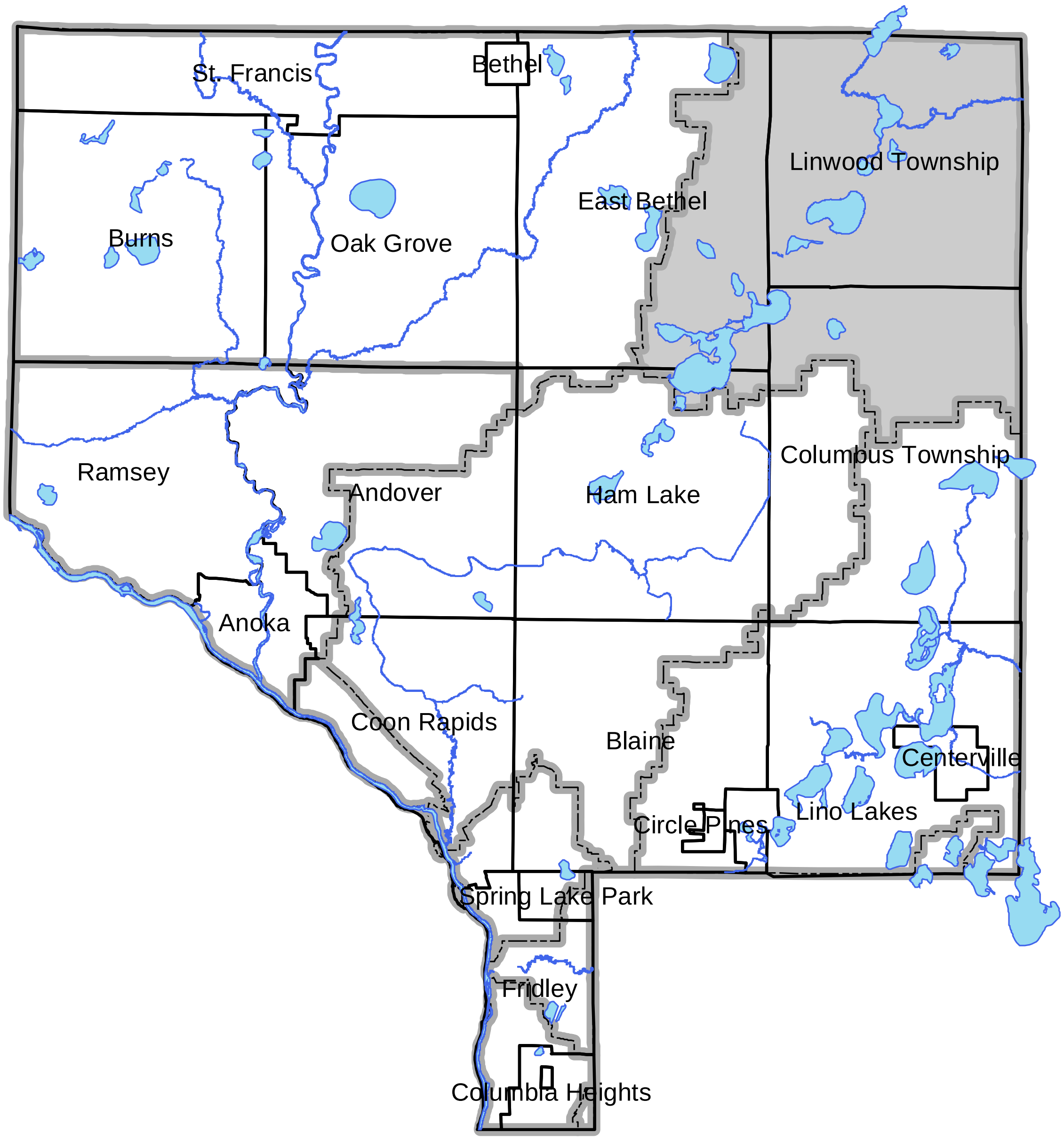
Excerpt from the
2012 Anoka Water Almanac

Chapter 2: Sunrise River Watershed

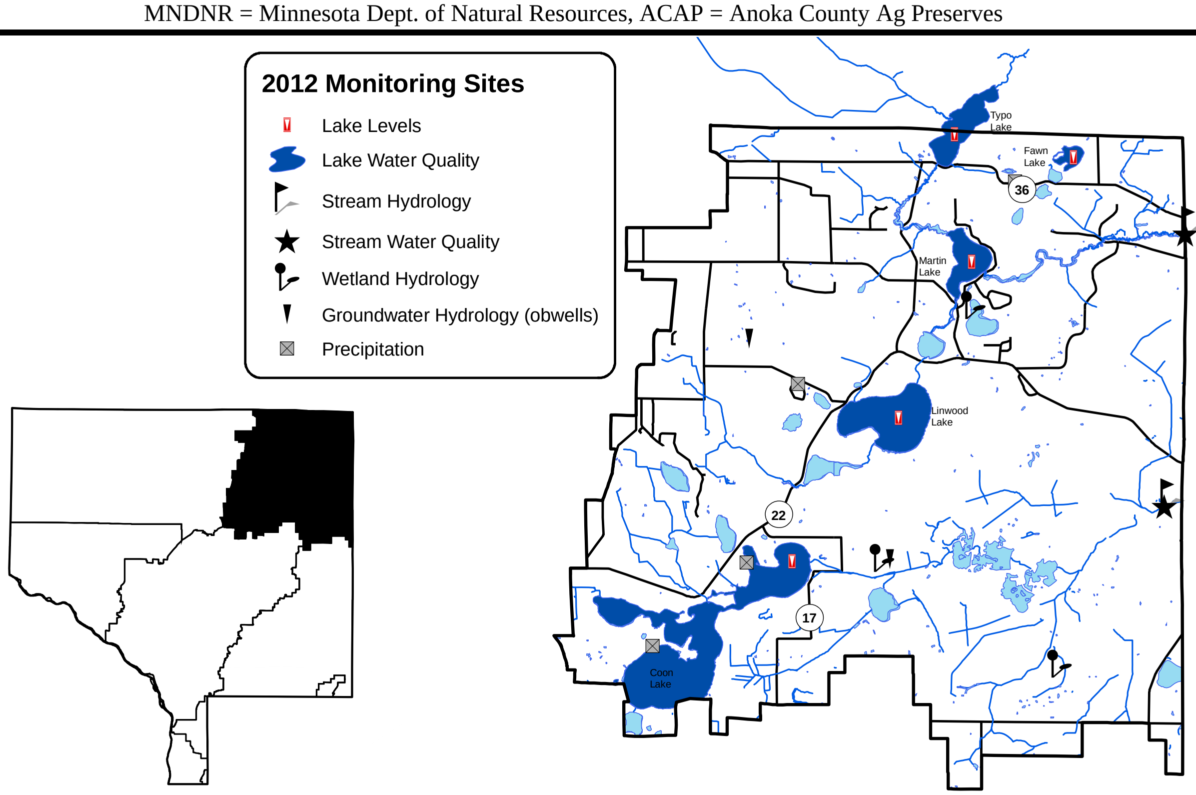


Prepared by the Anoka Conservation District

CHAPTER 2: SUNRISE RIVER WATERSHED

Task	Partners	Page
Lake Levels	SRWMO, ACD, MN DNR, volunteers	2-28
Lake Water Quality	SRWMO, ACD, ACAP	2-30
Stream Water Quality	SRWMO, ACD	2-47
Stream Hydrology	SRWMO, ACD	2-61
Stream Rating Curves	SRWMO, ACD	2-64
Wetland Hydrology	SRWMO, ACD, ACAP	2-66
Water Quality Grant Fund	SRWMO, ACD	2-70
Water Quality Improvement Projects	SRWMO, ACD, landowners, and others	2-71
Coon Lake Area Stormwater Retrofit Assessment	SRWMO, ACD	2-73
Lakeshore Landscaping Education	SRWMO, ACD	2-74
Annual Education Publication	SRWMO, ACD	2-76
SRWMO Website	SRWMO, ACD	2-77
Grant Search and Applications	SRWMO, ACD	2-78
SRWMO 2011 Annual Report	SRWMO, ACD	2-79
Review Local Water Plans	SRWMO, ACD	2-80
On-call Administrative Services	SRWMO, ACD	2-81
Financial Summary		2-82
Recommendations		2-83
Groundwater Hydrology (obwells)	ACD, MNDNR	See Chapter 1
Precipitation	ACD, volunteers	See Chapter 1

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 years are shown below, and all historic data are available on the Minnesota DNR website using the "LakeFinder" feature (www.dnr.mn.us.state\lakefind\index.html).

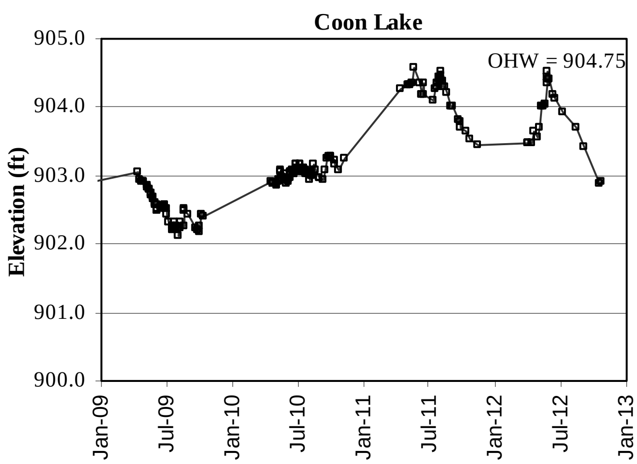
Purpose: To understand lake hydrology, including the impact of climate or other water budget changes. These data are useful for regulatory, building/development, and lake management decisions.

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

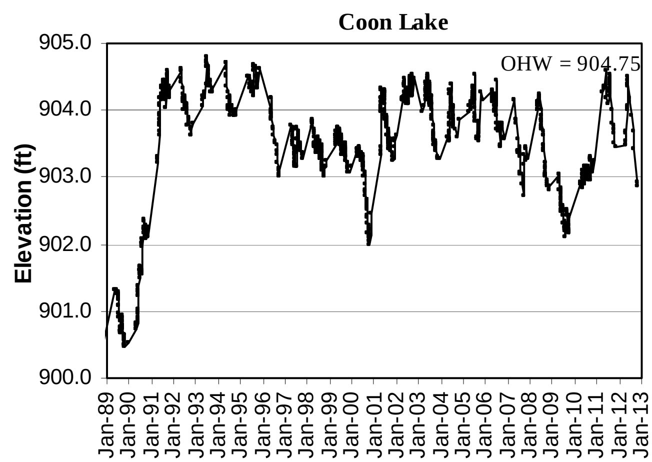
Results: Lake levels were measured by volunteers throughout the 2012 open water season. Lake gauges were installed and surveyed by the Anoka Conservation District and MN DNR. Lakes had sharply increasing water levels in spring and early summer 2012 when heavy rainfall totals occurred. Little rainfall fell later in the year and lake levels fell dramatically.

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.

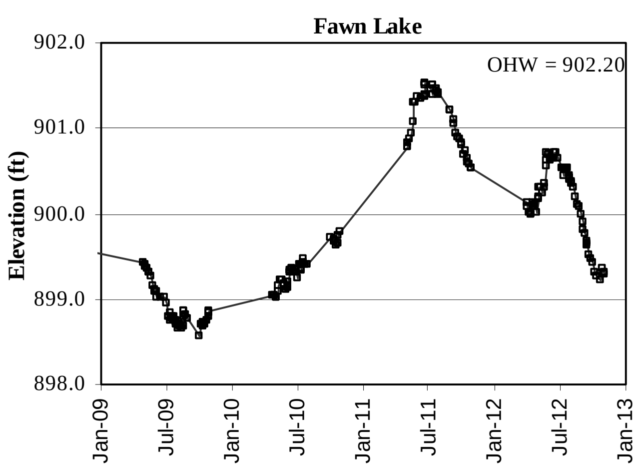
Coon Lake Levels – last 5 years



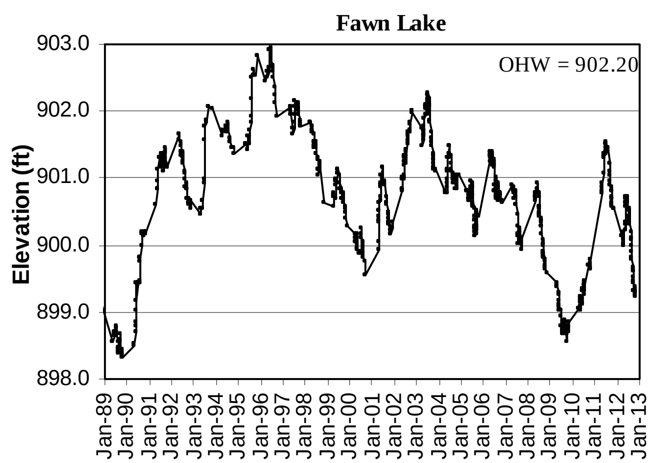
Coon Lake Levels – last 24 years



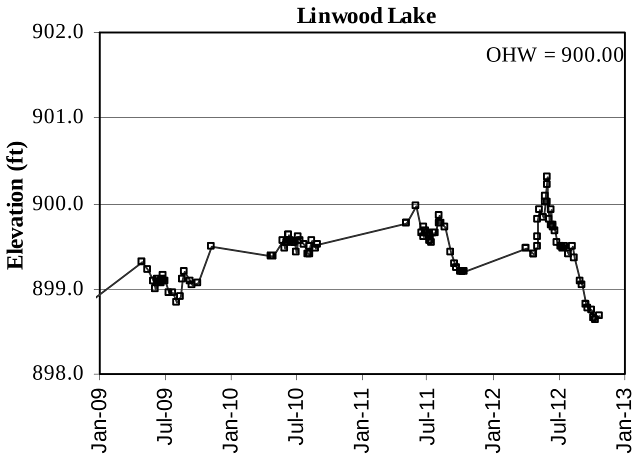
Fawn Lake Levels – last 5 years



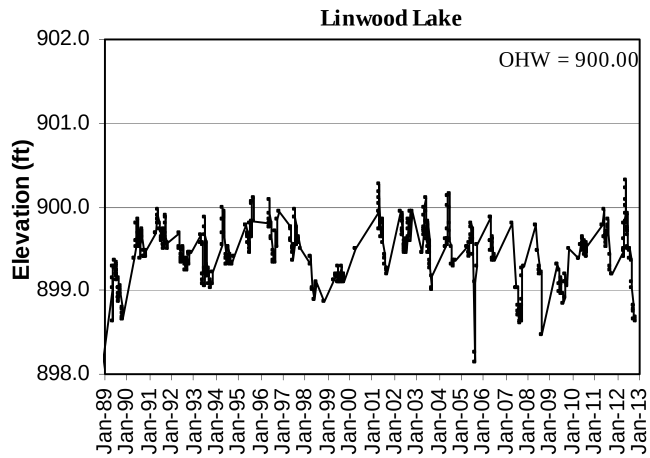
Fawn Lake Levels – last 24 years



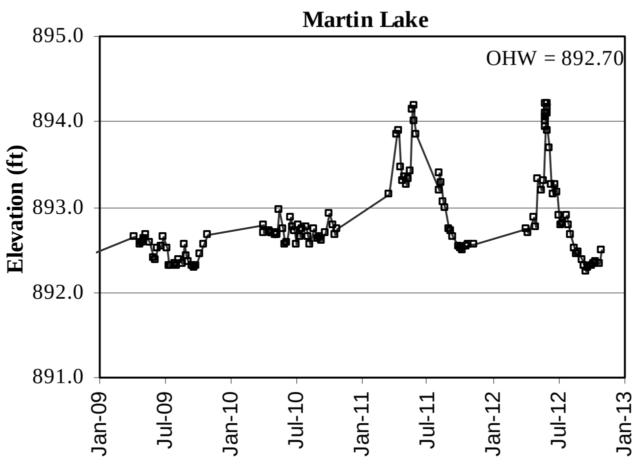
Linwood Lake Levels – last 5 years



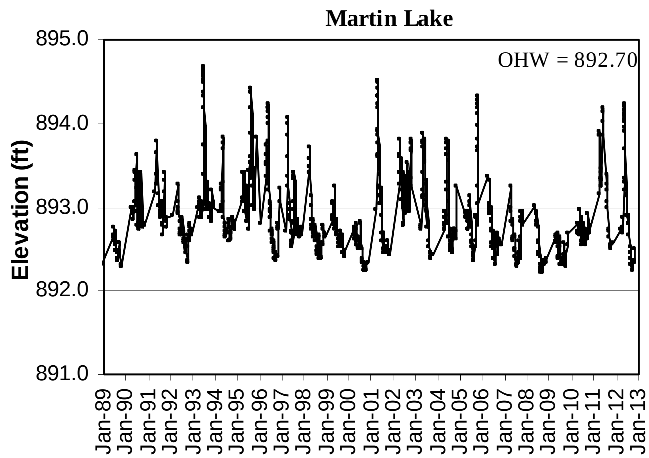
Linwood Lake Levels – last 24 years



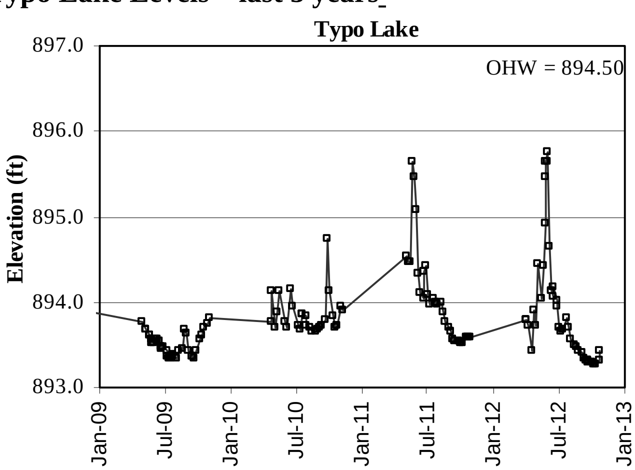
Martin Lake Levels – last 5 years



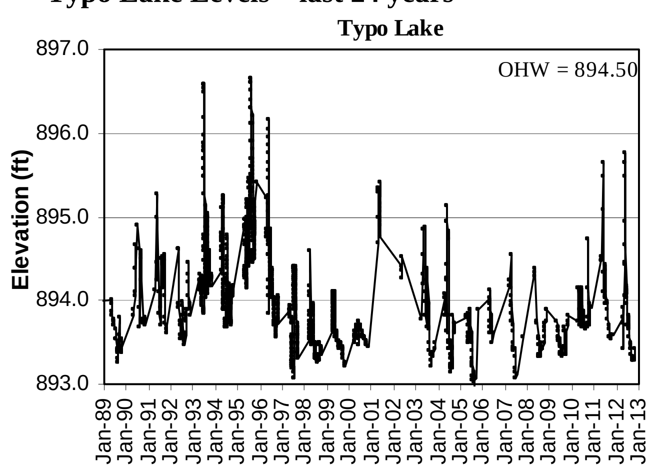
Martin Lake Levels – last 24 years



Typo Lake Levels – last 5 years



Typo Lake Levels – last 24 years



Lake Water Quality

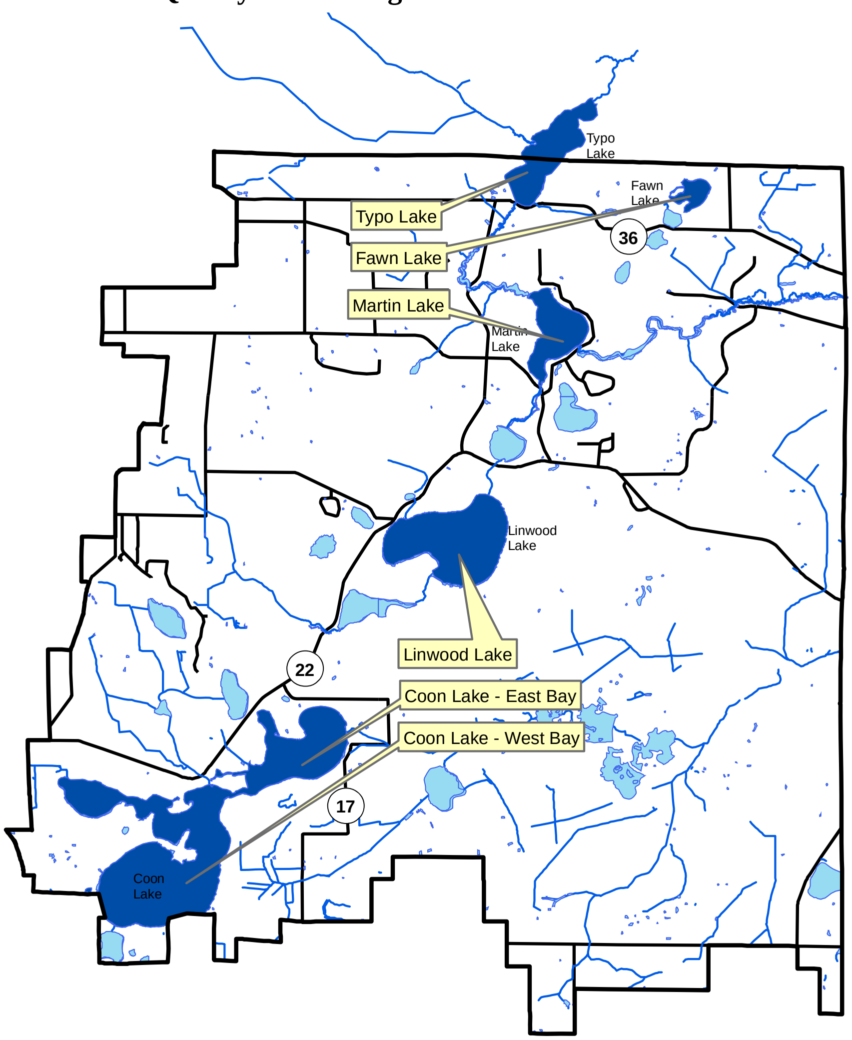
Description: May through September every-other-week monitoring of the following parameters: total phosphorus, chlorophyll-a, secchi transparency, dissolved oxygen, turbidity, temperature, conductivity, pH, and salinity.

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

Locations:
Coon Lake East Bay
Coon Lake West Bay
Linwood Lake
Typo Lake
Fawn 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 ACD. Refer to Chapter 1 for additional information on interpreting the data and on lake dynamics.

Sunrise Watershed Lake Water Quality Monitoring Sites



Coon Lake –East and West Bays
City of East Bethel, City of Ham Lake & City of Columbus, Lake ID # 02-0042

Background

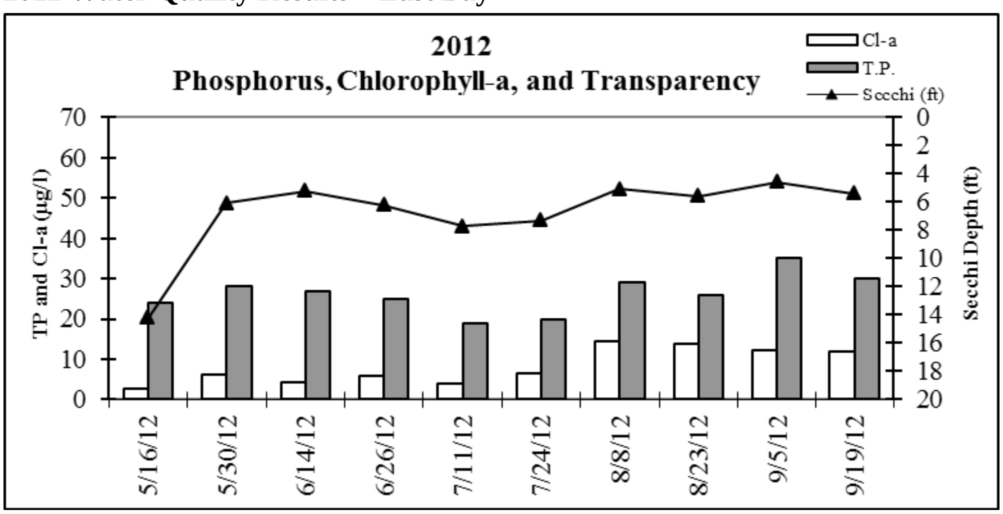
Coon Lake is located in east central Anoka County and is the county's largest lake. Coon Lake has a surface area of 1498 acres and a maximum depth of 27 feet (9 m). Public access is available at three locations with boat ramps, including one park with a swimming beach. The lake is used extensively by recreational boaters and fishers. Most of the lake is surrounded by private residences. The watershed of 6,616 acres is rural residential.

This report includes separate information for the East Bay (aka northeast or north bay) and West Bay (aka southwest or south bay) of Coon Lake. The 2010-12 data is from the Anoka Conservation District (ACD) monitoring at the MN Pollution Control Agency (MPCA) monitoring site #203 for the East Bay and #206 for the West Bay. Over the years, other sites have been monitored and are included in this report's trend analysis when appropriate. When making comparisons between the two bays, please consider that both bays were monitored simultaneously only in 2010 and 2012; data from other years do not lend themselves well to direct comparisons because monitoring regimes were likely different.

2012 Results – East Bay

In 2012 the East Bay had slightly better than average water quality for this region of the state (NCHF Ecoregion), receiving a B grade. Average values of important water quality parameters included 26 µg/L for total phosphorus, 8.2 µg/L chlorophyll-a, and Secchi transparency of 6.7 feet. Chlorophyll-a levels were the lowest of all monitored years. Phosphorus and transparency were similar to previous years. The subjective observations of the lake's physical characteristics and recreational suitability by the ACD staff indicated that lake conditions were excellent for swimming and boating until August and September, when there was a slight to moderate algae impairment.

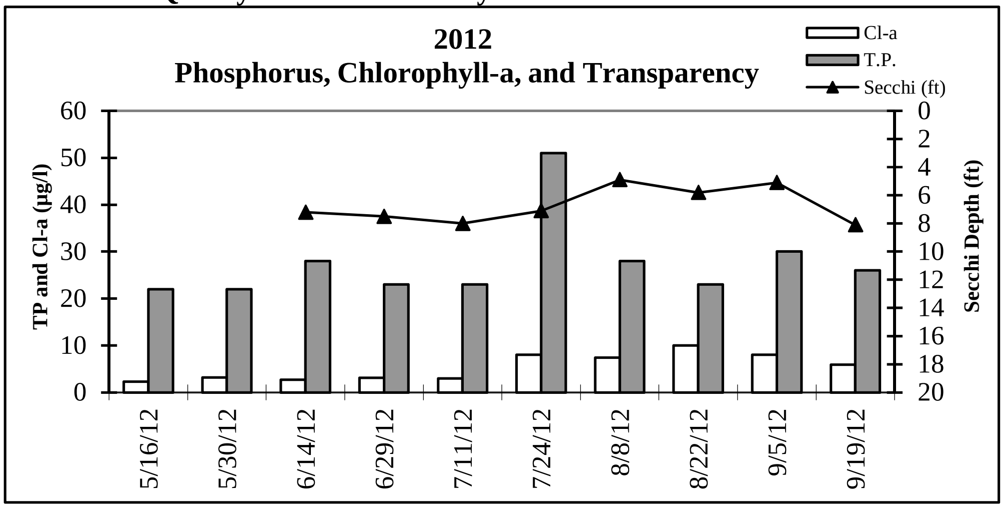
2012 Water Quality Results – East Bay



2012 Results – West Bay

In 2012 the West Bay had slightly better than average water quality for this region of the state (NCHF Ecoregion), receiving an A- letter grade. West Bay total phosphorus averaged 28.0 µg/L and chlorophyll-a averaged 5.4 µg/L. Secchi transparency could not be measured on two occasions because it exceeded basin's depth.

2012 Water Quality Results –West Bay



Comparison of the Bays

The East and West Bays of Coon Lake often have noticeably different water quality. In 2010, on every date water quality was better in the West Bay than East, with an average difference of 13 µg/L phosphorus and 5.4 µg/L chlorophyll-a (algae). In 2012, water quality in the two bays was more similar. Neither bay had consistently lower phosphorus and the average phosphorus reading differed by only 2 µg/L. Chlorophyll-a readings were more frequently lower in the West bay but the average reading only differed by 2.8 µg/L. A direct comparison of average Secchi transparency was not possible in 2010 or 2012 because transparency exceeded the lake depth on multiple occasions in the West Bay and a reading could not be obtained.

Trend Analysis

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

East Bay Trend Analysis

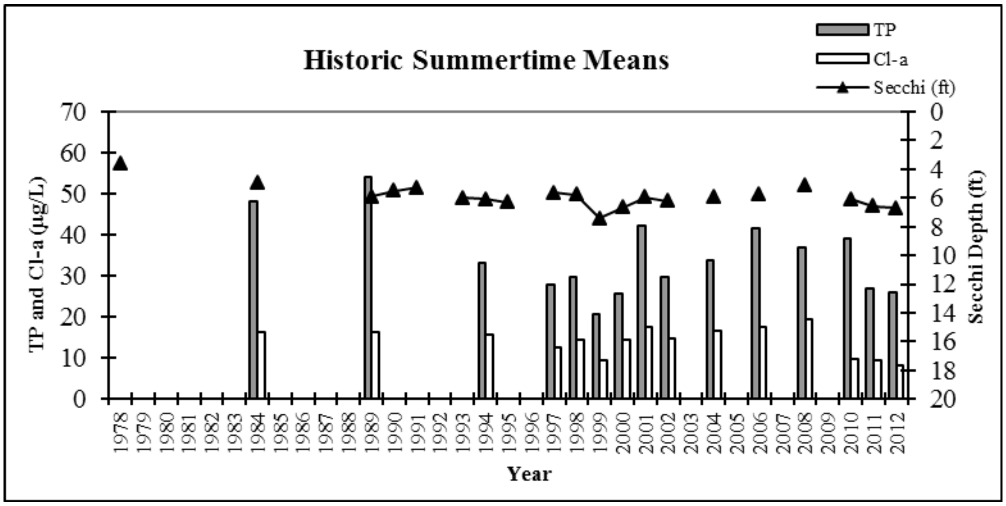
In the East Bay twenty years of water quality data have been collected since 1978. During the most recent 12 years that were monitored (since 1996), the data collected included total phosphorus, chlorophyll-a, and Secchi transparency. For most of the other eight years (all pre-1997) only Secchi transparency data is available. This provides an adequate dataset for a trend analysis, however given that most of the data is from the last 20 years, the analysis is not strong at detecting changes that occurred prior to 1990.

No water quality trend exists when we examined those years with total phosphorus, chlorophyll-a, and Secchi transparency, excluding the years with only Secchi transparency data. The analysis was a repeated measures MANOVA with response variables TP, Cl-a, and Secchi depth ($F_{2,12}$=1.7, p=0.22). This is our preferred approach because it examines all three parameters simultaneously.

We also examined Secchi transparencies alone across all 18 years using a one-way ANOVA. Including all years, a significant trend of improving transparency is found ($F_{1,18}$=11.74, p=0.003). This result appears highly influenced by the low transparency in 1978. If we exclude 1978 and re-run the analysis we find the trend is still present, but just outside the bounds of statistical significance (p=0.06, p values of 0.05 or less indicate statistical significance at the 95% confidence level). In summary, it appears that mild improvements in transparency have been occuring.

It is noteworthy that a water quality improvement seems to have occurred between 1989 and 1994 (see graph below). The reason for such a change, if real, is unknown. Because there are only two years of phosphorus and chlorophyll-a data before 1994 it is difficult to determine if water quality was chronically poorer prior to 1994 or if the available monitoring data is not representative of typical conditions.

Historic Water Quality - East Bay

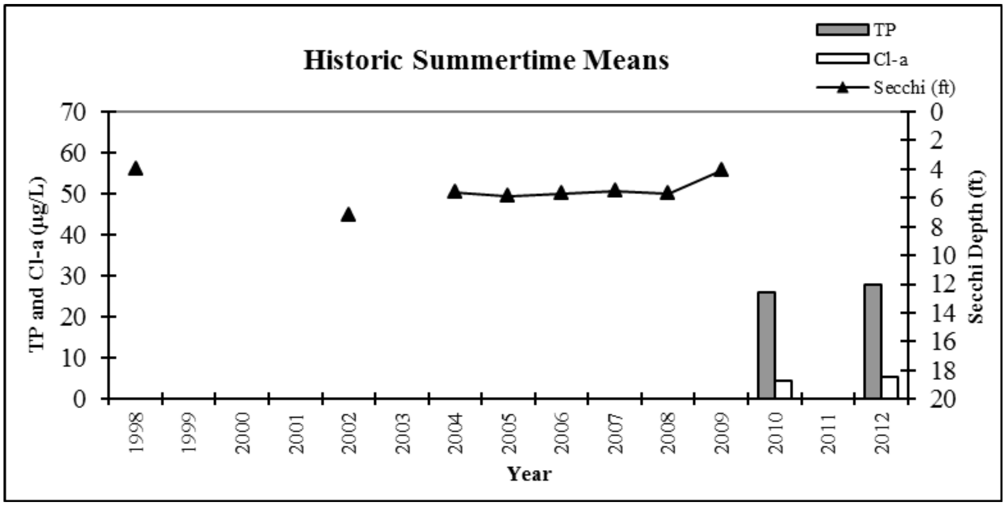


<u>West Bay Trend Analysis</u>

Ten years of data are available for the West Bay including only two years with phosphorus and chlorophyll-a data, so a powerful trend analysis is not possible. The dataset for Secchi transparency is longer, but data from 2010 and 2012 must be excluded because a full suite of Secchi measurements is not available due to clarity exceeding the lake depth occasionally. Therefore, a statistical analysis would not be highly meaningful. Instead, we'll use a non-analytical look at the data.

In 2012 the average secchi was 6.7 feet (excludes two measurements of >10feet). In 2010 the average secchi was 7.2 feet (excludes three measurements of >10feet). For eight monitored years in 1998-2009, seven of those years had average secchi of <6 feet. One year was 7.18 feet. It's notable that in the two most recent years the average secchi transparency was greater than in all but one of previous years. It suggests that if anything, transparency is mildly improving. We can speculate that the introduction of Eurasian watermilfoil to the lake may be resulting in increased clarity.

Historic Water Quality - West Bay



Discussion

While Coon Lake is not listed as “impaired” by the MN Pollution Control Agency, the East Bay is close to the state water quality standard of 40 µg/L of phosphorus or greater. In 2006 phosphorus averaged 42 µg/L, was 37 µg/L in 2008, and in 2010 was 39 µg/L. In 2012 phosphorus was lower (averaged 26 µg/L). Voluntary efforts to improve water quality are strongly encouraged to prevent the lake from becoming designated as “impaired.” Such a designation would trigger an in-depth study under the Federal Clean Water Act.

Given the highly-developed nature of the lakeshore, the practices of lakeshore homeowners are a reasonable place to begin water quality improvement efforts. Residents should increase the use of shoreline practices that improve water quality and lake health, such as native vegetation buffers and rain gardens. Clearing of native vegetation to create a “cleaner” lakefront should be avoided because this vegetation is important to lake health and water quality. Septic system maintenance and replacement where necessary, should be a priority on an individual home basis and on a community level. This might be most beneficial in the Hiawatha Beach, Interlachen, and Coon Lake Beach neighborhoods, where the greatest frequency of septic system failures is suspected.

A final challenge for Coon Lake is the aquatic invasive species Eurasian water milfoil (EWM) and Curly Leaf Pondweed (CLP). EWM was discovered in the lake in 2003 and has spread rapidly. In 2008 a Coon Lake Improvement District (CLID) was formed, with EWM management as a core of its function. EWM is actively monitored and treated with herbicide in accordance with DNR rules and a lake vegetation management plan, yet it continues to expand. CLP has been present longer. It can cause a spike in phosphorus levels in early summer. CLID started treatment of CLP in 2009. In 2010 the East Bay was accepted into a five year pilot program for treatment of CLP.

2012 Coon Lake East Bay Water Quality Data

Coon Lake East Bay

2012 Water Quality Data		Date	5/16/2012	5/30/2012	6/14/2012	6/26/2012	7/11/2012	7/24/2012	8/8/2012	8/23/2012	9/5/2012	9/19/2012			
		Time	9:50	9:40	11:20	10:15	9:35	10:05	10:20	9:45	9:50	9:40			
	Units	R.L.*	Results	Results	Results	Results	Results	Results	Results	Results	Results	Results	Average	Min	Max
pH		0.1	8.62	7.95	8.04	8.34	8.34	8.52	8.59	8.75	8.62	8.12	8.39	7.95	8.75
Conductivity	mS/cm	0.01	0.198	0.185	0.179	0.179	0.158	0.139	0.186	0.183	0.168	0.150	0.173	0.139	0.198
Turbidity	FNRU	1.0	2	4	4	5	5	3	6	8	9	4	5	2	9
D.O.	mg/L	0.01	9.66	9.14					8.22	10.11	8.95	8.31	9.07	8.22	10.11
D.O.	%	1.0	100%	93%					101%	118%	108%	87%	101%	87%	118%
Temp.	°C	0.10	18.7	19.3	20.9	23.9	28.1	27.6	25.8	23.0	24.7	17.8	23.0	17.8	28.1
Temp.	°F	0.10	65.7	66.7	69.6	75.0	82.6	81.7	78.4	73.4	76.5	64.0	73.4	64.0	82.6
Salinity	%	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cl-a	µg/L	1.0	2.7	6.2	4.4	5.9	4.0	6.6	14.4	13.9	12.1	12.0	8.2	2.7	14.4
T.P.	mg/L	0.005	0.024	0.028	0.027	0.025	0.019	0.020	0.029	0.026	0.035	0.030	0.026	0.019	0.035
T.P.	µg/L	5	24	28	27	25	19	20	29	26	35	30	26	19	35
Secchi	ft	0.1	14.2	6.1	5.2	6.2	7.7	7.3	5.1	5.6	4.6	5.4	6.7	4.6	14.2
Secchi	m	0.1	4.3	1.9	1.6	1.9	2.3	2.2	1.6	1.7	1.4	1.6	2.1	1.4	4.3
Physical			2	2.0	2.0	2.0	2.0	2.0	2.0	4.0	4.0	2.0	2.4	2.0	4.0
Recreational			2	2.0	2.0	2.0	2.0	2.0	2.0	3.0	3.0	2.0	2.2	2.0	3.0

*Reporting Limit

Coon Lake East Bay Historic Summertime Mean Values

Agency	unknown	unknown	unknown	unknown	unknown	unknown	unknown	unknown	unknown	ACD	ACD	ACD	ACD	ACD	ACD	ACD	ACD	ACD	ACD	ACD
Year	1978	1984	1989	1990	1991	1993	1994	1995	1997	1998	1999	2000	2001	2002	2004	2006	2008	2010	2011	2012
TP		48.0	54.0				33.0		28.0	29.8	20.6	25.8	42.3	29.6	33.7	41.7	36.8	39.0	27.0	26.0
Cl-a		16.2	16.4				15.8		12.6	14.4	9.4	14.6	17.6	14.8	16.6	17.6	19.5	9.8	9.6	8.2
Secchi (m)	1.11	1.50	1.80	1.68	1.62	1.83	1.86	1.93	1.72	1.76	2.26	2.04	1.82	1.90	1.81	1.80	1.55	1.90	2.00	2.10
Secchi (ft)	3.6	4.9	5.9	5.5	5.3	6.0	6.1	6.3	5.6	5.8	7.4	6.7	6.0	6.2	5.9	5.8	5.1	6.1	6.6	6.7

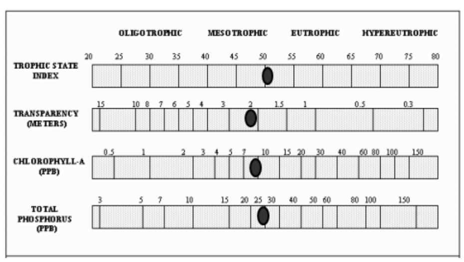
Carlsons trophic state indices

TSIP		60	62				55		52	53	48	51	58	53	55	58	56	57	52	51
TSIC		58	58				58		55	57	53	57	59	57	58	59	60	53	53	51
TSIS	58	54	52	53	53	51	51	51	52	52	48	50	51	51	51	52	54	51	50	49
TSI		57	57				54		53	54	50	53	56	54	55	56	57	54	51	51

Coon Lake Water Quality Report Card

Year	1978	1984	1989	1990	1991	1993	1994	1995	1997	1998	1999	2000	2001	2002	2004	2006	2008	2010	2011	2012
TP		C	C				C		B	B	A	B	C	B	C	C	C	C	B	B
Cl-a		B	B				B		B	B	A	B	B	B	B	B	B	A	A	A
Secchi	D	C	C	C	C	C	C	C	C	C	B	C	C	C	C	C	C	C	C	C+
Overall	**D**	**C**	**C**	**C**	**C**	**C**	**C**	**C**	**B**	**B**	**A**	**B**	**C**	**B**	**C**	**C**	**C**	**B-**	**B**	**B**

Carlson's Trophic State Index



2012 Coon Lake West Bay

Water Quality Data

Coon Lake West Bay

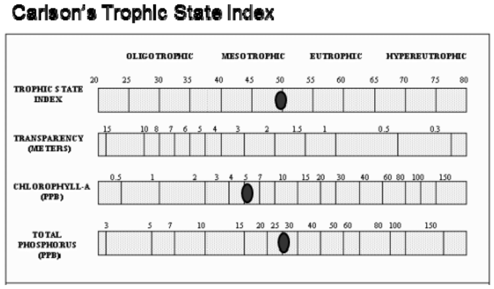
2012 Water Quality Data		Date	5/16/2012	5/30/2012	6/14/2012	6/29/2012	7/11/2012	7/24/2012	8/8/2012	8/22/2012	9/5/2012	9/19/2012			
		Time	9:30	9:20	10:45	9:35	10:00	10:30	10:40	10:05	10:15	9:20			
	Units	R.L.*	Results	Results	Results	Results	Results	Results	Results	Results	Results	Results	Average	Min	Max
pH		0.1	8.72	7.87	8.12	8.29	8.16	8.25	8.41	8.68	8.23	7.94	8.27	7.87	8.72
Conductivity	mS/cm	0.01	0.157	0.152	0.145	0.148	0.126	0.117	0.159	0.156	0.145	0.129	0.14	0.117	0.159
Turbidity	FNRU	1.0	2	2	2	3	4	3	7	7	7	2	3.90	2	7
D.O.	mg/L	0.01	9.53	8.88					8.66	9.72	7.37	8.28	8.74	7.37	9.72
D.O.	%	1.0	98%	89%					105%	112%	88%	83%	0.96	83%	112%
Temp.	°C	0.10	18.9		20.1	24.0	27.9	27.9	25.3	22.4	24.5	16.2	23.02	16.2	27.9
Temp.	°F	0.10	66.0	32.0	68.2	75.2	82.2	82.2	77.5	72.3	76.1	61.2	69.30	61.2	82.2
Salinity	%	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cl-a	µg/L	1.0	2.3	3.2	2.7	3.1	3.0	8.0	7.4	10.0	8.0	5.9	5.36	2.3	10.0
T.P.	mg/L	0.005	0.022	0.022	0.028	0.023	0.023	0.051	0.028	0.023	0.030	0.026	0.028	0.022	0.051
T.P.	µg/L	5	22	22	28	23	23	51	28	23	30	26	28	22	51
Secchi	ft	0.1	>10.6	>10.3	7.2	7.5	8.0	7.1	4.9	5.8	5.1	8.1	NA	4.9	>9.8
Secchi	m	0.1	>3.2	>3.1	2.2	2.3	2.4	2.2	1.5	1.8	1.6	2.5	NA	1.5	>3.0
Physical			2	2.0	2.0	2.0	3.0	2.0	2.0	4.0	4.0	2.0	2.5	2.0	4.0
Recreational			2	2.0	2.0	2.0	2.0	2.0	2.0	3.0	3.0	2.0	2.2	2.0	3.0

*Reporting Limit

Coon Lake West Bay Historic Summertime Mean Values

Agency	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	ACD	ACD
Year	1998	2002	2004	2005	2006	2007	2008	2009	2010	2012
TP									26.0	28.0
Cl-a									4.4	5.4
Secchi (m)	1.21	2.19	1.71	1.79	1.74	1.68	1.74	1.24		
Secchi (ft)	3.97	7.18	5.61	5.87	5.71	5.51	5.71	4.07		
Carlsons trophic state indices										
TSIP									51	52
TSIC									45	47
TSIS	57	49	52	52	52	53	52	57		
TSI									48	50
Coon Lake Water Quality Report Card										
Year	98	2002	2004	2005	2006	2007	2008	2009	2010	2012
TP									B	B
Cl-a									A	A
Secchi	C	C	C	C	C	C	C	C		
Overall									**A-**	**A-**

Carlson's Trophic State Index



Linwood Lake

Linwood Township, Lake ID # 02-0026

Background

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

Linwood Lake is on the Minnesota Pollution Control Agency's 303(d) list of impaired waters for excess nutrients.

2012 Results

In 2012 Linwood Lake had average or slightly below average water quality for this region of the state (NCHF Ecoregion), receiving an overall C grade. The lake is slightly eutrophic. In 2012 total phosphorus averaged 43 µg/L, chlorophyll-a averaged 18.2 µg/L, and Secchi transparency averaged 1.0 m. These measurements were average relative to the range observed in other years. ACD staff's subjective observations of the lake's physical characteristics were that there were large suspended algae in mid-May with a more significant algae bloom beginning in July and continuing through September. ACD staff subjectively ranked the lake as having some impairment of swimming in early May and again from mid-June through September.

Trend Analysis

Sixteen years of water quality data have been collected by the Metropolitan Council (1980, '81, '83, '89, '94, '97, 2008) and the ACD (1998-2001, 2003, '05, '07, '09, '12). Water quality has not significantly changed from 1980 to 2012 (repeated measures MANOVA with response variables TP, Cl-a, and Secchi depth; $F_{2,13}=0.78$, $p=0.20$).

Discussion

Linwood Lake is on the Minnesota Pollution Control Agency's (MPCA) list of impaired waters, but it is a borderline case. Linwood Lake was placed on the state impaired waters because summertime average total phosphorus is routinely over the water quality standard of 40 µg/L for deep lakes. The state has since added separate standards for shallow lakes. Linwood does not technically meet the definition of a shallow lake (maximum depth of <15 ft or >80% of the lake shallow enough to support aquatic plants) due to a deep spot. However it is very similar to other shallow lake systems and expectations for water quality should be more in line with shallow lake standards (total phosphorus <60 µg/L, chlorophyll-a <20 µg/L, and Secchi transparency >1m). In the last 10 years Linwood has been substantially lower than the shallow lake phosphorus standard, but it has occasionally exceeded the other two standards. Regardless, water quality improvement is needed.

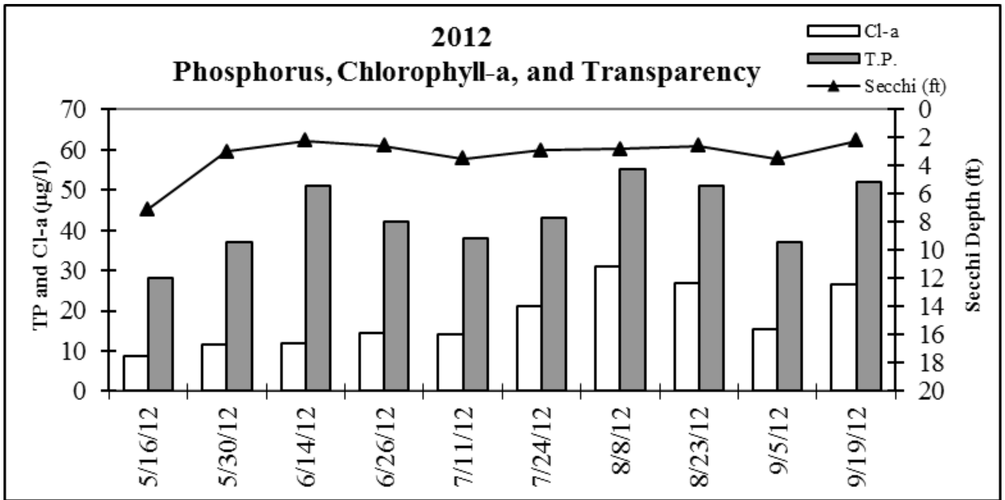
It is likely that major factors degrading water quality originate from the lake itself and/or its developed shoreline. The primary inlet to Linwood Lake comes from Boot Lake, a scientific and natural area, and it likely has good water quality (though has not been monitored). Threats to Linwood Lake likely include rough fish, failing shoreland septic systems, poor lakeshore lawn care practices, and natural sources such as nutrient-rich lake sediments. High powered boats may be impacting water quality by disturbing sediments because the lake is large enough for these boats to get up to full speed, but is mostly shallow.

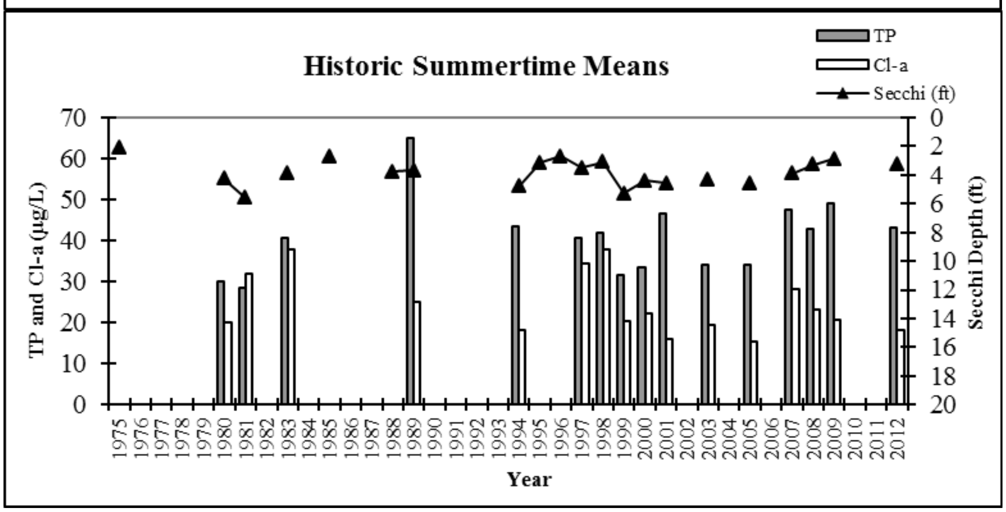
2012 Linwood Lake Water Quality Data

Linwood Lake 2012 Water Quality Data		Date	5/16/2012	5/30/2012	6/14/2012	6/26/2012	7/11/2012	7/24/2012	8/8/2012	8/23/2012	9/5/2012	9/19/2012			
		Time	10:35	10:15	11:45	10:50	10:45	11:20	11:40	10:55	10:50	10:20			
	Units	R.L.*	Results	Results	Results	Results	Results	Results	Results	Results	Results	Results	Average	Min	Max
pH		0.1	8.20	7.86	7.96	8.68	8.85	8.84	8.50	8.85	8.73	7.96	8.44	7.86	8.85
Conductivity	mS/cm	0.01	0.265	0.242	0.233	0.228	0.196	0.172	0.236	0.228	0.209	0.191	0.220	0.172	0.265
Turbidity	FNRU	1	4	12	16	15	12	17	17	17	11	11	13	4	17
D.O.	mg/L	0.01	9.84	8.49					8.64	11.01	8.46	7.31	8.96	7.31	11.01
D.O.	%	1	103%	86%					106%	127%	101%	76%	100%	76%	127%
Temp.	°C	0.1	18.3	18.8	20.2	24.2	28.1	27.3	25.6	22.5	24.4	17.5	22.7	17.5	28.1
Temp.	°F	0.1	64.9	65.8	68.4	75.6	82.6	81.1	78.1	72.5	75.9	63.5	72.8	63.5	82.6
Salinity	%	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
Cl-a	µg/L	1	8.6	11.6	11.8	14.5	14.1	21.1	31.0	27.0	15.5	26.4	18.2	8.6	31.0
T.P.	mg/L	0.005	0.028	0.037	0.051	0.042	0.038	0.043	0.055	0.051	0.037	0.052	0.043	0.028	0.055
T.P.	µg/L	5	28	37	51	42	38	43	55	51	37	52	43	28	55
Secchi	ft	0.10	7.10	3.00	2.20	2.60	3.50	2.90	2.80	2.60	3.50	2.20	3.24	2.20	7.10
Secchi	m	0.1	2.2	0.9	0.7	0.8	1.1	0.9	0.9	0.8	1.1	0.7	1.0	0.7	2.2
Physical			4.0	2.0	3.0	3.0	4.0	3.0	3.0	4.0	4.0	4.0	3.4	2.0	4.0
Recreational			4.0	2.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	2.0	4.0

*reporting limit

Linwood Lake Water Quality Results





Linwood Lake Summertime Historic Mean

	CAMP	MC	MC	MC	CAMP	CAMP	MC	MC	CAMP	CAMP	MC	ACD	ACD	ACD	ACD	ACD	ACD	ACD	CAMP	ACD	ACD
	1975	1980	1981	1983	1985	1988	1989	1994	1995	1996	1997	1998	1999	2000	2001	2003	2005	2007	2008	2009	2012
TP (ug/L)		30.0	28.5	40.7			64.8	43.3			40.6	45.7	48.6	44.4	46.6	34.2	34.0	47.4	42.8	49.0	43.0
Cl-a (ug/L)		20.0	32.0	37.9			25.1	18.3			34.4	40.0	31.7	31.2	16.1	19.4	15.3	28.3	23.1	20.7	18.2
Secchi (m)	0.64	1.30	1.70	1.20	0.82	1.17	1.12	1.45	0.96	0.82	1.06	0.94	1.10	1.34	1.4	1.31	1.4	1.19	1.01	0.88	1
Secchi (ft)	2.1	4.3	5.6	3.9	2.7	3.8	3.7	4.8	3.2	2.7	3.5	3.1	3.6	4.4	4.6	4.3	4.6	3.9	3.3	2.9	3.2

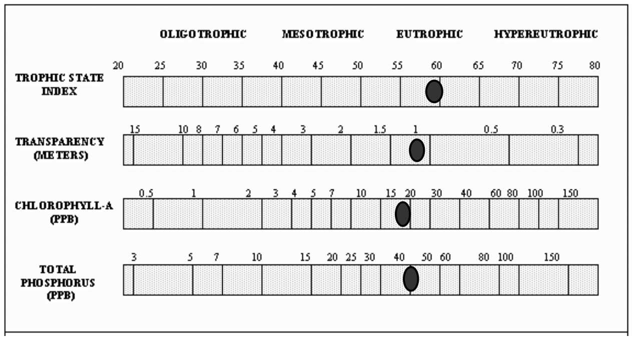
Carlson's Tropic State Indices

TSIP		53	52	58			64	58			58	59	54	54	59	55	55	60	58	60	58
TSIC		60	65	66			62	59			65	67	60	61	57	60	57	63	62	60	59
TSIS	66	56	52	57	63	58	58	55	61	63	59	61	53	55	56	56	55	57	60	62	60
TSI		57	57	60			62	57			61	62	56	57	57	57	56	60	60	61	59

Linwood Lake Water Quality Report Card

Year	1975	1980	1981	1983	1985	1988	1989	1994	1995	1996	1997	1998	1999	2000	2001	2003	2005	2007	2008	2009	2012
TP		B	B	C			C	C			C	C	C	C	C	C	C	C	C	C	C
Cl-a		B	B	C			C	B			C	C	C	C	B	B	B	C	C	C+	B
Secchi	F	C	C	C	D	D	D	C	D	D	D	D	D	C	C	C	C	D	D	D	D
Overall		**B**	**B**	**C**			**C**	**C**			**C**	**C**	**C**	**C**	**C**	**C**	**C**	**C**	**C**	**C**	**C**

Carlson's Trophic State Index



Typo Lake

Linwood Township, Lake ID # 03-0009

Background

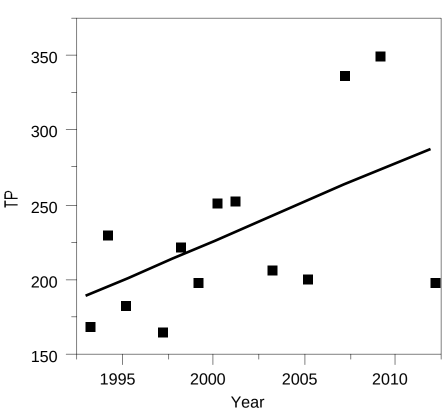
Typo Lake is located in the northeast portion of Anoka County and the southeast portion of Isanti County. It has a surface area of 290 acres and maximum depth of 6 feet (1.82 m), though most of the lake is about 3 feet deep. The lake has a mucky, loose, and unconsolidated bottom in some areas, while other areas have a sandy bottom. Public access is at the south end of the lake along Fawn Lake Drive. The lake is used very 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.

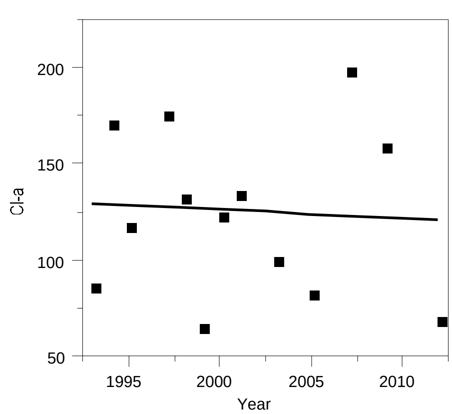
2012 Results

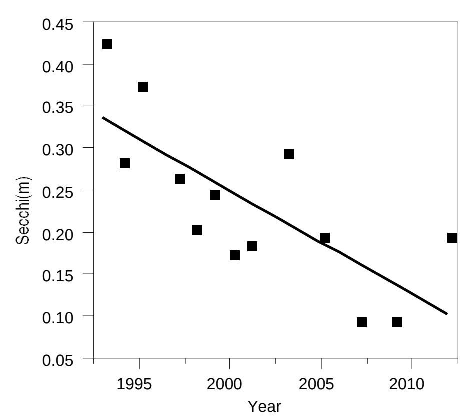
In 2012 Typo Lake had extremely poor water quality compared to other lakes in this region (NCHF Ecoregion), receiving an overall F letter grade. This is the same letter grade as the previous twelve years monitored, but 2007 and 2009 were the worst of all. In those two years total phosphorus averaged 340 and 353 µg/L, respectively. Total phosphorus in 2012 averaged 201 µg/L. Algae levels were also lower in 2012 (71 µg/L) than in 2009 (116 µg/L) or 2007 (201 µg/L). In both 2007 and 2009 a bright white Secchi disk could be seen only 5-6 inches below the surface, on average. There was a slight improvement in 2012 to 9-10 inches. The reason for the especially poor conditions in 2007 and 2009 seems to be drought-induced low water levels. This theory is supported by September 2012 monitoring results that occurred after several months without a significant rain event. Phoshorus increased substantially at that time. During drought it seems that internal loading (wind, rough fish, etc) builds nutrients and algae to very high levels because there is little flushing by storm water. Phosphorus and algae levels dropped substantially in the late summer of both 2007 and 2009 when ample rains fell.

Trend Analysis

Thirteen 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). Water quality has significantly deteriorated from 1993 to 2012 (one-way ANOVAs on the individual response variables TP, Cl-a, and Secchi depth, $F_{2,10}=4.53$, $p=0.04$). Total phosphorus has significantly increased over time, chlorophyll-a has stayed relatively the same, while Secchi transparency has declined (see figures below). The trend toward poorer phosphorus and transparency continue to be strong despite the fact that in 2012 these parameters were slightly better than the previous two years monitored.







Discussion

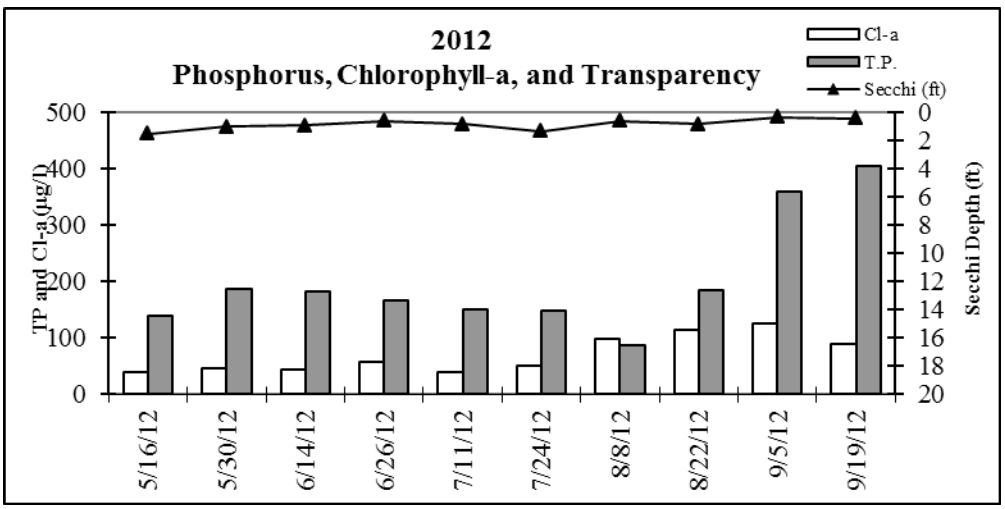
Typo Lake, along with Martin Lake downstream, were the subject of TMDL study by the Anoka Conservation District which was approved by the State and EPA in 2012. This study documented the source of nutrients to the lake, the degree to which each is impacting the lake, and put forward lake rehabilitation strategies. Some factors impacting water quality on Typo Lake include rough fish, high phosphorus inputs from a ditched wetland west of the lake, and lake sediments.

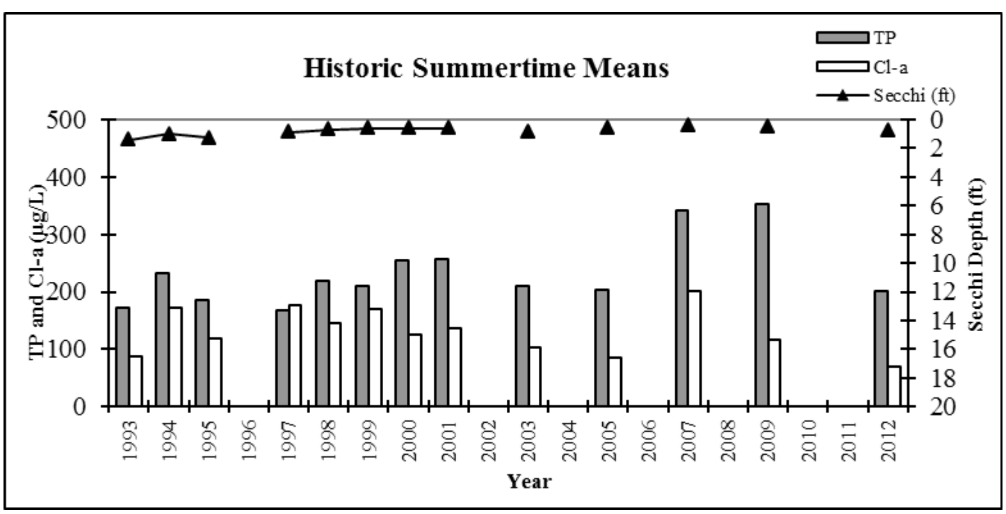
Typo Lake Water Quality Results

Typo Lake

2012 Water Quality Data		Date	16-May-12	30-May-12	14-Jun-12	6/26/2012	7/11/2012	7/24/2012	8/8/2012	8/22/2012	9/5/2012	9/19/2012			
		Time	11:40	11:20	12:45	12:00	11:45	12:25	12:50	12:10	11:45	11:30			
	Units	R.L.*	Results	Results	Results	Results	Results	Results	Results	Results	Results	Results	Average	Min	Max
pH		0.1	9.17	8.12	8.90	9.35	9.14	9.29	9.40	9.60	9.17	9.24	9.14	8.12	9.60
Conductivity	mS/cm	0.01	0.231	0.178	0.203	0.212	0.186	0.167	0.202	0.195	0.204	0.191	0.197	0.167	0.231
Turbidity	FNRU	1	47.00	40.00	75.00	120.00	88	67	125.00	164.00	224.00	104.00	105	40	224
D.O.	mg/L	0.01	10.20	10.03					13.28	14.24	8.90	11.73	11.40	8.90	14.24
D.O.	%	1	106%	101%					168%	166%	107%	117%	128%	101%	168%
Temp.	°C	0.1	20.1	18.6	18.8	23.9	28.0	27.9	25.4	22.8	24.8	15.4	22.6	15.4	28.0
Temp.	°F	0.1	68.2	65.5	65.8	75.0	82.4	82.2	77.7	73.0	76.6	59.7	72.6	59.7	82.4
Salinity	%	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cl-a	µg/L	1.0	39.3	46.0	44.9	58.1	40.4	51	99	115	125	89	70.7	39.3	125.0
T.P.	mg/L	0.005	0.140	0.187	0.182	0.167	0.151	0.149	0.087	0.185	0.360	0.406	0.201	0.087	0.406
T.P.	µg/L	5	140	187	182	167	151	149	87	185	360	406	201	87	406
Secchi	ft	0.1	1.5	1.0	0.9	0.6	0.8	1.3	0.6	0.8	0.3	0.4	0.8	0.3	1.5
Secchi	m	0.1	0.5	0.3	0.3	0.2	0.2	0.4	0.2	0.2	0.1	0.1	0.2	0.1	0.5
Physical			5.00	4.00	5.00	5.00	4.0	4.0	4.00	5.00	5.00	5.00	4.6	4.0	5.0
Recreational			5.00	3.00	4.00	4.00	4.0	4.0	5.00	4.00	4.00	4.00	4.1	3.0	5.0

*reporting limit





Lake Typo Summertime Historic Mean

Agency	CLMP	CLMP	MPCA	MPCA	MPCA	ACD	ACD	ACD	ACD	ACD	ACD	ACD	ACD	ACD	ACD
Year	1974	1975	1993	1994	1995	1997	1998	1999	2000	2001	2003	2005	2007	2009	2012
TP (ug/L)			172.0	233.0	185.6	168.0	225.7	202.1	254.9	256.0	209.8	204	340.5	353.0	201.0
Cl-a (ug/L)			88.1	172.8	119.6	177.8	134.7	67.5	125.3	136.0	102.5	84.7	200.9	116.2	70.7
Secchi (m)	0.23	0.27	0.43	0.29	0.38	0.27	0.21	0.25	0.18	0.19	0.3	0.2	0.1	0.1	0.2
Secchi (ft)	0.2	0.3	1.4	1.0	1.3	0.9	0.7	0.8	0.6	0.6	0.9	0.6	0.4	0.5	0.8

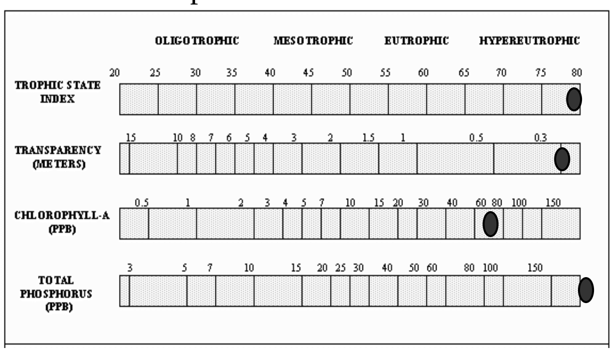
Carlson's Tropic State Indices

TSIP			78	83	79	78	82	81	83	82	81	81	88	89	81
TSIC			75	81	78	82	79	72	74	77	76	74	83	77	72
TSIS	81	79	72	78	74	79	82	80	86	85	77	83	93	93	83
TSI			75	81	77	79	81	78	81	81	78	79	88	86	79

Lake Typo Water Quality Report Card

Year	74	75	93	94	95	97	98	99	2000	2001	2003	2005	2007	2009	2012
TP			F	F	F	F	F	F	F	F	F	F	F	F	F
Cl-a			F	F	F	F	F	D	F	F	F	F	F	F	D
Secchi	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F
Overall			**F**	**F**	**F**	**F**	**F**	**F**	**F**	**F**	**F**	**F**	**F**	**F**	**F**

Carlson's Trophic State Index



Fawn Lake

Linwood Township Lake ID # 02-0035

Background

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

Fawn is one of the clearest lakes in the county. Groundwater likely feeds this lake to a large extent. Vegetation in the lake is healthy, but not so prolific to be a nuisance, and contributes to high water quality. In 2008 and 2010 an invasive plant species, curly-leaf pondweed, was noticed in a few locations, although it may have been present for some time. It does not appear occur in high densities.

2012 Results

Fawn Lake is classified as mesotrophic and has some of the clearest water in Anoka County. In 2012, Fawn Lake continued its trend of excellent water quality for this region of the state (NCHF Ecoregion) by receiving an overall A grade. Water clarity was high while total phosphorus and chlorophyll *a* were low throughout the 2012 sampling season. Water clarity was 18.5 feet in spring, and averaged 12.6 feet from May through September. The subjective observations of the lake's physical characteristics and recreational suitability by the ACD staff indicated that lake conditions were excellent for swimming and boating throughout the summer.

Trend Analysis

Twelve years of water quality data have been collected by the Minnesota Pollution Control Agency (1988) and the Anoka Conservation District (between 1997 and 2010). If we examine all years, there is a nearly statistically significant trend of improving water quality (repeated measures MANOVA with response variables TP, Cl-a, and Secchi depth, $F_{2,9} = 0.55$, $p = 0.07$). However, this is driven nearly entirely by poor water quality in the earliest year monitored (1988). If 1988 is excluded, water quality has been consistent among years monitored.

Discussion

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

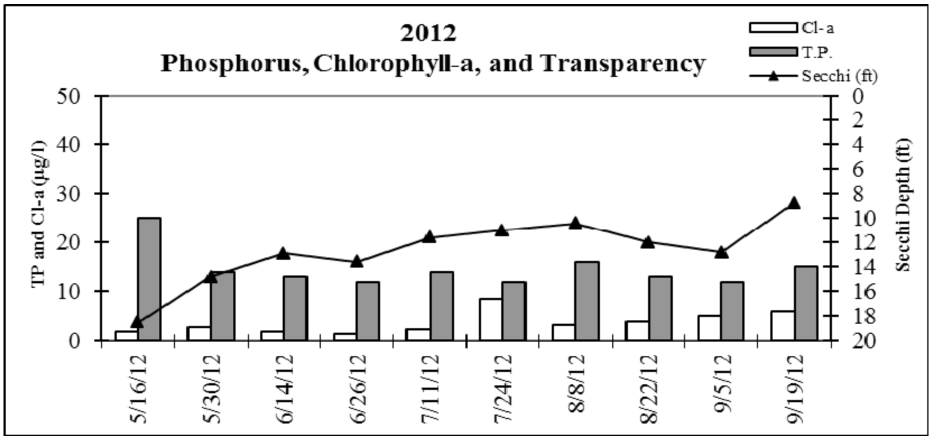
2012 Fawn Lake Water Quality Data

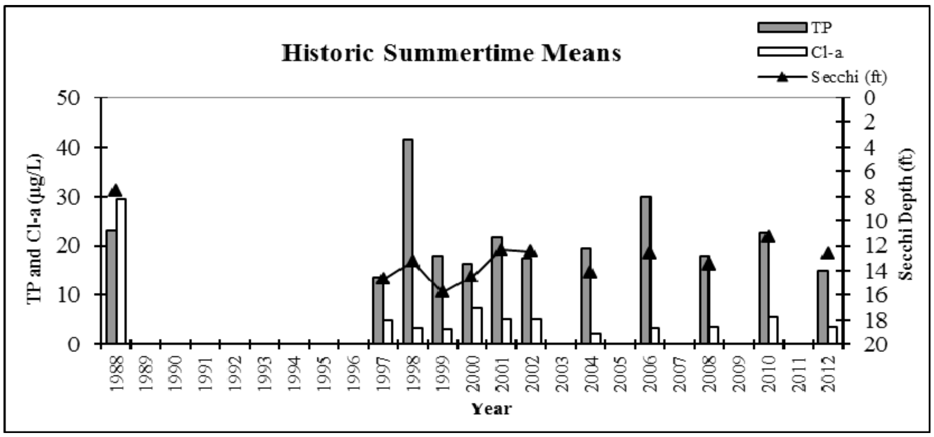
Fawn Lake
2012 Water Quality Data

		Date	5/16/2012	5/30/2012	6/14/2012	6/26/2012	7/11/2012	7/24/2012	8/8/2012	8/22/2012	9/5/2012	9/19/2012			
		Time	12:10	11:45	13:15	12:45	12:20	12:45	13:20	12:35	12:10	12:00			
	Units	R.L.*	Results	Results	Results	Results	Results	Results	Results	Results	Results	Results	Average	Min	Max
pH		0.1	8.83	8.28	8.40	8.79	8.59	8.69	8.71	8.86	8.98	8.20	8.63	8.20	8.98
Conductivity	mS/cm	0.01	0.210	0.192	0.184	0.179	0.154	0.137	0.184	0.180	0.162	0.150	0.173	0.137	0.210
Turbidity	FNRU	1.0	2	1	1	2	2	1	1	2	1	1	1	1	2
D.O.	mg/L	0.01	10.22	9.19					8.88	10.40	9.54	6.84	9.18	6.84	10.40
D.O.	%	1.0	109	95					110	122	116%	73%	73	1	122
Temp.	°C	0.10	19.9	19.4	21.2	24.7	29.0	28.3	26.3	23.4	25.1	18.6	23.6	18.6	29.0
Temp.	°F	0.10	67.8	66.9	70.2	76.5	84.2	82.9	79.3	74.1	77.2	65.5	74.5	65.5	84.2
Salinity	%	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cl-a	µg/L	1.0	1.8	2.8	1.8	1.4	2.3	8.4	3.2	3.9	5.0	6.0	3.7	1.4	8.4
T.P.	mg/L	0.005	0.025	0.014	0.013	0.012	0.014	0.012	0.016	0.013	0.012	0.015	0.015	0.012	0.025
T.P.	µg/L	5	25	14	13	12	14	12	16	13	12	15	15	12	25
Secchi	ft	0.1	18.5	14.8	12.9	13.6	11.6	11.0	10.4	12.0	12.8	8.7	12.6	8.7	18.5
Secchi	m	0.1	5.6	4.5	3.9	4.1	3.5	3.4	3.2	3.7	3.9	2.7	3.8	2.7	5.6
Physical			1.0	1.0	1.0	2.0	2.0	2.0	1.0	2.0	2.0	1.0	1.5	1.0	2.0
Recreational			1.0	1.0	2.0	2.0	2.0	1.0	1.0	2.0	2.0	1.0	1.5	1.0	2.0

*Reporting Limit

Fawn Lake Water Quality Results





Fawn Lake Historic Summertime Mean Values

Agency	MPCA	ACD	ACD	ACD	ACD	ACD	ACD	ACD	ACD	ACD	ACD	ACD
Year	1988	1997	1998	1999	2000	2001	2002	2004	2006	2008	2010	2012
TP (µg/L)	23.0	13.6	41.6	18.0	16.3	21.7	17.4	19.4	30.0	18.0	22.6	15.0
Cl-a (µg/L)	29.4	5.0	3.4	3.1	7.5	5.2	5.1	2.4	3.5	3.7	5.6	3.7
Secchi (m)	2.3	4.5	4.1	4.8	4.4	3.8	3.8	4.3	3.8	4.1	3.5	3.8
Secchi (ft)	7.5	14.7	13.3	15.7	14.5	12.3	12.5	14.1	12.6	13.5	11.3	12.6

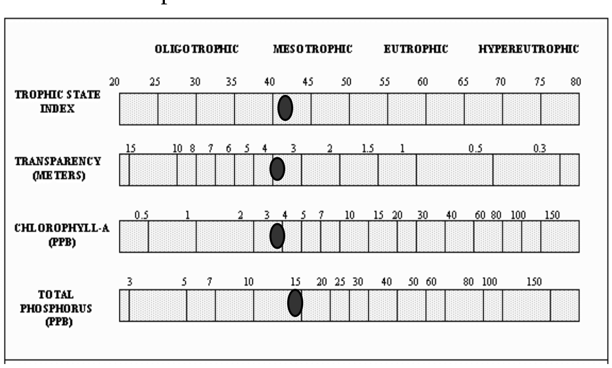
Carlson's Trophic State Indices

Year	1988	1997	1998	1999	2000	2001	2002	2004	2006	2008	2010	2012
TSIP	49	42	58	46	44	49	45	47	53	46	49	43
TSIC	64	46	43	42	50	47	47	39	43	44	47	43
TSIS	48	38	40	37	39	41	41	39	41	40	42	41
TSI	54	42	47	42	44	45	44	42	46	43	46	42

Fawn Lake Water Quality Report Card

Year	1988	1997	1998	1999	2000	2001	2002	2004	2006	2008	2010	2012
TP (µg/L)	B	A	C	A	A	A	A	A	B	A	A	A
Cl-a (µg/L)	C	A	A	A	A	A	A	A	A	A	A	A
Secchi (m)	A	A	A	A	A	A	A	A	A	A	A	A
Overall	**B**	**A**	**B**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**

Carlson's Trophic State Index



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. Public access is available 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 5402 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.

2012 Results

In 2012 Martin Lake had poor water quality compared to other lakes in the North Central Hardwood Forest Ecoregion (NCHF), receiving a D letter grade. This eutrophic lake has chronically high total phosphorus and chlorophyll-a. In 2012 total phosphorus averaged 85.0 µg/L, slightly below the lake's historical average but still well above the impairement threshold of 60 µg/L. Chlorophyll-a was also slightly below the lake's long term average in 2012. Average Secchi transparency was only 2.0 feet in 2012 and poorer than the historical average. ACD staff's subjective perceptions of the lake were that "high" algae made the lake unsuitable for swimming during the entire monitored period from May through September.

Trend Analysis

Twelve years of water quality data have been collected by the Minnesota Pollution Control Agency (1983), Metropolitan Council (1998, 2008), and ACD (1997, 1999-2001, 2003, 2005, 2007, 2009, 2012). Citizens monitored Secchi transparency 17 other years. Anecdotal notes from DNR fisheries data indicate poor water quality back to at least 1954. A water quality change from 1983 to 2009 is detectable with statistical tests (repeated measures MANOVA with response variables TP, Cl-a, and Secchi depth; $F_{2,9}=5.45$, $p=0.03$). However, further examination of the data reveals that no water quality parameter alone has changed significantly, and the direction of their changes is mixed. If the oldest year of data (1983) is excluded, there is no longer a statistically significant trend. Because the statistical trend is dependent upon on year's data and the direction of change is mixed among the parameters, the statistical trend can be largely discounted. No true trend likely exists.

Discussion

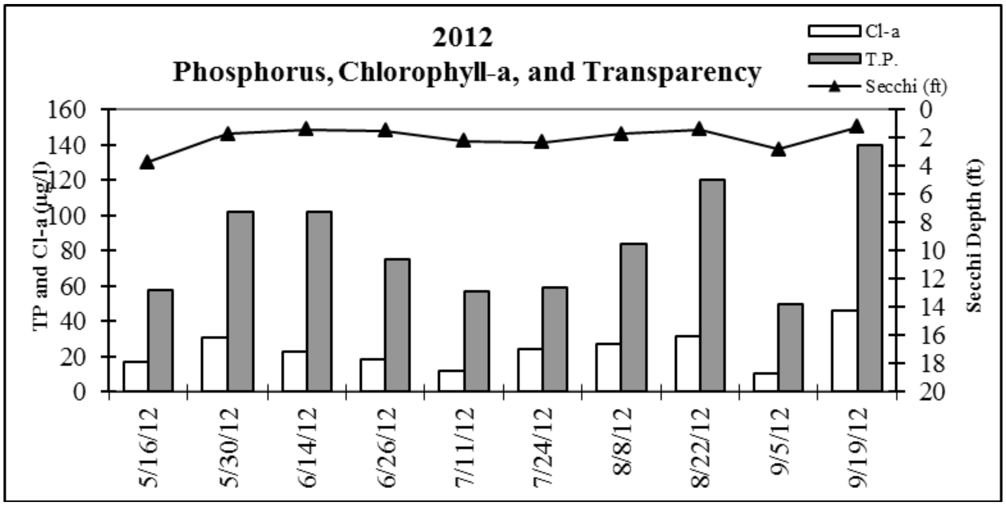
Martin Lake, along with Typo Lake upstream, were the subject of an TMDL study by the Anoka Conservation District that was approved by the State and EPA in 2012. This study documented the source of nutrients to the lake, the degree to which each is impacting the lake, and put forward lake rehabilitation 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.

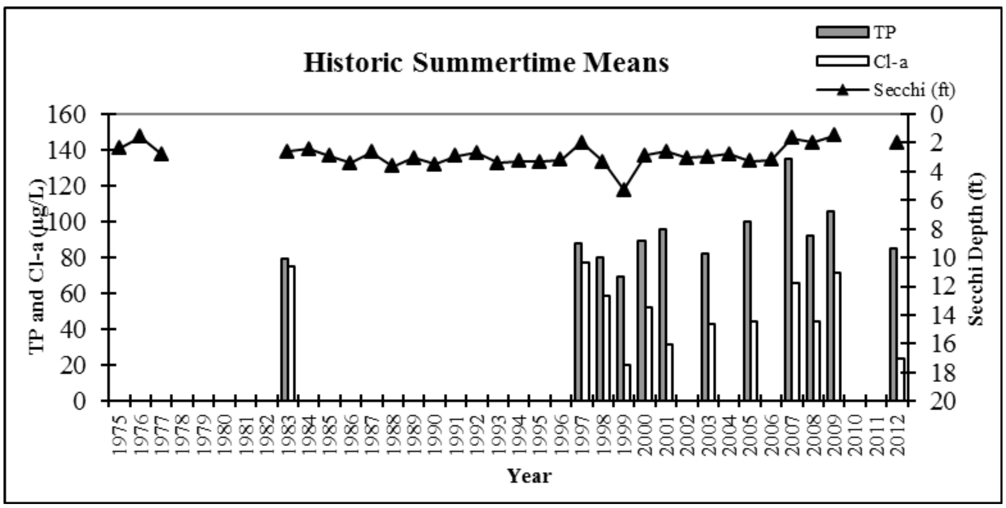
2012 Martin Lake Water Quality Data

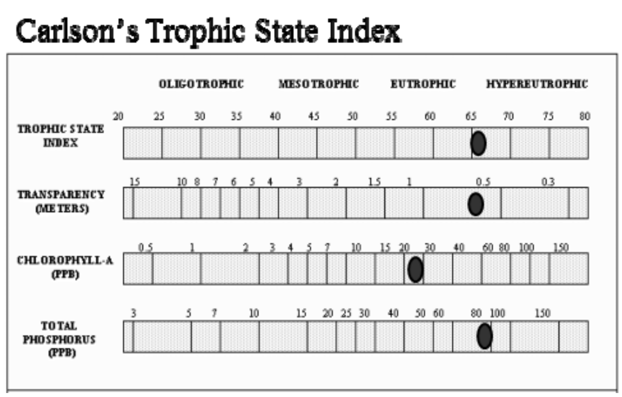
Martin Lake 2012 Water Quality Data	Units	Date Time R.L.*	5/16/2012 11:00 Results	5/30/2012 10:40 Results	6/14/2012 12:15 Results	6/26/2012 11:30 Results	7/11/2012 11:20 Results	7/24/2012 11:55 Results	8/8/2012 12:10 Results	8/22/2012 11:40 Results	9/5/2012 11:15 Results	9/19/2012 11:00 Results	Average	Min	Max
pH		0.1	8.66	8.14	8.09	9.17	8.99	8.61	8.38	8.45	9.08	8.33	8.59	8.09	9.17
Conductivity	mS/cm	0.01	0.274	0.228	0.227	0.225	0.210	0.197	0.276	0.272	0.218	0.206	0.233	0.197	0.276
Turbidity	FNRU	1	12.00	21.00	28.00	32.00	18.00	18.00	23.00	44.00	19.00	24.00	24	12	44
D.O.	mg/L	0.01	11.77	9.70					8.87	12.01	9.66	9.44	10.24	8.87	12.01
D.O.	%	1	124%	99%					109%	137%	116%	100%	114%	99%	137%
Temp.	°C	0.1	18.5	18.9	20.4	23.9	27.8	27.3	25.8	22.1	24.6	17.6	22.7	17.6	27.8
Temp.	°F	0.1	65.3	66.0	68.7	75.0	82.0	81.1	78.4	71.8	76.3	63.7	72.8	63.7	82.0
Salinity	%	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.01
Cl-a	µg/L	1	17.2	30.6	23.0	18.6	11.7	24.6	27.1	31.8	10.3	46.1	24.1	10.3	46.1
T.P.	mg/L	0.005	0.058	0.102	0.102	0.075	0.057	0.059	0.084	0.120	0.050	0.140	0.085	0.050	0.140
T.P.	µg/L	5	58	102	102	75	57	59	84	120	50	140	85	50	140
Secchi	ft	0.1	3.7	1.7	1.4	1.5	2.2	2.3	1.7	1.4	2.8	1.2	2.0	1.2	3.7
Secchi	m	0.1	1.1	0.5	0.4	0.5	0.7	0.7	0.5	0.4	0.9	0.4	0.6	0.4	1.1
Physical			4.00	4.00	4.00	4.00	4.00	4.00	4.00	5.00	5.00	4.00	4.2	4.0	5.0
Recreational			4.00	3.00	4.00	3.00	3.00	3.00	4.00	4.00	4.00	4.00	3.6	3.0	4.0

*reporting limit

Martin Lake Water Quality Results







Martin Lake Summertime Historic Means

Agency	CLMP	CLMP	CLMP	MPCA	CLMP	CLMP	CLMP	CLMP	CLMP	CLMP	CLMP	CLMP	CLMP	CLMP	CLMP	CLMP
Year	1975	1976	1977	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
TP (ug/L)				79.6												
Cl-a (ug/L)				75.4												
Secchi (m)	0.73	0.49	0.85	0.78	0.75	0.90	1.05	0.81	1.11	0.93	1.07	0.89	0.82	1.05	1.00	1.02
Secchi (ft)	2.4	1.6	2.8	2.6	2.5	3.0	3.4	2.7	3.6	3.1	3.5	2.9	2.7	3.4	3.3	3.4

Carlson's Tropic State Indices

TSIP				67												
TSIC				73												
TSIS	65	70	62	64	64	62	59	63	58	61	59	62	63	59	60	60
TSI				68												

Martin Lake Water Quality Report Card

Year	1975	1976	1977	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
TP				D												
Cl-a				D												
Secchi	D	F	D	D	D	D	D	D	D	D	D	D	D	D	D	D
Overall				**D**												

Martin Lake Summertime Historic Means

Agency	CLMP	ACD	MC	ACD	ACD	ACD	CLMP	ACD	CLMP	ACD	ACD	ACD	CAMP	CAMP	ACD
Year	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2012
TP (ug/L)		88.0	80.0	61.7	89.4	95.4		81.9		100		135.0	92.0	106.0	85.0
Cl-a (ug/L)		77.0	58.8	18.0	52.5	31.4		43.3		44.3		65.8	44.1	71.4	24.1
Secchi (m)	0.98	0.61	0.97	1.80	0.88	0.78	0.93	0.90	0.85	1.00	0.97	0.5	0.6	0.4	0.6
Secchi (ft)	3.22	2.0	3.3	5.3	2.9	2.6	3.1	3.0	2.8	3.3	3.2	1.7	2	1.5	2

Carlson's Tropic State Indices

TSIP		69	67	64	68	69		68		71		75	69	71	68
TSIC		73	71	59	67	63		68		68		72	68	73	62
TSIS	60	67	60	52	63	65	65	62	62	60	60	70	67	73	67
TSI		70	66	58	66	66		66		66		72	68	72	66

Martin Lake Water Quality Report Card

Year	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2012
TP		D	D	C	D	D		D		D		D	D	D	D
Cl-a		D	D	B	C	C		C		C		D	C	D	C
Secchi	D	F	D	C	D	D	D	D	D	D	D	F	F	F	F
Overall		**D**	**D**	**C**	**D**	**D**		**D**		**D**		**D**	**D**	**D**	**D**

Stream Water Quality

Description: Stream water quality is monitored with grab samples on eight occasions throughout the open water season including immediately following four storms and four times during baseflow. The selected are the farthest downstream limits of the Sunrise River Watershed Management Organization's jurisdictional area. Parameters monitored include water level, pH, conductivity, turbidity, transparency, dissolved oxygen, salinity, phosphorus, total suspended solids, chlorides, hardness, and sulfates. This data can be paired with stream hydrology monitoring to do pollutant loading calculations.

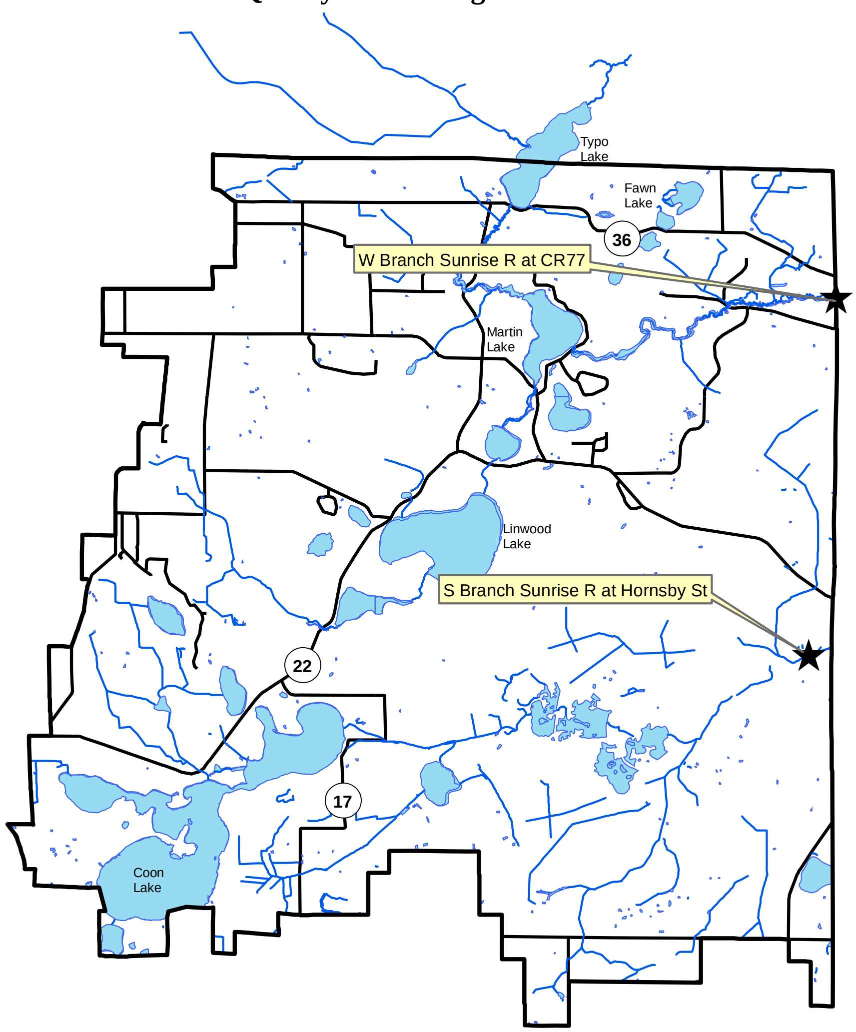
Purpose: To detect water quality trends and problems, and diagnose the source of problems.

Locations: West Branch of Sunrise River at CR 77

South Branch of Sunrise River at Hornsby St

Results: Results are presented on the following pages.

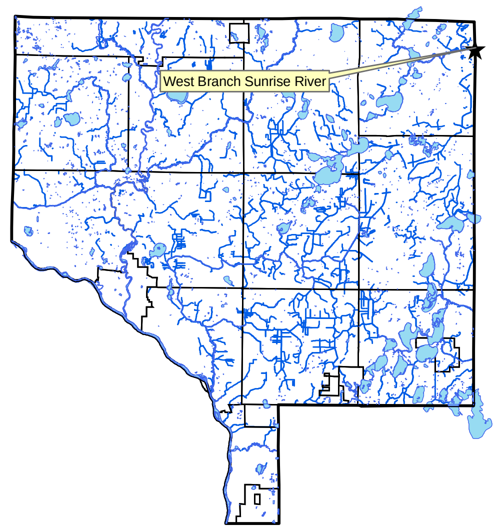
Sunrise Watershed Stream Water Quality Monitoring Sites



WEST BRANCH SUNRISE RIVER

at Co Road 77, Linwood Township

STORET SiteID = S001-424



Years Monitored

2001, 2003, 2006, 2012

Background

This monitoring site is the bottom of this watershed in Anoka County, at the Chisago County border. Upstream, this river drains through Boot, Linwood, Island, Martin, and Typo Lakes. The Sunrise River Watershed Management Organization monitors this site because it is at the bottom of their jurisdictional area. Flows in the West Branch of the Sunrise River are often around 70 cfs, but range from 15 cfs to near 200 cfs.

This segment of the river is listed by the MN Pollution Control Agency as impaired for turbidity and for poor fish and invertebrate communities. A TMDL study is underway and should be completed in 2013 or 2014.

Methods

In 2001, 2003, 2006, and 2012 the West Branch of the Sunrise River ws monitored at County Road 77 (Lyons St). This location is the boundary between Anoka and Chisago Counties. It is also the farthest downstream point within the Sunirse River Watershed Management Organization's jurisdiction.

The river was monitored by grab samples. Eight water quality samples were taken each year; half during baseflow and half following storms. Storms were generally defined as one-inch or more of rainfall in 24 hours or a significant snowmelt event combined with rainfall. Parameters tested with portable meters included pH, conductivity, turbidity, temperature, salinity, and dissolved oxygen. Parameters tested by water samples sent to a state-certified lab included total phosphorus, total suspended solids, and chlorides. In 2012 lab tests for hardness and sulfates were added. Water level is monitored continuously in the open water season and a rating curve has been developed to calculate flows from those water level records.

Results and Discussion

Summary

Summarized water quality monitoring findings and management implications include:

- Dissolved pollutants, as measured by conductivity and chlorides, are at low and healthy levels.

  Management discussion: Road deicing salts are a concern region-wide. They are measurable in area streams year-round, including in the Sunrise River. While they may be low here, excessive use should be avoided.

- Phosphorus was on the high end of acceptable levels. When state water quality standards are developed for phosphorus in streams, the West Branch of the Sunrise River may exceed it.

  Management discussion: Management in upstream lakes will help reduce phosphorus in the river.

- Suspended solids and turbidity were high, and in exceedance of state water quality standards. The largest source is likely algae from upstream lakes.

  Management discussion: Management in upstream lakes will help reduce phosphorus in the river.

- pH was within the range considered normal and healthy for streams in this area.

- Dissolved oxygen (DO) was typically within the range considered normal and healthy, but other data collected by MPCA shows problems. We found two occassions of low dissolved oxygen, but these measurements were taken in the afternoon when oxygen would be expected to be highest. The MPCA has taken around-the-clock DO measurements for eight days in 2012 and found it dipped below 5 mg/L every morning.

  Management discussion: Low dissolved oxygen is likely impacting aquatic life. The Sunrise River TMDL project should provide insights into the cause and corrective actions.

This reach of the West Branch of the Sunrise River has an impaired invertebrate and fish community according to the MPCA. There was one invert sample taken for this determination. The invertebrate monitoring crew sampled overhanging vegetation and macrophytes and did not sample the stream bed. The stream bed is difficult to sample because sediments are deep and unconsolidated. There were two fish samples taken at County Road 77, and another right upstream. The fish visits were scored against a low gradient Index of Biotic Integrity (IBI), which is appropriate for this river.

A Total Maximum Daily Load (TMDL) study for this river reach is being completed in 2013. It is part of a larger Sunrise River Watershed Restoration and Protection Project (WRAPP) led by the Chisago Soil and Water Conservation District and MN Pollution Control Agency. Local entities should become involved in this project as it will determine causes of the turbidity and biotic impairments and set forth measures needed to correct them.

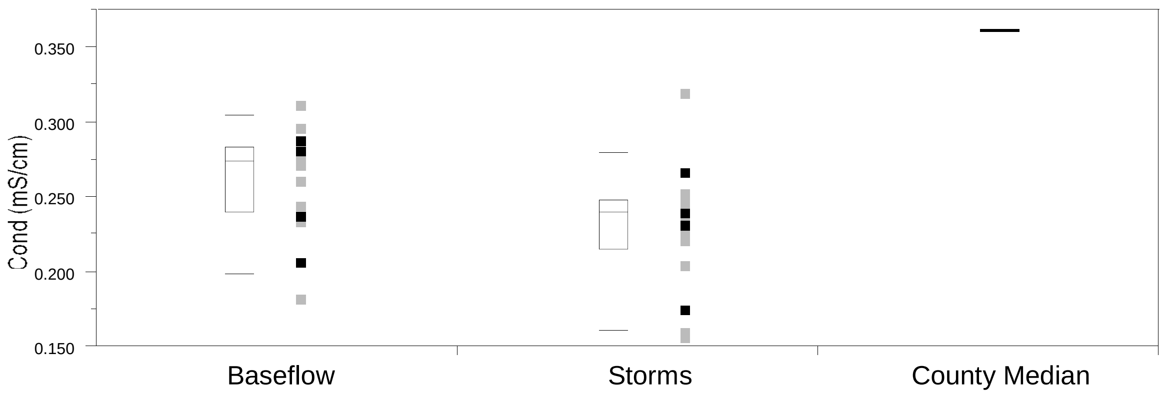
Conductivity and chlorides

Conductivity and chlorides are measures of dissolved pollutants. Dissolved pollutant sources include urban road runoff, industrial chemicals, and others. Metals, hydrocarbons, road salts, and others are often of concern in a suburban environment. 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 tests for chloride salts, the most common of which are road de-icing chemicals. Chlorides can also be present in other pollutant types, such as wastewater. These pollutants are of greatest concern because of the effect they can have on the stream's biological community.

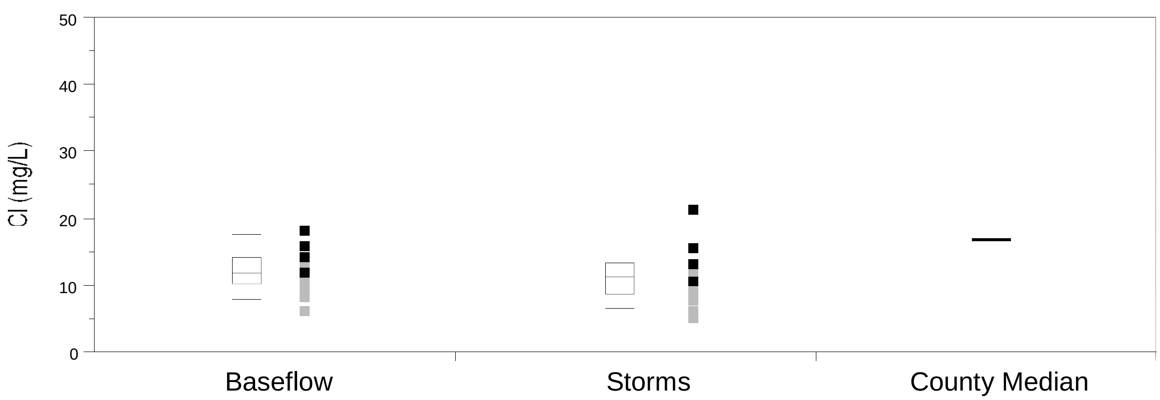
Conductivity was acceptably low in the West Branch of the Sunrise River. Median conductivity across all years was 0.247 mS/cm. This is notably lower than the median for 34 Anoka County streams of 0.362 mS/cm. Conductivity was lowest during storms, suggesting that stormwater runoff contains fewer dissolved pollutants than the surficial water table that feeds the river during baseflow. High baseflow conductivity has been observed in many other area streams too, studied extensively, and the largest cause is road salts that have infiltrated into the shallow aquifer.

Chloride results parallel those found for conductivity. Median chloride levels in the West Branch of the Sunrise River across all years are the same as the median for Anoka County streams of 12 mg/L. The levels observed are much lower than the Minnesota Pollution Control Agency's (MPCA) chronic standard for aquatic life of 230 mg/L. The primary reason for low chloride levels in this river is low road densities in the watershed, and therefore less use or road deicing salts.

Conductivity during baseflow and storm conditions Black squares are 2012 readings. Grey squares are individual readings from previous years. Box plots show the median (middle line), 25th and 75th percentile (ends of box), and 10th and 90th percentiles (floating outer lines).



Chloride during baseflow and storm conditions Black squares are 2012 readings. Grey squares are individual readings from previous years. Box plots show the median (middle line), 25th and 75th percentile (ends of box), and 10th and 90th percentiles (floating outer lines).

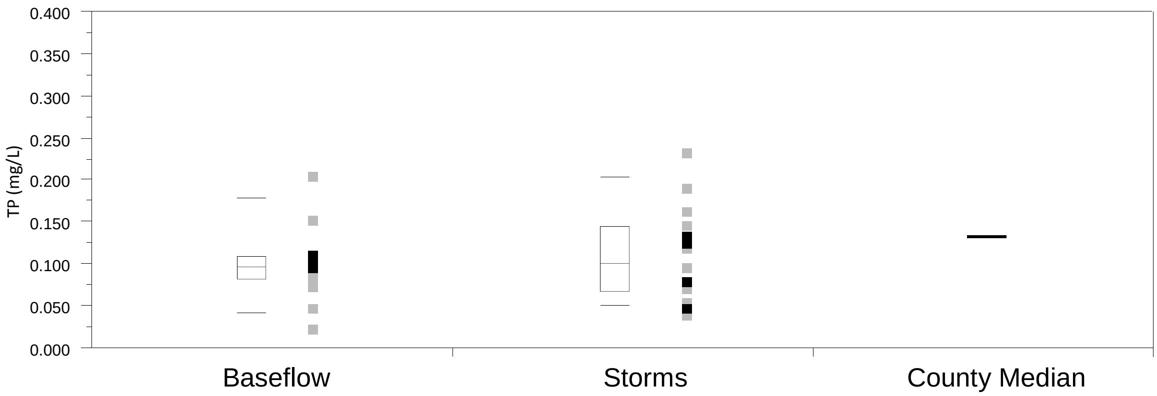


Total Phosphorus

Total phosphorus (TP), a nutrient, is one of the most common pollutants in our region, and can be associated with urban runoff, agricultural runoff, wastewater, and many other sources. Total phosphorus in the West Branch of the Sunrise River is on the high end of the acceptable range. The median TP for Anoka County streams is 128 ug/L and future state water quality standard is likely to be similar. The median phosphorus concentration in the West Branch of the Sunrise River across all years was 101.5 ug/L, and in 2012 alone was 112.5 ug/L. Six of 32 samples (19%) from all years had TP higher than 150 ug/L and two samples were higher than 200 ug/L.

These phosphorus levels are common for the area. In the case of the West Branch of the Sunrise River, phosphorus levels are, at least in part, reflective of conditions of Martin Lake about 3 miles upstream from the sampling site. Martin Lake is impaired for excess phosphorus, with a summertime average of 100 ug/L during the last 10 years. Water quality improvements to Martin Lake will benefit the river downstream.

Total phosphorus during baseflow and storm conditions Black squares are 2012 readings. Grey squares are individual readings from previous years. Box plots show the median (middle line), 25th and 75th percentile (ends of box), and 10th and 90th percentiles (floating outer lines).



Turbidity and Total Suspended Solids (TSS)

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

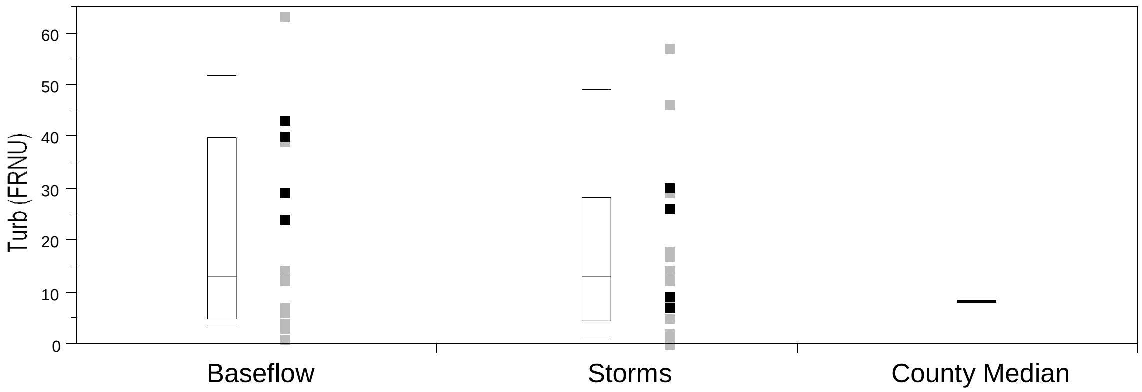
It is important to note the suspended solids can come from sources in and out of the river. Sources on land include soil erosion, road sanding, and others. Riverbank erosion and movement of the river bottom also contributes to suspended solids. A moderate amount of this “bed load” is natural and expected.

The West Branch of the Sunrise River has been declared as “impaired” for excess turbidity by the MN Pollution Control Agency. Their threshold is 25 NTU turbidity. If a river exceeds this value on three occassions and at least 10% of all sampling events, then it is declared impaired for turbidity. Based on all years of data, the West Branch of the Sunrise River has exceeded 25 NTU turidity on 11 of 32 sampling occassions (34%). In 2012 alone, six of eight samples had turbidity of 25 NTU or higher, and the maximum was 44 NTU.

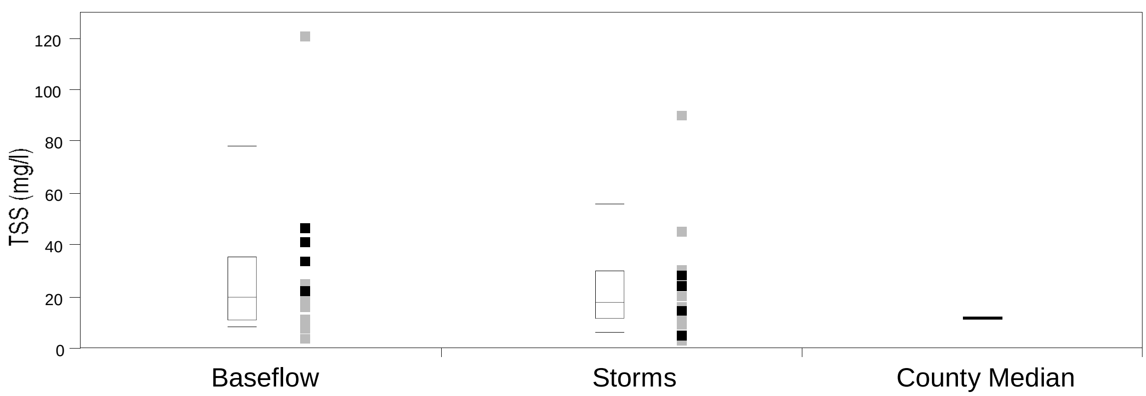
When inadequate turbidity data exists, total suspended solids can be used as a surrogate. The threshold value is 100 mg/L. Only one of 32 samples exceeded that threshold, and none in 2012. Regardless of this, the turbidity standard is clearly exceeded.

The most obvious source of turbidity is algae from upstream lakes. Three of the four immediately upstream lakes are impaired for excessive nutrients and high algae. They include Linwood, Martin, and Typo Lakes. The river sampling site is just 3 miles downstream from Martin Lake. The intervening area between the lake and sampling site is a wide floodplain fringe and forests with little human impacts that would be expected to add sediment to the river. Therefore, efforts to reduce suspended material in the river should focus on the upstream lakes. It is also worth noting that this section of the river has unconsolidated bottom material which can move around and contribute to turbidity.

Turbidity during baseflow and storm conditions Black squares are 2012 readings. Grey squares are individual readings from previous years. 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 Black squares are 2012 readings. Grey squares are individual readings from previous years. Box plots show the median (middle line), 25th and 75th percentile (ends of box), and 10th and 90th percentiles (floating outer lines).



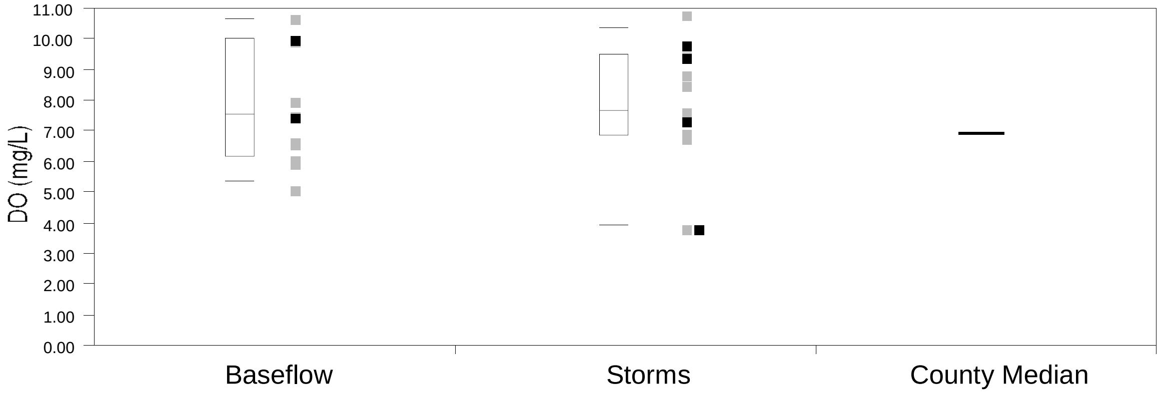
Dissolved Oxygen

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

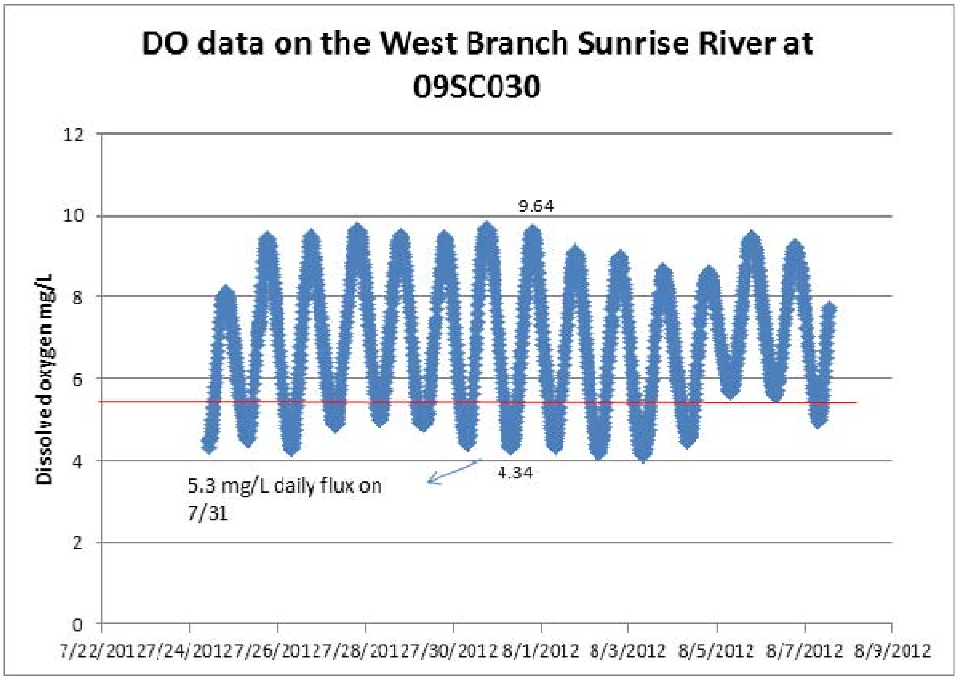
For the West Branch of the Sunrise River there are two datasets to consider. First, spot measurements were taken with the other water quality monitoring described in this report. Dissolved oxygen has twice been found at 4 mg/L. Both were during storm events, one in 2003 and one in 2012. All of these measurements were taken in afternoon when DO is typically highest. Secondly, MPCA took around-the-clock DO measurements for eight days in 2012. They found DO dipped below 5 mg/L every morning.

The river have been designated as impaired for poor fish and invertebrate communities. Low dissovled oxygen could definitely contribute to or cause this impairment. The Sunrise River TMDL study should provide further diagnosis of the low DO and corrective measures.

Dissolved oxygen results during baseflow and storm conditions Black squares are 2012 readings. Grey squares are individual readings from previous years. Box plots show the median (middle line), 25th and 75th percentile (ends of box), and 10th and 90th percentiles (floating outer lines).



Dissolved oxygen results during 2012 around-the-clock dissolved oxygen monitoring by the MPCA and Chisago SWCD.

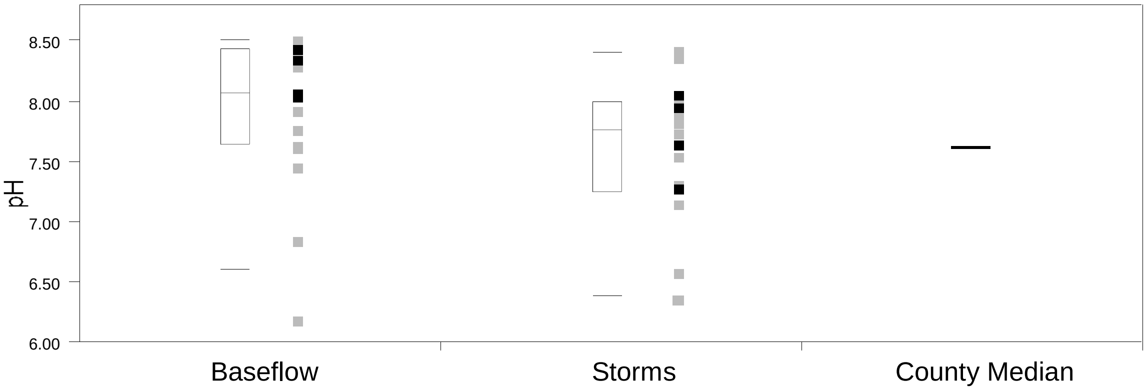


pH

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

It is interesting to note that pH is lower during storms than during baseflow. This is because the pH of rain is typically lower (more acidic). While acid rain is a longstanding problem, it's affect on this aquatic system is small.

pH results during baseflow and storm conditions Black squares are 2012 readings. Grey squares are individual readings from previous years. Box plots show the median (middle line), 25th and 75th percentile (ends of box), and 10th and 90th percentiles (floating outer lines).



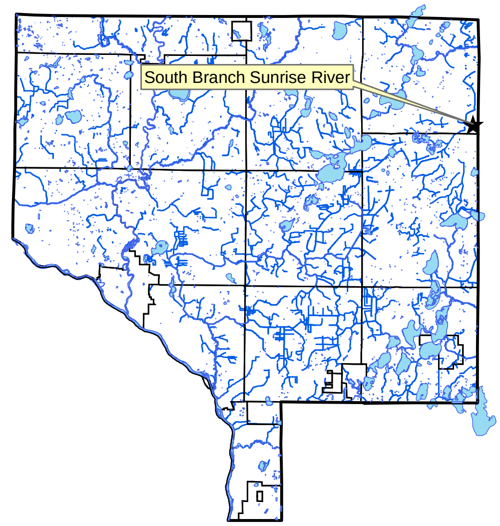
Recommendations

A Total Maximum Daily Load (TMDL) study is underway to determine address impairments of this river. The study will identify sources of problems, reductions needed to reach goals, and suggested actions. At this time, it appears that many of the issues in the river are best addressed by water quality improvement projects targeted at upstream lakes, however low dissolved oxygen may be an in-river problem.

SOUTH BRANCH SUNRISE RIVER

at Hornsby Street, Linwood Township

STORET SiteID = S005-640



Years Monitored
2012 only

Background

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

2012 was the first year of water quality monitoring at this site. Other monitoring downstrem has occurred. Hydrology (stage) monitoring has been done since 2009. No rating curve has been established.

The MN Pollution Control Agency has designated this site as “impaired” due to low dissolved oxygen. A TMDL study is underway and should be completed in 2013 or 2014.

Methods

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

Dry River Sampling on October 23, 2012

An anomoly occurred during the final 2012 sampling event. On October 23, 2012, immediately following a storm, staff visited the site. The river was dry, except for intermittent pools in the channel. This is highly unusual and staff speculated that management operations in Carlos Avery WMA pools may have caused the river drawdown.

Staff believed that sampling the water in the intermittent pool channels could be valuable for understanding the river’s water quality. There has been speculation that poor water quality in this river may be due to upstream wetlands and native soils. On October 23, 2012 the water was strongly red and extremely turbid, even more so than when the river is flowing. Because there was no flow, and hence no watershed runoff, testing the pools of water seemed a good opporutnity to test the impact of native soils on water quality. The data from those tests are discussed here, but not included in the graphs or discussions elsewhere in this report because they are not representative of water quality when the river is flowing.

<u>October 23, 2012 water quality results for intermittent pools within the otherwise dry river channel</u>

pH	Conductivity (mS/cm)	Turbidity (FNRU)	DO (mg/L)	Temp (C)	Sal (%)	TP (mg/L)	Cl (mg/L)	TSS (mg/L)
7.35	0.186	504	4.28	12.5	0.00	1.64	<30	113

The South Branch of the Sunrise River at this site has had a reddish color on previous occasions, particularly when flows and dissolved oxygen are low. It has been speculated that iron-rich soils are the source of this color. When oxygen is low, bacteria change iron to its reduced form. This reduced form is more mobile and less able to hold phosphorus.

On October 23, 2012, when the stream channel held only intermittent pools of water, the water was even more intensely red, turbid, and had extremely high phosphorus. This result is consistent with the theory that iron-rich native soils are an important source of turbidity and phosphorus. It does not appear that watershed practices are to blame.

Results and Discussion

Summary

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

The issues of low oxygen, turbidity, and phoshorus appear to be related. Addressing them in concert may be helpful. The water has a notable reddish color during baseflow, when dissolved oxygen would be expected to be lowest. This color may be due to reduction of iron in soils. Iron in its reduced form is more mobile (hence the reddish water color) and less able to hold phoshorus. High turbidity and phoshorus coincide with low oxygen and baseflow. Low oxygen is likely due to decomposition in upstream wetlands, which might be described as "natural."

Summarized water quality results include:

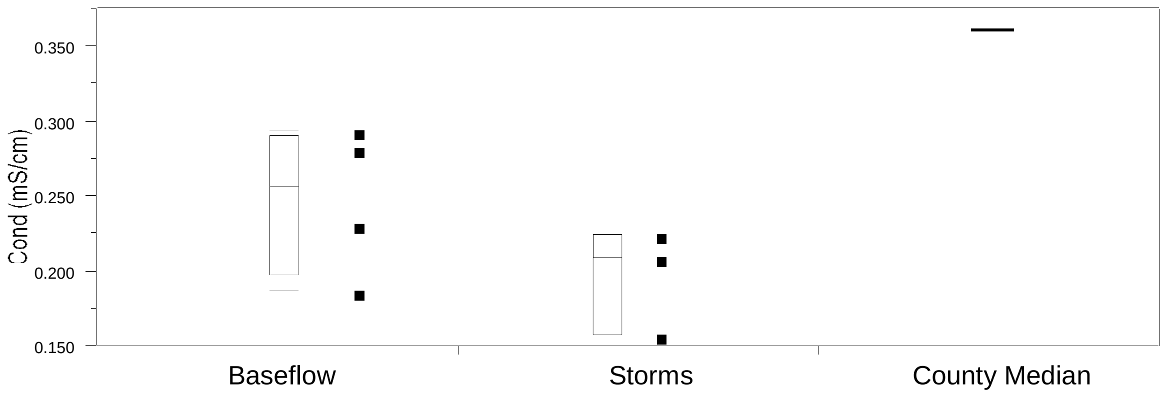
- Dissolved pollutants, as measured by conductivity and chlorides, are low.
- Phosphorus was high during baseflow. The source may be wetland soils in a low oxygen environment. When state water quality standards are developed for phosphorus in streams, the South Branch of the Sunrise River may exceed it.
- Suspended solids and turbidity were high during baseflow. Twenty measurements, which we do not yet have, are required determine if it fails to meet state water quality standards. However the data to date suggest the site may fail to meet state standards.
- pH was within the range considered normal and healthy for streams in this area. Interestingly, pH was lower during baseflow than storms. This is the opposite of most streams.
- Dissolved oxygen was occassionally low. This river reach is already listed by the State as "impaired" for low dissolved oxygen.

Conductivity and chlorides

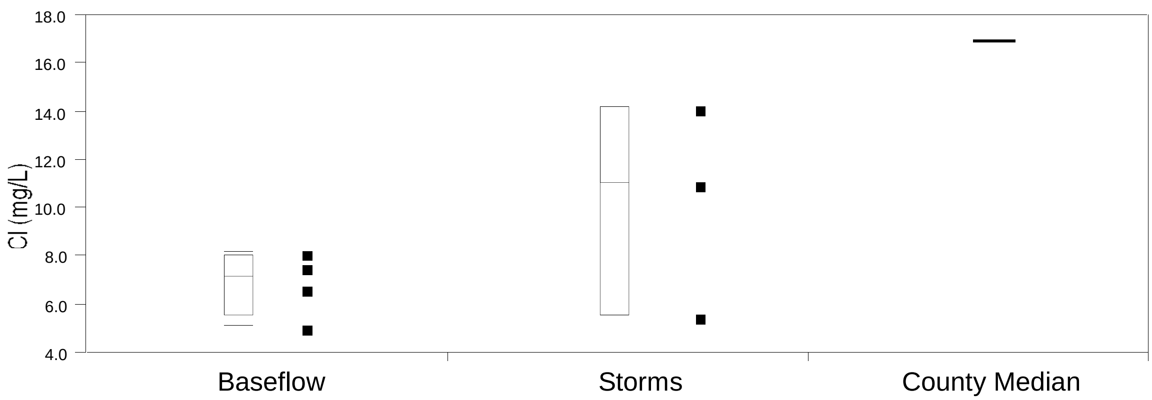
Conductivity and chlorides are measures of dissolved pollutants. Dissolved pollutant sources include urban road runoff, industrial chemicals, and others. Metals, hydrocarbons, road salts, and others are often of concern in a suburban environment. Conductivity is the broadest measure of dissolved pollutants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

Conductivity is low in the South branch of the Sunrise River. Conductivity was lowest during storms, suggesting that stormwater runoff contains fewer dissolved pollutants than the surficial water table that feeds the river during baseflow. Higher conductivity during baseflow suggests an impact from road deicing salts that have infiltrated to the shallow groundwater and feed the stream during baseflow.

Conductivity during baseflow and storm conditions Black squares are 2012 readings. Box plots show the median (middle line), 25th and 75th percentile (ends of box), and 10th and 90th percentiles (floating outer lines).



Chloride during baseflow and storm conditions Black squares are 2012 readings. Box plots show the median (middle line), 25th and 75th percentile (ends of box), and 10th and 90th percentiles (floating outer lines).



Chlorides are low in the South Branch of the Sunrise River. The levels observed are much lower than the Minnesota Pollution Control Agency's (MPCA) chronic standard for aquatic life of 230 mg/L. This is likely because of low road densities (and therefore deicing salt use) in the watershed. Because of large expanses of public natural areas in the watershed, future increases in chlorides should be minimal.

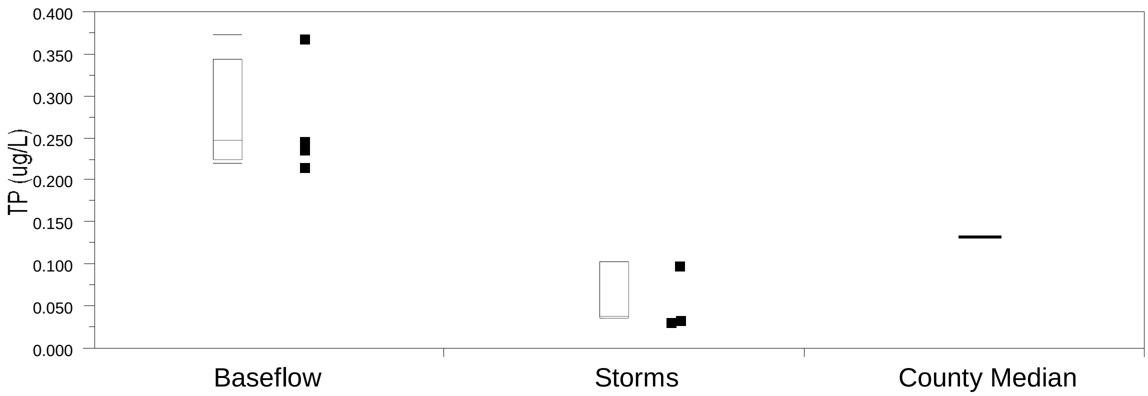
Total Phosphorus

Total phoshporus (TP) was high during baseflow (average 274 ug/L) but low during storms (average 61 ug/L). This is the opposite of most streams, where watershed runoff contributes phosphorus. As described earlier, we've hypothesized that an important source of phosphorus and turbidity in this river is native soils and low oxygen. During baseflow conditions the water is often red, dissolved oxygen is low, and phosphorus is high. When oxygen is low, the iron in soils would become reduced. Reduced iron is more mobile (hence the red color) and less able to hold phosphorus.

A management implication of these findings is that if dissolved oxygen is kept higher, then turbidity and phosphorus should fall as well. However there will likely be challenges achieving higher oxygen.

Decomposition within the vast wetlands and pools of the Carlos Avery Wildlife Management Area upstream is likely the cause of low oxygen.

Total phosphorus during baseflow and storm conditions Black squares are 2012 readings. Box plots show the median (middle line), 25th and 75th percentile (ends of box), and 10th and 90th percentiles (floating outer lines).



Turbidity and Total Suspended Solids (TSS)

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

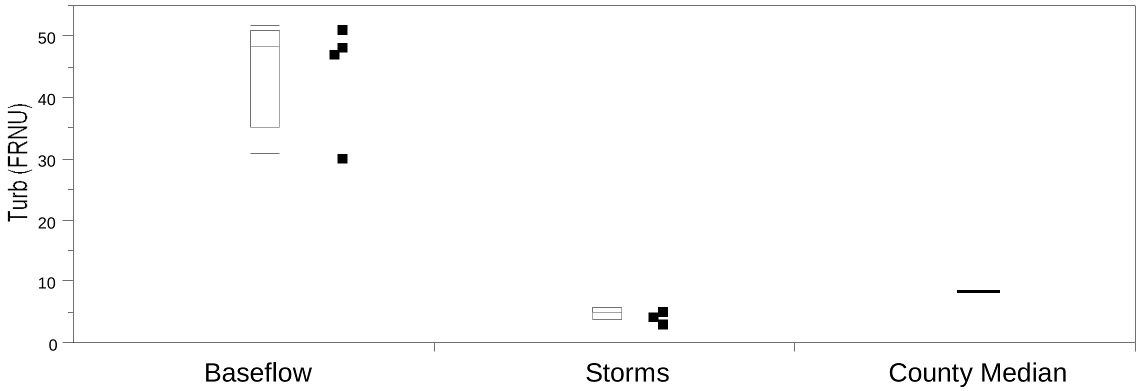
Turbidity and TSS were high during baseflow, but low during storms. This is the opposite of most streams, where watershed runoff contributes phosphorus. During baseflow, average turbidity was 45 FNRU, while it was only 5 FNRU during storms. Average TSS during baseflow was 15 mg/L, but only 5 mg/L during storms.

The South Branch of the Sunrise River would likely be designated as "impaired" for turbidity if more data existed. The state water quality standard is based on turbidity; TSS can be used as a surrogate if turbidity is not available. The threshold for impairment is at turbidity of 25. If 10% and at least 3 of all measurements exceed this value, the river is impaired. At least 20 measurements are required, but only seven have been taken at this site.

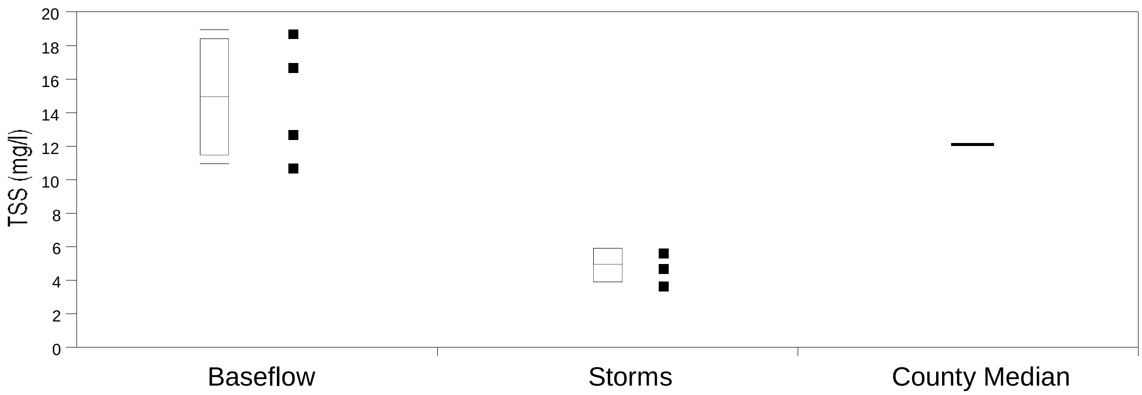
The cause of high turbidity, like high phoshorus, is likely iron-rich native soils in low oxygen conditions. Reduced iron is more mobile. The river frequently a reddish color during baseflow and low oxygen conditions.

Another cause of turbidity may be the nature of the peat soils through which the river flows. Especially when dried these soils can be susceptible to crumbling easily. Their snow-flake like particles stay suspended in the water column.

Turbidity during baseflow and storm conditions Black squares are 2012 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 Black squares are 2012 readings. Box plots show the median (middle line), 25th and 75th percentile (ends of box), and 10th and 90th percentiles (floating outer lines).

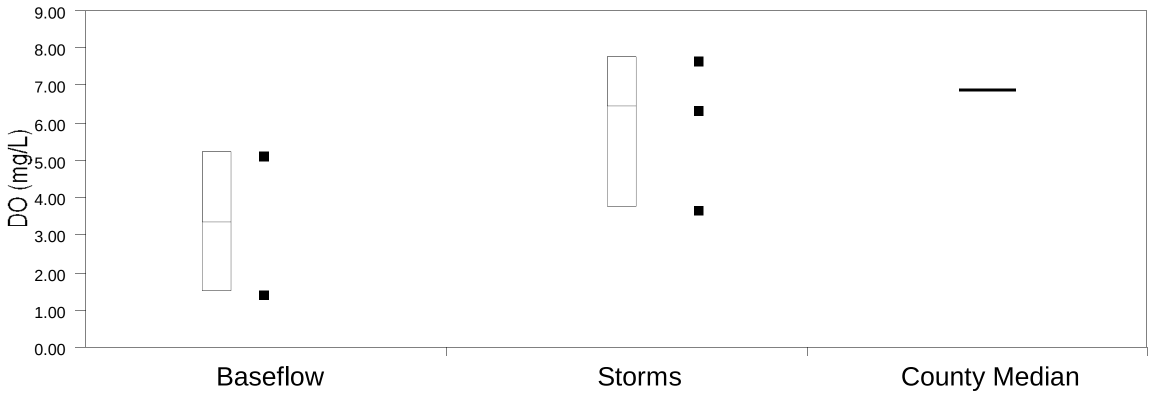


Dissolved Oxygen (DO)

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

The South Branch of the Sunrise River is already designated as “impaired” for low dissolved oxygen. In 2012 only five DO measurements were taken; equipment failures occurred on two other occassions. Of these, low measurements of 1.55 and 3.86 mg/L were found. Another measurement of 5.30 mg/L is concerningly low, especially considering all measurements were taken in the afternoon when DO is typically highest. We speculate that decomposition in the vast wetlands and pools of the Carlos Avery Wildlife Management Area upstream consume oxygen is likely the cause of low oxygen.

Dissolved oxygen results during baseflow and storm conditions Black squares are 2012 readings. Box plots show the median (middle line), 25th and 75th percentile (ends of box), and 10th and 90th percentiles (floating outer lines).

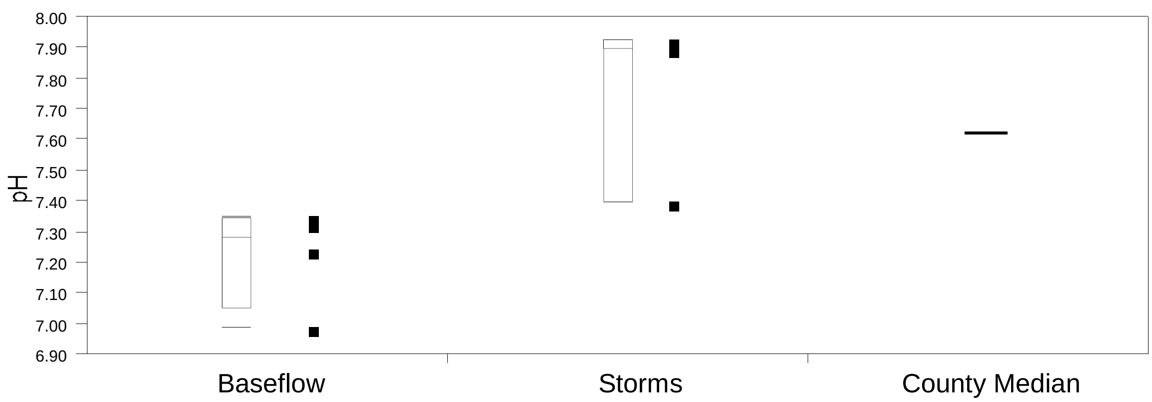


pH

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

pH in the South Branch of the Sunrise River is within the acceptable range, however it's changes between storm and baseflow are the opposite of most streams. In most streams, pH lowers during storms due to the acidity of rainfall. At this river pH was higher during storms. The reason is not known.

pH results during baseflow and storm conditions Black squares are 2012 readings. Box plots show the median (middle line), 25th and 75th percentile (ends of box), and 10th and 90th percentiles (floating outer lines).



Recommendations

A Total Maximum Daily Load (TMDL) study is underway to determine address impairments of this river. The study will identify sources of problems, reductions needed to reach goals, and suggested actions. While presently this river's impairment is dissolved oxygen, we suggest that the TMDL should also look at turbidity and total phosphorus. These are high as well, and may be linked to to the low oxygen problem.

Stream Hydrology

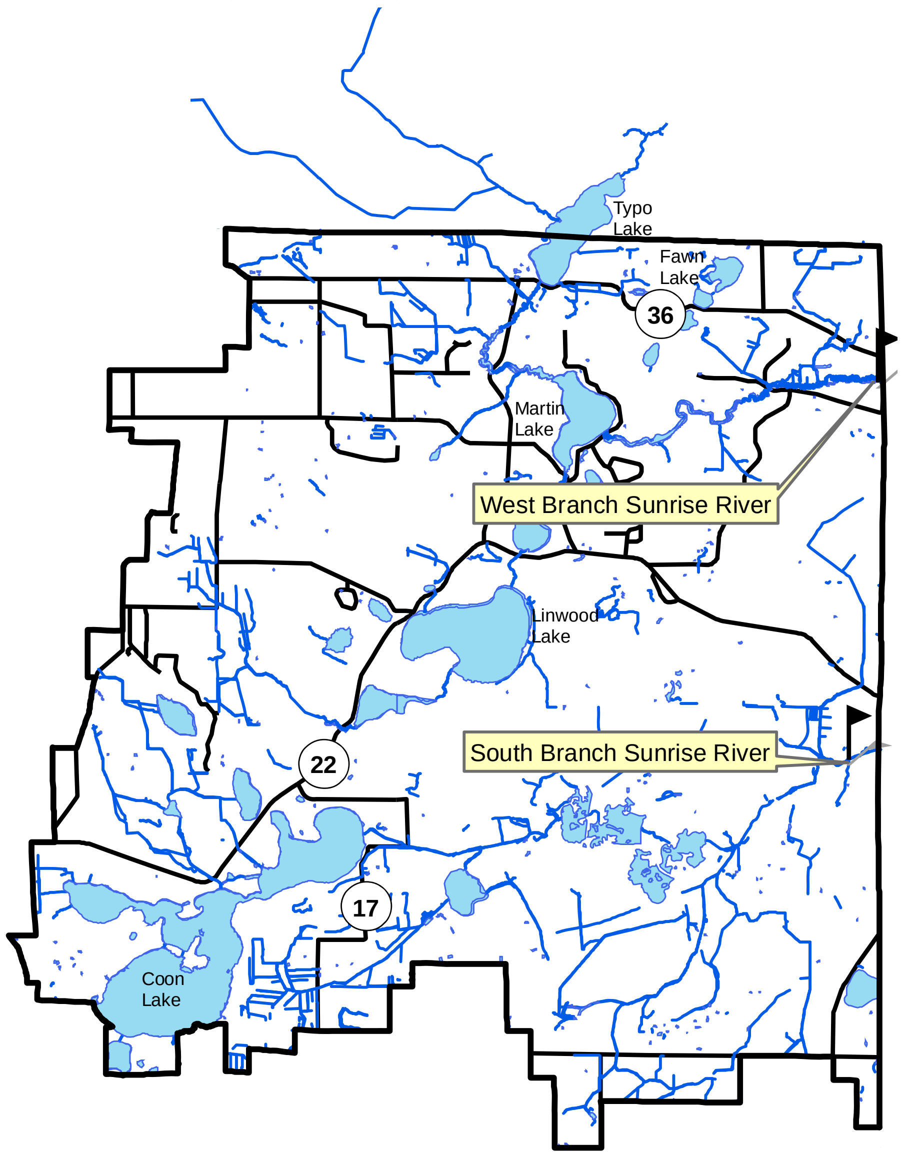
Description: Continuous water level monitoring in streams.

Purpose: To provide understanding of stream hydrology, including the impact of climate, land use or discharge changes. These data are also needed for calculation of pollutant loads and use of computer models for developing management strategies. In the Sunrise River Watershed, the monitoring sites are the outlets of the Sunrise River Watershed Management Organization's jurisdictional area, thereby allowing estimation of flows and pollutant loads leaving the jurisdiction.

Locations: South Branch Sunrise River at Hornsby St NE

West Branch Sunrise River at Co Rd 77

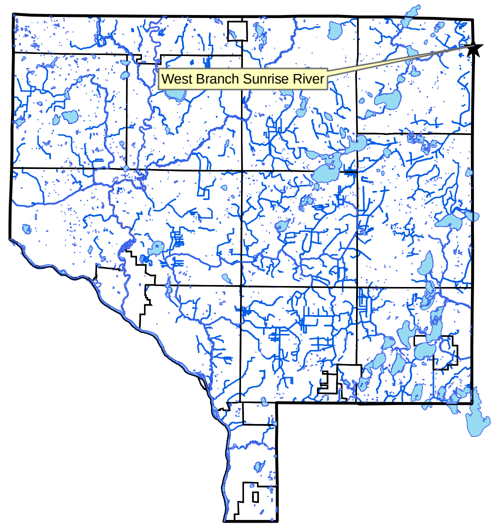
Sunrise Watershed Stream Hydrology Monitoring Sites



WEST BRANCH OF SUNRISE RIVER

At Co Rd 77, Linwood Township

Notes

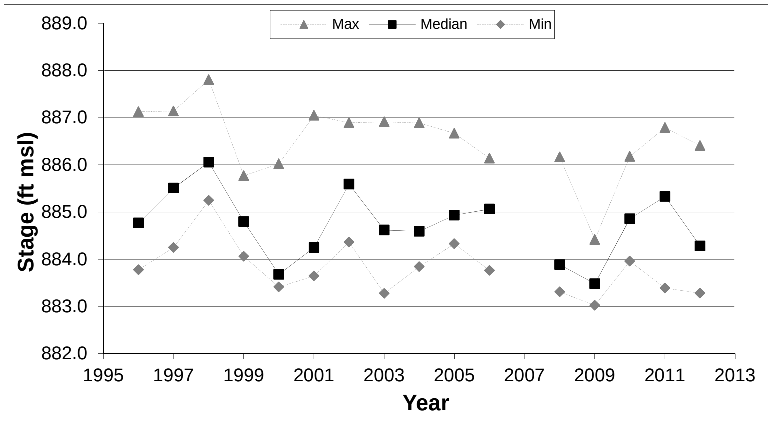


This monitoring site is the bottom of this watershed in Anoka County, at the Chisago County border. Upstream, this river drains through Linwood, Island, Martin, and Typo Lakes. The Sunrise River Watershed Management Organization monitors this site because it is at the bottom of their jurisdictional area. They have done water quality monitoring at this site and created a rating curve to estimate flow volumes from the water level measurements. In 2008 and 2009 this site was also monitored to collect data for a computer model of the entire Sunrise River watershed being done by the US Army Corps of Engineers, Chisago County, and other partners.

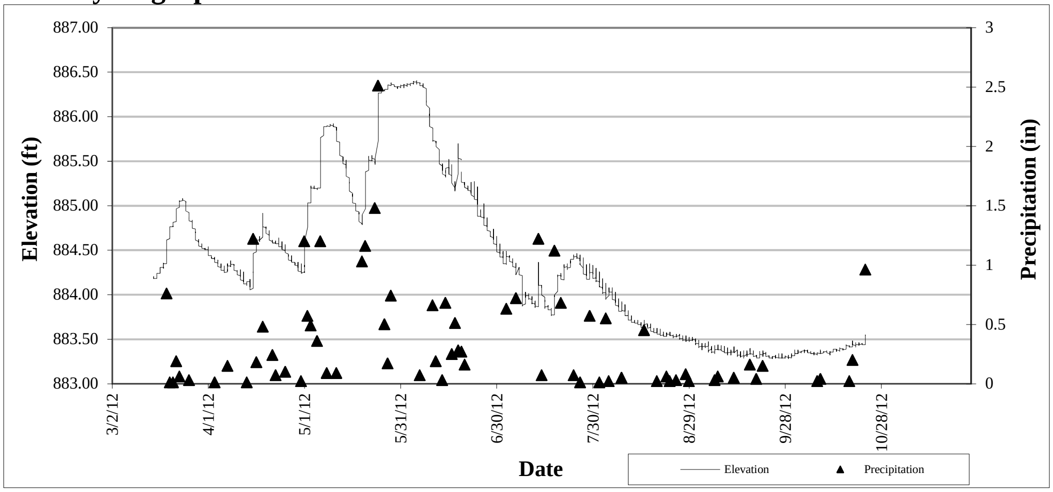
The rating curve to calculate flows (cfs) from stage data is:
Discharge (cfs) = $5.2509(\text{stage}-882.5)^2 + 10.88(\text{stage}-883.5) + 2.699$
$R^2=0.87$

This rating curve was first prepared in 2002. Five additional flow-stage measurements were taken in 2008-09 to keep the equation updated.

Summary of All Monitored Years

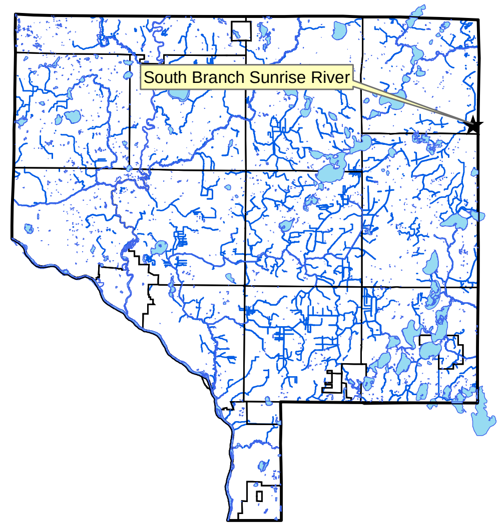


2012 Hydrograph



SOUTH BRANCH OF SUNRISE RIVER

At Hornsby St, Linwood Township

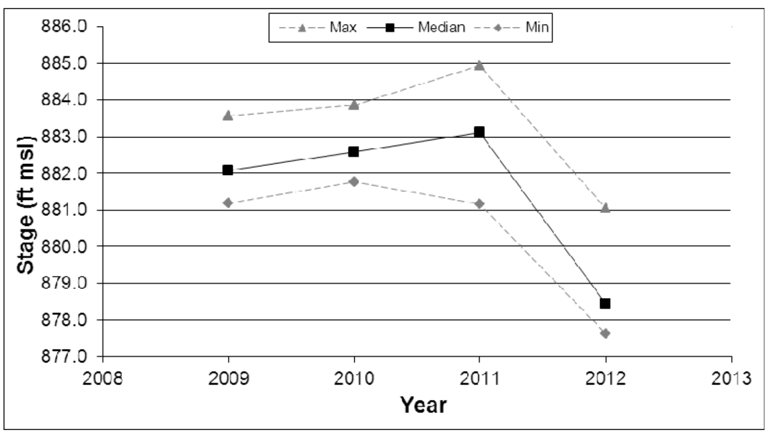


Notes

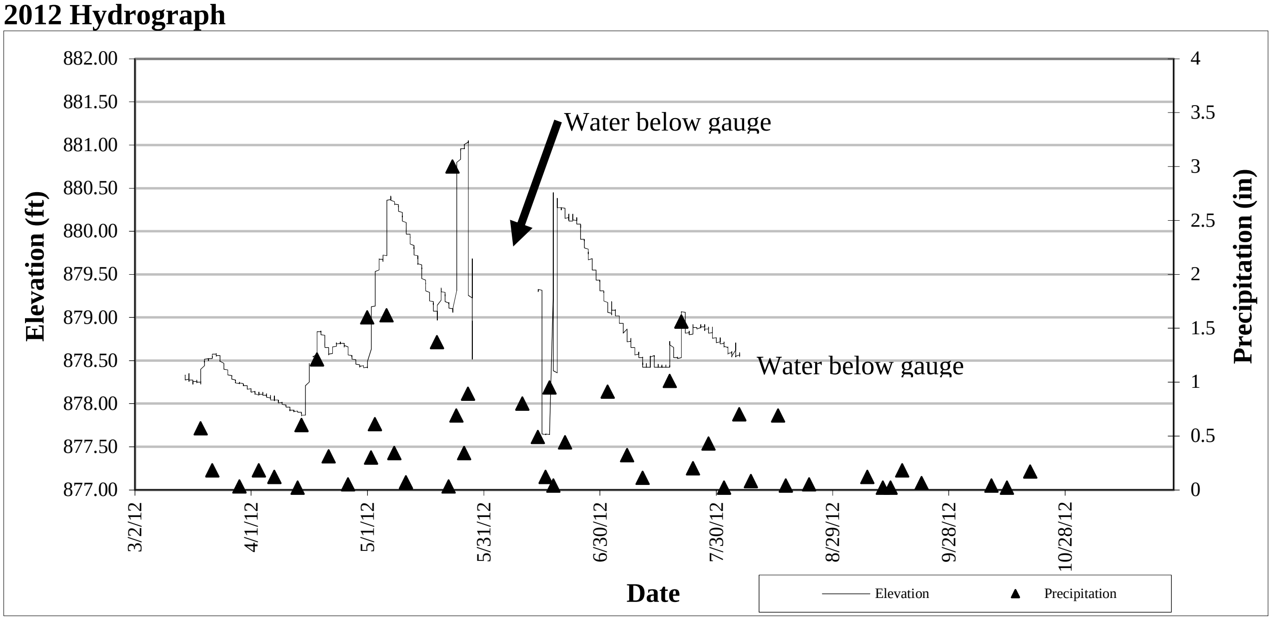
This monitoring site is the bottom of this watershed in Anoka County, at the closest accessible point to the Anoka-Chisago County boundary. Upstream, this river drains from Coon Lake and through the Carlos Avery Wildlife Management Area. The Sunrise River Watershed Management Organization monitors this site because it is at the bottom of their jurisdictional area. This site was first monitored in 2009 to collect data for a computer model of the entire Sunrise River watershed being done by the US Army Corps of Engineers, Chisago County, and other partners. Water quality monitoring has not yet occurred at this site, nor has a rating curve been created to estimate flow volumes from the water level measurements.

No rating curve exists for this site.

Summary of All Monitored Years



2012 Hydrograph



Stream Rating Curves

Description: Rating curves are the mathematical relationship between water level and flow volume. They are developed by manually measuring flow at a variety of water levels. These water level and flow measurements are plotted against eachother and the equation of the line best fitting these points is calculated. That equation allows flow to be calculated from continuous water level monitoring in streams.

Purpose: To allow flow to be calculated from water level, which is much easier to monitor.

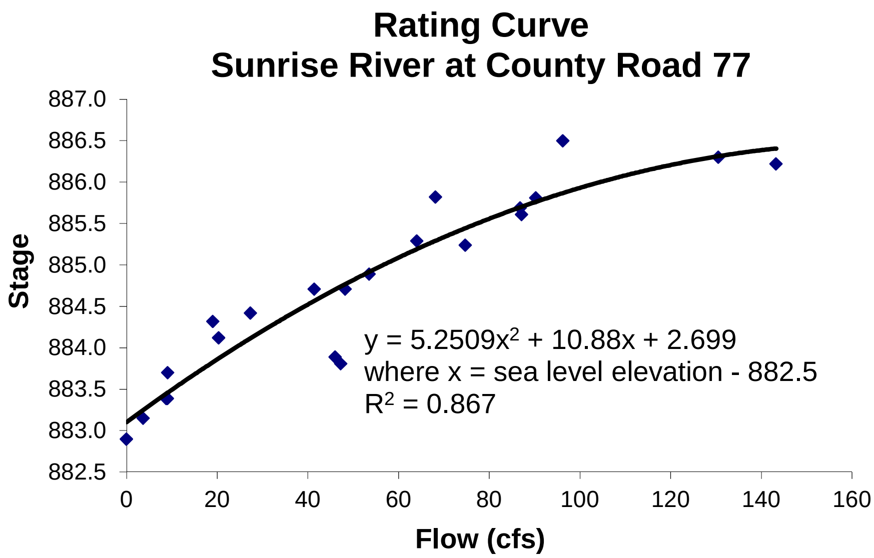
Locations: West Branch Sunrise River at County Road 77

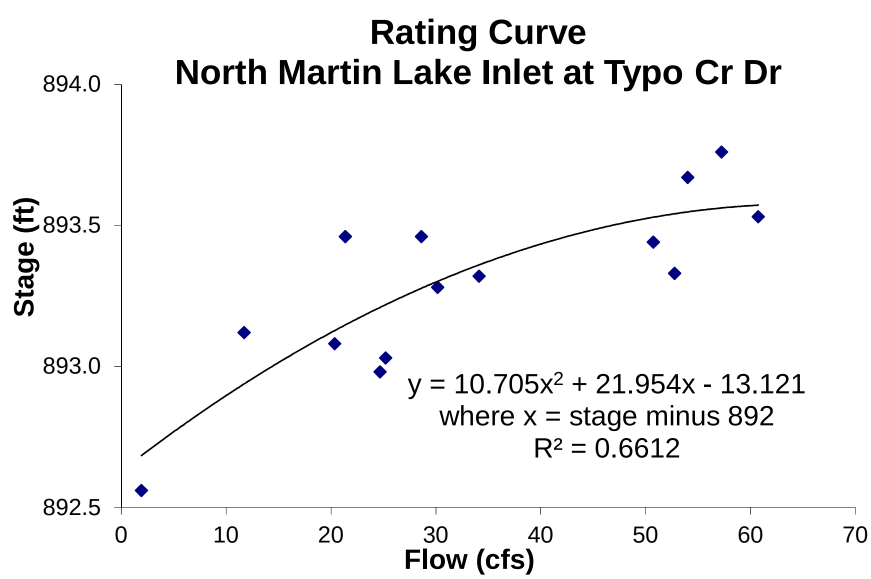
North Inlet of Martin Lake (Typo Cr) at Typo Creek Drive

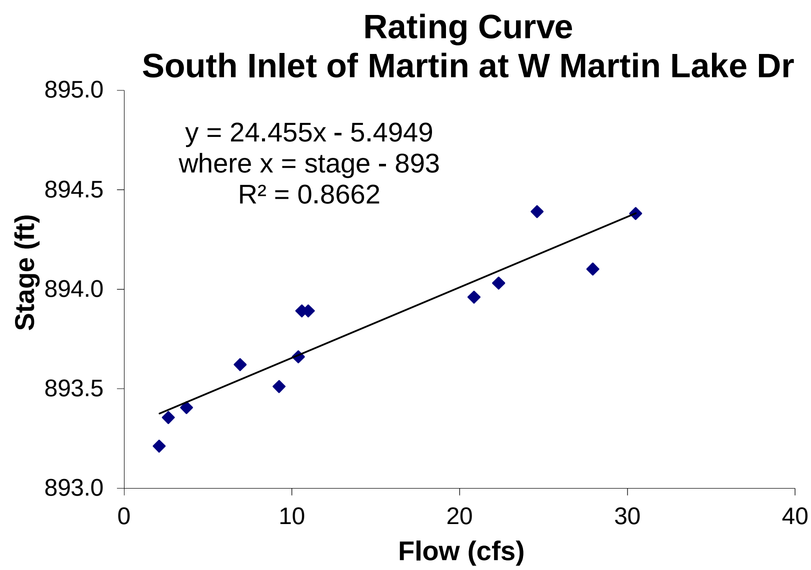
South Inlet of Martin Lake at West Martin Lake Drive

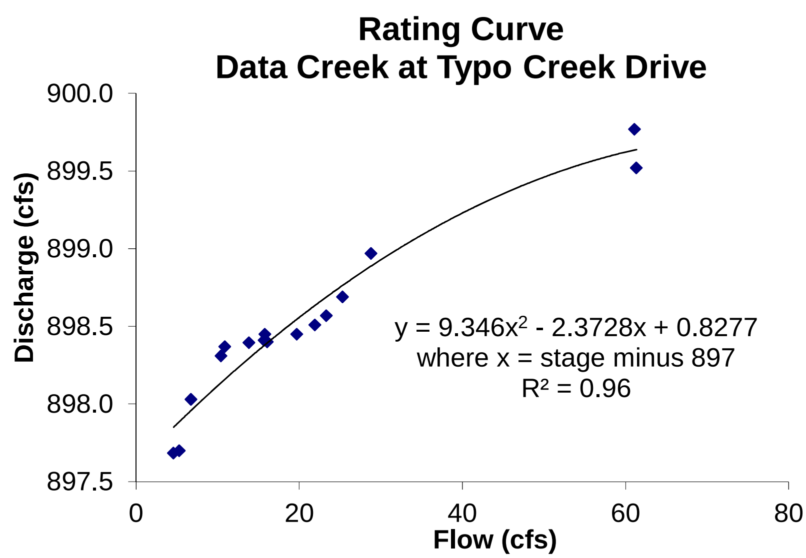
Data Creek at Typo Creek Drive

Results: Rating curves were developed for the sites listed above in previous years. In 2012 ACD staff discovered an error in the equations and corrected them. They also corrected all past hydrology records that used the equations. Below are the corrected rating curves.






Rating Curve
South Inlet of Martin at W Martin Lake Dr
y = 24.455x - 5.4949
where x = stage - 893
R² = 0.8662
Stage (ft)
895.0
894.5
894.0
893.5
893.0
0
10
20
30
40
Flow (cfs)


Rating Curve
Data Creek at Typo Creek Drive
y = 9.346x² - 2.3728x + 0.8277
where x = stage minus 897
R² = 0.96
Discharge (cfs)
900.0
899.5
899.0
898.5
898.0
897.5
0
20
40
60
80
Flow (cfs)

Wetland Hydrology

Description: Continuous groundwater level monitoring at a wetland boundary, to a depth of 40 inches. County-wide, the ACD maintains a network of 18 wetland hydrology monitoring stations.

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

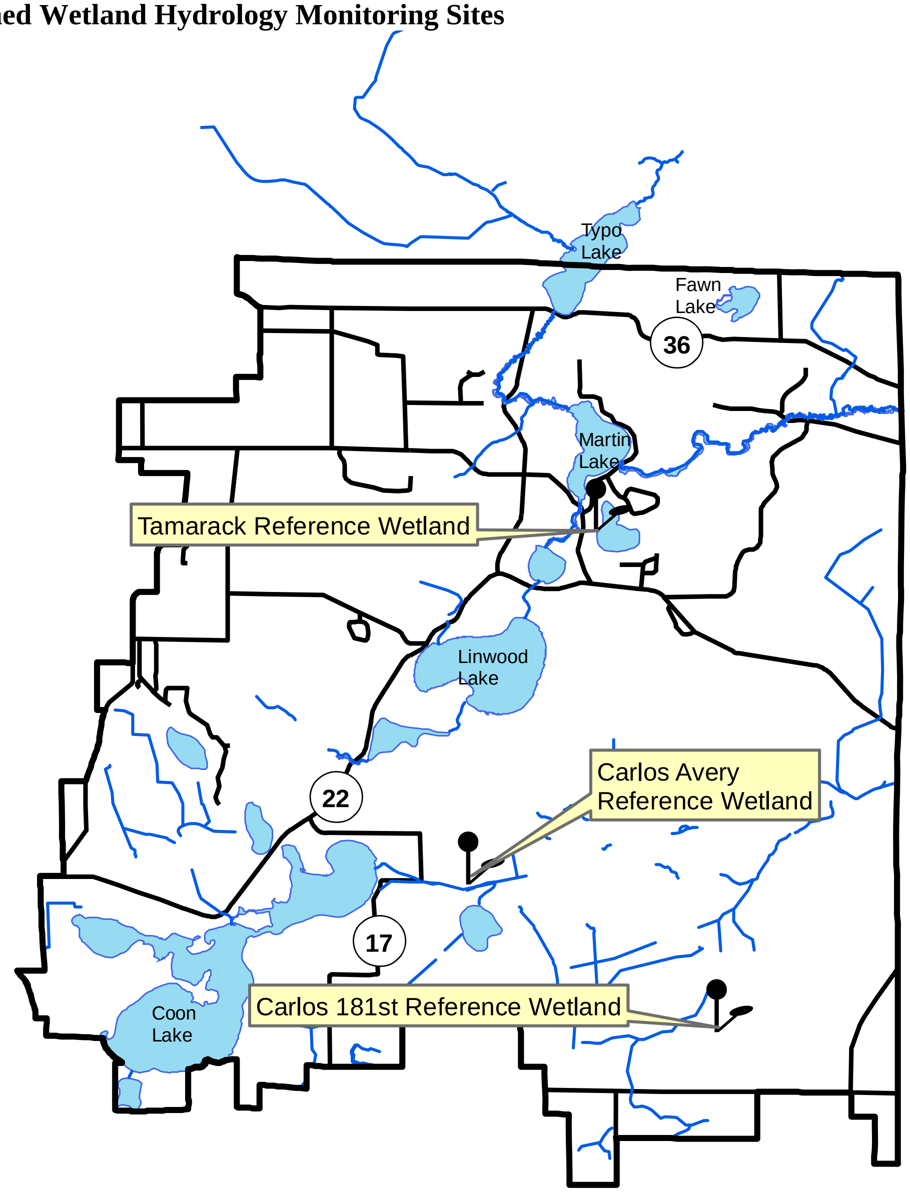
Locations: Carlos Avery Reference Wetland, Carlos Avery Wildlife Management Area, City of Columbus

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

Tamarack Reference Wetland, Linwood Township

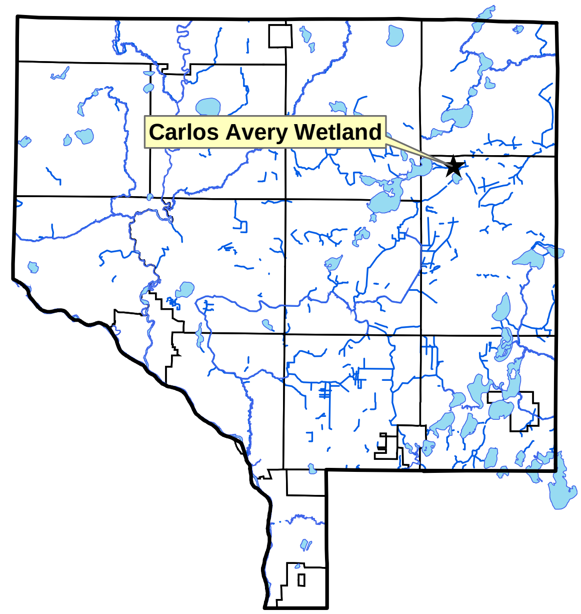
Results: See the following pages. Raw data and updated graphs can be downloaded from www.AnokaNaturalResources.com using the Data Access Tool.

Sunrise Watershed Wetland Hydrology Monitoring Sites



CARLOS AVERY REFERENCE WETLAND

Carlos Avery Wildlife Management Area, City of Columbus



Site Information

Monitored Since: 1997

Wetland Type: 3

Wetland Size: >300 acres

Isolated Basin? No

Connected to a Ditch? Yes

Soils at Well Location:

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

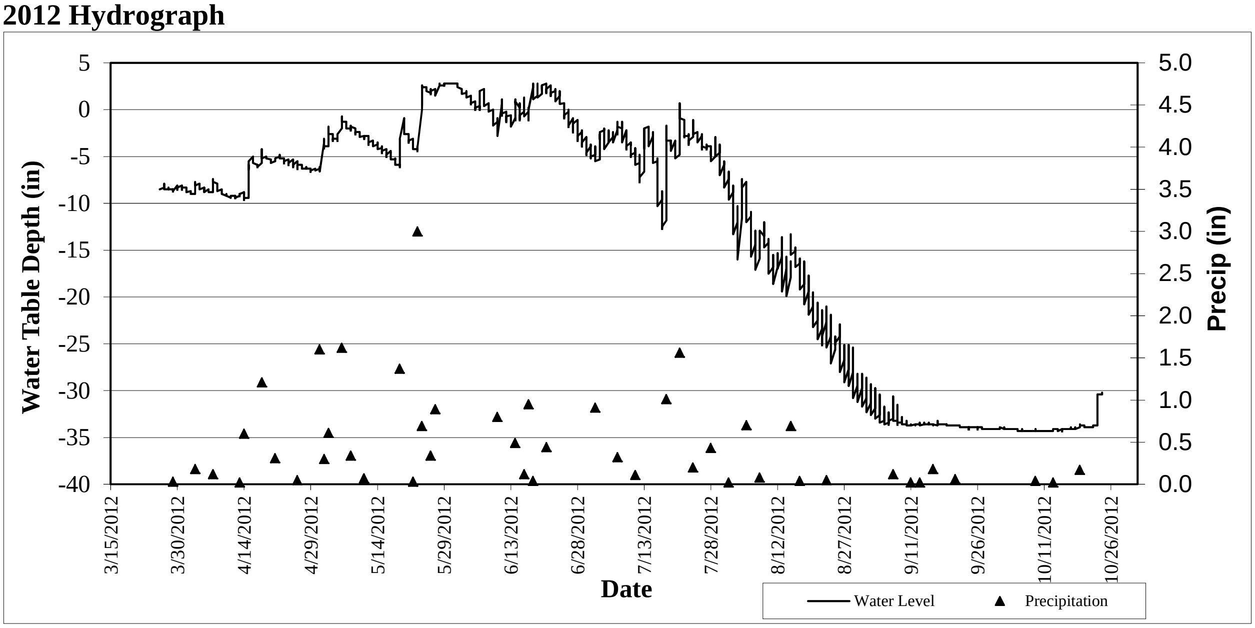
Surrounding Soils: Lino loamy fine sand

Vegetation at Well Location:

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

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

2012 Hydrograph

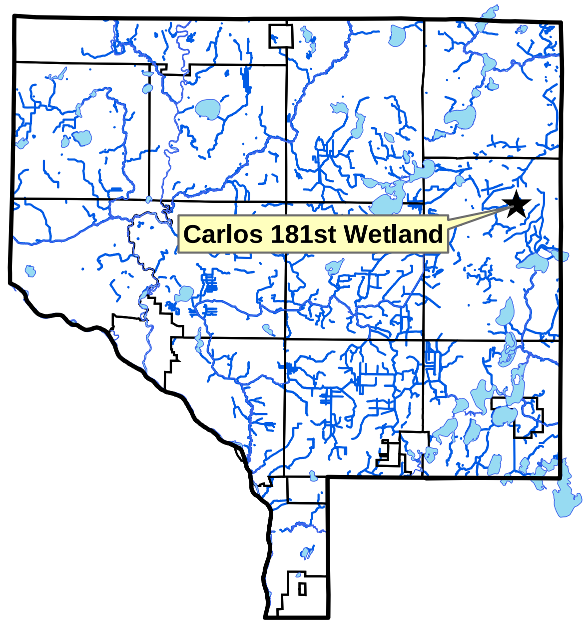


Well depths were 40 inches, so a reading of –40 indicates water levels were at an unknown depth greater than or equal to 40 inches.

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	-

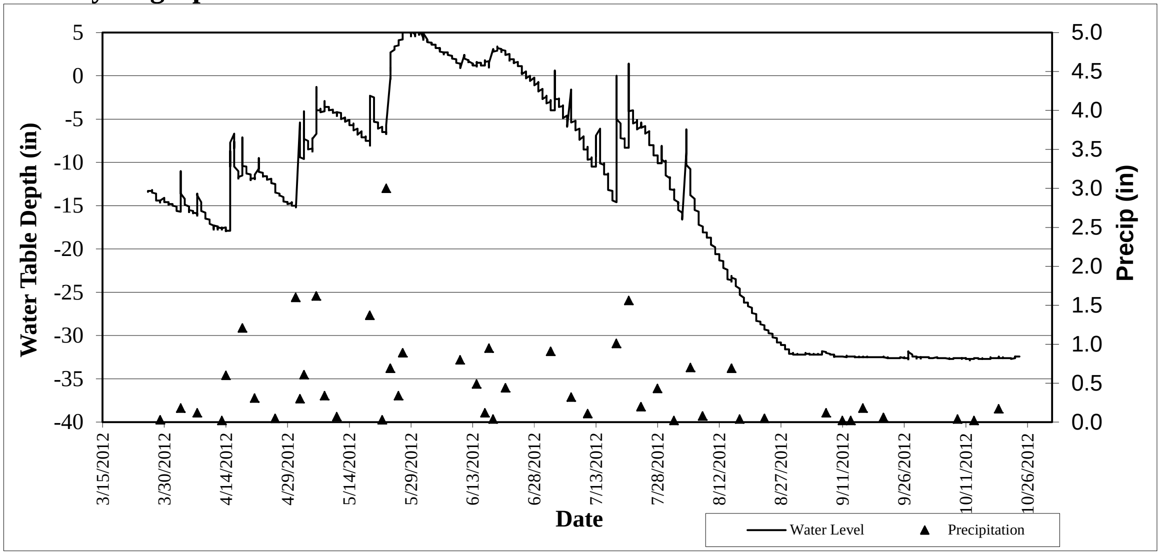
Surrounding Soils: Soderville fine sand

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 MN DNR. Access is from 181st Avenue.

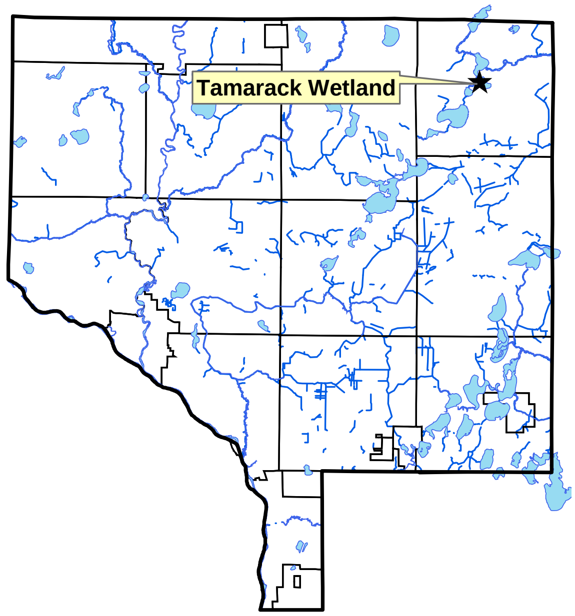
2012 Hydrograph



Well depths were 40 inches, so a reading of –40 indicates water levels were at an unknown depth greater than or equal to 40 inches.

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	-

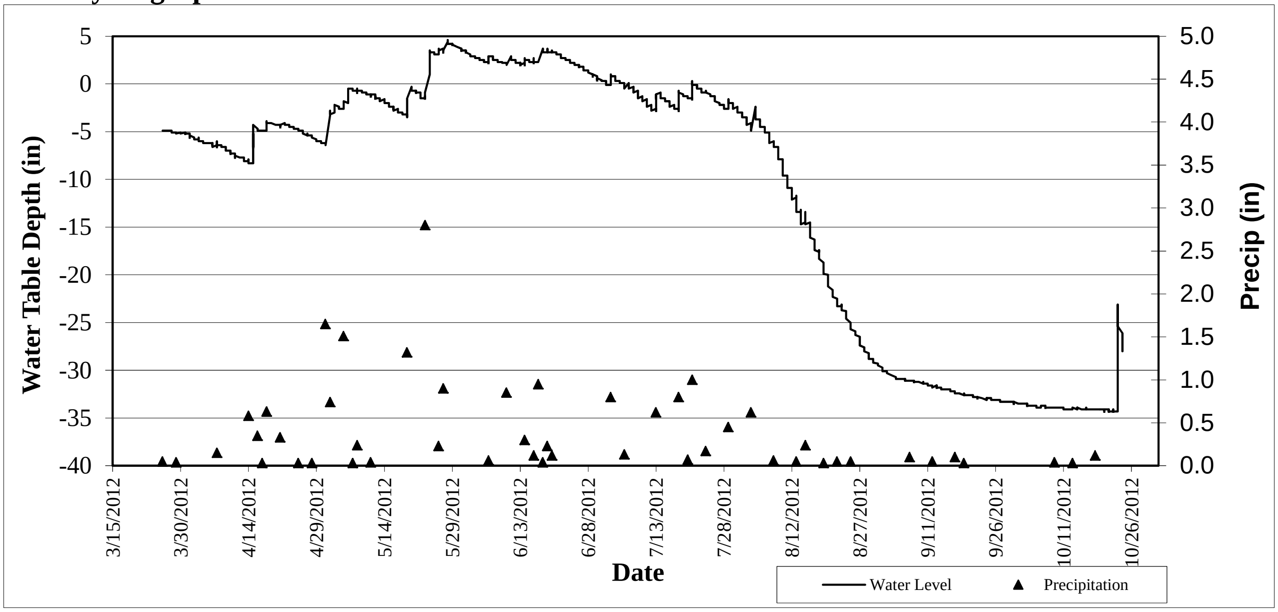
Surrounding Soils: Sartell fine sand

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.

2012 Hydrograph



Well depth was 35 inches, so a reading of –35 indicates water levels were at an unknown depth greater than or equal to 35 inches.

Water Quality Grant Fund

Description: The Sunrise River Watershed Management Organization (SRWMO) offers cost share grants 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: In 2012 one lakeshore restoration project at Linwood Lake was awarded a grant from this fund. Additionally, $4,300 was transferred out of this fund at the discretion of the SRWMO Board and directed to the Martin and Typo Lakes Carp Barriers project.

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
Fund Balance		**$5,848.74**

Water Quality Improvement Projects

Description: Projects on either public or private property that will improve water quality, such as repairing streambank erosion, restoring native shoreline vegetation, or rain gardens. These projects are partnerships between the landowner, the Anoka Conservation District, state agencies, lake associations, or others.

Purpose: To improve water quality in lakes streams and rivers by correcting erosion problems and providing buffers or other structures that filter runoff before it reaches the water bodies.

Results: Projects in-progress or installed in 2012 in the SRWMO include:

- **Linwood Lake – Gustafson Lakeshore Restoration.**
  Description: Replaced turf grass with native plants. Also installed native aquatic plants at the water's edge. The project is located in place where topography leads to concentrated runoff into the lake. The project size was 98 square feet.
  An important purpose of this project was to serve as a demonstration for other lakeshore homeowners. The Linwood Lake Association's annual meeting was held at the project site. The Anoka Conservation District gave a short presentation about the project and Native Plant Nursery, Inc. also gave a presentation.

  Funding:
  SRWMO Cost Share Grant $37.35
  Landowner $37.35
  Plants donated by Native Plant Nursery, Inc (approx value $72)

- **Carp barriers at Martin and Typo Lakes**. In 2012 and 2013 carp barriers will be installed at four sites around Martin and Typo Lakes. Additionally, commercial carp harvests will be conducted with the aid of radio tracking the schooling fish in wintertime. This project aims to improve water quality in these lakes by reducing the carp population.

  Carp are a high percentage of the fish biomass in these waterbodies. They strongly degrade habitat and water quality throughout their feeding and spawning behaviors. Carp control will improve water clarity, increase plants, improve the game fishery, and enhance wildlife opportunities. Barriers are an effective strategy for carp control because Typo and Martin Lake each provide something important for carp, and moving between the lakes is important to their success. Martin Lake is deeper, and good for overwintering. Typo Lake is shallow and good for spawning. Stopping migrations between the lakes will reduce overwintering survival and spawning success. The barriers alone will achieve this over time, but we will accelerate results with carp harvests.

  This project encounted challenges in 2012. Original cost estimates from the project engineer proved to be far too low. In response, the SRWMO committed an additional $14,300 to the project which matched an additional $92,392 in DNR Conservation Partners Legacy Grant funds. This new, larger budget was based upon on-site feedback from construction contractors. Unfortunately, when the project was bid in December 2012 the lowest contractor bid was nearly double the project budget. Options for proceeding are being evaluated.

This project is a collaboration between the SRWMO, Anoka Conservation District, Martin Lakers Association, MN DNR, and Linwood Township. Major funding is provided by the SRWMO, Martin Lakers Association, and the Outdoor Heritage Fund (from the Clean Water, Land, and Legacy Amendment).

- **Coon Lake Stormwater Retrofits -** In 2012 the City of East Bethel installed additional stormwater treatment while rehabilitating road surfaces in the Coon Lake Beach Neighborhood. Stormwater that would otherwise reach Coon Lake will be diverted into roadside swales for infiltration. This project was guided with input from the Anoka Conservation District who accelerated a stormwater assessment study to find these opportunities for improved stormwater treatment. Funding for installation was from the City of East Bethel.

Coon Lake Area Stormwater Retrofit Analysis

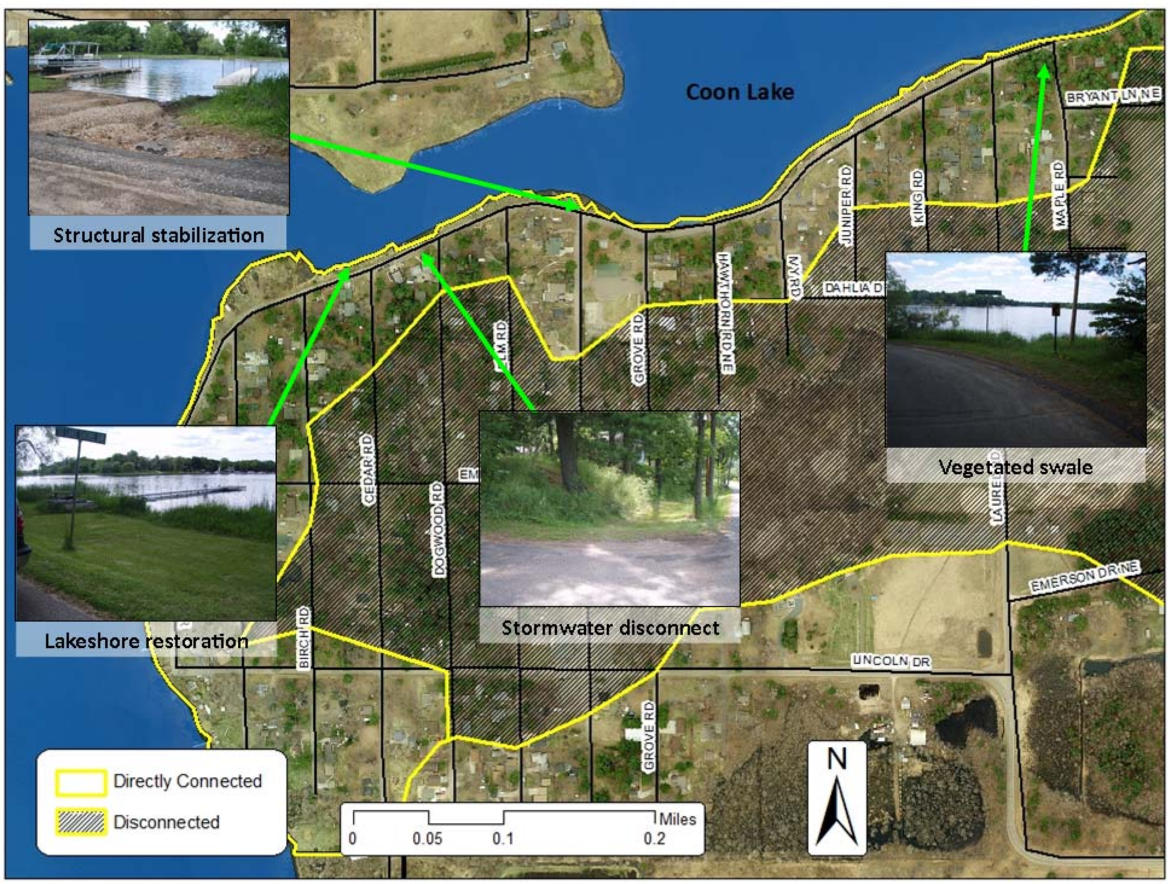
Description: A Stormwater Retrofit Analysis is a systematic approach of identifying opportunities for improved stormwater treatment within a subwatershed of a high priority waterbody. Once stormwater retrofit options are identified, they are modeled to determine pollutant removal benefits. Costs for each potential project are estimated. Finally, the cost effectiveness of each project is calculated and projects are ranked accordingly. The final report serves as a guide for installing water quality projects in a cost effective manner.

Purpose: To improve Coon Lake water quality.

Results: The Anoka Conservation District was contracted to complete a Stormwater Retrofit Analysis of the Coon Lake subwatershed beginning in 2012 with the majority of work and delivery of final report to occur in 2013. Recent water quality data shows total phosphorus concentrations in Coon Lake are close to the state standard of 40 µg/L. Therefore, even relatively small reductions in phosphorus are helpful to remain below the standard. The retrofit analiysis will identify and prioritize projects that improve the quality and reduce the volume of stormwater runoff.

In 2012 the City of East Bethel implemented a street reconstruction project in the Coon Lake Beach neighborhood. The Coon Lake Beach neighborhood, or "catchment," is estimated to deliver 37 pounds of phosphorus and 11,000 pounds of sediment to the lake via stormwater runoff annually. To take advantage of the planned construction, ACD accelerated the retrofit analysis for the area. Several retrofit opportunities were identified including stormwater disconnects, vegetated swales, lakeshore restorations, and rain gardens. Several stormwater disconnects (redirecting stormwater into roadside ditches) were installed during street reconstruction by the City. Analysis of the remaining lake subwatershed will be completed in 2013.

Stormwater retrofit opportunities identified in the Coon Lake Beach neighborhood in 2012.



Lakeshore Landscaping Education

Description: One goal of the Sunrise River WMO is to encourage and facilitate lakeshore restorations with native plants. These projects, usually accomplished by homeowners with assistance from agencies like the SRWMO, are beneficial to overall lake health. By planting native plants at the shoreline runoff into the lake is filtered, and fish and wildlife habitat is substantially improved. To move toward its goal, the SRWMO does regular education and marketing of lakeshore restorations to homeowners.

Purpose: To improve lake water quality and lake health.

Results: In 2012 the SRWMO contracted the Anoka Conservation District (ACD) to accomplish the tasks listed below to further lakeshore landscaping education:

Linwood Lake Association Presentation **–** A presentation about lakeshore landscaping to the Linwood Lake Association was completed on behalf of the SRWMO. The presentation was given at the lake association's annual meeting.

Rather than give a traditional presentation with displays and photos, the ACD worked with the landowner to install a lakeshore restoration at the meeting site (see Gustafson Lakeshore restoration on previous pages). Staff then described to the group of how the project came together, labor involved, costs, and how it will look in coming years. To futher bolster the presentation, Native Plant Nursery, Inc. also talked about plants they offer and why homeowners should choose native plants.

SRWMO Display Banner – The SRWMO has regularly borrowed displays from the Anoka Conservation District for community events, however it has lacked a banner with the organization's name. The ACD created four banner designs for SRWMO Board consideration. The design selected was printed onto solid plastic fits existing display boards.

Web Video Promotion – In 2011 the SRWMO and ACD created a web video about lakeshore landscaping. That video resides on the SRWMO webpage. In 2012 the ACD promoted that video by emailing it to all SRWMO cities and lake associations, asking that they forward it to others would would be interested.

Blue Thumb membership – Blue Thumb is a consortium of Minnesota agencies, plant nurseries, landscapers, and others who share resources in their efforts to promote the use of native plants to improve water quality through shoreline stabilizations, rain gardens, and native plant gardens. Resources that are shared amongst Blue Thumb members include pre-fab marketing materials, displays, how-to manuals, and others. The ACD enrolled the SRWMO in Blue Thumb and performed all necessary administration to maintain the membership and renew it in 2012.

The ACD manages the SRWMO's Blue Thumb membership by submitting annual membership applications and tracking SRWMO contributions. Maintaining a Blue Thumb membership requires an annual contribution of either $1,500 cash or 30 hours of efforts. The SRWMO chooses to meet this requirement by incorporating Blue Thumb into a variety of tasks that are already planned and benefit from Blue Thumb (including those listed above). In 2012 the SRWMO exceeded the 30 hour commitment with the following work:

- Web video about shoreline stabilization.
- Presentation at Linwood Lake Association annual meeting
- Demonstration project at Linwood Lake, Gustafson property.
- Grant applications for potential projects.
- Martin Lake rain garden maintenance.

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, and accomplishments.

Results: In 2012 the SRWMO contracted with the ACD to write the annual newsletter and provide it to member communities for distribution in their newsletters. Topics for annual newsletter were discussed by the SRWMO Board, and septic system maintenance was chosen. The article was also to include the SRWMO website address and general organizational information.

Limited space in city newsletters was recognized as an issue. To keep the article size minimal, yet deliver a memorable message, ACD staff wrote a poem. This form kept the article snappy and somewhat humorous. It was provided to member cities for their city newsletters in May.

SRWMO 2012 newsletter article, which was published in member city newsletters

Ode to the Septic System

A magical thing happens right under my lawn
I flush the toilet, it goes there, then gone!
That wonderful septic takes all that we do
Every drop is digested, even numbers one & two

Sounds like my job, perhaps you might say
Then you understand TLC can brighten the day
Attention and maintenance is not merely a perk
So let's take a look at how that septic system works

Because of the baffles, the tank keeps the poo
Which needs to be pumped every 3rd year or two
The liquids pass on to the drainfield with ease
Its pipes have holes, just like Swiss cheese

Speaking of doo, here's what you should
Using less water is wonderfully good
Don't do the laundry many loads in a row
Overloading could cause the system to blow

The 'don't' list is longer and cannot be rushed
A whole lot of things just shouldn't be flushed
Kleenex, solvents, paints, and antifreeze
Foods like fat, oil, coffee grounds, and veggies

Poison, cigarettes, and anti-bacterials too
Old meds and even feminine products are taboo

Don't drive on the drainfield or it will get crushed
Light a match near the tank and explode in a rush
Inside the tank is icky, and no place to play
If you smell yuck in your home call for help right away

When will I know there's a problem you think?
How about when your basement is flooded with stink
If your drains won't dry even after you plunge
The yard becomes soggy like a big poopy sponge

So for the sake of our lakes, streams, and your piggy bank
Please have someone regularly pump your septic tank

Brought to you by the Sunrise River Watershed Management Organization (SRWMO). We are considering establishing a low interest loan program to help homeowners with septic system upgrade or replacement, particularly in shoreland areas. If interested, please contact Jamie Schurbon at 763-434-2030 ext. 12 or jamie.schurbon@anokaswcd.org.

For more information about the SRWMO, please visit www.AnokaNaturalResources.com\srwmo

SRWMO Website

Description: The Sunrise River Watershed Management Organization (SRWMO) contracted the Anoka Conservation District (ACD) to design and maintain a website about the SRWMO and the Sunrise River watershed. The website has been in operation since 2003.

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.AnokaNaturalResources.com/SRWMO

Results: 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.

Other tools on the website include:

- an interactive mapping tool that shows natural features and aerial photos
- an interactive data download tool that allows users to access all water monitoring data that has been collected
- narrative discussions of what the monitoring data mean

SRMWO Website Homepage

Grant Searches and Applications

Description: The Anoka Conservation District (ACD) assisted 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: At the direction of the SRWMO Board, in 2012 ACD staff prepared two grant requests in cooperation with the SRWMO:

1. **Martin and Coon Lake Stormwater Retrofits, BWSR Clean Water Fund Request**

   We proposed to install stormwater retrofits identified in the Martin Lake (complete) and Coon Lake (2013) stormwater retrofit assessments. Those studies identify opportunties to improve stormwater treatment to the lake. We proposed to install a network of a network of up to seven strategically-placed rain gardens, retrofit up to two catch basins with SAFL Baffles (a screen that reduces turbulence inside the structure and improves its ability to retain sediment), and add check dams to an existing roadside swale. In total, these projects would reduce discharge of phosphorus to these lakes by 4.22 lbs/yr and suspended solids by 3,862 lbs/yr. Our grant request was for $82,046. The SRWMO committed the minimum allowable match of $20,512 (25% of grant). This grant application was not successful.

   Grant awarded: No

2. **Typo and Martin Lake Carp Barriers, DNR Conservation Partners Legacy Request**

   This project was awarde a DNR Conservation Partners Legacy grant in 2011 for $128,938. Later, we discovered this budget would be inadequate for project installation; the engineer's original cost estimate was too low. We requested an additional $92,392 and the SRWMO provided additional match required. This grant request was successful.

   Grant awarded: Yes. $92,392

SRWMO 2011 Annual Report to BWSR

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).

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 a 2011 Sunrise River WMO Annual Report. ACD drafted the report and a cover letter. The draft was provided to the SRWMO Board on March 29, 2012. After SRWMO Board review, on April 13, 2012, 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

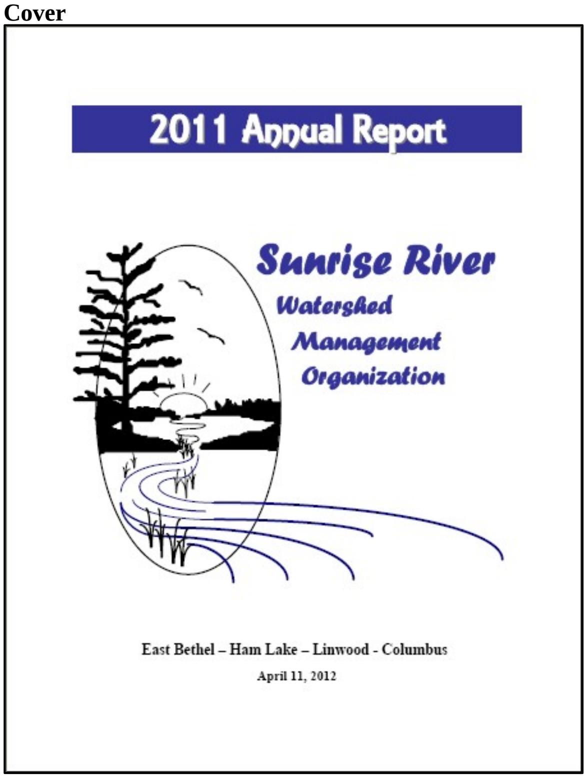


Table of Contents

Table of Contents

1

Review Local Water Plans

Description: SRWMO member municipalities must update their Local Water Management Plans and ordinances within 2 years of the adoption of the new SRWMO Plan (MN Rules 8410.0130 and 84100160). All must be consistent with the SRWMO Plan. The SRWMO has approval authority over the Local Water Management Plans. Once a community submits their updated Local Water Management Plan to the WMO for review, the WMO has 60 days to provide comments. The Metropolitan Council has a simultaneous 45-day review period, and the WMO's review of the Plan must include a review of Metropolitan Council's comments. ACD assists the SRWMO by providing a technical review of Local Water Management Plans, as they are completed, and Metropolitan Council's comments on each.

ACD's assistance includes:

- Reviewing each of the four member municipalities' draft local water management plan, and any relevant ordinances, for consistency with the SRWMO Plan.
- Writing comments in the form of a letter to the municipality and presenting it to the SRWMO Board.
- Sending the comments to the municipality when authorized by the SRWMO Board.
- Do all of the above within the 60 day comment period allowed by law.

Purpose: To ensure consistency between municipal local water plans and the SRWMO Watershed Management Plan.

Results: All local water plans, except Ham Lake, have been approved. The following is the status of each city or township's local water plan, as of December 17, 2012:

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

Ham Lake – The Ham Lake Local Water Plan was reviewed in January 2012. The staff recommendation is for approval, contingent upon inclusion of the SRWMO wetland standards. In 2012 the City has expressed concerns about inconsistencies between the URRWMO and SRWMO standards, both of which affect the City. The situation is not yet rectified.

East Bethel – The SRWMO received a draft local water plan in June 2010. Changes were requested. In May 2011 a final draft was received and approved.

Columbus – Approved at the February 2011 SRWMO meeting.

Deadline for all – June 3, 2012 is the deadline for all SRWMO cities and townships to revise local water plans and ordinances to be consistent with the SRWMO 3rd Generation Watershed Management Plan.

On-call Administrative Services

Description: The Anoka Conservation District Water Resource Specialist provides limited, on-call administrative assistance to the SRWMO. Tasks are limited to those defined in a contractual agrenement.

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

Results: In 2012 a total of 26.2 hours of administrative assistance were performed. This exceeded the alloted hours and budgeted amout of 20.5 hours. Acutal hours also exceeded the budget in 2011. It is recommended that the SRWMO increase its budget for administrative services in the future.

The following tasks were accomplished:

- Facilitated the Watershed Plan amendment process including writing amendments, sending them for agency review, posting public notices, writing the record of public hearing, and providing final drafts to all member communities and agencies.
- Annual financial reporting to the State Auditor, which is separtate from annual reporting to BWSR.
- Posted notice of one special meeting.
- Reminders to member cities to submit annual reports to the SRWMO.
- Responded to board member emails.
- Correspondenced with member cities including budget information and a request for copies of the JPA.
- Reviewed Linwood Township's comprehensive plan.
- Tabulated the SRWMO's Blue Thumb in-kind contributions and reported them on the Blue Thumb website.
- Administrative reporting of the SRWMO's cost share grant fund.
- Corresponded with Ham Lake regarding their concerns about SRWMO wetland standards.
- Attended SRWMO meetings to discuss the above issues.
- Meeting preparations including distributing materials to Board members and the agenda.
- Prepared 2014 SRWMO draft budget.

Financial Summary

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	Ref Wet	Lake Lvl	Stream Level	Lake WQ	Stream WQ	Martin/Typo Carp Bariers	SRWMO Admin	Cost Share/ Lakescape/ Rain Garden	SRWMO Outreach/Promo	SRWMO Retrofit Promo	SRWMO Retrofit Install	Coon Lake Assmt	On-call SRWMO admin (hourly)	SRWMO Grant Search	Total
Revenues															
SRWMO	1650	850	1100	6570	2660	11651	1195	29	1490	0	0	0	1500	1000	29696
State	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Anoka Conservation District	0	0	0	0	0	18827	0	0	961	0	278	2745	413	421	23645
County Ag Preserves	0	0	0	1946	0	0	0	0	0	2431	0	0	0	0	4378
Regional/Local	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Service Fees	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Local Water Planning	0	105	0	1295	346	0	0	0	0	0	0	0	0	0	1746
TOTAL	1650	955	1100	9811	3006	30478	1195	29	2451	2431	278	2745	1913	1421	59464
Expenses-															
Capital Outlay/Equip	12	9	6	83	19	190	3	0	16	0	0	24	23	29	412
Personnel Salaries/Benefits	1106	819	852	6176	1594	16172	675	0	2088	0	245	2364	1648	1184	34923
Overhead	88	65	69	537	130	1357	59	0	167	0	15	201	127	143	2958
Employee Training	2	2	3	8	5	36	4	0	6	0	0	3	6	0	76
Vehicle/Mileage	24	17	18	134	32	339	12	0	48	0	8	58	28	18	736
Rent	49	38	44	257	76	733	45	0	99	0	10	97	81	48	1575
Program Participants	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Program Supplies	8	4	27	2617	1150	11651	135	0	27	2431	0	0	0	0	18052
McKay Expenses	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	1290	955	1020	9811	3006	30478	932	0	2451	2431	278	2745	1913	1421	58732
NET	360	0	80	0	0	0	263	29	0	0	0	0	0	0	732

Recommendations

- **Participate the Sunrise River Watershed Restoration and Protection Project (WRAPP)** which is led by Chisago SWCD and MPCA. It will result in TMDLs for the Sunrise River and Linwood Lake.
- **Install stormwater retrofits around Coon and Martin Lakes.** A stormwater assessment is complete for Martin Lake and will be complete in 2013 for Coon Lake. They identify and rank stormwater retrofit projects that will benefit lake water quality.
- **Continue efforts to secure grants.** A number of water quality improvement projects are being identified. Outside funding will be necessary for installation of most of these. These projects should be highly competitive for those grants.
- **Bolster lakeshore landscaping education efforts.** The SRWMO Watershed Management Plan sets a goal of 3 lakeshore restorations per year. Few are occurring. New efforts or incentives are planned for 2013, and new approaches should be welcomed.
- **Increase the use of web videos as an effective education and reporting tool.**
- **Continue the SRWMO cost share grant program** to encourage water quality projects.
- **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.