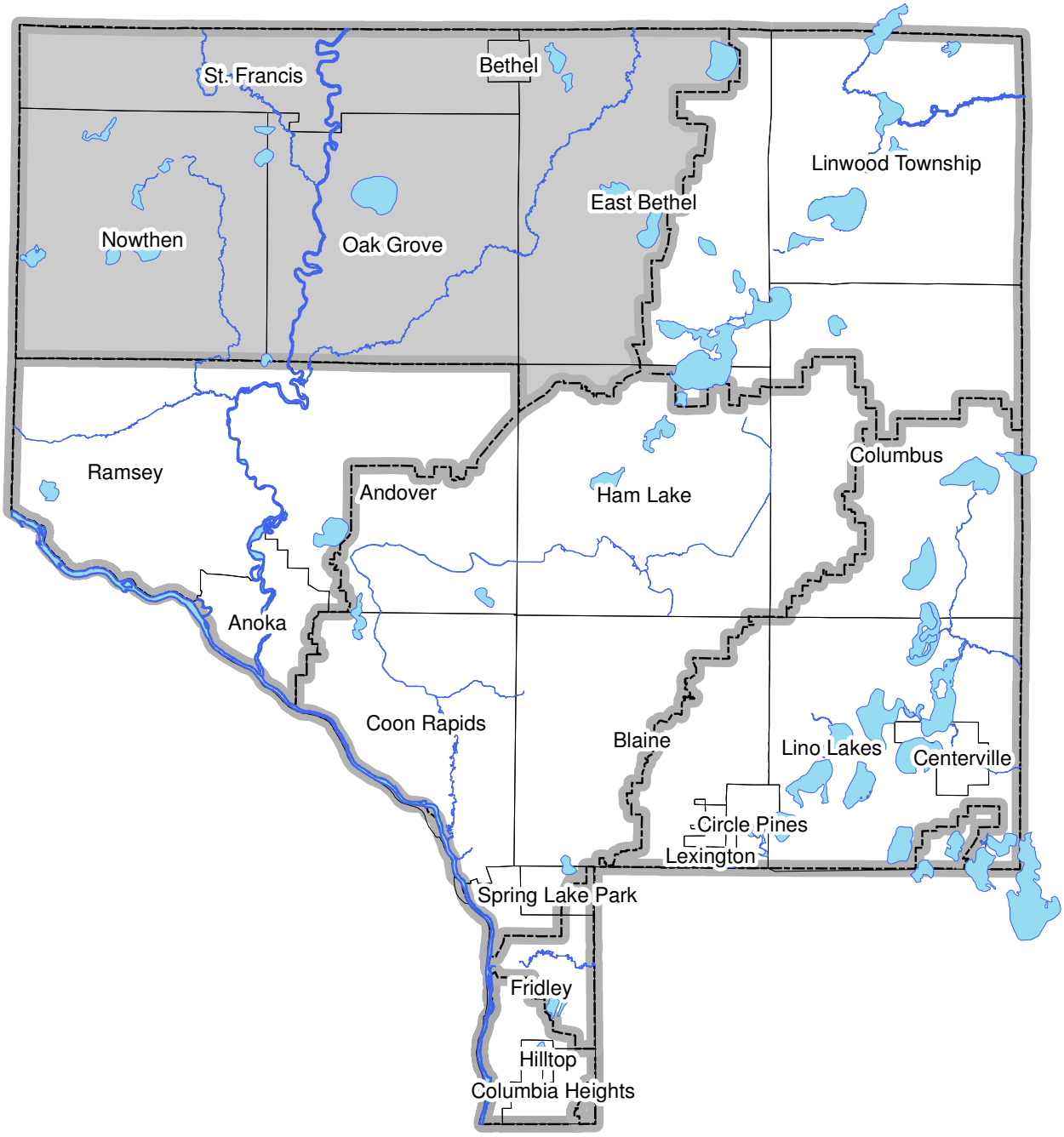
Excerpt from the
2014 Anoka Water Almanac

Chapter 3: Upper Rum River Watershed



Prepared by the Anoka Conservation District

CHAPTER 3:
UPPER RUM RIVER WATERSHED

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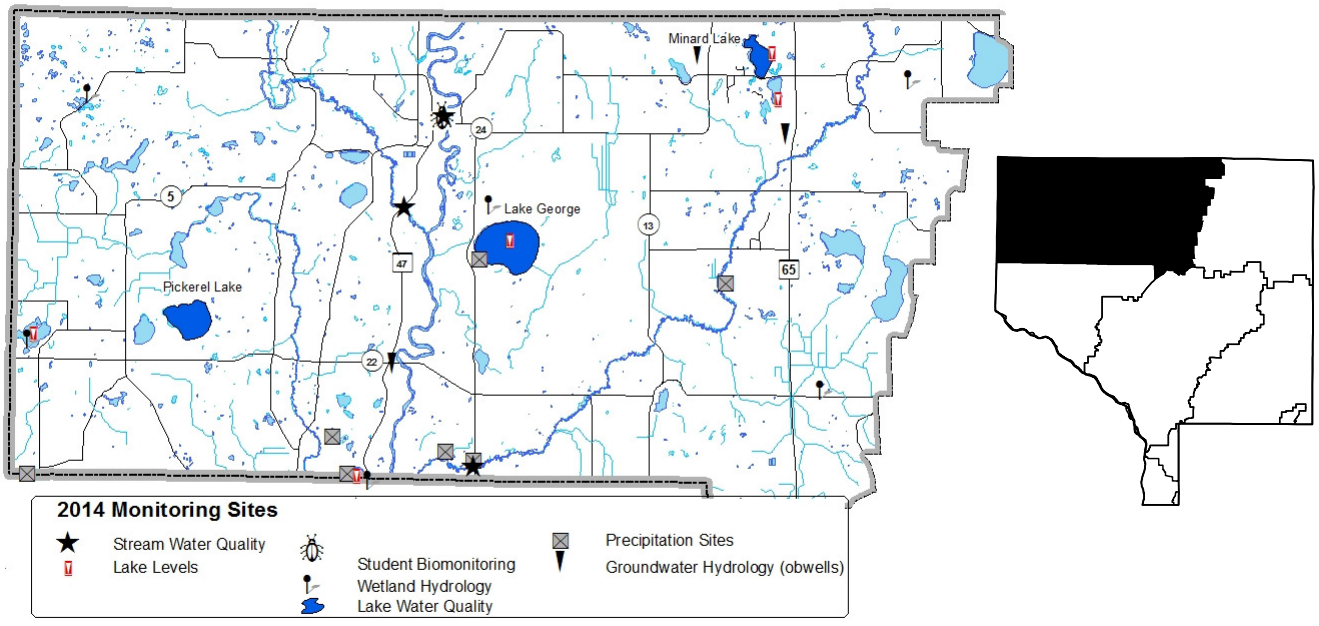
ACAP = Anoka County Ag Preserves, ACD = Anoka Conservation District,
LRRWMO = Lower Rum River Watershed Mgmt. Org, MC = Metropolitan Council
MNDNR = Minnesota Dept. of Natural Resources, URRWMO = Upper Rum River Watershed Mgmt. Org



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: East Twin Lake, Lake George, Rogers Lake, Minard Lake, Coopers Lake

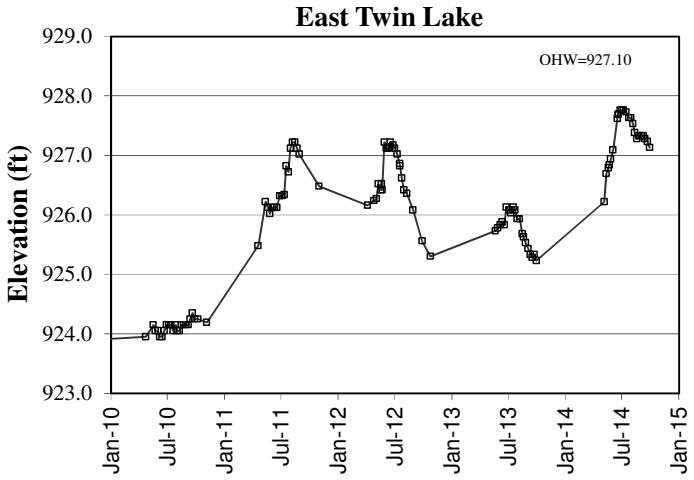
Results: Lake levels were measured by volunteers throughout the 2014 open water season. Lake gauges were installed and surveyed by the Anoka Conservation District and MN DNR. Lakes had sharply increasing water levels in spring and early summer 2014 when well above average rainfall occurred. Little rainfall 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.

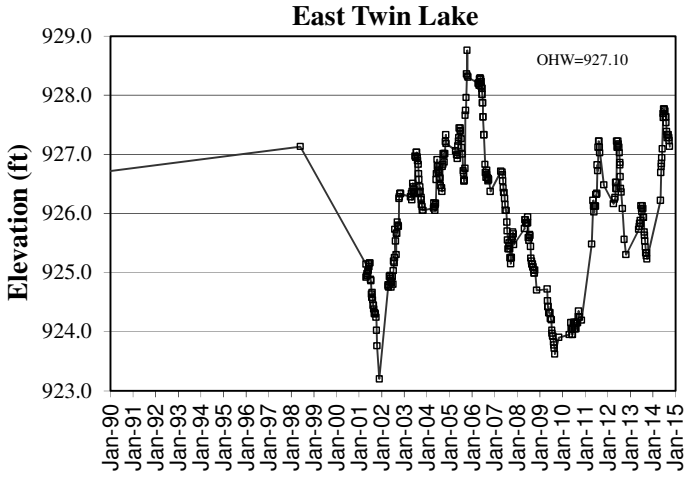
2011 and 2012 were the first years for monitoring Coopers and Minard Lakes. In recent years, there had been complaints about disproportionately low water in Coopers Lake and questions about why Minard Lake did not seem to have this problem. Indeed, both lakes have had similar maximum water levels in spring (Minard slightly higher because it is upstream). But Coopers Lake level drops rapidly by several feet in dry conditions, while Minard Lake is maintained higher.

The reasons for differences between Minard and Coopers Lake are likely due to both the elevation of the culvert between the lakes, as well as differences in geology and groundwater interaction. Minard Lake can flow into Coopers Lake through a road culvert when the water is high enough. More often, Minard Lake does not outflow. It therefore maintains higher water even during drought. Coopers Lake can have surface water outflows at lower elevations; it drains to wetlands south of the lake. At very low water levels surface water runout from Coopers Lake also ceases but lake levels continue to drop. Anoka County LiDAR confirms this, suggesting geology and groundwater connections also are important.

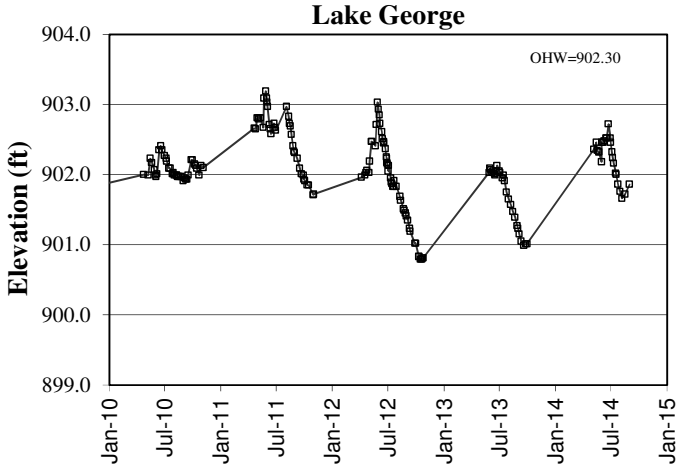
East Twin Lake Levels – last 5 years



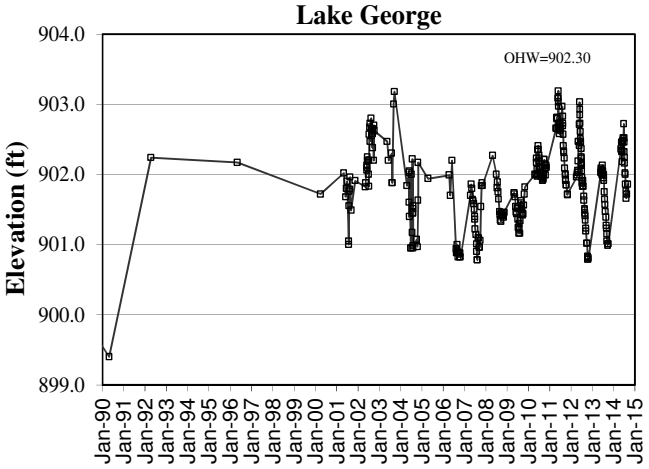
East Twin Lake Levels – last 25 years



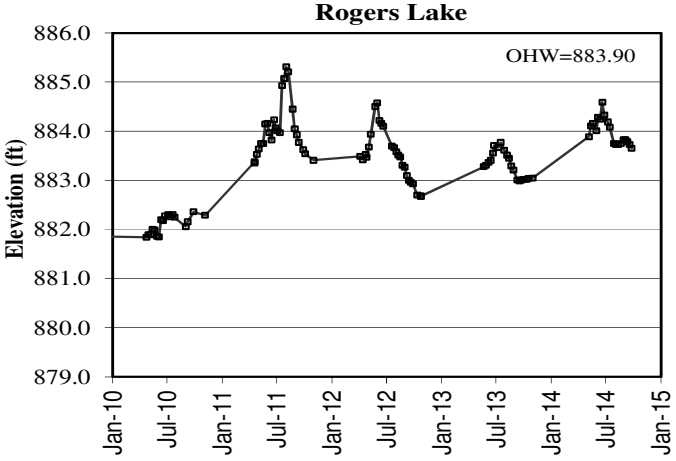
Lake George Levels – last 5 years



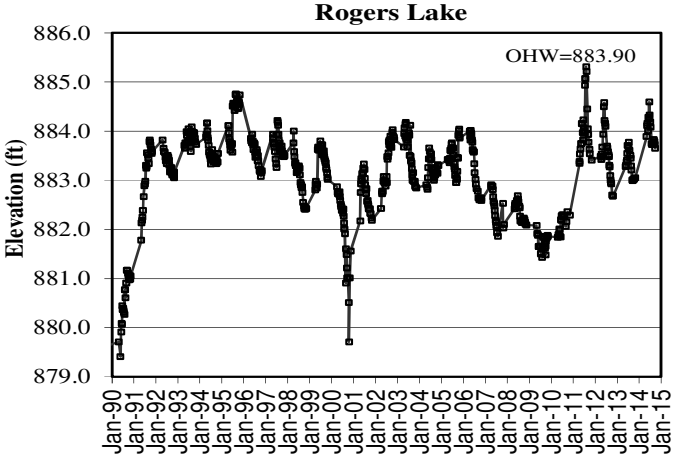
Lake George Levels – last 25 years



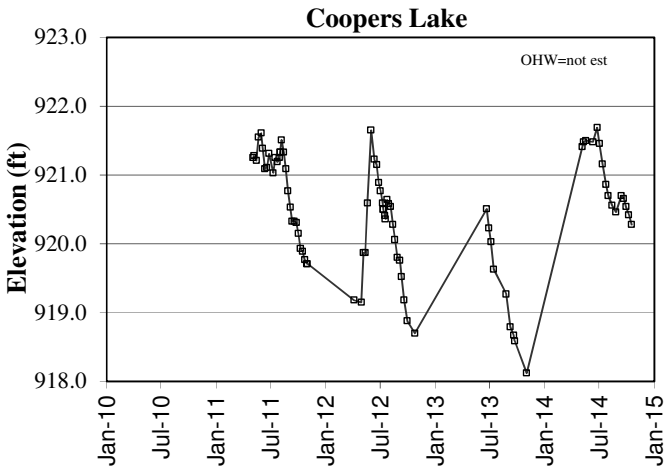
Rogers Lake Levels – last 5 years



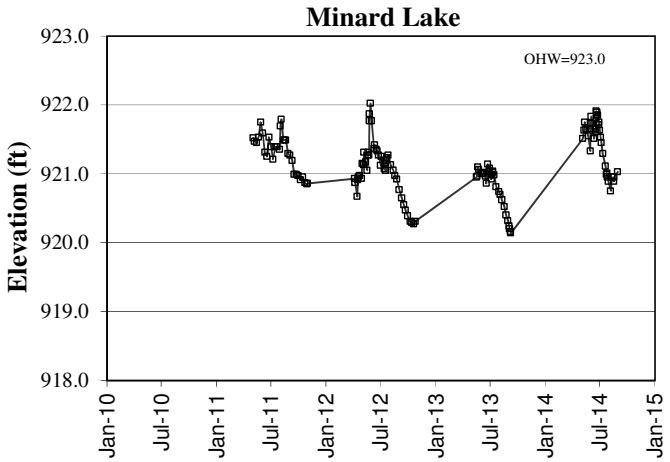
Rogers Lake Levels – last 25 years



Coopers Lake Levels – last 5 years



Minard Lake Levels – last 5 years



Lake Water Quality

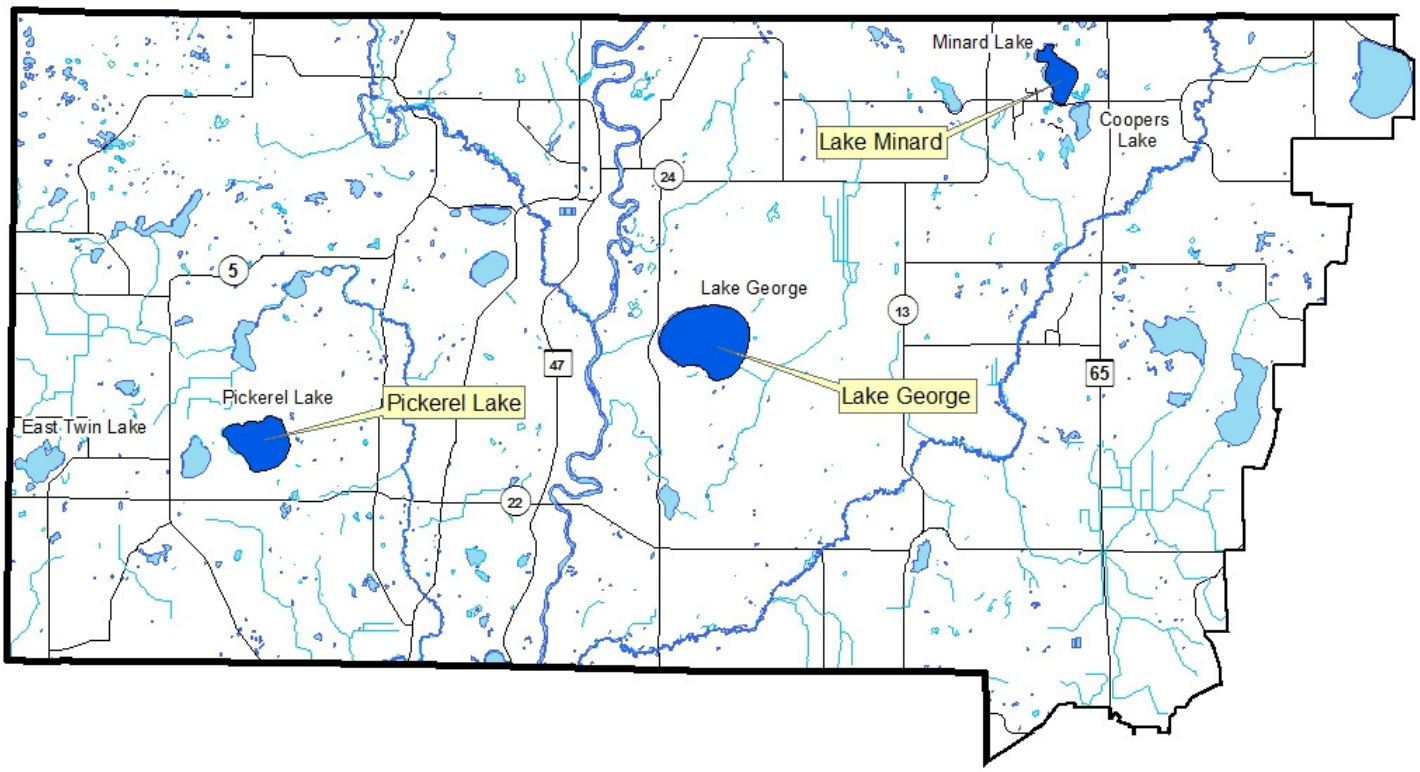
Description: May through September at least once-monthly monitoring of the following parameters: total phosphorus, chlorophyll-a, Secchi transparency, dissolved oxygen, turbidity, temperature, conductivity, pH, and salinity.

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

Locations: Lake George
Lake Minard
Pickerel 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 at the MPCA's electronic data access website. Refer to Chapter 1 for additional information on interpreting the data and on lake dynamics.

Upper Rum River Watershed Lake Water Quality Monitoring Sites



Lake George

CITY OF OAK GROVE, LAKE ID # 02-0091

Background

Lake George is located in north-central Anoka County. The lake has a surface area of 535 acres with a maximum depth of 32 feet (9.75 m). Public access is from Lake George County Park on the lake's north side, where there is both a swimming beach and boat launch. About 70% of the lake is circumscribed by homes; the remainder is county parkland. The watershed is mostly undeveloped or vacant, with some residential areas, particularly on the lakeshore and in the southern half of the watershed. Two invasive exotic aquatic plants are established in this lake, Curly-leaf pondweed and Eurasian Water Milfoil. The lake improvement district treats both with herbicide.

2014 Results

In 2014 Lake George had good water quality for this region of the state (NCHF Ecoregion), receiving an overall B grade. The lake is mesotrophic. Total phosphorus averaged 25.5 ug/L, lower from the previous year. Secchi transparency was over 15 feet in late-May, but dropped to as low as 3.1 feet in late July. Average Secchi transparency was 7.4 feet, the second poorest observed. Chlorophyll-a averaged 6.4 mg/L, which is below the average of all years monitored. Total Phosphorous, Chlorophyll-a, and transparency were poorest in July.

Trend Analysis

Fifteen years of water quality data have been collected by the Metropolitan Council (between 1980 and '94, 1998 and 2009) and the Anoka Conservation District (1997, 1999, 2000, 2002, 2005, 2008, 2011,2013 and 2014). Water quality as a whole has not significantly changed from 1980 to 2014 (repeated measures MANOVA with response variables TP, Cl-a, and Secchi depth, $F_{2,14}= 0.76$, $p=0.49$). However, when analyzed individually Secchi Transparency indicates a significant decrease (one-way ANOVA $F_{1,15}= 6.18$, $p=0.03$)

Discussion

Lake George remains one of the clearest of Anoka County Lakes. Lake George and nearby East Twin Lake are valuable resources because of their condition, size, suitability for many types of recreation, and public access. Lake George is especially valuable to Anoka County due to its unique ecosystem. Most metro area lakes have a biodiversity of 10-12 different aquatic plant species; Lake George is home to 24.

Continued efforts are needed to maintain the lakes' quality including monitoring, education, and lakeshore and nutrient best management practices. One example is residential lakeshore restorations which have occurred on several properties. Still, many properties on Lake George aggressively manicure their lakeshore in ways that are detrimental to lake health. Around any developed lake failing septic systems can also be a threat to water quality. This concern exists at Lake George, but is reduced because many homes are served by a community sewer system.

Two exotic invasive plants are present in Lake George, Curly leaf pondweed and Eurasian Water milfoil. A Lake Improvement District was formed to orchestrate control of these plants and multiple years of localized treatments have occurred. Concern has been voiced that plant treatments may have a negative impact on water quality. In 2013 water quality monitoring showed a dramatic rise in phosphorus shortly after curly leaf pondweed treatment and it was suspected that the herbicide treatment may have caused the phosphorus increase. In The 2014 water quality data was collected immediately before and after herbicide treatment to determine if this was the case. In

2014, no upward spike of phosphorus occurred after herbicide treatment, however the water quality results were similar 2013.

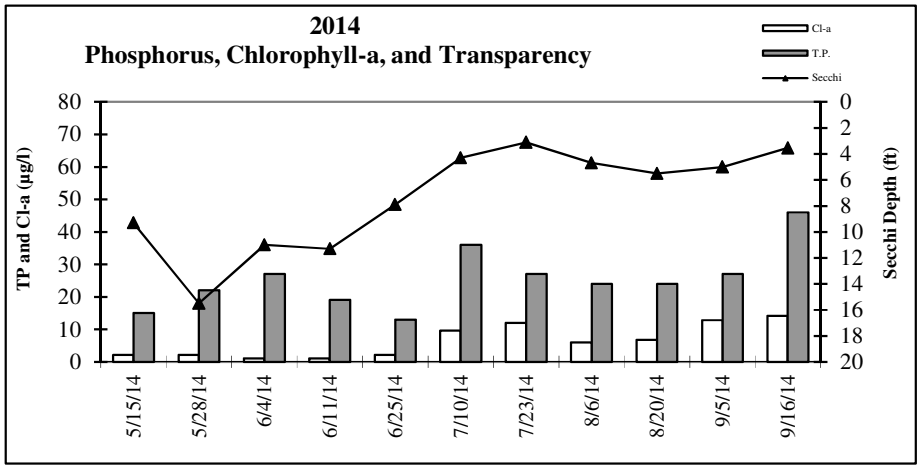
In 2014 the invasive plants were mapped out earlier in the season to allow for earlier treatment. While immediate impacts were not observed in 2014 future monitoring and continued modified herbicide treatments may provide insight. The lake improvement district, DNR, and Anoka Conservation District are continuing to mold a plan that includes additional water quality monitoring especially before and after herbicide treatments, annual plant surveys, sediment coring to determine internal nutrient loading, examining fish data to determine any possible water quality impacts of fish and management strategies, observing water introduced through the lake's inlets, and treating curly leaf pondweed earlier to minimize water quality impacts that are more likely when water is warmer.

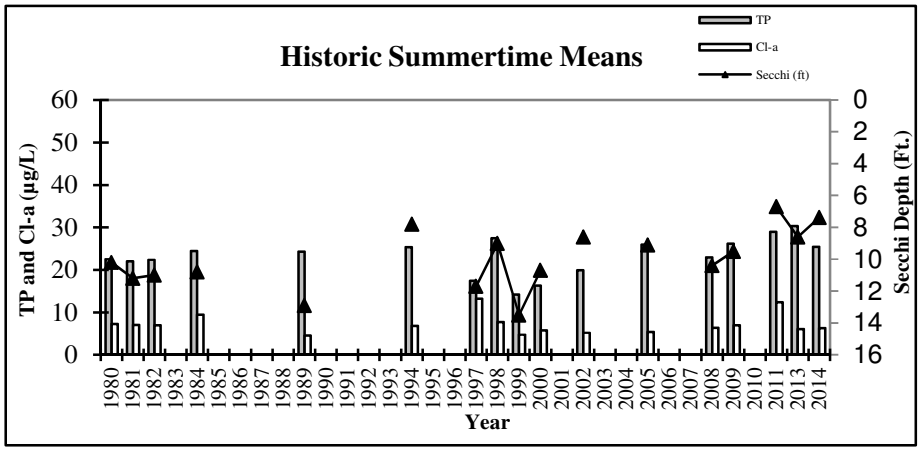
2014 Lake George Water Quality Data

Lake George 2014 Water Quality Data			5/15/2014 13:15	5/28/2014 13:15	6/4/2014 13:45	6/11/2014 12:45	6/25/2014 12:45	7/10/2014 13:00	7/23/2014 12:30	8/6/2014 13:15	8/20/2014 15:30	9/5/2014 13:50	9/16/2014 13:25			
	Units	R.L.*	Results	Results	Results	Results	Results	Results	Results	Results	Results	Results	Results	Average	Min	Max
pH		0.1	8.4	8.38	8.39	8.57	8.54	8.92	9.14	9.52	9.48	8.66	8.77	8.80	8.38	9.52
Conductivity	mS/cm	0.01	0.226	0.221	0.213	0.214	0.211	0.211	0.222	0.233	0.232	0.254	0.234	0.22	0.211	0.254
Turbidity	NTU	1.00	1.30	0.00	0.00	0.80	8.80	7.50	19.10	6.60	3.50	12.20	11.50	6.48	0.00	19.10
D.O.	mg/L	0.01	12.17	9.41	8.48	9.44	8.54	9.36	8.58	10.03	9.69	8.56	9.83	9.46	8.48	12.17
D.O.	%	1	115.9%	105.2%	100.6%	109.7%	103.4%	115.6%	107.0%	125.5%	122.2%	98.1%	103.8%	110%	98%	126%
Temp.	°C	0.1	12	20	22	22	24	25	25	25	25	22	17	21.78	11.9	25.4
Temp.	°F	0.1	53.3	68.5	72.2	72.3	74.8	76.2	77.7	77.6	77.3	71.0	62.3	71.21	53.3	77.7
Salinity	%	0.01	0.11	0.11	0.1	0.1	0.1	0.1	0.11	0.11	0.11	0.12	0.11	0.11	0.10	0.12
Cl-a	ug/L	0.5	2.1	2.1	1.1	1.1	2.1	9.6	12	6	6.8	12.8	14.2	6.35	1.1	14.2
T.P.	mg/L	0.010	0.015	0.022	0.027	0.019	0.013	0.036	0.027	0.024	0.024	0.027	0.046	0.03	0.013	0.046
T.P.	ug/L	10	15	22	27	19	13	36	27	24	24	27	46	25.45	13	46
Secchi	ft	0.1	9.3	15.5	11	11.3	7.9	4.3	3.11	4.7	5.5	5	3.55	7.38	3.1	15.5
Secchi	m	0.03	2.83	4.72	3.35	3.44	2.41	1.31	0.95	1.43	1.68	1.52	1.08	2.25	0.9	4.7
Physical			1.0	1.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0	2.0	1.0	1.18	1.0	2.0
Recreational			1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.00	1.0	1.0

*reporting limit

		2014 Median
pH		8.80
Conductivity	mS/cm	0.225
Turbidity	FNRU	6.00
D.O.	mg/l	9.46
D.O.	%	110.00%
Temp.	°C	21.80
Temp.	°F	71.20
Salinity	%	0.11
Cl-a	ug/L	6.40
T.P.	mg/l	0.03
T.P.	ug/l	25.50
Secchi	ft	7.40
Secchi	m	2.20





Lake George Summertime Annual Means

Agency	MC	MC	MC	MC	MC	MC	ACD	MC	ACD	ACD	ACD	ACD	ACD	MC	MC	ACD	ACD
Year	1980	1981	1982	1984	1989	1994	1997	1998	1999	2000	2002	2005	2008	2009	2011	2013	2014
TP	22.5	22.0	22.3	24.4	24.3	25.4	17.4	27.5	14.2	16.3	19.9	26.0	23.0	26.2	29.0	30.3	25.5
Cl-a	7.3	7.1	7.0	9.5	4.5	6.9	13.2	7.8	4.8	5.8	5.2	5.4	6.4	7.0	12.4	6.1	6.4
Secchi (m)	3.1	3.4	3.4	3.3	3.9	2.4	3.6	2.7	4.1	2.8	2.6	2.8	3.2	2.9	1.8	2.6	2.2
Secchi (ft)	10.2	11.2	11.0	10.8	12.9	7.8	11.7	9.0	13.5	10.7	8.6	9.1	10.4	9.5	6.7	8.6	7.4

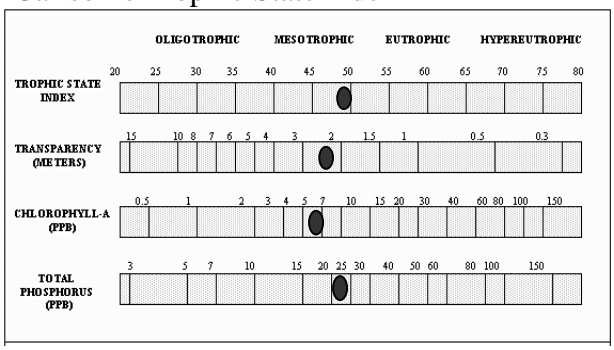
Carlson's Tropic State Indices

TSIP	49	49	49	50	50	51	45	52	42	44	47	51	49	51	53	53	51
TSIC	50	50	50	53	45	50	56	51	46	48	47	47	49	50	55	48	49
TSIS	44	42	43	43	40	48	42	45	40	45	46	45	43	45	52	46	49
TSI	48	47	47	49	45	49	48	49	43	46	47	48	47	49	53	49	49

Lake George Water Quality Report Card

Year	80	81	82	84	89	94	97	98	99	2000	2002	2005	2008	2009	2011	2013	2014
TP	A	A	A	B	B	B	A	B	A	A	A	B	B+	B	B	B	B
Cl-a	A	A	A	A	A	A	B	A	A	A	A	A	A	A	B	A	A
Secchi	A	A	A	A	A	B	A	B	A	B	B	B	A	B	C	B	B
Overall	**A**	**A**	**A**	**A**	**A**	**B**	**A**	**B**	**A**	**A**	**A**	**B**	**A**	**B**	**B**	**B**	**B**

Carlson's Trophic State Index



MINARD LAKE

CITY OF EAST BETHEL, LAKE ID # 02-0067

Background

Minard Lake is located in the northern portion of the county near the City of Bethel. Public access is available only along the right of way of 237th Avenue. According to the MNDNR Lakes Database, Minard Lake has a surface area of 135 acres with a maximum depth of 7.0 feet (2.13 m). Aquatic plants grow to near the surface on much of the lake, though no invasive species were noted during sampling. The watershed is mostly undeveloped or vacant, with some residential areas on the East side of the watershed.

In 2013 and 2014 this lake was monitored by the Anoka Conservation District as part of the MPCA's Rum River Watershed Restoration and Protection Project (WRAP).

2014 Results

In 2014, the overall water quality grade for Minard Lake was a B grade. The limited data available indicates that the lake is mesotrophic. In 2014 the average surface total phosphorus (TP) concentration was 38 µg/l (maximum of 62 µg/l and a minimum of 24 µg/l) receiving a B grade. The average Chlorophyll-a (Cl-a) concentration was 2.3 µg/l (maximum of 3.2 µg/l and a minimum of 1.1 µg/l) receiving an A grade. Vegetation prevented accurate Secchi transparency readings.

Trend Analysis

Insufficient historical data available to conduct any trend analysis. Aside from 2013 and 2014, the only available data are Secchi transparency readings from 1990, 1991, and 2008. Those readings are similar to 2013 and 2014.

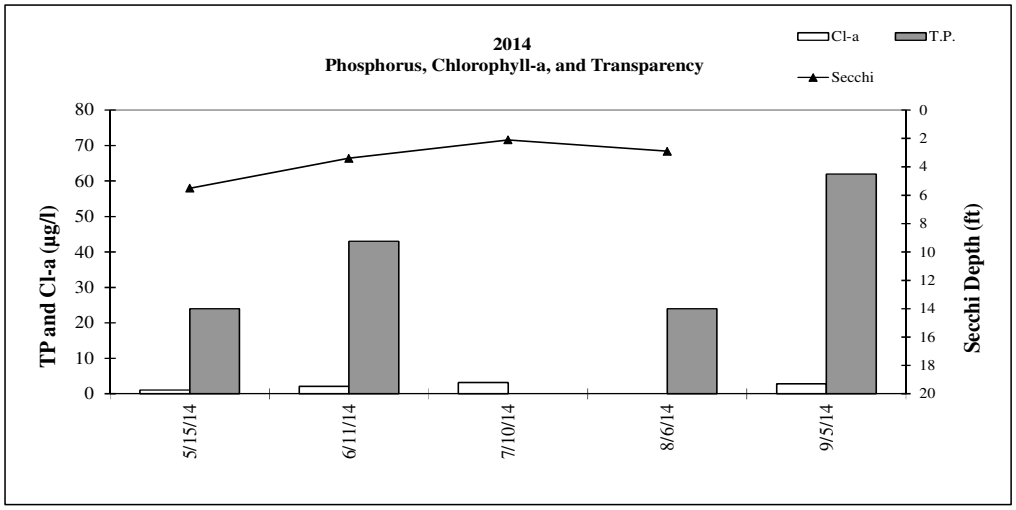
Discussion

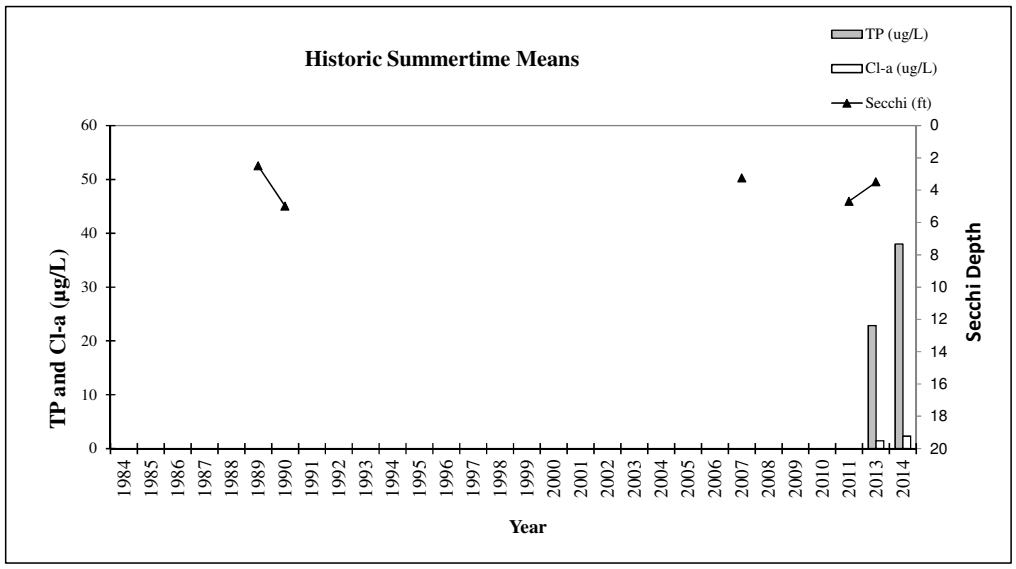
During each sampling event, the recreational suitability and physical conditions were evaluated. These rankings are based on the subjective perception of ACD staff regarding the appearance of the lake. The physical condition of the lake was consistently perceived as having an abundance of aquatic vegetation. This vegetation has a negative impact on recreation, but is indicative of a healthy shallow lake.

2014 Minard Lake Water Quality Data

Lake Minard	Units	R.L.*	5/15/2014 12:30 Results	6/11/2014 11:50 Results	7/10/2014 13:20 Results	8/6/2014 12:35 Results	9/5/2014 13:10 Results	Average	Min	Max
pH		0.1	8.13	8.11	7.87	9.66	7.59	8.272	7.59	9.66
Conductivity	mS/cm	0.01	0.159	0.167	0.172	0.18	0.203	0.1762	0.159	0.203
Turbidity	NTU	1	2	2.9	7.1	1.4	6.8	4.04	1.4	7
D.O.	mg/L	0.01	11.26	9.22	1.21	9.94	6.8	7.686	1.21	11.26
D.O.	%	1	105.2%	109.0%	12.7%	123.1%	77.0%	85.4%	12.7%	123%
Temp.	°C	0.1	12	23	23	24	20	21	12	24.4
Temp.	°F	0.1	53.9	73.7	73.9	76.0	68.6	69.2	53.9	76.0
Salinity	%	0.01	0.08	0.08	0.09	0.09	0.1	0.088	0.08	0.10
Cl-a	ug/L	0.5	1.1	2.1	3.2	<1	2.8	2.3	1.1	3.2
T.P.	mg/L	0.010	0.024	0.043		0.024	0.062	0.03825	0.024	0.062
T.P.	ug/L	10	24	43		24	62	38.25	24	62.0
Secchi	ft	0.1	5.5	3.4	2.11	2.9	> 3	3.4775	2.11	5.5
Secchi	m	0.1	1.68	1.04	0.64	0.88		1.06	0.64	1.68
Physical			1.0	1.0	1.0	2.0	1.0	1.2	1.0	2.0
Recreational			1.0	1.0	1.0	4.0	1.0	1.6	1.0	4.0

*reporting limit





Lake Minard Summertime Historic Mean

Agency	ACD	ACD	ACD	ACD	ACD	ACD	ACD	ACD	ACD	ACD
Year	1998	1999	2000	2002	2004	2007	2008	2010	2013	2014
TP (µg/L)									22.8	38.0
Cl-a (µg/L)									1.5	2.3
Secchi (m)							1.0		1.4	1.1
Secchi (ft)							3.2		4.7	3.5

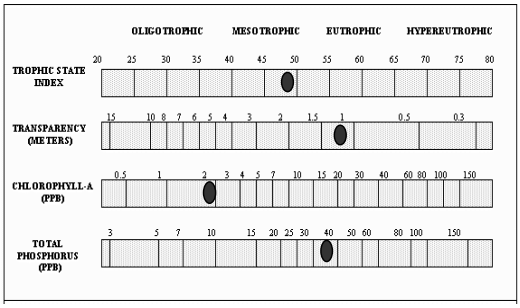
Carlson's Tropic State Indices

Year	1998	1999	2000	2003	2005	2007	2008	2010	2013	2014
TSIP									49	57
TSIC									34	39
TSIS							60		55	59
TSI							60		42	48

Lake Minard Water Quality Report Card

Year	1998	1999	2000	2003	2005	2007	2008	2010	2013	2014
TP (µg/L)									A	C
Cl-a (µg/L)									A	A
Secchi (m)									n/a	n/a
Overall									**A**	**B**

Carlson's Trophic State Index



The depth of Minard Lake and its aquatic vegetation prohibited representative Secchi disk measurements. This parameter was not included in the overall grade for the lake or the TSI for the data presented here.

PICKEREL LAKE
CITY OF NOWTHEN, LAKE ID # 02-0130

Background

Pickerel Lake is located in the northwest portion of the county. According to the MNDNR Lakes Database, Pickerel Lake has a surface area of 250 acres with a maximum depth of 5.5 feet (1.67 m). A public access is provided at the south end of the lake. Because of the shallow lake depth, recreation is limited to fishing and waterfowling.

In 2013 and 2014 this lake was monitored by the Anoka Conservation District as part of the MPCA's Rum River Watershed Restoration and Protection Project (WRAP).

2014 Results

In 2014, Pickerel Lake had above average water quality, receiving an A grade. The average surface total phosphorus (TP) concentration was 16 µg/l (maximum of 30 µg/l and a minimum of 12 µg/l) receiving an A grade. TP was below the historical average and the lowest monitored since 2010. The average Chlorophyll-a (Cl-a) concentration was 1.8 µg/l (maximum of 3.2 µg/l and a minimum of 1.1 µg/l) falling well below the historical average and receiving an A grade. The average Secchi transparency measurement was 4.9 feet (maximum of 5.6 ft. and a minimum of 3.8 ft.) receiving a C grade. The shallow depth of the lake and aquatic vegetation prohibited representative Secchi disk measurements so this parameter was not included in the overall grade for the lake.

Trend Analysis

Nine years of water quality data have been collected by the Metropolitan Council (1980, 1995, 2010 and 2011) and the Anoka Conservation District (1997, 1998, 1999, 2000, and 2013). Water quality has not significantly changed from 1980 to 2013 (repeated measures MANOVA with response variables TP, Cl-a, and Secchi depth, $F_{2,6}$= 1.02, p>0.05).

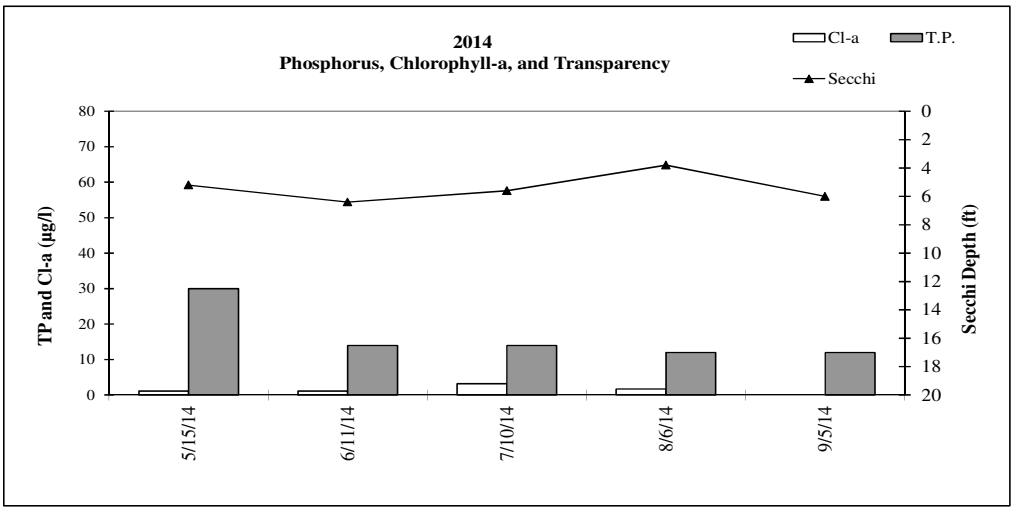
Discussion

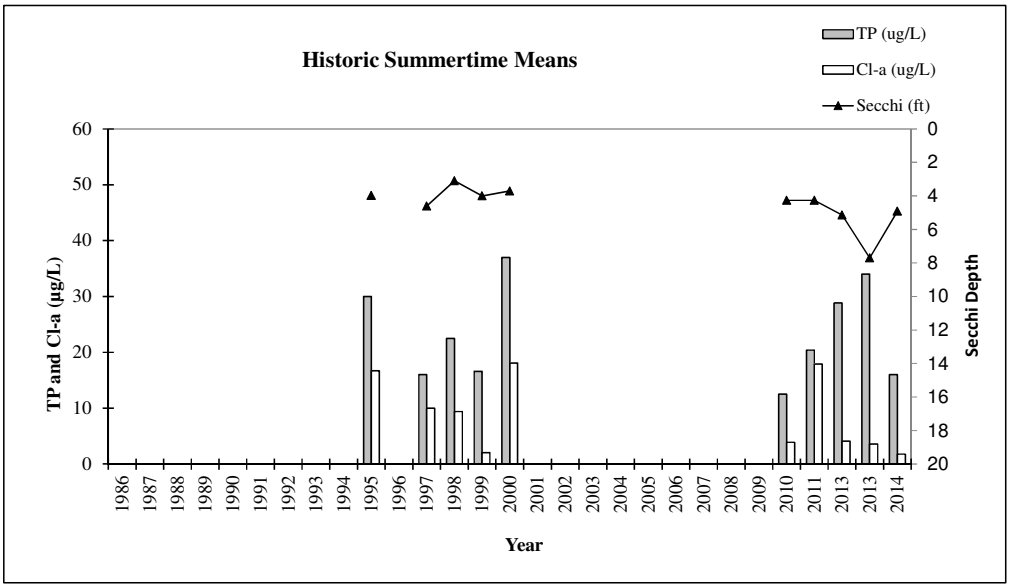
In 2014 the physical condition of the lake was consistently perceived as beautiful with occasional aesthetic issues. In terms of recreational suitability, Pickerel Lake is limited due to the abundance of rooted aquatic vegetation. This is to be expected in a healthy shallow lake, and is not problematic.

2014 Pickerel Lake Water Quality Data

Pickerel Lake			5/15/2014 13:50	6/11/2014 13:30	7/10/2014 14:10	8/6/2014 13:45	9/5/2014 14:35			
	Units	R.L.*	Results	Results	Results	Results	Results	Average	Min	Max
pH		0.1	8.35	8.79	9.21	9.24	8.57	8.83	8.35	9.24
Conductivity	mS/cm	0.01	0.235	0.207	0.185	0.197	0.238	0.212	0.185	0.238
Turbidity	NTU	1	2	0.1	3.2	1.4	2.7	2	0	3
D.O.	mg/L	0.01	12.38	10.73	10.8	8.76	8.95	10.32	8.76	12.38
D.O.	%	1	1.135	1.261	1.344	1.111	1.02	1.17	1.02	1.344
Temp.	°C	0.1	12	23	25	26	21	21.4	12.3	25.6
Temp.	°F	0.1	54.1	74.1	76.6	78.0	69.4	70.4	32.0	78.0
Salinity	%	0.01	0.11	0.1	0.09	0.1	0.11	0.10	0.09	0.11
Cl-a	ug/L	0.5	1.1	1.1	3.2	1.7	<1	1.8	1.1	3.2
T.P.	mg/L	0.010	0.03	0.014	0.014	0.012	0.012	0.016	0.012	0.030
T.P.	ug/L	10	30	14	14	12	12	16.4	0.0	30.0
Secchi	ft	0.1	5.2	>6.4	5.6	3.8	>6.0	4.9	3.8	5.6
Secchi	m	0.1	1.58		1.71	1.16		1.48		
Physical			1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Recreational			1.0	1.0	1.0	3.0	1.0	1.4	1.0	3.0

*reporting limit

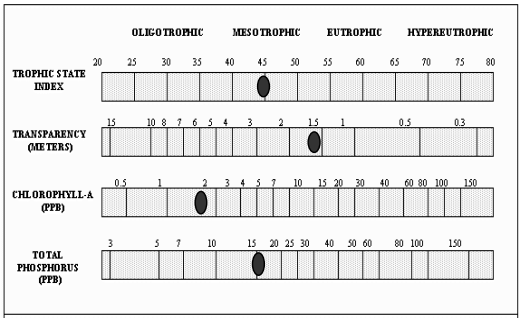




Lake Pickerel Summertime Historic Mean (Used MPCA data collected at 1 meter or less only)

Agency	MC	MC	ACD	ACD	ACD	ACD	MC	CLMP	ACD	ACD
Year	1980	1995	1997	1998	1999	2000	2010	2011	2013	2014
TP (µg/L)	32.5	30.0	16.0	22.5	16.6	37.0	12.5	20.4	28.8	16.0
Cl-a (µg/L)	19.5	16.7	10.0	9.4	2.1	18.1	3.9	17.9	4.1	1.8
Secchi (m)	0.9	1.2	1.4	0.9	1.2	1.1	1.3	1.3	1.6	1.5
Secchi (ft)	2.8	4.0	4.6	3.1	4.0	3.7	4.3	4.3	5.1	4.9
Carlson's Tropic State Indices										
Year	1980	1995	1997	1998	1999	2000	2010	2011	2013	2014
TSIP	54	53	44	49	45	56	41	48	53	44
TSIC	60	58	53	53	38	59	44	59	45	36
TSIS	62	57	55	61	57	58	56	56	54	54
TSI	59	56	51	54	47	58	47	54	49	45
Lake Pickerel Water Quality Report Card										
Year	1980	1995	1997	1998	1999	2000	2010	2011	2013	2014
TP (µg/L)	C	B	A	A	B	C	A	A	B	A
Cl-a (µg/L)	B	B	A	A	B	B	A	B	A	A
Secchi (m)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	C
Overall	**C**	**B**	**A**	**A**	**B**	**C**	**A**	**B+**	**B+**	**A**

Carlson's Trophic State Index



Aquatic Invasive Vegetation Mapping

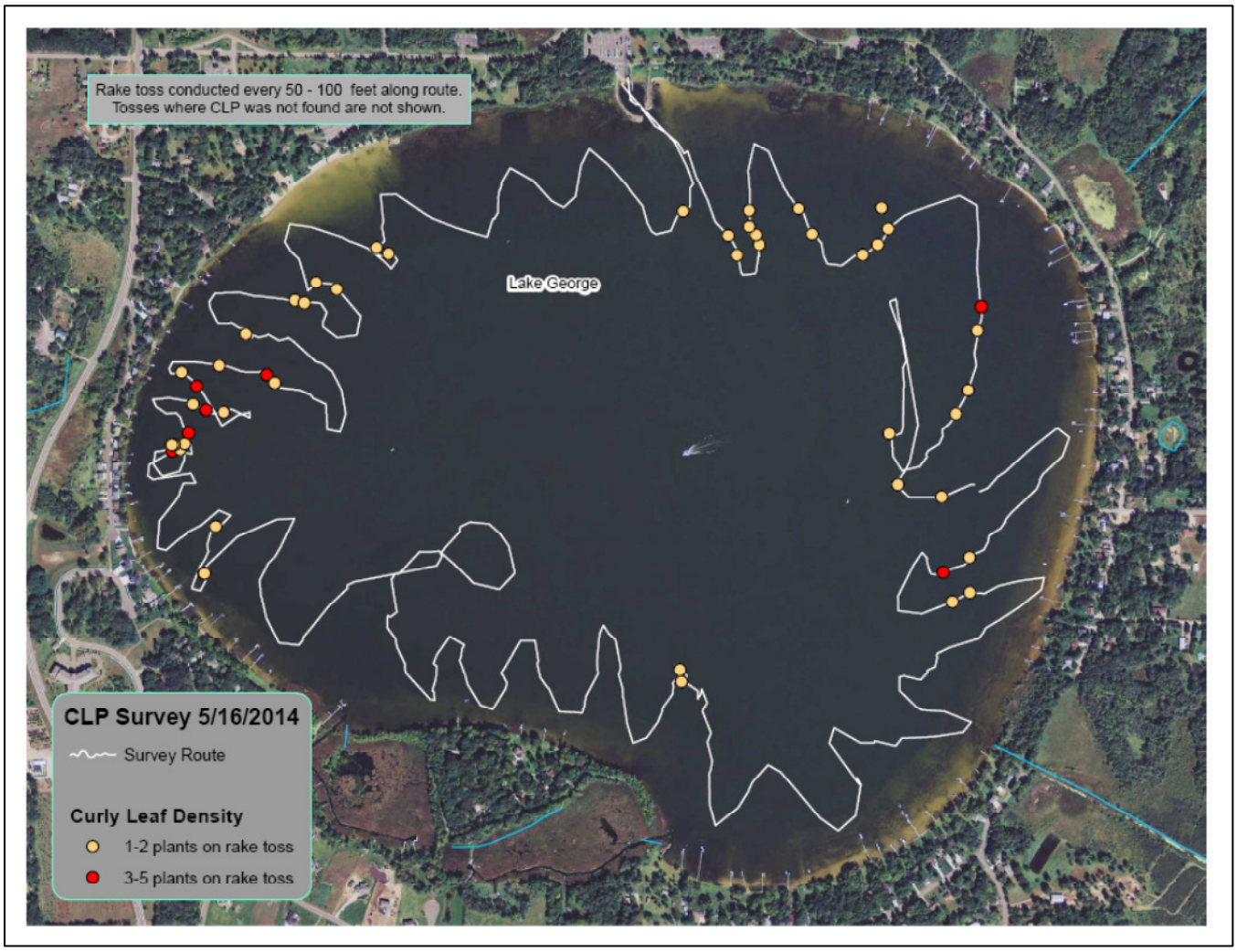
Description: The Anoka Conservation District (ACD) was contracted through the Lake George Lake Improvement District (LID) to conduct an aquatic invasive vegetation delineation.

Purpose: To map out the presence of Curly Leaf Pondweed (CLP) and Eurasian Water Milfoil (EWM) earlier in the season. This would allow for sooner chemical treatment with the goal of eliminating the bounce in nutrients following treatment seen in years past.

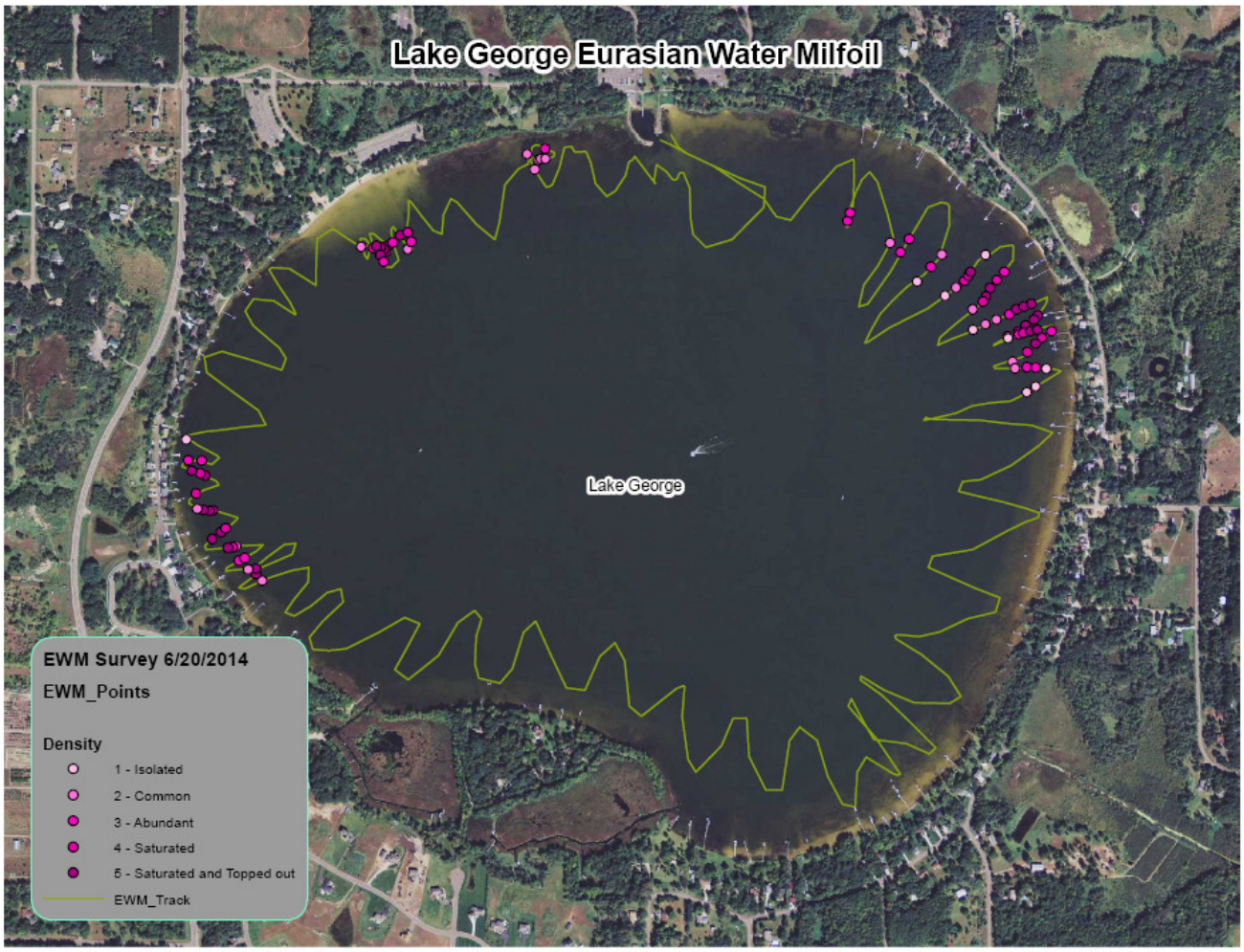
Locations: Lake George

Results: Maps are presented on the following pages. These maps were reviewed by the MNDNR and herbicide treatments occurred in areas with the most invasive plants.

2014 Lake George Curly Leaf Pondweed (CLP) Survey



2014 Lake George Eurasian Water Milfoil (EWM) Survey



Stream Water Quality - Chemical Monitoring

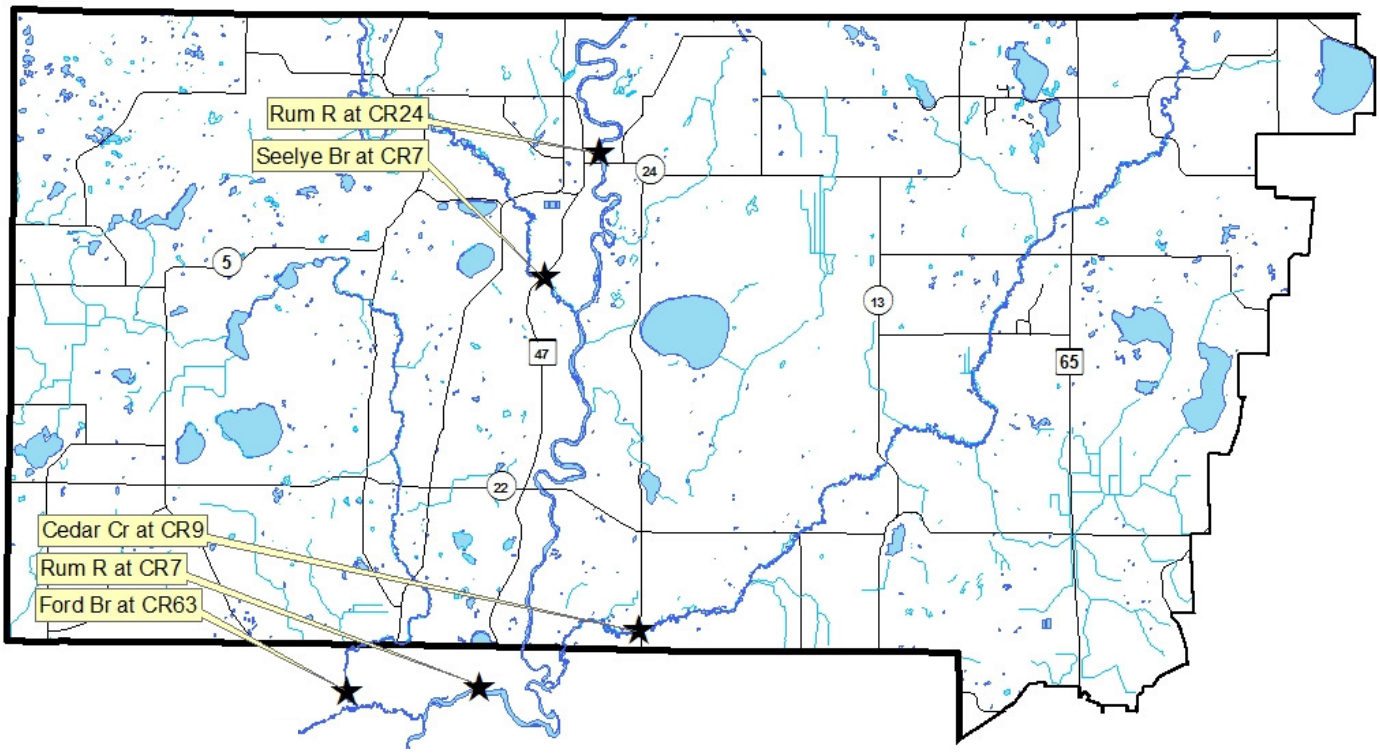
Description: The Anoka Conservation District (ACD) is conducting stream monitoring in 2014 and 2015 in addition to Surface Water Assessment Grant (SWAG) monitoring for the MPCA. Monitoring events are scheduled May through September for of the following parameters: total suspended solids, e. coli, total phosphorus, Secchi tube transparency, dissolved oxygen, turbidity, temperature, conductivity, pH, and salinity.

Purpose: To detect water quality trends and problems, and diagnose the source as well as provide an initial assessment of water quality to be used in the completion of the Rum River Watershed Restoration and Protection Plan (WRAPP).

Locations:
Rum River at Co Rd 24
Rum River at Co Rd 7
Seeyle Brook at Co Rd 7
Cedar Creek at Co Rd 9
Ford Brook at Co Rd 63

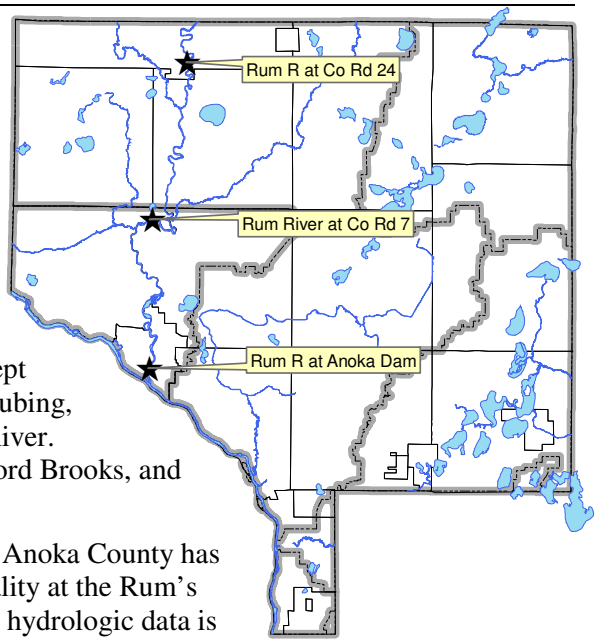
Results: Results are presented on the following pages.

Upper Rum River Watershed and SWAG Stream Water Quality Monitoring Sites



RUM RIVER

Rum River at Co. Rd. 24 (Bridge St), St. Francis	STORET SiteID =	S000-066
Rum River at Co. Rd. 7 (Roanoke St), Ramsey	STORET SiteID =	S004-026
Rum River at Anoka Dam, Anoka	STORET SiteID =	S003-183



Years Monitored

At Co. Rd. 24 – 2004, 2009, 2010, 2011, 2014

At Co. Rd. 7 – 2004, 2009, 2010, 2011, 2014

At Anoka Dam – 1996-2011 by the Met Council WOMP program

Background

The Rum River is regarded as one of Anoka County's highest quality and most valuable water resources. It is designated as a state scenic and recreational river throughout Anoka County, except south of the county fairgrounds in Anoka. It is used for boating, tubing, and fishing. Much of western Anoka County drains to the Rum River. Subwatersheds that drain to the Rum include Seelye, Trott, and Ford Brooks, and Cedar Creek.

The extent to which water quality improves or is degraded within Anoka County has been unclear. The Metropolitan Council has monitored water quality at the Rum's outlet to the Mississippi River since 1996. This water quality and hydrologic data is well suited for evaluating the river's water quality just before it joins the Mississippi River. Monitoring elsewhere has been sporadic and sparse. Water quality changes might be expected from upstream to downstream because land use changes dramatically from rural residential in the upstream areas of Anoka County to suburban in the downstream areas.

Methods

In 2004, 2009, 2010, 2011 and 2014 monitoring was conducted to determine if Rum River water quality changes in Anoka County, and if so, generally where changes occur. The data is reported together for a more comprehensive analysis of the river from upstream to downstream.

In 2014 the river was monitored during both storm and baseflow conditions by grab samples. Four water quality samples will be taken each year 2014 and 2015; 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. In some years, particularly the drought year of 2009, smaller storms were sampled because of a lack of larger storms. All storms sampled were significant runoff events. 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. During every sampling the water level (stage) was recorded. The monitoring station at the Anoka Dam includes automated equipment that continuously tracks water levels and calculates flows. Water level and flow data for other sites was obtained from the US Geological Survey, who maintains a hydrological monitoring site at Viking Boulevard.

The purpose of this report is to make an upstream to downstream comparison of Rum River water quality. It includes only parameters tested in 2014. It does not include additional parameters tested at the Anoka Dam or additional monitoring events at that site. For that information, see Metropolitan Council reports at http://www.metrocouncil.org/Environment/RiversLakes. All other raw data can be obtained from the Anoka

Conservation District and is also available through the Minnesota Pollution Control Agency's EQuIS database, which is available through their website.

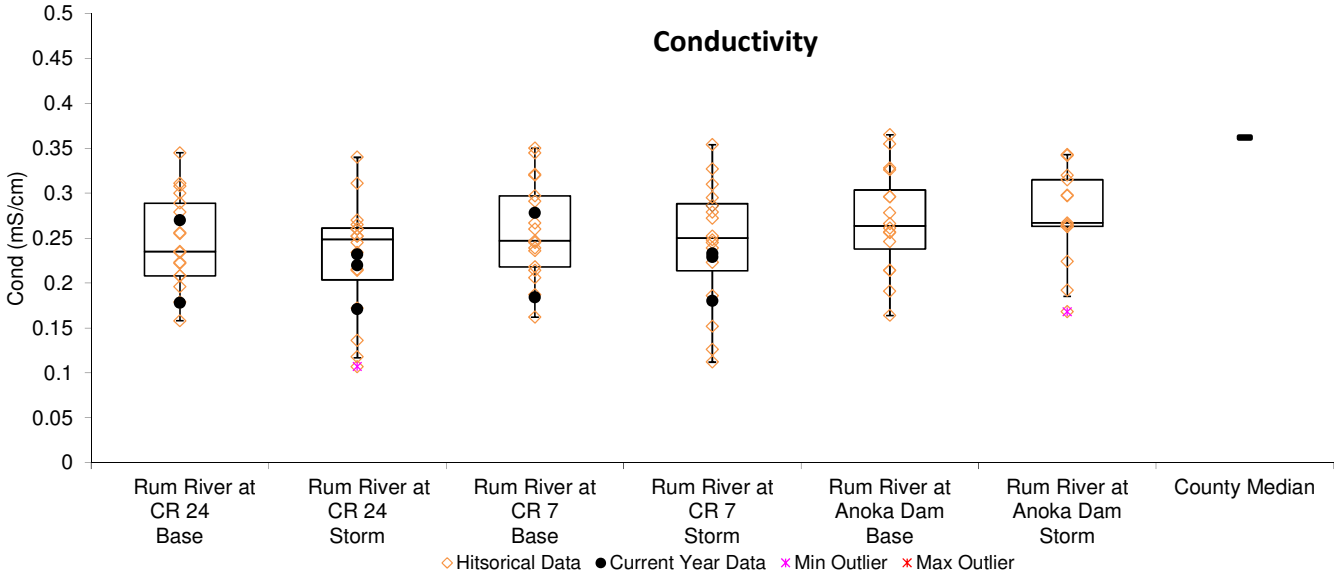
Results and Discussion

On the following pages data are presented and discussed for each parameter. Management recommendations will be included in the 2015 report at the conclusion of this monitoring project. The Rum River is an exceptional waterbody, and its protection and improvement should be a high priority.

Conductivity

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 were not sampled in 2014 and thus not displayed below. Historical chloride data can be obtained from the Anoka Conservation District and is also available through the Minnesota Pollution Control Agency's EQuIS database, which is available through their website. These pollutants are of greatest concern because of the effect they can have on the stream's biological community. They can also be of concern because the Rum River is upstream from the Twin Cities drinking water intakes on the Mississippi River.

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



Conductivity is acceptably low in the Rum River, but increases downstream (see figures above) and during baseflow. Median conductivity from upstream to downstream of the sites monitored in 2014 was 0.220 mS/cm and 0.269 mS/cm, respectively. This is lower than the median for 34 Anoka County streams of 0.362 mS/cm. The 2014 maximum observed conductivity in the Rum River was 0.278 mS/cm.

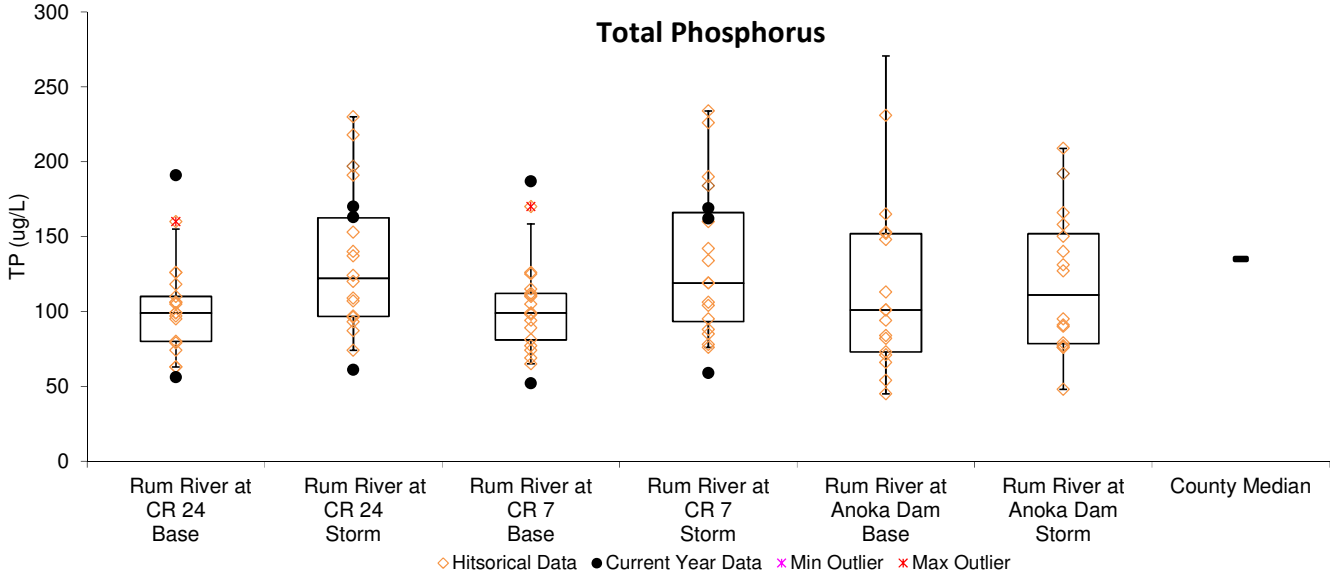
Conductivity was lowest at all sites during storms, suggesting that stormwater runoff contains fewer dissolved pollutants than the surficial water table that feeds the river during baseflow. High baseflow conductivity has been observed in most other nearby streams too, studied extensively, and the largest cause has been found to be road salts that have infiltrated into the shallow aquifer. Geologic materials also contribute, but to a lesser degree.

Conductivity increased from upstream to downstream. During baseflow this increase from upstream to downstream reflects greater road densities and deicing salt application. During storms, the higher conductivity downstream is reflective of greater stormwater runoff and pollutants associated with the more densely developed lower watershed.

Total Phosphorus

Total phosphorus in the Rum River is acceptably low and is similar to the median for all other monitored 34 Anoka County streams (see figure below). Though 2014 did find some of the highest and lowest readings ever observed. This 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. The median phosphorus concentration at the two monitored sites was 163 and 162 ug/L. These upstream-to-downstream differences are negligible and there is no trend of increasing phosphorus downstream. All sites occasionally experience phosphorus concentrations higher than the median for Anoka County streams of 135 ug/L. In 2014 the highest observed total phosphorus readings were during one particular baseflow event, including the maximums at each site of 191 and 187 ug/L (upstream to downstream). In all, phosphorus in the Rum River is at acceptable levels but should continue to be an area of pollution control effort as the area urbanizes.

Total phosphorus during baseflow and storm conditions 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. In 2014 Suspended solids in the Rum River were low.

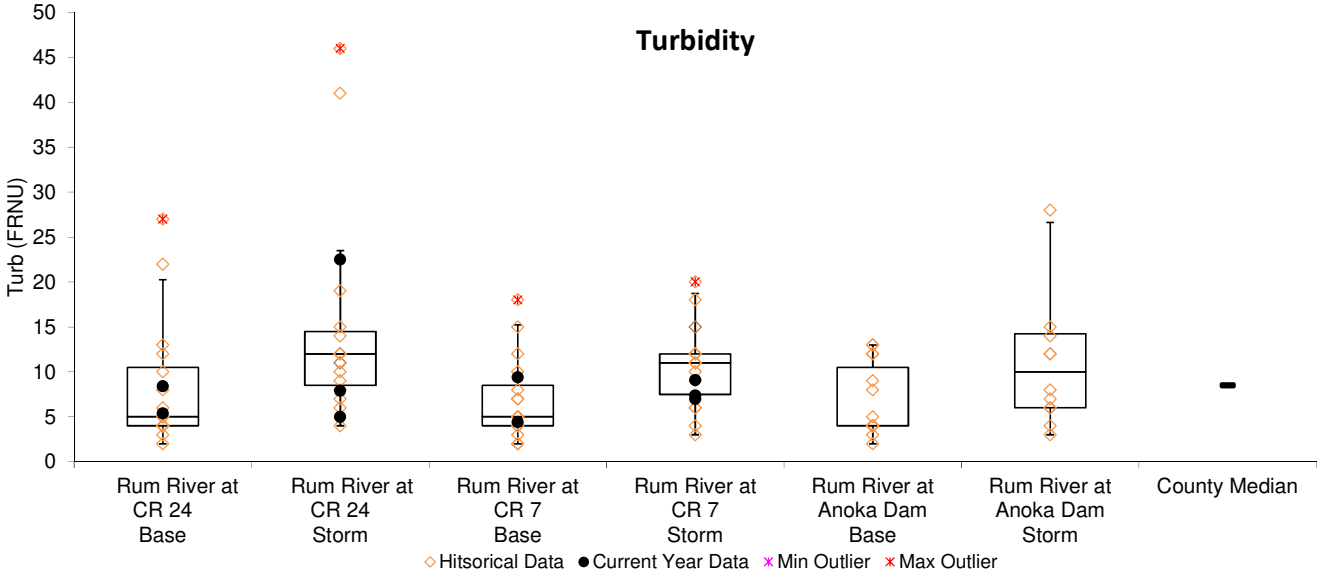
It is important to note the suspended solids can come from sources within and outside of the river channel. Sources on land include soil erosion, road sanding, and others. Riverbank erosion and movement of the river bottom also contributes to suspended solids. A moderate amount of this "bed load" is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

In the Rum River, turbidity was low with only slight increases during storms and a very slight decrease at downstream monitoring sites (see figure below). The median turbidity at each site was 7.9, and 7 FNRU (upstream to downstream), which is similar to the median for Anoka County streams of 8 FNRU. Turbidity was elevated on a few occasions, especially during storms. In 2014 the maximum observed was 22.5 FNRU during an early season monitoring event.

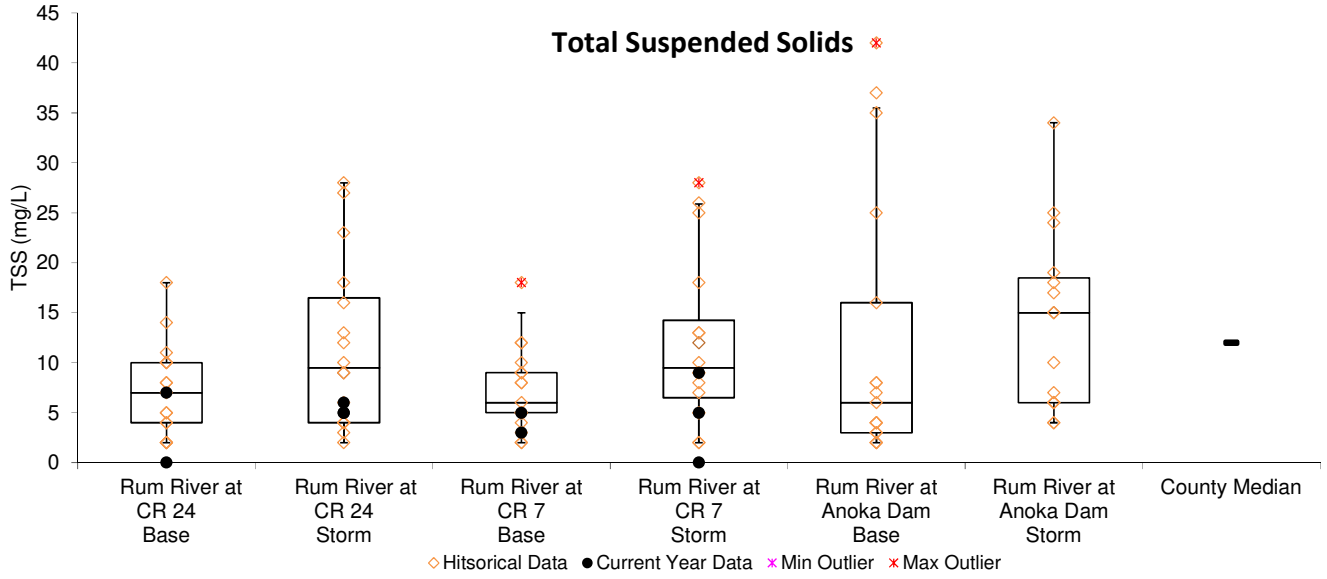
Rigorous stormwater treatment should occur as the Rum River watershed develops, or the collective pollution caused by many small developments will seriously impact the river. Bringing stormwater treatment up to date in older developments is also important.

Differences between TSS and turbidity lend insight into the nature of any problems. TSS showed increases at the downstream monitoring site, while turbidity did not. Turbidity is most sensitive to large particles. Therefore, the downstream increases are likely due to smaller particles. Other pollutants, such as phosphorus and metals, are most highly correlated with smaller particles. These other pollutants can "hitch a ride" on smaller particles because of their greater surface area and, in the case of certain soils, ionic charge. Furthermore, small particles stay suspended in the water column and therefore are more likely to be transported by stream flows and are more difficult to remove with stormwater practices like settling ponds.

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



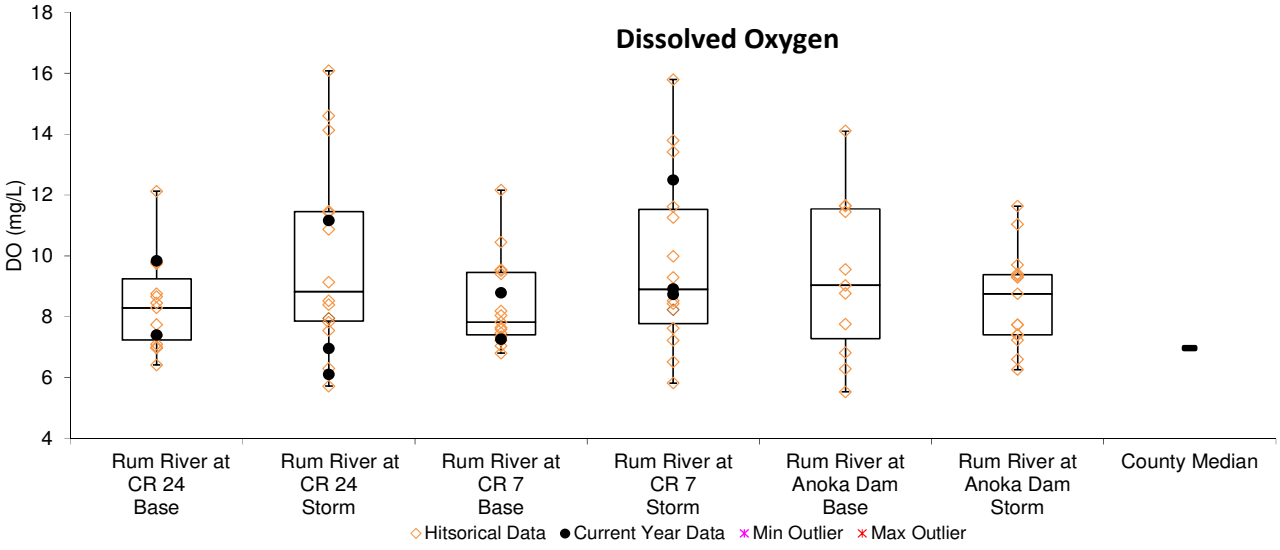
Total suspended solids during baseflow and storm conditions Box plots show the median (middle line), 25th and 75th percentile (ends of box), and 10th and 90th percentiles (floating outer lines).



Dissolved Oxygen

Dissolved oxygen is necessary for aquatic life, including fish. Organic pollution consumes oxygen when it decomposes. If oxygen levels fall below 4 mg/L aquatic life begins to suffer. In the Rum River dissolved oxygen was always above 5.5 mg/L at all monitoring sites.

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

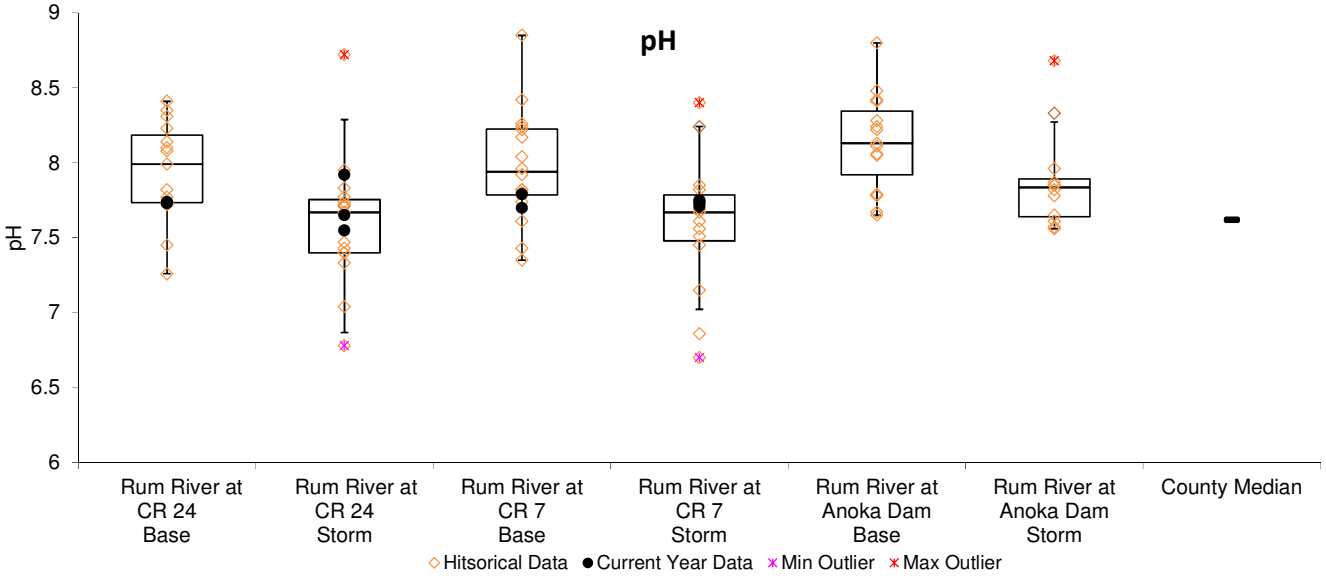


pH

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. The Rum River is regularly within this range (see figure below).

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, its affect on this aquatic system is small.

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

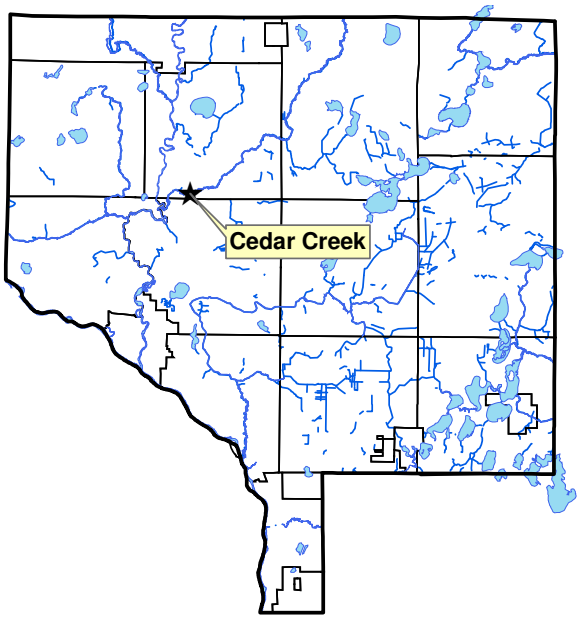


Summary and Recommendations

The Rum River's water quality is very good. It does show a slight increase in suspended solids and conductivitydownstream. Protection of the Rum River should be a high priority for local officials. Large population increases are expected for the Rum River's watershed within Anoka County and have the potential to degrade water quality unless carefully sited and managed. Development pressure is likely to be especially high near the river because of its scenic and natural qualities.

CEDAR CREEK

at Hwy 9, Oak Grove



Background

Cedar Creek originates in south-central Isanti County and flows south. Cedar Creek is a tributary to the Rum River. In north-central Anoka County it flows through some areas of high quality natural communities, including the Cedar Creek Ecosystem Science Reserve. Habitat surrounding the stream in other areas is of moderate quality overall.

Cedar Creek is one of the larger streams in Anoka County. Stream widths of 25 feet and depths greater than 2 feet are common at baseflow. The stream bottom is primarily silt. The watershed is moderately developed with scattered single family homes, and continues to develop rapidly.

Results and Discussion

This report includes data from 2014. A reason this monitoring is being performed is due to the lack of historical data for the state to determine if the creek is meeting state water quality standards. That assessment process is part of the Rum River Watershed Restoration and Protection Project (WRAPP). The following is a summary of results.

- Dissolved constituents, as measured by conductivity and chlorides, in Cedar Creek were average when compared to similar Anoka County streams. Conductivity averaged 0.352 mS/cm Maximum of 0.485 mS/cm and a minimum of 0.247 mS/cm). Chlorides were last sampled in 2013 where they averaged 26 mg/l (maximum of 32 mg/l and a minimum of 17 mg/l).
- Phosphorous averaged over the proposed MPCA water quality standard of 100 ug/l. If the proposed standard is approved Cedar Creek often exceeds the limit, even during baseflow periods. Phosphorous results in Cedar Creek averaged 118.4 ug/l (maximum of 181 ug/l and a minimum of 43 ug/l).
- Suspended solids and turbidity both stayed below the state standards each sampling event and averaged well below the standards. Total suspended solids averaged 3.5 mg/l (maximum of 5 mg/l and a minimum of <2 mg/l). Turbidity averaged 9.24 NTU (maximum of 19.7 NTU and a minimum of 2 NTU).
- pH and dissolved oxygen were with the range considered normal and healthy for streams in this area. However, on two sampling occasions DO fell below the 5.0 mg/l. While these sampling events did fall below the daily average standard, they did not exceed the daily minimum. pH averaged 7.71 (maximum of 8.11 and a minimum of 7.45). DO averaged 6.82 mg/l (maximum of 10.44 mg/l and a minimum of 4.77 mg/l).

For a significant number of the results below there are no current state standards. However, this data will be used as a baseline for future assessments of the watershed.

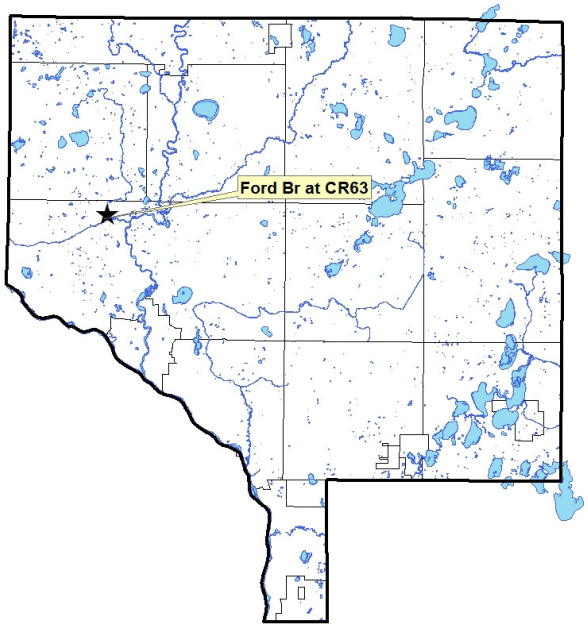
Grey Columns indicate events with E.coli samples only.

Cedar Creek at CR 9			4/28/2014	5/9/2014	6/2/2014	6/16/2014	7/2/2014	7/21/2014	8/5/2014	8/26/2014			
	Units	R.L.*	Results	Results	Results	Results	Results	Results	Results	Results	Average	Min	Max
pH		0.1	7.58	7.60	7.46	7.45	7.45	7.97	8.05	8.11	7.71	7.45	8.11
Conductivity	mS/cm	0.01	0.247	0.280	0.258	0.262	0.350	0.427	0.505	0.485	0.352	0.247	0.505
Turbidity	NTU	1	6.0	2.5	14.2	2.0	2.1	19.7	12.0	15.9	9.30	2.00	19.70
D.O.	mg/L	0.01	10.44	4.77	5.07	4.81	6.25	6.86	7.93	8.41	6.82	4.77	10.44
D.O.	%	1	83.8	43.2	37.6	38.6	59.2	81.9	88.6	91.2	65.5	37.6	91.2
Temp.	°C	0.1	4.86	11.88	20.02	18.00	19.22	22.44	18.90	18.16	16.7	4.9	22.4
Salinity	%	0.01	0.11	0.13	0.12	0.13	0.17	0.21	0.24	0.23	0.17	0.11	0.24
T.P.	ug/L	10	60	43	178	130	181				118	43	181
TSS	mg/L	2	2	<2	4	3	5				3.5	2.0	5.0
Secchi-tube	cm		>100	>100	>100	>100	>100	67	>100	79	>90	67	>100
E coli	MPN				308.0	261.0	26.0	291.0	<1	308.0	238.8	26.0	308.0
Appearance					1B	1B	1B	2	1B	2			
Recreational					2	2	2	2	2	2	2	2	2

*reporting limit

FORD BROOK

At CR 63, Oak Grove



Background

Ford Brook originates at Goose Lake in north-western Anoka County and flows south. Ford Brook is a tributary to the Rum River. In north-western Anoka County it flows through the relatively undisturbed community of Nowthen before joining Trott Brook just prior to the Rum River.

Ford Brook is one of the smaller streams in Anoka County. The watershed is moderately developed with scattered single family homes, but continues to grow.

Results and Discussion

This report includes data from 2014. A reason this monitoring is being performed is due to the lack of historical data for the state to determine if the creek is meeting state water quality standards. That assessment process is part of the Rum River Watershed Restoration and Protection Project (WRAPP). The following is a summary of results.

- Dissolved constituents, as measured by conductivity, in Ford Brook was average when compared to similar Anoka County streams. Conductivity averaged 0.299 mS/cm (maximum of 0.394 mS/cm and a minimum of 0.128 mS/cm).
- Phosphorous averaged over the proposed MPCA water quality standard of 100 ug/l. If the proposed standard is approved, Ford Brook often exceeds the limit, even during baseflow periods. Phosphorous results in Ford Brook averaged 120.2 ug/l (maximum of 176 ug/l and a minimum of 54 ug/l).
- Suspended solids and turbidity both stayed below the state standards each sampling event and averaged well below the standards. Total suspended solids averaged 8.80 mg/l (maximum of 19 mg/l and a minimum of 3 mg/l). Turbidity averaged 15.86 NTU (maximum of 50.0 NTU and a minimum of 4.1 NTU). Water flow during the 50.0 NTU reading was extremely fast and turbulent due to abnormal rainfall.
- pH and dissolved oxygen were with the range considered normal and healthy for streams in this area. pH averaged 7.64 (maximum of 7.71 and a minimum of 7.58). DO averaged 9.58 mg/l (maximum of 14.73 mg/l and a minimum of 6.19 mg/l).

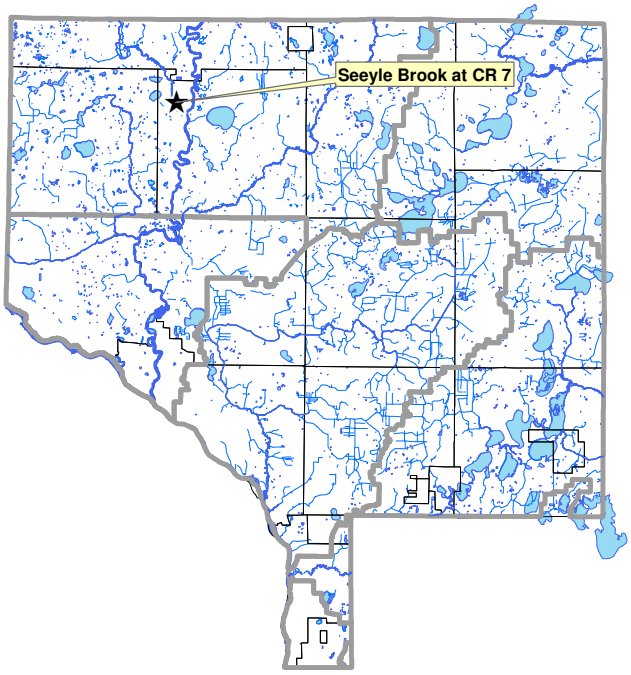
For a significant number of the results below there are no current state standards. However, this data will be used as a baseline for future assessments of the watershed.

FordBrook at CR63			4/28/2014	5/9/2014	6/2/2014	6/16/2014	7/2/2014			
	Units	R.L.*	Results	Results	Results	Results	Results	Average	Min	Max
pH		0.1	7.7	7.71	7.58	7.6	7.6	7.64	7.58	7.71
Conductivity	mS/cm	0.01	0.314	0.128	0.344	0.316	0.394	0.299	0.128	0.394
Turbidity	NTU	1	50.0	4.1	10.4	8.0	7.0	15.90	4.10	50.00
D.O.	mg/L	0.01	12.29	7.35	14.73	7.33	6.19	9.58	6.19	14.73
D.O.	%	1	97.7	70.8	75	71	69.8	76.9	69.8	97.7
Temp.	°C	0.1	4.7	11.6	20.5	18.5	19.8	15.0	4.7	20.5
Salinity	%	0.01	0.14	0.03	0.16	0.15	0.19	0.13	0.03	0.19
T.P.	ug/L	10	98	54	176	121	152	120	54	176
TSS	mg/L	2	19	4	10.0	3	8	8.8	3.0	19.0
Secchi-tube	cm		43	>100	83	97	92	>100	43	97
E coli	MPN				93.0	161.6	224.7	159.8	93.0	224.7
Appearance					1B	2	3			
Recreational					2	2	2	2	2	2

*reporting limit

SEEYLE BROOK

Seeyle Brook at Co. Rd. 7, St. Francis STORET SiteID = S003-204



Background

Seelye Brook originates in southwestern Isanti County and flows south through northwest Anoka County, draining into the Rum River just east of the sampling site. This stream is low-gradient, like most other streams in the area. It has a silty or sandy bottom and lacks riffle-pool sequences. It is a moderate to large stream for Anoka County, with a typical baseflow width of 20-25 feet.

The sampling site is in the road right of way of the Highway 7 crossing. The bridge footings and poured concrete are significant features of the sampling site, which is otherwise sandy-bottom. This site also experiences scour during high flow because flow is constricted under the bridge. Banks are steep and undercut.

Results

This report includes data from 2014. A reason this monitoring is being performed is due to the lack of historical data to assess. The following is a summary of results.

- Dissolved constituents, as measured by conductivity and chlorides. Conductivity results in Seeyle Brook are considered average when compared to similar Anoka County streams. Conductivity averaged 0.375 mS/cm (maximum of 0.580 mS/cm and a minimum of 0.223 mS/cm).
- Phosphorous averaged over the proposed MPCA water quality standard of 100 ug/L. If the proposed standard is approved Seeyle Brook often exceeds the limit, even during baseflow periods. Phosphorous is Seeyle Brook averaged 111 ug/l (maximum of 199 ug/l and a minimum of 40 ug/l).
- Suspended solids and turbidity both stayed below the state standards throughout the season. Suspended solids averaged 3.7 mg/l (maximum of 5.0 mg/l and a minimum of 2.0 mg/l). Turbidity averaged 4.46 NTU's (maximum of 8.50 NTU's and a minimum of 2.0 NTU's)
- pH and dissolved oxygen averaged within the range considered normal and healthy for streams in this area. pH averaged 7.79 (maximum of 8.10 and a minimum of 7.52). DO averaged 8.86 mg/l (maximum of 14.23 mg/l and a minimum of 5.95 mg/l).

For a significant number of the results below there are no current state standards. However, this data will be used as a baseline for future assessments of the watershed.

Grey Columns indicate events with E.coli samples only.

Seeyle Brook at CR 7			4/28/2014	5/9/2014	6/2/2014	6/16/2014	7/2/2014	7/21/2014	8/5/2014	8/26/2014			
	Units	R.L.*	Results	Results	Results	Results	Results	Results	Results	Results	Average	Min	Max
pH		0.1	7.73	7.7	7.55	7.52	7.61	8.02	8.1	8.06	7.79	7.52	8.10
Conductivity	mS/cm	0.01	0.231	0.26	0.223	0.314	0.403	0.477	0.58	0.515	0.375	0.223	0.580
Turbidity	NTU	1	2.3	2.0	7.9	4.0	5.9	8.5	2.0	3.1	4.46	2.00	8.50
D.O.	mg/L	0.01	12.65	8.34	5.95	14.23	6.36	6.85	8.42	8.08	8.86	5.95	14.23
D.O.	%	1	90.3	63.5	69.4	77.9	69.3	81	90.2	86.9	78.6	63.5	90.3
Temp.	℃	0.1	5.0	11.7	21.0	17.8	18.8	22.1	18.1	17.9	16.6	5.0	22.1
Salinity	%	0.01	0.11	0.12	0.11	0.15	0.20	0.23	0.28	0.25	0.18	0.11	0.28
T.P.	ug/L	10	40	41	151	126	199				111	40	199
TSS	mg/L	2	<2	<2	4.0	2	5				3.7	2.0	5.0
Secchi-tube	cm		>100	>100	>100	>100	87	89	>100	>100	>100	87	89
E coli	MPN				93.0	161.6	224.7	86.7	488.4	127.4	197.0	86.7	488.4
Appearance					1B	2	3	2	1B	1B			
Recreational					2	2	2	2	2	2	2	2	2

*reporting limit

Stream Water Quality – Biological Monitoring

Description: This program combines environmental education and stream monitoring. Under the supervision of ACD staff, high school science classes collect aquatic macroinvertebrates from a stream, identify their catch to the family level, and use the resulting numbers to gauge water and habitat quality. These methods are based upon the knowledge that different families of macroinvertebrates have different water and habitat quality requirements. The families collectively known as EPT (Ephemeroptera, or mayflies; Plecoptera, or stoneflies; and Trichoptera, or caddisflies) are pollution intolerant. Other families can thrive in low quality water. Therefore, a census of stream macroinvertebrates yields information about stream health.

Purpose: To assess stream quality, both independently as well as by supplementing chemical data.
To provide an environmental education service to the community.

Locations: Rum River at Hwy 24, Rum River North County Park, St. Francis

Results: Results for each site are detailed on the following pages.

Tips for Data Interpretation

Consider all biological indices of water quality together rather than looking at each alone, as each gives only a partial picture of stream condition. Compare the numbers to county-wide averages. This gives some sense of what might be expected for streams in a similar landscape, but does not necessarily reflect what might be expected of a minimally impacted stream. Some key numbers to look for include:

Families — Number of invertebrate families. Higher values indicate better quality.

EPT — Number of families of the generally pollution-intolerant orders Ephemeroptera (mayflies), Plecoptera (stoneflies), Trichoptera (caddisflies). Higher numbers indicate better stream quality.

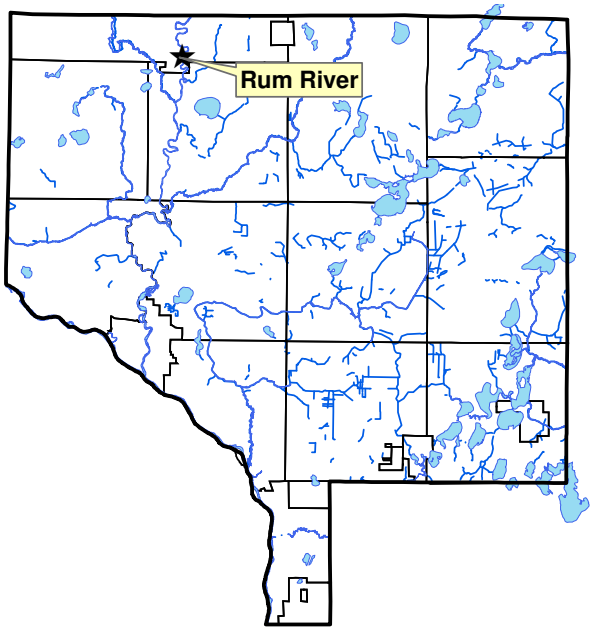
Family Biotic Index (FBI) — An index that utilizes known pollution tolerances for each family. Lower numbers indicate better stream quality.

FBI	Stream Quality Evaluation
0.00-3.75	Excellent
3.76-4.25	Very Good
4.26-5.00	Good
5.01-5.75	Fair
5.76-6.50	Fairly Poor
6.51-7.25	Poor
7.26-10.00	Very Poor

% Dominant Family — High numbers indicates an uneven community, and likely poorer stream health.

RUM RIVER

at Hwy 24, Rum River North County Park, St. Francis



Last Monitored

By St. Francis High School in 2014

Monitored Since

2000

Student Involvement

35 students in 2014, approximately 1,323 since 2000

Background

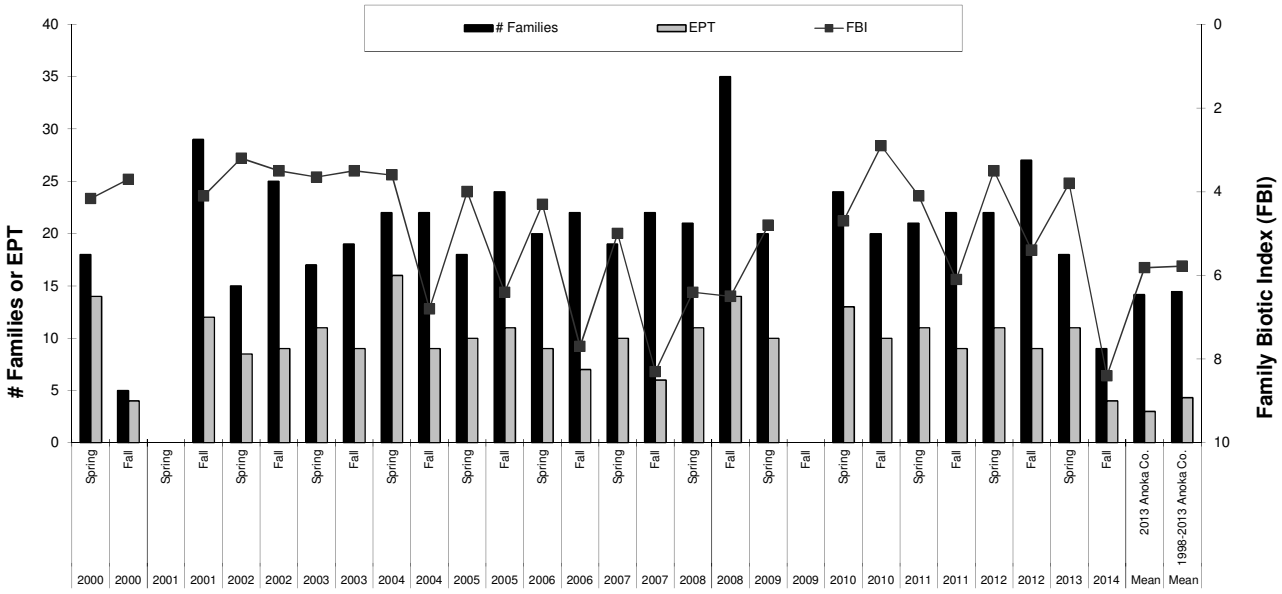
The Rum River originates from Lake Mille Lacs, and flows south through western Anoka County where it joins the Mississippi River in the City of Anoka. Other than the Mississippi, this is the largest river in the county. In Anoka County the river has both rocky riffles as well as pools and runs with sandy bottoms. The river's condition is generally regarded as excellent. Portions of the Rum in Anoka County have a state "scenic and recreational river" designation.

The sampling site is in Rum River North County Park. This site is typical of the Rum in northern Anoka County, having a rocky bottom with numerous pool and riffle areas.

Results

St. Francis High School classes monitored the Rum River in fall 2014, with Anoka Conservation District (ACD) oversight. Biological data for 2014 appears to be an anomaly when compared with the historical data. Results were far worse than have been observed in over a decade. In fall 2014, 9 families were found which is the lowest ever observed. The number of EPT families were still above the county averages.

Summarized Biomonitoring Results for Rum River at Hwy 24, St. Francis (samplings by St. Francis High School and Crossroads Schools in 2002-2003 are averaged)



Biomonitoring Data for Rum River at Rum River North County Park, St. Francis

Data presented from the most recent five years. Contact the ACD to request archived data.

Year	2008	2008	2009	2009	2010	2010	2011	2011	2012	2012	2013	2014	Mean	Mean
Season	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	2013 Anoka Co.	1998-2013 Anoka Co.
FBI	6.40	6.50	4.80	Unusable	4.7	2.9	4.1	6.1	3.5	5.4	3.8	8.4	5.8	5.8
# Families	21	35	20	Sample	24	20	21	22	22	27	18	9	14.2	14.5
EPT	11	14	10		13	10	11	9	11	9	11	4	3.0	4.3
Date	27-May	30-Sep	29-Apr	13-Oct	27-Apr	29-Oct	10-Jun	28-Sep	22-May	27-Sep	20-May	24-Oct		
Sampled By	SFHS	SFHS	SFHS	SFHS	SFHS	ACD	ACD	SFHS	SFHS	SFHS	SFHS	SFHS		
Sampling Method	MH	MH	MH	MH	MH	MH	MH	MH	MH	MH	MH	MH		
Mean # Individuals/Rep.	348	156	267		142	274	418	443	144	333	247.5	219		
# Replicates	2	4	2		3	1	1	2	2	1	2	1		
Dominant Family	Corixidae	Corixidae	Corixidae		Nemouridae	Leptophlebiidae	baetidae	hydrophilidae	hydropsy	veliidae	Baetiscida	Corixidae		
% Dominant Family	57.5	61.4	24.3		28.1	39.4	66.3	21.4	36.6	13.8	34.7	86.3		
% Ephemeroptera	11.9	17.9	18.7		23.9	51.1	81.3	3.6	43.2	34.2	54.1	3.7		
% Trichoptera	5.9	6.9	20.2		10.8	6.2	6.0	4.3	41.1	4.2	6.3	0.5		
% Plecoptera	17.1	2.1	27.7		32.8	26.6	3.8	9.7	5.2	11.1	30.3	2.3		

Supplemental Stream Chemistry Readings

Data presented from the most recent five years. Contact the ACD to request archived data.

Parameter	4/29/2009	10/13/2009	4/27/2010	10/29/2010	4/27/2010	9/28/2011	5/22/2012	9/27/2012	5/21/2013
pH	7.62	7.87	na	7.51	na	8.35	8.14	7.87	7.70
Conductivity (mS/cm)	0.266	0.291	0.324	0.249	0.324	0.228	0.275	0.239	0.193
Turbidity (NTU)	6	na	2	na	2	na	18	2	9
Dissolved Oxygen (mg/L)	10.53	12.22	9.14	na	9.14	8.7	8.24	8.17	7.98
Salinity (%)	0.01	0.01	0.01	0	0.01	0	0.01	0	0
Temperature (°C)	12.2	5.2	12	7.2	12	13.8	17.5	10.3	17.3

Discussion

Historically, both chemical and biological monitoring indicate the good quality of this river. 2014 observed the worst biomonitoring results for this site in recent history. The lack of families found as well as the dominant family making up such a high percentage were the key factors in the poor Family Biotic Index observed in 2014. . Habitat is ideal for a variety of stream life, and includes a variety of substrates, plenty of woody snags, riffles, and pools. Water chemistry monitoring done at various locations on the Rum River throughout Anoka County found that water quality is also good. Both habitat and water quality decline, but are still good, in the downstream reaches of the Rum River where development is more intense and the Anoka Dam creates a slow moving pool. This season did see higher than average water flow which could have flushed some critters out. Additionally, this is the latest into the season we have monitored this location and temperature could have played a factor. Both may have contributed to the poorer than average results. While there does not appear to be any trend, this location should continue to be observed closely.

Water resource management should be focused upon protecting the Rum's quality. Some steps to protect the Rum River could include:

- Enforce scenic river law building and clear cutting setbacks .
- Retrofit stormwater conveyance systems to provide better water quality treatment, especially in St. Francis and Anoka where older areas have little or no stormwater treatment.
- Education programs to encourage actions by residents that will benefit the river's health.
- Continue water quality monitoring programs.

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 23 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: Alliant Tech Reference Wetland, Alliant Tech Systems property, St. Francis

Cedar Creek, Cedar Creek Natural History Area, East Bethel

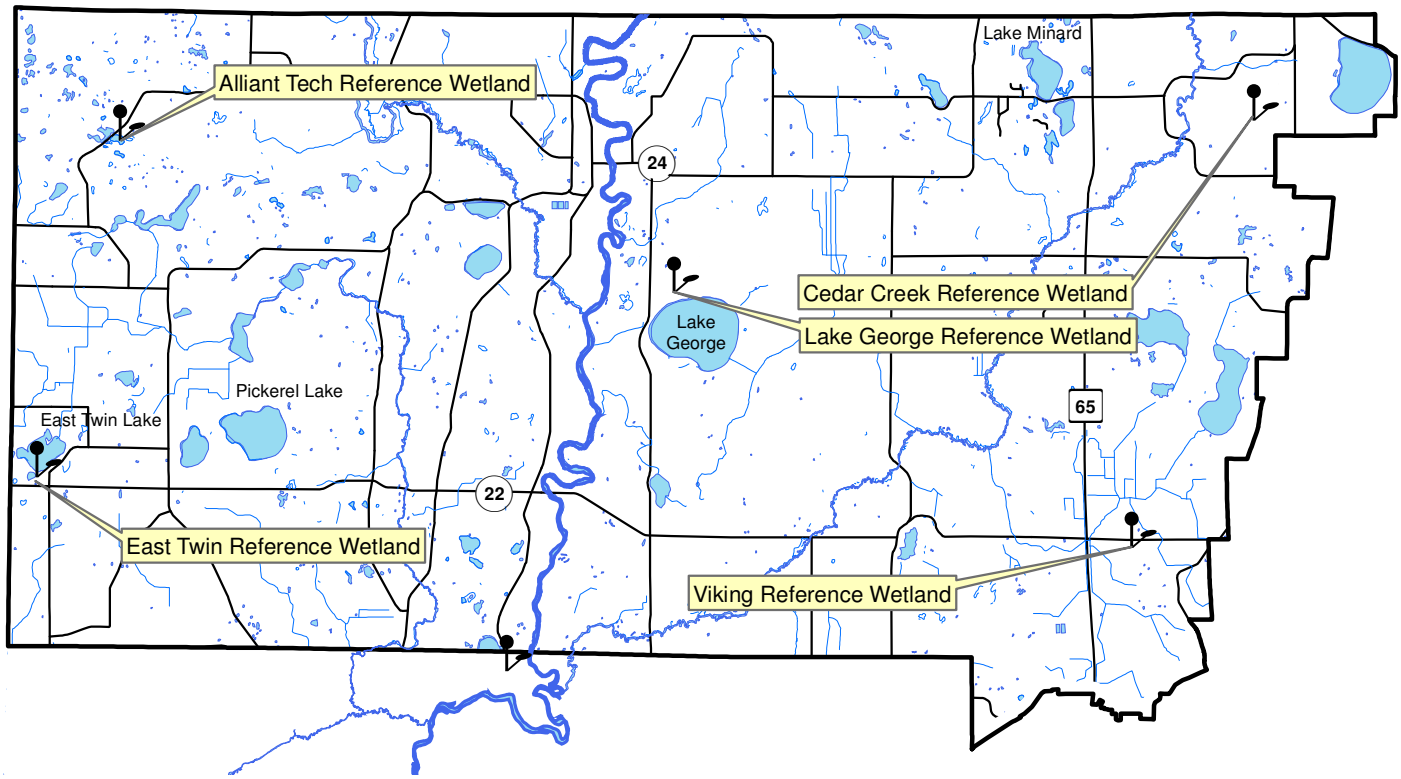
East Twin Reference Wetland, East Twin Township Park, Nowthen

Lake George Reference Wetland, Lake George County Park, Oak Grove

Viking Meadows Reference Wetland, Viking Meadows Golf Course, East Bethel

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

Upper Rum River Watershed Wetland Hydrology Monitoring Sites

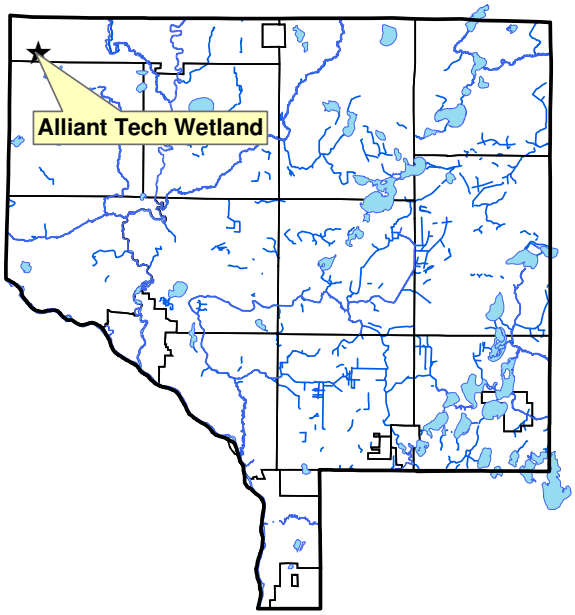


Wetland Hydrology Monitoring

ALLIANT TECH REFERENCE WETLAND

Alliant Techsystems Property, St. Francis

Site Information



Monitored Since: 2001

Wetland Type: 5

Wetland Size: ~12 acres

Isolated Basin? Yes

Connected to a Ditch? No

Soils at Well Location:

Horizon	Depth	Color	Texture	Redox
A	0-8	N2/0	Mucky loam	-
Bg	8-35	5y5/1	Sandy loam	-

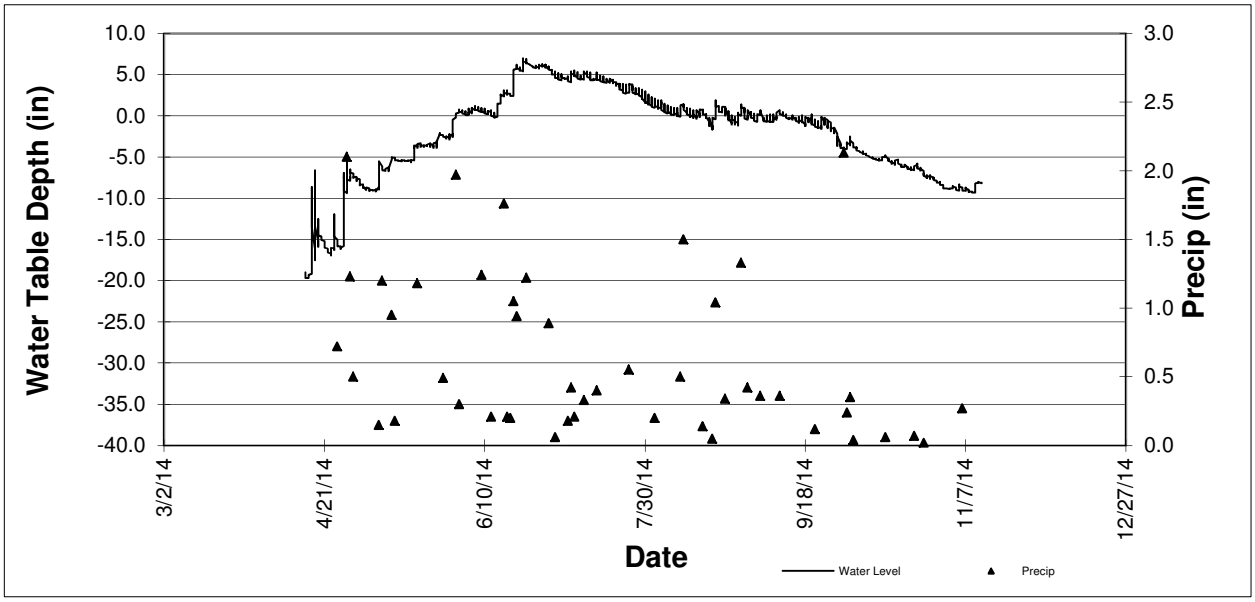
Surrounding Soils: Emmert

Vegetation at Well Location:

Scientific	Common	% Coverage
Carex Spp	Sedge undiff.	90
Lycopus americanus	American Bungleweed	20
Phalaris arundinacea	Reed Canary Grass	5

Other Notes: This wetland lies next to the highway, in a low area surrounded by hilly terrain. It holds water throughout the year, and has a beaver den.

2014 Hydrograph

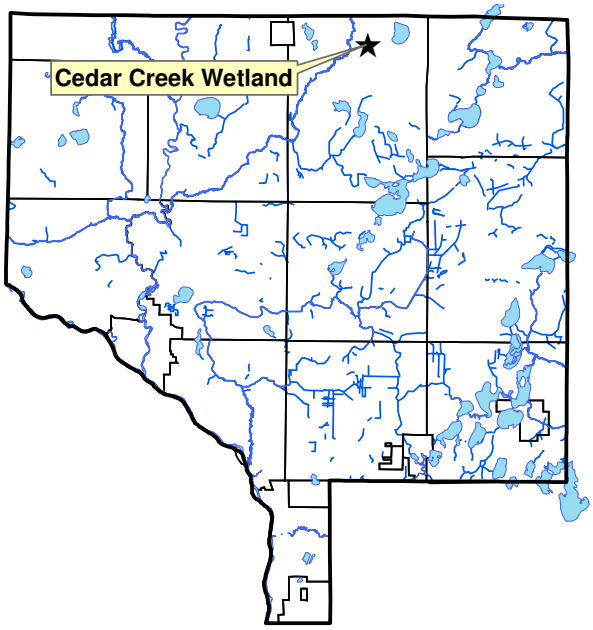


Well depth was 40 inches, so a reading of –40 indicates water levels were at an unknown depth greater than or equal to 40 inches.

CEDAR CREEK REFERENCE WETLAND

Univ. of Minnesota Cedar Creek Natural History Area, East Bethel

Site Information



Monitored Since: 1996

Wetland Type: 6

Wetland Size: unknown, likely >150 acres

Isolated Basin? No

Connected to a Ditch? No

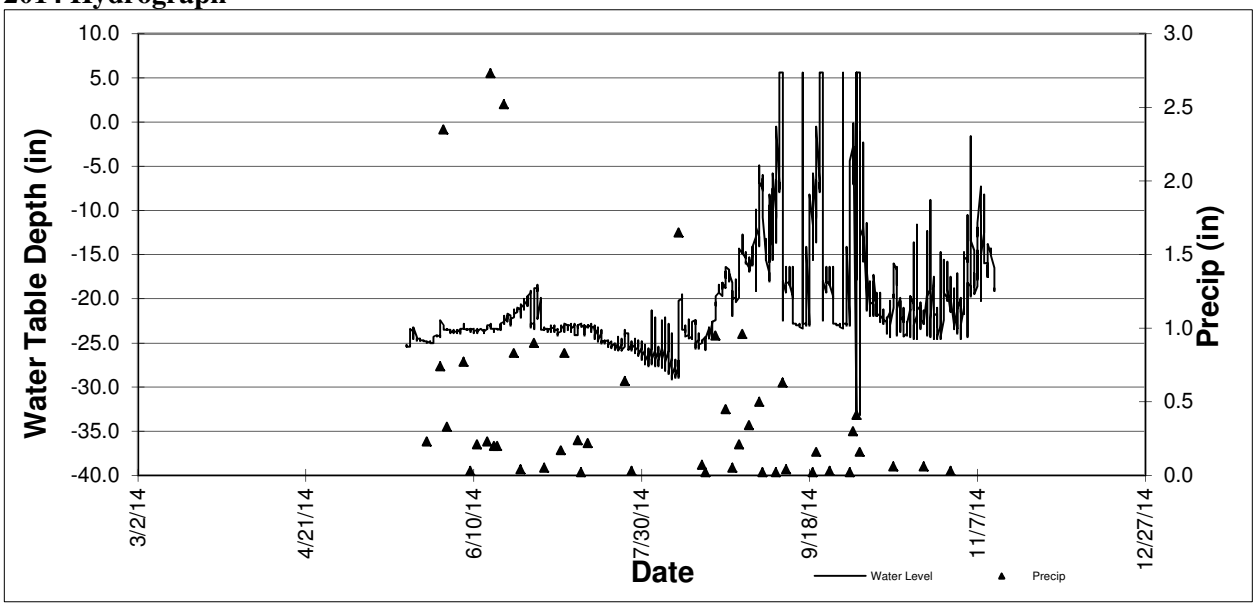
Soils at Well Location: not yet available

Surrounding Soils: Zimmerman

Vegetation at Well Location: not yet available

Other Notes: The Cedar Creek Ecosystem Science Reserve, where this wetland is located, is a University of Minnesota research area. Much of this area, including the area surrounding the monitoring site, is in a natural state. This wetland probably has some hydrologic connection to the floodplain of Cedar Creek, which is 0.7 miles from the monitoring site.

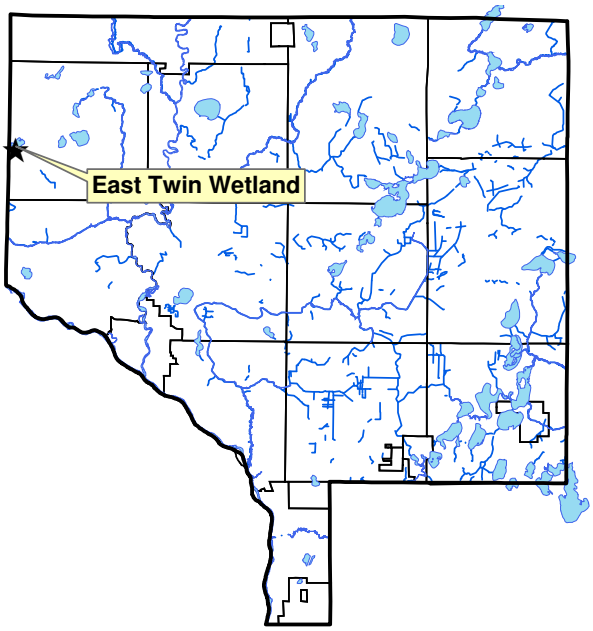
2014 Hydrograph



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

EAST TWIN REFERENCE WETLAND

East Twin Lake Township Park, Nowthen



Site Information

Monitored Since: 2001

Wetland Type: 5

Wetland Size: ~5.9 acres

Isolated Basin? Yes

Connected to a Ditch? No

Soils at Well Location:

Horizon	Depth	Color	Texture	Redox
A	0-8	10yr 2/1	Mucky Loam	-
Oa	Aug-40	N2/0	Organic	-

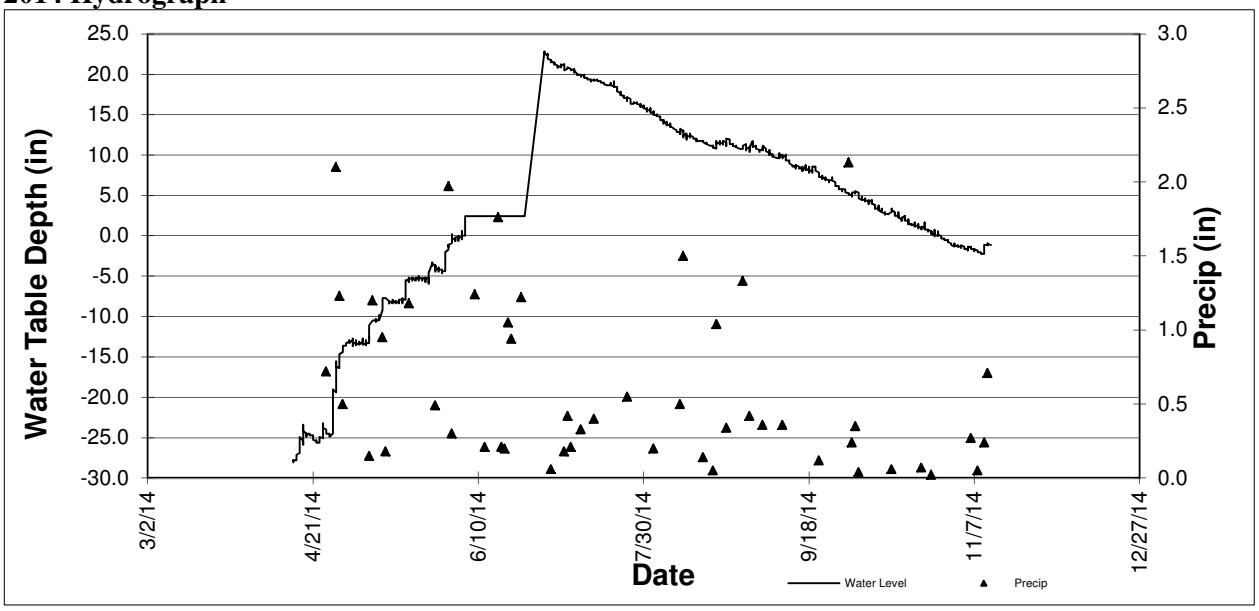
Surrounding Soils: Lake Beach, Growton and Heyder fine sandy loams

Vegetation at Well Location:

Scientific	Common	% Coverage
Phalaris arundinacea	Reed Canary Grass	100
Cornus amomum	Silky Dogwood	30
Fraxinus pennsylvanica	Green Ash	30

Other Notes: This wetland is located within East Twin Lake County Park, and is only 180 feet from the lake itself. Water levels in the wetland are influenced by lake levels.

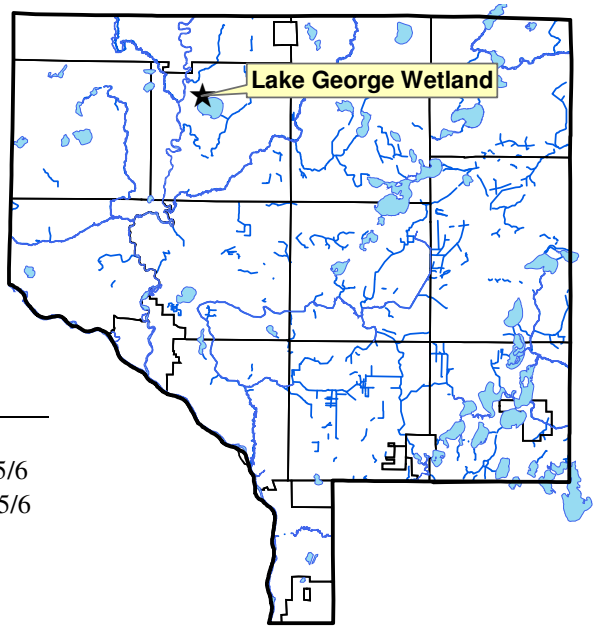
2014 Hydrograph



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

LAKE GEORGE REFERENCE WETLAND

Lake George County Park, Oak Grove



Site Information

Monitored Since: 1997

Wetland Type: 3/4

Wetland Size: ~9 acres

Isolated Basin? Yes, but only separated from wetland complexes by roadway.

Connected to a Ditch? No

Soils at Well Location:

Horizon	Depth	Color	Texture	Redox
A	0-8	10yr2/1	Sandy Loam	-
Bg	8-24	2.5y5/2	Sandy Loam	20% 10yr5/6
2Bg	24-35	10gy 6/1	Silty Clay Loam	10% 10yr 5/6

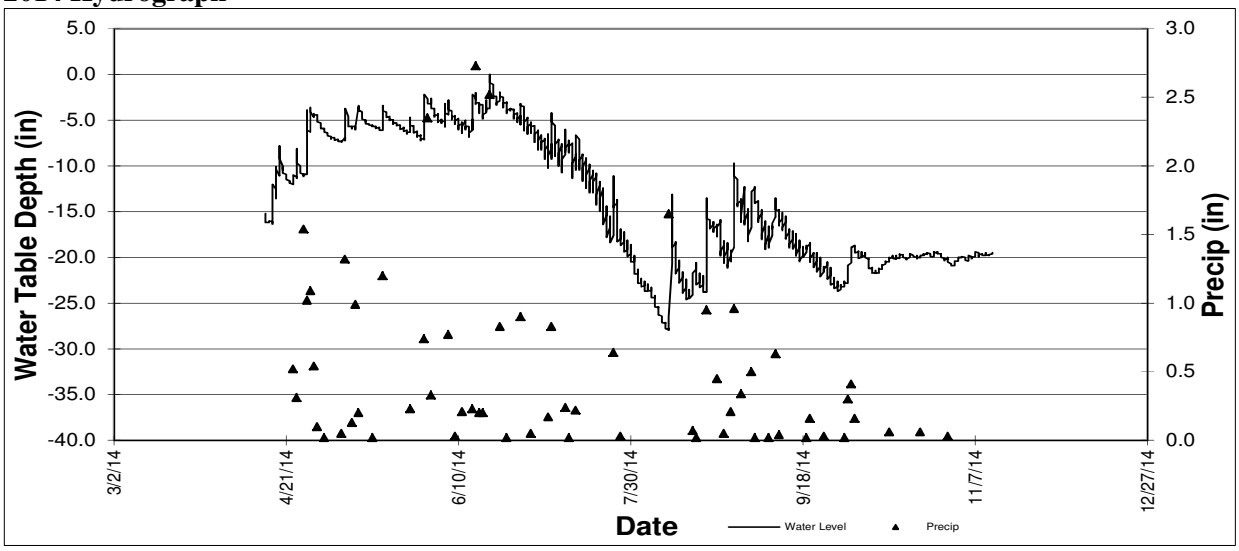
Surrounding Soils: Lino loamy fine sand and Zimmerman fine sand

Vegetation at Well Location:

Scientific	Common	% Coverage
Cornus stolonifera	Red-osier Dogwood	90
Populus tremuloides	Quaking Aspen	40
Quercus rubra	Red Oak	30
Onoclea sensibilis	Sensitive Fern	20
Phalaris arundinacea	Reed Canary Grass	10

Other Notes: This wetland is located within Lake George County Park, and is only about 600 feet from the lake itself. Much of the vegetation within the wetland is cattails.

2014 Hydrograph



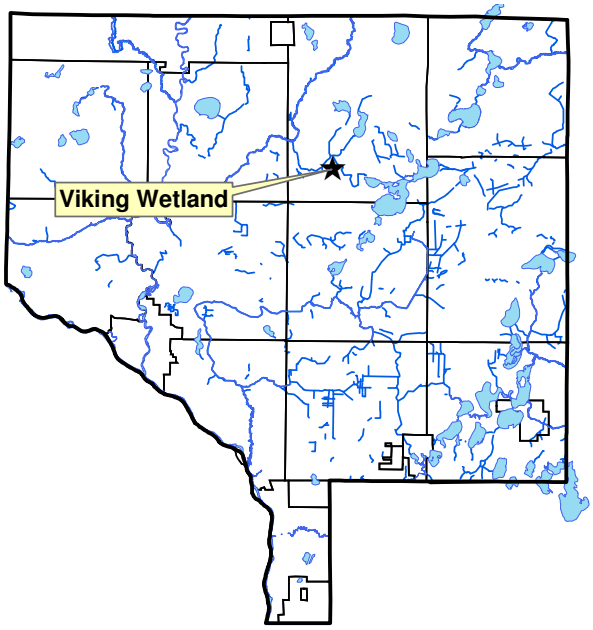
Well depth was 40 inches, so a reading of –40 indicates water levels were at an unknown depth greater than or equal to 40 inches.

Wetland Hydrology Monitoring

VIKING MEADOWS REFERENCE WETLAND

Viking Meadows Golf Course, East Bethel

Site Information



Monitored Since: 1999

Wetland Type: 2

Wetland Size: ~0.7 acres

Isolated Basin? No

Connected to a Ditch? Yes, highway ditch is tangent to wetland

Soils at Well Location:

Horizon	Depth	Color	Texture	Redox
A	0-12	10yr2/1	Sandy Loam	-
Ab	12-16	N2/0	Sandy Loam	-
Bg1	16-25	10yr4/1	Sandy Loam	-
Bg2	25-40	10yr4/2	Sandy Loam	5% 10yr5/6

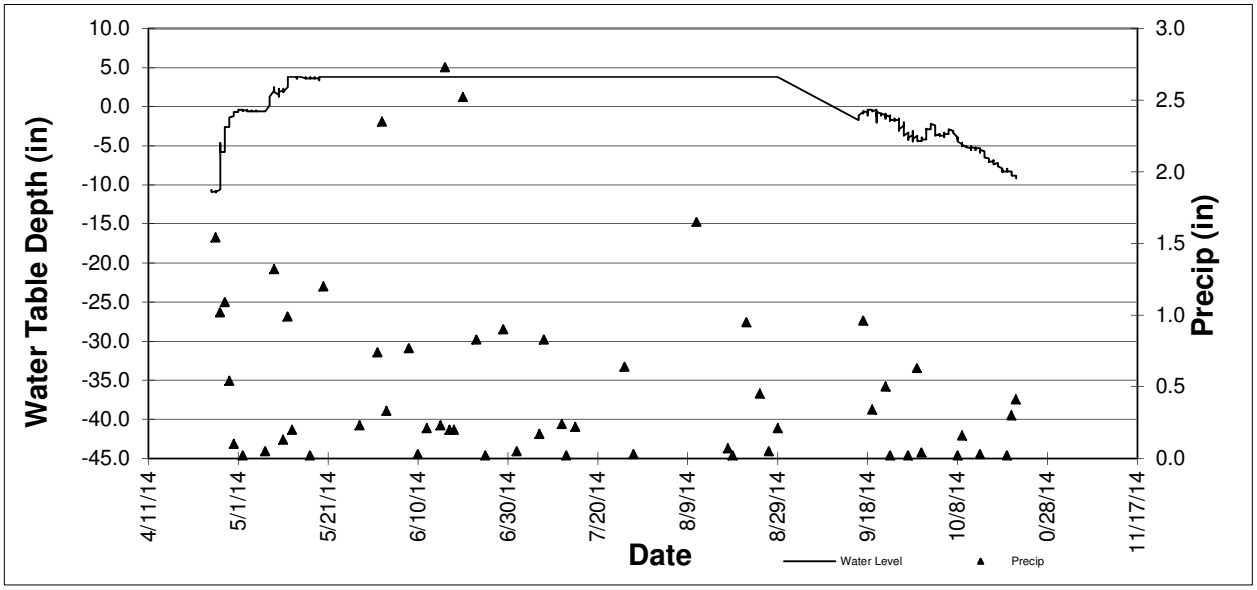
Surrounding Soils: Zimmerman fine sand

Vegetation at Well Location:

Scientific	Common	% Coverage
Phalaris arundinacea	Reed Canary Grass	100
Acer rubrum (T)	Red Maple	75
Acer negundo (T)	Boxelder	20

Other Notes: This wetland is located at the entrance to Viking Meadows Golf Course, and is adjacent to Viking Boulevard (Hwy 22).

2014 Hydrograph



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

Water Quality Grant Fund

Description: The Upper River Watershed Management Organization (URRWMO) partners with the Anoka Conservation District's (ACD) Water Quality Cost Share Program. The URRWMO contributes funds to be used as cost share grants for projects that improve water quality in lakes, streams, or rivers within the URRWMO area. The ACD provides administration of the grants. Grant awards follow ACD policies and generally cover 50% or 70% of materials (see ACD website for full policies). The ACD Board of Supervisors approves any dispersements.

Grant administration is through the Anoka Conservation District for efficiency and simplicity. The ACD administers a variety of other similar grants, thus providing a one-stop-shop for residents. Additionally, the ACD's technical staff provides project consultation and design services at low or no cost, which is highly beneficial for grant applicants. ACD staff also has expertise to process and scrutinize grant requests. Lastly, the ACD Board meets monthly, and can therefore respond to grant requests rapidly, while URRWMO meetings are much less frequent.

The Anoka Conservation District (ACD) and Upper Rum River WMO have both undertaken efforts to promote these types of projects and the availability of grants. The ACD mentions the grants during presentations to lake associations and other community groups, in newsletters, and in website postings. In order to promote these types of projects the ACD also assists landowners throughout projects, including design, materials acquisition, installation, and maintenance.

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

Locations: Throughout the watershed.

Results: Projects are reported in the year they are installed.

URRWMO Cost Share Fund Summary

2006 URRWMO Contribution	+	$ 990.00
2006 Expenditures		$ 0.00
2007 URRWMO Contribution	+	$ 1,000.00
2007 Expenditures		$ 0.00
2008 Expenditures		$ 0.00
2009 Expenditures		$ 0.00
2010 URRWMO Contribution	+	$ 500.00
2011 URRWMO Contribution	+	$ 567.00
2010-11 Expenditure Petro streambank stabilization	-	$1,027.52
2011 Expenditure Erickson lakeshore restoration	-	$ 233.63
2012 Expenditure Erickson lakeshore restoration	-	$ 137.97
2012 URRWMO Contribution	+	$1,000.00
2013 URRWMO Contribution	+	$ 0
2014 Expenditure – Stitt lakeshore restoration	-	$1,059.69
2013 Correction	+	$ 0.48
Fund Balance		**$ 1598.67**

Special note: For all funds contributed after 2013, the URRWMO has asked to re-evaluate how these grants are administered. The WMO may choose to administer the funds themselves or with other oversight of the ACD's process.

URRWMO Website

Description: The Upper Rum River Watershed Management Organization (URRWMO) contracted the Anoka Conservation District (ACD) to design and maintain a website about the URRWMO and the Upper Rum River watershed. The original website had been in operation since 2003. A new website and domain for the URRWMO was created by ACD in 2013.

Purpose: To increase awareness of the URRWMO and its programs. The website also provides tools and information that helps users better understand water resources issues in the area.

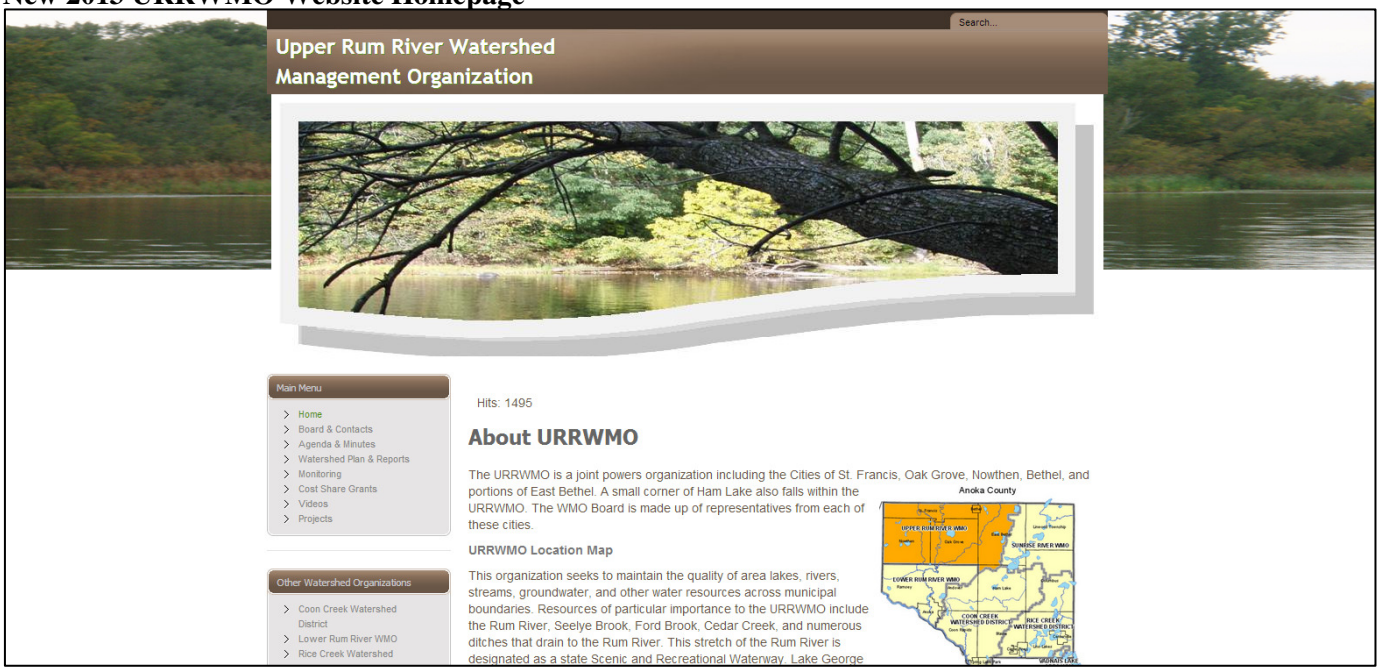
Location: www.URRWMO.org

Results: In 2013 the upgraded, redesigned, and re-launched the URRWMO website. These updates were necessary because the old website platform was incompatible with certain tablet computers and smartphones. Additionally, the old website was hosted with in the ACD website, while the new website is completely independent, offering the WMO future management choices.

The URRWMO website contains information about both the URRWMO and about natural resources in the area. Information about the URRWMO includes:

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

New 2013 URRWMO Website Homepage



URRWMO Annual Newsletter

Description: The URRWMO Watershed Management Plan and state rules call for an annual URRWMO newsletter in addition to the website. The URRWMO will produce a newsletter article including information about the URRWMO, its programs, related educational information, and the URRWMO website address. This article will be provided to each member city, and they will be asked to include it in their city newsletters.

Purpose: To increase public awareness of the URRWMO and its programs as well as receive input.

Locations: Watershed-wide.

Results: The Anoka Conservation District (ACD) assisted the URRWMO by drafting the annual newsletter article. The URRWMO discussed topics to be covered in the article. It was decided that the newsletter article would be requesting public input regarding Rum River Watershed Restoration and Protection Project (WRAPP) as well as providing a background of the project.

ACD staff drafted the newsletter article and sent it to the URRWMO Board for review. The URRWMO Board reviewed and edited the draft article. The finalized article was posted to the URRWMO Website, sent to each member community, as well as to the Independent School District 15 publication, "The Courier."

2014 URRWMO Newsletter Article

Public Input Sought on Rum River Watershed Management

An effort is underway to protect and improve water quality in the almost one million acre Rum River watershed. The Rum River Watershed Restoration and Protection Project (WRAP) will create a management plan for the entire watershed, including each lake, stream and the river. Public input is being sought through an online survey.

The survey allows respondents to tell managers what issues are important for them, suspected sources of problems and preferred management. It can also address how to keep good quality waterbodies in good condition. Comments can pertain to lakes, wetlands, streams or the Rum River itself. The survey takes about 10 minutes to complete. It is posted at www.URRWMO.org.

With its beginning at Lake Mille Lacs, most of the Rum River is a State Scenic and Recreational Waterway. The Rum is known for canoeing, smallmouth bass fishing, and high water quality. Many of the watershed's tributaries and lakes, including lakes George and East Twin, are also of high quality.

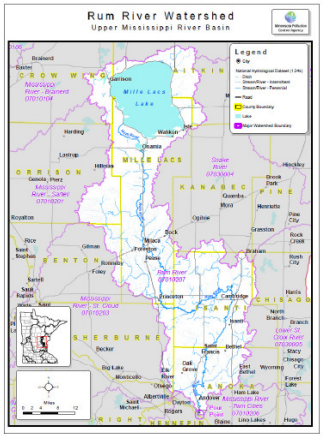
The Rum River WRAP project began in 2013 and will be completed in 2016. It will include:

- Water quality monitoring (2013-14).
- Special investigations of water quality problems (2014).
- Computer modeling to answer "what if" questions (2013-15).
- Total Maximum Daily Load (TMDL) planning for waterbodies not meeting state water quality standards (2015-16).
- A WRAP report that prescribes future management approaches (2015-16).

After completion of the WRAP, local agencies will implement projects to protect and improve water quality. State funding, including the State Clean Water Fund from the Clean Water, Land and Legacy Amendment, will ensure financial support exists for these projects.

At the local level, the Upper Rum River Watershed Management Organization (URRWMO) will be working for the Rum River and our lakes. The URRWMO is a joint powers organization of the Cities of Bethel, East Bethel, Ham Lake, Nowthen, Oak Grove and St. Francis. Learn more at www.URRWMO.org.

The WRAP is funded and overseen by the Minnesota Pollution Control Agency, and the Anoka Conservation District is the project lead. Nine other counties in the watershed are also involved. For more information on the Rum River WRAP project visit www.pca.state.mn.us and search for "Rum River WRAP" or call Jamie Schurbon at the Anoka Conservation District at 763-434-2030 ext. 12.



URRWMO 2013 Annual Reports to the State

Description: The Upper Rum River Watershed Management Organization (URRWMO) is required by law to submit an annual report to the Minnesota Board of Water and Soil Resources (BWSR). This report consists of an up-to-date listing of URRWMO Board members, activities related to implementing the URRWMO Watershed Management Plan, the status of municipal water plans, financial summaries, and other work results. The report is due annually 120 days after the end of the URRWMO's fiscal year (April 30th).

Additionally, the URRWMO is required to perform annual financial reporting to the State Auditor. This includes submitting a financial report and filling out a multi-worksheet form.

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

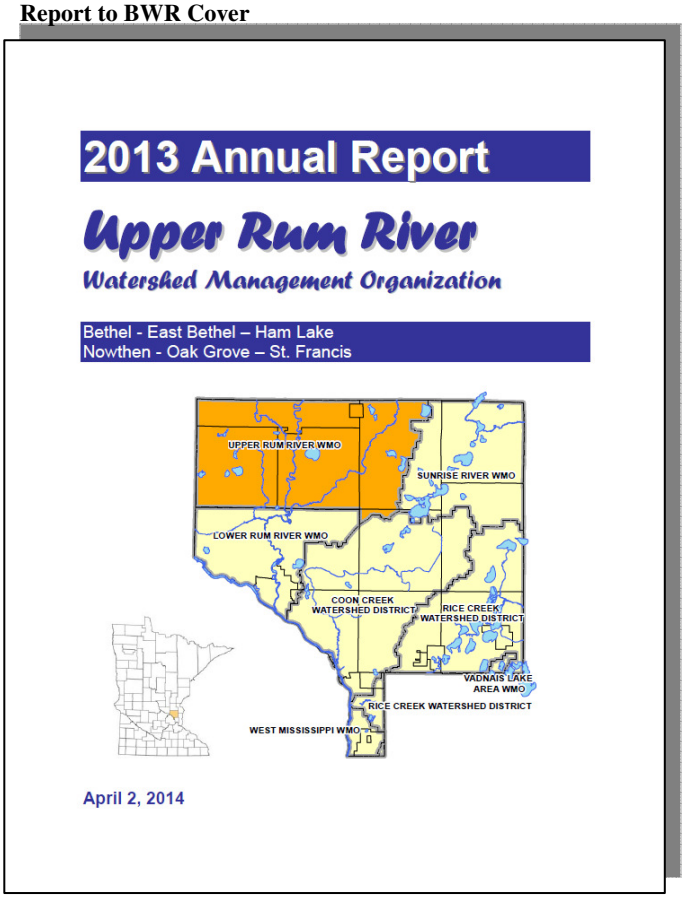
Locations: Watershed-wide

Results: The Anoka Conservation District assisted the URRWMO with preparation of a 2013 Upper Rum River WMO Annual Report to BWSR and reporting to the State Auditor. This included:

- preparation of an unaudited financial report,
- a report to BWSR meeting MN statutes
- and the State Auditor's reporting forms through the State's SAFES website.

All were completed by the end of April 2014. The report to BWSR and financial report are available on the URRWMO website.

Report to BWR Cover



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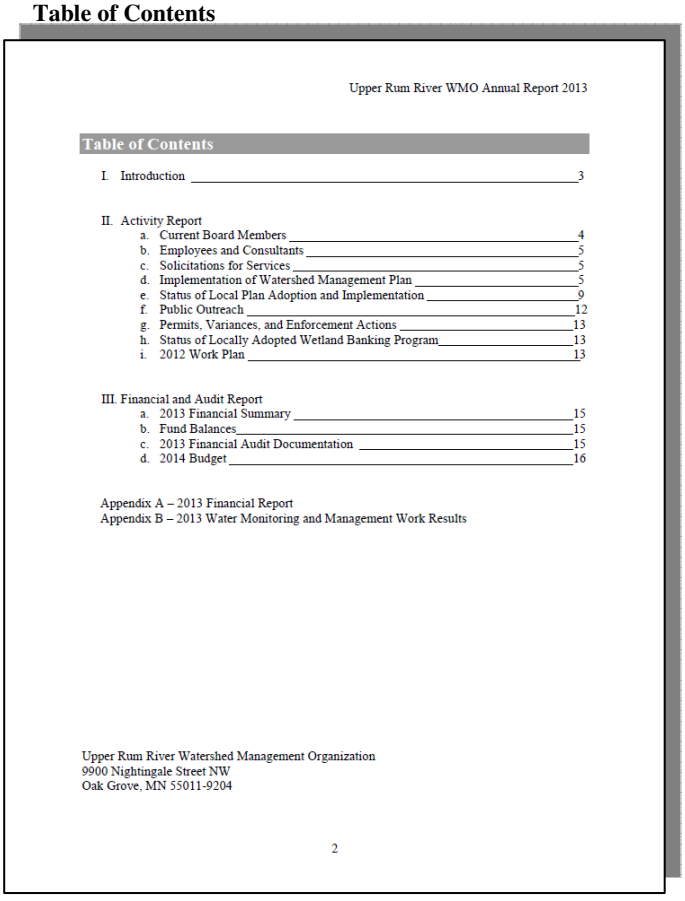

Financial Summary

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.

Upper Rum River Watershed Financial Summary

Upper Rum River Watershed	WMO Asst (no charge)	Volunteer Precipitation	Reference Wetlands	DNR Observation Wells	Lake Levels	Lake WQ - SWAG	Stream Water Quality	Watershed Outlet Monitoring	Student Biomonitoring	URRWMO Admin	URRWMO Outreach/Promo	Website Management	Rum River Stabilization	Rum River WRAPP	Lake George CLP Mapping	Cost Share - Local/State	Total
Revenues																	
URRWMO	0	0	1725	0	1000	0	4050	0	825	1365	500	480	0	0	0	1060	11005
State	0	0	0	360	0	3395	4473	0	0	0	0	0	0	16480	0	0	24707
Anoka Conservation District	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Anoka Co. General Services	586	0	0	230	0	293	0	0	0	0	0	0	90	0	1393	0	2593
County Ag Preserves	0	0	0	0	0	0	0	0	39	0	0	0	0	0	0	1	40
Regional/Local	0	0	0	0	0	0	0	720	0	0	0	0	0	0	0	0	720
Other Service Fees	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BWSR Cons Delivery	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BWSR Cost Share TA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Local Water Planning	0	593	1602	0	0	0	0	287	0	455	0	14	0	0	0	0	2950
TOTAL	586	593	3327	590	1000	3688	8523	1007	864	1820	500	494	90	16480	1393	1060	42015
Expenses-																	
Capital Outlay/Equip	13	13	69	13	19	69	137	22	18	38	5	9	2	118	31	0	578
Personnel Salaries/Benefits	505	511	2722	509	765	2720	5390	867	708	1494	214	337	78	4642	1200	0	22661
Overhead	34	34	183	34	51	183	362	58	48	100	14	23	5	312	81	0	1523
Employee Training	4	4	20	4	6	20	39	6	5	11	2	2	1	34	9	0	165
Vehicle/Mileage	9	9	48	9	14	48	96	15	13	27	4	6	1	82	21	0	402
Rent	22	22	118	22	33	118	233	37	31	65	9	15	3	201	52	0	979
Program Participants	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1060	1060
Program Supplies	0	0	99	0	3	530	1217	0	42	0	0	0	0	11090	0	0	12981
McKay Expenses	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	586	593	3259	590	891	3688	7474	1007	864	1734	249	391	90	16480	1393	1060	40350

Recommendations

- **Actively participate in the MPCA Rum River WRAPP (Watershed Restoration and Protection Plan) which began in 2013.** This WRAPP is an assessment of the entire Rum River watershed. This is an opportunity for the URRWMO to prioritize and coordinate efforts with upstream entities and state agencies.
- **Develop a plan to diagnose declining water quality in Lake George..** This effort might be paired with the Rum River WRAPP project.
- **Consider a St. Francis stormwater assessment** that is aimed at identifying and installing cost effective stormwater treatment opportunities before water is discharged into the Rum River. The assessment should be focused on those portions of the city that are generally lacking sufficient stormwater treatment. A large portion of the funding may be available through ACD.
- **Promote groundwater conservation.** Metropolitan Council models predict 3+ft drawdown of surface waters in parts of the URRWMO by 2030, and 5+ft by 2050.
- **Correct riverbank erosion issues discovered during the 2010 Rum River survey**. Several locations of riverbank erosion were documented. Landowners were contacted, and some responded, however none have committed to corrective work. Part of the reason is that these projects are expensive and the landowner would bear some of the cost.
- **Participate with county and DNR efforts to upgrade the water control structure in Ditch 19, the only inlet to Lake George**. Residents have complained that condition of the ditch and water control structures are contributing to low lake water levels in recent years. Anoka County is the legal ditch authority.
- **Promote water quality improvement projects** for lakes, streams, and rivers. Cost share grants are available through the URRWMO and ACD to encourage landowners to do projects that will have public benefits to water quality. Technical assistance for landowners is available through the Anoka Conservation District.