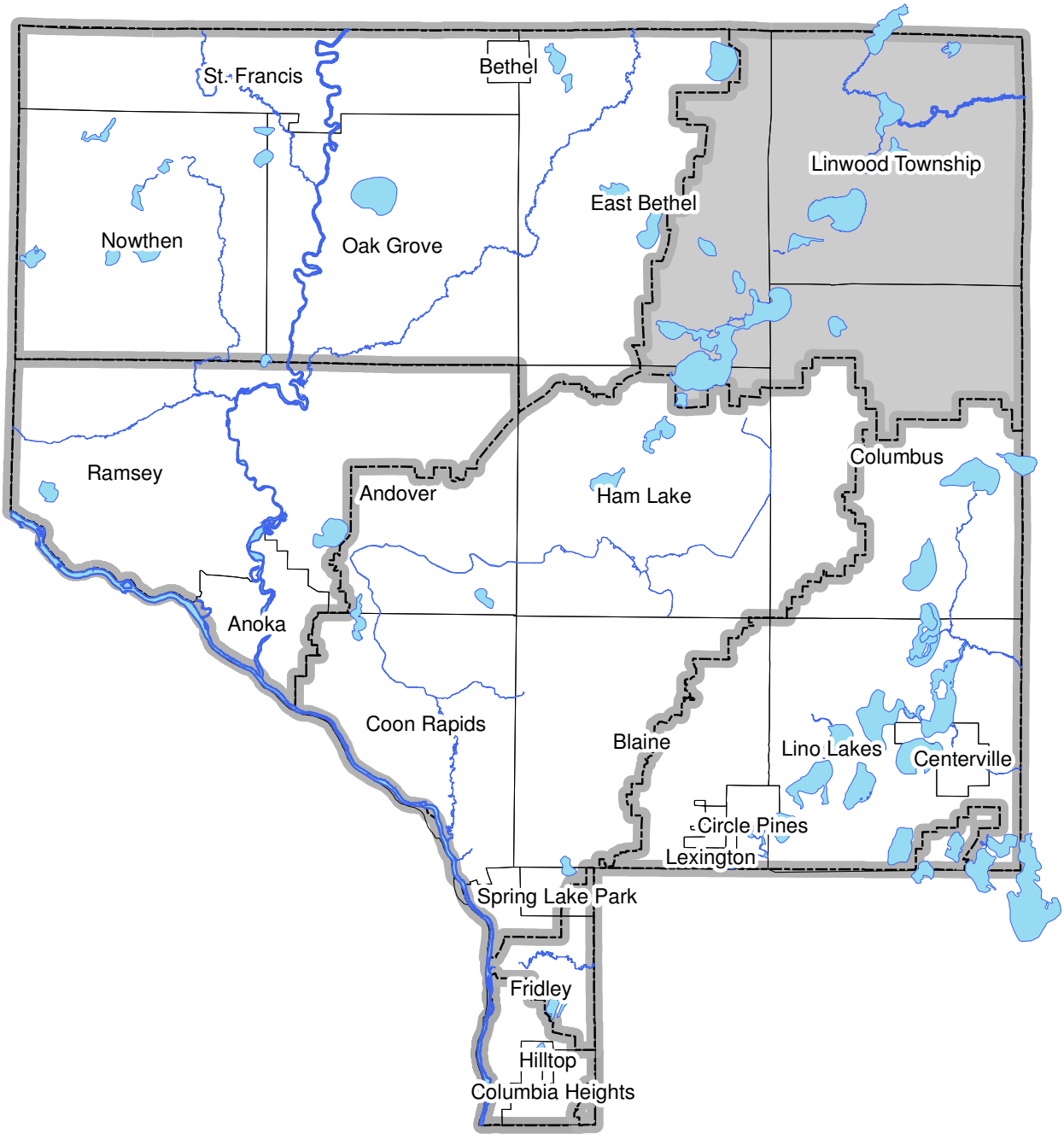
Excerpt from the 2017 Anoka Water Almanac

Chapter 2: Sunrise River Watershed



Prepared by the Anoka Conservation District

Chapter 2:
Sunrise River Watershed

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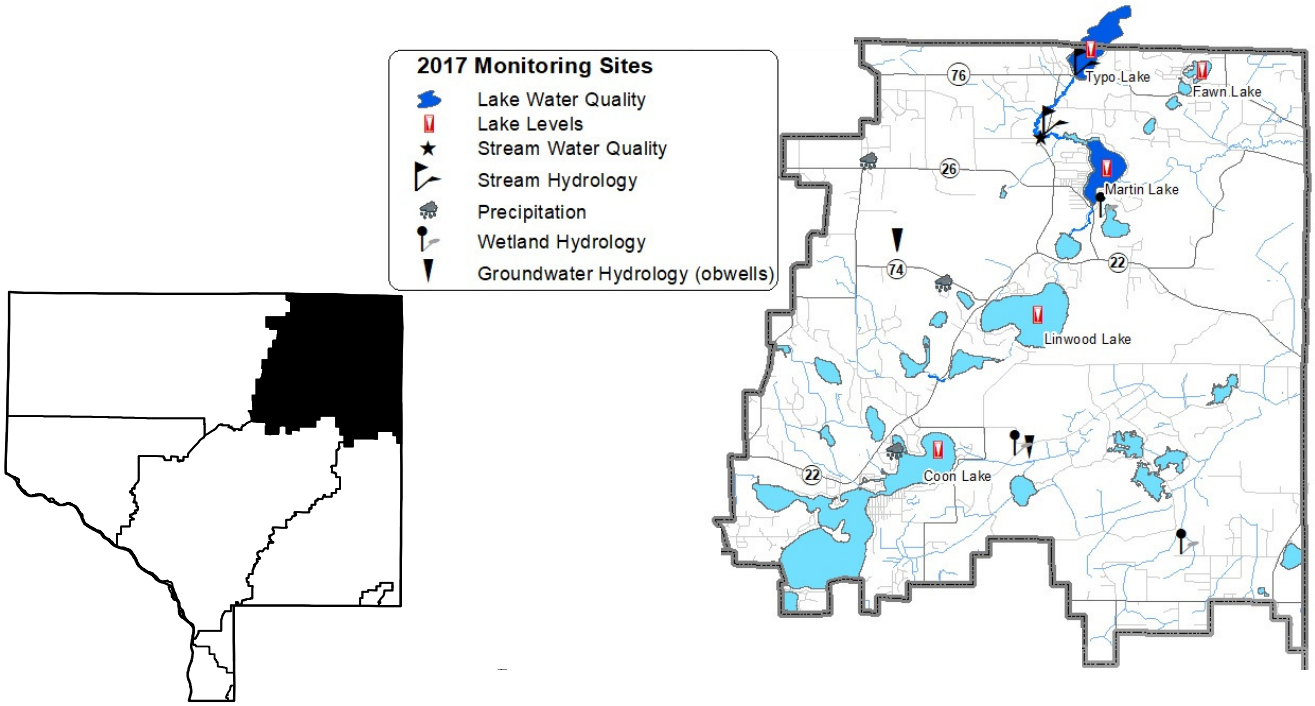
ACD = Anoka Conservation District, SRWMO = Sunrise River Watershed Management Organization,
MNDNR = Minnesota Dept. of Natural Resources, ACAP = Anoka County Ag Preserves



Lake Levels

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

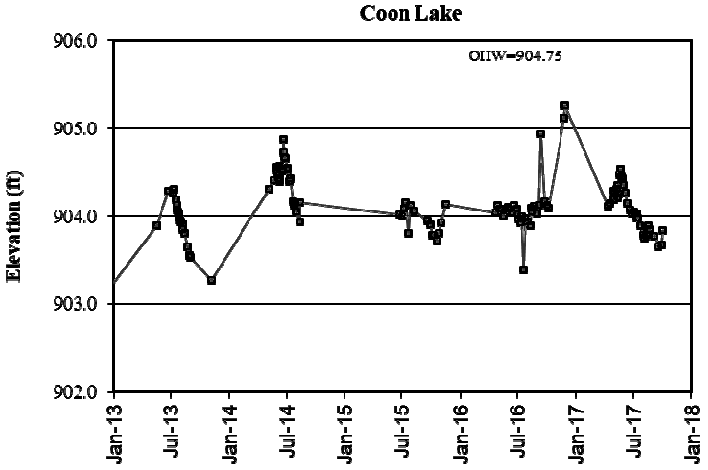
Purpose: To understand lake hydrology, including the impact of climate or other water budget changes. These data are useful for regulatory, building/development, and lake management decisions.

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

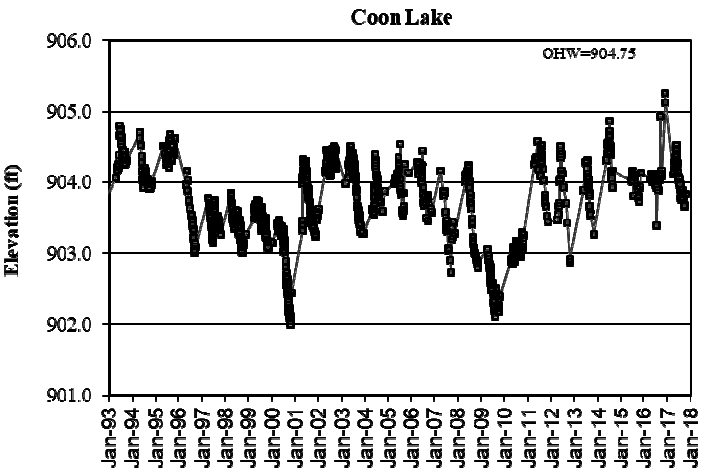
Results: Lake levels were measured by volunteers throughout the 2017 open water season. Lake gauges were installed and surveyed by the Anoka Conservation District and MN DNR. In 2017, lakes followed the expected pattern of increasing water levels in spring and early summer and then fell later in the summer due to less rainfall. Martin and Linwood Lakes saw a slight rebound in levels through fall after a large early October rain event.

All lake level data can be downloaded from the MN DNR website's Lakefinder feature. Ordinary High Water Level (OHW), the elevation below which a DNR permit is needed to perform work, is listed for each lake on the corresponding graphs below.

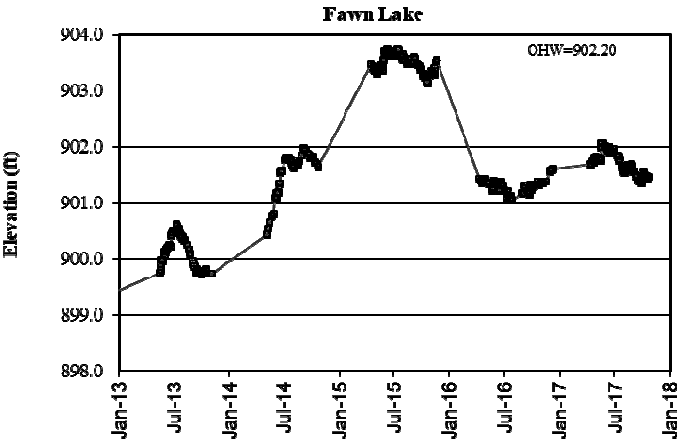
Coon Lake Levels – last 5 years



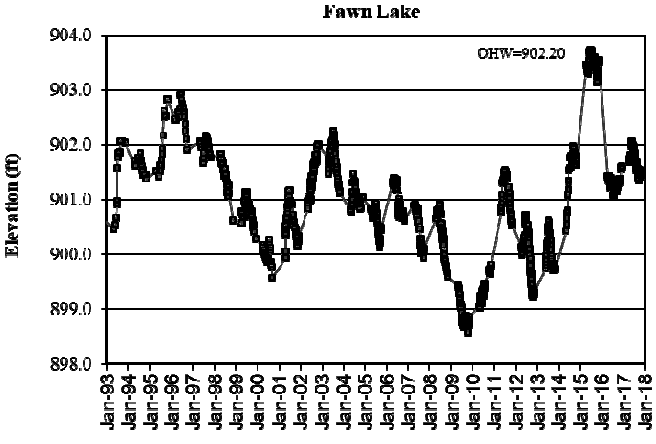
Coon Lake Levels – last 25 years



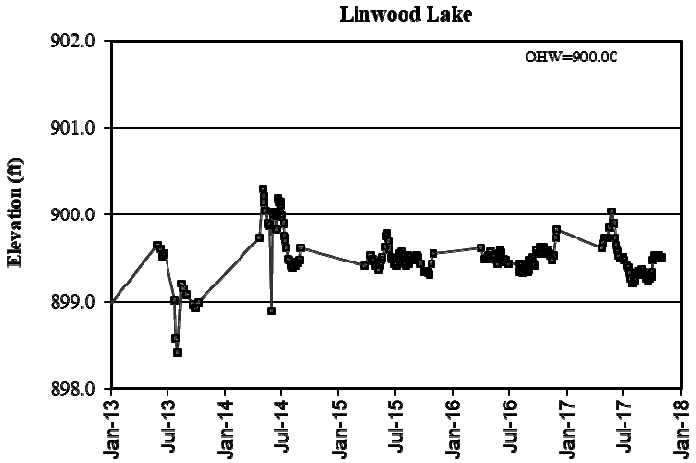
Fawn Lake Levels – last 5 years



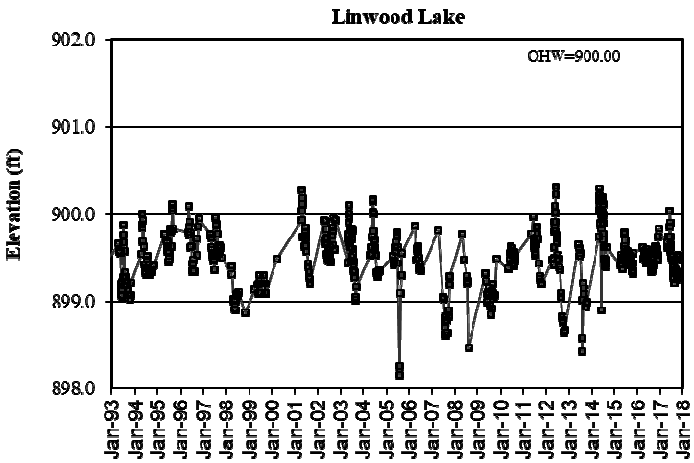
Fawn Lake Levels – last 25 years



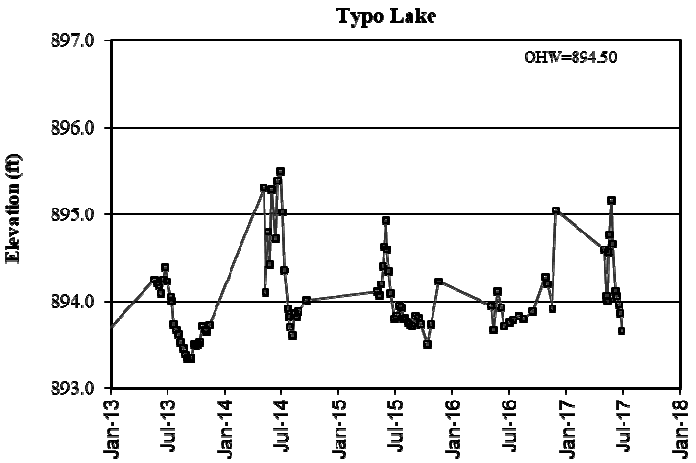
Linwood Lake Levels – last 5 years



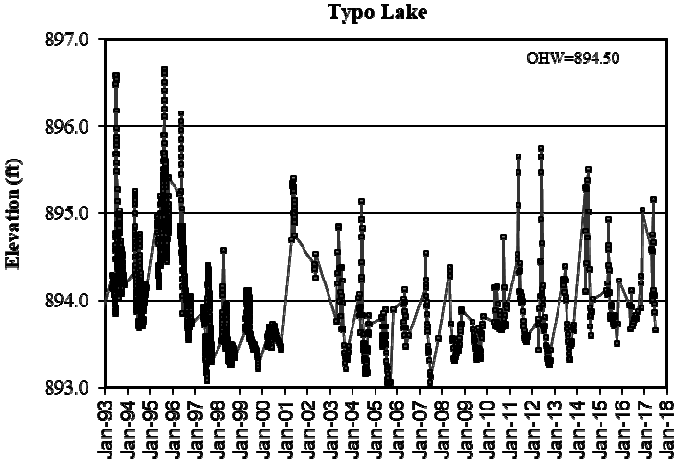
Linwood Lake Levels – last 25 years



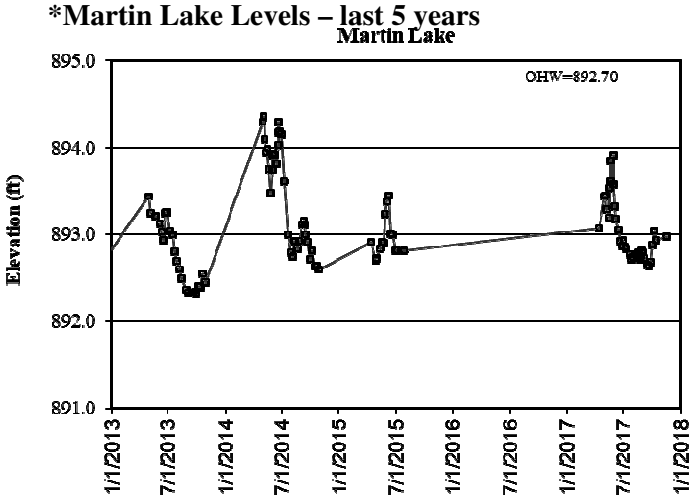
Typo Lake Levels – last 5 years



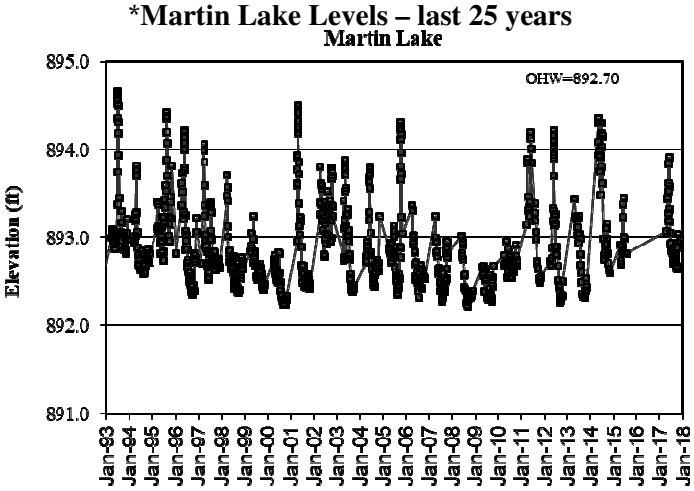
Typo Lake Levels – last 25 years



***Martin Lake Levels – last 5 years**



***Martin Lake Levels – last 25 years**



*No lake level data was received for Martin Lake in 2016

Lake Water Quality

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

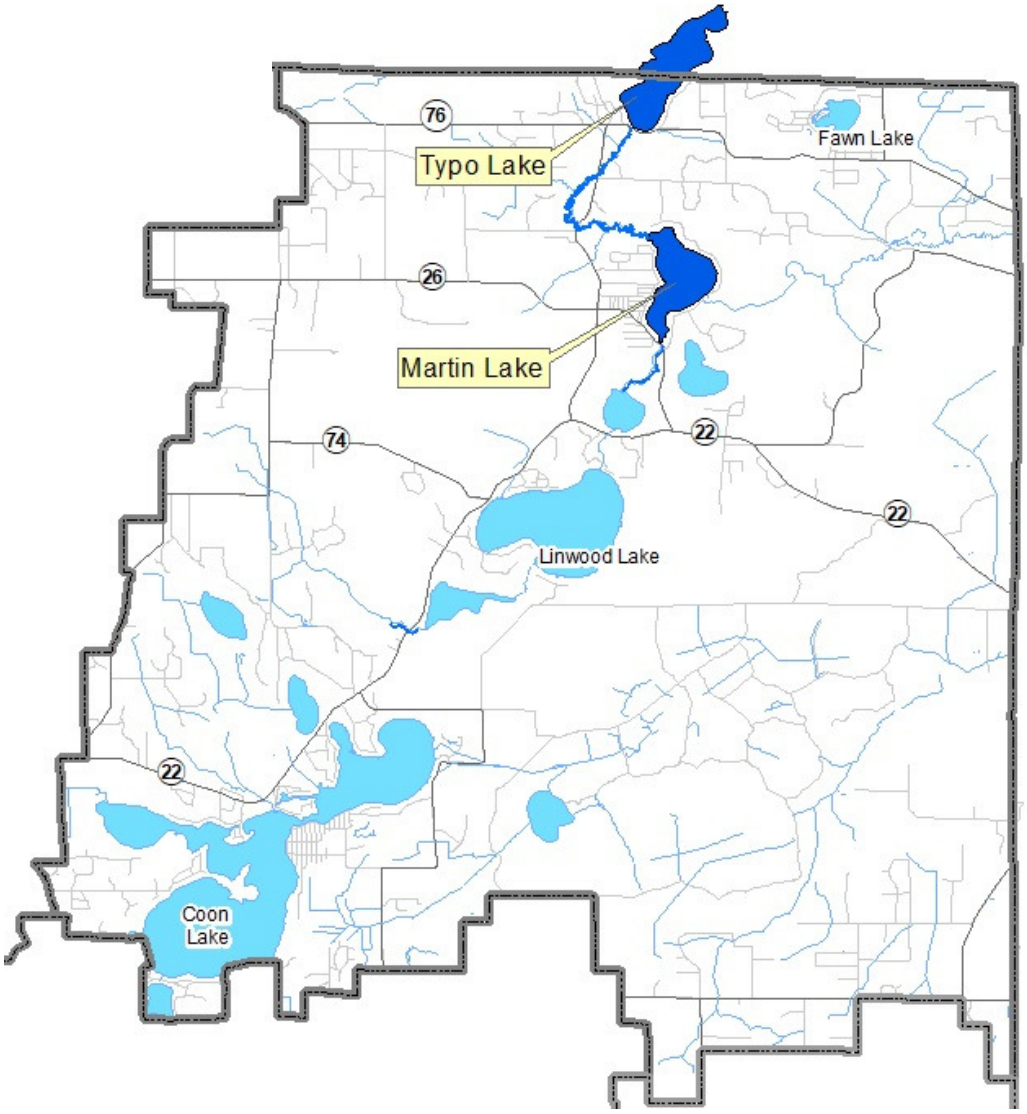
Purpose: To detect water quality trends and diagnose the cause of changes.

Locations: Typo Lake

Martin Lake

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

Sunrise Watershed Lake Water Quality Monitoring Sites



Typo Lake
Linwood Township, Lake ID # 30-0009

Background

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

2017 Results

In 2017 Typo Lake had extremely poor water quality compared to other lakes in this region (NCHF Ecoregion), receiving an overall F letter grade. This overall grade is consistent with all previous years monitored except for the D- achieved in 2014. Average total phosphorus (TP) was higher than the previous five years monitored at 226 µg/L. However, removing two very high outliers lowers the average to 134 µg/L, which would be lowest average on record. While total phosphorus levels continue to far exceed the 60 µg/L state standards, average concentrations appear to be staying well below averages from a decade ago. Continuing to pursue and fund restoration projects in the lakeshed, as well as managing rough fish populations in the lake, should continue to produce lower phosphorus levels.

Chlorophyll-a (Cl-a) levels in 2017 averaged 66.7 µg/L. This is well below the historical average of 115.3 µg/L, lower than the 2016 average of 83.4 µg/L, but above average concentrations in 2014 and 2015.

Average Secchi transparency in 2017 was 1.2 feet. While this marks an improvement from a decade ago (in 2007 and 2009 a Secchi disk could be seen only 5-6 inches below the surface, on average) it is still far below the state standard of over 3 feet. There was a slight improvement in 2012 to 9-10 inches and a larger improvement in 2014 to 21-22 inches. In 2016, average Secchi transparency declined back to under a foot (about 11inches).

Trend Analysis

Seventeen years of water quality monitoring have been conducted by the Minnesota Pollution Control Agency (1993, '94, and '95) and the Anoka Conservation District (1997-2001, '03, '05, '07, '09, '12, 20014-2017). Water quality has improved from 1993 to 2017 in a statistically significant way (repeated measures MANOVA with response variables TP, Cl-a, and Secchi depth; $F_{2,14}$=5.7, p=0.02). When we tested these response variables individually with one-way ANOVAs TP and Secchi depth still show no significant change across this time period. Cl-a, however, is now showing a statistically significant decline ($F_{1,15}$ =4.55, p=<0.05). A superficial look at graphs of these parameters suggests that total phosphorus is actually generally increasing, though this increase is driven by very high concentrations in 2007 and 2009. Excluding these outliers actually shows a slight declining trend in TP. Secchi depth appears to be increasing. The major driver of improved water quality is decreasing Cl-a concentrations.

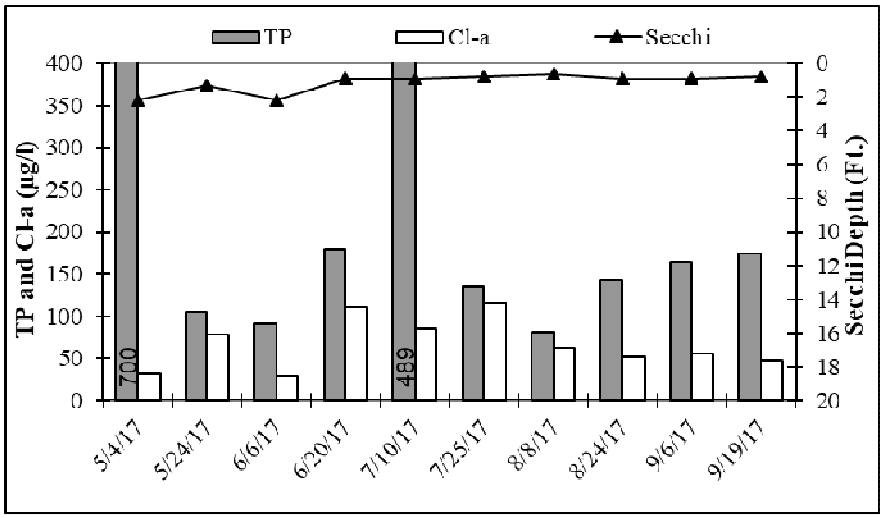
Discussion

Typo Lake, along with Martin Lake downstream, were the subject of a Total Maximum Daily Load (TMDL) study by the Anoka Conservation District, which was approved by the State and EPA in 2012. This study documented the sources of nutrients to the lake, the degree to which each is impacting the lake, and put forward lake rehabilitation strategies. Some factors impacting water quality on Typo Lake include the presence of rough fish, high phosphorus inputs from a ditched wetland west of the lake, and lake sediments. Recent work has included installation of carp barriers (completed in 2016), carp removals (2017-19) and a feasibility study of ditched wetland restorations upstream of Typo Lake (final reporting in early 2018).

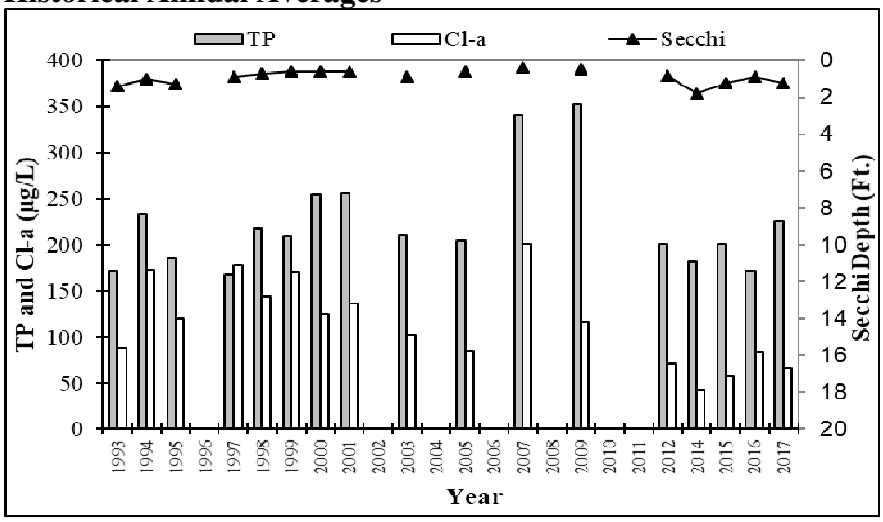
Typo Lake

Linwood Township, Lake ID # 30-0009

2017 Results



Historical Annual Averages



Historical Report Card

Year	TP	Cl-a	Secchi	Overall
1974			F	
1975			F	
1993	F	F	F	F
1994	F	F	F	F
1995	F	F	F	F
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
2017 average	226* µg/L	66.7 µg/L	0.4 meters	
State standards	60 µg/L	20 µg/L	1.0 meters	

*Two outliers removed lowers avg. to 134 µg/L

2017 Raw Data

		Date	5/4/2017	5/24/2017	6/6/2017	6/20/2017	7/10/2017	7/25/2017	8/8/2017	8/24/2017	9/6/2017	9/19/2017			
		Time	13:40	13:40	14:50	13:10	10:25	10:15	10:25	11:00	10:20	10:10			
	Units	R.L.*	Results	Results	Results	Results	Results	Results	Results	Results	Results	Results	Average	Min	Max
pH		0.1	9.06	9.10	8.78	9.16	8.44	8.92	9.48	9.34	9.18	9.05	9.05	8.44	9.48
Conductivity	mS/cm	0.01	0.213	0.228	0.297	0.280	0.264	0.265	0.250	0.240	0.255	0.276	0.257	0.213	0.297
Turbidity	NTU	1	23.40	32.40	30.50	89.30	86.20	123.00	84.50	79.20		96.90	65	23	97
D.O.	mg/l	0.01	14.02	13.38	9.61	12.13	7.40	10.38	13.55	12.13	10.72	8.64	11.20	7.40	14.02
D.O.	%	1	136%	135%	116%	146%	92%	127%	161%	138%	112%	95%	126%	92%	161%
Temp.	°C	0.1	13.0	14.1	22.1	22.5	24.8	24.2	23.0	21.8	16.3	17.5	19.93	13.00	24.82
Temp.	°F	0.1	55.4	57.3	71.8	72.4	76.7	75.6	73.5	71.2	61.4	63.4	67.9	55.4	76.7
Salinity	%	0.01	0.10	0.11	0.14	0.13	0.13	0.13	0.12	0.12	0.12	0.13	0.1	0.1	0.1
Cl-a	µg/l	1	32.0	78.3	28.5	112.0	85.4	115.0	61.9	51.3	55.5	47.0	66.7	28.5	115.0
T.P.	mg/l	0.005	0.700	0.105	0.091	0.179	0.489	0.136	0.081	0.143	0.165	0.174	0.226	0.081	0.700
T.P.	µg/l	5	700	105	91	179	489	136	81	143	165	174	226	81	700
Secchi	ft	0.1	2.2	1.3	2.2	0.9	0.9	0.8	0.7	0.9	0.9	0.8	1.2	0.7	2.2
Secchi	m	0.1	0.7	0.4	0.7	0.3	0.3	0.2	0.2	0.3	0.3	0.2	0.4	0.2	0.7
Field Observations			Brown, Cloud	Brown	Brown	Murky	Brown	Green	Brown	Brown	Brown	Brown			
Physical			4	4	4	4	4	3	4	5	4	5	4.1	3.0	5.0
Recreational			4	4	4	3	3	2	2	4	4	4	3.4	2	4

*reporting limit

Martin Lake

Linwood Township, Lake ID # 02-0034

Background

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

2017 Results

In 2017 Martin Lake had typical water quality compared to other recent years, which compares poorly to other lakes in the North Central Hardwood Forest Ecoregion (NCHF), and received a C letter grade. Martin Lake is quite eutrophic for a lake of its size and depth due to chronically high total phosphorus (TP) and chlorophyll-a (Cl-a). In 2017 total phosphorus levels, however, continued a three-year improvement averaging 59.3 µg/L. This is the lowest average on record, though it remains above the impairment threshold of 40 µg/L. This now marks two consecutive years with lowest average total phosphorus on record for Martin Lake following the previous record low average of 69.1 µg/L in 2016. These averages are half, or less than half, of averages from a decade ago (135.0 µg/L in 2007)

Chlorophyll-a dropped slightly from the previous year to 24.9 µg/L in 2017. While the 5 year average since 2012 (22.19 µg/L) has been much lower than the 2005-2009 average (108.3 µg/L), this average still remains above the impairment standard of 14 µg/L.

Average Secchi transparency was 3.0 feet in 2017, exactly matching its historical average. This average remains about 30% below the State impairment threshold of 4.6 feet. The ACD staff continue to note green water during late summer months.

Trend Analysis

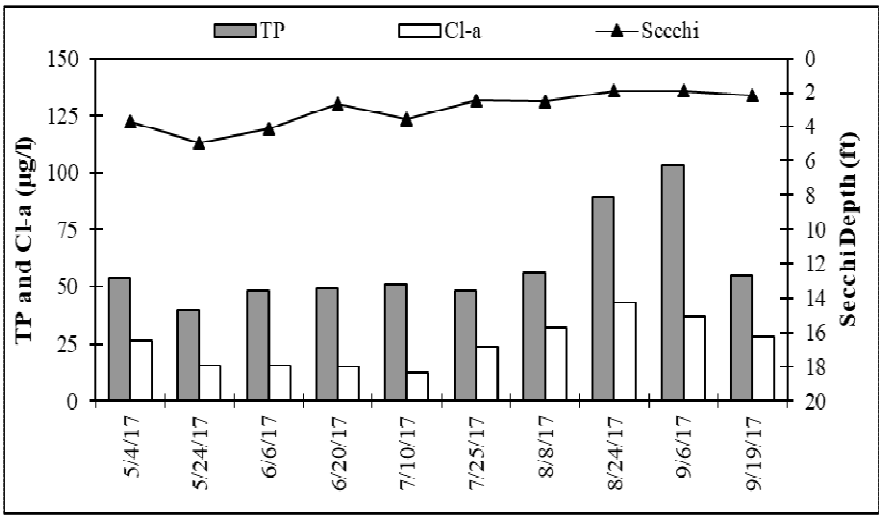
Sixteen years of water quality data have been collected by the Minnesota Pollution Control Agency (1983), Metropolitan Council (1998, 2008), and the ACD (1997, 1999-2001, 2003, 2005, 2007, 2009, 2012-2017). Citizens monitored Secchi transparency 17 other years. Anecdotal notes from DNR fisheries data indicate poor water quality dating back to at least 1954. Although still pretty poor, water quality in Martin Lake has actually shown an improvement from 1983 to 2017 that is statistically significant (repeated measures MANOVA with response variables TP, Cl-a, and Secchi depth; $F_{2,13}$=5.82, p=<0.02). Further examination of the data (one-way ANOVAs on the individual response variables) shows that while TP and Secchi depth appear to be staying virtually flat, Cl-a has shown a statistical decrease ($F_{1,14}$=9.25, p=<0.01). Similar to Typo Lake, a decrease in Cl-a concentrations are driving a statistically significant improvement in overall water quality.

Discussion

Martin Lake, along with Typo Lake upstream, was the subject of a TMDL study by the Anoka Conservation District that was approved by the State and EPA in 2012. This study documented the source of nutrients to the lake, the degree to which each is impacting the lake, and put forward lake rehabilitation strategies. Water from Typo Lake and internal loading (carp, septic systems, sediments, etc.) are two of the largest negative impacts on Martin Lake water quality. Installation of carp barriers was completed in 2016. Carp removals and other management efforts are taking place in 2017-19. Upstream of Typo Lake, a feasibility study is being completed in early 2018 regarding restoration of ditched wetlands. In the neighborhoods adjacent to Martin Lake three rain gardens were installed in 2011. Recent water quality monitoring results suggest these management approaches are improving conditions in these lakes, but reaching goals will require additional efforts and time.

Martin Lake
Linwood Township, Lake ID # 02-0034

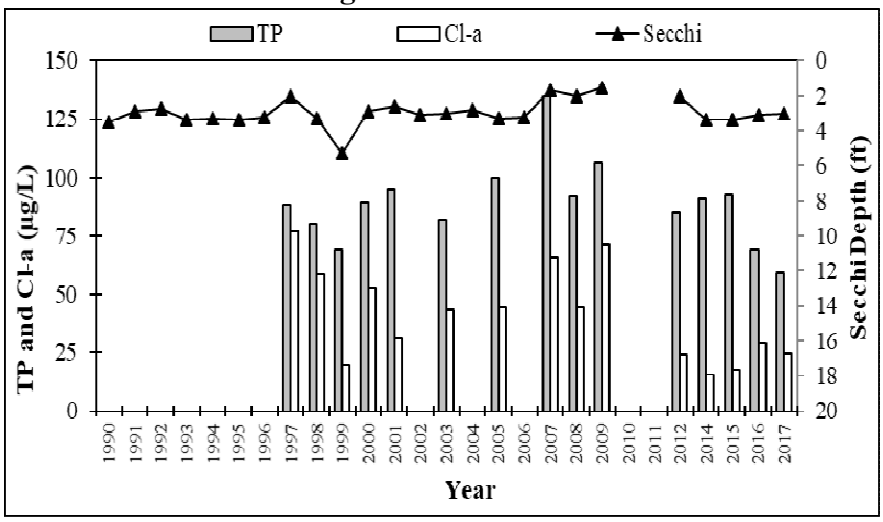
2017 Results



Historical Report Card

Year	TP	Cl-a	Secchi	Overall
1996			D	
1997	D	D	F	D
1998	D	D	D	D
1999	C	B	C	C
2000	D	C	D	D
2001	D	C	D	D
2002			D	
2003	D	C	D	D
2004			D	
2005	D	C	D	D
2006			D	
2007	D	D	F	D
2008	D	C	F	D
2009	D	D	F	D
2012	D	C	F	D
2014	D	B	D	C
2015	D	B	D	C
2016	C	C	D	C
2017	C	C	D	C
2017 average	59.3 µg/L	24.9 µg/L	0.4 meters	
State standards	40 µg/L	14 µg/L	1.4 meters	

Historical Annual Averages



2017 Raw Data

		Date:	5/4/2017	5/24/2017	6/6/2017	6/20/2017	7/10/2017	7/25/2017	8/8/2017	8/24/2017	9/6/2017	9/19/2017			
		Time:	14:15	14:10	15:25	13:45	9:50	9:45	9:55	10:35	9:55	9:45			
	Units	R.L.*	Results	Results	Results	Results	Results	Results	Results	Results	Results	Results	Average	Min	Max
pH		0.1	13.090	8.070	8.280	8.170	8.600	8.490	8.740	8.700	8.920	9.200	9.026	8.070	13.090
Conductivity	mS/cm	0.01	0.25	0.28	0.30	0.29	0.29	0.35	0.34	0.31	0.31	0.30	0.30	0.25	0.35
Turbidity	NTU	1	12.00		8.40	26.10	7.80	33.60	28.60	33.40		22.30	19.80	7.80	33.40
D.O.	mg/l	0.01	1308%	872%	989%	904%	818%	991%	1117%	1054%	1053%	943%	1005%	818%	1308%
D.O.	%	1	1.2	1.0	1.2	1.1	1.0	1.2	1.4	1.2	1.2	1.1	1.2	1.0	1.4
Temp.	°C	0.1	11.9	14.8	22.4	22.7	25.2	24.8	23.6	22.0	19.3	19.2	20.6	11.9	25.2
Temp.	°F	0.1	53.38	58.57	72.23	72.77	77.27	76.59	74.41	71.64	66.67	66.47	69.00	53.38	77.27
Salinity	%	0.01	0.1	0.1	0.2	0.1	0.1	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.2
Cl-a	µg/l	1.000	26.300	15.700	15.700	15.000	12.100	23.900	32.000	42.700	37.400	27.800	24.860	12.100	42.700
T.P.	mg/l	0.005	0.054	0.040	0.048	0.049	0.051	0.048	0.056	0.089	0.103	0.055	0.059	0.040	0.103
T.P.	µg/l	5	54.0	40.0	48.0	49.0	51.0	48.0	56.0	89.0	103.0	55.0	59.3	40.0	103.0
Secchi	ft		3.7	4.9	4.1	2.7	3.6	2.4	2.5	1.9	1.9	2.2	3.0	1.9	4.9
Secchi	m		1.1	1.5	1.2	0.8	1.1	0.7	0.8	0.6	0.6	0.7	0.9	0.6	1.5
Field Observations/Appearance			Fairly Brown	Murky	Brown	Brown	Green	Brown	Brown	Green	Green	Green			
Physical			2	1	1	1	3	3	3	4	3	4	3	1	4
Recreational			2	1	1	1	1	1	1	3	2	3	1.6	1	3

*reporting limit

Stream Hydrology Monitoring

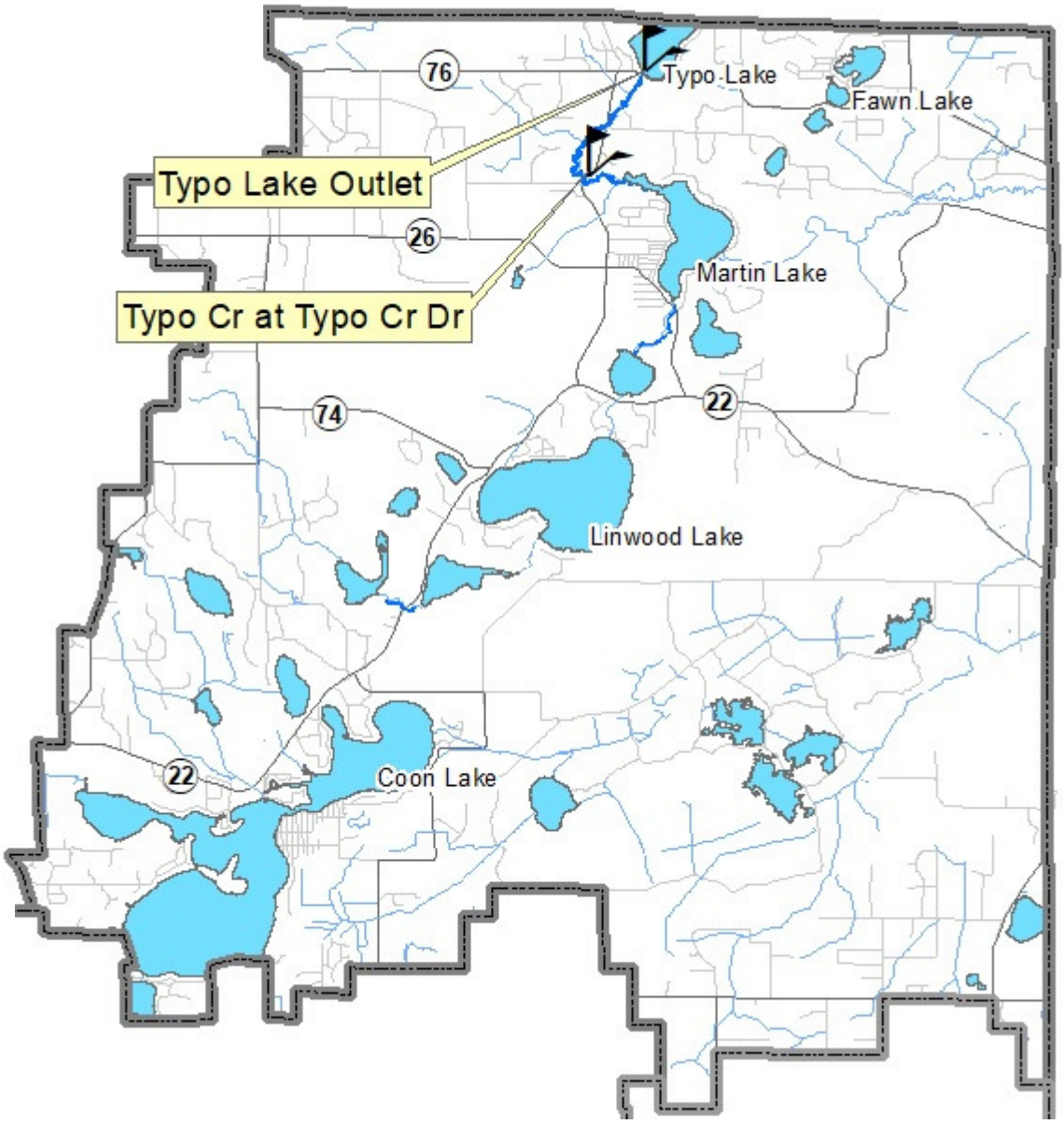
Description: Continuous water level monitoring in streams.

Purpose: To provide understanding of stream hydrology, including the impact of climate, land use or discharge changes. These data also facilitate calculation of pollutant loads, use of computer models for developing management strategies, and water appropriations permit decisions. The Typo Lake outlet and Typo Creek carp barriers were monitored on either side to assess whether the barriers were affecting flow.

Locations: Typo Lake outlet carp barrier and Typo Creek carp barrier

Results: Results are presented on the following pages

2017 Sunrise River Watershed Stream Hydrology Monitoring Sites



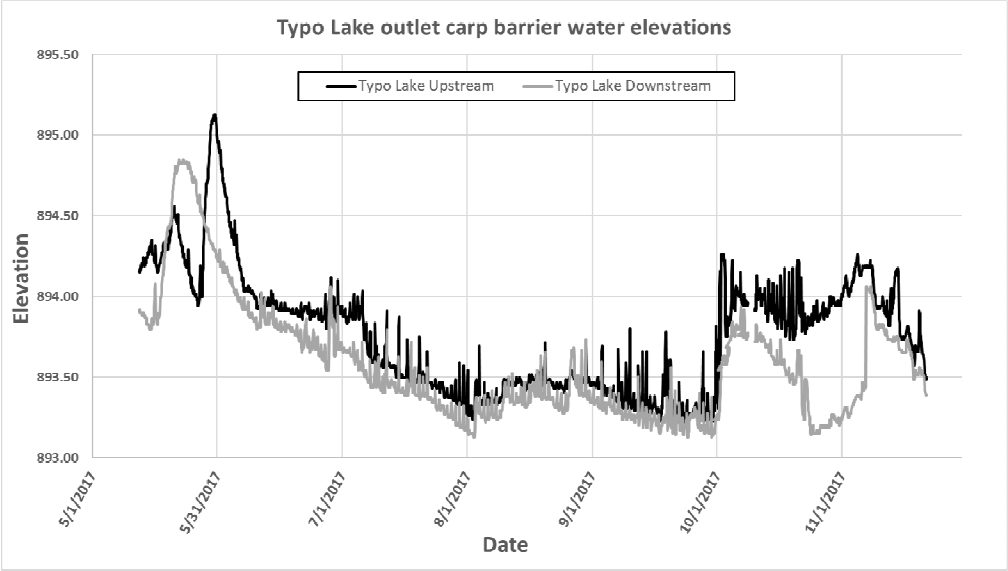
TYPO CREEK

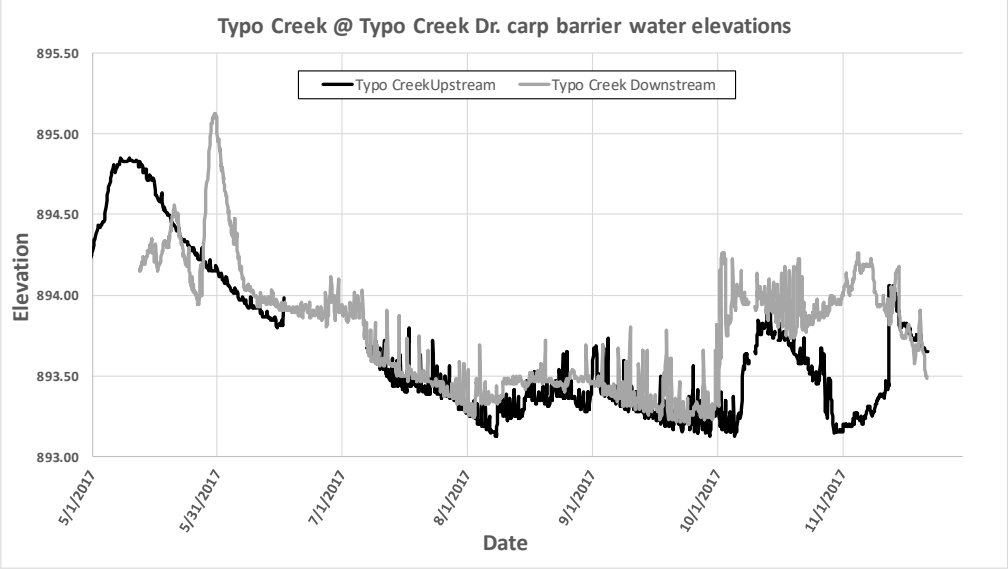
At Typo Lake outlet and Typo Creek Drive, Linwood Township

Years Monitored: 2016-2017

Background: The carp barrier structures installed in Typo Creek are made up of a series of stacked aluminum grates between two secure piling structures. The metal grates facilitate water passage out of Typo Lake and through Typo Creek, while preventing carp from migrating through to spawn. There was concern during the early stages of the projects that the barriers may clog up with floating cattail rafts, algae, and other debris, holding water back and causing flooding. The Anoka Conservation District installed and surveyed continuous level loggers on the upstream and downstream sides of both carp barriers to assess whether the barriers were affecting flow. Throughout most of the year, both sites read very similar levels upstream and downstream. Differences early and late in the year are likely, at least partially, due to instrument performance.

2017 Typo Lake outlet and Typo Creek at Typo Creek Drive carp barrier water elevations





Stream Water Quality

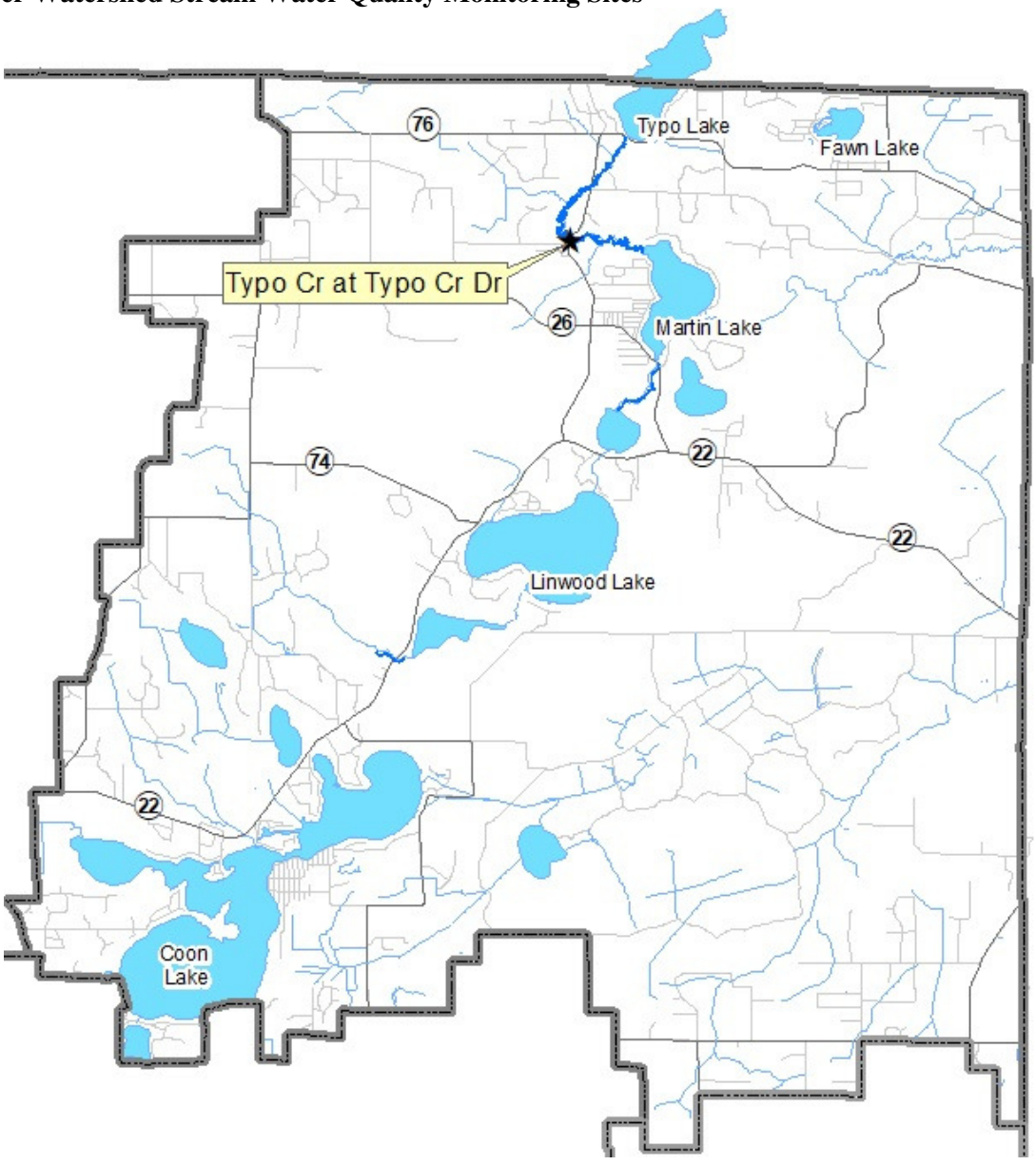
Description: Stream water quality is monitored with grab samples on eight occasions throughout the open water season, including four times immediately following a storm (1" of rain within a 24hr period) and four times during baseflow conditions. The selected site was chosen to monitor the impacts of the carp barriers installed in the watershed over time. Parameters monitored include water level, pH, conductivity, turbidity, transparency, dissolved oxygen, total phosphorus and total suspended solids. This data can be paired with stream hydrology monitoring to do pollutant-loading calculations.

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

Location: Typo Creek at Typo Creek Drive near 233rd Ave. NE

Results: Results are presented on the following pages.

2017 Sunrise River Watershed Stream Water Quality Monitoring Sites



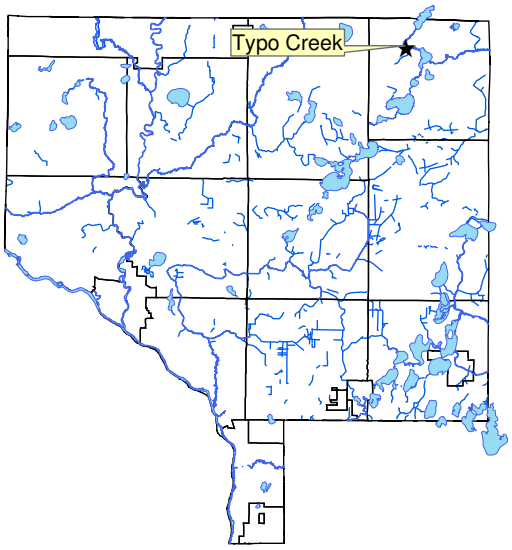
TYPO CREEK AT TYPO CREEK DR.

Near Typo Creek Dr. and 233rd Ave. NE, Linwood Township

STORET SiteID = S003-188

Years Monitored

1998, 2000, 2001, 2003, 2016-2017



Background

The northern inlet to Martin Lake, also called Typo Creek, flows from the outlet of Typo Lake about 1.9 miles south to Martin Lake. It is the primary inlet to Martin Lake. The watershed is primarily 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 (completed 2016) and carp harvests (2017-2019) are aimed at improving water quality in this stream and the lakes it connects.

Methods

The creek was monitored by grab samples. Eight water quality sampling events were conducted in 2017, four during baseflow and four following storms. Storms were generally defined as one-inch or more of rainfall in 24 hours or a significant snowmelt event combined with rainfall. Parameters tested with portable meters included pH, conductivity, turbidity, temperature, dissolved oxygen, and salinity. Parameters tested by water samples sent to a state-certified lab included total phosphorus, and total suspended solids.

Summary

Summarized water quality monitoring findings and management implications include:

- Dissolved pollutants, as measured by conductivity and chlorides, are at low and healthy levels. However, 2016 and 2017 baseflow concentrations were higher than years tested previously.

  Management discussion: Road deicing salts are a concern region-wide. They are measurable in area streams year-round, including Typo Creek. While they may be acceptably low now, levels do appear to be higher during recent years. Excessive de-icing efforts should be minimized in the area, and future monitoring should consider testing chlorides approximately every third year.

- Phosphorus loading and eutrophication remains the largest concern for Typo Creek. Measured total phosphorus (TP) routinely exceeds state impairment standards. TP in 2017 was within the same range observed in other years. Phosphorus levels here are reflective of conditions in Typo Lake immediately upstream. Typo Creek phosphorus is discharged into Martin Lake.

  Management discussion: Management in response to the TMDL report, including projects like the installation of carp barriers and harvesting of carp, should reduce phosphorus levels in the creek as well as the upstream and downstream lakes. Additional funding and projects are likely necessary into the future to bring phosphorus in this system as a whole down to healthy levels.

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

Management discussion: Efforts involved with the reduction of nutrient loading and management of carp populations should have a direct effect on the suspended solids and turbidity issues in Typo Creek.

- pH, on average, was within the range considered normal and healthy for streams in this area again during 2017. In previous years it was outside the range that is considered healthy. The creek was listed by the State as impaired for high pH in 2006 due to swings above and below state standards. pH appears to be more stable and within the acceptable range in recent years. Improved water quality in Typo Lake upstream due to restoration projects should continue to help bring pH to more stable and neutral levels.
- 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 levels.

  Management discussion: Low dissolved oxygen is likely having an impact on native aquatic life. For example, it 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, and subsequent decomposition, as well as organic soils in the waterway. Because of the long history of nutrient and organic matter loading to this creek, even the best management practices will take many years to achieve goals.

Results and Discussion

Excessive nutrient loading is the root cause of intense high algae, turbidity and pH in Typo Creek. This, along with populations of common carp, is having a profound negative impact on the water quality, and likely the flora and fauna, of this system as a whole. A TMDL study has been completed for this stream, and corrective projects are being implemented. While the lakes seem to be experiencing improved water quality in response to these projects, notable improvement has not been observed in Typo Creek. The severity of the issues facing this creek, and the rest of its watershed, will require a large amount of time, involvement and project development to reach goals.

Conductivity and chlorides

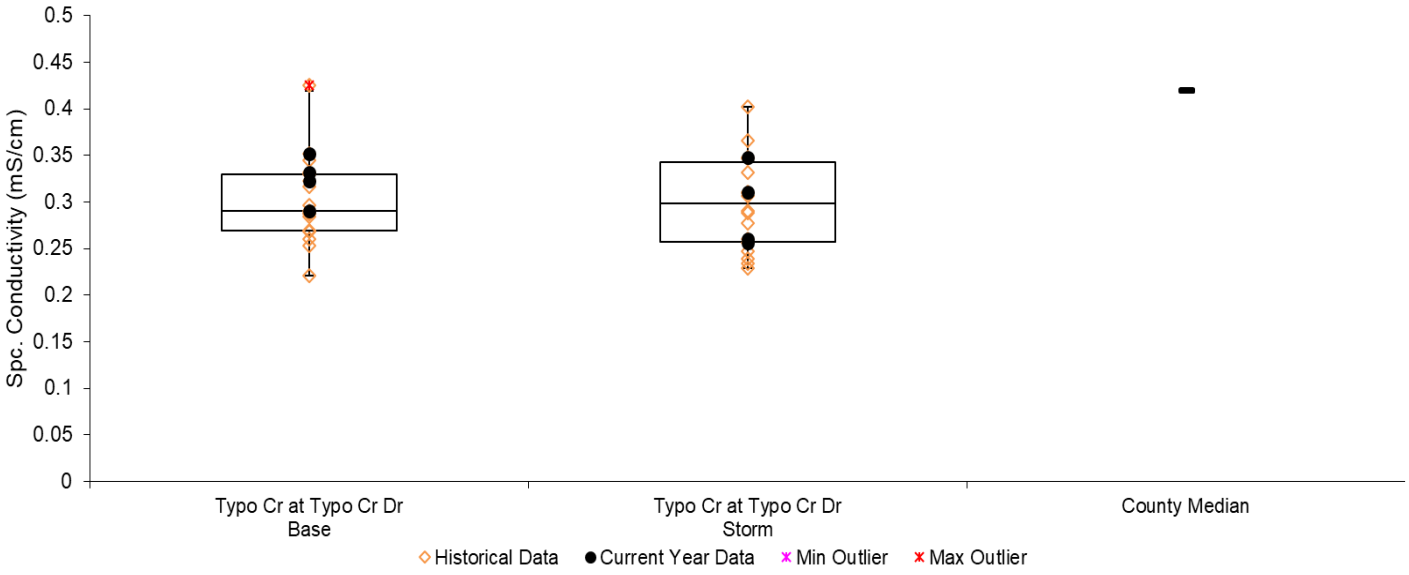
Conductivity and chlorides are measures of dissolved pollutants. Dissolved pollutant sources include urban road runoff and industrial chemicals, among many others. Metals, hydrocarbons, road salts, and others are often of concern in a suburban environment. Conductivity is the broadest measure of dissolved pollutants we used. It measures electrical conductivity of the water; pure water with no dissolved constituents has zero conductivity. Chlorides are the measure of chloride salts, the most common of which are road de-icing chemicals. Chlorides can also be present in other pollutant types, such as wastewater. These pollutants are of greatest concern because of the effect they can have on the stream's biological community.

Conductivity was higher than typical in Typo Creek, averaging 0.309 mS/cm over the 2017 sampling season. This is lower than the median for 34 Anoka County streams of 0.420 mS/cm (county-wide average is driven by urban areas with greater road density and road salting). In other years, Typo Creek conductivity has been similar to 2017. These conductivity levels are not problematic, but could become problematic if baseflow levels continue to increase.

Conductivity was slightly lower during storms, suggesting that stormwater runoff contains fewer dissolved pollutants than the surficial water table that feeds the river 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.

Chlorides were not tested in 2017, 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 Minnesota Pollution Control Agency's (MPCA) chronic standard for aquatic life of 230 mg/L. Given that conductivity has increased, it would be prudent to periodically monitor chlorides to determine if chlorides are a cause of increased conductivity.

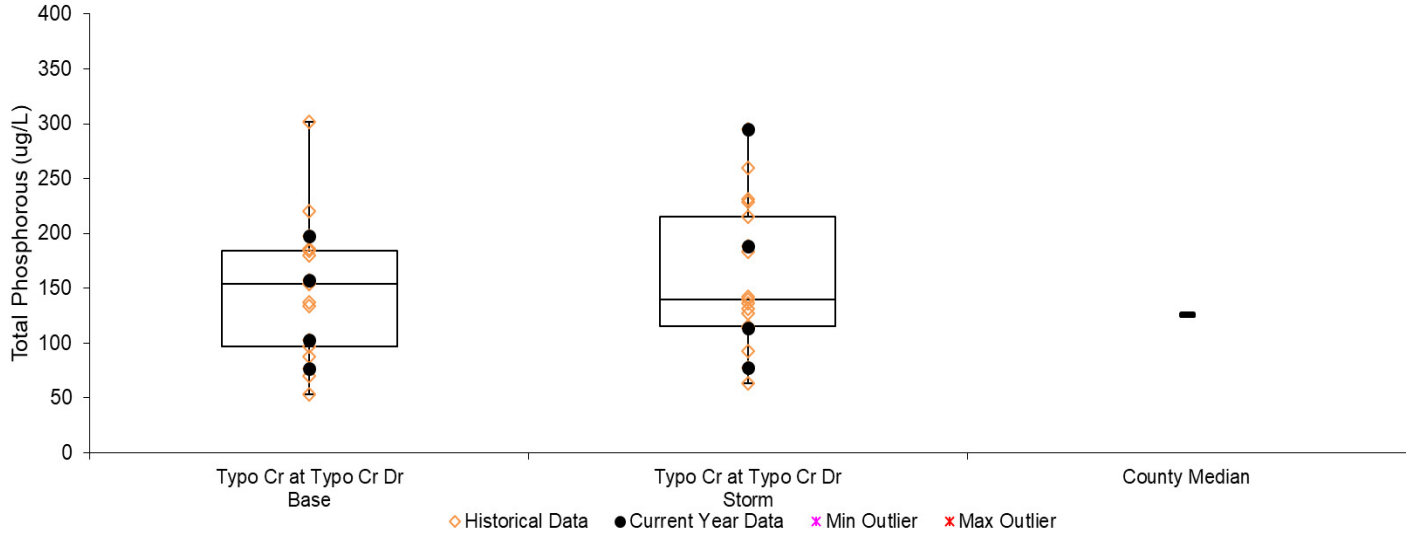
Conductivity during baseflow and storm conditions Orange diamonds are historical data from previous years and black circles are 2017 readings. Box plots show the median (middle line), 25th and 75th percentile (ends of box), and 10th and 90th percentiles (floating outer lines).



Total Phosphorus

The nutrient phosphorus is one of the most common pollutants in our region, and can be associated with urban runoff, agricultural runoff, wastewater, and many other sources. The average total phosphorus concentration of Typo Creek in 2017 was 151 µg/L, up from the 2016 average of 138 µg/L and within the range observed since 2001.

Total phosphorus during baseflow and storm conditions Orange diamonds are historical data from previous years and black circles are 2017 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)

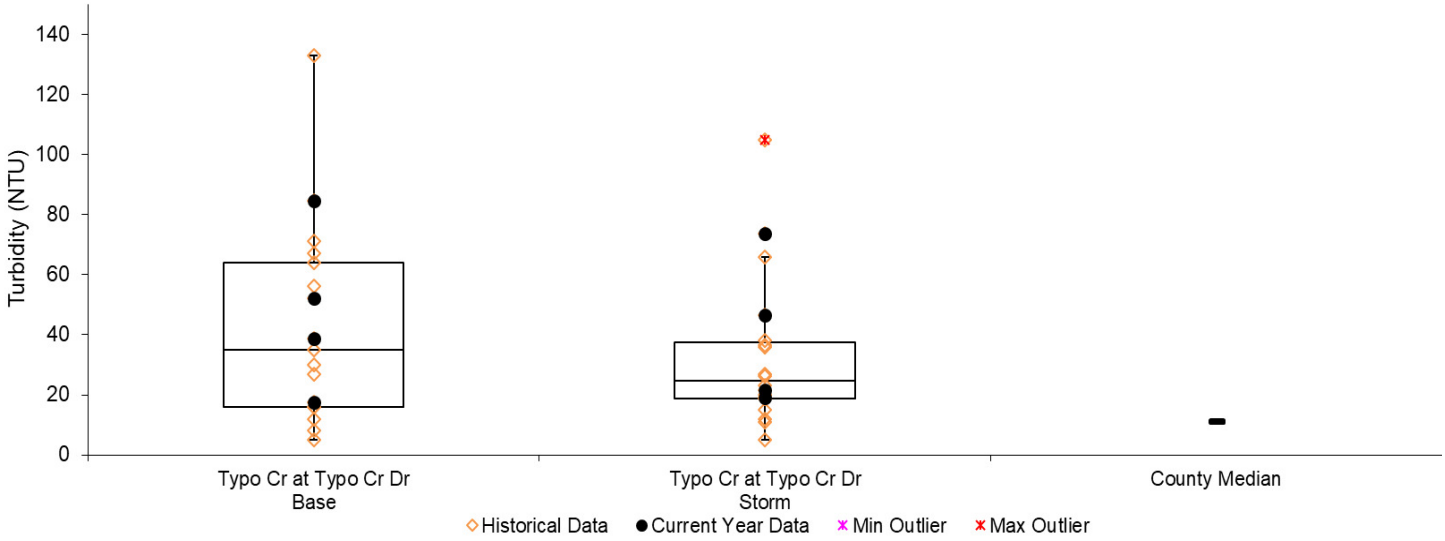
Turbidity and total suspended solids (TSS) are two different measurements of solid material suspended in the water. Turbidity is measured by refraction of a light beam passed through a water sample and is most sensitive to large particles. TSS is measured by filtering solids from a water sample and weighing 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.

It is important to note that suspended solids 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 strongly to Typo Creek.

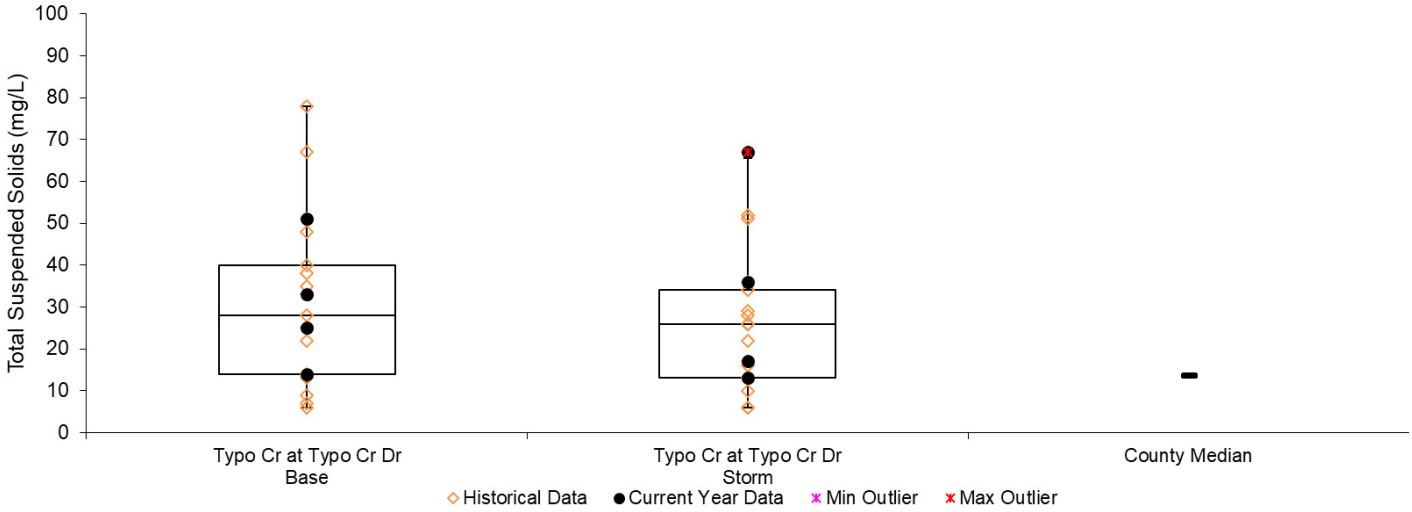
Typo Creek has been on the MPCA Impaired Waters List for high turbidity since 2006. The threshold is 25 NTU turbidity. If a stream exceeds this value on three occasions and at least 10% of all sampling events it is declared impaired for turbidity. Based on all years of ACD sampling, Typo Creek has exceeded 25 NTU turbidity on 19 of 35 sampling occasions, or 54% of the time. In both 2016 and 2017 five of eight samples had turbidity in excess of 25 NTU, with levels over 70 NTU measured each year. The average turbidity in 2017 was 44 NTU.

The high turbidity levels in Typo Creek are likely due to many factors within the watershed. Typo Lake upstream is hypertrophic, 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 are abundant in this system and disturb the sediments.

Turbidity during baseflow and storm conditions Orange diamonds are historical data from previous years and black circles are 2017 readings. Box plots show the median (middle line), 25th and 75th percentile (ends of box), and 10th and 90th percentiles (floating outer lines).



Total suspended solids during baseflow and storm conditions Orange diamonds are historical data from previous years and black circles are 2017 readings. Box plots show the median (middle line), 25th and 75th percentile (ends of box), and 10th and 90th percentiles (floating outer lines).

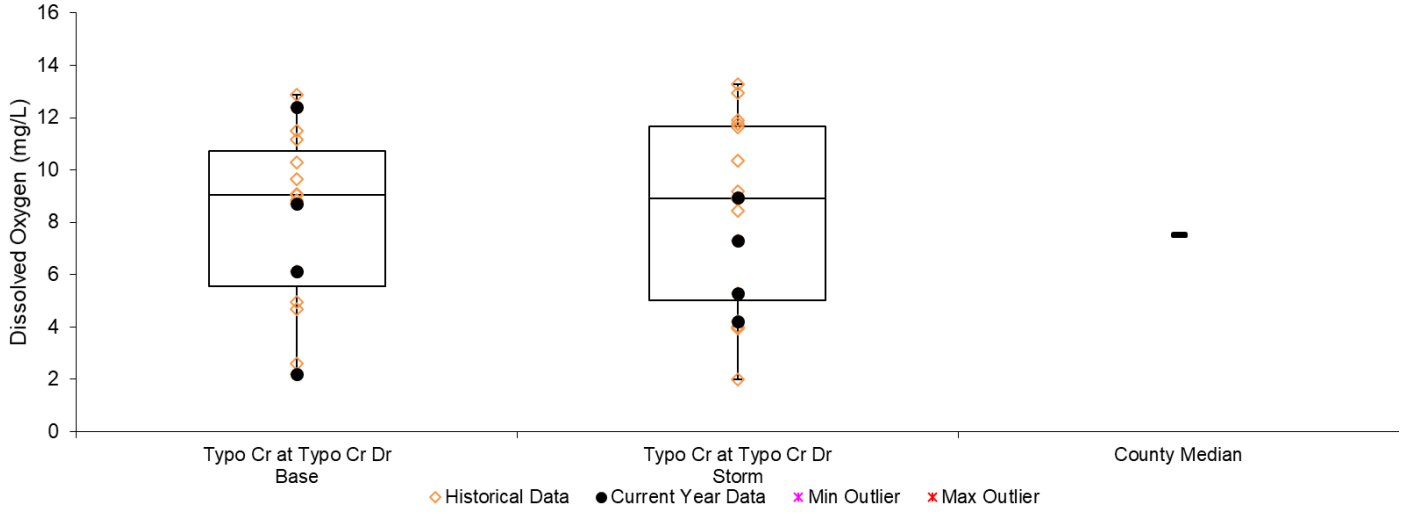


Dissolved Oxygen

Dissolved oxygen is necessary for aquatic life, including fish. 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.

In three years of sampling from 2000-2003, Typo Creek only had a DO level below 5 mg/L on one occasion. In 2016, five of eight samples yielded sub-5 mg/L results. This result was concerning and one reason for continued monitoring in 2017. In 2017, two of eight samples were <5mg/L. Average DO concentrations were over 6.5mg/L in 2016 and 2017. This suggests a mildly impaired condition. High algal production in upstream Typo Lake and subsequent decomposition is a likely cause.

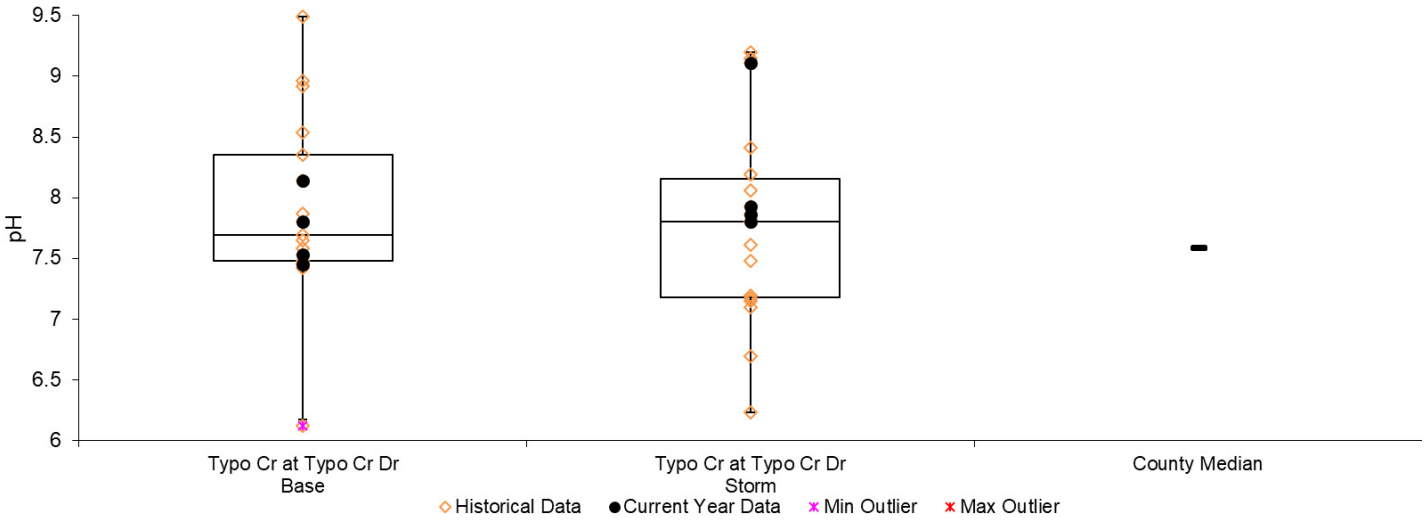
Dissolved oxygen results during baseflow and storm conditions Orange diamonds are historical data from previous years and black circles are 2017 readings. Box plots show the median (middle line), 25th and 75th percentile (ends of box), and 10th and 90th percentiles (floating outer lines).



pH

pH refers to the acidity of the water, and has an effect on a stream's ability to support aquatic life. The Minnesota Pollution Control Agency's water quality standard is for pH to be between 6.5 and 8.5. Typo Creek has been listed as impaired for pH since 2006 due to great swings both above and below the state standard range. In 2016, however, pH was much more stable, ranging from 7.10 to 8.06. In 2017, pH on average was higher than in 2016, but only one measurement occurred above 8.5 (9.11). These recent results are an improvement.

pH results during baseflow and storm conditions Orange diamonds are historical data from previous years and black circles are 2017 readings. Box plots show the median (middle line), 25th and 75th percentile (ends of box), and 10th and 90th percentiles (floating outer lines).



Recommendations

A Total Maximum Daily Load (TMDL) plan was approved in 2012 for Typo Creek for pH and turbidity. Water quality issues in Typo Creek are driven by the nutrient loading, eutrophication and carp activity in upstream Typo Lake. Projects including the Martin and Typo Lake carp barriers (completed in 2016), carp removal (2017-19) and projects in ditched wetlands upstream of Typo Lake (feasibility study completed early 2018) aim to address these issues. Conditions in Typo Creek are not likely to improve until the water quality of Typo Lake upstream improves.

Wetland Hydrology

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

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

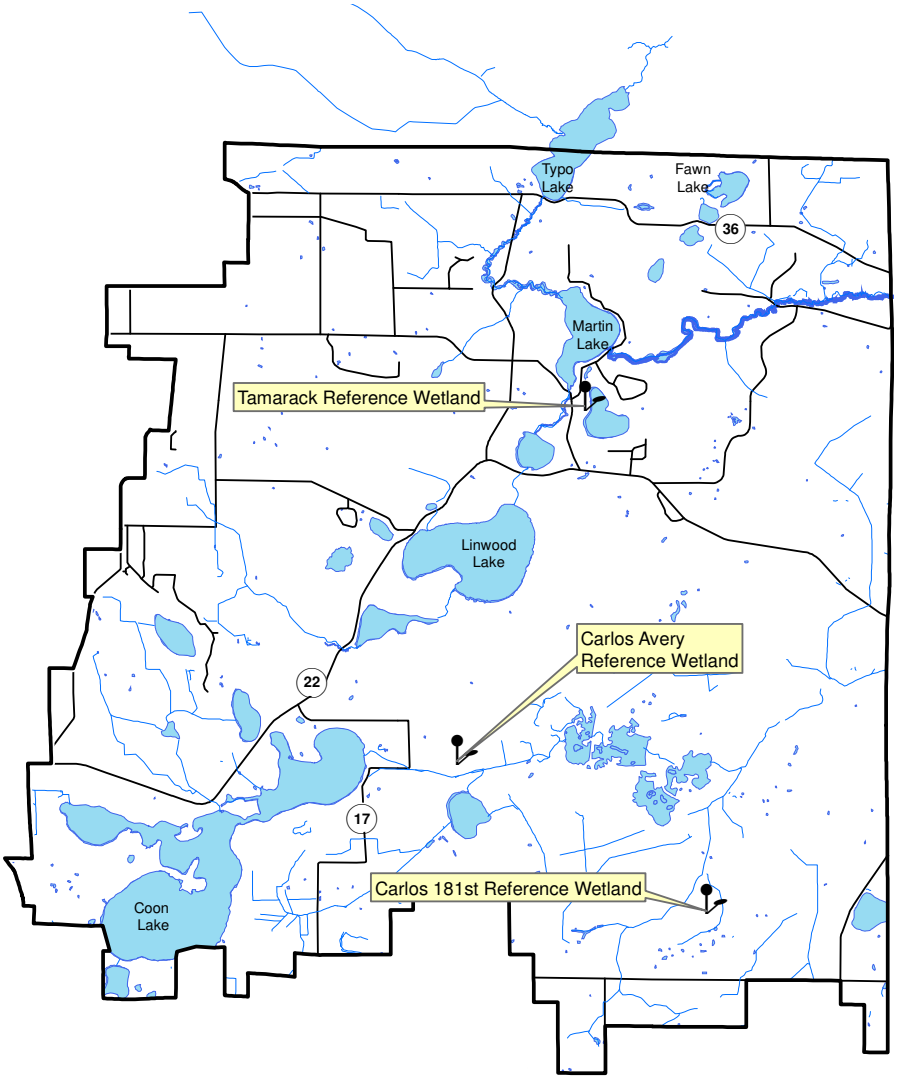
Locations: Carlos Avery Reference Wetland, Carlos Avery Wildlife Management Area, City of Columbus

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

Tamarack Reference Wetland, Linwood Township

Results: See the following pages.

Sunrise Watershed Wetland Hydrology Monitoring Sites

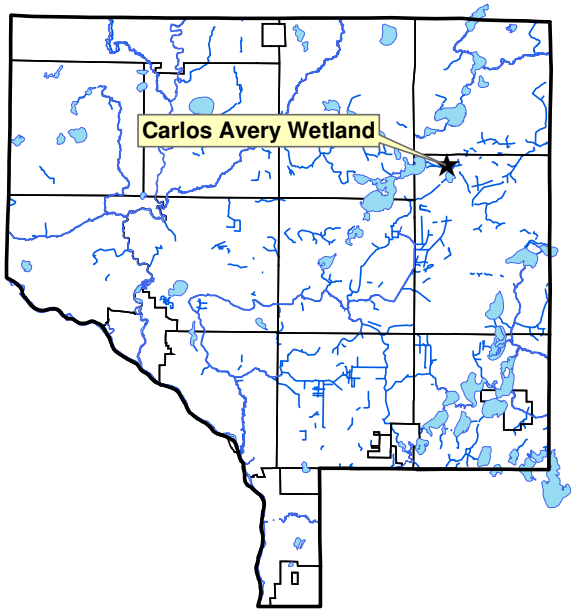


Wetland Hydrology Monitoring

CARLOS AVERY REFERENCE WETLAND

Carlos Avery Wildlife Management Area, City of Columbus

Site Information



Monitored Since: 1997

Wetland Type: 3

Wetland Size: >300 acres

Isolated Basin? No

Connected to a Ditch? Yes

Soils at Well Location:

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

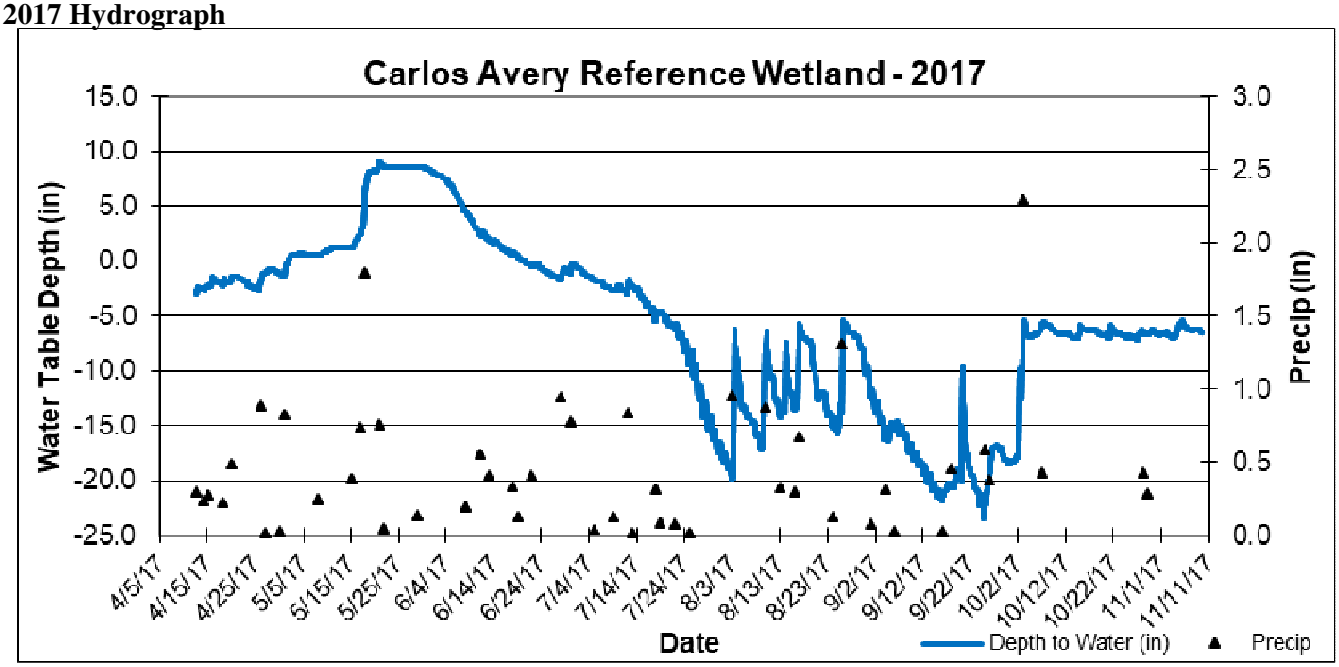
Surrounding Soils: Lino loamy fine sand

Vegetation at Well Location:

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

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

2017 Hydrograph



Wetland Hydrology Monitoring

CARLOS 181ST REFERENCE WETLAND

Carlos Avery Wildlife Management Area, City of Columbus

Site Information

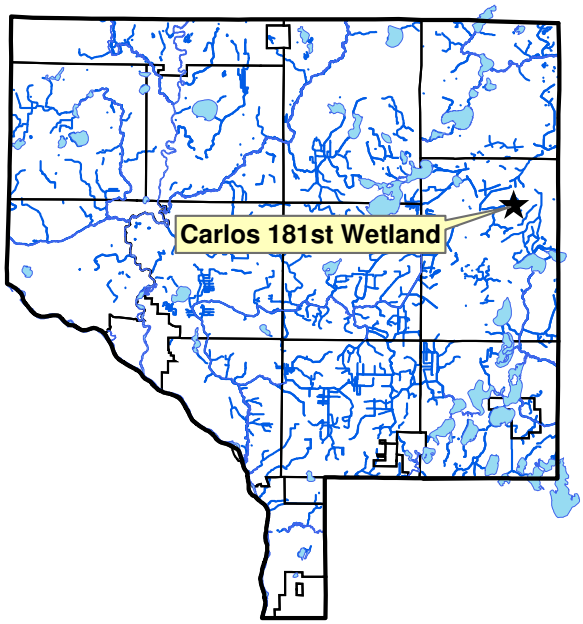
Monitored Since: 2006

Wetland Type: 2-3

Wetland Size: 3.9 acres (approx)

Isolated Basin? Yes

Connected to a Ditch? Roadside swale only



Soils at Well Location:

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	-

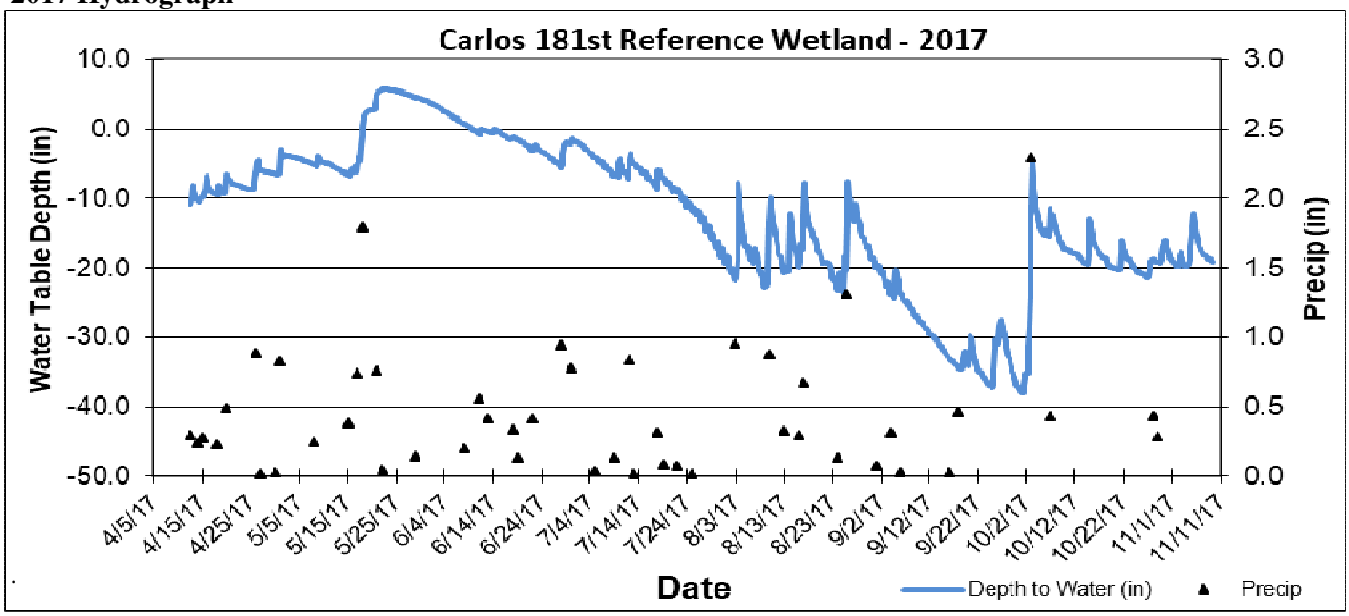
Surrounding Soils: Soderville fine sand

Vegetation at Well Location:

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

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

2017 Hydrograph



Wetland Hydrology Monitoring

TAMARACK REFERENCE WETLAND

Martin-Island-Linwood Regional Park, Linwood Township

Site Information

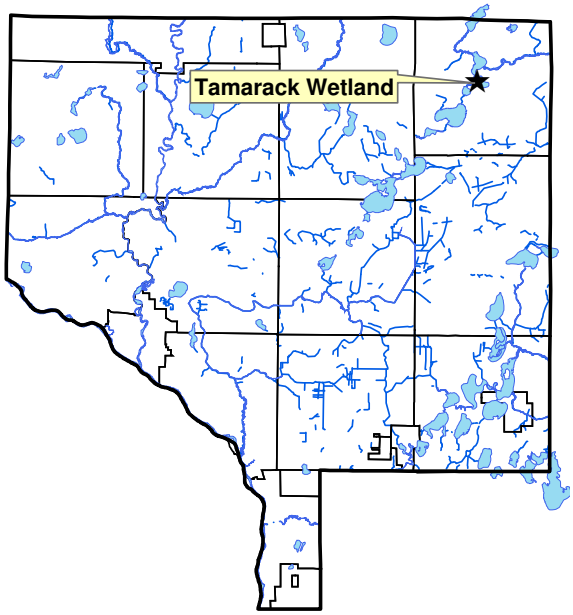
Monitored Since: 1999

Wetland Type: 6

Wetland Size: 1.9 acres (approx)

Isolated Basin? Yes

Connected to a Ditch? No



Soils at Well Location:

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	-

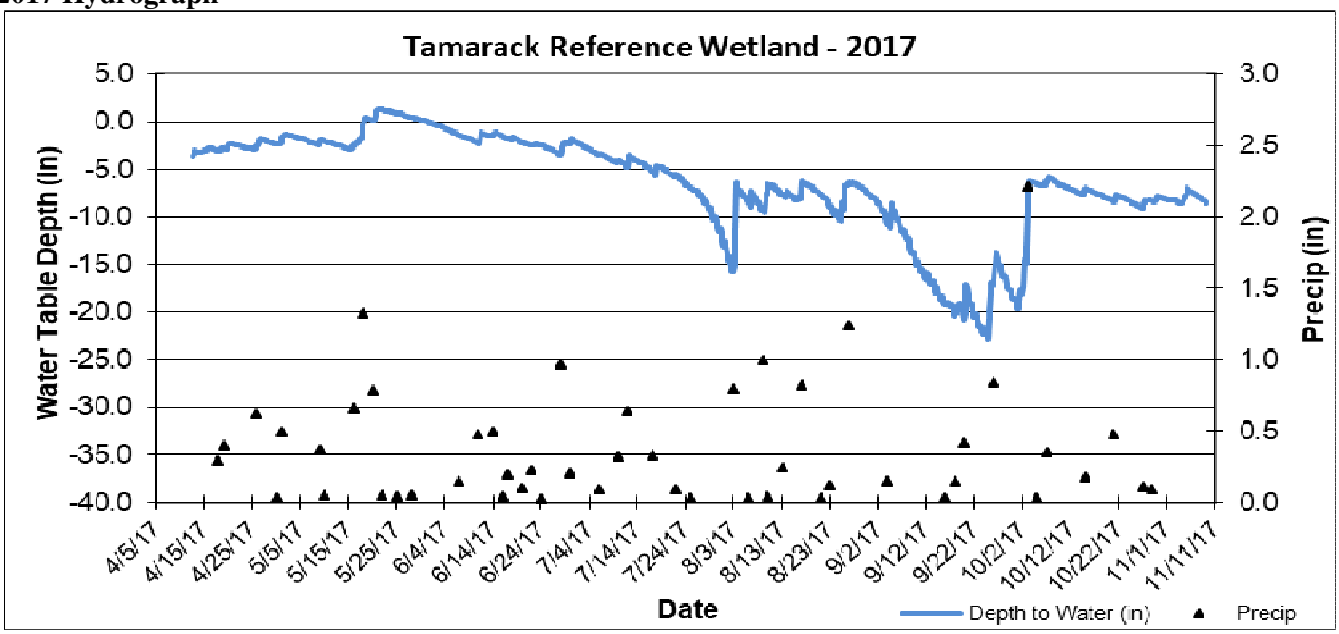
Surrounding Soils: Sartell fine sand

Vegetation at Well Location:

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

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

2017 Hydrograph



Water Quality Grant Fund

Description: The Sunrise River Watershed Management Organization (SRWMO) offers cost share grants to encourage projects that will benefit lake and stream water quality. These projects include lakeshore restorations, rain gardens, erosion correction, and others. These grants, administered by the ACD, offer 50-70% cost sharing of the materials needed for a project. The landowner is responsible for the remaining materials expenses, all labor, and any aesthetic components of the project. The ACD assists interested landowners with design, materials acquisition, installation, and maintenance.

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

Locations: Throughout the watershed.

Results: Projects reported in the year they are installed.

SRWMO Cost Share Fund Summary

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

Martin and Typo Lake Carp Removal Project

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

In 2015-2016 carp barriers were installed at four strategic locations near the inlets and outlets of both lakes to prevent carp migration, overwintering and spawning. In 2017-2018 carp are being removed. Additionally, a detailed assessment of the carp population, age structure and spawning history is being completed. A long-term management plan for carp will be prepared in 2019.

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

Location: Typo and Martin Lakes

Results: In 2017 the following work was completed:

- 20 carp were radio tagged and released back into each Typo and Martin Lakes. These carp are being tracked monthly. They will also be used to locate schools in the winter for commercial harvest.
- 209 carp heads were preserved for aging during winter 2017-18. Fish age is determined by internal balance organs called otoliths. The population age structure reveals the spawning history.
- 2,100 carp were removed from Typo Lake using box nets.

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

A sprung box net in Typo Lake. Nets were set, baited and sprung at three sites in Typo Lake for a total of 17 nettings on seven different days from August through October, 2017.

A boat full of harvested carp. A total of 2,100 carp were removed from Typo Lake during the fall of 2017. Harvest efforts in both lakes will continue through 2019.

Ditch 20 Feasibility Study

Description: In 2016-17 a feasibility study was undertaken to improve understanding of how wetland adjacent to Ditch 20 exported phosphorus that negatively affected downstream lakes. The study identified and ranked projects that would reduce this problem.

This project was undertaken because Ditch 20 was identified as a significant contributor of phosphorus to impaired waters during Total Maximum Daily Load (TMDL) studies for Martin and Typo Lakes. Ditch 20 flows to Typo Lake, Martin Lake, the Sunrise River and St. Croix River

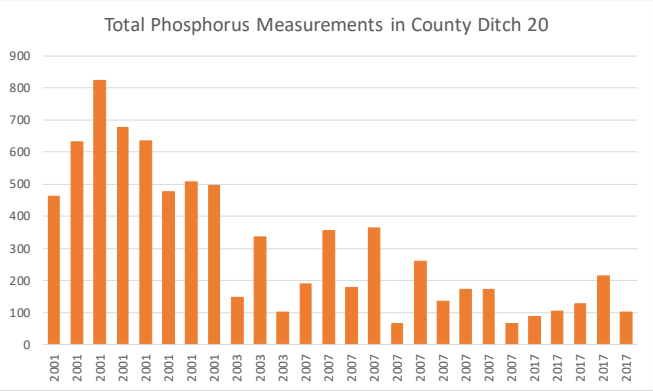
Purpose: To identify and evaluate projects that will reduce phosphorus export from lands adjacent to Ditch 20, thereby benefitting water quality in downstream impaired waterbodies including Typo Lake and Martin Lake.

Location: Ditch 20 subwatershed – northeastern Anoka, southeastern Isanti Counties

Results: A suite of four projects were identified which are cost effective, feasible and have landowner support. Concept designs and cost estimates were developed. Projects were ranked by cost effectiveness at reducing phosphorus. A full report was produced and is available from the Anoka Conservation District.

Water Monitoring

Water quality and quantity were monitored at two locations in the main channel of Ditch 20 and in one lateral ditch throughout the summer of 2017. Previous monitoring had been conducted in the Ditch 20 and Data Creek system in 2001-2007. Initial years of monitoring found extremely high phosphorus (see figure to right). Subsequently, total phosphorus has decreased without any management activity or landscape changes. In fact, in 2017 phosphorus levels averaged 127.6 µg/L, which is only slightly worse than the State water quality standard and right at the median of Anoka County streams (126 µg/L). This may lead watershed managers to make projects on Ditch 20 a lower priority.



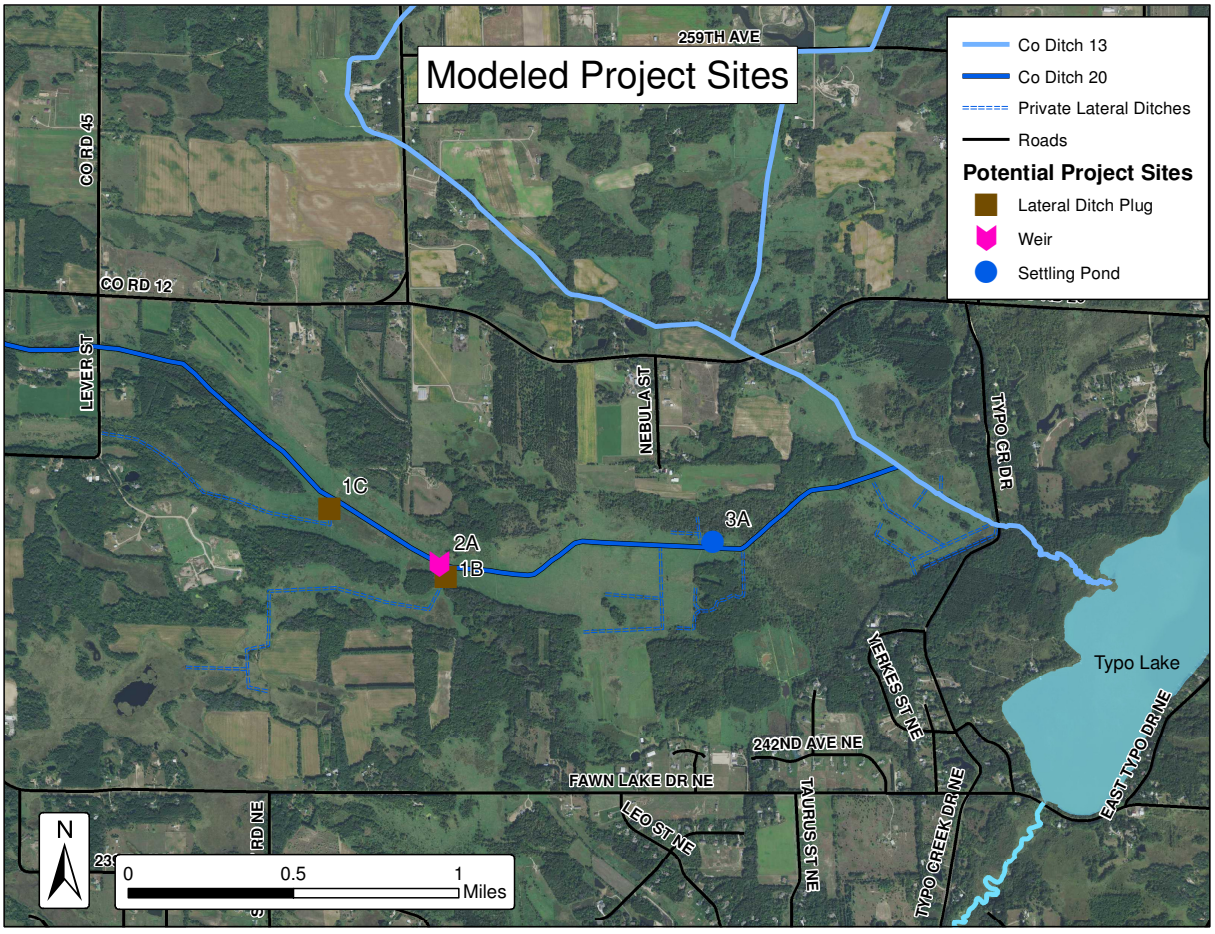
Identification and Ranking of Potential Water Quality Projects

During this feasibility study a number of possible water quality projects were examined. Projects that appeared most feasible and had landowner support were explored in detail through hydrologic modeling, concept designs, phosphorus reduction estimation, and cost estimation. Those projects (see map below) included two lateral ditch plugs and one weir on Ditch 20 that restore wetland hydrology to ditched wetland. We also explored constructing a settling pond through which the ditch would flow.

From a cost effectiveness standpoint, all of these projects are favorable. We calculated cost effectiveness by comparing the total costs of permitting, design, construction and maintenance over a 30-year lifespan and estimated phosphorus reductions during the same period. Costs per pound of phosphorus removed were <$100 for each project.

There is uncertainty in these cost effectiveness estimates. First, phosphorus reductions from wetland restorations can vary widely, and even result in phosphorus increases. While we utilized a typical result, actual results found in the literature vary widely. Moreover, construction of certain projects may require new bypass ditches, which, if built, may cause more drainage than the current condition and result in overall greater phosphorus export.

Permitting costs also carry uncertainty. Permitting of projects that may affect upstream drainage and impact wetlands is a substantial undertaking. Needed permits may include County (wetland impacts, mining) and the US Army Corps of Engineers. Several years of hydrological monitoring may be needed in advance of any construction to assure permitting agencies that there will be no negative hydrological repercussions. Moreover, permitting agencies will want there to be an entity willing to own and maintain these practices, and all likely entities have so far expressed disinterest.



Recommendations

Because they may offer cost effective habitat restoration and water quality projects, the projects identified by this study are worth pursuing. Given the uncertainties with phosphorus reduction and challenges with permitting, maintenance and construction, it might be best to view these primarily as wetland restoration projects with secondary water quality benefits. The MN Board of Water and Soil Resources has a program for wetland restorations, and these projects may be a good fit. That program's staff would be best equipped to address the technical challenges. The program also offers financial benefits to cooperating landowners.

Four entities should pursue these projects: Anoka Conservation District, Sunrise River Watershed Management Organization, Isanti Soil and Water Conservation District and Isanti County. Each should consider including these projects in their comprehensive plans.

Full results of this feasibility study are available from the Anoka Conservation District.

Annual Education Publication

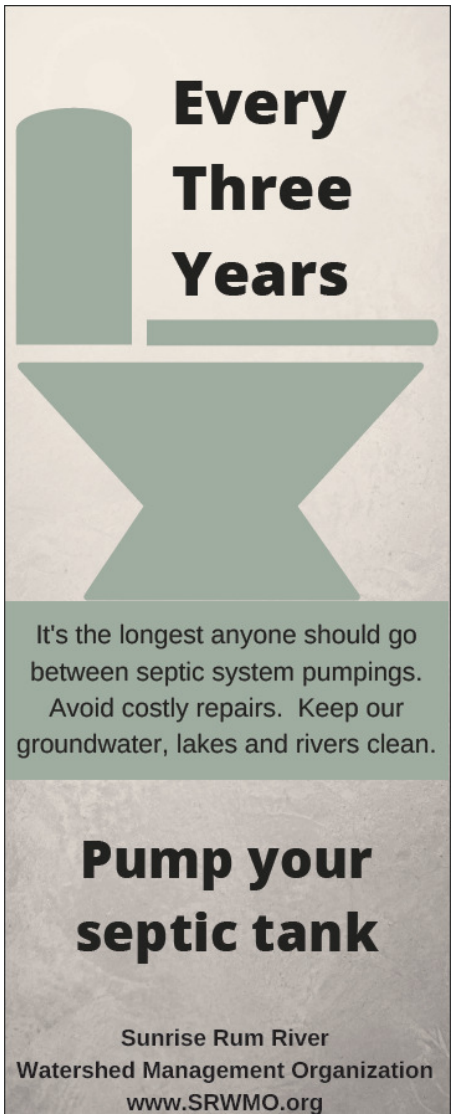
Description: An annual newsletter article about the SRWMO is required by MN Rules 8410.010 subpart 4, and planned in the SRWMO Watershed Management Plan.

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

Location: Watershed-wide

Results: In 2017 the SRWMO contracted with the ACD to prepare its annual education publication. Instead of a traditional newsletter article, the WMO decided to utilize an infographic after presenting this approach to the MN Board of Water and Soil Resources, which oversees WMOs. This method is more likely to be consumed by the public and better fits within the limited publishing space available. To ensure broad distribution and manage costs, educational materials are provided to the SRWMO's member communities for publication in their newsletters. SRWMO Board chose to focus their 2017 education infographic on septic system maintenance.

SRWMO 2017 Education Infographic



SRWMO Website

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

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

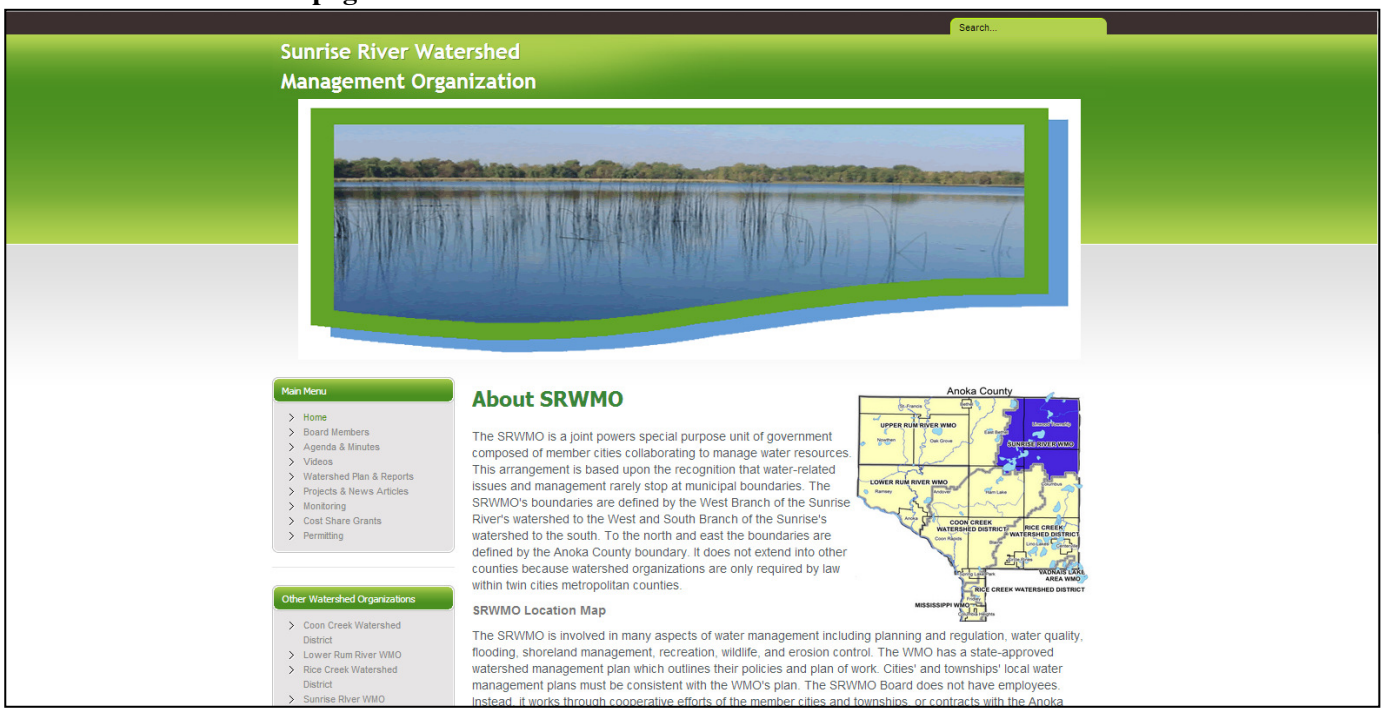
Location: www.SRWMO.org

Results: In 2013, the ACD re-launched the SRWMO website.

Regular website updates occurred throughout 2017. The SRWMO website contains information about both the SRWMO and about natural resources in the area.
Information about the SRWMO includes:

- a directory of board members,
- meeting minutes and agendas,
- the watershed management plan and information about plan updates,
- descriptions of work that the organization is directing,
- highlighted projects.

SRMWO Website Homepage



Grant Searches and Applications

Description: The Anoka Conservation District (ACD) partners with the SRWMO with 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 2017 a grant application was prepared for a Martin and Typo Lakes Carp Harvest Project. A $99,000 grant from the MN DNR Conservation Partners Legacy Grant Program was secured. Work to secure the grant included:

- Securing matching funds from the SRWMO ($5,000), Martin Lakers Association ($4,900) and the Anoka Conservation District ($5,000).
- Negotiating and securing a contract with Carp Solutions, Inc.
- Preparing the grant application.

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

2014 Martin and Typo Lake Carp Barriers, site 2	MN DNR CPL	$ 35,770
2014 Martin and Typo Lake Carp Barriers, sites 1,3,4	MN DNR CPL	$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 CPL	$ 99,000
2017 Septic System Fix Up Fund*	MPCA	$ 25,931
	TOTAL	$676,071

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

SRWMO Annual Report to BWSR and State Auditor

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

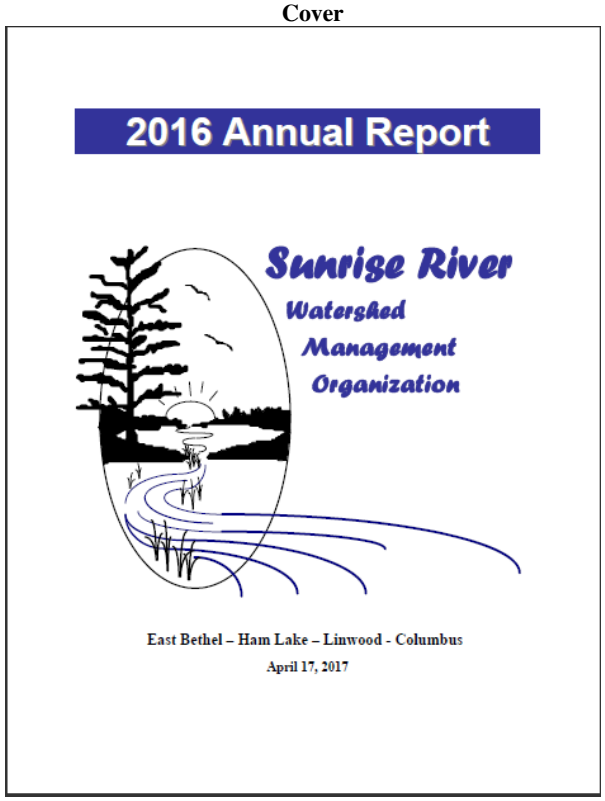
The SRWMO must also submit an annual financial report to the State Auditor. They accept unaudited financial reports for financial districts with annual revenues less than $185,000.

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

Locations: Watershed-wide

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

Cover



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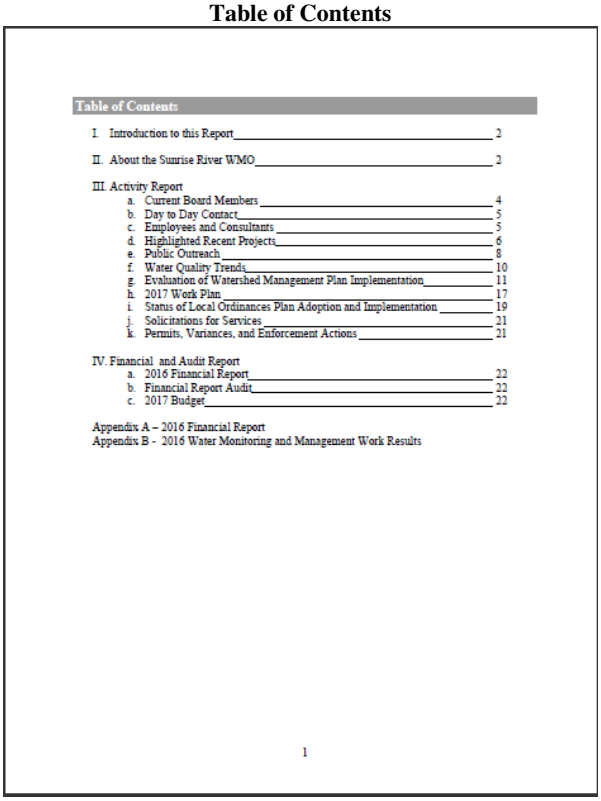
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On-call Administrative Services

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

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

Results: In 2017 a total of 77 hours of administrative assistance were provided to the SRWMO by the Anoka Conservation District. The following tasks were accomplished:

- **Meeting prep** - Planned 5 SRWMO meeting agendas, prepared meeting packets and emailed them to the board a week in advance.
- **Meeting attendance** - Attended 5 SRWMO meetings to provide project updates and advise the board.
- **Plan addendum** - Prepared a required SRWMO Watershed Plan addendum to incorporate new state buffer law information and presented it to the board for approval.
- **Funding updates** - Emailed Watershed Based Funding (aka fund the plan) to SRWMO board members and city staff.
- **State inquiries** - Responded to the State Campaign Finance Board regarding failure of a board member to complete required Campaign Finance Disclosure forms. The member resigned over objections to the form as an intrusion.
- **Boundary adjustments** – Addressed proposals for 3 SRWMO boundary adjustments sought by the City of Ham Lake. They were contentious, and included several meetings with city and watershed district staff. The proposals were mapped and presented to the SRMWO board. None of the adjustments was finalized.
- **Regional reporting** – Reported SRWMO projects to the St. Croix River Partnership to document TMDL progress.
- **Inquiries** – Fielded approximately 8 inquiries from developers, landowners and others about SRWMO permitting (there is none), grants and other programs.
- **1W1P** - Attended 4 Lower St. Croix "One Watershed, One Plan" meetings to represent the SRWMO. Nearly all other WMOs, watershed districts, counties and SWCDs also had staff present.
- **2018 budget** – Completed the 2018 budget through revisions directed by the board, providing it to cities for ratification, and tracking city ratification.
- **2019 budget** – Prepared the 1st draft 2019 budget to present to the board.

Financial Summary

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

Sunrise River Watershed Financial Summary

Sunrise River Watershed	SRWMO Admin/Reporting/Grant Search	County, City, SWCD Asst (no charge)	WMO Asst (no charge)	SRWMO Promo/Website	Volunteer Precip	Reference Wetlands	DNR Groundwater Wells	Lake Levels	Lake Water Quality	Stream Levels	Stream Water Quality	Shoreland - NRBG - Linwood Lake SSTS	Martin/Typo Lake Carp Barriers	Carp Management - Typo and Martin Lakes	Coon Lake Retrofits	Ditch 20 Analysis	Inventory - Linwood Lake SSTS	Total
Revenues																		
SRWMO	4040			1305		1725		1250	3500	1350	1400			2350	131	4881		21932
State - Other							280					2615				41836		44731
MPCA																		0
DNR OHF																		0
DNR CPL													43778	37473				81251
BWSR Cons Delivery	1669	417	416				295								101			2897
BWSR Capacity Staff														5289			4126	9414
BWSR Capacity Direct																		0
BWSR Cost Share																		0
BWSR Cost Share TA																		0
BWSR Local Water Planning	207		175	58	219				165	371					10			1205
Metro ETA & NPEAP																		0
Metro AWQCP																		0
Regional/Local															524			524
Anoka Co. General Services	32	336	416									29		2630	242	1653		5338
County Ag Preserves/Projects																5000	958	5958
Service Fees															600			600
Investment Dividend																		0
Rents																		0
Product Sales																		0
TOTAL	5947	754	1006	1363	219	1725	575	1250	3665	1721	1400	2644	43778	47742	1608	53371	5083	173851
Expenses-																		
Capital Outlay/Equip	225	19	59	51	10	50	39	48	140	47	21	3	209	223	130	1065	69	2409
Personnel Salaries/Benefits	5299	680	874	962	180	1421	459	1160	2309	1348	423	137	6272	9281	1217	27808	4529	64359
Overhead	235	27	41	49	12	107	40	68	157	106	30	7	252	319	86	1316	178	3029
Employee Training	16	3	3	2	1	12	3	6	18	11	2	1	11	61	3	126	30	308
Vehicle/Mileage	52	8	5	10	3	43	10	22	48	38	10	2	83	112	6	361	59	871
Rent	120	17	24	24	6	75	24	42	115	61	19	3	160	273	37	779	106	1886
Project Installation													18754		22			18775
Project Supplies				266	7	17		13	878	69	271	2491	9588	37473	109	22553	112	73848
McKay Expenses																		0
TOTAL	5947	754	1006	1363	219	1726	575	1359	3665	1680	776	2644	35328	47742	1608	54009	5083	165484
NET	0	0	0	0	0	-1	0	-109	0	41	624	0	8450	0	0	-638	0	8367

Recommendations

- **Begin update of the SRWMO Watershed Management Plan** no later than May 2018 in order to complete by December 2019 when the current plan expires.
- **Engage in the Lower St. Croix One Watershed, One Plan process.** This plan will identify regional priorities.
- **Secure new Watershed Based Funding for SRWMO priority projects.** This new program replaces some competitive grants and is aimed at projects in approved water plans. $826,000 is available in Anoka County to be divided by mutual agreement of eligible entities by June 30, 2018.
- **Pursue Linwood Lake management activities.** The association has recently become more active, and has requested partnerships to manage aquatic invasive species and improve water quality. Ongoing and upcoming projects include 2018 Boot Lake water quality monitoring, 2017-18 septic system outreach. Projects to consider include an assessment of the carp population and alum dosing.
- **Support the Linwood Lake Association.** The association has recently become more active, and has requested partnerships to manage aquatic invasive species and improve water quality. The SRWMO may be able to help with identifying and promoting projects, or assisting with fundraising.
- **Forward wetland restoration projects near Ditch 20 by connecting landowners with State wetland banking programs.** A feasibility study was recently completed. Three identified wetland restorations would likely benefit water quality in Typo and Martin Lakes. These are challenging projects from a feasibility and permitting standpoint, but the State wetland banking program may provide the resources and expertise.
- **Continue installation of stormwater retrofits around Coon and Martin Lakes** where completed studies have identified and ranked projects.
- **Promote newly available Septic System Fix Up Grants to landowners,** particularly in shoreland areas.
- **Identify likely ailing septic systems in shoreland areas.** Work done at Linwood Lake in 2017-18 can serve as a model.
- **Bolster lakeshore landscaping education efforts.** The SRWMO Watershed Management Plan sets a goal of three lakeshore restorations per year. Few are occurring. Fresh approaches should be welcomed.
- **Encourage communities to report water quality projects to the SRWMO.** An overarching goal in the SRWMO Plan is to reduce phosphorus by 20% (986 lbs). State oversight agencies will evaluate efforts toward this goal. Both WMO and municipal project benefits should be counted.