2022 Results



2022 Medians

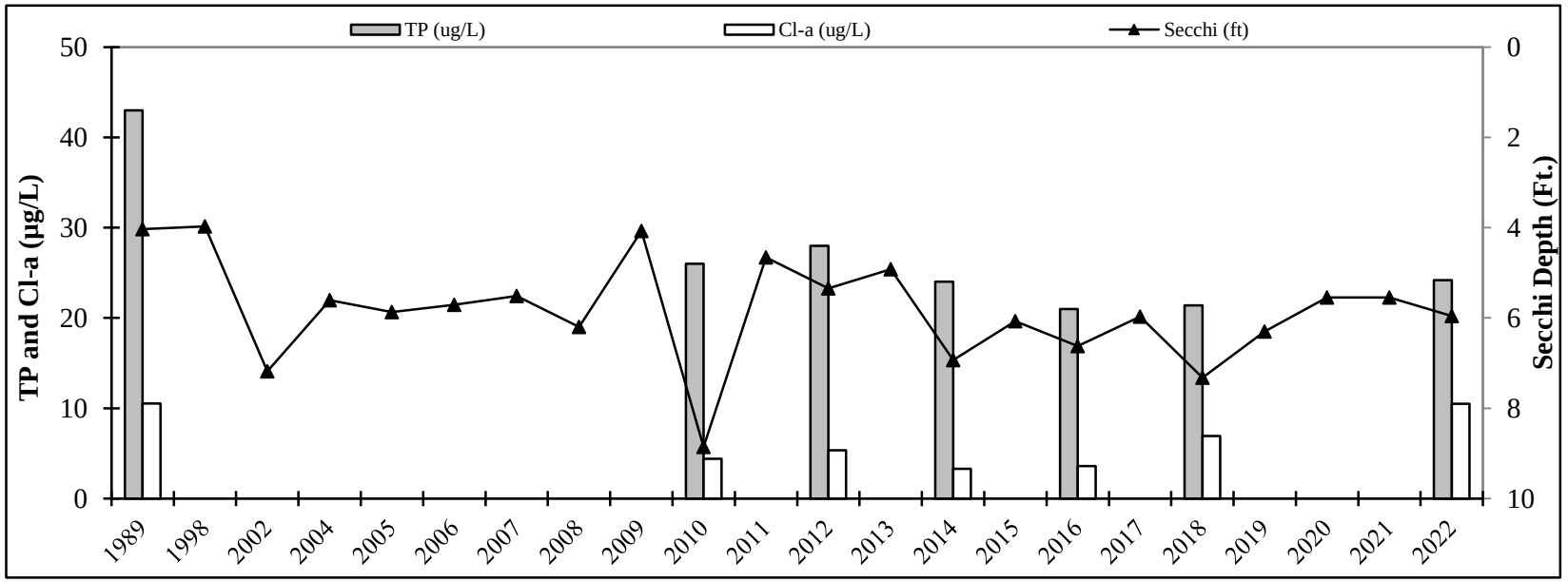
pH		8.42
Specific Conductivity	mS/cm	0.17
Turbidity	NTU	5.10
D.O.	mg/l	9.09
D.O.	%	109.35
Temp.	°F	73.07
Salinity	%	0.08
Cl-a	µg/L	8.45
T.P.	µg/l	24.00
Secchi	ft	6.08

Coon Lake West Bay
2022 Water Quality Data

	Units	R.L.*	Date: 5/16/2022	6/1/2022	6/14/2022	6/29/2022	7/20/2022	8/3/2022	8/16/2022	8/31/2022	9/12/2022	9/26/2022	Average	Min	Max
			Time: 10:20	11:30	13:20	9:40	16:15	14:20	11:40	13:50	14:10	13:10			
pH		0.1	7.79	7.96	8.31	7.88	8.76	8.91	8.53	8.64	8.88	8.21	8.39	7.79	8.91
Specific Conductivity	mS/cm	0.01	0.194	0.198	0.186	0.170	0.167	0.169	0.183	0.166	0.111	0.179	0.172	0.111	0.198
Turbidity	FNRU	1	8.60	5.10	0.50	5.60	0.60	15.70	2.90	0.30	7.30	7.90	5.5	0	9
D.O.	mg/l	0.01	9.34	8.93	9.05	9.12	8.31	8.96	9.46	9.42	9.40	10.06	9.21	8.31	10.06
D.O.	%	1	102.5	98.1	110.3	109.3	106.5	115.1	112.0	113.3	109.4	102.7	108	98	115
Temp.	°C	0.1	18.49	18.53	23.09	23.03	25.87	26.07	22.60	23.38	21.67	15.38	21.8	15.4	26.1
Temp.	°F	0.1	65.3	65.4	73.6	73.5	78.6	78.9	72.7	74.1	71.0	59.7	71.3	59.7	78.9
Salinity	%	0.01	0.09	0.10	0.09	0.08	0.08	0.08	2.90	0.08	0.08	0.08	0.37	0.08	2.90
Cl-a	mg/m^3	1	8.00	9.80	19.60	6.20	8.00	8.90	16.00	2.10	14.70	11.70	10.50	2.10	19.60
T.P.	mg/l	0.005	0.024	0.031	0.024	0.021	0.023	0.026	0.024	0.020	0.027	0.022	0.024	0.020	0.031
T.P.	ug/l	5	24	31	24	21	23	26	24	20	27	22	24.2	20	31
Secchi	ft		6.7	7.7	7.3	6.1	5.3	4.8	4.4	6.4	5.3	5.8	5.96	4.4	7.7
Secchi	m		2.0	2.3	2.2	1.9	1.6	1.5	1.3	2.0	1.6	1.8	1.8	1.3	2.3
Physical			3	4	4	4	4	4	3	4	4	4	3.8	3.0	4.0
Recreational			5	4	4	4	4	3	3	4	4	4	3.9	3.0	5.0

*reporting limit

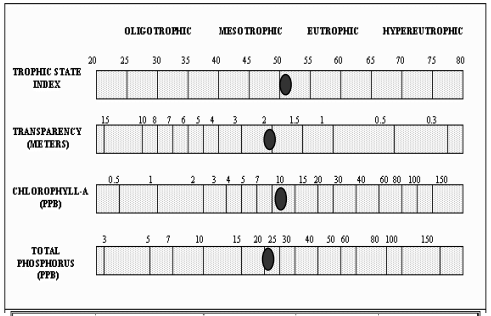
Historical Annual Averages



Historical Report Card

Year	TP	Cl-a	Secchi	Overall
1998			C	
2002			C	
2004			C	
2005			C	
2006			C	
2007			C	
2008			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**
2022	B+	B+	C	**B**

Carlson's Trophic State Index



Grade	Percentile	TP (µg/L)	Cl-a (µg/L)	Secchi Disk (m)
A	< 10	<23	<10	>3.0
B	10 - 30	23 – 32	10 - 20	2.2 - 3.0
C	30 – 70	32 – 68	20 – 48	1.2 – 2.2
D	70 – 90	68 – 152	48 – 77	0.7 – 1.2
F	> 90	> 152	> 77	< 0.7

Stream Water Quality Monitoring

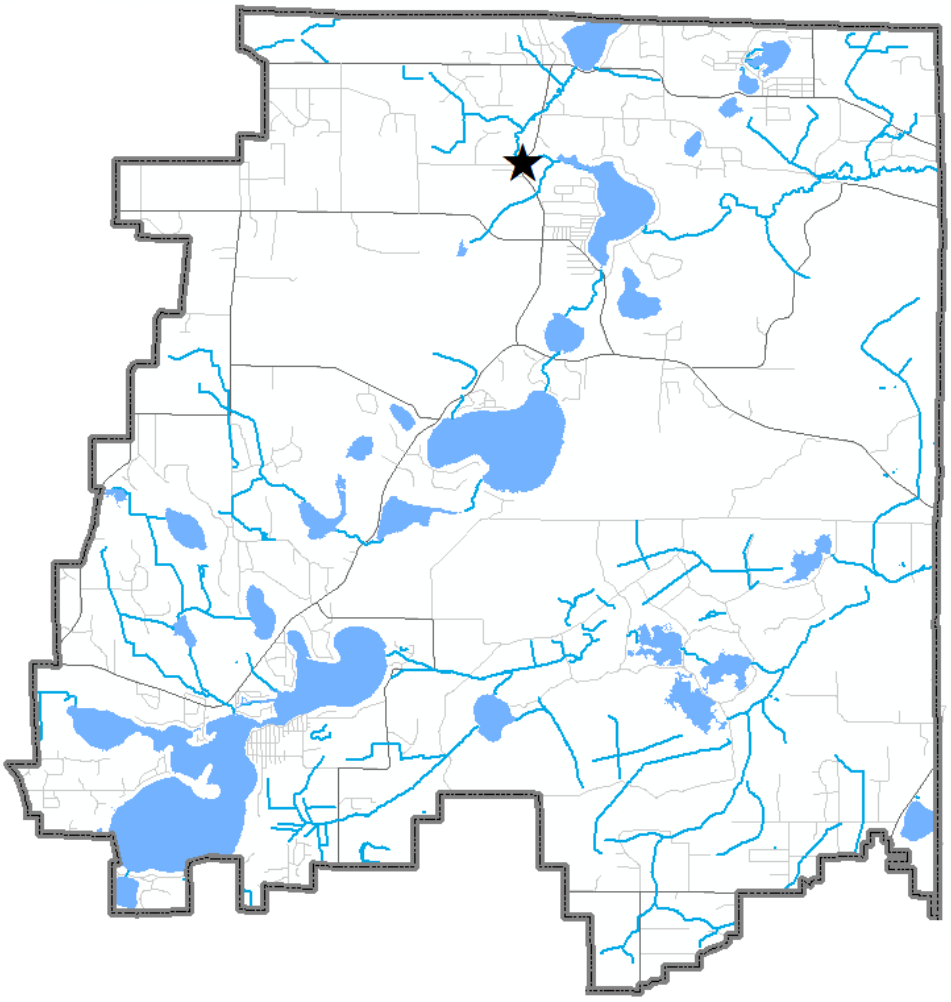
Description: Stream water quality is monitored with the collection of grab samples on eight occasions throughout the open water season, including four times immediately following a storm (1" of rain within a 24hr period) and four times during baseflow conditions. The selected site was chosen to monitor the impacts of installed carp barriers, recent carp harvests, and other BMP's installed in the watershed over time. 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

Location: Typo Creek at Typo Creek Drive

Results: Results are presented on the following pages.

2022 Sunrise River Watershed Stream Water Quality Monitoring Sites



TYPO CREEK AT TYPO CREEK DRIVE

STORET SiteID = S003-188

Years Monitored

1998, 2000, 2001, 2003, 2016-2017, 2022

Background

The northern inlet to Martin Lake, also called Typo Creek, flows south from the outlet of Typo Lake about 1.9 miles where it enters into Martin Lake. This creek is the primary inlet to Martin Lake. The watershed is mostly undeveloped. This stream carries a relatively large volume of water, with flows ranging from 4-6 cfs during baseflow and 10-17 cfs during stormflow. Upstream water quality projects including carp barriers and carp harvests are aimed at improving water quality in this stream and the Sunrise River chain of lakes. Typo Creek connects Typo Lake and Martin Lake, both listed as impaired for excess nutrients, but can also be viewed as part of the West Branch of the Sunrise River which inlets into Typo Lake and outlets from Martin Lake eastward.

Summary

Summarized water quality monitoring findings and management implications include:

- Dissolved pollutants, as measured by specific conductivity, are at low and healthy levels. However, specific conductivity in 2022 was higher than previous monitoring years, especially during baseflow conditions.

  Management discussion: Continued de-icing salt reductions would be helpful. Future monitoring should consider testing chlorides approximately every third year.

- Phosphorus loading and eutrophication remains the largest concern for Typo Creek. Total phosphorus levels in the creek routinely exceed state impairment standards. High phosphorus levels in Typo Creek are reflective of conditions in Typo Lake immediately upstream and then Typo Creek phosphorus is discharged into Martin Lake, immediately downstream.

- Suspended solids and turbidity remain a problem in Typo Creek and are directly related to the issues causing excessive nutrient loading.

- pH, on average, was within the range considered normal and healthy for streams in this area in 2022. Previous monitoring years' pH was outside the range that is considered healthy. A likely explanation for the pH improvement is the reduction in nutrient eutrophication that has occurred in Typo Lake.

- Dissolved oxygen (DO) remains lower in Typo Creek than would be ideal. The excessive nutrients and algal growth, and subsequent decomposition, is likely driving low DO.

Results and Discussion

Water improvement management efforts should be focused on reducing nutrient loading in the whole system including Typo Lake upstream and Martin Lake downstream. Excessive nutrient loading is the root cause of intense high algae blooms, high levels of total phosphorus, turbidity, suspended solids, and low dissolved oxygen. A TMDL study was completed for this stream, and some of the listed corrective projects are being implemented, the largest of which have been including carp management and stormwater treatment.

While area lakes seem to be experiencing improved water quality in response to these recent projects, notable improvement has not yet been documented in Typo Creek. This is primarily because Typo Creek has been monitored less frequently and that monitoring has by chance occurred in years when the lakes had higher nutrients. The stream conditions are reflective of lake conditions, which fluctuate. The severity of the issues facing this creek, its watershed, and even the accumulation of organic sludge in the creek will require a large amount of time and effort to reach goals.

Conductivity and chlorides

Conductivity and chlorides are measures of dissolved pollutants. Dissolved pollutant sources include urban road runoff and industrial chemicals, among many others. Conductivity is a broad measure of dissolved pollutants. It measures electrical conductivity of the water; pure water with no dissolved constituents has zero conductivity. Significant changes in water conductivity may indicate new pollutant sources to the waterbody.

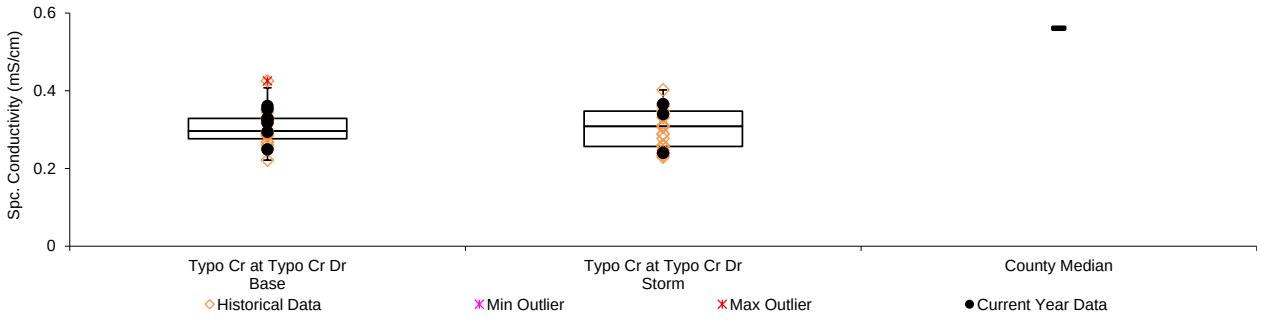
Conductivity in Typo Creek was higher than in previous years monitored, averaging 0.305 mS/cm over the 2022 sampling season. This is lower than the median for all Anoka County streams (0.561 mS/cm) which is a county-wide average driven by urban areas with greater road density and road salting. Conductivity was slightly lower during storms, suggesting that stormwater runoff contains fewer dissolved pollutants than the surficial water table that feeds the creek during baseflow. High baseflow conductivity has been observed in many other area streams with the largest cause believed to be road salts that have infiltrated into the shallow aquifer.

Chloride levels were not monitored in recent years, and were last sampled at this site in 2003. Chloride results in 2003 ranged between 8 mg/L and 12 mg/L, far below the MPCA's chronic standard for aquatic life of 230 mg/L. Given that conductivity has increased over time, it would be beneficial to periodically monitor chlorides to determine if chlorides are a cause of increased conductivity.

Chlorides are the measure of chloride salts, the most common of which are road de-icing chemicals or water softener discharge. 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. Excessive application of road deicing salts are a concern region-wide and chlorides are now measurable in area streams year-round, including Typo Creek. While chloride levels may be acceptably low currently, they should be monitored and proactive prevention practices should be implemented to limit pollution in the future.

	Average Specific Conductance (mS/cm	Median Specific conductance (mS/cm)	State Standard	N
Baseflow	0.305	0.297	Specific conductance – none	23
Storms	0.304	0.308		22
All	0.305	0.307		45

Conductivity during baseflow and storm conditions Orange diamonds are historical data from previous years and black circles are 2022 readings. Box plots show the median (middle line), 25th and 75th percentile (ends of box), and 10th and 90th percentiles (floating outer lines).



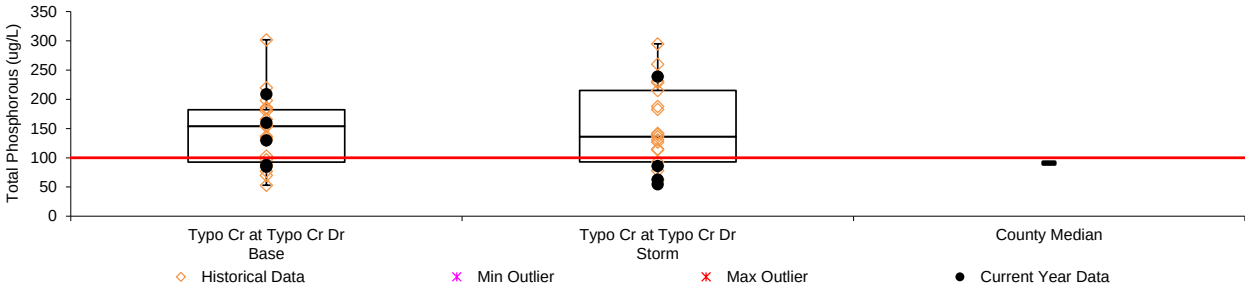
Total Phosphorus

The nutrient phosphorus is one of the most common pollutant to local waterways, and can be associated with stormwater runoff, wastewater, fertilizers, soil loss, and many other sources. Since it is an essential nutrient in the natural ecosystem, even a slight increase of phosphorus levels in a stream can result in harmful algae blooms, accelerated plant growth, low dissolved oxygen levels and other negative effects to fish, macroinvertebrates, and other aquatic animals.

In 2022, total phosphorus concentrations, across all conditions in Typo Creek averaged 128.1 µg/L. This was an improvement from when the site was last monitored in 2017 (151.25 µg/L) and 2016 (138.0 µg/L). High phosphorus levels in Typo Creek is primarily driven by the nutrient loading in Typo Lake, and subsequent decomposition, as well as loose organic soils in the waterway. An effort should be made to continue to implement water improvement management strategies in response to the TMDL report. Additional projects like the previously installed carp barriers and carp removal, have reduced phosphorus levels in the creek as well as the upstream and downstream lakes. Additional funding is likely necessary into the future to bring phosphorus in this system down to goal levels.

	Average Specific Conductance (µg/L)	**Median Specific conductance** (µg/L)	**State Standard**	**N**
Baseflow	144.87	154.0	100 µg/L	23
Storms	151.57	136.0		21
All	148.06	138.5		44
Occasions > state standard				16 (baseflow) 69% 15 (storm) 71%

Total phosphorus during baseflow and storm conditions Orange diamonds are historical data from previous years and black circles are 2022 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 and is most sensitive to large particles. TSS 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. Suspended solids in the waterway can come from sources both internal and external of the stream. Sources on land include soil erosion, road sanding, and many others. Internally, bank erosion and movement of the bottom substrate also contributes to suspended solids. Algal production and sediment disturbance in upstream lakes, like Typo Lake, also contribute suspended solids to Typo Creek.

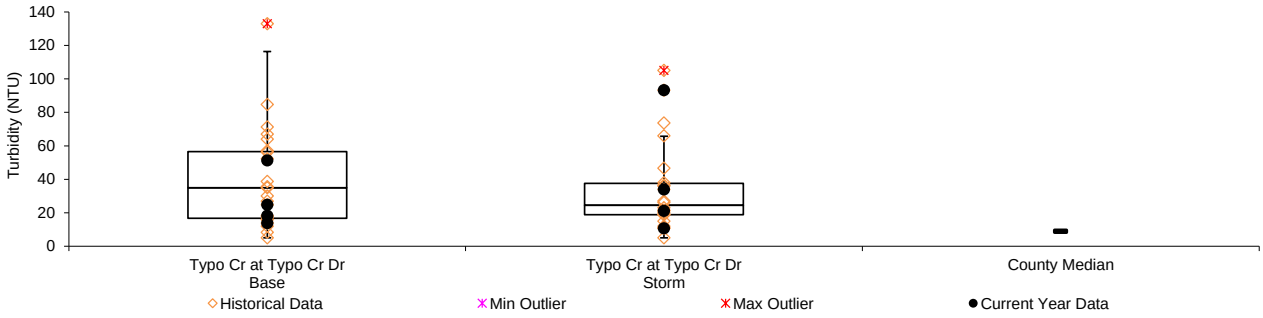
Portions of the Sunrise River West Branch were designated impaired for turbidity in 2008. The state later discontinued this measure of stream impairment. If the state were still using turbidity as a water quality standard, Typo Creek would be exceeding it, as it continuously exceeds 25 NTU. Based on all years, over all conditions, Typo Creek has exceeded 25 NTU on 25 of 45 sampling occasions, or 55% of the time. The average turbidity in 2022 was 40 NTU during storm events and 33.4 NTU during baseflow conditions. 2022 turbidity levels were similar to the turbidity averages documented in 2016-2017.

In 2022, Typo Creek exceeded the state standard of 30 mg/L for TSS on 4 out of the 10 sampling occasions and averaged 25 mg/L across all conditions. This was an improvement from the 2017 average when the site was last monitored (32 mg/L) but an increase from 2016 (15.8 mg/L). Based on all years of ACD sampling, Typo Creek has exceeded 30 mg/L on 17 of 44 sampling occasions, or 38% of the time. The overall average for all years, across all conditions (28.2 mg/L), is less than the state standard but it is nearing the threshold and preventive measures should be considered to avoid further degradation.

The higher TSS and turbidity levels recorded in Typo Creek are likely due to many factors within the watershed. Typo Lake upstream is hypereutrophic, and Typo Creek therefore has high algal levels. Additionally, Typo Creek and Typo Lake each have a very loose, unconsolidated, silty bottom that easily mixes with the water column and readily remains suspended. Rough fish populations also remain present in this system and disturb the sediments.

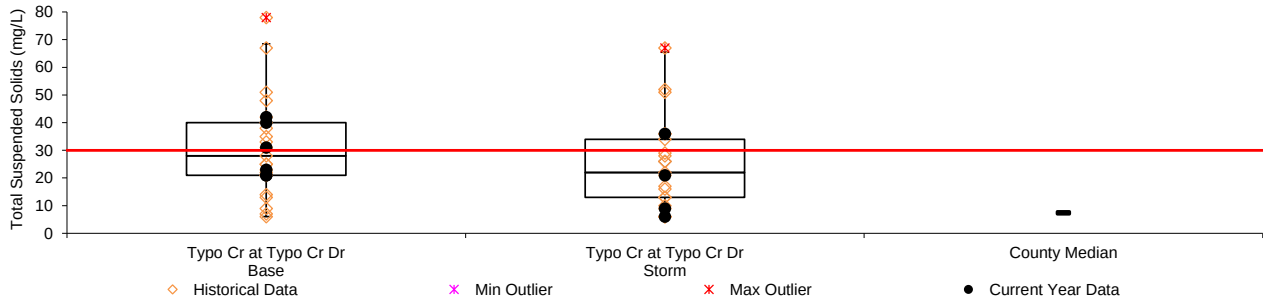
	Average Turbidity (NTU)	Median Turbidity (NTU)	State Standard	N
Baseflow	40.63	35.00	No Standard	23
Storms	34.51	24.55		22
All	37.64	27		45

Turbidity during baseflow and storm conditions Orange diamonds are historical data from previous years and black circles are 2022 readings. Box plots show the median (middle line), 25th and 75th percentile (ends of box), and 10th and 90th percentiles (floating outer lines).



	Average Total Suspended Solids	Median Total Suspended Solids	State Standard	N
Baseflow	31.17	28	>30 mg/L	23
Storms	29.95	22		21
All	28.20	25.5		44
Occasions >30 mg/L				11 (baseflow) 48% 6 (storm) 29%

Total suspended solids during baseflow and storm conditions Orange diamonds are historical data from previous years and black circles are 2022 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

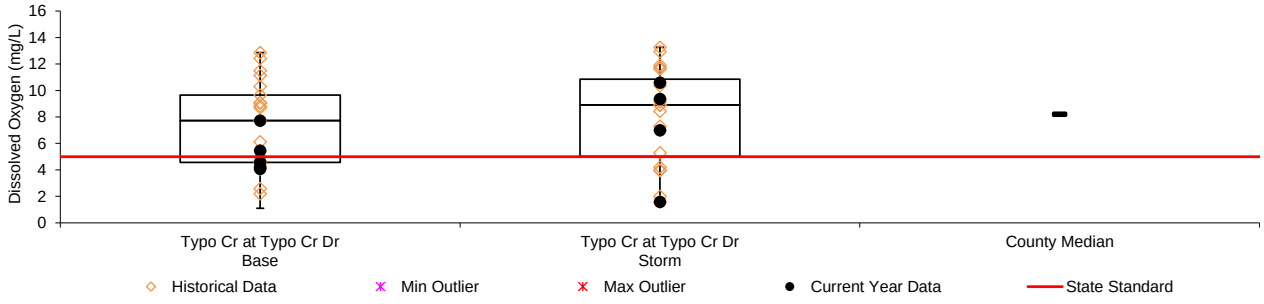
Dissolved oxygen is an important indicator of water quality as it is necessary for aquatic life, including fish. Decomposition of organic materials or organic pollution causes oxygen to be consumed. If oxygen levels fall below 5 mg/L aquatic life begins to suffer, therefore, the state water quality standard is a daily minimum of 5 mg/L. A stream is considered 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.

When Typo Creek was monitored in years 2000-2003, only one DO reading of <5 mg/L was recorded. Recent monitoring of the site, 2016-2022, documented results that were <5 mg/L on 12 separate sampling occasions. In 2022, five out of ten samples were <5 mg/L, but the overall average was 7.65 mg/L. Measurements were taken during daytime, and lower levels likely occur in early morning hours.

These results are concerning and justification for additional monitoring of the stream. These recent results suggest that Typo Creek is mildly impaired for DO. High amounts of algal production in Typo Lake upstream, and the subsequent decomposition is a likely cause. Low DO levels is presumably having a negative impact on native aquatic life. For example, low DO in the waterway may favor rough fish species over game fish because they can tolerate lower oxygen levels. This issue is primarily driven by the nutrient loading in Typo Lake, as well as organic soils in the waterway. Because of the long history of nutrient and organic matter loading to this creek, even successfully implemented best management practices will take many years to achieve water quality goals.

	Average Dissolved Oxygen (mg/L)	Median Dissolved Oxygen (mg/L)	State Standard	N
Baseflow	7.21	7.73	5 mg/L daily minimum	21
Storms	8.13	8.91		20
All	7.65	8.7		
Occasions <5 mg/L				8 (baseflow) 38% 5 (storm) 25%

Dissolved oxygen results during baseflow and storm conditions Orange diamonds are historical data from previous years and black circles are 2022 readings. Box plots show the median (middle line), 25th and 75th percentile (ends of box), and 10th and 90th percentiles (floating outer lines).

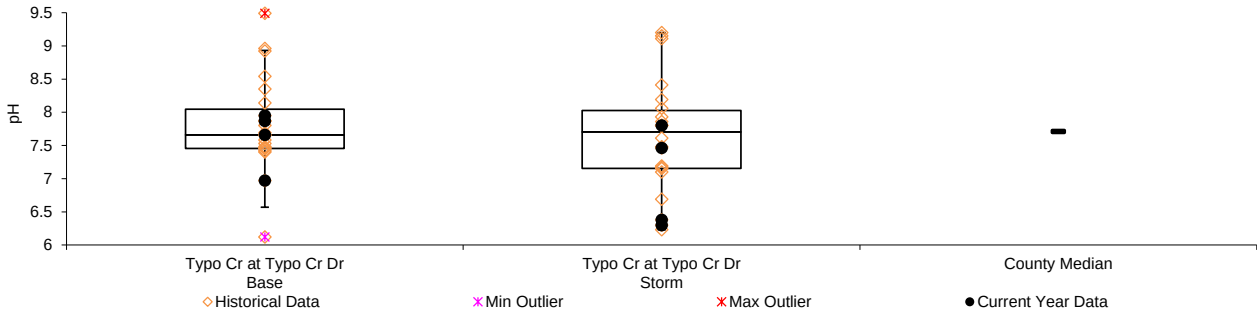


pH

pH refers to the acidity of the water, and influences the stream's ability to support aquatic life. The state standard for pH is between 6.5 and 8.5. Sunrise River West Branch was previously listed as impaired for pH but was delisted in 2012. In recent monitoring years, pH has been more stable, ranging from 6.30 to 7.95 in 2022. In 2017, pH was higher on average than in 2016, but only one measurement throughout the year was recorded above 8.5 (9.11). These recent results are an improvement. Improved water quality in Typo Lake upstream due to restoration projects should continue to help bring pH to more stable and neutral levels.

	Average pH	Median pH	State Standard	N
Baseflow	7.81	7.66	6.5-8.5	23
Storms	7.64	7.71		22
All	7.73	7.66		45
Occasions outside state standard				4 (baseflow) 17% 3 (storm) 14%

pH results during baseflow and storm conditions Orange diamonds are historical data from previous years and black circles are 2022 readings. Box plots show the median (middle line), 25th and 75th percentile (ends of box), and 10th and 90th percentiles (floating outer lines).



Wetland Hydrology

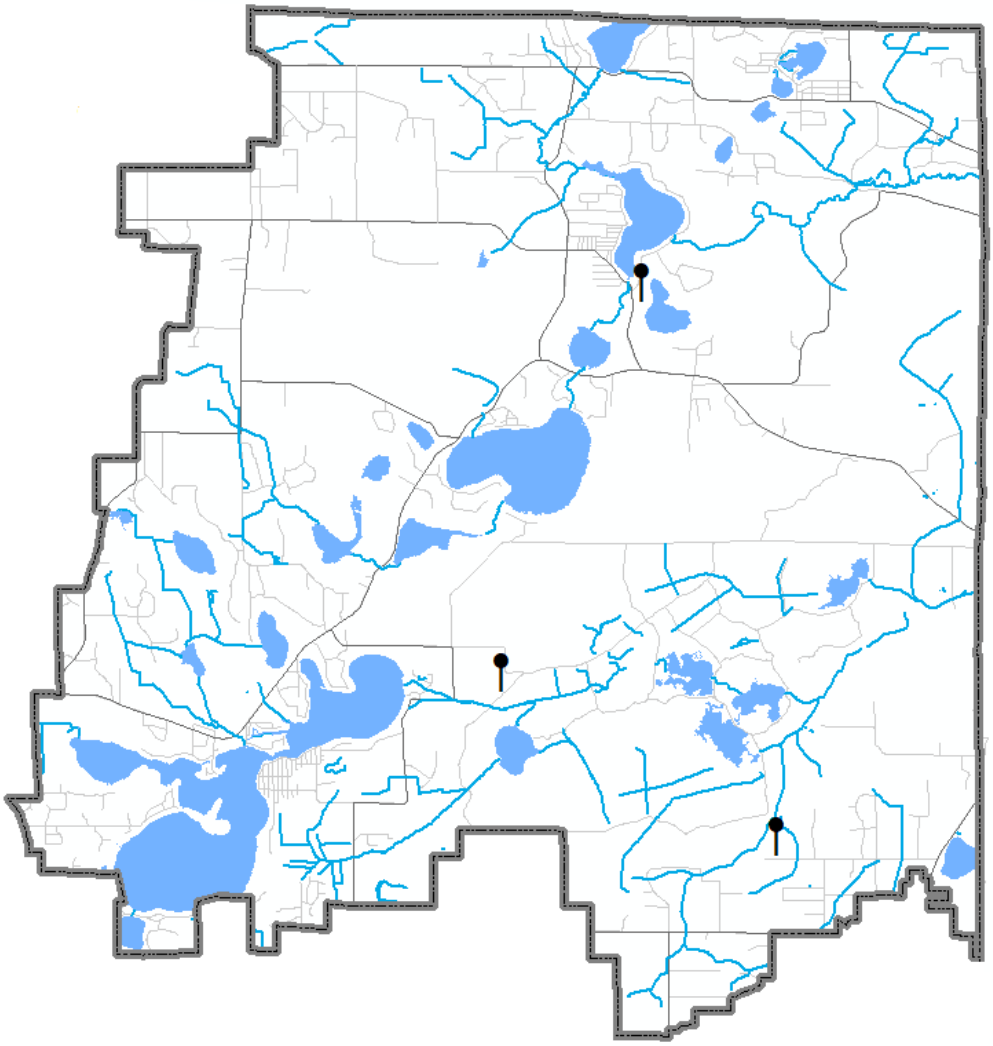
Description: Continuous groundwater level monitoring. Countywide, ACD maintains a network of 23 wetland hydrology monitoring stations.

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

Locations: Carlos Avery Wetland, Carlos 181st Wetland, Tamarack Wetland

Results: See the following pages.

2022 Sunrise River Watershed Wetland Hydrology Monitoring Sites

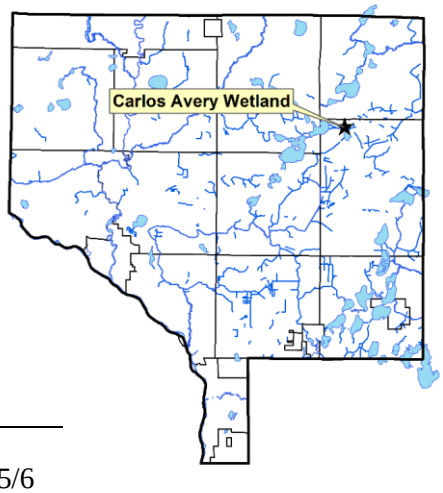


CARLOS AVERY REFERENCE WETLAND

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 Ditch: Yes
Surrounding Soils: Lino loamy fine sand



Soils at Well Location:

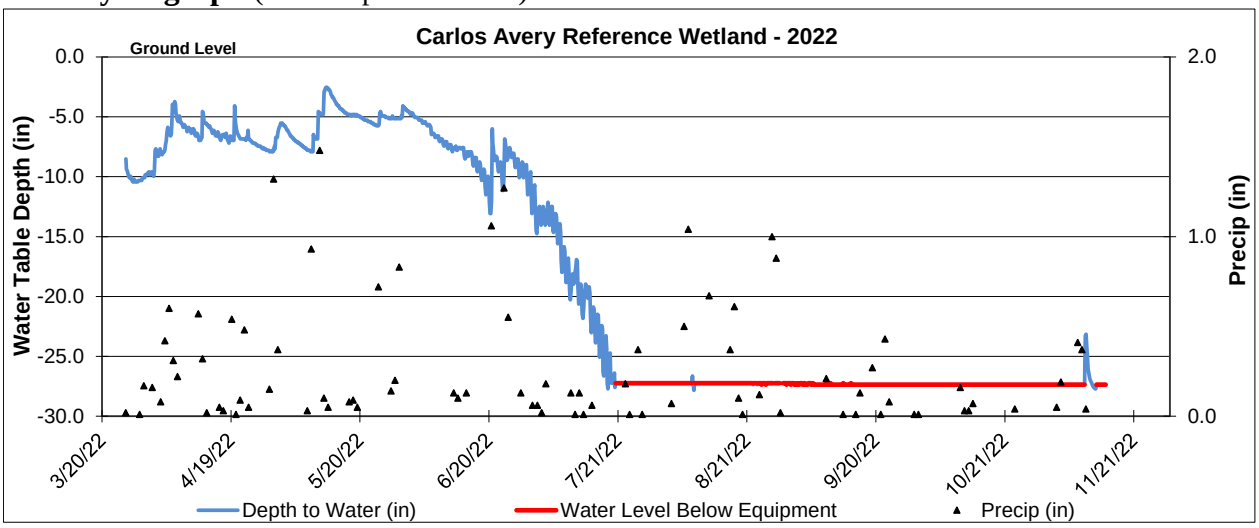
Horizon	Depth	Color	Texture	Redox
Oa	0-4	N2/0	Organic	-
Bg	4-25	10yr 5/2	Sandy Loam	25% 10yr 5/6 with organic streaking

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 wetland is within a state managed WMA. Anoka County was abnormally dry or in a state of drought most of the growing season, which caused this boring to go dry late summer-fall.

2022 Hydrograph (Well Depth 28 inches)

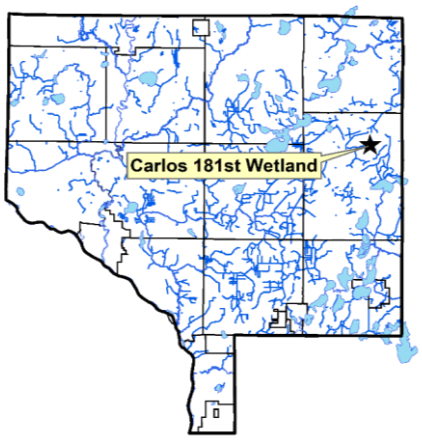


CARLOS 181st REFERENCE WETLAND

Carlos Avery Wildlife Management Area, City of Columbus

Site Information

Monitored Since: 2006
Wetland Type: 2-3
Wetland Size: Approx. 3.9 acres
Isolated Basin: Yes
Connected to Ditch: Roadside swale only
Surrounding Soils: Soderville fine sand



Soils at Well Location:

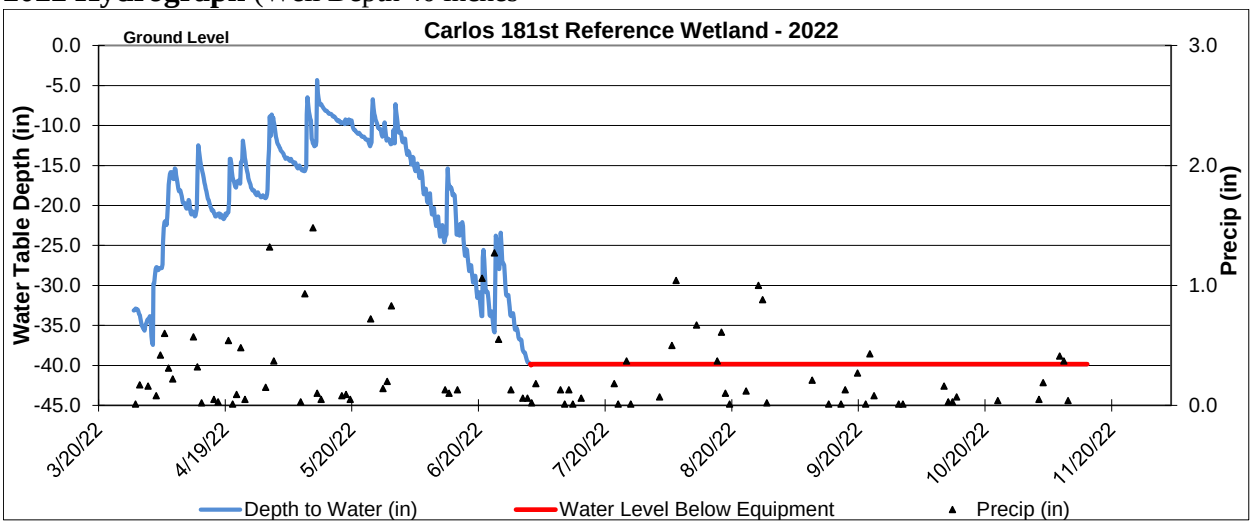
Horizon	Depth	Color	Texture	Redox
Oa	0-3	N2/0	Sapric	-
A	3-10	N2/0	Mucky Fine Sandy Loam	-
Bg1	10-14	10yr 3/1	Fine Sandy Loam	-
Bg2	14-27	5Y 4/3	Fine Sandy Loam	-
Bg3	27-40	5y 4/2	Fine Sandy Loam	-

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: This site is managed by the Minnesota DNR. In 2022, Anoka County was abnormally dry or in a state of drought most of the growing season. This caused this boring to go dry the majority of the monitoring season.

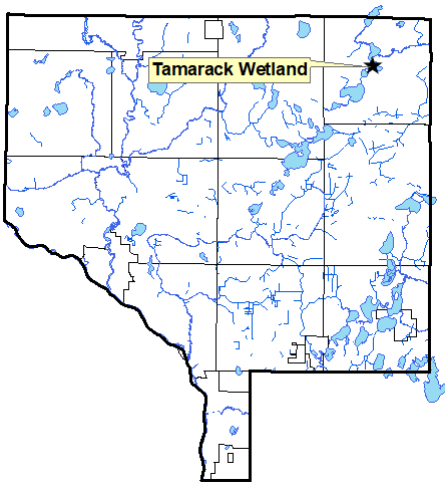
2022 Hydrograph (Well Depth 40 inches



TAMARACK REFERENCE WETLAND

Carlos Avery Wildlife Management Area, City of Columbus

Site Information



Monitored Since: 1999
Wetland Type: 6
Wetland Size: Approx. 1.9 acres
Isolated Basin: Yes
Connected to Ditch: No
Surrounding Soils: Sartell fine sand

Soils at Well Location:

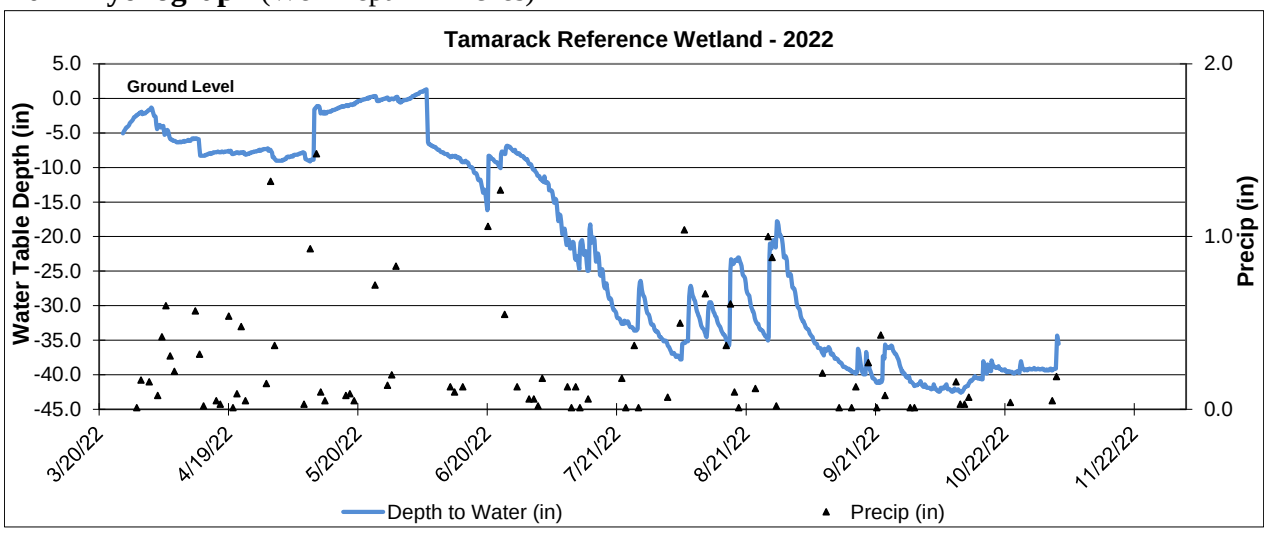
Horizon	Depth	Color	Texture	Redox
A	0-6	N2/0	Mucky Sandy Loam	-
A2	6-21	10yr 2/1	Sandy Loam	-
AB	21-29	10yr3/2	Sandy Loam	-
Bg	29-40	2.5y5/3	Medium Sand	-

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 managed by Anoka County Parks with the boring located on the edge of the wetland. Anoka County was abnormally dry or in a state of drought most of the growing season.

2022 Hydrograph (Well Depth 42 inches)



Secchi Transparency Lake Monitoring – Volunteer Coordination

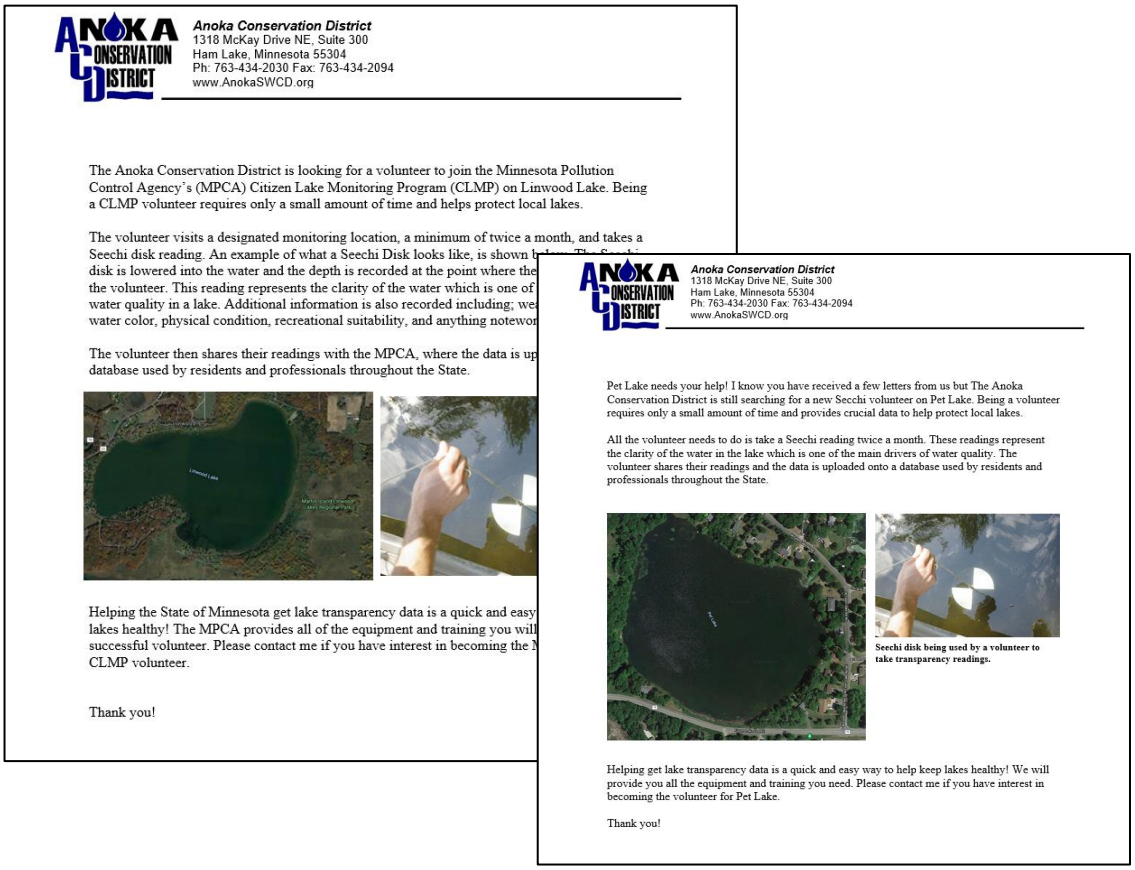
Description: Anoka Conservation District identified and provided outreach efforts to enroll new volunteers into the Minnesota Pollution Control Agency's (MPCA) Citizen Monitoring Program. These volunteers would monitor Secchi transparency during the open water season and report their data to the State. The MPCA provides equipment, coordinates data collection, and train volunteers as needed.

Purpose: To gain transparency data for lakes within the watershed that currently do not have active volunteers.

Location: Watershed-wide

Results: Seechi volunteers are established on Martin, and Coon (East and West Bay), Linwood, and Typo Lake. In 2022, ACD continued outreach efforts to try and secure volunteers at Fawn, Rice, Tamarack, Pet, and Island Lake. Finding volunteers on these smaller lakes has proven to be difficult due to the limited number of homes and lack of public access. Rice Lake, for example, only has six residents.

Lake-specific volunteer recruitment letters



Anoka Conservation District
1318 McKay Drive NE, Suite 300
Ham Lake, Minnesota 55304
Ph: 763-434-2030 Fax: 763-434-2094
www.AnokaSWCD.org

The Anoka Conservation District is looking for a volunteer to join the Minnesota Pollution Control Agency's (MPCA) Citizen Lake Monitoring Program (CLMP) on Linwood Lake. Being a CLMP volunteer requires only a small amount of time and helps protect local lakes.

The volunteer visits a designated monitoring location, a minimum of twice a month, and takes a Seechi disk reading. An example of what a Seechi Disk looks like, is shown b
disk is lowered into the water and the depth is recorded at the point where the
the volunteer. This reading represents the clarity of the water which is one of
water quality in a lake. Additional information is also recorded including; we
water color, physical condition, recreational suitability, and anything notewor

The volunteer then shares their readings with the MPCA, where the data is up
database used by residents and professionals throughout the State.

Helping the State of Minnesota get lake transparency data is a quick and easy
lakes healthy! The MPCA provides all of the equipment and training you will
successful volunteer. Please contact me if you have interest in becoming the
CLMP volunteer.

Thank you!

Anoka Conservation District
1318 McKay Drive NE, Suite 300
Ham Lake, Minnesota 55304
Ph: 763-434-2030 Fax: 763-434-2094
www.AnokaSWCD.org

Pet Lake needs your help! I know you have received a few letters from us but The Anoka Conservation District is still searching for a new Secchi volunteer on Pet Lake. Being a volunteer requires only a small amount of time and provides crucial data to help protect local lakes.

All the volunteer needs to do is take a Seechi reading twice a month. These readings represent the clarity of the water in the lake which is one of the main drivers of water quality. The volunteer shares their readings and the data is uploaded onto a database used by residents and professionals throughout the State.

Seechi disk being used by a volunteer to take transparency readings.

Helping get lake transparency data is a quick and easy way to help keep lakes healthy! We will provide you all the equipment and training you need. Please contact me if you have interest in becoming the volunteer for Pet Lake.

Thank you!

Water Quality Grant Funds

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 control, and others. These grants, administered by ACD, offer cost sharing of the materials needed for a project. The landowner is responsible for some expenses. ACD assists interested landowners with design, materials acquisition, installation, and maintenance.

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

Locations: Throughout the watershed.

Results: Projects reported in the year they were installed.

SRWMO Cost Share Fund Summary

2021 Year-End Balance	$3,024.24
2022 SRWMO contribution	$1,500.00
Fund Balance	**$4,524.24**

Projects Funded since inception:

2006 – Coon Lakeshore restoration - Rogers
2008 – Martin Lakeshore restoration - Moos
2012 – Linwood Lakeshore restoration, Gustafson
2012 – Transfer to Martin – Typo Lakes Carp Barriers
2016 – Coon Lake Rain Garden - Voss
2018 – Coon Lakeshore Restoration - Gunnink
2020 – Coon Lakeshore Restoration - Scheiderich
2021 – Linwood Elementary Rain Garden

2022 Water Quality Projects

The following water quality projects were installed in 2022 in the Sunrise River WMO. Each project is detailed on the following pages:

- Martin Lakeshore Stabilization – 22845 Martin Lake Dr, Lucas residence
- Fawn Lakeshore Stabilization – 24234 Rutgers St NE, Dale residence
- Linwood Lakeshore Pollinator Planting – 6764 215th Ave NE, Goldstrand residence

PROJECT PROFILE

22845 E Martin Lake Drive, Martin Lakeshore Restoration

Lakeshore Restoration

Project Summary

A lakeshore stabilization was completed at the Lucas property located on the east side of Martin Lake. The project corrected active erosion to benefit water quality.

The shoreline was stabilized by installing coir (coconut fiber) logs along the shore. The logs, made of natural materials, provide 5-10 years of protection from wave erosion, during which time they become vegetated and biodegrade. Thereafter, the plants provide shoreline protection. The material is inexpensive, effective, and able to be shaped to the shoreline.

This project stabilized 70 linear feet on Martin Lake, which is a state impaired water and priority for the local watershed organization. Funding was from the landowner and the ACD cost-share program. ACD provided project administration, design services, and project installation.

Biolog installation. October 2022.

Project Specs

Date Installed ..... October 2022
Shoreline Length Restored..... 70 ft.
Phosphorus reduction .....1.3 lbs/yr
Sediment reduction ..... 1.3 tons/yr

Project Cost

Materials..... $1,264.19
Construction $1,136.89
Project administration, design, and installation were provided by ACD.

Project Funding

ACD Cost-Share..... $1,200.54
Landowner..... $1,200.55
Total Project Funding $2,401.08

Installation Process

Before: The shoreline had eroded back ~5 ft in comparison to adjacent forested shoreline, with additional undercutting visible. In addition to loss of real estate, shoreline erosion contributes nutrients that cause poor water quality including algae blooms.

After: Coir logs were installed along 70 linear ft of shore to protect against waves & favor long term stabilization by vegetation. Coir logs were installed at an elevation that will intercept most lake water levels. The owners plan to leave a larger unmowed shoreline buffer than in the past.

PROJECT PROFILE

24234 RUTGERS ST, FAWN LAKESHORE RESTORATION LINWOOD TWP,

ANOKA CONSERVATION DISTRICT

Lakeshore Restoration

Project Summary

A lakeshore stabilization was completed at the Dale property located on the east side of Fawn Lake. The project corrected active erosion to benefit water quality and included large native plant buffer for near-shore habitat.

200 linear feet of shoreline was stabilized and planted. Coir (coconut fiber) logs were installed along shore. The logs provide protection from wave erosion, while the shoreline becomes fully vegetated. Thereafter, the plants provide shoreline protection. Above the waterline, the area was seeded with a native plant mix and supplemented with native plugs. The planting area was approximately 4,000 sq ft.

Fawn Lake is a high quality lake with a small watershed, so shoreline practices are important to maintaining its good condition. ACD provided project administration, design services, and project installation.

Project area. Installed July 2022.

Project Specs

Date Installed ..... July 2022
Shore Length Restored..... 200 ln ft.
Native Planting Buffer .....4,000 sq ft
Native Plugs Installed.....715
Native Plant Species 39

Project Cost

Materials.....$6.088.00
Construction $1,507.50
Project administration, design, and installation were provided by ACD.

Project Funding

ACD Cost-Share.....$6,141.30
Landowner..... $1,454.20
Total Project Funding $7,595.50

Installation Process

Before: The shoreline had eroded and developed an ice ridge. Erosion was most significant at higher lake levels. Lower lake levels during the project offered an opportunity to stabilize while working above the water.

After: Coir logs were installed along 200 linear ft of shore at an elevation to intercept most lake water levels to favor long term stabilization by vegetation. A native seed mix was broadcasted, erosion blanket was installed on the slope and upland, shoreline and aquatic plants were planted.

PROJECT PROFILE

6764 215 AVE NE, LINWOOD LAKESHORE RESTORATION LINWOOD TWP,

Lakeshore Restoration

Project Summary

A lakeshore pollinator planting was completed at the Goldstrand property located on the north side of Linwood Lake. The project converted turf lawn to native species that benefit pollinators.

This project was aimed at both long term lakeshore stability and near-shore habitat improvement. The owners have experienced shoreline erosion that has mostly been corrected with rock rip rap however ice heaving still occurs. Native plantings may reduce ice heaving and can conceal it when it occurs. Moreover, replacing turf grass with native plants offers pollinator habitat in a critical location: at the shoreline.

This project planted an area of approximately 720 sq ft. The owner removed sod, installed plants and is maintaining the plantings. ACD provided project administration and design services.

Shoreline after planting. July 2022.

Project Specs

Date Installed 2021-2022
Shoreline Area Restored .... 720 sq ft.
Native Plants Installed.....180
Native Plant Species 24

Project Cost

Materials $617.33
Landowner Labor $392.00
Project administration & design were provided by ACD.

Project Funding

ACD Cost-Share $483.65
Landowner.....$525.68
Total Project Funding $1,009.33

Installation Process

Before: The shoreline was slumping and loosing soil between previously installed rock. In addition to loss of real estate, shoreline erosion contributes nutrients that cause poor water quality including algae blooms.

After: Aquatic and shoreline plants were installed along 70 linear ft of shore to protect against waves & favor long term stabilization by vegetation. The owners removed sod and planted native plants to leave a larger unmowed shoreline buffer than in the past.

Sunrise River Chain of Lakes Carp Removal Project

Description: Linwood, 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 actively green or brown, and the game fishery is depressed. Carp are one 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 water quality, habitat, and the native fishery.

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

Location: Linwood, Island, Martin, and Typo lakes.

Results:

2022 accomplishments:

- Linwood Lake:
  - At the lake outlet a temporary carp barrier (photo below) was constructed to contain any spring migrating carp between the outlet weir and barrier. Too few carp were observed to justify removal.
- Martin Lake:
  - 90 carp captured by boat electrofishing, fin clipped, PIT tagged, and released back into the lake.
  - PIT antenna installed at north inlet of the lake to detect migrating carp. A partial barrier was constructed, with the remaining barrier to be erected if enough migrating carp were in the area to justify removal. Carp aggregations occurred, but only briefly (graph below) and a removal did not occur.
  - Six volunteer-operated box nets were used on three occasions capturing a total of 389 carp. Two nets had PIT antennas to tell us when carp were visiting in the greatest numbers and the nets were sprung at those times.
  - Updated population and biomass estimate.
- Typo Lake:
  - PIT antenna installed near lake outlet to detect any aggregations of spring migrating carp so they could be seined. Insufficient numbers were found to justify harvesting.
  - Four volunteer-operated box nets were used on three occasions capturing a total of 497 carp. Two nets had PIT antennas to tell us when carp were visiting in the greatest numbers and the nets were sprung at those times.
  - Updated population and biomass estimate. Depending on method, 2,485 or 3,365 are the estimated number of carp remaining in Typo Lake. Estimated biomass is 44.5 or 64.4 lb/ac which is below the goal of 89 lb/ac.
- State Clean Water Fund grant for this work expired 12/31/2022.

Project accomplishments to date:

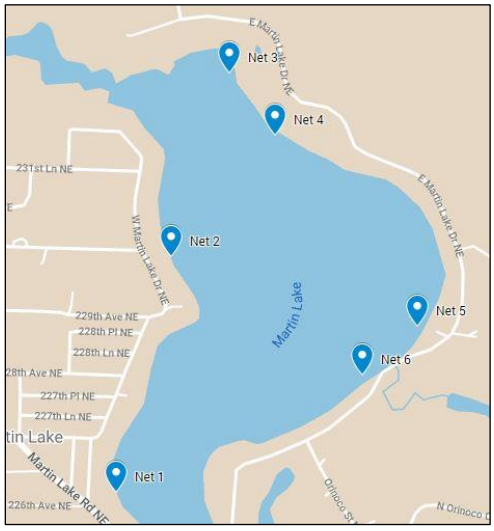
- Typo Lake – Removed 8,161 carp or 76.7% by weight. Current biomass of carp (44.5-64.4 lb/ac) is better than the goal (89 lb/ac). Water quality has an improving trend but is still far from state standards.

- Martin Lake – Removed 6,357 carp or 68.1% by weight. Current biomass of carp (100 lb/ac) is above the goal of 89 lb/ac by 600 carp. Water quality has an improving trend and is now close to state standards.
- Linwood Lake – Removed 235 carp despite several failed seine attempts.

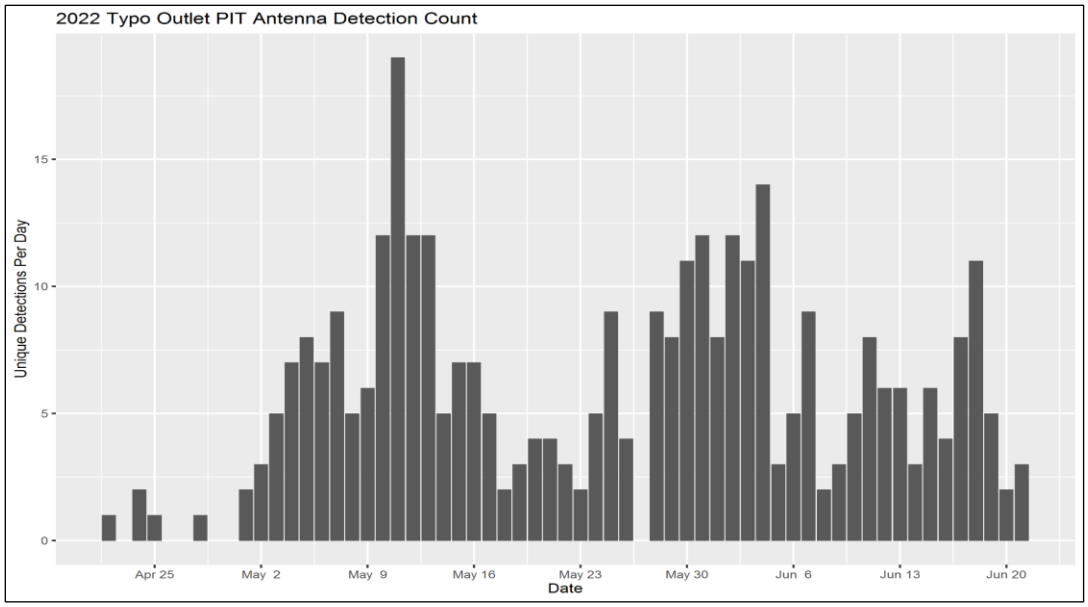
Upcoming work:

- Maintenance harvests at Martin Lake using leased box nets and volunteer labor. Funding anticipated from the SRWMO & Martin Lakers Association.

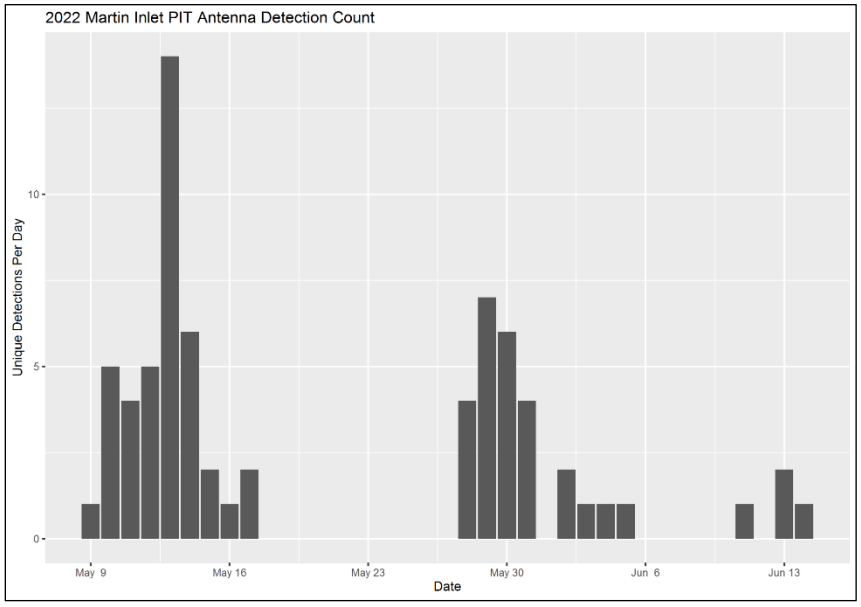
Left: Temporary carp barrier at Linwood Lake outlet.
Right: July 2022 carp box netting at Martin Lake.



Box net locations in 2022 at Martin Lake (left) and Typo Lake (right).



Graph of the number of unique PIT tags detected per day at PIT antennas at the outlet Typo Lake.



Graph of the number of unique PIT tags detected per day at the PIT antenna at the Typo Creek inlet of Martin Lake.

On–call Administrative Services

Description: The Anoka Conservation District Watershed Projects Manager provides 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.

Location: Watershed-wide

Results: Administrative assistance provided to the SRWMO commonly includes:

- Assist the SRWMO Board with day-to-day operational items
- Prepare and distribute meeting materials
- Prepare budgets
- Advise or represent the WMO on water management issues
- Annual MN Campaign Finance Board documents
- Joint powers agreement updates
- Respond to public inquiries about SRWMO programs, permitting, and grants
- Respond to board member and member community questions
- Process resident requests for SRWMO cost share grant funds
- Complete annual risk assessments required by the WMO's insurer
- Prepare meeting minutes in the Recording Secretary's absence
- Prepare materials for State performance reviews of the WMO
- Order annual audits and prepare related information

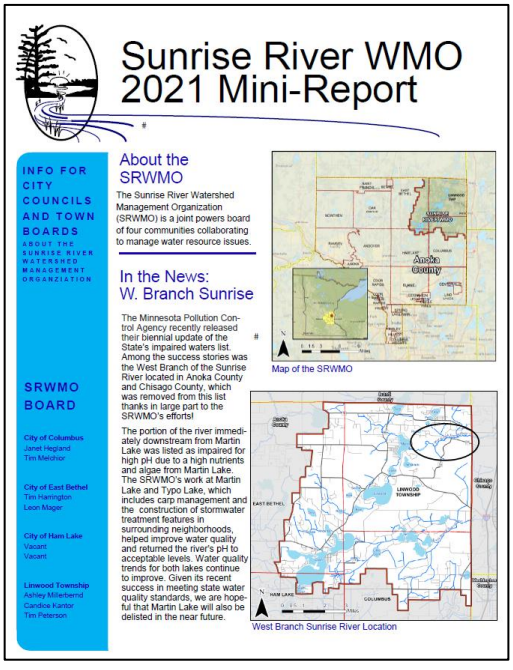
Annual Written Communication to Member Communities

Description: The Anoka Conservation District provides a summary of activities completed in the preceding years.

Purpose: To create a summary for board members to use during annual reporting.

Location: Watershed wide

Results: A one page, double-sided summary of SRWMO activities for the preceding years was prepared by ACD. This summary included work accomplished, finances, leveraged funds, and current events. Board members will use it during annual reporting to their city councils and town boards in January-March.


Sunrise River WMO
2021 Mini-Report

INFO FOR CITY COUNCILS AND TOWN BOARDS

ABOUT THE SUNRISE RIVER WATERSHED MANAGEMENT ORGANIZATION

About the SRWMO

The Sunrise River Watershed Management Organization (SRWMO) is a joint powers board of four communities collaborating to manage water resource issues.

In the News: W. Branch Sunrise

The Minnesota Pollution Control Agency recently released their biennial update of the State's impaired waters list. Among the success stories was the West Branch of the Sunrise River located in Anoka County and Chisago County, which was removed from this list thanks in large part to the SRWMO's efforts!

The portion of the river immediately downstream from Martin Lake was listed as impaired for high pH due to a high nutrients and algae from Martin Lake. The SRWMO's work at Martin Lake and Typo Lake, which includes carp management and the construction of stormwater treatment features in surrounding neighborhoods, helped improve water quality and returned the river's pH to acceptable levels. Water quality trends for both lakes continue to improve. Given its recent success in meeting state water quality standards, we are hopeful that Martin Lake will also be delisted in the near future.

Map of the SRWMO

West Branch Sunrise River Location

SRWMO BOARD

City of Columbus
Janet Hegland
Tim Melonor

City of East Bethel
Tim Harrington
Leon Mager

City of Ham Lake
Vacant
Vacant

Linwood Township
Ashley Millerbernd
Candice Kantor
Tim Peterson

SRWMO Annual Report to BWSR and State Auditor

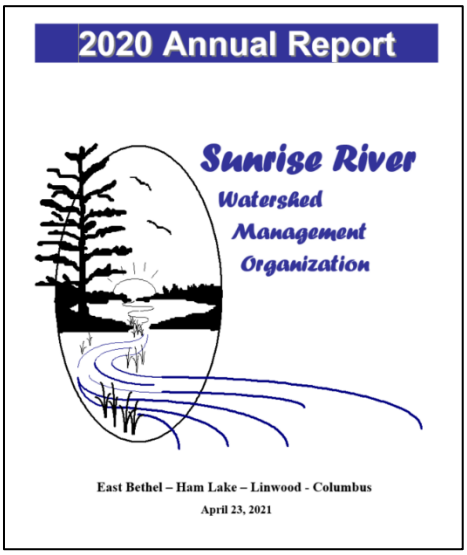
Description: The Sunrise River Watershed Management Organization (SRWMO) is required by law to submit an annual report to the Minnesota Board of Water and Soil Resources (BWSR), the state agency with oversight authority. This report consists of an up-to-date listing of SRWMO Board members, activities 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.

Location: Watershed-wide.

Results: Anoka Conservation District assisted the SRWMO with preparation of the annual Sunrise River WMO Annual Report. ACD drafted the report and cover letter. After SRWMO Board review, the final draft was forwarded to BWSR. The report is also shared with SRWMO communities' staff and elected officials, and is publicly available on the SRWMO website.



Grant Search 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 2022 the SRWMO and ACD pursued a State Clean Water Fund grant for shoreline stabilizations and are being awarded $78,500. The grant expires in three years. It will be focused at Martin Lake, and secondarily to Linwood and Coon Lakes. ACD is the grant recipient.

In 2023, $10,000 was requested and received from the Lower St. Croix Partnership for soil health practices. The grant funds various agricultural practices that benefit water quality. Promotion to landowners will begin in early 2023. ACD is the grant recipient.

Since 2014, the following grants have been secured for SRWMO projects through the assistance of ACD:

Project	Grant Source	Amount
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	$23,040
2018 Watershed Based Funding – stormwater retrofits & more	BWSR WBIF	$156,750
2018 Septic System Fix Up Fund*	MPCA	$27,055
2019 Septic System Fix Up Fund*	MPCA	$40,000
2019-20 Surface Water Monitoring Grant, Sunrise R	MPCA	$5,102
2019 Sunrise River Chain of Lakes Carp Mgmt	BWSR CWF	$148,000
2020 Septic System Fix Up Fund*	MPCA	$25,447
2021 Lower St. Croix WBIF –internal loading analyses	BWSR WBIF	$0
2021 Septic System Fix Up Fund*	MPCA	$34,876
2022 Septic System Fix Up Fund*	MPCA	$34,876
2023 Septic System Fix Up Fund*	MPCA	$33,418
2023 Sunrise Chain of Lakes Shoreline Stabilizations	BWSR CWF	$78,500
2023 Soil Health grant	Chisago SWCD, Lower St. Croix Partnership	$10,000
TOTAL		$1,194,876

*Countywide Grant

Participate in 1W1P

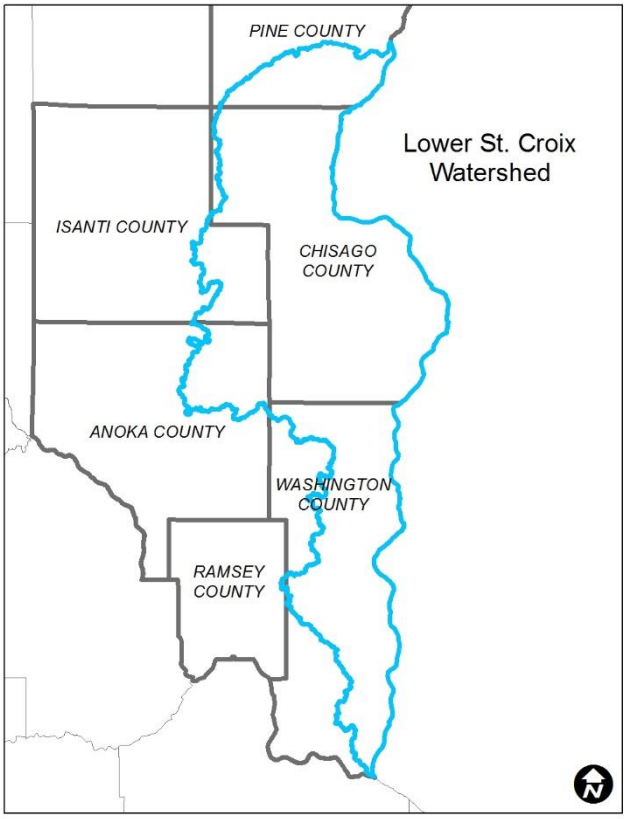
Description: Anoka Conservation District staff members served as the staff representative for the SRWMO on the Lower St. Croix One Watershed One Plan (1W1P) Advisory Committee.

Purpose: Seek to advance SRWMO priorities and associated funding.

Results: In 2022, an ACD staff member attended eight 1W1P meetings and advocated for SRWMO priorities. SRWMO priorities included in the 1W1P; internal loading analyses at Linwood, Martin and Typo Lakes (funding was requested); subwatershed assessment study for Linwood Lake; carp management; agricultural outreach, stormwater retrofits, and more. $10,000 has been secured for agricultural practices that benefit water quality.

In 2022 the SRWMO decided to leave the Lower St. Croix Partnership. ACD continues to participate and may receive funds for use in the Sunrise River watershed.

County	Total Acres Watershed	Percentage of Watershed
Anoka County	45,192	7.7%
Chisago County	277,185	47.3%
Isanti County	42,929	7.3%
Pine County	50,207	8.6%
Ramsey County	335	0.1%
Washington County	169,889	29.0%



Outreach and Education

Description: Anoka Conservation District conducted public outreach and education including newsletter articles, workshops, community events, and others. Topics included; lakeshore stewardship, financial assistance for fixing failing septic systems, native aquatic plants, and the mission of the SRWMO.

Purpose: To provide information and education to the public through lake association and city newsletters.

Location: Watershed-wide

Results: Outreach efforts are collaborative. Some tasks are exclusively performed by the ACD for the SRWMO. The SRWMO also provides funding to support the Anoka County Water Resources Outreach Program which uses funds pooled from various watersheds and grants to perform regional outreach. Finally, the SRWMO area benefits from outreach by the Lower St. Croix Partnership without SRWMO funding. All are listed below.

<u>City newsletter content:</u>

- Septic system maintenance.
- Septic system fix-up grants.
- Aquatic invasive species.

<u>Lake association newsletter content:</u>

- Septic system maintenance.
- Septic system fix-up grants.
- Lakeshore stewardship.

<u>Workshops promotion</u>

- Workshop at the Winery – water quality collaboration workshop for local officials. Hosted by the Lower St. Croix Partnership.
- Minimum Impact Development Standards (MIDS) workshop for local officials on a St. Croix Riverboat. Hosted the Lower St. Croix Partnership.
- Smart Salting training and certification by the MPCA was promoted to SRWMO member communities for their plow drivers. Most groups are already certified.

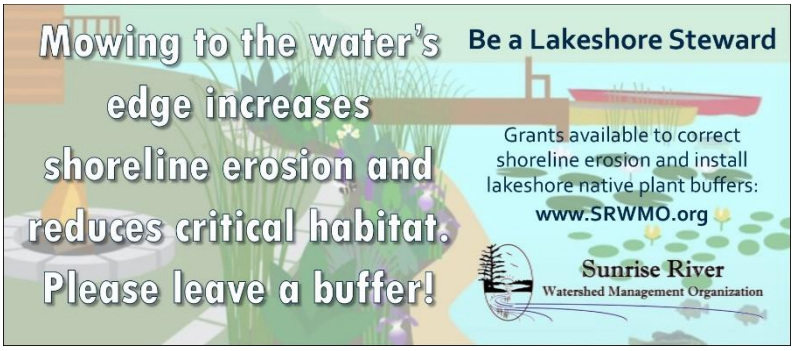
<u>Community events</u>

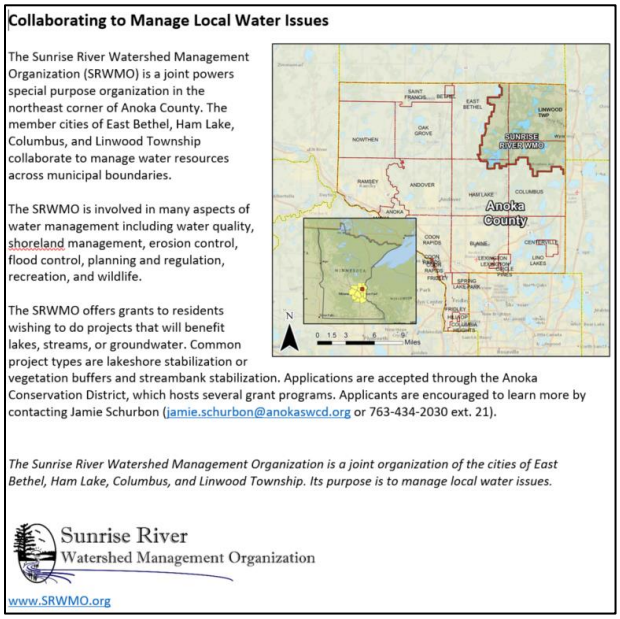
- Linwood Family Fun Day, SRWMO booth created by ACD and staffed by SRWMO board members
- Martin Lakers Association annual meeting. A presentation about SRWMO programs was given by ACD staff and Lower St. Croix Partnership staff gave a lakeshore stewardship presentation. Approximately 60 residents attended.

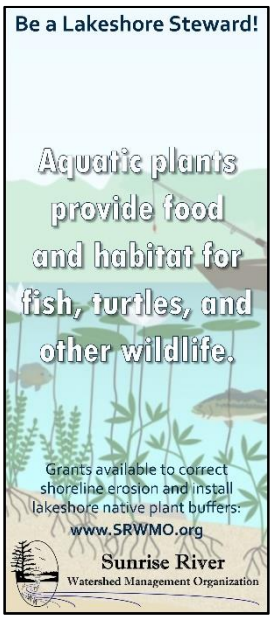
<u>Other</u>

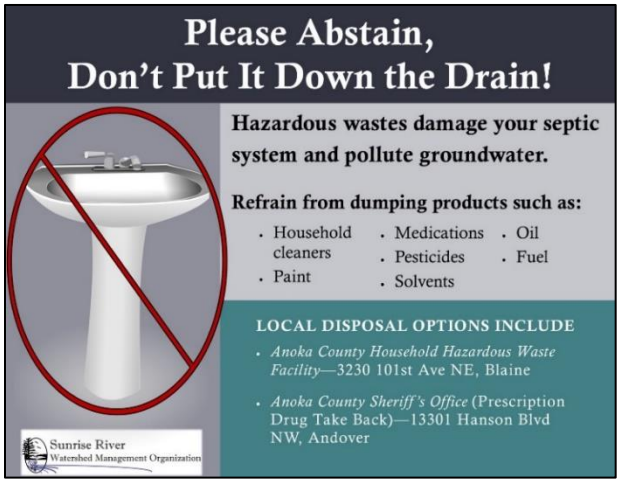
- Lakeshore stewardship promotion – Produced a brochure with SRWMO branding that was distributed at workshops and community events. Lower St. Croix Partnership staff gave a presentation at a Martin Lakers Association meeting.
- Adopt a Drain – ACD promoted this program through the Martin Lake Association. 11 storm drains were adopted by volunteers that will clean them periodically to benefit lake water quality.

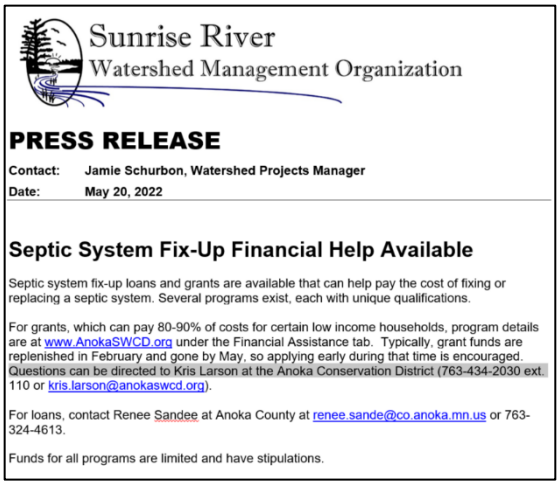
Sampling of outreach and education in 2022 printed materials











Website

Description: The Sunrise River Watershed Management Organization (SRWMO) contracts the Anoka Conservation District (ACD) to maintain a website on behalf of 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 resource issues in the area. The website serves as the SRWMO's alternative to a state-mandated newsletter.

Location: www.srwmo.org

Results: In 2022, ACD maintained the SRWMO website and posted board minutes and agenda.