PRIOR LAKE-SPRING LAKE WATERSHED DISTRICT

2012 ANNUAL MONITORING REPORT

OCTOBER 2013

PRIOR LAKE - SPRING LAKE
WATERSHED DISTRICT

CONTENTS

EXECUTIVE SUMMARY

Lakes in the Prior Lake – Spring Lake Watershed District (PLSLWD or District) are known for their popularity in recreational use. Fishing, swimming, and boating attract people from all around. However, it is also well known that some of the lakes in the watershed are impaired for nutrients and this can negatively impact the experience of those that use these lakes.

The District has four lakes that are greater than 100 acres and eight lakes that are between 20 and 100 acres. The lakes greater than 100 acres that also support fishing, swimming, and other body and non-body contact recreational uses (Spring, Upper Prior and Lower Prior Lake) are considered priority lakes for the District. According to the MPCA Lake Water Quality Assessment, four of them are impaired for high nutrients (Upper Prior, Spring, Fish, and Pike), one is partially supporting (Crystal), two are fully supporting (Lower Prior and Cates), and five do not have enough monitoring data to be analyzed (Buck, Rice, Sutton, Swamp, and Arctic).

Monitoring in 2012 included a mix of staff led, volunteer based, and contracted work which incorporated in-lake, stream, flow, precipitation and aquatic vegetation monitoring according to the PLSLWD 2012 Monitoring Plan. Partners included Metropolitan Council Environmental Services, Three Rivers Park District, Shakopee Mdewakanton Sioux Community, Scott Soil and Water Conservation District (SWCD), Blue Water Science, and Emmons and Oliver Resources (EOR).

Data collected in streams and lakes throughout the District is used in order to answer a variety of questions like: How is the water quality changing over time? How does the quality in this stream affect the quality of that lake? How does the quality of this lake compare to other lakes? Is this goal a realistic goal? What are some ways we can try to improve the quality of water? Data can be used and analyzed in many different ways.

Some of these questions can be answered with the data we have collected so far, but additional data are needed for others. Data can also lead to new questions like, why is the phosphorus so high in this stream? This report only skims the surface of uses for this data.

The following report is a summary of the monitoring programs and results of the data collected in 2012. The monitoring sites that are referenced in the report are mapped in Figure 1.

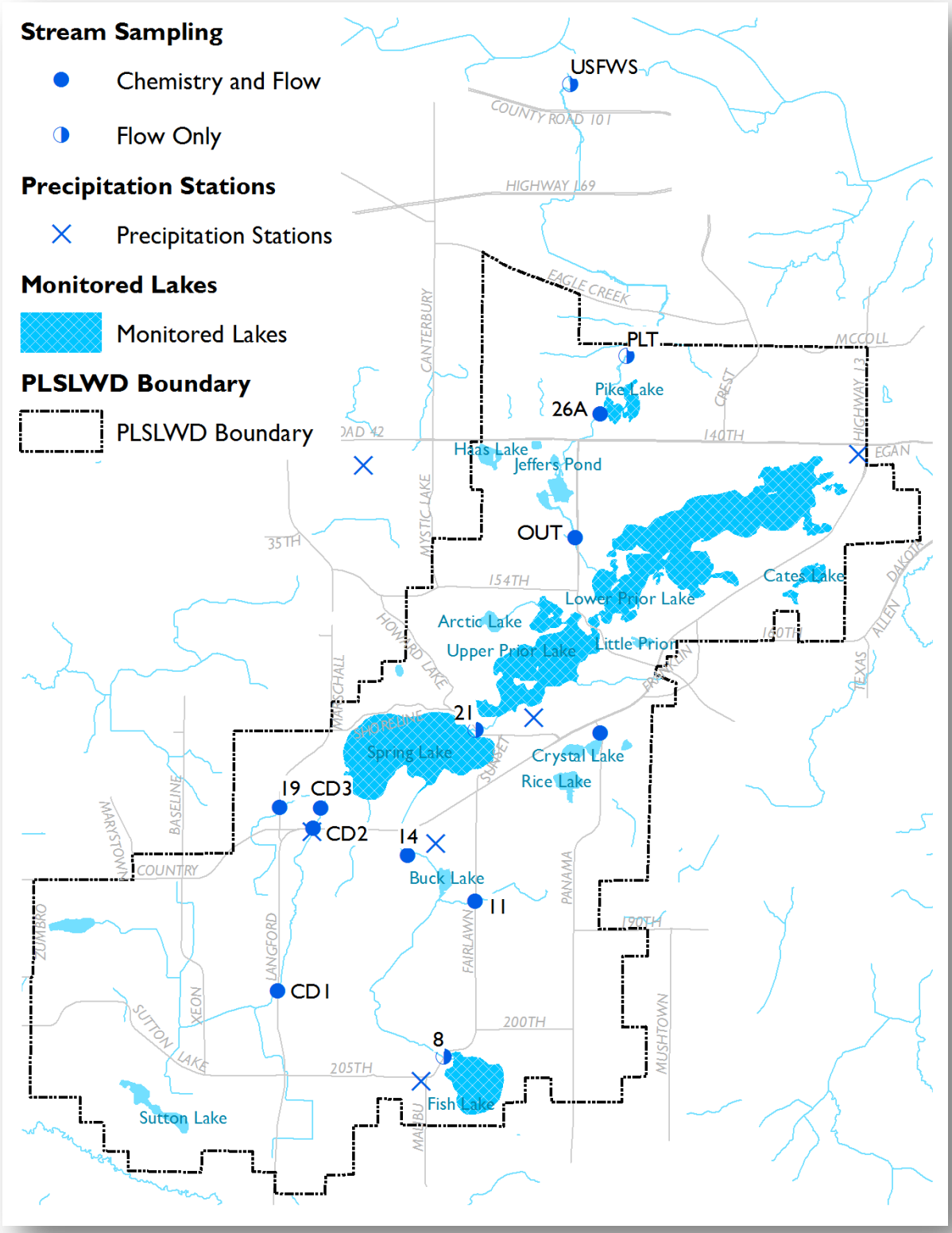


FIGURE 1 2012 MONITORING SITES WITHIN THE PLSLWD

LAKE WATER QUALITY SUMMARY

The conditions of lakes and streams are analyzed by comparison to state water quality standards, which are also known as ecoregion means. Water quality standards vary depending on the ecoregion. Within those ecoregions, water quality standards vary depending on the depth of the lake (shallow or deep) and its beneficial use (i.e., if is it used for drinking water or just recreation). The PLSLWD is located in the North Central Hardwood Forest (NCHF) ecoregion and contains both shallow and deep lakes. Spring, Fish, and Lower Prior are the only deep lakes in the District; the rest are considered shallow.

When comparing the lakes in the PLSLWD to water quality standards, a few things become apparent. Spring Lake and Pike Lake consistently exceed water quality standards, and Pike Lake water quality values are approximately two times worse than Spring Lake's. Upper Prior Lake often exceeds the standards, but not by very much. Fish Lake usually meets the standard, but occasionally exceeds it. Cates and Lower Prior Lake are generally in good condition and do not exceed the standards.

Use the table below to reference water quality standards in the following graphs.

TABLE 1 STATE WATER QUALITY STANDARDS FOR LAKES IN NCHF ECOREGION

Lake Type	Total Phosphorus	Chlorophyll-a	Secchi Depth
Shallow	0.060 mg/L	20 µg/L	Not < 1 meter
Deep	0.040 mg/L	14 µg/L	Not < 1.4 meters

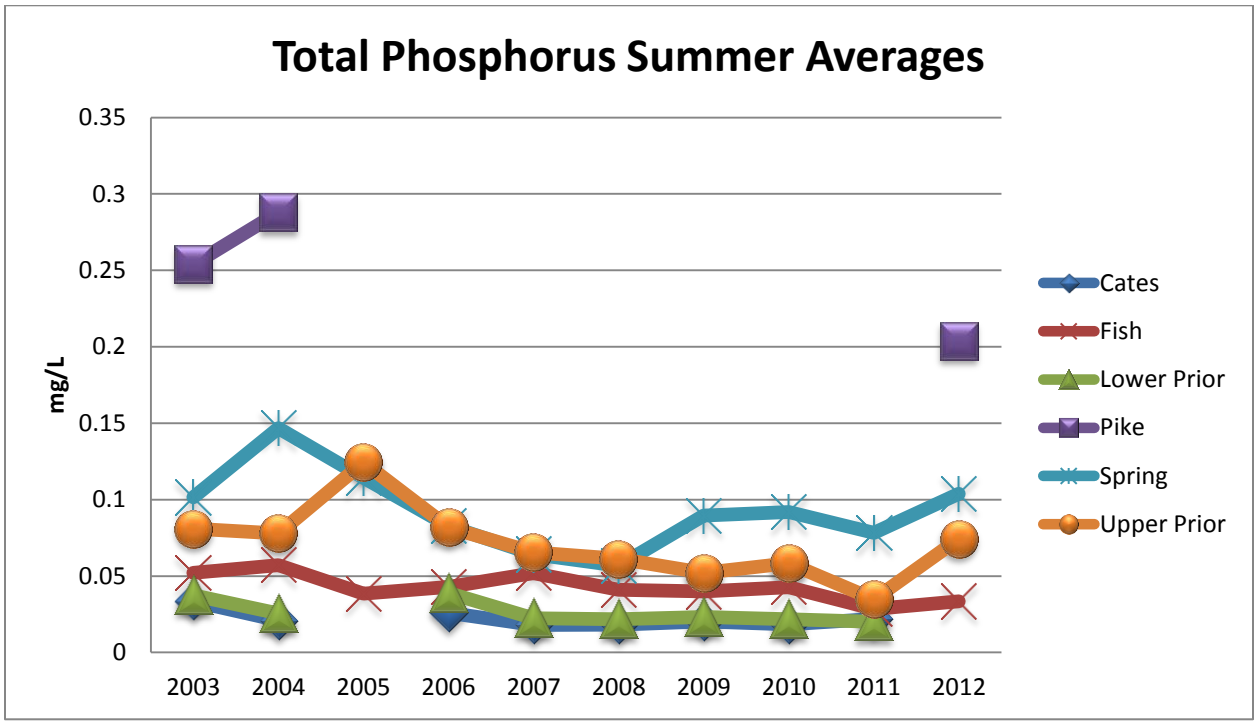


FIGURE 2 SUMMER (JUNE-SEPTEMBER) AVERAGES OF TOTAL PHOSPHORUS USING DATA COLLECTED FROM CAMP AND THREE RIVERS PARK DISTRICT MONITORING PROGRAMS.

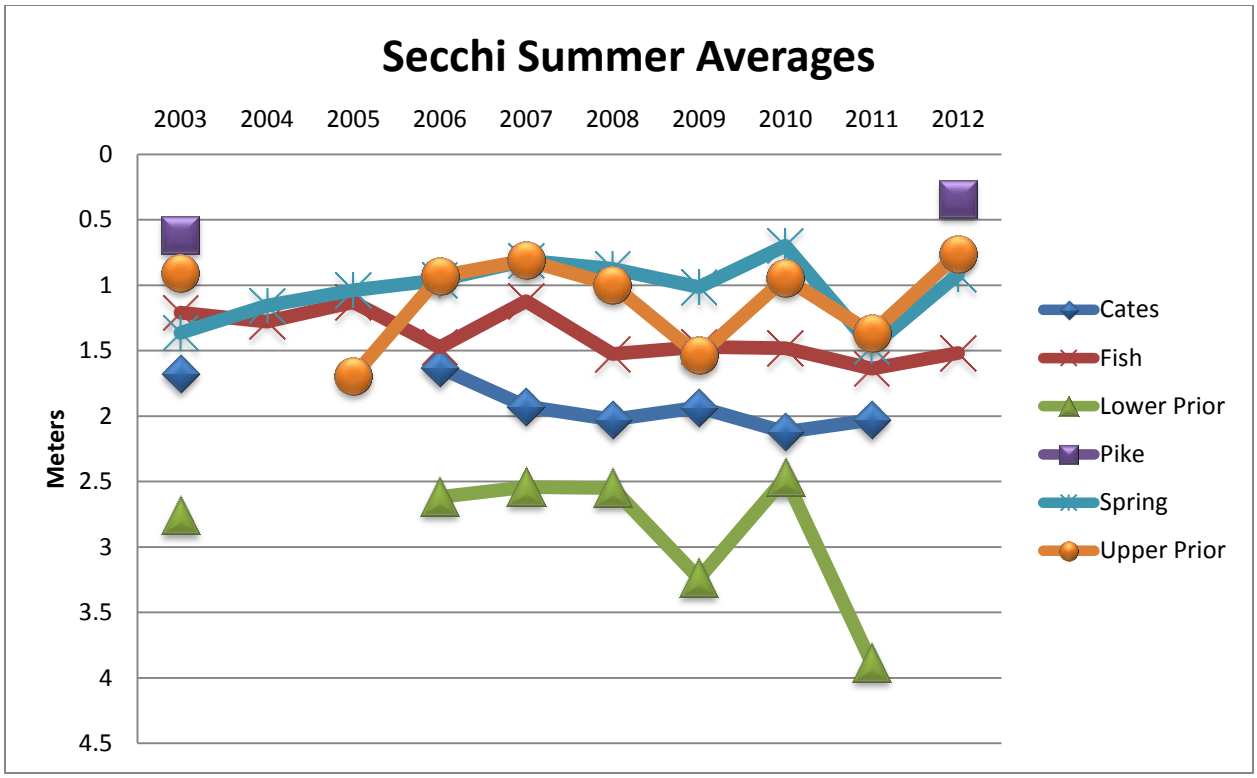


FIGURE 3 SUMMER (JUNE-SEPTEMBER) AVERAGES OF SECCHI DEPTH USING DATA COLLECTED FROM CAMP AND THREE RIVERS PARK DISTRICT MONITORING PROGRAMS.

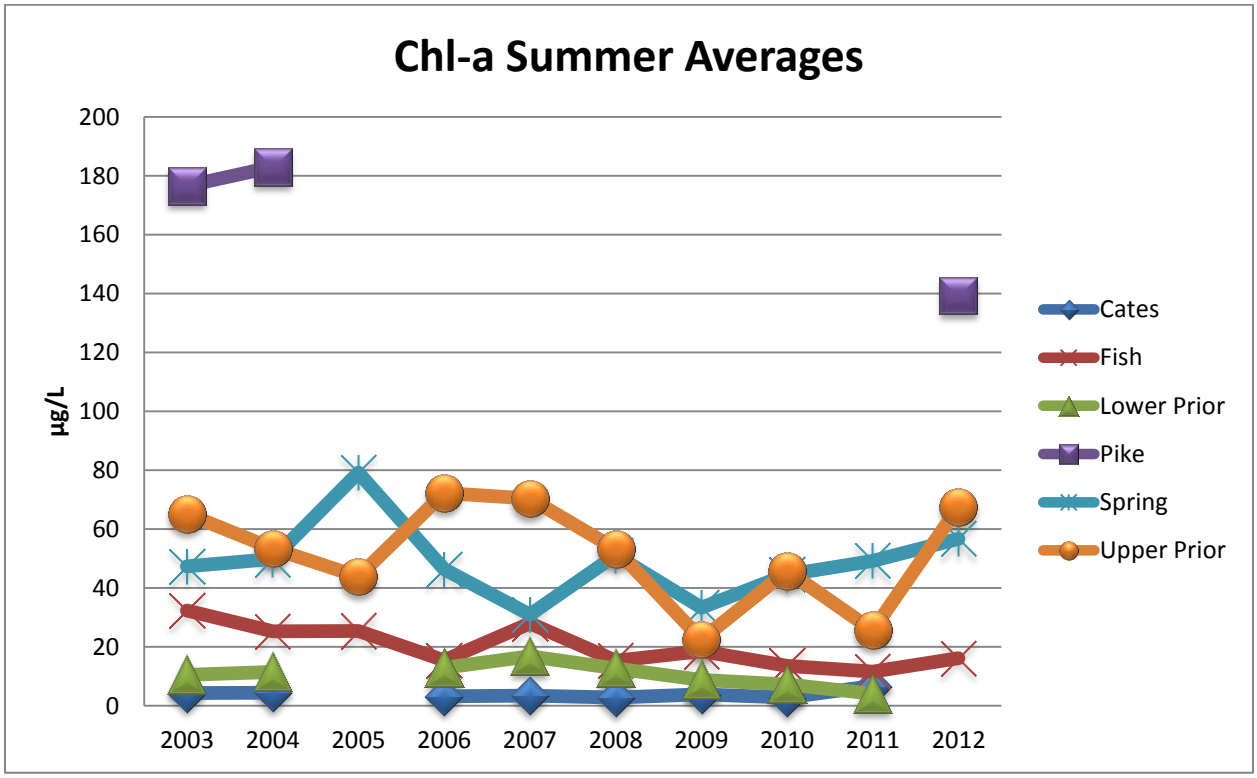


FIGURE 4 SUMMER (JUNE-SEPTEMBER) AVERAGES OF CHLOROPHYLL-A USING DATA COLLECTED FROM CAMP AND THREE RIVERS PARK DISTRICT MONITORING PROGRAMS.

CAMP LAKE MONITORING PROGRAM

Citizen-Assisted Monitoring Program (CAMP) is a volunteer lake monitoring program run by Metropolitan Council and Environmental Services (MCES). Data are used to determine if lakes are meeting state water quality standards for nutrients, how water quality is changing over time and seasons, and how lakes compare to each other. Meanwhile, citizens have a chance to learn more about water quality on their lake.

SITE DESCRIPTIONS

Volunteers collected surface water quality samples on Cates, Fish, Lower Prior, Upper Prior, and Spring Lake.

METHODOLOGY

FIGURE 5 CAMP VOLUNTEER MEASURING SECCHI DEPTH

PLSLWD staff recruits volunteers that are interested in getting involved with lake monitoring. The volunteer must have their own boat and be able to commit at least an hour of their time every other week. Once the volunteers have been recruited, Met Council provides training and equipment to volunteers. Volunteers sample every other week and freeze the samples until the designated pick-up weeks. At that time, PLSLWD staff collects the samples from the volunteers, or the volunteer brings the samples into the office. Met Council collects the samples from the PLSLWD.

Samples are then analyzed in the Met Council lab. The data are reviewed and checked for accuracy by Met Council staff and the data are provided to the PLSLWD in an excel spreadsheet. The Met Council also creates an annual report that includes a two page summary of the results from each lake that were monitored within the District, as well as the whole metropolitan area.

Volunteers in the CAMP program collect samples every other week throughout the summer – approximately 14 samples. Samples are collected from the same location in the lake, which is normally the deepest spot. PLSLWD staff assists volunteers when needed.

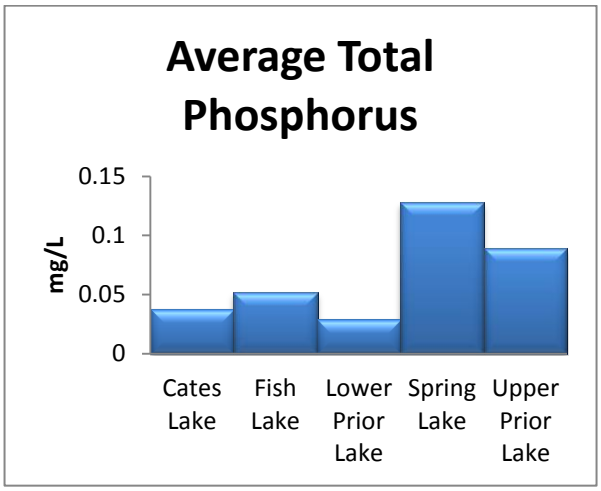
DATA AND RESULTS

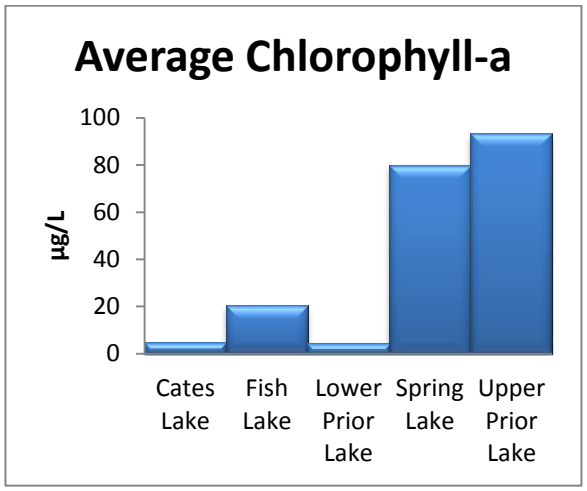
Volunteers record a number of observations while collecting samples, such as water color, water odor, lake level, physical condition, recreational suitability, and comments when appropriate. The water samples are sent to the lab to analyze Chlorophyll-a, Chlorophyll-b, Chlorophyll-c, Total Kjeldahl Nitrogen, Pheophytin-a, and Total Phosphorus. All of the results are included in the Appendix.

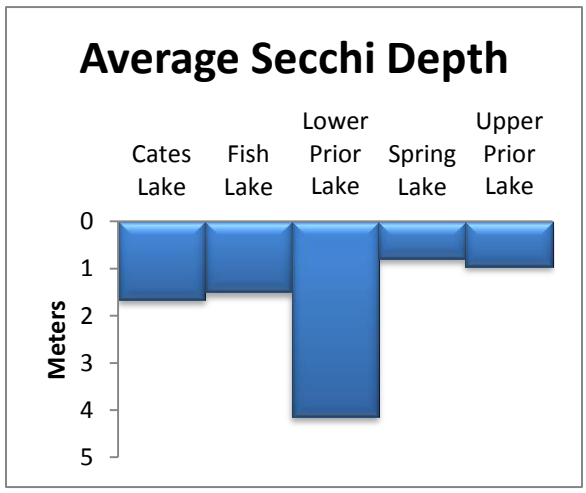
Volunteers in the Citizen Assisted Monitoring Program collected a total of 52 samples on lakes in 2012. Five samples collected on Cates, 14 on Fish, 14 on Lower Prior, 11 on Upper Prior, and 8 on

Spring Lake. Spring and Upper Prior Lake did not meet water quality standards in 2012. Fish Lake barely met the standards, and Cates and Lower Prior Lake had good water quality.

All of the raw data are included in Appendix B.







THREE RIVERS PARK DISTRICT LAKE PROFILE MONITORING

FIGURE 6 THREE RIVERS PARK DISTRICT STAFF TAKING PROFILE MEASURMENTS

Water quality samples collected by Three Rivers Park District are similar to the CAMP monitoring, but more in depth. While CAMP volunteers are only able to collect surface water samples, the Park District collects samples along the lake profile, taking samples on the surface, middle, and bottom. Also, more parameters and a different set of lakes are analyzed by the Park District. Data are used to determine if lakes are impaired, how the lakes compare to each other, and how the quality changes over time. By monitoring the profiles, we get a clearer understanding of whether a lake separates into different strata (and if it does, when and how), which can guide decisions about internal load management, pollutant loading calculations, and more.

SITE DESCRIPTIONS

Three Rivers Park District collects water quality data on Fish, Upper Prior, Spring, and Pike lakes. Pike Lake has two monitoring locations – the east and west bay.

METHODOLOGY

Lake sampling occurred bi-weekly from ice out (April) through the completion of fall turnover (October).

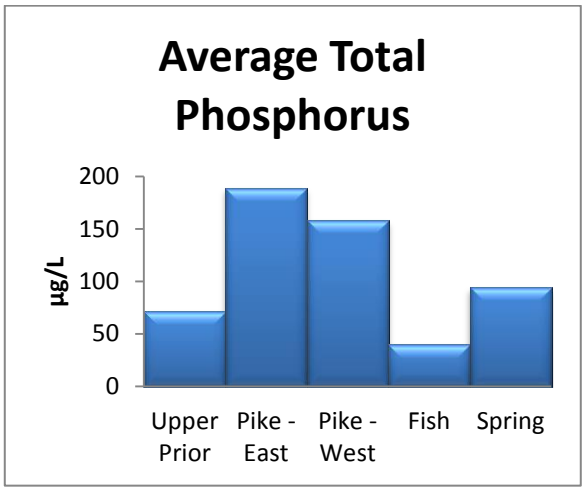
Physical water quality parameters (temperature, dissolved oxygen, conductivity, and pH) were collected at 1-m intervals from surface to bottom for all lakes sampled. Water clarity was also measured for each lake using a Secchi disk.

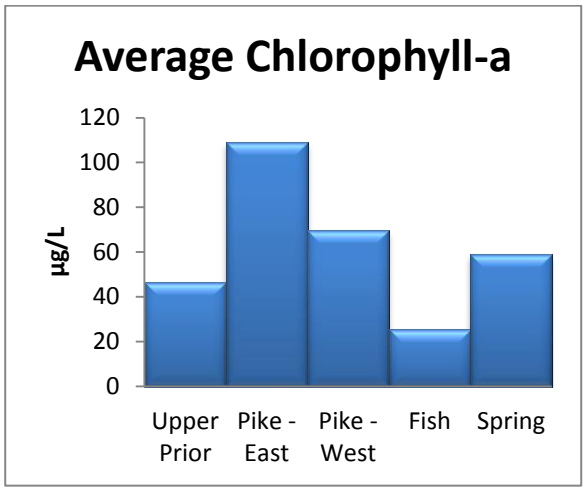
A 2-m composite surface water chemistry sample was collected from all lakes. Those lakes that were deep enough for the development of stratification had chemistry samples collected at the thermocline and 1 meter from the bottom with a Kemmer bottle. A field duplicate was collected from one lake during each bi-weekly sampling period. Chemistry samples are analyzed at the Three Rivers Park District water quality lab, and include total phosphorus, soluble reactive phosphorus, total nitrogen, chlorophyll-a, Secchi depth, and chlorides.

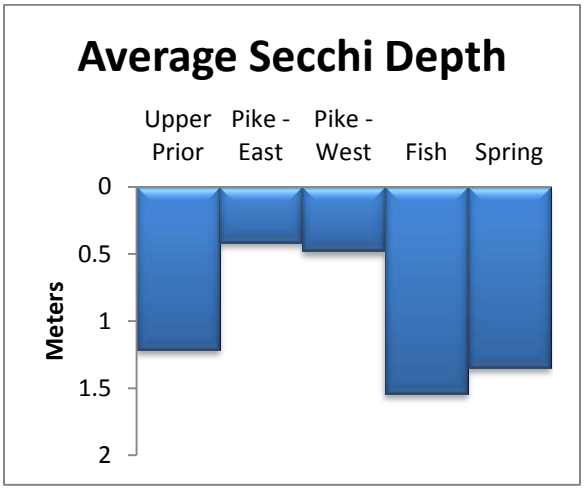
DATA AND RESULTS

Pike Lake showed excessive nutrients, high chlorophyll-a, and extremely low Secchi depth readings. All standards were exceeded significantly. Spring Lake also exceeded standards quite significantly. Upper Prior Lake was close to the standards, but exceeded them all slightly. Fish Lake was very

close to the Chlorophyll-a and total phosphorus standards, but met the Secchi standard. All of the 2012 raw data are included in Appendix A.







LAKE LEVEL MONITORING

Lake level was monitored by PLSLWD staff in 2012. Lakeshore owners on Prior Lake are especially concerned about the level of Prior Lake since flooding can severely impact lakeshore residents. The current level of Prior Lake can be accessed on the PLSLWD website.

SITE DESCRIPTIONS

PLSLWD monitored three staff gauges for the MN DNR – Cates, Pike, and Prior.

The PLSLWD staff and EOR installed an automated lake level logger on Lower Prior Lake in 2012. Three more automated level loggers are to be installed on Pike, Fish, and Spring Lake in 2013.

FIGURE 7 STAFF GAUGE AT CATES LAKE

METHODOLOGY

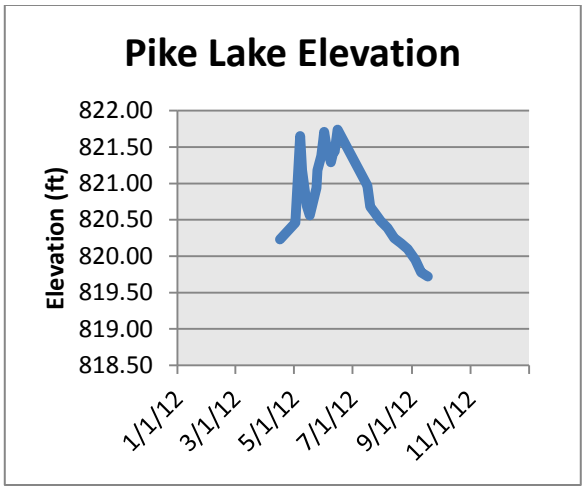
Lake surface elevation was recorded in conjunction with the DNR lake level monitoring program by manually reading a calibrated staff gauge every week. The data are reported to the DNR monthly and then provided on the DNR Lake Finder website (http://www.dnr.state.mn.us/lakefind/index.html).

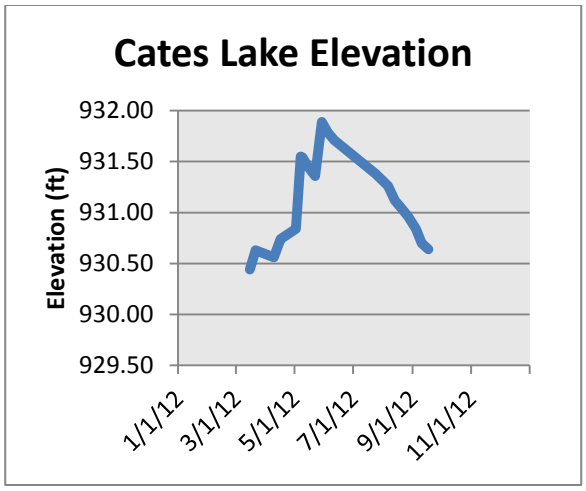
The automated level logger is mounted on the Prior Lake Outlet Structure and the lake level is updated automatically on our website in near real time data. The lake level on the Outlet Structure is tied to the Prior Lake staff gauge. The logger was installed on August 4th and was removed before ice-in on October 1st. The logger has telemetry capabilities and remotely connects to the PLSLWD computer server to download the data and updates the website every hour.

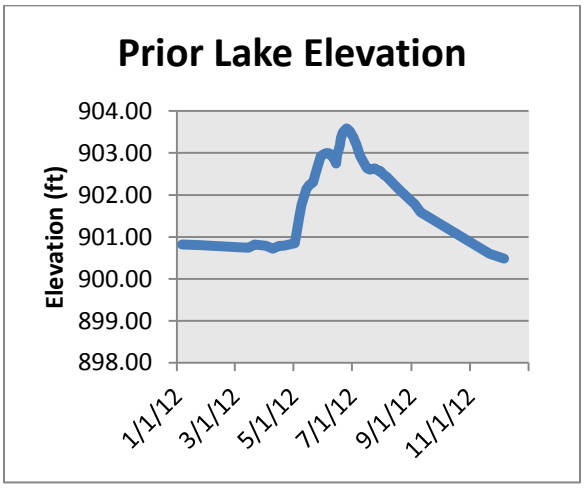
DATA AND RESULTS

TABLE 2 LAKE LEVEL RECORDS

Lake	2012 Highest	Highest Recorded	2012 Lowest	Lowest Recorded
Cates	931.89 (5/29/2012)	933.37 (10/15/2002)	930.44 (3/15/2012)	930.41 (11/03/2003)
Pike	821.74 (6/15/2012)	823.58 (5/10/2001)	819.72 (9/17/2012)	818.58 (8/10/2007)
Prior	903.59 (6/25/2012)	905.68 (7/20/1983)	900.48 (12/6/2012)	893.48 (10/25/1940)


Pike Lake Elevation
Elevation (ft)
822.00
821.50
821.00
820.50
820.00
819.50
819.00
818.50
1/1/12
3/1/12
5/1/12
7/1/12
9/1/12
11/1/12


Cates Lake Elevation
Elevation (ft)
932.00
931.50
931.00
930.50
930.00
929.50
1/1/12
3/1/12
5/1/12
7/1/12
9/1/12
11/1/12


Prior Lake Elevation
Elevation (ft)
904.00
903.00
902.00
901.00
900.00
899.00
898.00
1/1/12
3/1/12
5/1/12
7/1/12
9/1/12
11/1/12

Stream monitoring results indicate that site 19 (Spring West subwatershed) consistently provides the highest sediment and phosphorus concentrations within the Upper Watershed (see Figure 8 and Figure 9). However, preliminary estimates from FLUX modeling suggest that the total annual loads of the County Ditch 13 subwatershed are contributing the most sediment and phosphorus to Spring Lake (see Figure 10). Future monitoring efforts should focus on refining the load estimates from the subwatersheds.

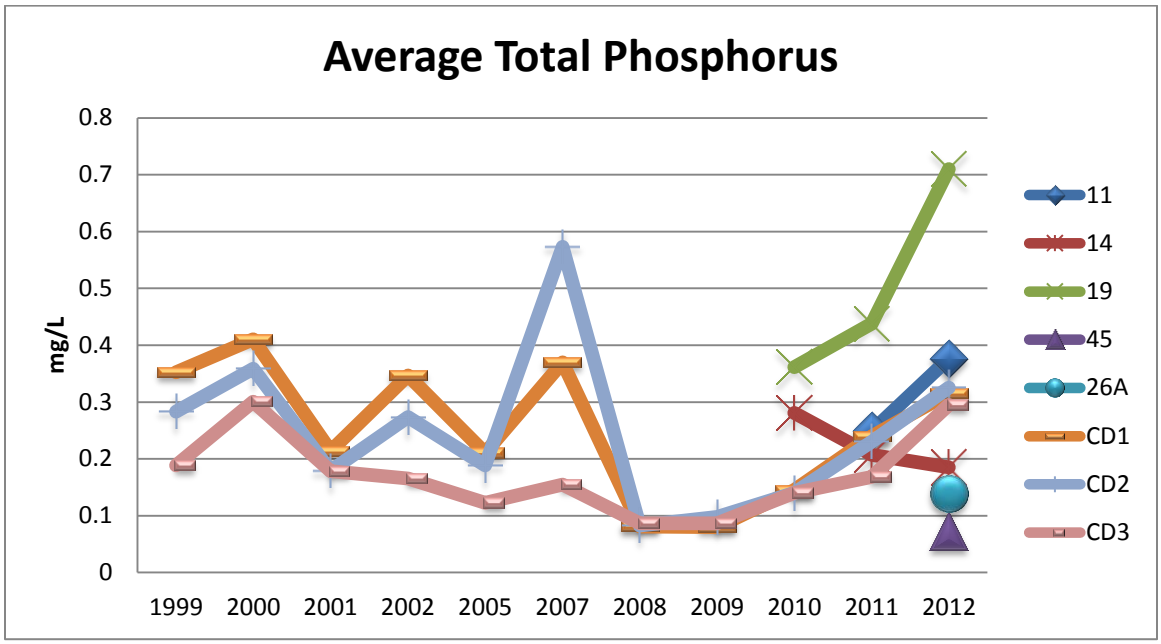


FIGURE 8 AVERAGE TOTAL PHOSPHORUS AT STREAM MONITORING LOCATIONS

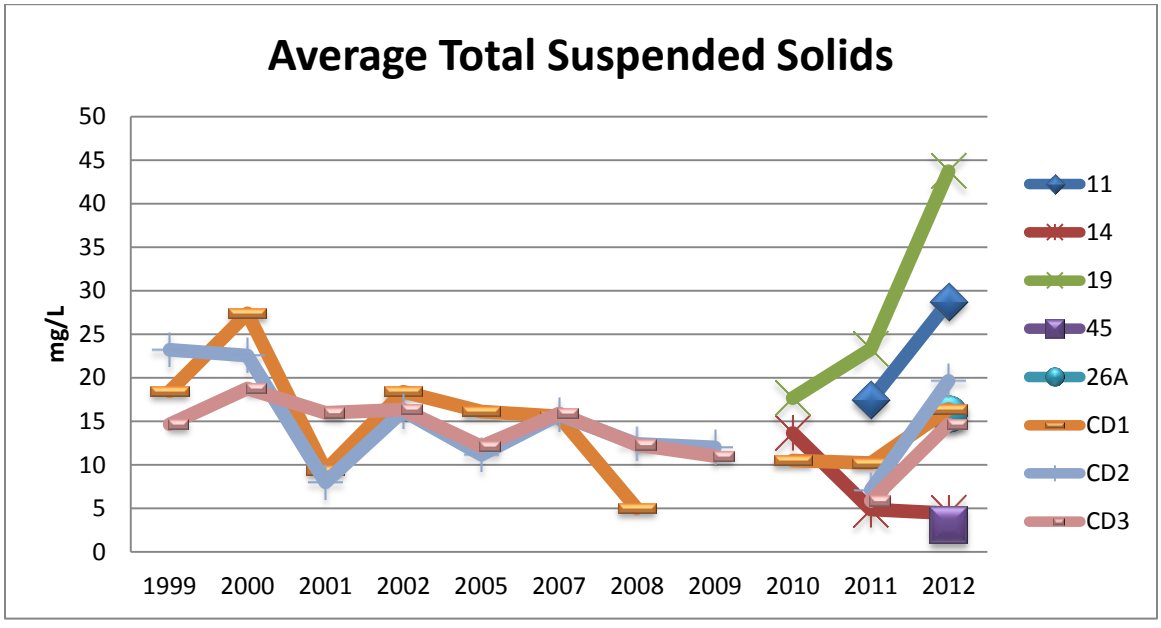


FIGURE 9 AVERAGE TOTAL SUSPENDED SOLIDS AT STREAM MONITORING LOCATIONS

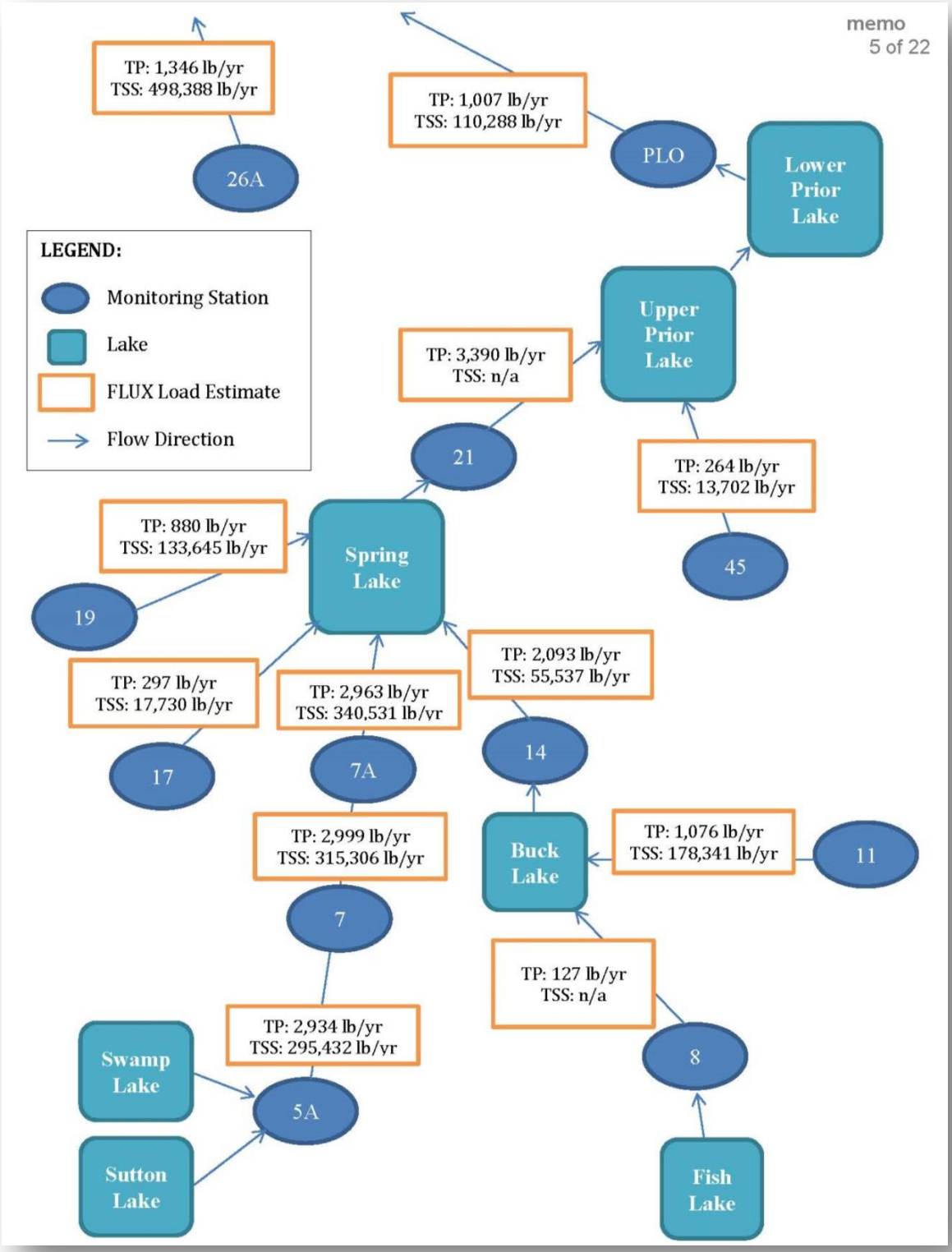


FIGURE 10 PRELIMINARY ESTIMATES OF ANNUAL LOADS OF TOTAL PHOSPHORUS AND TOTAL SUSPENDED SEDIMENT FROM EOR MEMO (APPENDIX D)

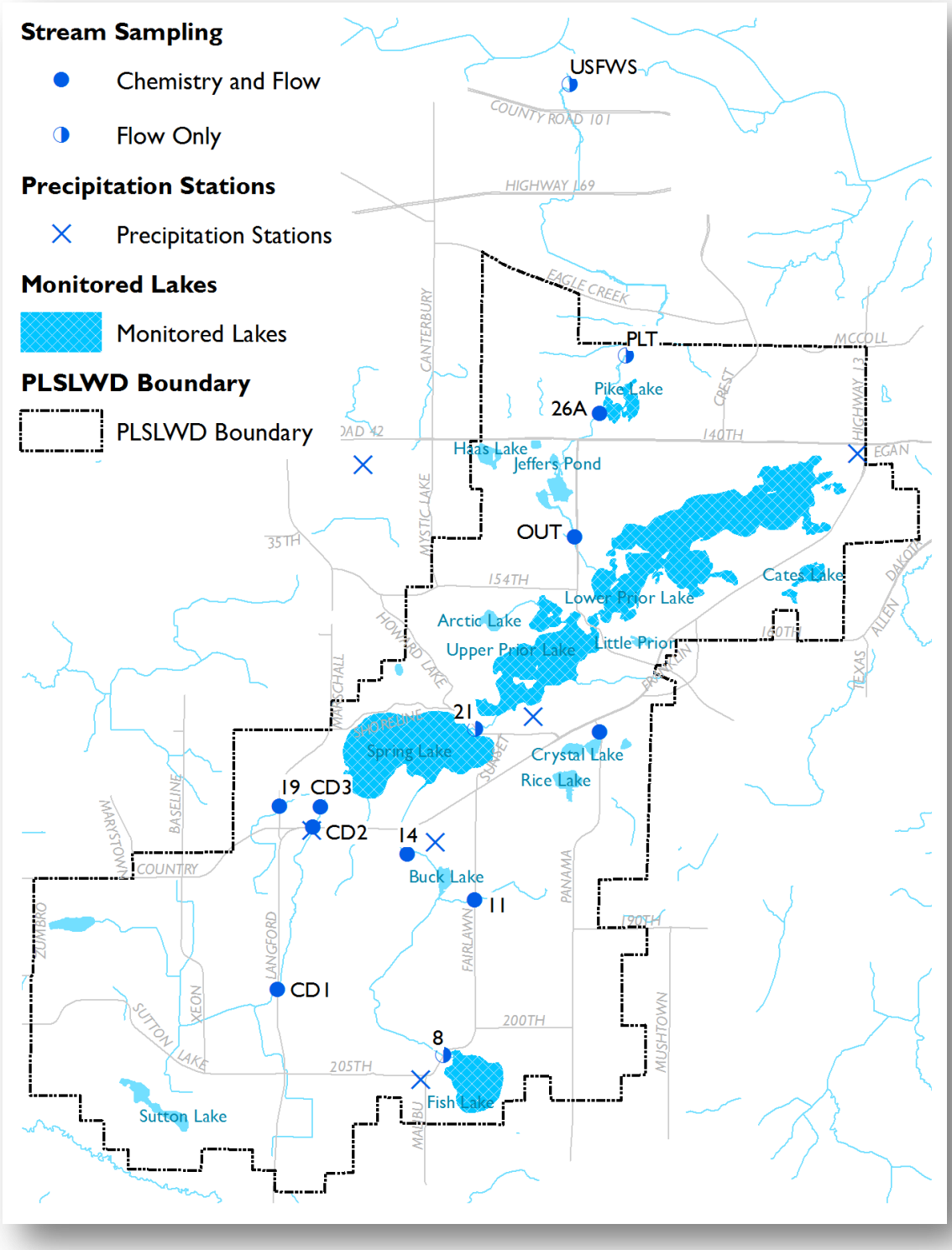


FIGURE 11 STREAM AND FLOW MONITORING SITES

STREAM CHEMISTRY SAMPLING

Stream chemistry sampling is conducted to determine how streams or ditches in the watershed contribute to lake water quality. For instance, Spring Lake is impaired for nutrients, but has many tributaries. In order to better understand why Spring Lake is impaired, and where the pollution is coming from, streams are monitored before inletting into Spring Lake. Since the streams in the District are intermittent, state water quality standards do not directly apply to the streams. However, regardless of the type of stream, the quality of those water bodies still impact the water quality of lakes, so we use the state water quality standards as a reference to overall stream health and the impact they have on the lakes.

SITE DESCRIPTIONS

Water quality samples were collected at nine sites by Scott Soil and Water Conservation District (SWCD) and PLSLWD staff. Those sites include streams in the upper watershed (including the Ferric Chloride sites) and along the outlet channel: CD1, CD2, CD3, Outlet, ST_11, ST_14, ST_19, ST_26A, and ST_45. Two additional sites (ST_26C and ST_26D) were only monitored a couple times during a large storm event (see Figure 11).

FIGURE 12 SITE 14 (OUTLET OF BUCK LAKE)

METHODOLOGY

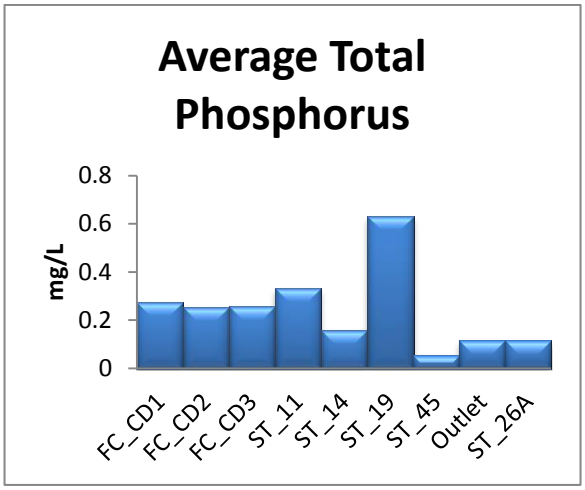
Scott SWCD collected a total of 58 stream water quality samples in 2012. Twenty samples were collected at two sites (Outlet and ST_26A) along the Prior Lake Outlet Channel and 38 samples were collected in the upper watershed (ST_11, ST_14, ST_19, and ST_45). Data are to be used in conjunction with the flow monitoring in order to quantify pollutant loads. Parameters collected include a combination of: dissolved oxygen, pH, conductivity, turbidity, water temperature, total phosphorus, soluble reactive phosphorus (also commonly referred to as orthophosphate), total suspended solids, volatile suspended solids, nitrate + nitrite, total kjeldahl nitrogen, and chloride. Samples were collected and sent to Braun Intertec for lab analysis. Field parameters were collected using a Hydrolab sonde.

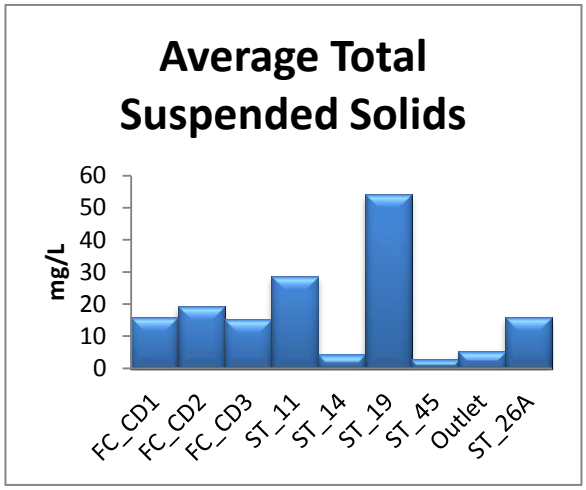
DATA AND RESULTS

Stream chemistry sampling shows us that the highest total phosphorus and total suspended solids concentrations come from site ST_19 (site 19). This is a small watershed with lots of agriculture and some commercial land use. Although the concentrations are high, the flow is relatively low.

Preliminary estimates of annual loads were determined by combining stream flow and pollutant concentrations in the model FLUX (see Figure 10). It should be noted that considerable variability was observed in the FLUX model, so these loads should be used for future monitoring guidance only. However, we present them here because they provide an initial snapshot of potential high source loads. Site 19 contributes approximately 880 pounds per year to Spring Lake (data at site 19

and 8 are calculated using lake data, not stream data). Even though the concentrations of total phosphorus at other sites are lower, total annual loads to Spring Lake are higher because the amount of flow is higher. The highest annual load into Spring Lake comes from site 7A (also referred to as site FC_CD3) with a total of 2,963 pounds per year. This tributary is called County Ditch 13 and is a highly agriculture dominated watershed.
Data from the chemistry sampling is summarized in more detail in a memo titled *2011 and 2012 Watershed Monitoring Summary*, which is included in Appendix D. Raw data are included in Appendix C.





FERRIC CHLORIDE TREATMENT SYSTEM MONITORING

In 1998, the PLSLWD constructed a ferric chloride treatment system to precipitate dissolved phosphorus out of County Ditch 13, the main inflow to Spring Lake. In 2004, the treatment system permit was renewed as a National Pollutant Discharge Elimination System permit administered by the MPCA. In 2012, the system was redesigned in order to release the $FeCl_3$ solution into a desiltation basin, rather than the stream (requirement of the MPCA). This redesign was completed in 2013.

SITE DESCRIPTIONS

Three monitoring sites constitute the Ferric Chloride monitoring system. CD1 is located upstream of the Ferric Chloride treatment system, CD2 is located at the weir next to the treatment building, and CD3 is located after the desiltation basin, where the treatment normally occurs.

METHODOLOGY

Monitoring requirements of the permit include maintaining continuous flow data. Grab sampling is required once per week while the system is under operation.

Sixty-six samples were collected throughout the entire monitoring season (March through October) regardless of actual dosing operation. Parameters analyzed in the grab samples are total iron, total phosphorus, soluble reactive phosphorus, total dissolved phosphorus, and total suspended solids.

Continuous stage and flow were also measured at CD1 and CD2. Because of the short distance between CD2 and CD3, flow is assumed to be the same.

DATA AND RESULTS

Even though the $FeCl_3$ system was not dosing in 2012, sampling still resumed in order to analyze dissolved phosphorus (soluble reactive phosphorus) and total phosphorus removal as it moves through the desiltation pond.

Results in Figure 13 show that phosphorus did not decrease by flowing through the desiltation basin, which underscores the need to continue treating with ferric chloride in the future.

All of the water quality data are included in Appendix C.

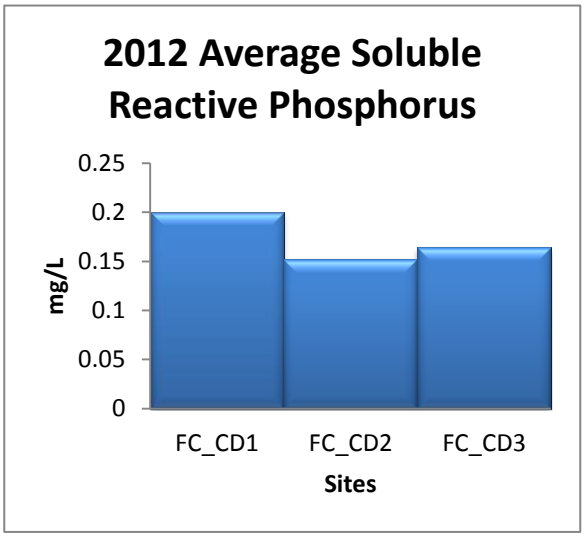


FIGURE 13

STAGE AND FLOW MONITORING

Level loggers are placed at chemistry monitoring sites. These record stage (depth of water) and with multiple flow measurements, stage is able to be converted to flow.

With the combination of chemistry and flow data, we are able to calculate an annual volume of water and loads (total amount of a pollutant in one year) by using a program called FLUX.

PLSLWD also monitors stage and flow at the Prior Lake Outlet Structure. This enables us to determine how much water leaves Prior Lake, which is used to regulate flooding potential for lakeshore owners.

Stage and flow were monitored at two locations along the outlet channel for purposes of XP-SWMM model calibration, a model used to estimate runoff values throughout the watershed to the outlet channel.

SITE DESCRIPTIONS

Continuous stage and flow were collected at 10 monitoring stations by using level loggers and flow meters. These sites include CD1, CD2, CD3, 8, 11, 14, 19, 21, 45, 26A and the Outlet (see Figure 11). Forty-four flow measurements were collected by Scott SWCD in streams throughout the watershed.

EOR collected 20 flow measurements at 2 locations (PLT and USFWS) along the outlet channel for purposes of calibrating the XP-SWMM model.

METHODOLOGY

A level logger is located at stream chemistry sites and logs the stage every 15 minutes. Flow measurements are taken with a flow meter at various stages in order to create a stage-discharge relationship (rating curve).

Once enough flow measurements have been taken to make a rating curve, the stage data that was logged on the level logger can be used to calculate how much water passed that site in one year. By using the water quality data and a program called FLUX, you can calculate how of a pollutant has passed that site.

Rating curves and hydrographs for all monitoring sites were created by EOR and were used for determining pollutant loads in Figure 10.

FIGURE 14 SCOTT SWCD COLLECTING FLOW MEASUREMENT AT SITE 26A

Scott SWCD conducted the majority of stream flow measurements for the District using a flow meter – either a FlowTracker or Marsh McBirney. EOR took some flow measurements using a Marsh-McBirney FloMate flow

meter, calculated rating curves, and created hydrographs for each site. This information is needed to help calculate pollutant loads (using the chemistry data) and determine the amount of volume that passes each site. The rating curves for a few sites were weak due to variability in stream stage measurements due to debris or physical disturbance of the meters. These rating curves will be strengthened with future monitoring data.

DATA AND RESULTS

Stage and flow data from 2011 and 2012 were used to estimate average annual flow, flow weighted mean concentrations, and total annual loads at each site using the model FLUX. This is a table that EOR created in the 2011 and 2012 Watershed Monitoring Summary memo.

TABLE 3 ANNUAL FLOW AND FLOW WEIGHTED MEAN CONCENTRATIONS

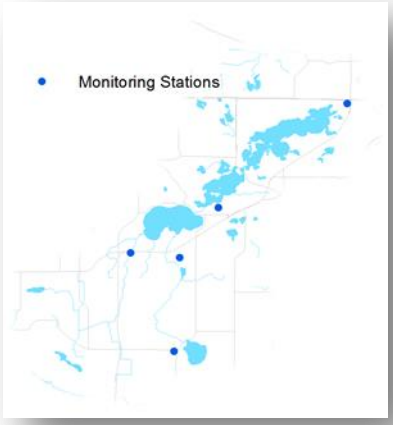
Site	**Location Description**	**Flow Weighted Mean Concentration**		**Annual Flow**
		TP (mg/l)	*TSS (mg/l)*	*(ac-ft/yr)*
CD1	Highway 13 crossing	0.29	30	2,252
CD2	Upstream Side of Ferric Chloride System	0.33	35	2,555
CD3*	Downstream Side of Ferric Chloride System	0.32	37	2,555
8*	Fish Lake outlet	0.048	N/A	506
11	Buck Lake inlet	0.27	45	758
14	Buck Lake outlet	0.21	6	2,307
19	Marschall Road crossing	0.56	85	334
21	Spring Lake outlet	0.07	N/A	7,433
45*	Crystal Lake outlet	0.08	4	586
Outlet	Prior Lake outlet	0.04	4	5,668
26A	Pike Lake inlet	0.07	26	3,215

*Relatively weak rating curve due to stream channel fluctuations, few flow measurements, etc. Data should be used with caution.

OTHER MONITORING

PRECIPITATION MONITORING

In collaboration with the State Climatology Office, volunteers and the PLSLWD staff recorded daily precipitation. Data was used both by the Climatology office for conducting weather reports and by PLSLWD staff for analyzing water quality data.



SITE DESCRIPTIONS

Precipitation monitoring locations are scattered throughout the watershed. Volunteers monitor precipitation from rain gauges that are located on their property and the PLSLWD staff has a gauge located in the office parking lot. An automated tipping bucket is located at the Ferric Chloride site and two sites along the Prior Lake Outlet Channel.

METHODOLOGY

Three volunteers and PLSLWD staff used a 4" plastic rain gauge to record precipitation (rain and melted snow), which is provided by the State Climatology Office. Data collected by staff and volunteers is submitted to the State Climatology Office monthly and is then available online on the State Climatology website.

Two automated tipping bucket rain gauges were operating in 2012. Automated tipping-bucket rain gauges log the total rainfall every 15 minutes. One recorded precipitation at the Ferric Chloride site. This information is especially important for analyzing stream flow and water quality response to precipitation events. EOR originally installed two automated tipping buckets along the outlet channel for use in calibrating the XP-SWMM model (only one worked).

DATA AND RESULTS

TABLE 4 MONTHLY TOTAL PRECIPITATION (INCHES) OBSERVATIONS WITHIN THE DISTRICT

Month	Cohen	Schultz	Meuller	Office
Jan	0.36	0.23	0.34	0.42
Feb	1.76	1.45	1.68	1.69
Mar	1.68	1.52	1.47	1.56
Apr	2.54	3.45	3.19	2.8
May	11.56	9.82	10.08	10.85
Jun	6.26	6.06	N/A	5.95
Jul	2.98	3.68	2.73	3.52
Aug	1.33	1.87	1.92	1.19
Sep	0.53	0.64	0.63	0.7
Oct	1.28	1.37	1.38	0.14
Nov	0.62	N/A	0.62	0.55
Dec	1.54	1.97	1.08	1.2
2012 Total	**32.44**	**N/A**	**N/A**	**30.57**

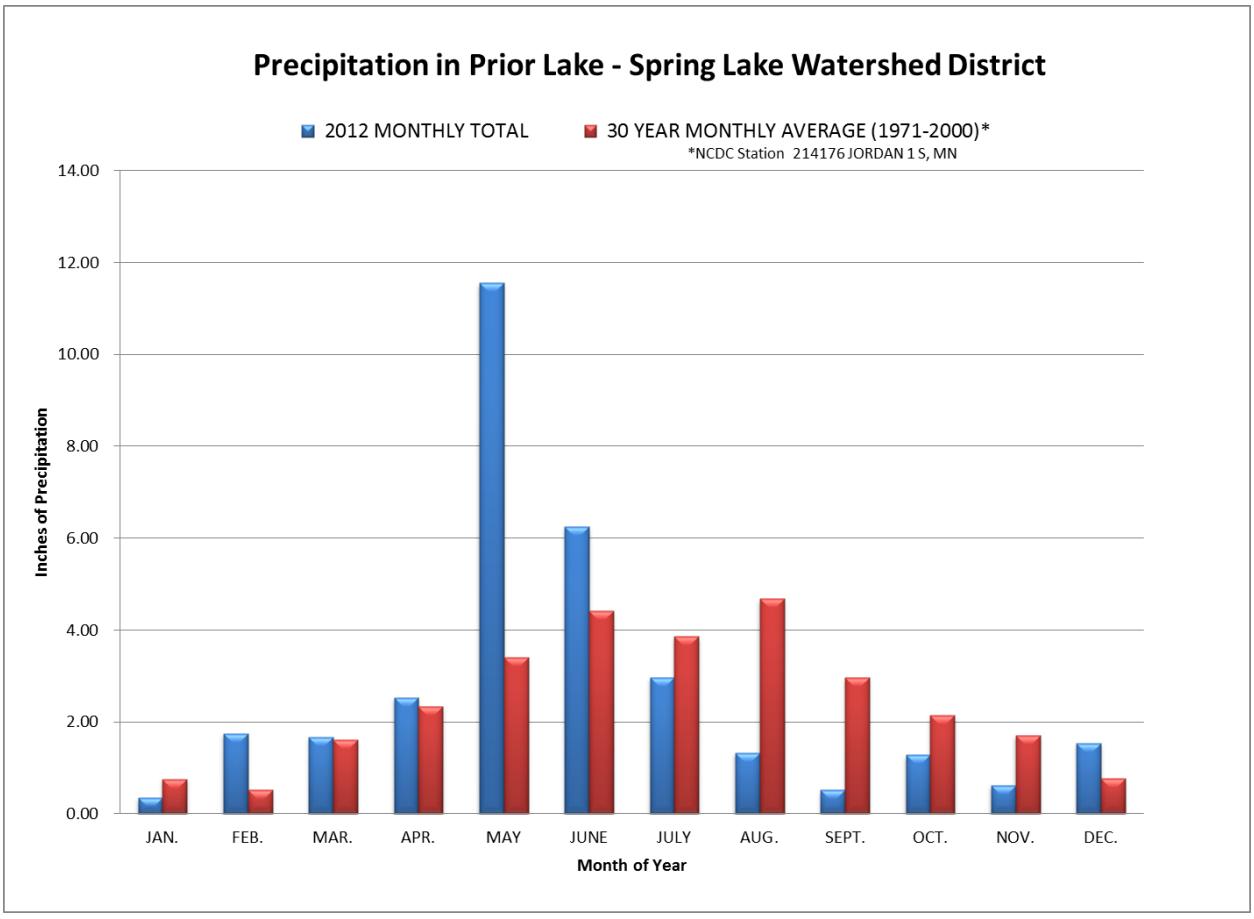


FIGURE 15 ANNUAL PRECIPITATION IN PLSLWD

VEGETATION SURVEYS AND LAKE SEDIMENT SAMPLING

Blue Water Science has been surveying vegetation in the watershed since 1998. Plant density and diversity has a strong correlation with water quality and a strong impact on aquatic life.

SITE DESCRIPTIONS

In 2012, Pike, Spring, Upper Prior, Lower Prior, and Fish lake were surveyed.

METHODOLOGY

Using a rake, Blue Water Science sampled the number of submerged plants per square foot in various (randomly distributed) locations around a lake. This is primarily used for determining curlyleaf pondweed density and obtaining a summary of other plant species diversity and density. Additional sediment sampling has been completed in conjunction with and as a part of vegetation surveys to establish potential growth analysis for curlyleaf pondweed.

FIGURE 16 CURLYLEAF PONDWEED SAMPLED FROM SPRING LAKE

Surveys are completed two times per year, once in spring and once in summer. The spring survey is used to determine the curlyleaf pondweed density and potential need for treatment. The summer survey is needed to examine the effectiveness of curlyleaf treatment (if applicable) and to survey the density and diversity of other aquatic vegetation.

DATA AND RESULTS

The full aquatic plant survey reports are available on the PLSLWD website or by contacting the PLSLWD office, but here is a summary.

Spring Lake: Vegetation surveys were conducted on April 17 and June 5 in 2012. In April, curlyleaf was found at 7 out of 50 sites and the density was light. The June assessment found similar conditions and density was still light. There has not been any curlyleaf treatment since 2007 and no treatment was recommended for this year.

Prior Lake: Vegetation surveys were conducted on April 6 and May 29. A total of 32 acres of curlyleaf were delineated with a potential for heavy growth. These conditions lead to likelihood for treatment in 2013, but not yet recommended for 2012.

Pike Lake: Only one survey was conducted on August 6th to characterize conditions of native aquatic plants and to look for non-native Eurasian watermilfoil. Pike Lake had a low diversity of submerged aquatic plants. Only one of the 74 sites had Eurasian watermilfoil and this was the first time it has been documented on this lake. The shoreline was ringed with natural emergent vegetation.

Fish Lake: Two assessments were conducted on April 17 and June 5. In April, curlyleaf was found at 10 out of the 11 sites monitored. On the second assessment, curlyleaf had increased in abundance at several areas. Overall, curlyleaf growth has been mostly light to moderate in the last few years, but there were several acres of heavy curlyleaf growth in 2012. Fish Lake has not been treated for curlyleaf since 2008, but there is a potential need for treatment in 2013.

SEDIMENT CORING

Sediment coring was conducted on Spring Lake to determine historic phosphorus conditions by analyzing lake sediment deposits. This work was completed by the St. Croix Watershed Research Station and the Science Museum of Minnesota.

SITE DESCRIPTIONS

Multiple sediment cores were taken at the bottom of Spring Lake.

FIGURE 17 COLLECTING SEDIMENT CORE SAMPLES ON SPRING LAKE

METHODOLOGY

Samples of the core were inspected at different depths (representing time). Diatoms were observed to determine what condition the lake was in before European settlement. This was used to determine if it is attainable for Spring Lake to ever meet the water quality standard of 40 ppb of total phosphorus.

DATA AND RESULTS

Prior to settlement, the results show that the lake water total phosphorus was approximately 60 (±5) ppb. While this is considerably less than today's observations, it does suggest that the lake was historically nutrient-rich. The cores also suggest that total phosphorus started increasing in the 1920's, which is also when the development of Prior Lake started accelerating and mechanized agriculture began in the watershed. The complete report is provided in Appendix E.

Figure 18 shows the current TMDL standard in the thin, red line. The range of TP concentrations measured from 1996-2006 is shown as the red shaded area. The grey shaded line is the suggested pre-settlement TP levels. The black line is the diatom-modeled TP concentrations.

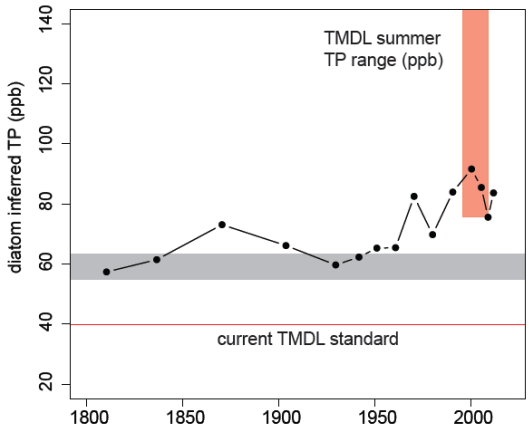


FIGURE 18 DIATOM MODELED TP CONCENTRATIONS OVER THE LAST 200 YEARS.

MICROCYSTIN SAMPLING

Because of some extremely green water and the presence of blue-green algae on Spring Lake, a concern arose about the potential for a toxic byproduct of blue-green algae called microcystin. The PLSLWD took samples which confirmed microcystin was indeed present in the Spring Lake outlet channel. This toxin can have harmful effects on humans and pets, so it is advised to stay out of the water when the quality of the water is questionable.

FIGURE 19 WATER SAMPLED FROM THE SPRING LAKE OUTLET CHANNEL IN 2012

APPENDIX A - THREE RIVERS PARK DISTRICT DATA

Site	Date	Depth	Sonde Depth	Temp, °C	DO, mg/l	DO, Sat %	SpCond, µS/cm	pH	TP, µg/l	SRP, µg/l	TN, mg/l	CLA, µg/l	Secchi, m	Chloride, mg/l
Fish Lake	17-Apr-12	0.00	0.51	11.68	11.00	101.5	449	8.12	56.1	4.6	1.33	12	1.85	
Fish Lake	17-Apr-12	1.00	1.02	11.68	10.31	95.1	449	7.80						
Fish Lake	17-Apr-12	2.00	2.05	11.58	10.14	93.3	449	8.08						
Fish Lake	17-Apr-12	3.00	3.00	11.53	10.10	92.9	449	8.13						
Fish Lake	17-Apr-12	4.00	4.03	11.41	10.06	92.2	449	8.13	69.8	9.03				
Fish Lake	17-Apr-12	5.00	4.99	11.24	9.98	91.1	449	8.16						
Fish Lake	17-Apr-12	6.00	6.03	11.06	9.80	89.1	450	8.06						
Fish Lake	17-Apr-12	7.00	7.04	11.00	9.46	85.9	450	8.06						
Fish Lake	17-Apr-12	8.00	8.00	10.91	9.36	84.8	450	8.03	57.1	7.57				
Fish Lake	17-Apr-12	8.73	8.73	10.75	4.23	38.2	463	7.23						

Site	Date	Depth	Sonde Depth	Temp, °C	DO, mg/l	DO, Sat %	SpCond, µS/cm	pH	TP, µg/l	SRP, µg/l	TN, mg/l	CLA, µg/l	Secchi, m	Chloride, mg/l
Fish Lake	02-May-12	0.00	0.23	15.67	12.01	120.9	430	8.68	42.4	7.61	1.24	29.3	2.54	
Fish Lake	02-May-12	1.00	1.04	14.52	12.72	124.9	431	8.84						
Fish Lake	02-May-12	2.00	2.05	13.61	14.18	136.6	430	8.86						
Fish Lake	02-May-12	3.00	3.05	13.03	14.85	141.2	434	8.85						
Fish Lake	02-May-12	4.00	4.04	12.73	14.72	139.0	437	8.80						
Fish Lake	02-May-12	5.00	5.05	11.98	12.12	112.5	444	8.58	59.6	4.37				
Fish Lake	02-May-12	6.00	6.05	11.64	10.96	101.0	448	8.43						
Fish Lake	02-May-12	7.00	7.03	11.29	6.65	60.8	452	8.04						
Fish Lake	02-May-12	8.00	8.06	10.98	3.47	31.5	456	7.80	80.1	7.24				
Fish Lake	02-May-12	8.97	8.97	10.84	1.54	14.0	461	7.51						
Fish Lake	09-May-12	0.00	0.56	15.85	11.01	111.3	423	8.64						

Site	Date	Depth	Sonde Depth	Temp, °C	DO, mg/l	DO, Sat %	SpCond, µS/cm	pH	TP, µg/l	SRP, µg/l	TN, mg/l	CLA, µg/l	Secchi, m	Chloride, mg/l
Fish Lake	09-May-12	1.00	1.06	15.81	11.02	111.3	423	8.62						
Fish Lake	09-May-12	2.00	2.02	15.70	10.98	110.6	423	8.59						
Fish Lake	09-May-12	3.00	3.05	15.62	10.94	110.1	424	8.62						
Fish Lake	09-May-12	4.00	4.04	15.54	10.83	108.8	424	8.60						
Fish Lake	09-May-12	5.00	5.03	13.11	10.62	101.2	449	8.31						
Fish Lake	09-May-12	6.00	6.03	12.42	6.27	58.8	452	7.84						
Fish Lake	09-May-12	7.00	7.04	11.96	2.92	27.1	458	7.59						
Fish Lake	09-May-12	8.00	8.02	11.80	2.51	23.2	459	7.48						
Fish Lake	09-May-12	9.00	9.01	11.55	0.87	8.0	464	7.09						
Fish Lake	09-May-12	9.15	9.15	11.56	0.26	2.3	466	7.00						
Fish Lake	15-May-12	0.00	0.22	18.98	12.66	136.6	411	8.94	40	4.55	0.96	15	2.5	

Site	Date	Depth	Sonde Depth	Temp, °C	DO, mg/l	DO, Sat %	SpCond, µS/cm	pH	TP, µg/l	SRP, µg/l	TN, mg/l	CLA, µg/l	Secchi, m	Chloride, mg/l
Fish Lake	15-May-12	1.00	1.03	18.92	12.61	135.9	412	8.95						
Fish Lake	15-May-12	2.00	2.04	18.89	12.49	134.5	411	8.94						
Fish Lake	15-May-12	3.00	3.01	18.54	12.42	132.8	413	8.91						
Fish Lake	15-May-12	4.00	4.09	15.41	9.36	93.8	422	8.55						
Fish Lake	15-May-12	5.00	5.06	14.11	8.00	77.9	430	8.31						
Fish Lake	15-May-12	6.00	6.04	12.36	3.71	34.8	442	7.81						
Fish Lake	15-May-12	7.00	7.06	11.47	0.95	8.7	447	7.59	41.4	6.02				
Fish Lake	15-May-12	8.00	8.07	11.42	0.77	7.1	449	7.56						
Fish Lake	15-May-12	9.00	9.02	11.23	0.51	4.7	454	7.49	87.5	17.59				
Fish Lake	15-May-12	9.07	9.07	11.21	0.48	4.4	454	7.48						
Fish Lake	30-May-12	0.00	0.29	19.49	9.85	107.4	413	8.52	44.3	3.89	1.18	35.4	1.3	

Site	Date	Depth	Sonde Depth	Temp, °C	DO, mg/l	DO, Sat %	SpCond, µS/cm	pH	TP, µg/l	SRP, µg/l	TN, mg/l	CLA, µg/l	Secchi, m	Chloride, mg/l
Fish Lake	30-May-12	1.00	1.05	19.43	9.79	106.6	413	8.48						
Fish Lake	30-May-12	2.00	2.06	19.13	9.46	102.3	413	8.45						
Fish Lake	30-May-12	3.00	3.02	19.11	9.26	100.2	414	8.43						
Fish Lake	30-May-12	4.00	4.05	19.07	9.20	99.4	414	8.43						
Fish Lake	30-May-12	5.00	5.03	18.53	6.41	68.6	421	8.13						
Fish Lake	30-May-12	6.00	6.07	14.18	0.77	7.5	455	7.35	44.5	8.14				
Fish Lake	30-May-12	7.00	7.07	12.57	0.52	4.9	464	7.27						
Fish Lake	30-May-12	8.00	8.06	11.77	0.45	4.2	473	7.16						
Fish Lake	30-May-12	9.00	9.00	11.50	0.40	3.7	487	6.96	80.8	37.83				
Fish Lake	30-May-12	9.13	9.13	11.43	0.33	3.1	507	6.62						
Fish Lake	12-Jun-12	0.00	0.28	22.20	8.49	97.6	405	8.67	42.3	6.21	1.1	30.1	1.1	

Site	Date	Depth	Sonde Depth	Temp, °C	DO, mg/l	DO, Sat %	SpCond, µS/cm	pH	TP, µg/l	SRP, µg/l	TN, mg/l	CLA, µg/l	Secchi, m	Chloride, mg/l
Fish Lake	12-Jun-12	1.00	1.07	22.16	8.40	96.4	405	8.62						
Fish Lake	12-Jun-12	2.00	2.06	22.10	8.36	95.9	405	8.54						
Fish Lake	12-Jun-12	3.00	3.07	21.98	7.95	91.0	406	8.43						
Fish Lake	12-Jun-12	4.00	4.04	21.04	3.32	37.3	416	7.93						
Fish Lake	12-Jun-12	5.00	5.07	17.06	0.82	8.5	443	7.42	38.6	4.01				
Fish Lake	12-Jun-12	6.00	6.05	14.70	0.40	3.9	468	7.23						
Fish Lake	12-Jun-12	7.00	7.06	12.91	0.37	3.5	482	7.09						
Fish Lake	12-Jun-12	8.00	8.05	11.96	0.33	3.1	495	6.87	320.2	140.67				
Fish Lake	12-Jun-12	8.95	8.95	11.74	0.32	3.0	512	6.66						
Fish Lake	26-Jun-12	0.00	0.29	23.86	9.71	115.2	387	8.72	40.5	5.16	1.16	24.2	1.12	
Fish Lake	26-Jun-12	1.00	1.04	23.86	9.82	116.4	388	8.72						

Site	Date	Depth	Sonde Depth	Temp, °C	DO, mg/l	DO, Sat %	SpCond, µS/cm	pH	TP, µg/l	SRP, µg/l	TN, mg/l	CLA, µg/l	Secchi, m	Chloride, mg/l
Fish Lake	26-Jun-12	2.00	2.04	23.85	9.84	116.6	388	8.69						
Fish Lake	26-Jun-12	3.00	3.03	23.65	8.48	100.2	390	8.56						
Fish Lake	26-Jun-12	4.00	4.05	21.23	0.92	10.3	405	7.41	49.7	6.54				
Fish Lake	26-Jun-12	5.00	5.05	18.53	0.61	6.6	434	7.39						
Fish Lake	26-Jun-12	6.00	6.07	15.27	0.52	5.2	472	7.30						
Fish Lake	26-Jun-12	7.00	7.06	13.48	0.48	4.6	489	7.06						
Fish Lake	26-Jun-12	8.00	8.02	12.63	0.45	4.3	499	6.88	385.9	214.55				
Fish Lake	26-Jun-12	9.02	9.02	12.23	0.42	3.9	514	6.53						
Fish Lake	10-Jul-12	0.00	0.52	29.20	9.82	128.2	386	8.87	35.8	7.9	1.11	13.5	1.36	
Fish Lake	10-Jul-12	1.00	1.02	28.63	9.25	119.6	385	8.72						
Fish Lake	10-Jul-12	2.00	2.01	28.40	9.17	118.1	385	8.60						

Site	Date	Depth	Sonde Depth	Temp, °C	DO, mg/l	DO, Sat %	SpCond, µS/cm	pH	TP, µg/l	SRP, µg/l	TN, mg/l	CLA, µg/l	Secchi, m	Chloride, mg/l
Fish Lake	10-Jul-12	3.00	3.06	26.39	7.76	96.5	396	8.31						
Fish Lake	10-Jul-12	4.00	4.03	21.75	0.96	10.9	419	7.12	53.5	7.36				
Fish Lake	10-Jul-12	5.00	5.03	18.17	0.61	6.4	450	7.30						
Fish Lake	10-Jul-12	6.00	6.07	15.19	0.55	5.5	483	6.72						
Fish Lake	10-Jul-12	7.00	7.08	13.38	0.54	5.2	503	6.95						
Fish Lake	10-Jul-12	8.00	8.05	12.42	0.52	4.9	524	6.75	502.6	282.75				
Fish Lake	10-Jul-12	8.87	8.87	12.14	0.50	4.6	538	6.50						
Fish Lake	24-Jul-12	0.00	0.35	27.44	8.93	113.0	356	8.96	37.3	12.27	1.35	39	0.75	
Fish Lake	24-Jul-12	1.00	1.07	27.43	9.11	115.2	356	9.03						
Fish Lake	24-Jul-12	2.00	2.06	27.44	9.15	115.9	357	9.03						
Fish Lake	24-Jul-12	3.00	3.00	27.39	8.77	110.9	358	8.98						

Site	Date	Depth	Sonde Depth	Temp, °C	DO, mg/l	DO, Sat %	SpCond, µS/cm	pH	TP, µg/l	SRP, µg/l	TN, mg/l	CLA, µg/l	Secchi, m	Chloride, mg/l
Fish Lake	24-Jul-12	4.00	4.04	23.16	0.80	9.4	412	7.76	54.8	20.13				
Fish Lake	24-Jul-12	5.00	5.04	19.71	0.71	7.8	432	7.65						
Fish Lake	24-Jul-12	6.00	6.09	15.77	0.64	6.5	467	7.49						
Fish Lake	24-Jul-12	7.00	7.02	13.65	0.36	3.5	498	7.17						
Fish Lake	24-Jul-12	8.00	8.01	12.99	0.35	3.3	508	7.01	707.4	329.09				
Fish Lake	24-Jul-12	8.96	8.96	12.53	0.41	3.9	529	6.74						
Fish Lake	07-Aug-12	0.00	0.21	26.81	9.77	122.3	356	8.94	40.5	8.7	0.92	24.2	1	
Fish Lake	07-Aug-12	1.00	1.04	26.62	9.86	123.0	355	8.87						
Fish Lake	07-Aug-12	2.00	2.05	26.19	9.76	120.8	356	8.82						
Fish Lake	07-Aug-12	3.00	3.06	25.73	7.01	86.0	358	8.62						
Fish Lake	07-Aug-12	4.00	4.02	24.27	0.85	10.1	381	7.68	32	15.42				

Site	Date	Depth	Sonde Depth	Temp, °C	DO, mg/l	DO, Sat %	SpCond, µS/cm	pH	TP, µg/l	SRP, µg/l	TN, mg/l	CLA, µg/l	Secchi, m	Chloride, mg/l
Fish Lake	07-Aug-12	5.00	5.03	20.08	0.56	6.2	442	7.46						
Fish Lake	07-Aug-12	6.00	6.05	15.95	0.36	3.6	476	7.25						
Fish Lake	07-Aug-12	7.00	7.04	14.07	0.19	1.8	501	7.01						
Fish Lake	07-Aug-12	8.00	8.02	13.15	0.13	1.2	520	6.85	744.9	131.57				
Fish Lake	07-Aug-12	8.93	8.93	12.55	0.15	1.4	565	6.52						
Fish Lake	21-Aug-12	0.00	0.30	22.87	9.80	114.1	377	8.74	15.5	9.51	1.24	18.3	1.25	
Fish Lake	21-Aug-12	1.00	1.06	22.70	10.15	117.8	376	8.84						
Fish Lake	21-Aug-12	2.00	2.03	22.28	10.09	116.2	377	8.80						
Fish Lake	21-Aug-12	3.00	3.06	22.07	7.75	88.9	379	8.53						
Fish Lake	21-Aug-12	4.00	4.03	21.80	6.12	69.8	384	8.41						
Fish Lake	21-Aug-12	5.00	5.05	20.36	1.65	18.3	416	7.90						

Site	Date	Depth	Sonde Depth	Temp, °C	DO, mg/l	DO, Sat %	SpCond, µS/cm	pH	TP, µg/l	SRP, µg/l	TN, mg/l	CLA, µg/l	Secchi, m	Chloride, mg/l
Fish Lake	21-Aug-12	6.00	6.03	15.94	0.96	9.7	493	7.69	34.2	5.23				
Fish Lake	21-Aug-12	7.00	7.05	13.49	0.58	5.6	527	7.44						
Fish Lake	21-Aug-12	8.00	8.06	12.41	0.38	3.5	543	7.28	654.6	320.23				
Fish Lake	21-Aug-12	8.85	8.85	12.19	0.26	2.4	573	7.13						
Fish Lake	05-Sep-12	0.00	0.29	24.72	8.58	103.4	384	8.58	29.7	7.1	1.12	10.5	1.92	
Fish Lake	05-Sep-12	1.00	1.07	24.66	8.75	105.3	384	8.62						
Fish Lake	05-Sep-12	2.00	2.05	24.48	8.86	106.3	384	8.64						
Fish Lake	05-Sep-12	3.00	3.04	24.37	8.49	101.7	386	8.62						
Fish Lake	05-Sep-12	4.00	4.04	23.16	3.83	44.8	389	8.19						
Fish Lake	05-Sep-12	5.00	5.07	20.78	0.94	10.5	418	7.70	42.6	6.97				
Fish Lake	05-Sep-12	6.00	6.07	16.27	0.51	5.2	512	7.38						

Site	Date	Depth	Sonde Depth	Temp, °C	DO, mg/l	DO, Sat %	SpCond, µS/cm	pH	TP, µg/l	SRP, µg/l	TN, mg/l	CLA, µg/l	Secchi, m	Chloride, mg/l
Fish Lake	05-Sep-12	7.00	7.06	14.60	0.28	2.8	535	7.13						
Fish Lake	05-Sep-12	8.00	8.07	13.74	0.25	2.4	552	6.98	703.4	313.11				
Fish Lake	05-Sep-12	8.86	8.86	13.19	0.23	2.2	569	6.80						
Fish Lake	18-Sep-12	0.00	0.33	18.71	5.72	61.4	406	7.78	42.5	7.15	1.32	8.6	2.34	
Fish Lake	18-Sep-12	1.00	1.05	18.69	5.54	59.4	406	7.75						
Fish Lake	18-Sep-12	2.00	2.05	18.67	5.45	58.4	406	7.76						
Fish Lake	18-Sep-12	3.00	3.07	18.62	5.27	56.4	406	7.77						
Fish Lake	18-Sep-12	4.00	4.05	18.47	4.98	53.2	405	7.74						
Fish Lake	18-Sep-12	5.00	5.09	18.41	4.54	48.4	406	7.69						
Fish Lake	18-Sep-12	6.00	6.06	18.10	4.11	43.6	407	7.64						
Fish Lake	18-Sep-12	7.00	7.08	14.86	0.81	8.0	544	7.13	133.8	81.99				

Site	Date	Depth	Sonde Depth	Temp, °C	DO, mg/l	DO, Sat %	SpCond, µS/cm	pH	TP, µg/l	SRP, µg/l	TN, mg/l	CLA, µg/l	Secchi, m	Chloride, mg/l
Fish Lake	18-Sep-12	8.00	8.08	12.84	0.40	3.8	595	6.84	657.8	359.85				
Fish Lake	18-Sep-12	8.25	8.25	12.86	0.33	3.1	605	6.68						
Fish Lake	23-Oct-12	0.00	0.27	11.48	11.75	107.9	413	8.37	53.4	6.13	1.87	70.9	1	
Fish Lake	23-Oct-12	1.00	1.07	11.46	12.19	111.8	413	8.40						
Fish Lake	23-Oct-12	2.00	2.04	11.47	12.33	113.2	413	8.40						
Fish Lake	23-Oct-12	3.00	3.04	11.45	12.45	114.2	413	8.38						
Fish Lake	23-Oct-12	4.00	4.06	11.42	12.15	111.4	400	8.36	49.4	12.16				
Fish Lake	23-Oct-12	5.00	5.04	11.30	12.11	110.8	414	8.30						
Fish Lake	23-Oct-12	6.00	6.05	11.06	11.62	105.6	401	8.23						
Fish Lake	23-Oct-12	7.00	7.06	10.95	11.13	101.0	415	8.18						
Fish Lake	23-Oct-12	8.00	8.09	10.79	10.69	96.6	419	8.04	50.7	21.38				

Site	Date	Depth	Sonde Depth	Temp, °C	DO, mg/l	DO, Sat %	SpCond, µS/cm	pH	TP, µg/l	SRP, µg/l	TN, mg/l	CLA, µg/l	Secchi, m	Chloride, mg/l
Fish Lake	23-Oct-12	8.49	8.49	10.83	2.30	20.8	421	7.50						
Pike Lake - East	17-Apr-12	0.00	0.50	12.17	10.20	95.1	425	8.64	112.7	2.31	2.02	46.4	0.65	
Pike Lake - East	17-Apr-12	1.00	1.03	12.00	10.20	94.8	424	8.63						
Pike Lake - East	17-Apr-12	2.00	2.00	11.64	8.23	75.8	432	8.32						
Pike Lake - East	02-May-12	0.00	0.32	16.37	14.79	151.1	410	8.73	101.5	6.17	1.77	29.9	0.85	
Pike Lake - East	02-May-12	1.00	1.04	15.18	10.73	106.9	413	8.67						
Pike Lake - East	02-May-12	2.00	2.04	12.57	4.46	42.0	433	8.07						
Pike Lake - East	02-May-12	2.27	2.27	12.50	0.52	4.9	435	7.67						
Pike Lake - East	15-May-12	0.00	0.26	20.44	12.56	139.5	362	9.34	148.1	4.61	1.7	40.8	0.68	
Pike Lake - East	15-May-12	1.00	1.03	20.17	12.82	141.6	351	9.32						
Pike Lake - East	15-May-12	2.00	2.06	15.95	1.39	14.1	364	7.43						

Site	Date	Depth	Sonde Depth	Temp, °C	DO, mg/l	DO, Sat %	SpCond, µS/cm	pH	TP, µg/l	SRP, µg/l	TN, mg/l	CLA, µg/l	Secchi, m	Chloride, mg/l
Pike Lake - East	15-May-12	2.24	2.24	15.34	1.41	14.1	371	7.21						
Pike Lake - East	30-May-12	0.00	0.36	19.01	10.25	110.7	340	9.18	153.2	5.96	2.48	93.8	0.5	
Pike Lake - East	30-May-12	1.00	1.08	18.76	10.94	117.5	339	9.20						
Pike Lake - East	30-May-12	2.00	2.01	17.84	6.23	65.7	348	8.42						
Pike Lake - East	30-May-12	2.50	2.50	17.06	0.68	7.1	434	6.89						
Pike Lake - East	13-Jun-12	0.00	0.33	21.54	7.56	85.8	346	9.25	178.3	5.89	2.6	103.8	0.49	
Pike Lake - East	13-Jun-12	1.00	1.02	21.54	7.78	88.2	346	9.26						
Pike Lake - East	13-Jun-12	2.00	2.02	20.75	1.76	19.7	385	8.31						
Pike Lake - East	13-Jun-12	2.42	2.42	17.05	0.85	8.8	485	6.92						
Pike Lake - East	26-Jun-12	0.00	0.33	23.21	10.39	121.7	345	9.00	165.3	7.12	2.34	62.6	0.39	
Pike Lake - East	26-Jun-12	1.00	1.01	23.06	10.16	118.6	345	9.01						

Site	Date	Depth	Sonde Depth	Temp, °C	DO, mg/l	DO, Sat %	SpCond, µS/cm	pH	TP, µg/l	SRP, µg/l	TN, mg/l	CLA, µg/l	Secchi, m	Chloride, mg/l
Pike Lake - East	26-Jun-12	2.00	2.02	20.53	0.64	7.2	329	7.79						
Pike Lake - East	26-Jun-12	2.96	2.96	18.11	0.27	2.9	459	6.65						
Pike Lake - East	10-Jul-12	0.00	0.31	27.28	15.40	194.3	363	9.26	147	11.09	2.68	132.2	0.29	
Pike Lake - East	10-Jul-12	1.00	1.01	26.74	10.45	130.7	368	8.96						
Pike Lake - East	10-Jul-12	2.00	2.04	20.52	0.37	4.1	397	7.10						
Pike Lake - East	10-Jul-12	2.66	2.66	19.18	0.29	3.1	433	6.87						
Pike Lake - East	24-Jul-12	0.00	0.34	26.56	7.55	94.0	353	8.66	210.2	8.38	3.63	201.2	0.25	
Pike Lake - East	24-Jul-12	1.00	1.03	26.54	6.40	79.7	355	8.55						
Pike Lake - East	24-Jul-12	2.00	2.02	22.79	0.51	5.9	468	7.09						
Pike Lake - East	24-Jul-12	2.30	2.30	22.13	0.34	4.0	492	6.88						
Pike Lake - East	07-Aug-12	0.00	0.34	25.89	15.71	193.4	332	9.28	237.5	13.84	3.67	231.3	0.22	

Site	Date	Depth	Sonde Depth	Temp, °C	DO, mg/l	DO, Sat %	SpCond, µS/cm	pH	TP, µg/l	SRP, µg/l	TN, mg/l	CLA, µg/l	Secchi, m	Chloride, mg/l
Pike Lake - East	07-Aug-12	1.00	1.05	25.03	4.52	54.7	345	8.41						
Pike Lake - East	07-Aug-12	2.00	2.06	23.70	0.90	10.7	366	7.67						
Pike Lake - East	07-Aug-12	2.22	2.22	23.61	0.94	11.1	399	7.10						
Pike Lake - East	21-Aug-12	0.00	0.32	21.91	12.34	141.0	344	9.20	209.2	53.8	3.89	149.3	0.2	
Pike Lake - East	21-Aug-12	1.00	1.02	21.37	10.40	117.7	345	9.05						
Pike Lake - East	21-Aug-12	2.00	2.01	20.86	0.92	10.3	394	7.08						
Pike Lake - East	21-Aug-12	2.11	2.11	20.86	0.65	7.2	391	7.00						
Pike Lake - East	05-Sep-12	0.00	0.31	24.25	6.72	80.2	381	8.50	217.1	9.18	3.99	116.2	0.27	
Pike Lake - East	05-Sep-12	1.00	1.02	23.97	5.17	61.4	382	8.25						
Pike Lake - East	05-Sep-12	2.00	2.01	22.55	1.30	15.1	576	6.74						
Pike Lake - East	05-Sep-12	2.08	2.08	22.51	1.14	13.2	589	6.59						

Site	Date	Depth	Sonde Depth	Temp, °C	DO, mg/l	DO, Sat %	SpCond, µS/cm	pH	TP, µg/l	SRP, µg/l	TN, mg/l	CLA, µg/l	Secchi, m	Chloride, mg/l
Pike Lake - East	18-Sep-12	0.00	0.30	17.77	7.80	82.0	377	8.24	328.4	6.38	4.86	99.5	0.3	
Pike Lake - East	18-Sep-12	1.00	1.02	17.67	7.68	80.6	378	8.24						
Pike Lake - East	18-Sep-12	1.99	1.99	17.53	0.35	3.7	521	6.95						
Pike Lake - East	23-Oct-12	0.00	0.29	12.26	11.69	109.2	433	8.32	247.6	10.81	4.15	110.3	0.28	
Pike Lake - East	23-Oct-12	1.00	1.01	12.18	11.62	108.4	433	8.40						
Pike Lake - East	23-Oct-12	1.71	1.71	12.03	0.89	8.3	644	7.24						
Pike Lake - West	17-Apr-12	0.00	0.50	10.89	10.61	96.1	510	7.99	81.4	25.31	1.33	7.5	>0.87	
Pike Lake - West	17-Apr-12	0.87	0.87	10.41	10.40	93.2	511	7.94						
Pike Lake - West	02-May-12	0.00	0.32	14.43	9.71	95.3	421	8.74	94.3	20.6	1.24	21.7	>1.2	
Pike Lake - West	02-May-12	1.00	1.05	10.48	5.77	51.8	468	8.00						
Pike Lake - West	02-May-12	1.26	1.26	10.11	0.98	8.7	484	7.47						

Site	Date	Depth	Sonde Depth	Temp, °C	DO, mg/l	DO, Sat %	SpCond, µS/cm	pH	TP, µg/l	SRP, µg/l	TN, mg/l	CLA, µg/l	Secchi, m	Chloride, mg/l
Pike Lake - West	15-May-12	0.00	0.23	19.08	8.19	88.6	387	8.28	125.4	46.64	1.15	12.8	0.91	
Pike Lake - West	15-May-12	1.00	1.05	15.37	1.54	15.4	399	7.56						
Pike Lake - West	15-May-12	1.26	1.26	15.30	0.98	9.8	401	7.44						
Pike Lake - West	30-May-12	0.00	0.32	17.93	8.83	93.3	372	8.23	73.6	14.84	0.96	16.6	0.92	
Pike Lake - West	30-May-12	1.00	1.06	17.88	8.76	92.3	372	8.21						
Pike Lake - West	30-May-12	1.42	1.42	17.66	0.47	5.0	476	7.00						
Pike Lake - West	13-Jun-12	0.00	0.33	21.39	8.13	92.0	423	8.26	125.2	4.5	1.59	44.9	0.5	
Pike Lake - West	13-Jun-12	1.00	1.02	21.36	8.01	90.6	425	8.20						
Pike Lake - West	13-Jun-12	1.60	1.60	20.99	0.77	8.7	562	6.83						
Pike Lake - West	26-Jun-12	0.00	0.38	23.69	9.36	110.6	406	8.44	99.1	17.9	1.54	26.7	0.75	
Pike Lake - West	26-Jun-12	1.00	1.01	23.53	9.24	108.9	407	8.41						

Site	Date	Depth	Sonde Depth	Temp, °C	DO, mg/l	DO, Sat %	SpCond, µS/cm	pH	TP, µg/l	SRP, µg/l	TN, mg/l	CLA, µg/l	Secchi, m	Chloride, mg/l
Pike Lake - West	26-Jun-12	2.00	2.00	20.59	0.76	8.4	429	6.89						
Pike Lake - West	26-Jun-12	2.13	2.13	20.52	0.46	5.1	436	6.83						
Pike Lake - West	10-Jul-12	0.00	0.30	27.73	8.06	102.6	415	8.33	129.9	10.14	1.95	51.3	0.44	
Pike Lake - West	10-Jul-12	1.00	1.06	26.99	6.43	80.7	417	8.13						
Pike Lake - West	10-Jul-12	1.63	1.63	26.79	1.19	14.8	450	7.21						
Pike Lake - West	24-Jul-12	0.00	0.34	26.43	7.64	94.9	377	8.03	256.8	11.67	3.52	159.1	0.25	
Pike Lake - West	24-Jul-12	1.00	1.04	26.02	5.30	65.4	374	7.72						
Pike Lake - West	24-Jul-12	1.33	1.33	25.92	1.40	17.2	415	7.10						
Pike Lake - West	07-Aug-12	0.00	0.35	25.63	12.01	147.1	350	8.87	198.8	20.58	2.98	166.6	0.25	
Pike Lake - West	07-Aug-12	1.00	1.01	24.33	2.82	33.7	366	7.97						
Pike Lake - West	07-Aug-12	1.32	1.32	24.04	0.89	10.6	480	7.31						

Site	Date	Depth	Sonde Depth	Temp, °C	DO, mg/l	DO, Sat %	SpCond, µS/cm	pH	TP, µg/l	SRP, µg/l	TN, mg/l	CLA, µg/l	Secchi, m	Chloride, mg/l
Pike Lake - West	21-Aug-12	0.00	0.32	21.96	8.21	93.9	375	8.51	180.2	77.02	3.24	83	0.3	
Pike Lake - West	21-Aug-12	1.00	1.02	21.32	4.10	46.3	379	7.80						
Pike Lake - West	21-Aug-12	1.23	1.23	21.32	0.76	8.6	392	7.39						
Pike Lake - West	05-Sep-12	0.00	0.35	24.50	5.78	69.3	404	7.77	239.3	7.59	3.68	130.3	0.31	
Pike Lake - West	05-Sep-12	1.00	1.01	23.47	0.94	11.1	441	7.03						
Pike Lake - West	05-Sep-12	1.14	1.14	23.46	0.67	7.9	436	6.91						
Pike Lake - West	18-Sep-12	0.00	0.34	16.75	9.18	94.5	389	8.34	233	5.27	3.58	100.3	0.35	
Pike Lake - West	18-Sep-12	1.00	1.01	16.68	0.75	7.7	465	7.30						
Pike Lake - West	18-Sep-12	1.06	1.06	16.72	0.42	4.3	489	7.27						
Pike Lake - West	23-Oct-12	0.00	0.25	13.04	11.10	105.5	459	8.04	220.9	8.67	3.61	83.5	0.31	
Pike Lake - West	23-Oct-12	0.86	0.86	12.86	0.44	4.1	509	7.13						

Site	Date	Depth	Sonde Depth	Temp, °C	DO, mg/l	DO, Sat %	SpCond, µS/cm	pH	TP, µg/l	SRP, µg/l	TN, mg/l	CLA, µg/l	Secchi, m	Chloride, mg/l
Upper Prior Lake	10-Feb-12	0.00	0.33	3.88	13.40	102.1	560	8.35						61
Upper Prior Lake	10-Feb-12	1.00	1.05	4.20	13.17	101.2	566	8.44						
Upper Prior Lake	10-Feb-12	2.00	2.05	4.19	13.19	101.3	568	8.47						
Upper Prior Lake	10-Feb-12	3.00	3.00	3.98	12.37	94.5	572	8.39						
Upper Prior Lake	10-Feb-12	4.00	4.01	4.11	11.39	87.3	580	8.24						
Upper Prior Lake	10-Feb-12	5.00	5.03	4.00	8.30	63.4	585	8.05						
Upper Prior Lake	10-Feb-12	6.00	6.04	3.98	6.99	53.4	589	7.92						
Upper Prior Lake	10-Feb-12	7.00	7.05	3.95	4.44	33.9	594	7.73						
Upper Prior Lake	10-Feb-12	8.00	8.03	3.99	2.94	22.5	599	7.67						
Upper Prior Lake	10-Feb-12	9.00	9.05	4.06	1.97	15.1	607	7.60						
Upper Prior Lake	10-Feb-12	10.00	10.00	4.04	1.63	12.5	616	7.57						

Site	Date	Depth	Sonde Depth	Temp, °C	DO, mg/l	DO, Sat %	SpCond, µS/cm	pH	TP, µg/l	SRP, µg/l	TN, mg/l	CLA, µg/l	Secchi, m	Chloride, mg/l
Upper Prior Lake	10-Feb-12	11.00	11.09	4.23	1.54	11.8	634	7.33						
Upper Prior Lake	10-Feb-12	12.00	12.01	4.51	0.89	6.9	669	7.07						71
Upper Prior Lake	10-Feb-12	12.29	12.29	4.53	0.67	5.2	699	6.91						
Upper Prior Lake	17-Apr-12	0.00	0.51	12.27	11.30	105.6	527	8.26	48.1	3.3	1.1	12.8	2.01	59
Upper Prior Lake	17-Apr-12	1.00	1.00	12.23	10.67	99.7	527	8.26						
Upper Prior Lake	17-Apr-12	2.00	1.99	12.17	10.50	97.9	527	8.22						
Upper Prior Lake	17-Apr-12	3.00	3.01	12.13	10.44	97.3	527	8.15						
Upper Prior Lake	17-Apr-12	4.00	4.02	12.12	10.39	96.9	526	8.14						
Upper Prior Lake	17-Apr-12	5.00	5.04	11.64	10.42	96.1	527	8.10						
Upper Prior Lake	17-Apr-12	6.00	6.04	11.55	10.22	94.0	528	8.08	44.7	5.49				
Upper Prior Lake	17-Apr-12	7.00	7.01	11.46	9.52	87.4	529	8.00						

Site	Date	Depth	Sonde Depth	Temp, °C	DO, mg/l	DO, Sat %	SpCond, µS/cm	pH	TP, µg/l	SRP, µg/l	TN, mg/l	CLA, µg/l	Secchi, m	Chloride, mg/l
Upper Prior Lake	17-Apr-12	8.00	8.01	11.43	9.21	84.5	529	7.98						
Upper Prior Lake	17-Apr-12	9.00	9.00	11.37	9.03	82.7	529	7.99						
Upper Prior Lake	17-Apr-12	10.00	9.99	11.13	9.07	82.6	535	7.92						
Upper Prior Lake	17-Apr-12	11.00	10.96	8.98	8.18	70.8	603	7.53	92	23				64
Upper Prior Lake	17-Apr-12	11.74	11.74	7.25	3.31	27.5	666	6.76						
Upper Prior Lake	02-May-12	0.00	0.35	15.31	11.53	115.3	517	8.21	35.5	3.92	0.78	12.2	2.84	
Upper Prior Lake	02-May-12	1.00	1.04	14.81	11.52	113.9	517	8.30						
Upper Prior Lake	02-May-12	2.00	2.07	13.92	11.30	109.6	517	8.36						
Upper Prior Lake	02-May-12	3.00	3.04	13.54	11.21	107.9	517	8.36						
Upper Prior Lake	02-May-12	4.00	4.08	13.39	11.04	105.8	519	8.35						
Upper Prior Lake	02-May-12	5.00	5.09	13.28	10.83	103.6	520	8.33						

Site	Date	Depth	Sonde Depth	Temp, °C	DO, mg/l	DO, Sat %	SpCond, µS/cm	pH	TP, µg/l	SRP, µg/l	TN, mg/l	CLA, µg/l	Secchi, m	Chloride, mg/l
Upper Prior Lake	02-May-12	6.00	6.08	12.88	10.26	97.3	524	8.24						
Upper Prior Lake	02-May-12	7.00	7.06	12.32	8.58	80.3	526	8.12						
Upper Prior Lake	02-May-12	8.00	8.07	11.64	6.05	55.7	529	7.91						
Upper Prior Lake	02-May-12	9.00	9.05	11.19	2.56	23.3	535	7.71						
Upper Prior Lake	02-May-12	10.00	10.04	10.64	0.94	8.5	547	7.56	85.9	18.27				
Upper Prior Lake	02-May-12	11.00	11.05	10.32	0.64	5.7	560	7.47	96.2	44.79				
Upper Prior Lake	02-May-12	11.73	11.73	9.41	0.38	3.3	595	7.07						
Upper Prior Lake	15-May-12	0.00	0.39	19.47	12.60	137.3	478	8.76	36	4.04	1.07	23.3	1.61	
Upper Prior Lake	15-May-12	1.00	1.07	19.41	13.02	141.7	479	8.79						
Upper Prior Lake	15-May-12	2.00	2.06	19.29	13.03	141.4	478	8.78						
Upper Prior Lake	15-May-12	3.00	3.02	17.11	10.11	104.9	490	8.40						

Site	Date	Depth	Sonde Depth	Temp, °C	DO, mg/l	DO, Sat %	SpCond, µS/cm	pH	TP, µg/l	SRP, µg/l	TN, mg/l	CLA, µg/l	Secchi, m	Chloride, mg/l
Upper Prior Lake	15-May-12	4.00	4.07	16.28	8.56	87.3	482	8.28						
Upper Prior Lake	15-May-12	5.00	5.07	15.38	6.62	66.3	496	8.07						
Upper Prior Lake	15-May-12	6.00	6.05	14.31	4.21	41.2	507	7.86						
Upper Prior Lake	15-May-12	7.00	7.02	13.03	2.11	20.1	516	7.70						
Upper Prior Lake	15-May-12	8.00	8.05	12.21	0.92	8.6	522	7.60	41.9	8.57				
Upper Prior Lake	15-May-12	9.00	9.03	11.79	0.58	5.4	527	7.53						
Upper Prior Lake	15-May-12	10.00	10.03	11.20	0.41	3.8	535	7.37						
Upper Prior Lake	15-May-12	11.00	11.09	11.06	0.40	3.7	539	7.34	131	78.66				
Upper Prior Lake	15-May-12	12.00	12.01	10.92	0.40	3.6	542	7.30						
Upper Prior Lake	15-May-12	12.08	12.08	10.83	0.48	4.4	545	7.27						
Upper Prior Lake	30-May-12	0.00	0.36	19.93	9.32	102.5	478	8.31	48.2	4.63	1.41	37.6	1.2	

Site	Date	Depth	Sonde Depth	Temp, °C	DO, mg/l	DO, Sat %	SpCond, µS/cm	pH	TP, µg/l	SRP, µg/l	TN, mg/l	CLA, µg/l	Secchi, m	Chloride, mg/l
Upper Prior Lake	30-May-12	1.00	1.05	19.57	8.98	98.1	478	8.16						
Upper Prior Lake	30-May-12	2.00	2.03	19.46	8.64	94.1	479	8.14						
Upper Prior Lake	30-May-12	3.00	3.05	19.41	8.06	87.7	480	8.09						
Upper Prior Lake	30-May-12	4.00	4.01	19.40	7.93	86.3	480	8.07						
Upper Prior Lake	30-May-12	5.00	5.03	19.36	7.61	82.7	482	8.01						
Upper Prior Lake	30-May-12	6.00	6.02	18.73	5.91	63.4	486	7.78						
Upper Prior Lake	30-May-12	7.00	7.08	15.85	0.93	9.4	523	7.34	39.9	7.23				
Upper Prior Lake	30-May-12	8.00	8.01	13.14	0.66	6.3	542	7.26						
Upper Prior Lake	30-May-12	9.00	9.05	12.31	0.48	4.5	547	7.10						
Upper Prior Lake	30-May-12	10.00	10.03	11.75	0.41	3.8	557	6.95						
Upper Prior Lake	30-May-12	11.00	11.04	11.52	0.36	3.3	563	6.84						

Site	Date	Depth	Sonde Depth	Temp, °C	DO, mg/l	DO, Sat %	SpCond, µS/cm	pH	TP, µg/l	SRP, µg/l	TN, mg/l	CLA, µg/l	Secchi, m	Chloride, mg/l
Upper Prior Lake	30-May-12	12.00	12.03	11.20	0.36	3.3	572	6.78	285.6	230.7				
Upper Prior Lake	30-May-12	12.31	12.31	11.10	0.31	2.8	612	6.53						
Upper Prior Lake	12-Jun-12	0.00	0.34	22.81	8.61	100.2	481	8.13	70	21.95	1.46	35.7	1.09	
Upper Prior Lake	12-Jun-12	1.00	1.04	22.73	7.81	90.7	482	8.31						
Upper Prior Lake	12-Jun-12	2.00	2.08	22.56	7.84	90.8	482	8.28						
Upper Prior Lake	12-Jun-12	3.00	3.01	22.25	7.35	84.5	483	8.21						
Upper Prior Lake	12-Jun-12	4.00	4.06	22.16	6.75	77.5	484	8.13						
Upper Prior Lake	12-Jun-12	5.00	5.05	20.47	0.99	11.0	498	7.52	45.2	22.65				
Upper Prior Lake	12-Jun-12	6.00	6.04	18.15	0.72	7.6	508	7.50						
Upper Prior Lake	12-Jun-12	7.00	7.05	17.20	0.59	6.1	518	7.48						
Upper Prior Lake	12-Jun-12	8.00	8.05	14.23	0.50	4.9	554	7.41						

Site	Date	Depth	Sonde Depth	Temp, °C	DO, mg/l	DO, Sat %	SpCond, µS/cm	pH	TP, µg/l	SRP, µg/l	TN, mg/l	CLA, µg/l	Secchi, m	Chloride, mg/l
Upper Prior Lake	12-Jun-12	9.00	9.05	12.67	0.40	3.8	567	7.22						
Upper Prior Lake	12-Jun-12	10.00	10.05	11.94	0.38	3.6	577	7.06						
Upper Prior Lake	12-Jun-12	11.00	11.07	11.54	0.38	3.5	586	6.92	454.1	326.74				
Upper Prior Lake	12-Jun-12	11.98	11.98	11.23	0.34	3.1	621	6.63						
Upper Prior Lake	26-Jun-12	0.00	0.27	24.16	10.58	126.2	448	8.71	68.6	1.33	2.02	58.5	0.8	
Upper Prior Lake	26-Jun-12	1.00	1.07	24.06	10.75	128.0	448	8.67						
Upper Prior Lake	26-Jun-12	2.00	2.04	23.97	10.57	125.6	449	8.57						
Upper Prior Lake	26-Jun-12	3.00	3.07	23.85	10.37	123.0	450	8.47						
Upper Prior Lake	26-Jun-12	4.00	4.07	23.72	9.81	116.1	452	8.40						
Upper Prior Lake	26-Jun-12	5.00	5.01	21.75	0.91	10.3	473	7.24	60.1	9.39				
Upper Prior Lake	26-Jun-12	6.00	6.04	19.42	0.66	7.2	501	7.28						

Site	Date	Depth	Sonde Depth	Temp, °C	DO, mg/l	DO, Sat %	SpCond, µS/cm	pH	TP, µg/l	SRP, µg/l	TN, mg/l	CLA, µg/l	Secchi, m	Chloride, mg/l
Upper Prior Lake	26-Jun-12	7.00	7.07	17.22	0.54	5.6	526	7.27						
Upper Prior Lake	26-Jun-12	8.00	8.05	15.05	0.52	5.2	551	7.11						
Upper Prior Lake	26-Jun-12	9.00	9.07	13.12	0.48	4.6	570	6.88						
Upper Prior Lake	26-Jun-12	10.00	10.04	12.26	0.45	4.2	582	6.79						
Upper Prior Lake	26-Jun-12	11.00	11.08	11.98	0.44	4.1	587	6.73						
Upper Prior Lake	26-Jun-12	12.00	12.07	11.77	0.43	4.0	591	6.65	574.4	471.34				
Upper Prior Lake	26-Jun-12	12.71	12.71	11.46	0.43	4.0	604	6.41						
Upper Prior Lake	10-Jul-12	0.00	0.34	29.74	10.19	134.4	435	8.75	70.6	9.33	1.81	51.2	0.65	
Upper Prior Lake	10-Jul-12	1.00	1.05	28.49	10.23	131.9	434	8.73						
Upper Prior Lake	10-Jul-12	2.00	2.03	28.07	6.77	86.7	440	8.41						
Upper Prior Lake	10-Jul-12	3.00	3.04	27.85	5.98	76.2	441	8.24						

Site	Date	Depth	Sonde Depth	Temp, °C	DO, mg/l	DO, Sat %	SpCond, µS/cm	pH	TP, µg/l	SRP, µg/l	TN, mg/l	CLA, µg/l	Secchi, m	Chloride, mg/l
Upper Prior Lake	10-Jul-12	4.00	4.06	24.80	0.80	9.6	471	7.35	74.3	9				
Upper Prior Lake	10-Jul-12	5.00	5.07	20.68	0.54	6.0	498	7.25						
Upper Prior Lake	10-Jul-12	6.00	6.07	19.00	0.48	5.1	515	7.19						
Upper Prior Lake	10-Jul-12	7.00	7.04	16.98	0.46	4.8	539	7.07						
Upper Prior Lake	10-Jul-12	8.00	8.06	15.09	0.46	4.6	563	6.90						
Upper Prior Lake	10-Jul-12	9.00	9.06	13.20	0.46	4.4	586	6.77						
Upper Prior Lake	10-Jul-12	10.00	10.06	12.42	0.46	4.3	602	6.64						
Upper Prior Lake	10-Jul-12	11.00	11.03	12.05	0.45	4.2	611	6.63						
Upper Prior Lake	10-Jul-12	12.00	12.05	11.69	0.45	4.2	631	6.42	854.9	626.06				
Upper Prior Lake	10-Jul-12	12.43	12.43	11.62	0.51	4.7	657	6.28						
Upper Prior Lake	24-Jul-12	0.00	0.37	27.66	8.20	104.3	428	8.49	69.4	13.98	1.9	70.4	0.7	49

Site	Date	Depth	Sonde Depth	Temp, °C	DO, mg/l	DO, Sat %	SpCond, µS/cm	pH	TP, µg/l	SRP, µg/l	TN, mg/l	CLA, µg/l	Secchi, m	Chloride, mg/l
Upper Prior Lake	24-Jul-12	1.00	1.08	27.65	8.10	102.9	428	8.52						
Upper Prior Lake	24-Jul-12	3.00	3.03	27.56	7.17	91.0	431	8.35						
Upper Prior Lake	24-Jul-12	4.00	4.03	26.45	0.66	8.2	452	7.62	69.5	19.74				
Upper Prior Lake	24-Jul-12	5.00	5.06	23.34	0.39	4.6	482	7.42						
Upper Prior Lake	24-Jul-12	6.00	6.05	19.25	0.76	8.2	502	7.15						
Upper Prior Lake	24-Jul-12	7.00	7.10	17.06	0.18	1.8	524	7.08						
Upper Prior Lake	24-Jul-12	8.00	8.06	14.59	0.05	0.5	559	6.88						
Upper Prior Lake	24-Jul-12	9.00	9.09	13.47	0.16	1.6	574	6.82						
Upper Prior Lake	24-Jul-12	10.00	10.01	12.86	0.16	1.5	588	6.76						
Upper Prior Lake	24-Jul-12	11.00	11.06	12.31	0.13	1.3	600	6.72						
Upper Prior Lake	24-Jul-12	12.00	12.07	11.96	0.14	1.3	616	6.64	949.8	783.82				60

Site	Date	Depth	Sonde Depth	Temp, °C	DO, mg/l	DO, Sat %	SpCond, µS/cm	pH	TP, µg/l	SRP, µg/l	TN, mg/l	CLA, µg/l	Secchi, m	Chloride, mg/l
Upper Prior Lake	24-Jul-12	12.50	12.50	11.79	0.23	2.1	631	6.51						
Upper Prior Lake	07-Aug-12	0.00	0.33	27.95	14.81	189.2	413	8.86	76.7	19.95	1.89	93.2	0.4	
Upper Prior Lake	07-Aug-12	1.00	1.00	26.66	15.61	171.6	415	8.66						
Upper Prior Lake	07-Aug-12	2.00	2.00	26.21	10.18	128.0	420	8.41						
Upper Prior Lake	07-Aug-12	3.00	3.00	25.92	7.18	88.6	423	8.12						
Upper Prior Lake	07-Aug-12	4.00	4.00	25.55	3.59	44.1	427	7.77						
Upper Prior Lake	07-Aug-12	5.00	5.00	24.73	0.47	5.1	443	7.48	91.3	21.29				
Upper Prior Lake	07-Aug-12	6.00	6.00	19.93	0.15	1.8	511	7.07						
Upper Prior Lake	07-Aug-12	7.00	7.00	16.71	0.07	0.6	534	7.09						
Upper Prior Lake	07-Aug-12	8.00	8.00	14.98	0.00	0.0	561	6.93						
Upper Prior Lake	07-Aug-12	9.00	9.00	13.54	0.00	0.0	587	6.79						

Site	Date	Depth	Sonde Depth	Temp, °C	DO, mg/l	DO, Sat %	SpCond, µS/cm	pH	TP, µg/l	SRP, µg/l	TN, mg/l	CLA, µg/l	Secchi, m	Chloride, mg/l
Upper Prior Lake	07-Aug-12	10.00	10.00	12.80	0.00	0.0	605	6.75						
Upper Prior Lake	07-Aug-12	11.00	11.00	12.52	0.06	0.6	613	6.70						
Upper Prior Lake	07-Aug-12	12.00	12.00	12.00	0.90	0.1	693	6.33	683	315.7				
Upper Prior Lake	07-Aug-12	12.15	12.15	12.00	0.12	1.1		6.32						
Upper Prior Lake	21-Aug-12	0.00	0.27	23.27	9.80	115.0	439	8.42	49.7	14.22	2.14	72.5	0.55	
Upper Prior Lake	21-Aug-12	1.00	1.06	22.59	9.48	109.8	440	8.45						
Upper Prior Lake	21-Aug-12	2.00	2.03	22.22	7.27	83.6	443	8.19						
Upper Prior Lake	21-Aug-12	3.00	3.06	22.15	5.03	57.8	445	7.99						
Upper Prior Lake	21-Aug-12	4.00	4.07	22.02	3.70	42.4	438	7.89						
Upper Prior Lake	21-Aug-12	5.00	5.03	21.90	2.73	31.2	451	7.82						
Upper Prior Lake	21-Aug-12	6.00	6.05	21.40	0.80	9.1	465	7.71	73.7	7.71				

Site	Date	Depth	Sonde Depth	Temp, °C	DO, mg/l	DO, Sat %	SpCond, µS/cm	pH	TP, µg/l	SRP, µg/l	TN, mg/l	CLA, µg/l	Secchi, m	Chloride, mg/l
Upper Prior Lake	21-Aug-12	7.00	7.05	17.17	0.32	3.4	555	7.45						
Upper Prior Lake	21-Aug-12	8.00	8.02	15.52	0.28	2.8	575	7.37						
Upper Prior Lake	21-Aug-12	9.00	9.04	13.36	0.18	1.7	608	7.15						
Upper Prior Lake	21-Aug-12	10.00	10.02	12.47	0.17	1.6	634	6.97						
Upper Prior Lake	21-Aug-12	11.00	11.07	11.93	0.13	1.2	654	6.86	1117.9	857.27				
Upper Prior Lake	21-Aug-12	11.95	11.95	11.62	0.09	0.8	688	6.78						
Upper Prior Lake	05-Sep-12	0.00	0.32	25.98	10.10	124.6	450	8.48	81.5	10.02	2.23	71.1	0.85	
Upper Prior Lake	05-Sep-12	1.00	1.04	24.89	9.80	118.4	451	8.36						
Upper Prior Lake	05-Sep-12	2.00	2.09	24.66	8.25	99.3	453	8.19						
Upper Prior Lake	05-Sep-12	3.00	3.06	24.48	6.33	76.0	456	7.97						
Upper Prior Lake	05-Sep-12	4.00	4.06	24.15	3.07	36.6	459	7.66						

Site	Date	Depth	Sonde Depth	Temp, °C	DO, mg/l	DO, Sat %	SpCond, µS/cm	pH	TP, µg/l	SRP, µg/l	TN, mg/l	CLA, µg/l	Secchi, m	Chloride, mg/l
Upper Prior Lake	05-Sep-12	5.00	5.03	22.91	0.88	10.2	467	7.50	74.7	23.38				
Upper Prior Lake	05-Sep-12	6.00	6.05	20.83	0.41	4.6	500	7.32						
Upper Prior Lake	05-Sep-12	7.00	7.06	18.39	0.26	2.7	555	7.06						
Upper Prior Lake	05-Sep-12	8.00	8.04	15.50	0.14	1.4	603	6.88						
Upper Prior Lake	05-Sep-12	9.00	9.07	13.55	0.13	1.3	634	6.72						
Upper Prior Lake	05-Sep-12	10.00	10.04	12.93	0.14	1.4	655	6.66						
Upper Prior Lake	05-Sep-12	11.00	11.05	12.34	0.14	1.3	684	6.55	1401.1	1241.32				
Upper Prior Lake	05-Sep-12	11.82	11.82	12.16	0.21	1.9	708	6.42						
Upper Prior Lake	18-Sep-12	0.00	0.21	19.20	7.39	80.1	463	7.85	100.1	12.71	2.38	61.8	0.7	
Upper Prior Lake	18-Sep-12	1.00	1.02	18.88	7.20	77.6	463	7.87						
Upper Prior Lake	18-Sep-12	2.00	2.03	18.89	7.11	76.5	462	7.86						

Site	Date	Depth	Sonde Depth	Temp, °C	DO, mg/l	DO, Sat %	SpCond, µS/cm	pH	TP, µg/l	SRP, µg/l	TN, mg/l	CLA, µg/l	Secchi, m	Chloride, mg/l
Upper Prior Lake	18-Sep-12	3.00	3.08	18.79	7.00	75.2	463	7.85						
Upper Prior Lake	18-Sep-12	4.00	4.05	18.71	6.82	73.1	462	7.82						
Upper Prior Lake	18-Sep-12	5.00	5.05	18.66	6.54	70.1	462	7.80						
Upper Prior Lake	18-Sep-12	6.00	6.06	18.66	6.31	67.7	462	7.77						
Upper Prior Lake	18-Sep-12	7.00	7.10	18.41	2.88	30.7	482	7.40						
Upper Prior Lake	18-Sep-12	8.00	8.10	16.89	0.73	7.5	593	6.98	259.6	177.55				
Upper Prior Lake	18-Sep-12	9.00	9.06	13.38	0.39	3.7	636	6.74						
Upper Prior Lake	18-Sep-12	10.00	10.03	12.32	0.30	2.8	670	6.60	1350.3	1115.31				
Upper Prior Lake	18-Sep-12	10.87	10.87	11.99	0.30	2.8	719	6.50						
Upper Prior Lake	23-Oct-12	0.00	0.42	11.62	0.17	1.6	485	7.57	168.4	159.35	2.59	3.3	2.35	
Upper Prior Lake	23-Oct-12	1.00	1.08	11.60	0.27	2.5	485	7.54						

Site	Date	Depth	Sonde Depth	Temp, °C	DO, mg/l	DO, Sat %	SpCond, µS/cm	pH	TP, µg/l	SRP, µg/l	TN, mg/l	CLA, µg/l	Secchi, m	Chloride, mg/l
Upper Prior Lake	23-Oct-12	2.00	2.05	11.55	0.34	3.2	485	7.51						
Upper Prior Lake	23-Oct-12	3.00	3.05	11.52	0.45	4.1	484	7.49						
Upper Prior Lake	23-Oct-12	4.00	4.04	11.51	0.56	5.1	485	7.49						
Upper Prior Lake	23-Oct-12	5.00	5.03	11.52	0.67	6.1	485	7.47						
Upper Prior Lake	23-Oct-12	6.00	6.07	11.51	0.69	6.3	484	7.46	168.9	163.93				
Upper Prior Lake	23-Oct-12	7.00	7.03	11.51	0.80	7.3	485	7.46						
Upper Prior Lake	23-Oct-12	8.00	8.07	11.50	1.01	9.3	485	7.46						
Upper Prior Lake	23-Oct-12	9.00	9.03	11.50	1.06	9.7	485	7.46						
Upper Prior Lake	23-Oct-12	10.00	10.04	11.49	1.12	10.3	485	7.46						
Upper Prior Lake	23-Oct-12	11.00	11.05	11.43	1.19	10.9	485	7.45	177.9	174.8				
Upper Prior Lake	23-Oct-12	11.55	11.55	11.36	0.51	4.7	483	7.34						

Site	Date	Depth	Sonde Depth	Temp, °C	DO, mg/l	DO, Sat %	SpCond, µS/cm	pH	TP, µg/l	SRP, µg/l	TN, mg/l	CLA, µg/l	Secchi, m	Chloride, mg/l
Spring Lake	17-Apr-12	0.00	0.51	11.92	12.16	112.7	497	8.65	68.2	14.1	1.27	20.7	2.91	
Spring Lake	17-Apr-12	1.00	1.00	11.87	12.43	115.1	498	8.54						
Spring Lake	17-Apr-12	2.00	2.00	11.84	12.34	114.2	498	8.54						
Spring Lake	17-Apr-12	3.00	3.02	11.78	12.30	113.7	498	8.53						
Spring Lake	17-Apr-12	4.00	4.02	11.62	12.26	112.9	498	8.53						
Spring Lake	17-Apr-12	5.00	4.99	11.40	12.20	111.9	499	8.51	68.4	34.35				
Spring Lake	17-Apr-12	6.00	6.01	11.26	11.79	107.7	499	8.49						
Spring Lake	17-Apr-12	7.00	7.02	11.19	11.63	106.1	499	8.46						
Spring Lake	17-Apr-12	8.00	7.96	11.08	11.49	104.5	500	8.44						
Spring Lake	17-Apr-12	9.00	9.00	10.90	11.08	100.4	505	8.36						
Spring Lake	17-Apr-12	10.00	10.01	10.49	10.37	93.1	506	8.32	79.1	19.23				

Site	Date	Depth	Sonde Depth	Temp, °C	DO, mg/l	DO, Sat %	SpCond, µS/cm	pH	TP, µg/l	SRP, µg/l	TN, mg/l	CLA, µg/l	Secchi, m	Chloride, mg/l
Spring Lake	17-Apr-12	10.41	10.41	10.41	6.71	60.1	521	7.85						
Spring Lake	02-May-12	0.00	0.34	14.91	12.10	119.9	494	8.69	63.2	8.42	1.33	14.5	3.66	
Spring Lake	02-May-12	1.00	1.09	13.78	12.24	118.3	494	8.74						
Spring Lake	02-May-12	2.00	2.03	13.35	12.21	116.9	493	8.74						
Spring Lake	02-May-12	3.00	3.04	13.18	11.99	114.4	493	8.73						
Spring Lake	02-May-12	4.00	4.03	13.07	11.76	111.9	493	8.71						
Spring Lake	02-May-12	5.00	5.03	12.91	11.43	108.4	493	8.69	54.5	10.95				
Spring Lake	02-May-12	6.00	6.06	12.56	10.82	101.9	494	8.64						
Spring Lake	02-May-12	7.00	7.04	11.86	9.93	92.0	499	8.59						
Spring Lake	02-May-12	8.00	8.05	11.69	9.47	87.4	500	8.56						
Spring Lake	02-May-12	9.00	9.06	11.31	8.17	74.7	503	8.45						

Site	Date	Depth	Sonde Depth	Temp, °C	DO, mg/l	DO, Sat %	SpCond, µS/cm	pH	TP, µg/l	SRP, µg/l	TN, mg/l	CLA, µg/l	Secchi, m	Chloride, mg/l
Spring Lake	02-May-12	10.00	10.03	11.22	7.39	67.5	505	8.39	95.5	14.54				
Spring Lake	02-May-12	10.98	10.98	10.89	3.33	30.2	517	7.54						
Spring Lake	15-May-12	0.00	0.26	19.25	15.36	166.6	453	9.08	67.3	3.3	1.63	43.2	1.57	
Spring Lake	15-May-12	1.00	1.07	19.22	17.02	184.5	453	9.09						
Spring Lake	15-May-12	2.00	2.02	19.19	17.62	191.0	453	9.07						
Spring Lake	15-May-12	3.00	3.05	19.14	17.66	191.1	454	9.07						
Spring Lake	15-May-12	4.00	4.05	16.35	13.63	139.3	474	8.64						
Spring Lake	15-May-12	5.00	5.05	15.22	6.79	67.7	479	8.33						
Spring Lake	15-May-12	6.00	6.02	14.27	4.74	46.4	484	8.12						
Spring Lake	15-May-12	7.00	7.01	13.51	1.84	17.7	493	7.93	109.1	60.74				
Spring Lake	15-May-12	8.00	8.08	12.22	0.93	8.7	504	7.78						

Site	Date	Depth	Sonde Depth	Temp, °C	DO, mg/l	DO, Sat %	SpCond, µS/cm	pH	TP, µg/l	SRP, µg/l	TN, mg/l	CLA, µg/l	Secchi, m	Chloride, mg/l
Spring Lake	15-May-12	9.00	9.09	11.52	0.59	5.4	508	7.70						
Spring Lake	15-May-12	10.00	10.04	11.45	0.48	4.4	508	7.67	218.1	184.88				
Spring Lake	15-May-12	10.62	10.62	11.41	0.40	3.7	509	7.65						
Spring Lake	30-May-12	0.00	0.40	19.79	10.02	109.8	465	8.49	81.6	11.38	1.86	56.5	1.55	
Spring Lake	30-May-12	1.00	1.04	19.22	9.84	106.6	466	8.50						
Spring Lake	30-May-12	2.00	2.01	18.98	8.78	94.8	467	8.41						
Spring Lake	30-May-12	3.00	3.02	18.74	8.16	87.6	470	8.31						
Spring Lake	30-May-12	4.00	4.05	18.68	7.97	85.5	470	8.26						
Spring Lake	30-May-12	5.00	5.02	18.63	7.76	83.2	471	8.23						
Spring Lake	30-May-12	6.00	6.04	18.47	7.20	76.9	474	8.17						
Spring Lake	30-May-12	7.00	7.02	18.11	6.76	71.6	474	8.11						

Site	Date	Depth	Sonde Depth	Temp, °C	DO, mg/l	DO, Sat %	SpCond, µS/cm	pH	TP, µg/l	SRP, µg/l	TN, mg/l	CLA, µg/l	Secchi, m	Chloride, mg/l
Spring Lake	30-May-12	8.00	8.10	15.14	0.92	9.2	511	7.47	191.2	154.55				
Spring Lake	30-May-12	9.00	9.07	12.77	0.59	5.6	530	7.33						
Spring Lake	30-May-12	10.00	10.02	12.13	0.47	4.4	536	7.18	403.1	367.88				
Spring Lake	30-May-12	10.74	10.74	12.05	0.33	3.1	546	6.96						
Spring Lake	12-Jun-12	0.00	0.28	22.14	9.65	110.8	462	8.74	85.2	20.79	1.89	74	1.05	
Spring Lake	12-Jun-12	1.00	1.05	22.08	9.56	109.6	463	8.72						
Spring Lake	12-Jun-12	2.00	2.07	22.01	9.20	105.4	463	8.66						
Spring Lake	12-Jun-12	3.00	3.01	21.82	8.60	98.2	465	8.56						
Spring Lake	12-Jun-12	4.00	4.08	21.58	8.72	99.0	466	8.54						
Spring Lake	12-Jun-12	5.00	5.04	21.39	8.35	94.5	468	8.48						
Spring Lake	12-Jun-12	6.00	6.06	18.47	0.99	10.6	500	7.53	105.1	34.92				

Site	Date	Depth	Sonde Depth	Temp, °C	DO, mg/l	DO, Sat %	SpCond, µS/cm	pH	TP, µg/l	SRP, µg/l	TN, mg/l	CLA, µg/l	Secchi, m	Chloride, mg/l
Spring Lake	12-Jun-12	7.00	7.06	17.21	0.70	7.3	512	7.43						
Spring Lake	12-Jun-12	8.00	8.06	15.73	0.49	5.0	530	7.28						
Spring Lake	12-Jun-12	9.00	9.08	14.20	0.44	4.3	548	7.15						
Spring Lake	12-Jun-12	10.00	10.08	13.49	0.39	3.7	556	7.07	577.7	489.16				
Spring Lake	12-Jun-12	10.67	10.67	13.18	0.36	3.4	559	6.82						
Spring Lake	26-Jun-12	0.00	0.27	23.55	11.66	137.5	420	8.86	113.2	25.25	2.22	81.3	0.87	
Spring Lake	26-Jun-12	1.00	1.05	23.49	12.08	142.3	421	8.83						
Spring Lake	26-Jun-12	2.00	2.06	23.44	11.98	141.0	422	8.78						
Spring Lake	26-Jun-12	3.00	3.04	23.24	10.58	124.0	425	8.61						
Spring Lake	26-Jun-12	4.00	4.09	22.72	8.53	99.0	432	8.31						
Spring Lake	26-Jun-12	5.00	5.04	21.63	1.64	18.7	444	7.37						

Site	Date	Depth	Sonde Depth	Temp, °C	DO, mg/l	DO, Sat %	SpCond, µS/cm	pH	TP, µg/l	SRP, µg/l	TN, mg/l	CLA, µg/l	Secchi, m	Chloride, mg/l
Spring Lake	26-Jun-12	6.00	6.05	20.42	0.93	10.3	466	7.40	157.2	147.95				
Spring Lake	26-Jun-12	7.00	7.07	18.49	0.58	6.2	501	7.31						
Spring Lake	26-Jun-12	8.00	8.04	16.88	0.45	4.7	528	7.16						
Spring Lake	26-Jun-12	9.00	9.06	15.54	0.44	4.5	546	7.02						
Spring Lake	26-Jun-12	10.00	10.06	14.76	0.41	4.1	553	6.88	827	743.45				
Spring Lake	26-Jun-12	10.98	10.98	14.20	0.39	3.8	564	6.59						
Spring Lake	10-Jul-12	0.00	0.19	29.95	9.58	126.7	400	8.96	68.9	7.44	1.98	49.5	0.75	
Spring Lake	10-Jul-12	1.00	1.06	28.03	10.80	138.2	400	8.91						
Spring Lake	10-Jul-12	2.00	2.05	27.70	6.97	88.7	406	8.59						
Spring Lake	10-Jul-12	3.00	3.06	25.90	0.83	10.2	433	7.56	50.9	8.06				
Spring Lake	10-Jul-12	4.00	4.07	22.70	0.51	5.9	452	7.37						

Site	Date	Depth	Sonde Depth	Temp, °C	DO, mg/l	DO, Sat %	SpCond, µS/cm	pH	TP, µg/l	SRP, µg/l	TN, mg/l	CLA, µg/l	Secchi, m	Chloride, mg/l
Spring Lake	10-Jul-12	5.00	5.04	21.18	0.47	5.3	469	7.28						
Spring Lake	10-Jul-12	6.00	6.06	19.16	0.46	5.0	503	7.12						
Spring Lake	10-Jul-12	7.00	7.08	17.69	0.45	4.8	529	6.95						
Spring Lake	10-Jul-12	8.00	8.04	16.67	0.44	4.5	546	6.87						
Spring Lake	10-Jul-12	9.00	9.05	15.82	0.43	4.4	560	6.81						
Spring Lake	10-Jul-12	10.00	10.05	15.02	0.44	4.4	579	6.65	941.4	800.05				
Spring Lake	10-Jul-12	10.66	10.66	14.90	0.43	4.2	583	6.56						
Spring Lake	24-Jul-12	0.00	0.35	27.25	5.97	75.3	397	8.48	36.4	20.58	1.52	34.6	1.29	
Spring Lake	24-Jul-12	1.00	1.06	27.25	5.93	74.8	397	8.48						
Spring Lake	24-Jul-12	2.00	2.04	27.22	5.55	70.0	398	8.42						
Spring Lake	24-Jul-12	3.00	3.08	27.06	4.97	62.5	401	8.34						

Site	Date	Depth	Sonde Depth	Temp, °C	DO, mg/l	DO, Sat %	SpCond, µS/cm	pH	TP, µg/l	SRP, µg/l	TN, mg/l	CLA, µg/l	Secchi, m	Chloride, mg/l
Spring Lake	24-Jul-12	4.00	4.02	25.29	0.52	6.4	427	7.81	59.7	43.05				
Spring Lake	24-Jul-12	5.00	5.06	22.66	0.55	6.4	456	7.65						
Spring Lake	24-Jul-12	6.00	6.02	19.66	0.45	4.9	488	7.44						
Spring Lake	24-Jul-12	7.00	7.00	17.84	0.22	2.3	517	7.26						
Spring Lake	24-Jul-12	8.00	8.04	16.43	0.18	1.8	542	7.13						
Spring Lake	24-Jul-12	9.00	9.06	16.06	0.24	2.4	550	7.03						
Spring Lake	24-Jul-12	10.00	10.01	15.63	0.25	2.5	559	6.91	1190.8	1135.42				
Spring Lake	24-Jul-12	10.43	10.43	15.57	0.35	3.6	569	6.64						
Spring Lake	07-Aug-12	0.00	0.33	27.12	13.26	167.0	396	8.77	90	23.59	1.69	84.2	0.6	
Spring Lake	07-Aug-12	1.00	1.04	26.52	13.12	163.4	395	8.73						
Spring Lake	07-Aug-12	2.00	2.00	25.95	9.82	118.0	400	8.72						

Site	Date	Depth	Sonde Depth	Temp, °C	DO, mg/l	DO, Sat %	SpCond, µS/cm	pH	TP, µg/l	SRP, µg/l	TN, mg/l	CLA, µg/l	Secchi, m	Chloride, mg/l
Spring Lake	07-Aug-12	3.00	3.00	25.55	6.48	78.8	404	8.22						
Spring Lake	07-Aug-12	4.00	4.00	24.90	4.23	52.0	408	7.93						
Spring Lake	07-Aug-12	5.00	5.00	23.65	0.54	5.9	447	7.52	50.9	23.26				
Spring Lake	07-Aug-12	6.00	6.00	20.23	0.11	1.3	498	7.00						
Spring Lake	07-Aug-12	7.00	7.00	17.88	0.00	0.3	528	6.87						
Spring Lake	07-Aug-12	8.00	8.00	16.65	-0.02	-0.2	547	6.81						
Spring Lake	07-Aug-12	9.00	9.00	16.15	0.07	0.7	556	6.78						
Spring Lake	07-Aug-12	10.00	10.00	15.77	0.08	0.9	566	6.73	1214.3	477.93				
Spring Lake	07-Aug-12	10.37	10.37	15.58	0.14	1.4	577	6.56						
Spring Lake	21-Aug-12	0.00	0.26	23.30	15.41	180.9	402	9.05	107	19.24	2.11	71.4	0.8	
Spring Lake	21-Aug-12	1.00	1.02	22.81	15.34	178.3	402	9.00						

Site	Date	Depth	Sonde Depth	Temp, °C	DO, mg/l	DO, Sat %	SpCond, µS/cm	pH	TP, µg/l	SRP, µg/l	TN, mg/l	CLA, µg/l	Secchi, m	Chloride, mg/l
Spring Lake	21-Aug-12	2.00	2.02	22.07	10.72	122.9	416	8.73						
Spring Lake	21-Aug-12	3.00	3.05	21.65	3.47	39.5	426	8.15						
Spring Lake	21-Aug-12	4.00	4.03	21.47	2.05	23.2	430	7.95						
Spring Lake	21-Aug-12	5.00	5.04	21.39	1.06	12.1	432	7.82						
Spring Lake	21-Aug-12	6.00	6.04	20.66	0.56	6.2	469	7.72	84.6	61.94				
Spring Lake	21-Aug-12	7.00	7.04	18.40	0.24	2.6	542	7.31						
Spring Lake	21-Aug-12	8.00	8.02	16.42	0.24	2.5	565	7.21						
Spring Lake	21-Aug-12	9.00	9.05	15.59	0.17	1.7	585	7.07						
Spring Lake	21-Aug-12	10.00	10.03	15.20	0.17	1.7	598	7.03	1404.9	1261.8				
Spring Lake	21-Aug-12	10.79	10.79	14.96	0.15	1.5	611	6.86						
Spring Lake	05-Sep-12	0.00	0.33	25.18	14.13	171.7	394	9.08	136.1	31.14	2.11	119.9	0.65	

Site	Date	Depth	Sonde Depth	Temp, °C	DO, mg/l	DO, Sat %	SpCond, µS/cm	pH	TP, µg/l	SRP, µg/l	TN, mg/l	CLA, µg/l	Secchi, m	Chloride, mg/l
Spring Lake	05-Sep-12	1.00	1.04	24.61	12.15	146.2	398	8.93						
Spring Lake	05-Sep-12	2.00	2.06	24.42	9.79	117.3	401	8.84						
Spring Lake	05-Sep-12	3.00	3.02	23.90	4.37	51.9	412	8.41						
Spring Lake	05-Sep-12	4.00	4.07	23.31	2.57	30.2	417	8.13						
Spring Lake	05-Sep-12	5.00	5.08	22.44	0.96	11.1	431	7.79	81.8	45.72				
Spring Lake	05-Sep-12	6.00	6.06	21.02	0.41	4.6	470	7.46						
Spring Lake	05-Sep-12	7.00	7.04	19.47	0.33	3.6	521	7.19						
Spring Lake	05-Sep-12	8.00	8.08	17.54	0.22	2.3	575	6.94						
Spring Lake	05-Sep-12	9.00	9.03	16.65	0.19	2.0	593	6.80						
Spring Lake	05-Sep-12	10.00	10.05	16.16	0.19	1.9	605	6.74	1588.3	1468.84				
Spring Lake	05-Sep-12	10.36	10.36	15.91	0.24	2.5	624	6.63						

Site	Date	Depth	Sonde Depth	Temp, °C	DO, mg/l	DO, Sat %	SpCond, µS/cm	pH	TP, µg/l	SRP, µg/l	TN, mg/l	CLA, µg/l	Secchi, m	Chloride, mg/l
Spring Lake	18-Sep-12	0.00	0.35	18.70	3.42	36.7	431	7.44	203.6	151.04	2.16	33.9	0.72	
Spring Lake	18-Sep-12	1.00	1.03	18.68	3.34	35.8	431	7.45						
Spring Lake	18-Sep-12	2.00	2.04	18.62	3.35	35.9	430	7.47						
Spring Lake	18-Sep-12	3.00	3.06	18.50	3.96	42.3	429	7.49						
Spring Lake	18-Sep-12	4.00	4.06	18.42	4.28	45.6	428	7.51	194.9	147.28				
Spring Lake	18-Sep-12	5.00	5.05	18.36	4.65	49.5	428	7.53						
Spring Lake	18-Sep-12	6.00	6.07	18.15	4.86	51.6	428	7.54						
Spring Lake	18-Sep-12	7.00	7.04	18.06	4.63	49.0	428	7.54	203.9	146.46				
Spring Lake	18-Sep-12	7.92	7.92	18.07	0.58	6.1	460	7.11						
Spring Lake	23-Oct-12	0.00	0.28	11.30	2.68	24.5	418	8.81	104	31.97	1.79	83.8	1.1	
Spring Lake	23-Oct-12	1.00	1.04	11.30	3.28	30.0	418	8.84						

Site	Date	Depth	Sonde Depth	Temp, °C	DO, mg/l	DO, Sat %	SpCond, µS/cm	pH	TP, µg/l	SRP, µg/l	TN, mg/l	CLA, µg/l	Secchi, m	Chloride, mg/l
Spring Lake	23-Oct-12	2.00	2.06	11.27	3.69	33.8	418	8.84						
Spring Lake	23-Oct-12	3.00	3.06	11.26	3.85	35.2	418	8.84						
Spring Lake	23-Oct-12	4.00	4.07	11.25	4.39	40.1	418	8.83						
Spring Lake	23-Oct-12	5.00	5.06	11.14	4.72	43.0	419	8.82	114.1	26.15				
Spring Lake	23-Oct-12	6.00	6.07	11.08	4.76	43.3	419	8.81						
Spring Lake	23-Oct-12	7.00	7.05	11.07	4.97	45.2	420	8.80						
Spring Lake	23-Oct-12	8.00	8.04	10.69	5.22	47.1	422	8.74						
Spring Lake	23-Oct-12	9.00	9.05	10.59	5.01	45.1	423	8.71						
Spring Lake	23-Oct-12	10.00	10.05	10.65	4.70	42.3	430	8.43	133.7	33.1				
Spring Lake	23-Oct-12	10.36	10.36	10.66	0.86	7.7	439	7.61						

APPENDIX B - CAMP DATA

Lake Name	Sample Date	Secchi Depth (meters)	Water Temp (Celsius)	Water Color	Water Odor	Lake Level	Lake Gauge	Physical Condition	Recreation Suitability	Comments	Chlorophyll-a (µg/L)	Total Kjeldahl Nitrogen (mg/L)	Pheophytin-a (µg/L)	Phosphorus, Total (mg/L)
Cates Lake	4/24/2012 10:15	1.8	14		None	Below Normal	2.18	2	4		2.1	0.9	1	0.027
Cates Lake	5/7/2012 13:00	1.3	17		None		2.94	2	4		11	0.78	1	0.033
Cates Lake	5/16/2012 14:00	1.7	22		None		2.84			Secchi disk is visible on the lake bottom @ 1.7 m.	4	0.86	1	0.024
Cates Lake	6/1/2012 10:00	1.7	19		None	Above Normal	3.25	2	4		4.6	0.87	1.8	0.087
Cates Lake	6/18/2012 9:00	1.8	22		None			3	4	Lake level over the the top of the staff gauge.	4.9	0.94	1	0.075
Cates Lake	6/30/2012 8:45		26.4		None	Above Normal		3	4	Secchi disk visibility is blocked @ 2.0 m. Lake level is above staff gauge.	4.1	0.83	1	0.016
Cates Lake	7/9/2012 11:00		28.6		None	Above Normal	3.4	4	4	Secchi disk is visible on the lake bottom.	1.7	0.84	1	0.023
Cates Lake	7/30/2012 9:30		26.1		None		2.76	3	4	Secchi disk is visible on the lake bottom @ 1.7 m.	4	0.92	2	0.027
Cates	8/13/2012		24.1	Green	None		2.54	4	4		7	0.82	1.8	0.028

Lake Name	Sample Date	Secchi Depth (meters)	Water Temp (Celsius)	Water Color	Water Odor	Lake Level	Lake Gauge	Physical Condition	Recreation Suitability	Comments	Chlorophyll-a (µg/L)	Total Kjeldahl Nitrogen (mg/L)	Pheophytin-a (µg/L)	Phosphorus, Total (mg/L)
Lake	12:00													
Fish Lake	4/22/2012 11:12	3.1	11.8	Green	None	Normal	1.88	1	1		4.1	1.5	1.5	0.087
Fish Lake	5/6/2012 13:20	2.6	15.8	Green	None	Above Normal	2.6	1	1		4.8	0.92	1.6	0.083
Fish Lake	5/20/2012 15:24	1.7	19.4	Green	None	Above Normal	2.46	1	1		21	1.2	1	0.152
Fish Lake	6/3/2012 14:26	1	21.3	Green	None	Normal	2.32	4	3		19	0.93	1	0.025
Fish Lake	6/17/2012 18:19	1.1	22.2	Green	None	Normal	2.2	1	1		32	1.6	1	0.052
Fish Lake	7/1/2012 18:45	1.3	29	Green	None	Below Normal	2.2	3	2		14	1.4	1.3	0.025
Fish Lake	7/15/2012 17:30	1.3	29.5	Green	None	Below Normal	1.87	2	2		14	1.3	2.7	0.033
Fish Lake	7/29/2012 17:30	0.7	27.5	Green	None	Below Normal	1.9	2	2		39	1.8	1	0.034
Fish Lake	8/14/2012 18:30	1	25.8	Green	None	Below Normal	1.75	3	2		15	1.2	1	0.023
Fish Lake	8/26/2012 10:30	1.4	25.2	Green	None	Below Normal	1.71	2	1		17	1.3	1	0.023
Fish Lake	9/9/2012 16:30	1.9	23.2	Green	None	Below Normal	1.53	2	2		7.3	1.2	1.1	0.013
Fish Lake	9/23/2012 17:30	1.7	16.6	Green	None	Below Normal	1.32	2	1		8.9	1.8	1.8	0.055
Fish Lake	10/7/2012 18:30	1.2	13	Green		Below Normal	1.14	5	4	Odor = algal.	38	1.7	1	0.056
Fish Lake	10/21/2012 16:40	1	11.5	Green	None	Below Normal		3	4	Staff gauge removed.	53	1.3	1	0.066
Lower Prior Lake	4/24/2012 16:20	8.1	13.9	Clear	None	Below Normal		1	1		1	0.9	1.6	0.059
Lower Prior Lake	4/30/2012 16:20	7.6	13.2	Clear	None	Below Normal		1	1		1.4	0.88	1	0.037
Lower Prior Lake	5/22/2012 17:05	3.3	20.9	Green	Musty	Normal		2	1		2.4	0.78	1	0.106
Lower Prior Lake	5/30/2012 15:35	4	19.2	Green	Musty	Normal		2	1		3.8	0.86	1	0.038
Lower Prior Lake	6/12/2012 16:45	5.2	22.8	Clear	Musty	Normal		2	1		3.7	0.84	1	0.009
Lower Prior Lake	6/25/2012 17:10	3.9	24.3	Green	Musty	Above Normal		2	1		3.8	0.82	1	0.005
Lower Prior	7/9/2012 16:30	3.3		Green	Musty	Above Normal		2	1		3.2	0.96	1	0.013

Lake Name	Sample Date	Secchi Depth (meters)	Water Temp (Celsius)	Water Color	Water Odor	Lake Level	Lake Gauge	Physical Condition	Recreation Suitability	Comments	Chlorophyll-a (µg/L)	Total Kjeldahl Nitrogen (mg/L)	Pheophytin-a (µg/L)	Phosphorus, Total (mg/L)
Lake														
Lower Prior Lake	7/25/2012 17:00	2.9	28	Green	Musty	Normal		2	2		8.1	1.1	1	0.023
Lower Prior Lake	8/7/2012 16:15	3.1	27	Green	Musty	Normal		2	1		4.8	1	1	0.008
Lower Prior Lake	8/20/2012 16:45	3	24	Green	Musty	Normal		2	1		4.3	1	1	0.008
Lower Prior Lake	9/3/2012 9:30	2.9	26	Green	Musty	Normal		2	1		7.5	1	1	0.013
Lower Prior Lake	9/23/2012 13:45	2.8	18	Green	Musty	Below Normal		2	1		9.3	1.1	1.6	0.034
Lower Prior Lake	10/2/2012 16:45	3.8	19	Green	Musty	Below Normal		2	1		5.2	0.93	1.7	0.018
Lower Prior Lake	10/16/2012 13:15	4.1	14	Green	Musty	Below Normal		2	1		6	1.1	1.4	0.033
Upper Prior Lake	4/24/2012 18:45	2.1	15	Clear	None	Normal		1	1		2.6	0.61	1	0.019
Upper Prior Lake	5/7/2012 18:00	1.9	16.9	Clear	None	Above Normal		2	1		8.8	1.1	1	0.198
Upper Prior Lake	5/28/2012 10:30	1.2	22.7	Green	None	Above Normal		3	2		35	1.2	1	0.111
Upper Prior Lake	6/13/2012 19:00	0.9	22.4	Green	None	Above Normal		3	2		9.9	1.1	1	0.045
Upper Prior Lake	7/2/2012 18:30	0.7	29.7	Green	None	Normal		3	2		65	1.7	1	0.06
Upper Prior Lake	7/9/2012 18:30	0.6	28.8	Green	None	Normal		3	2		570	1.6	1	0.068
Upper Prior Lake	7/27/2012 19:14	0.6	27.2	Green	None	Normal		3	2			1.7		0.06
Upper Prior Lake	8/11/2012 17:00	0.4	25.7	Green	Fishy	Normal		3	2		97	1.8	1	0.088
Upper Prior Lake	8/22/2012 13:05	0.5	23.1	Green	None	Normal		3	2		71	2.1	3.5	0.077
Upper	9/8/2012	0.7	22.5	Green	None	Normal		3	2		37	1.9	1	0.064

Lake Name	Sample Date	Secchi Depth (meters)	Water Temp (Celsius)	Water Color	Water Odor	Lake Level	Lake Gauge	Physical Condition	Recreation Suitability	Comments	Chlorophyll-a (µg/L)	Total Kjeldahl Nitrogen (mg/L)	Pheophytin-a (µg/L)	Phosphorus, Total (mg/L)
Prior Lake	16:30													
Upper Prior Lake	9/29/2012 15:00	0.8	19.3	Green	Fishy	Below Normal			1		39	1.9	3.9	0.193
Spring Lake	7/4/2012 7:00	0.8	30.7	Green	None	Below Normal		3	2		150	1.7	1	0.07
Spring Lake	7/21/2012 7:05	1		Green	None	Normal		2	1		41	1.9	1	0.073
Spring Lake	8/4/2012 16:07	1	26.3	Brown	None	Normal		2	2		34	1.6	1	0.066
Spring Lake	8/18/2012 11:45	0.5	24.4	Green	Musty	Below Normal		4	3		78	2.2	1	0.157
Spring Lake	8/30/2012 7:45	0.8	24.5	Brown	None	Below Normal		3	3		55	2	1	0.113
Spring Lake	9/16/2012 4:40	0.6	20.3	Brown	None	Below Normal		3	2		115	2.1	1	0.2
Spring Lake	9/30/2012 16:30	0.9	18.7	Brown	None	Below Normal		2	2					
Spring Lake	10/6/2012 3:05	0.7		Brown	None	Below Normal		2	2		87	2.5	1	0.218

APPENDIX C - STREAM CHEMISTRY DATA

Site Name	Sample Date and Time	Analyte	Result	Units
FC_CD1	02/29/2012 14:45:00	Iron	560	µg/L
FC_CD1	02/29/2012 14:45:00	Total Suspended Solids	10	mg/L
FC_CD1	02/29/2012 14:45:00	Phosphorus, Total as P	0.96	mg/L
FC_CD1	02/29/2012 14:45:00	Orthophosphate as P	0.95	mg/L
FC_CD1	02/29/2012 14:45:00	Phosphorus, Total as P	1.2	mg/L
FC_CD1	03/07/2012 12:55:00	Iron	870	µg/L
FC_CD1	03/07/2012 12:55:00	Total Suspended Solids	10	mg/L
FC_CD1	03/07/2012 12:55:00	Phosphorus, Total as P	0.64	mg/L
FC_CD1	03/07/2012 12:55:00	Orthophosphate as P	0.53	mg/L
FC_CD1	03/07/2012 12:55:00	Phosphorus, Total as P	0.8	mg/L
FC_CD1	03/12/2012 11:50:00	Iron	2100	µg/L
FC_CD1	03/12/2012 11:50:00	Phosphorus, Total as P	0.13	mg/L
FC_CD1	03/12/2012 11:50:00	Orthophosphate as P	0.08	mg/L
FC_CD1	03/12/2012 11:50:00	Phosphorus, Total as P	0.34	mg/L
FC_CD1	03/12/2012 11:50:00	Total Suspended Solids	11	mg/L
FC_CD1	03/21/2012 10:05:00	Iron	670	µg/L
FC_CD1	03/21/2012 10:05:00	Phosphorus, Total as P	0.13	mg/L
FC_CD1	03/21/2012 10:05:00	Orthophosphate as P	0.079	mg/L
FC_CD1	03/21/2012 10:05:00	Phosphorus, Total as P	0.2	mg/L
FC_CD1	03/21/2012 10:05:00	Total Suspended Solids	5.6	mg/L
FC_CD1	04/02/2012 10:20:00	Iron	370	µg/L
FC_CD1	04/02/2012 10:20:00	Phosphorus, Total as P	0.08	mg/L
FC_CD1	04/02/2012 10:20:00	Orthophosphate as P	0.045	mg/L
FC_CD1	04/02/2012 10:20:00	Phosphorus, Total as P	0.11	mg/L
FC_CD1	04/02/2012 10:20:00	Total Suspended Solids	5.4	mg/L
FC_CD1	04/09/2012 12:55:00	Iron	150	µg/L
FC_CD1	04/09/2012 12:55:00	Phosphorus, Total as P	0.073	mg/L
FC_CD1	04/09/2012 12:55:00	Orthophosphate as P	0.047	mg/L
FC_CD1	04/09/2012 12:55:00	Phosphorus, Total as P	0.1	mg/L
FC_CD1	04/09/2012 12:55:00	Total Suspended Solids	4	mg/L
FC_CD1	04/16/2012 09:50:00	Iron	610	µg/L
FC_CD1	04/16/2012 09:50:00	Phosphorus, Total as P	0.18	mg/L
FC_CD1	04/16/2012 09:50:00	Orthophosphate as P	0.15	mg/L
FC_CD1	04/16/2012 09:50:00	Phosphorus, Total as P	0.24	mg/L
FC_CD1	04/16/2012 09:50:00	Total Suspended Solids	9.8	mg/L
FC_CD1	05/02/2012 09:10:00	Iron	740	µg/L
FC_CD1	05/02/2012 09:10:00	Phosphorus, Total as P	0.2	mg/L
FC_CD1	05/02/2012 09:10:00	Orthophosphate as P	0.19	mg/L

Site Name	Sample Date and Time	Analyte	Result	Units
FC_CD1	05/02/2012 09:10:00	Phosphorus, Total as P	0.29	mg/L
FC_CD1	05/02/2012 09:10:00	Total Suspended Solids	10	mg/L
FC_CD1	05/07/2012 09:25:00	Iron	3900	µg/L
FC_CD1	05/07/2012 09:25:00	Phosphorus, Total as P	0.31	mg/L
FC_CD1	05/07/2012 09:25:00	Phosphorus, Total as P	0.45	mg/L
FC_CD1	05/07/2012 09:25:00	Total Suspended Solids	60	mg/L
FC_CD1	05/07/2012 09:25:00	Orthophosphate as P	0.29	mg/L
FC_CD1	05/14/2012 09:45:00	Iron	490	µg/L
FC_CD1	05/14/2012 09:45:00	Phosphorus, Total as P	0.08	mg/L
FC_CD1	05/14/2012 09:45:00	Orthophosphate as P	0.065	mg/L
FC_CD1	05/14/2012 09:45:00	Phosphorus, Total as P	0.1	mg/L
FC_CD1	05/14/2012 09:45:00	Total Suspended Solids	6.6	mg/L
FC_CD1	06/04/2012 08:50:00	Iron	730	µg/L
FC_CD1	06/04/2012 08:50:00	Phosphorus, Total as P	0.082	mg/L
FC_CD1	06/04/2012 08:50:00	Orthophosphate as P	0.062	mg/L
FC_CD1	06/04/2012 08:50:00	Phosphorus, Total as P	0.11	mg/L
FC_CD1	06/04/2012 08:50:00	Total Suspended Solids	7	mg/L
FC_CD1	06/11/2012 10:15:00	Iron	1000	µg/L
FC_CD1	06/11/2012 10:15:00	Phosphorus, Total as P	0.17	mg/L
FC_CD1	06/11/2012 10:15:00	Orthophosphate as P	0.13	mg/L
FC_CD1	06/11/2012 10:15:00	Phosphorus, Total as P	0.2	mg/L
FC_CD1	06/11/2012 10:15:00	Total Suspended Solids	5.4	mg/L
FC_CD1	06/19/2012 11:20:00	Iron	3000	µg/L
FC_CD1	06/19/2012 11:20:00	Phosphorus, Total as P	0.26	mg/L
FC_CD1	06/19/2012 11:20:00	Phosphorus, Total as P	0.4	mg/L
FC_CD1	06/19/2012 11:20:00	Total Suspended Solids	58	mg/L
FC_CD1	06/19/2012 11:20:00	Orthophosphate as P	0.24	mg/L
FC_CD1	07/02/2012 08:20:00	Iron	840	µg/L
FC_CD1	07/02/2012 08:20:00	Phosphorus, Total as P	0.13	mg/L
FC_CD1	07/02/2012 08:20:00	Orthophosphate as P	0.12	mg/L
FC_CD1	07/02/2012 08:20:00	Phosphorus, Total as P	0.31	mg/L
FC_CD1	07/02/2012 08:20:00	Total Suspended Solids	22	mg/L
FC_CD1	07/16/2012 08:25:00	Iron	1000	µg/L
FC_CD1	07/16/2012 08:25:00	Phosphorus, Total as P	0.37	mg/L
FC_CD1	07/16/2012 08:25:00	Phosphorus, Total as P	0.46	mg/L
FC_CD1	07/16/2012 08:25:00	Total Suspended Solids	15	mg/L
FC_CD1	07/16/2012 08:25:00	Orthophosphate as P	0.35	mg/L
FC_CD1	07/24/2012 09:45:00	Iron	1200	µg/L
FC_CD1	07/24/2012 09:45:00	Phosphorus, Total as P	0.16	mg/L
FC_CD1	07/24/2012 09:45:00	Orthophosphate as P	0.15	mg/L

Site Name	Sample Date and Time	Analyte	Result	Units
FC_CD1	07/24/2012 09:45:00	Phosphorus, Total as P	0.24	mg/L
FC_CD1	07/24/2012 09:45:00	Total Suspended Solids	16	mg/L
FC_CD1	08/06/2012 09:20:00	Iron	1400	µg/L
FC_CD1	08/06/2012 09:20:00	Phosphorus, Total as P	0.27	mg/L
FC_CD1	08/06/2012 09:20:00	Phosphorus, Total as P	0.48	mg/L
FC_CD1	08/06/2012 09:20:00	Total Suspended Solids	15	mg/L
FC_CD1	08/06/2012 09:20:00	Orthophosphate as P	0.22	mg/L
FC_CD1	08/20/2012 11:45:00	Iron	590	µg/L
FC_CD1	08/20/2012 11:45:00	Phosphorus, Total as P	0.094	mg/L
FC_CD1	08/20/2012 11:45:00	Orthophosphate as P	0.087	mg/L
FC_CD1	08/20/2012 11:45:00	Phosphorus, Total as P	0.11	mg/L
FC_CD1	08/20/2012 11:45:00	Total Suspended Solids	4.6	mg/L
FC_CD1	08/27/2012 10:25:00	Phosphorus, Total as P	0.11	mg/L
FC_CD1	08/27/2012 10:25:00	Orthophosphate as P	0.12	mg/L
FC_CD1	08/27/2012 10:25:00	Phosphorus, Total as P	0.16	mg/L
FC_CD1	08/27/2012 10:25:00	Total Suspended Solids	10	mg/L
FC_CD1	08/27/2012 10:25:00	Iron	800	µg/L
FC_CD1	09/04/2012 10:05:00	Iron	2000	µg/L
FC_CD1	09/04/2012 10:05:00	Phosphorus, Total as P	0.15	mg/L
FC_CD1	09/04/2012 10:05:00	Orthophosphate as P	0.14	mg/L
FC_CD1	09/04/2012 10:05:00	Phosphorus, Total as P	0.26	mg/L
FC_CD1	09/04/2012 10:05:00	Total Suspended Solids	35	mg/L
FC_CD1	09/10/2012 09:45:00	Iron	950	µg/L
FC_CD1	09/10/2012 09:45:00	Phosphorus, Total as P	0.15	mg/L
FC_CD1	09/10/2012 09:45:00	Orthophosphate as P	0.15	mg/L
FC_CD1	09/10/2012 09:45:00	Phosphorus, Total as P	0.2	mg/L
FC_CD1	09/10/2012 09:45:00	Total Suspended Solids	14	mg/L
FC_CD2	02/29/2012 14:20:00	Iron	600	µg/L
FC_CD2	02/29/2012 14:20:00	Total Suspended Solids	8	mg/L
FC_CD2	02/29/2012 14:20:00	Phosphorus, Total as P	0.84	mg/L
FC_CD2	02/29/2012 14:20:00	Orthophosphate as P	0.81	mg/L
FC_CD2	02/29/2012 14:20:00	Phosphorus, Total as P	1	mg/L
FC_CD2	03/07/2012 12:35:00	Iron	940	µg/L
FC_CD2	03/07/2012 12:35:00	Phosphorus, Total as P	0.43	mg/L
FC_CD2	03/07/2012 12:35:00	Total Suspended Solids	9.2	mg/L
FC_CD2	03/07/2012 12:35:00	Orthophosphate as P	0.36	mg/L
FC_CD2	03/07/2012 12:35:00	Phosphorus, Total as P	0.62	mg/L
FC_CD2	03/12/2012 12:10:00	Iron	1400	µg/L
FC_CD2	03/12/2012 12:10:00	Phosphorus, Total as P	0.13	mg/L
FC_CD2	03/12/2012 12:10:00	Orthophosphate as P	0.072	mg/L

Site Name	Sample Date and Time	Analyte	Result	Units
FC_CD2	03/12/2012 12:10:00	Phosphorus, Total as P	0.4	mg/L
FC_CD2	03/12/2012 12:10:00	Total Suspended Solids	20	mg/L
FC_CD2	03/21/2012 09:35:00	Iron	760	µg/L
FC_CD2	03/21/2012 09:35:00	Phosphorus, Total as P	0.078	mg/L
FC_CD2	03/21/2012 09:35:00	Orthophosphate as P	0.011	mg/L
FC_CD2	03/21/2012 09:35:00	Phosphorus, Total as P	0.32	mg/L
FC_CD2	03/21/2012 09:35:00	Total Suspended Solids	28	mg/L
FC_CD2	04/02/2012 10:00:00	Iron	520	µg/L
FC_CD2	04/02/2012 10:00:00	Phosphorus, Total as P	0.067	mg/L
FC_CD2	04/02/2012 10:00:00	Orthophosphate as P	0.014	mg/L
FC_CD2	04/02/2012 10:00:00	Phosphorus, Total as P	0.15	mg/L
FC_CD2	04/02/2012 10:00:00	Total Suspended Solids	12	mg/L
FC_CD2	04/09/2012 13:10:00	Iron	31	µg/L
FC_CD2	04/09/2012 13:10:00	Phosphorus, Total as P	0.047	mg/L
FC_CD2	04/09/2012 13:10:00	Orthophosphate as P	0.0042	mg/L
FC_CD2	04/09/2012 13:10:00	Phosphorus, Total as P	0.13	mg/L
FC_CD2	04/09/2012 13:10:00	Total Suspended Solids	12	mg/L
FC_CD2	04/16/2012 10:10:00	Iron	300	µg/L
FC_CD2	04/16/2012 10:10:00	Phosphorus, Total as P	0.073	mg/L
FC_CD2	04/16/2012 10:10:00	Orthophosphate as P	0.031	mg/L
FC_CD2	04/16/2012 10:10:00	Phosphorus, Total as P	0.15	mg/L
FC_CD2	04/16/2012 10:10:00	Total Suspended Solids	8.6	mg/L
FC_CD2	05/02/2012 09:25:00	Iron	370	µg/L
FC_CD2	05/02/2012 09:25:00	Phosphorus, Total as P	0.056	mg/L
FC_CD2	05/02/2012 09:25:00	Orthophosphate as P	0.013	mg/L
FC_CD2	05/02/2012 09:25:00	Phosphorus, Total as P	0.15	mg/L
FC_CD2	05/02/2012 09:25:00	Total Suspended Solids	11	mg/L
FC_CD2	05/07/2012 09:45:00	Iron	4000	µg/L
FC_CD2	05/07/2012 09:45:00	Phosphorus, Total as P	0.29	mg/L
FC_CD2	05/07/2012 09:45:00	Phosphorus, Total as P	0.43	mg/L
FC_CD2	05/07/2012 09:45:00	Total Suspended Solids	48	mg/L
FC_CD2	05/07/2012 09:45:00	Orthophosphate as P	0.27	mg/L
FC_CD2	05/14/2012 10:00:00	Iron	500	µg/L
FC_CD2	05/14/2012 10:00:00	Phosphorus, Total as P	0.077	mg/L
FC_CD2	05/14/2012 10:00:00	Orthophosphate as P	0.062	mg/L
FC_CD2	05/14/2012 10:00:00	Phosphorus, Total as P	0.11	mg/L
FC_CD2	05/14/2012 10:00:00	Total Suspended Solids	7.8	mg/L
FC_CD2	06/04/2012 09:05:00	Iron	410	µg/L
FC_CD2	06/04/2012 09:05:00	Phosphorus, Total as P	0.063	mg/L
FC_CD2	06/04/2012 09:05:00	Orthophosphate as P	0.047	mg/L

Site Name	Sample Date and Time	Analyte	Result	Units
FC_CD2	06/04/2012 09:05:00	Phosphorus, Total as P	0.093	mg/L
FC_CD2	06/04/2012 09:05:00	Total Suspended Solids	3.6	mg/L
FC_CD2	06/11/2012 09:50:00	Iron	630	µg/L
FC_CD2	06/11/2012 09:50:00	Phosphorus, Total as P	0.094	mg/L
FC_CD2	06/11/2012 09:50:00	Orthophosphate as P	0.066	mg/L
FC_CD2	06/11/2012 09:50:00	Phosphorus, Total as P	0.17	mg/L
FC_CD2	06/11/2012 09:50:00	Total Suspended Solids	13	mg/L
FC_CD2	06/19/2012 10:55:00	Iron	3000	µg/L
FC_CD2	06/19/2012 10:55:00	Phosphorus, Total as P	0.24	mg/L
FC_CD2	06/19/2012 10:55:00	Phosphorus, Total as P	0.37	mg/L
FC_CD2	06/19/2012 10:55:00	Total Suspended Solids	54	mg/L
FC_CD2	06/19/2012 10:55:00	Orthophosphate as P	0.23	mg/L
FC_CD2	07/02/2012 08:55:00	Iron	630	µg/L
FC_CD2	07/02/2012 08:55:00	Phosphorus, Total as P	0.22	mg/L
FC_CD2	07/02/2012 08:55:00	Phosphorus, Total as P	0.22	mg/L
FC_CD2	07/02/2012 08:55:00	Total Suspended Solids	17	mg/L
FC_CD2	07/02/2012 08:55:00	Orthophosphate as P	0.25	mg/L
FC_CD2	07/16/2012 08:40:00	Iron	710	µg/L
FC_CD2	07/16/2012 08:40:00	Phosphorus, Total as P	0.35	mg/L
FC_CD2	07/16/2012 08:40:00	Total Suspended Solids	12	mg/L
FC_CD2	07/16/2012 08:40:00	Orthophosphate as P	0.32	mg/L
FC_CD2	07/16/2012 08:40:00	Phosphorus, Total as P	0.53	mg/L
FC_CD2	07/24/2012 10:30:00	Iron	1100	µg/L
FC_CD2	07/24/2012 10:30:00	Phosphorus, Total as P	0.21	mg/L
FC_CD2	07/24/2012 10:30:00	Orthophosphate as P	0.16	mg/L
FC_CD2	07/24/2012 10:30:00	Phosphorus, Total as P	0.39	mg/L
FC_CD2	07/24/2012 10:30:00	Total Suspended Solids	16	mg/L
FC_CD2	08/20/2012 10:40:00	Iron	1400	µg/L
FC_CD2	08/20/2012 10:40:00	Phosphorus, Total as P	0.095	mg/L
FC_CD2	08/20/2012 10:40:00	Orthophosphate as P	0.06	mg/L
FC_CD2	08/20/2012 10:40:00	Phosphorus, Total as P	0.32	mg/L
FC_CD2	08/20/2012 10:40:00	Total Suspended Solids	39	mg/L
FC_CD2	08/27/2012 09:25:00	Phosphorus, Total as P	0.13	mg/L
FC_CD2	08/27/2012 09:25:00	Orthophosphate as P	0.1	mg/L
FC_CD2	08/27/2012 09:25:00	Phosphorus, Total as P	0.29	mg/L
FC_CD2	08/27/2012 09:25:00	Total Suspended Solids	24	mg/L
FC_CD2	08/27/2012 09:25:00	Iron	1200	µg/L
FC_CD2	09/04/2012 09:50:00	Iron	870	µg/L
FC_CD2	09/04/2012 09:50:00	Phosphorus, Total as P	0.14	mg/L
FC_CD2	09/04/2012 09:50:00	Orthophosphate as P	0.11	mg/L

Site Name	Sample Date and Time	Analyte	Result	Units
FC_CD2	09/04/2012 09:50:00	Phosphorus, Total as P	0.36	mg/L
FC_CD2	09/04/2012 09:50:00	Total Suspended Solids	16	mg/L
FC_CD2	09/10/2012 09:20:00	Iron	1300	µg/L
FC_CD2	09/10/2012 09:20:00	Phosphorus, Total as P	0.1	mg/L
FC_CD2	09/10/2012 09:20:00	Orthophosphate as P	0.042	mg/L
FC_CD2	09/10/2012 09:20:00	Phosphorus, Total as P	0.29	mg/L
FC_CD2	09/10/2012 09:20:00	Total Suspended Solids	26	mg/L
FC_CD3	02/29/2012 14:05:00	Iron	560	µg/L
FC_CD3	02/29/2012 14:05:00	Phosphorus, Total as P	0.35	mg/L
FC_CD3	02/29/2012 14:05:00	Total Suspended Solids	12	mg/L
FC_CD3	02/29/2012 14:05:00	Orthophosphate as P	0.38	mg/L
FC_CD3	02/29/2012 14:05:00	Phosphorus, Total as P	0.63	mg/L
FC_CD3	03/07/2012 12:15:00	Iron	670	µg/L
FC_CD3	03/07/2012 12:15:00	Total Suspended Solids	8.8	mg/L
FC_CD3	03/07/2012 12:15:00	Phosphorus, Total as P	0.77	mg/L
FC_CD3	03/07/2012 12:15:00	Orthophosphate as P	0.61	mg/L
FC_CD3	03/07/2012 12:15:00	Phosphorus, Total as P	0.91	mg/L
FC_CD3	03/12/2012 12:30:00	Iron	540	µg/L
FC_CD3	03/12/2012 12:30:00	Phosphorus, Total as P	0.38	mg/L
FC_CD3	03/12/2012 12:30:00	Total Suspended Solids	11	mg/L
FC_CD3	03/12/2012 12:30:00	Orthophosphate as P	0.32	mg/L
FC_CD3	03/12/2012 12:30:00	Phosphorus, Total as P	0.51	mg/L
FC_CD3	03/21/2012 09:20:00	Iron	670	µg/L
FC_CD3	03/21/2012 09:20:00	Phosphorus, Total as P	0.067	mg/L
FC_CD3	03/21/2012 09:20:00	Orthophosphate as P	0.0095	mg/L
FC_CD3	03/21/2012 09:20:00	Phosphorus, Total as P	0.27	mg/L
FC_CD3	03/21/2012 09:20:00	Total Suspended Solids	20	mg/L
FC_CD3	04/02/2012 09:40:00	Iron	320	µg/L
FC_CD3	04/02/2012 09:40:00	Phosphorus, Total as P	0.053	mg/L
FC_CD3	04/02/2012 09:40:00	Orthophosphate as P	0.0081	mg/L
FC_CD3	04/02/2012 09:40:00	Phosphorus, Total as P	0.13	mg/L
FC_CD3	04/02/2012 09:40:00	Total Suspended Solids	10	mg/L
FC_CD3	04/09/2012 13:25:00	Iron	30	µg/L
FC_CD3	04/09/2012 13:25:00	Phosphorus, Total as P	0.047	mg/L
FC_CD3	04/09/2012 13:25:00	Orthophosphate as P	0.0062	mg/L
FC_CD3	04/09/2012 13:25:00	Phosphorus, Total as P	0.14	mg/L
FC_CD3	04/09/2012 13:25:00	Total Suspended Solids	8.4	mg/L
FC_CD3	04/16/2012 09:35:00	Iron	270	µg/L
FC_CD3	04/16/2012 09:35:00	Phosphorus, Total as P	0.072	mg/L
FC_CD3	04/16/2012 09:35:00	Orthophosphate as P	0.022	mg/L

Site Name	Sample Date and Time	Analyte	Result	Units
FC_CD3	04/16/2012 09:35:00	Phosphorus, Total as P	0.15	mg/L
FC_CD3	04/16/2012 09:35:00	Total Suspended Solids	9.6	mg/L
FC_CD3	05/02/2012 09:55:00	Iron	390	µg/L
FC_CD3	05/02/2012 09:55:00	Phosphorus, Total as P	0.047	mg/L
FC_CD3	05/02/2012 09:55:00	Orthophosphate as P	0.012	mg/L
FC_CD3	05/02/2012 09:55:00	Phosphorus, Total as P	0.15	mg/L
FC_CD3	05/02/2012 09:55:00	Total Suspended Solids	11	mg/L
FC_CD3	05/07/2012 10:00:00	Iron	4500	µg/L
FC_CD3	05/07/2012 10:00:00	Phosphorus, Total as P	0.29	mg/L
FC_CD3	05/07/2012 10:00:00	Phosphorus, Total as P	0.43	mg/L
FC_CD3	05/07/2012 10:00:00	Total Suspended Solids	63	mg/L
FC_CD3	05/07/2012 10:00:00	Orthophosphate as P	0.27	mg/L
FC_CD3	05/14/2012 10:25:00	Iron	490	µg/L
FC_CD3	05/14/2012 10:25:00	Phosphorus, Total as P	0.089	mg/L
FC_CD3	05/14/2012 10:25:00	Orthophosphate as P	0.068	mg/L
FC_CD3	05/14/2012 10:25:00	Phosphorus, Total as P	0.12	mg/L
FC_CD3	05/14/2012 10:25:00	Total Suspended Solids	8	mg/L
FC_CD3	06/04/2012 09:35:00	Iron	400	µg/L
FC_CD3	06/04/2012 09:35:00	Phosphorus, Total as P	0.072	mg/L
FC_CD3	06/04/2012 09:35:00	Orthophosphate as P	0.051	mg/L
FC_CD3	06/04/2012 09:35:00	Phosphorus, Total as P	0.095	mg/L
FC_CD3	06/04/2012 09:35:00	Total Suspended Solids	5.2	mg/L
FC_CD3	06/11/2012 09:25:00	Iron	370	µg/L
FC_CD3	06/11/2012 09:25:00	Phosphorus, Total as P	0.042	mg/L
FC_CD3	06/11/2012 09:25:00	Orthophosphate as P	0.011	mg/L
FC_CD3	06/11/2012 09:25:00	Phosphorus, Total as P	0.1	mg/L
FC_CD3	06/11/2012 09:25:00	Total Suspended Solids	8.5	mg/L
FC_CD3	06/19/2012 10:40:00	Iron	2800	µg/L
FC_CD3	06/19/2012 10:40:00	Phosphorus, Total as P	0.24	mg/L
FC_CD3	06/19/2012 10:40:00	Phosphorus, Total as P	0.36	mg/L
FC_CD3	06/19/2012 10:40:00	Total Suspended Solids	54	mg/L
FC_CD3	06/19/2012 10:40:00	Orthophosphate as P	0.23	mg/L
FC_CD3	07/02/2012 09:10:00	Iron	130	µg/L
FC_CD3	07/02/2012 09:10:00	Phosphorus, Total as P	0.039	mg/L
FC_CD3	07/02/2012 09:10:00	Orthophosphate as P	0.003	mg/L
FC_CD3	07/02/2012 09:10:00	Phosphorus, Total as P	0.15	mg/L
FC_CD3	07/02/2012 09:10:00	Total Suspended Solids	11	mg/L
FC_CD3	07/16/2012 09:00:00	Iron	270	µg/L
FC_CD3	07/16/2012 09:00:00	Phosphorus, Total as P	0.29	mg/L
FC_CD3	07/16/2012 09:00:00	Phosphorus, Total as P	0.37	mg/L

Site Name	Sample Date and Time	Analyte	Result	Units
FC_CD3	07/16/2012 09:00:00	Total Suspended Solids	10	mg/L
FC_CD3	07/16/2012 09:00:00	Orthophosphate as P	0.25	mg/L
FC_CD3	07/24/2012 10:00:00	Iron	370	µg/L
FC_CD3	07/24/2012 10:00:00	Phosphorus, Total as P	0.3	mg/L
FC_CD3	07/24/2012 10:00:00	Phosphorus, Total as P	0.41	mg/L
FC_CD3	07/24/2012 10:00:00	Total Suspended Solids	12	mg/L
FC_CD3	07/24/2012 10:00:00	Orthophosphate as P	0.29	mg/L
FC_CD3	08/06/2012 09:45:00	Iron	840	µg/L
FC_CD3	08/06/2012 09:45:00	Phosphorus, Total as P	0.18	mg/L
FC_CD3	08/06/2012 09:45:00	Orthophosphate as P	0.15	mg/L
FC_CD3	08/06/2012 09:45:00	Phosphorus, Total as P	0.45	mg/L
FC_CD3	08/06/2012 09:45:00	Total Suspended Solids	20	mg/L
FC_CD3	08/06/2012 10:05:00	Iron	270	µg/L
FC_CD3	08/06/2012 10:05:00	Phosphorus, Total as P	0.25	mg/L
FC_CD3	08/06/2012 10:05:00	Phosphorus, Total as P	0.32	mg/L
FC_CD3	08/06/2012 10:05:00	Total Suspended Solids	12	mg/L
FC_CD3	08/06/2012 10:05:00	Orthophosphate as P	0.22	mg/L
FC_CD3	08/20/2012 11:20:00	Iron	260	µg/L
FC_CD3	08/20/2012 11:20:00	Phosphorus, Total as P	0.24	mg/L
FC_CD3	08/20/2012 11:20:00	Phosphorus, Total as P	0.31	mg/L
FC_CD3	08/20/2012 11:20:00	Total Suspended Solids	9.2	mg/L
FC_CD3	08/20/2012 11:20:00	Orthophosphate as P	0.21	mg/L
FC_CD3	08/27/2012 10:00:00	Phosphorus, Total as P	0.17	mg/L
FC_CD3	08/27/2012 10:00:00	Orthophosphate as P	0.13	mg/L
FC_CD3	08/27/2012 10:00:00	Phosphorus, Total as P	0.26	mg/L
FC_CD3	08/27/2012 10:00:00	Total Suspended Solids	18	mg/L
FC_CD3	08/27/2012 10:00:00	Iron	480	µg/L
FC_CD3	09/04/2012 10:25:00	Iron	840	µg/L
FC_CD3	09/04/2012 10:25:00	Phosphorus, Total as P	0.2	mg/L
FC_CD3	09/04/2012 10:25:00	Orthophosphate as P	0.19	mg/L
FC_CD3	09/04/2012 10:25:00	Phosphorus, Total as P	0.39	mg/L
FC_CD3	09/04/2012 10:25:00	Total Suspended Solids	8.2	mg/L
FC_CD3	09/10/2012 10:10:00	Iron	740	µg/L
FC_CD3	09/10/2012 10:10:00	Phosphorus, Total as P	0.21	mg/L
FC_CD3	09/10/2012 10:10:00	Orthophosphate as P	0.17	mg/L
FC_CD3	09/10/2012 10:10:00	Phosphorus, Total as P	0.3	mg/L
FC_CD3	09/10/2012 10:10:00	Total Suspended Solids	5	mg/L
FC-CD Dup	04/02/2012 09:50:00	Iron	330	µg/L
FC-CD Dup	04/02/2012 09:50:00	Phosphorus, Total as P	0.064	mg/L
FC-CD Dup	04/02/2012 09:50:00	Orthophosphate as P	0.0083	mg/L

Site Name	Sample Date and Time	Analyte	Result	Units
FC-CD Dup	04/02/2012 09:50:00	Phosphorus, Total as P	0.13	mg/L
FC-CD Dup	04/02/2012 09:50:00	Total Suspended Solids	10	mg/L
FC-CD Dup	05/02/2012 00:00:00	Iron	380	µg/L
FC-CD Dup	05/02/2012 00:00:00	Phosphorus, Total as P	0.045	mg/L
FC-CD Dup	05/02/2012 00:00:00	Orthophosphate as P	0.011	mg/L
FC-CD Dup	05/02/2012 00:00:00	Phosphorus, Total as P	0.15	mg/L
FC-CD Dup	05/02/2012 00:00:00	Total Suspended Solids	12	mg/L
FC-CD Dup	06/04/2012 08:55:00	Iron	700	µg/L
FC-CD Dup	06/04/2012 08:55:00	Phosphorus, Total as P	0.085	mg/L
FC-CD Dup	06/04/2012 08:55:00	Orthophosphate as P	0.064	mg/L
FC-CD Dup	06/04/2012 08:55:00	Phosphorus, Total as P	0.11	mg/L
FC-CD Dup	06/04/2012 08:55:00	Total Suspended Solids	8.4	mg/L
FC-CD Dup	07/02/2012 08:45:00	Iron	630	µg/L
FC-CD Dup	07/02/2012 08:45:00	Phosphorus, Total as P	0.13	mg/L
FC-CD Dup	07/02/2012 08:45:00	Orthophosphate as P	0.12	mg/L
FC-CD Dup	07/02/2012 08:45:00	Phosphorus, Total as P	0.22	mg/L
FC-CD Dup	07/02/2012 08:45:00	Total Suspended Solids	27	mg/L
FC-CD Dup	08/06/2012 09:30:00	Iron	1400	µg/L
FC-CD Dup	08/06/2012 09:30:00	Phosphorus, Total as P	0.26	mg/L
FC-CD Dup	08/06/2012 09:30:00	Phosphorus, Total as P	0.44	mg/L
FC-CD Dup	08/06/2012 09:30:00	Total Suspended Solids	16	mg/L
FC-CD Dup	08/06/2012 09:30:00	Orthophosphate as P	0.23	mg/L
FC-CD Dup	09/04/2012 10:05:00	Iron	1900	µg/L
FC-CD Dup	09/04/2012 10:05:00	Phosphorus, Total as P	0.14	mg/L
FC-CD Dup	09/04/2012 10:05:00	Orthophosphate as P	0.14	mg/L
FC-CD Dup	09/04/2012 10:05:00	Phosphorus, Total as P	0.26	mg/L
FC-CD Dup	09/04/2012 10:05:00	Total Suspended Solids	35	mg/L
Fish Lake	08/06/2012 00:00:00	% Solids	10	% Wt
Fish Lake	08/06/2012 00:00:00	Phosphorus, Iron Adsorbed	160	mg/kg
Fish Lake	08/06/2012 00:00:00	Phosphorus, Total as P	1100	mg/kg
Outlet	03/01/2012 12:15:00	Total Kjeldahl Nitrogen	1.4	mg/L
Outlet	03/01/2012 12:15:00	Phosphorus, Total as P	0.43	mg/L
Outlet	03/01/2012 12:15:00	Total Suspended Solids	5	mg/L
Outlet	03/01/2012 12:15:00	Nitrate + Nitrite as N	1.2	mg/L
Outlet	03/01/2012 12:15:00	Orthophosphate as P	0.46	mg/L
Outlet	03/01/2012 12:15:00	Phosphorus, Total as P	0.51	mg/L
Outlet	03/01/2012 12:15:00	Chloride	130	mg/L
Outlet	05/24/2012 11:02:00	Phosphorus, Total as P	0.091	mg/L
Outlet	05/24/2012 11:02:00	Orthophosphate as P	0.083	mg/L
Outlet	05/24/2012 11:02:00	Phosphorus, Total as P	0.14	mg/L

Site Name	Sample Date and Time	Analyte	Result	Units
Outlet	05/24/2012 11:02:00	Total Suspended Solids	8	mg/L
Outlet	06/04/2012 12:40:00	Phosphorus, Total as P	0.024	mg/L
Outlet	06/04/2012 12:40:00	Orthophosphate as P	ND	mg/L
Outlet	06/04/2012 12:40:00	Phosphorus, Total as P	0.028	mg/L
Outlet	06/04/2012 12:40:00	Total Suspended Solids	3	mg/L
Outlet	06/15/2012 10:56:00	Phosphorus, Total as P	0.019	mg/L
Outlet	06/15/2012 10:56:00	Orthophosphate as P	0.0033	mg/L
Outlet	06/15/2012 10:56:00	Phosphorus, Total as P	0.029	mg/L
Outlet	06/15/2012 10:56:00	Total Suspended Solids	4.2	mg/L
Outlet	06/18/2012 10:15:00	Phosphorus, Total as P	0.021	mg/L
Outlet	06/18/2012 10:15:00	Orthophosphate as P	0.0029	mg/L
Outlet	06/18/2012 10:15:00	Phosphorus, Total as P	0.041	mg/L
Outlet	06/18/2012 10:15:00	Total Suspended Solids	5.8	mg/L
Outlet	07/02/2012 09:30:00	Phosphorus, Total as P	0.014	mg/L
Outlet	07/02/2012 09:30:00	Orthophosphate as P	0.0027	mg/L
Outlet	07/02/2012 09:30:00	Phosphorus, Total as P	0.046	mg/L
Outlet	07/02/2012 09:30:00	Total Suspended Solids	6.6	mg/L
Pike 14	08/06/2012 00:00:00	% Solids	30	% Wt
Pike 14	08/06/2012 00:00:00	Phosphorus, Iron Adsorbed	150	mg/kg
Pike 14	08/06/2012 00:00:00	Phosphorus, Total as P	910	mg/kg
Pike 48	08/06/2012 00:00:00	% Solids	33	% Wt
Pike 48	08/06/2012 00:00:00	Phosphorus, Iron Adsorbed	110	mg/kg
Pike 48	08/06/2012 00:00:00	Phosphorus, Total as P	1200	mg/kg
Pike 69	08/06/2012 00:00:00	% Solids	26	% Wt
Pike 69	08/06/2012 00:00:00	Phosphorus, Iron Adsorbed	93	mg/kg
Pike 69	08/06/2012 00:00:00	Phosphorus, Total as P	1200	mg/kg
ST_11	03/01/2012 11:00:00	Total Kjeldahl Nitrogen	3.9	mg/L
ST_11	03/01/2012 11:00:00	Total Suspended Solids	6	mg/L
ST_11	03/01/2012 11:00:00	Chloride	21	mg/L
ST_11	03/01/2012 11:00:00	Nitrate + Nitrite as N	1.5	mg/L
ST_11	03/01/2012 11:00:00	Phosphorus, Total as P	1.6	mg/L
ST_11	03/01/2012 11:00:00	Orthophosphate as P	1.4	mg/L
ST_11	03/01/2012 11:00:00	Phosphorus, Total as P	1.7	mg/L
ST_11	04/02/2012 10:25:00	Phosphorus, Total as P	0.064	mg/L
ST_11	04/02/2012 10:25:00	Orthophosphate as P	0.044	mg/L
ST_11	04/02/2012 10:25:00	Phosphorus, Total as P	0.077	mg/L
ST_11	04/02/2012 10:25:00	Total Suspended Solids	1.8	mg/L
ST_11	04/16/2012 10:35:00	Phosphorus, Total as P	0.11	mg/L
ST_11	04/16/2012 10:35:00	Orthophosphate as P	0.084	mg/L
ST_11	04/16/2012 10:35:00	Phosphorus, Total as P	0.17	mg/L

Site Name	Sample Date and Time	Analyte	Result	Units
ST_11	04/16/2012 10:35:00	Total Suspended Solids	17	mg/L
ST_11	05/02/2012 11:00:00	Phosphorus, Total as P	0.088	mg/L
ST_11	05/02/2012 11:00:00	Orthophosphate as P	0.071	mg/L
ST_11	05/02/2012 11:00:00	Phosphorus, Total as P	0.15	mg/L
ST_11	05/02/2012 11:00:00	Total Suspended Solids	26	mg/L
ST_11	05/07/2012 10:10:00	Phosphorus, Total as P	0.24	mg/L
ST_11	05/07/2012 10:10:00	Phosphorus, Total as P	0.34	mg/L
ST_11	05/07/2012 10:10:00	Total Suspended Solids	61	mg/L
ST_11	05/07/2012 10:10:00	Orthophosphate as P	0.22	mg/L
ST_11	05/24/2012 11:48:00	Phosphorus, Total as P	0.16	mg/L
ST_11	05/24/2012 11:48:00	Orthophosphate as P	0.15	mg/L
ST_11	05/24/2012 11:48:00	Phosphorus, Total as P	0.28	mg/L
ST_11	05/24/2012 11:48:00	Total Suspended Solids	43	mg/L
ST_11	06/04/2012 11:30:00	Phosphorus, Total as P	0.089	mg/L
ST_11	06/04/2012 11:30:00	Orthophosphate as P	0.069	mg/L
ST_11	06/04/2012 11:30:00	Phosphorus, Total as P	0.11	mg/L
ST_11	06/04/2012 11:30:00	Total Suspended Solids	2.4	mg/L
ST_11	06/15/2012 10:00:00	Phosphorus, Total as P	0.12	mg/L
ST_11	06/15/2012 10:00:00	Orthophosphate as P	0.1	mg/L
ST_11	06/15/2012 10:00:00	Phosphorus, Total as P	0.2	mg/L
ST_11	06/15/2012 10:00:00	Total Suspended Solids	27	mg/L
ST_11	06/18/2012 11:16:00	Phosphorus, Total as P	0.17	mg/L
ST_11	06/18/2012 11:16:00	Orthophosphate as P	0.17	mg/L
ST_11	06/18/2012 11:16:00	Phosphorus, Total as P	0.37	mg/L
ST_11	06/18/2012 11:16:00	Total Suspended Solids	97	mg/L
ST_11	07/02/2012 08:48:00	Phosphorus, Total as P	0.23	mg/L
ST_11	07/02/2012 08:48:00	Phosphorus, Total as P	0.37	mg/L
ST_11	07/02/2012 08:48:00	Total Suspended Solids	6	mg/L
ST_11	07/02/2012 08:48:00	Orthophosphate as P	0.2	mg/L
ST_14	03/01/2012 10:30:00	Total Kjeldahl Nitrogen	1.2	mg/L
ST_14	03/01/2012 10:30:00	Phosphorus, Total as P	0.12	mg/L
ST_14	03/01/2012 10:30:00	Orthophosphate as P	0.093	mg/L
ST_14	03/01/2012 10:30:00	Phosphorus, Total as P	0.19	mg/L
ST_14	03/01/2012 10:30:00	Total Suspended Solids	3.6	mg/L
ST_14	03/01/2012 10:30:00	Chloride	78	mg/L
ST_14	03/01/2012 10:30:00	Nitrate + Nitrite as N	0.1	mg/L
ST_14	04/02/2012 10:00:00	Phosphorus, Total as P	0.13	mg/L
ST_14	04/02/2012 10:00:00	Orthophosphate as P	0.096	mg/L
ST_14	04/02/2012 10:00:00	Phosphorus, Total as P	0.14	mg/L
ST_14	04/02/2012 10:00:00	Total Suspended Solids	1.6	mg/L

Site Name	Sample Date and Time	Analyte	Result	Units
ST_14	04/16/2012 10:15:00	Phosphorus, Total as P	0.13	mg/L
ST_14	04/16/2012 10:15:00	Orthophosphate as P	0.094	mg/L
ST_14	04/16/2012 10:15:00	Phosphorus, Total as P	0.16	mg/L
ST_14	04/16/2012 10:15:00	Total Suspended Solids	4	mg/L
ST_14	04/16/2012 10:15:00	Phosphorus, Total as P	0.13	mg/L
ST_14	04/16/2012 10:15:00	Orthophosphate as P	0.097	mg/L
ST_14	04/16/2012 10:15:00	Phosphorus, Total as P	0.16	mg/L
ST_14	04/16/2012 10:15:00	Total Suspended Solids	6	mg/L
ST_14	05/02/2012 00:00:00	Phosphorus, Total as P	0.11	mg/L
ST_14	05/02/2012 00:00:00	Orthophosphate as P	0.092	mg/L
ST_14	05/02/2012 00:00:00	Phosphorus, Total as P	0.12	mg/L
ST_14	05/02/2012 00:00:00	Total Suspended Solids	2	mg/L
ST_14	05/02/2012 10:42:00	Phosphorus, Total as P	0.11	mg/L
ST_14	05/02/2012 10:42:00	Orthophosphate as P	0.092	mg/L
ST_14	05/02/2012 10:42:00	Phosphorus, Total as P	0.13	mg/L
ST_14	05/02/2012 10:42:00	Total Suspended Solids	2	mg/L
ST_14	05/07/2012 09:45:00	Phosphorus, Total as P	0.14	mg/L
ST_14	05/07/2012 09:45:00	Orthophosphate as P	0.12	mg/L
ST_14	05/07/2012 09:45:00	Phosphorus, Total as P	0.18	mg/L
ST_14	05/07/2012 09:45:00	Total Suspended Solids	6	mg/L
ST_14	05/24/2012 12:01:00	Phosphorus, Total as P	0.17	mg/L
ST_14	05/24/2012 12:01:00	Orthophosphate as P	0.15	mg/L
ST_14	05/24/2012 12:01:00	Phosphorus, Total as P	0.22	mg/L
ST_14	05/24/2012 12:01:00	Total Suspended Solids	3.2	mg/L
ST_14	06/04/2012 11:02:00	Phosphorus, Total as P	0.14	mg/L
ST_14	06/04/2012 11:02:00	Orthophosphate as P	0.12	mg/L
ST_14	06/04/2012 11:02:00	Phosphorus, Total as P	0.15	mg/L
ST_14	06/04/2012 11:02:00	Total Suspended Solids	1.4	mg/L
ST_14	06/04/2012 11:02:00	Phosphorus, Total as P	0.14	mg/L
ST_14	06/04/2012 11:02:00	Orthophosphate as P	0.12	mg/L
ST_14	06/04/2012 11:02:00	Phosphorus, Total as P	0.15	mg/L
ST_14	06/04/2012 11:02:00	Total Suspended Solids	1.2	mg/L
ST_14	06/15/2012 09:43:00	Phosphorus, Total as P	0.12	mg/L
ST_14	06/15/2012 09:43:00	Orthophosphate as P	0.11	mg/L
ST_14	06/15/2012 09:43:00	Phosphorus, Total as P	0.17	mg/L
ST_14	06/15/2012 09:43:00	Total Suspended Solids	3.4	mg/L
ST_14	06/15/2012 09:43:00	Phosphorus, Total as P	0.12	mg/L
ST_14	06/15/2012 09:43:00	Orthophosphate as P	0.11	mg/L
ST_14	06/15/2012 09:43:00	Phosphorus, Total as P	0.16	mg/L
ST_14	06/15/2012 09:43:00	Total Suspended Solids	4.8	mg/L

Site Name	Sample Date and Time	Analyte	Result	Units
ST_14	06/18/2012 10:54:00	Phosphorus, Total as P	0.096	mg/L
ST_14	06/18/2012 10:54:00	Orthophosphate as P	0.08	mg/L
ST_14	06/18/2012 10:54:00	Phosphorus, Total as P	0.15	mg/L
ST_14	06/18/2012 10:54:00	Total Suspended Solids	9	mg/L
ST_14	07/02/2012 08:30:00	Phosphorus, Total as P	0.22	mg/L
ST_14	07/02/2012 08:30:00	Total Suspended Solids	12	mg/L
ST_14	07/02/2012 08:30:00	Orthophosphate as P	0.26	mg/L
ST_14	07/02/2012 08:30:00	Phosphorus, Total as P	0.51	mg/L
ST_19	03/01/2012 10:00:00	Total Kjeldahl Nitrogen	4.8	mg/L
ST_19	03/01/2012 10:00:00	Total Suspended Solids	24	mg/L
ST_19	03/01/2012 10:00:00	Nitrate + Nitrite as N	1.8	mg/L
ST_19	03/01/2012 10:00:00	Phosphorus, Total as P	1.2	mg/L
ST_19	03/01/2012 10:00:00	Orthophosphate as P	1.2	mg/L
ST_19	03/01/2012 10:00:00	Phosphorus, Total as P	1.6	mg/L
ST_19	03/01/2012 10:00:00	Chloride	240	mg/L
ST_19	04/16/2012 10:00:00	Phosphorus, Total as P	0.43	mg/L
ST_19	04/16/2012 10:00:00	Total Suspended Solids	19	mg/L
ST_19	04/16/2012 10:00:00	Orthophosphate as P	0.36	mg/L
ST_19	04/16/2012 10:00:00	Phosphorus, Total as P	0.72	mg/L
ST_19	05/02/2012 10:20:00	Phosphorus, Total as P	0.42	mg/L
ST_19	05/02/2012 10:20:00	Total Suspended Solids	16	mg/L
ST_19	05/02/2012 10:20:00	Orthophosphate as P	0.38	mg/L
ST_19	05/02/2012 10:20:00	Phosphorus, Total as P	0.57	mg/L
ST_19	05/07/2012 09:30:00	Phosphorus, Total as P	0.5	mg/L
ST_19	05/07/2012 09:30:00	Total Suspended Solids	61	mg/L
ST_19	05/07/2012 09:30:00	Orthophosphate as P	0.46	mg/L
ST_19	05/07/2012 09:30:00	Phosphorus, Total as P	0.62	mg/L
ST_19	05/24/2012 12:15:00	Total Suspended Solids	110	mg/L
ST_19	05/24/2012 12:15:00	Phosphorus, Total as P	0.62	mg/L
ST_19	05/24/2012 12:15:00	Orthophosphate as P	0.56	mg/L
ST_19	05/24/2012 12:15:00	Phosphorus, Total as P	1.1	mg/L
ST_19	06/04/2012 10:38:00	Phosphorus, Total as P	0.17	mg/L
ST_19	06/04/2012 10:38:00	Orthophosphate as P	0.15	mg/L
ST_19	06/04/2012 10:38:00	Phosphorus, Total as P	0.26	mg/L
ST_19	06/04/2012 10:38:00	Total Suspended Solids	4.4	mg/L
ST_19	06/15/2012 09:26:00	Phosphorus, Total as P	0.4	mg/L
ST_19	06/15/2012 09:26:00	Phosphorus, Total as P	0.48	mg/L
ST_19	06/15/2012 09:26:00	Total Suspended Solids	29	mg/L
ST_19	06/15/2012 09:26:00	Orthophosphate as P	0.37	mg/L
ST_19	06/18/2012 10:45:00	Phosphorus, Total as P	0.37	mg/L

Site Name	Sample Date and Time	Analyte	Result	Units
ST_19	06/18/2012 10:45:00	Total Suspended Solids	170	mg/L
ST_19	06/18/2012 10:45:00	Orthophosphate as P	0.35	mg/L
ST_19	06/18/2012 10:45:00	Phosphorus, Total as P	0.63	mg/L
ST_26A	03/01/2012 11:45:00	Total Kjeldahl Nitrogen	1.3	mg/L
ST_26A	03/01/2012 11:45:00	Total Suspended Solids	8.6	mg/L
ST_26A	03/01/2012 11:45:00	Nitrate + Nitrite as N	0.51	mg/L
ST_26A	03/01/2012 11:45:00	Phosphorus, Total as P	0.64	mg/L
ST_26A	03/01/2012 11:45:00	Orthophosphate as P	0.67	mg/L
ST_26A	03/01/2012 11:45:00	Phosphorus, Total as P	0.73	mg/L
ST_26A	03/01/2012 11:45:00	Chloride	150	mg/L
ST_26A	04/02/2012 11:10:00	Phosphorus, Total as P	0.042	mg/L
ST_26A	04/02/2012 11:10:00	Orthophosphate as P	0.02	mg/L
ST_26A	04/02/2012 11:10:00	Phosphorus, Total as P	0.06	mg/L
ST_26A	04/02/2012 11:10:00	Total Suspended Solids	2.6	mg/L
ST_26A	04/16/2012 11:10:00	Phosphorus, Total as P	0.061	mg/L
ST_26A	04/16/2012 11:10:00	Orthophosphate as P	0.046	mg/L
ST_26A	04/16/2012 11:10:00	Phosphorus, Total as P	0.11	mg/L
ST_26A	04/16/2012 11:10:00	Total Suspended Solids	5.2	mg/L
ST_26A	05/02/2012 11:40:00	Phosphorus, Total as P	0.063	mg/L
ST_26A	05/02/2012 11:40:00	Orthophosphate as P	0.034	mg/L
ST_26A	05/02/2012 11:40:00	Phosphorus, Total as P	0.097	mg/L
ST_26A	05/02/2012 11:40:00	Total Suspended Solids	4.2	mg/L
ST_26A	05/07/2012 11:30:00	Phosphorus, Total as P	0.03	mg/L
ST_26A	05/07/2012 11:30:00	Orthophosphate as P	0.0089	mg/L
ST_26A	05/07/2012 11:30:00	Phosphorus, Total as P	0.09	mg/L
ST_26A	05/07/2012 11:30:00	Total Suspended Solids	28	mg/L
ST_26A	05/24/2012 10:38:00	Phosphorus, Total as P	0.065	mg/L
ST_26A	05/24/2012 10:38:00	Orthophosphate as P	0.049	mg/L
ST_26A	05/24/2012 10:38:00	Phosphorus, Total as P	0.14	mg/L
ST_26A	05/24/2012 10:38:00	Total Suspended Solids	30	mg/L
ST_26A	06/04/2012 12:00:00	Phosphorus, Total as P	0.028	mg/L
ST_26A	06/04/2012 12:00:00	Orthophosphate as P	0.0095	mg/L
ST_26A	06/04/2012 12:00:00	Phosphorus, Total as P	0.049	mg/L
ST_26A	06/04/2012 12:00:00	Total Suspended Solids	10	mg/L
ST_26A	06/15/2012 11:16:00	Phosphorus, Total as P	0.029	mg/L
ST_26A	06/15/2012 11:16:00	Orthophosphate as P	0.021	mg/L
ST_26A	06/15/2012 11:16:00	Phosphorus, Total as P	0.056	mg/L
ST_26A	06/15/2012 11:16:00	Total Suspended Solids	15	mg/L
ST_26A	06/18/2012 09:45:00	Phosphorus, Total as P	0.026	mg/L
ST_26A	06/18/2012 09:45:00	Orthophosphate as P	0.0096	mg/L

Site Name	Sample Date and Time	Analyte	Result	Units
ST_26A	06/18/2012 09:45:00	Phosphorus, Total as P	0.08	mg/L
ST_26A	06/18/2012 09:45:00	Total Suspended Solids	42	mg/L
ST_26A	07/02/2012 09:45:00	Phosphorus, Total as P	0.019	mg/L
ST_26A	07/02/2012 09:45:00	Orthophosphate as P	0.012	mg/L
ST_26A	07/02/2012 09:45:00	Phosphorus, Total as P	0.056	mg/L
ST_26A	07/02/2012 09:45:00	Total Suspended Solids	14	mg/L
ST_26A	07/02/2012 09:45:00	Phosphorus, Total as P	0.022	mg/L
ST_26A	07/02/2012 09:45:00	Orthophosphate as P	0.012	mg/L
ST_26A	07/02/2012 09:45:00	Phosphorus, Total as P	0.057	mg/L
ST_26A	07/02/2012 09:45:00	Total Suspended Solids	15	mg/L
ST_26C	05/24/2012 10:12:00	Total Suspended Solids	1300	mg/L
ST_26C	05/24/2012 10:12:00	Phosphorus, Total as P	2.8	mg/L
ST_26C	05/24/2012 10:12:00	Orthophosphate as P	2	mg/L
ST_26C	05/24/2012 10:12:00	Phosphorus, Total as P	7	mg/L
ST_26D	05/24/2012 10:25:00	Phosphorus, Total as P	0.3	mg/L
ST_26D	05/24/2012 10:25:00	Total Suspended Solids	1300	mg/L
ST_26D	05/24/2012 10:25:00	Orthophosphate as P	0.28	mg/L
ST_26D	05/24/2012 10:25:00	Phosphorus, Total as P	2.3	mg/L
ST_26D	06/18/2012 09:30:00	Phosphorus, Total as P	0.2	mg/L
ST_26D	06/18/2012 09:30:00	Orthophosphate as P	0.17	mg/L
ST_26D	06/18/2012 09:30:00	Total Suspended Solids	800	mg/L
ST_26D	06/18/2012 09:30:00	Phosphorus, Total as P	1.4	mg/L
ST_45	05/07/2012 10:40:00	Phosphorus, Total as P	0.042	mg/L
ST_45	05/07/2012 10:40:00	Orthophosphate as P	0.0029	mg/L
ST_45	05/07/2012 10:40:00	Phosphorus, Total as P	0.086	mg/L
ST_45	05/07/2012 10:40:00	Total Suspended Solids	5.2	mg/L
ST_45	05/24/2012 11:28:00	Phosphorus, Total as P	0.042	mg/L
ST_45	05/24/2012 11:28:00	Orthophosphate as P	0.022	mg/L
ST_45	05/24/2012 11:28:00	Phosphorus, Total as P	0.063	mg/L
ST_45	05/24/2012 11:28:00	Total Suspended Solids	1	mg/L
ST_45	06/04/2012 11:50:00	Phosphorus, Total as P	0.048	mg/L
ST_45	06/04/2012 11:50:00	Orthophosphate as P	0.028	mg/L
ST_45	06/04/2012 11:50:00	Phosphorus, Total as P	0.068	mg/L
ST_45	06/04/2012 11:50:00	Total Suspended Solids	3.2	mg/L
ST_45	06/15/2012 10:27:00	Phosphorus, Total as P	0.041	mg/L
ST_45	06/15/2012 10:27:00	Orthophosphate as P	0.027	mg/L
ST_45	06/15/2012 10:27:00	Phosphorus, Total as P	0.075	mg/L
ST_45	06/15/2012 10:27:00	Total Suspended Solids	2.4	mg/L
ST_45	06/18/2012 11:30:00	Phosphorus, Total as P	0.023	mg/L
ST_45	06/18/2012 11:30:00	Orthophosphate as P	0.0086	mg/L

Site Name	Sample Date and Time	Analyte	Result	Units
ST_45	06/18/2012 11:30:00	Phosphorus, Total as P	0.06	mg/L
ST_45	06/18/2012 11:30:00	Total Suspended Solids	2.6	mg/L
ST_45	07/02/2012 09:05:00	Phosphorus, Total as P	0.047	mg/L
ST_45	07/02/2012 09:05:00	Orthophosphate as P	0.042	mg/L
ST_45	07/02/2012 09:05:00	Phosphorus, Total as P	0.083	mg/L
ST_45	07/02/2012 09:05:00	Total Suspended Solids	3.2	mg/L

memo

Project	2011 and 2012 Watershed Monitoring Summary	**Date**	August 2, 2013
To	Jaime Rockney	**Contact Info**	PLSLWD
Cc	Nat Kale; Mike Kinney	**Contact Info**	PLSLWD
From	Carl Almer; Meghan Jacobson; Lisa Tilman; Bruce Wilson	**Contact Info**	EOR
Regarding	Analysis of TP and TSS Loads based on 2011 & 2012 Monitoring Data		

Summary
The purpose of this memo is to summarize the 2011-2012 watershed monitoring data collected in the Prior Lake-Spring Lake watershed and provide modeled estimates of annual runoff volume and total phosphorus (TP) and total suspended solids (TSS) loads at the inlets and outlets of Spring and Prior Lakes, the outlet of Fish Lake, and the inlet and outlet of Buck Lake. In addition, hot spots of phosphorus loads in the watershed were identified based on modeled loads. The monitoring data analysis is organized by the following sections:

1. Monitoring Data Summary
2. Load Modeling Methods
3. Load Summary
4. Monitoring Recommendations

The following general observations were made based on modeled loads calculated from the 2011-2012 monitoring data:

- High uncertainty existed in the FLUX modeled loads; as a result, the loads presented in this report should be used for future monitoring guidance only
- Stage and flow relationships should be strengthened with additional field measurements at all monitoring stations
- Future monitoring work should focus on increasing the overall number of water quality samples and the number of samples collected at high flows to reduce uncertainty in TP and TSS load estimates
- The following monitoring recommendations may improve watershed load estimates:
    - Collect at least 25 water quality samples each year, with at least 3 samples collected during low flows and at least 20 samples collected during peak flow events (snowmelt and storm events)
    - Composite water quality samples during storm events to capture peak pollutant loads

Monitoring Data Summary
Monitoring data was collected at a number of sites in the Prior Lake Spring Lake Watershed District. This report analyzes that data to provide total phosphorus and total suspended solids loading rates and runoff volumes for the watershed in 2011 and 2012. Monitoring site locations are shown in Figure 1. Summaries of flow, TP and TSS data by date are also graphed by individual monitoring site in figures located at the end of this memo. The raw data for daily flow and sample results are included in the attached Excel spreadsheet titled: Appendix A.

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Methods

Available data from 2011 and 2012 were used in this analysis. Data was collected by the Prior Lake-Spring Lake Watershed District, the Three Rivers Park District, Scott Soil and Water Conservation District, and by volunteers through the Metropolitan Council's Citizen-Assisted Monitoring Program. In-lake water quality data was used to estimate loads at Spring Lake and Fish Lake where water quality monitoring was not conducted at the lake outlet.

Pollutant loads were estimated by monitoring station using FLUX. If multiple years of data were available, these were analyzed together in FLUX. Water quality samples collected on dates without monitored flow were excluded from the analysis. All loading estimates are reported using the flow-weighted average method in FLUX. The flow-weighted average method provides a loading estimate based on the flow-weighted average pollutant concentration times the mean flow over the averaging period. For sites 5A, 11, 19 (TSS only), and 21, data were stratified by the mean daily flow to provide more accurate load estimates. For all other sites, water quality data could not be stratified (i.e., grouped based on flow less than or greater than the mean) due to an insufficient number of water quality samples collected at either flows less than or greater than the mean flow. Sites with unstratified samples are more likely to have greater uncertainty in their FLUX load estimates. The FLUX model also provides guidance on the optimal number of water quality samples that need to be collected at high (greater than the mean) flows to obtain more robust estimates of watershed pollutant loads since the majority of non-point source watershed loads are derived during storm events (Table 4).

Table 1. Summary of flow, TP and TSS data collected at stream monitoring sites throughout the PLSLWD, 2011-2012

Site	Monitoring Year		Location Description	Flow Data	TP and TSS Data	
	2011	*2012*		*Date Range*	*Date Range*	*Number*
8	✓	✓	Fish Lake outlet	3/30/11-11/2/11 3/13/12-8/31/12	4/11-10/11* 4/12-10/12*	24 27
5A (CD1)	✓	✓	Highway 13 crossing	3/30/11-11/2/11 3/13/12-10/31/12	4/11-10/11 3/12-9/12	9 22
7 (CD2)	✓	✓	Upstream Side of Ferric Chloride System	4/28/11-12/31/11 3/6/12-12/31/12	4/11-10/11 4/12-9/12	9 22
7A (CD3)	✓	✓	Downstream Side of Ferric Chloride System	4/28/11-12/31/11 3/6/12-12/31/12	4/11-9/11 2/12-9/12	8 23
11	✓	✓	Buck Lake inlet	3/30/11-11/2/11 3/13/12-10/4/12	4/11-7/11 3/12-7/12	7 17
14	✓	✓	Buck Lake outlet	3/30/11-11/2/11 3/13/12-10/4/12	4/11-10/11 3/12-7/12	9 14
19	✓	✓	Marschall Road crossing	3/30/11-11/2/11 3/13/12-10/4/12	4/11-7/11 3/12-6/12	7 6
17	✓		Spring Lake Circle crossing	3/30/11-11/2/11	4/11-7/11	7
21	✓	✓	Spring Lake outlet	4/1/11-11/2/11 3/13/12-10/31/12	4/11-10/11* 4/12-10/12*	21 21
45		✓	Crystal Lake outlet	3/13/12-10/4/12	5/12-7/12	6
PLO	✓	✓	Prior Lake outlet	4/1/11-11/2/11 3/26/12-10/31/12	4/11-7/11 6/12-7/12	7 4
26A		✓	Pike Lake inlet	3/13/12-10/4/12	3/12-7/12	11

* In-Lake Data used to determine outflow TP loads

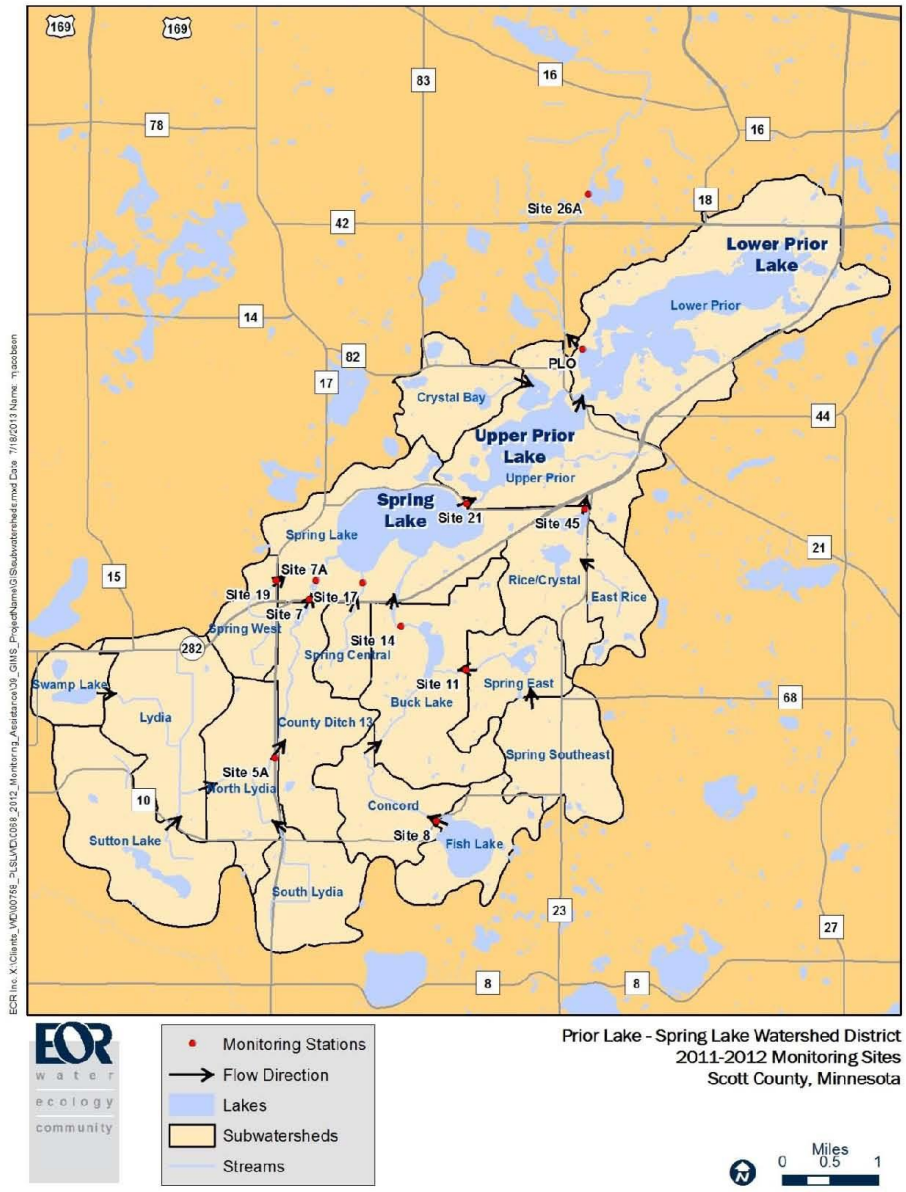

Figure 1. Monitoring Station and Subwatershed Locations, PLSLWD, 2011-2012

Load Summary

A flow chart showing the connections between monitoring stations and their estimated total phosphorus and total suspended solids loadings are shown in Figure 2. Table 2 provides a summary of drainage areas, total phosphorus loads, and total suspended sediment loads modeled in FLUX for the 2011-2012 monitoring sites. For all monitoring stations not located at a lake outlet, an areal load was calculated as the total load divided by the drainage area. **Due to high uncertainty in the FLUX modeled loads, the loads presented in this report should be used for monitoring guidance only.**

Flow and Load Verification

Runoff depths and areal loading rates were used to validate the FLUX flow and load estimates (Table 3, Table 4). A watershed runoff depth was estimated for each monitoring station as the annual flow (including losses via evaporation from waterbody surfaces) divided by the total watershed area. Runoff depths ranged from 6-10 inches for most stations, except at the Fish Lake outlet (17 inches). Most of the flow rating curves for the monitoring stations showed variability in the correlation between stage and flow. Poor rating curves were available for CD1 and the Fish Lake outlet, with fair rating curves at the Marschall Road crossing, Spring Lake outlet, and Crystal Lake outlet. Because a solid understanding of flow is the foundation for accurate load estimates, we recommend that stage and flow relationships for all monitoring stations be strengthened with additional field measurements.

Areal watershed loading rates were calculated for each monitoring station not located at a lake outlet. Areal loads could not be calculated at lake outlets due to an unknown amount of watershed load retained by lake sediments. The highest TP and TSS areal loads were estimated at the Marschall Road crossing (Table 2). This site also had high uncertainty (indicated by high CV in Table 4) in the FLUX loading estimates, especially for TSS. TSS load estimates are particularly sensitive to the number of water quality samples collected at very high flows. Samples collected at high flows ranged from 18% to 75% for all sites (Table 6). Optimal distributions of TSS samples collected at high flows should be greater than 90% for most sites. In contrast, optimal distributions of TP samples collected at high flows should range between 50-75%. Future monitoring work should focus on increasing the overall number of water quality samples and the number of samples collected at high flows to reduce uncertainty in TP and TSS load estimates.

FLUX Load Error Estimates

An error estimate of the load models was estimated in FLUX using coefficient of variation (CV, Table 4). The modeled load CV was related to the number of pollutant concentration samples and the distribution of those samples over the annual flow regime. In general, the modeled load CVs were high and divergent among the various FLUX models used to estimate load, indicating an inadequate number of pollutant concentration samples collected or an uneven distribution of those samples over the annual flow regime. Modeled load CVs ranged from 9-17% and 13-62% for total phosphorus and total suspended solids, respectively (Table 4). Ideally, modeled load CVs should be less than 10%. We recommend increasing the number of water quality samples collected to calculate watershed loads, especially at high flows.

Land Cover Connections

A survey of land cover distribution in each monitoring station drainage area was conducted to identify potential connections between monitored watershed loads and land cover (Table 5). Cropland, developed areas, and wetlands are expected to have the highest TP and/or TSS export rates. All monitoring stations had at least 40% cropland/developed/wetland land cover. The Marschall Road and Spring Lake Circle crossing station drainage areas had the highest cropland land cover (70 and 78%, respectively), which could lead to higher areal TP and TSS loadings from the contributing drainage areas to these monitoring stations.

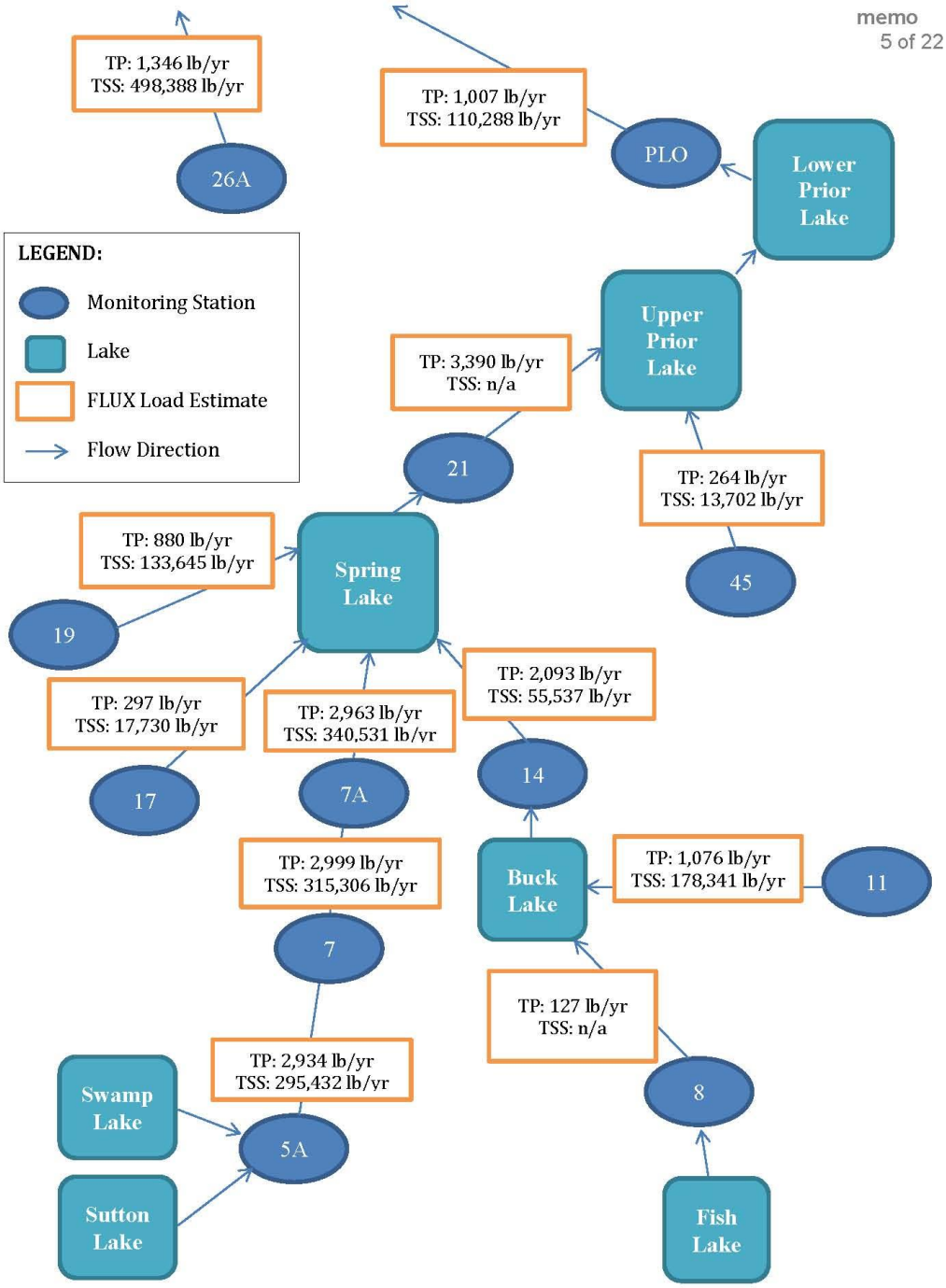

Figure 2. Flow Chart of Monitoring Stations and Preliminary Total Phosphorus and Total Suspended Solids Loads

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Table 2. Summary of monitoring station drainage areas and preliminary total phosphorus and suspended solid loads, 2011-2012

Site	Location Description	Direct Drainage Area (ac)	Cumulative Drainage Area (ac)	Annual Flow (ac-ft/yr)	Total Phosphorus		Total Suspended Solids	
					Total Load (lb/yr)	Areal Load (lb/ac/yr)	Total Load (lb/yr)	Areal Load (lb/ac/yr)
8	Fish Lake outlet	721	721	506	127	NC	N/A	NC
5A (CD1)	Highway 13 crossing	4,665	4,665	2,252	2,934	0.57	295,432	60
7 (CD2)	Upstream Side of Ferric Chloride System	971	5,636	2,555	2,999	0.53	315,306	56
7A (CD3)	Downstream Side of Ferric Chloride System	NC		2,555	2,963	N/A	340,531	N/A
11	Buck Lake inlet	1,463	1,463	758	1,076	0.74	178,341	121
14	Buck Lake outlet	1,971	4,155	2,307	2,093	NC	55,537	NC
19	Marschall Road crossing	415	415	334	880	2.2	133,645	322
17	Spring Lake Circle crossing	317	317	266	* 297	0.94	* 17,730	55.9
21	Spring Lake outlet	2,147	12,670	7,433	3,390	NC	N/A	NC
45	Crystal Lake outlet	1,202	1,202	586	** 264	NC	** 13,702	NC
PLO	Prior Lake outlet	3,802	17,674	5,668	1,007	NC	110,288	NC
26A	Pike Lake inlet	NC		3,215	** 1,346	N/A	** 498,388	N/A

* Data only available for 2011

** Data only available for 2012

NC = Not calculated. Areal loads were not calculated for sites at lake outlets due to unknown in-lake losses

Table 3. Summary of preliminary flow-weighted mean concentrations and annual runoff volume

Site	Location Description	Flow Weighted Mean Concentration		Annual Flow
		TP (mg/l)	*TSS (mg/l)*	*(ac-ft/yr)*
8	Fish Lake outlet	0.048	N/A	506
5A (CD1)	Highway 13 crossing	0.29	30	2,252
7	Upstream Side of Ferric Chloride System	0.33	35	2,555
7A	Downstream Side of Ferric Chloride System	0.32	37	2,555
11	Buck Lake inlet	0.27	45	758
14	Buck Lake outlet	0.21	6	2,307
19	Marschall Road crossing	0.56	85	334
17	Spring Lake Circle crossing	0.24	15	266
21	Spring Lake outlet	0.07	N/A	7,433
45	Crystal Lake outlet	0.08	4	586
PLO	Prior Lake outlet	0.04	4	5,668
26A	Pike Lake inlet	0.07	26	3,215

Table 4. FLUX flow (watershed runoff depth) and load error estimates (coefficient of variation)

Site	Location Description	Watershed Runoff Depth* (in/yr)	Coefficient of Variation	
			Total Phosphorus	*Total Suspended Solids*
8	Fish Lake outlet	17	14%	N/A
5A (CD1)	Highway 13 crossing	6.8	17%	38%
7 (CD2)	Upstream Side of Ferric Chloride System	5.6	13%	32%
7A (CD3)	Downstream Side of Ferric Chloride System	NC	15%	28%
11	Buck Lake inlet	7.0	11%	31%
14	Buck Lake outlet	7.1	15%	17%
19	Marschall Road crossing	9.8	12%	61%
17	Spring Lake Circle crossing	10.1	14%	21%
21	Spring Lake outlet	8.8	8.7%	N/A
45	Crystal Lake outlet	8.2	15%	33%
PLO	Prior Lake outlet	6.7	12%	14%
26A	Pike Lake inlet	NC	13%	37%

NC = not calculated (drainage area to monitoring station was not delineated as part of this study)
N/A = not applicable (no TSS data collected at monitoring station)
* Watershed runoff depth calculations include watershed flow lost via surface water evaporation prior to the monitoring station based on 36 inches/year of evaporation (1992 MN Hydrology Guide).

Table 5. Distribution of land cover in monitoring station drainage areas (National Land Cover Dataset 2006)

Site	Location Description	Land Cover (% of total area)					
		Developed	Cropland	Wetlands	Forest	Grassland	Open Water
8	Fish Lake outlet	17%	28%	5%	13%	31%	6%
5A (CD1)	Highway 13 crossing	5%	44%	10%	9%	29%	3%
7	Upstream Side of Ferric Chloride System	Drainage area not calculated					
7A	Downstream Side of Ferric Chloride System	Drainage area not calculated					
11	Buck Lake inlet	6%	24%	10%	15%	45%	0%
14	Buck Lake outlet	6%	45%	4%	5%	40%	0%
19	Marschall Road crossing	10%	70%	2%	4%	14%	0%
17	Spring Lake Circle crossing	3%	78%	1%	2%	16%	0%
21	Spring Lake outlet	11%	22%	8%	13%	33%	14%
45	Crystal Lake outlet	24%	15%	10%	17%	26%	8%
PLO	Prior Lake outlet	36%	13%	4%	17%	11%	19%
26A	Pike Lake inlet	Drainage area not calculated					

Monitoring Recommendations

General stream monitoring recommendations for all sites:

- Collect at least 25 water quality samples each year, with at least 3 samples collected during low flows and at least 20 samples collected during peak flow events (snowmelt and storm events)
- Composite water quality samples during storm events to capture peak pollutant loads

Samples can be stratified by flow in FLUX to more accurately model watershed loads at low and high flows. As part of this stratification, FLUX reports the distribution of monitoring samples collected at flows above and below the mean daily flow, and suggests an optimum distribution that is expected to reduce the uncertainty of the modeled annual load. A comparison of the actual 2011-2012 sample distribution and the FLUX optimal sample distribution about the mean daily flow is presented in Table 6. Bold text indicates stations where the optimal sample distribution is significantly different than the 2011-2012 actual sample distribution for TP or TSS. There were an inadequate number of samples collected at the Spring Lake Circle crossing, Prior Lake outlet, and Crystal Lake outlet to perform stratification.

Table 6. Comparison of 2011-2012 and FLUX optimal sample distribution about the mean daily flow. Bold text indicates stations where the optimal sample distribution is significantly different than the 2011-2012 actual sample distribution for TP or TSS.

ID	2011-2012 Mean daily flow (Q_{mean}, cfs)	2011-2012 Number of WQ Samples	Sample Distribution (% samples > Q_{mean})			
			Flow	WQ Samples	TP Optimal	TSS Optimal
8	1.31	39	35%	75%	79%	N/A
5A (CD1)	**5.06**	**25**	**32%**	**33%**	**88%**	**97%**
7 (CD2)	**4.90**	**26**	**22%**	**39%**	**78%**	**97%**
7A (CD3)	**4.90**	**25**	**22%**	**41%**	**68%**	**98%**
11	**2.03**	**16**	**34%**	**75%**	**79%**	**97%**
14	5.17	18	30%	72%	58%	64%
19	**0.80**	**12**	**19%**	**75%**	**62%**	**98%**
17	0.62	7	NC			
21	**23.28**	**27**	**36%**	**17%**	**63%**	**N/A**
45	1.77	6	NC			
PLO	13.14	12	NC			
26A	**9.65**	**9**	**30%**	**44%**	**64%**	**90%**

NC = not calculated due to an insufficient number of samples collected at flows less than or greater than the mean daily flow to stratify

Site PLO: Prior Lake Outlet

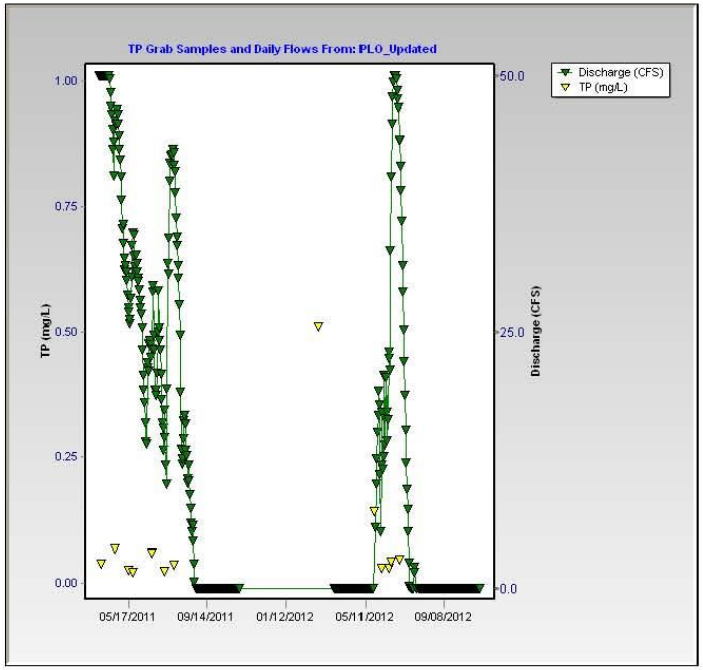

Figure 3. Prior Lake Outlet – Flow and Total Phosphorus, 2011 - 2012

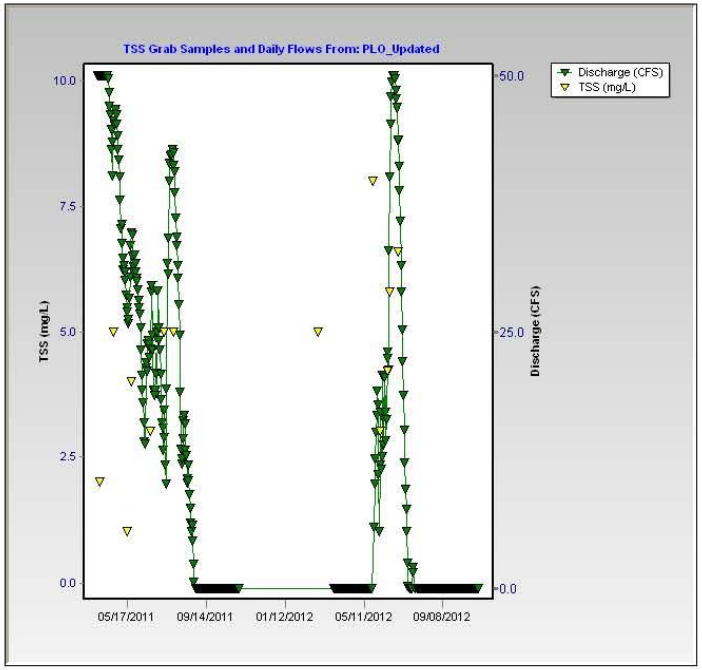

Figure 4. Prior Lake Outlet – Flow and Total Suspended Solids, 2011 - 2012

Site 5A (CD1): Highway 13 Crossing

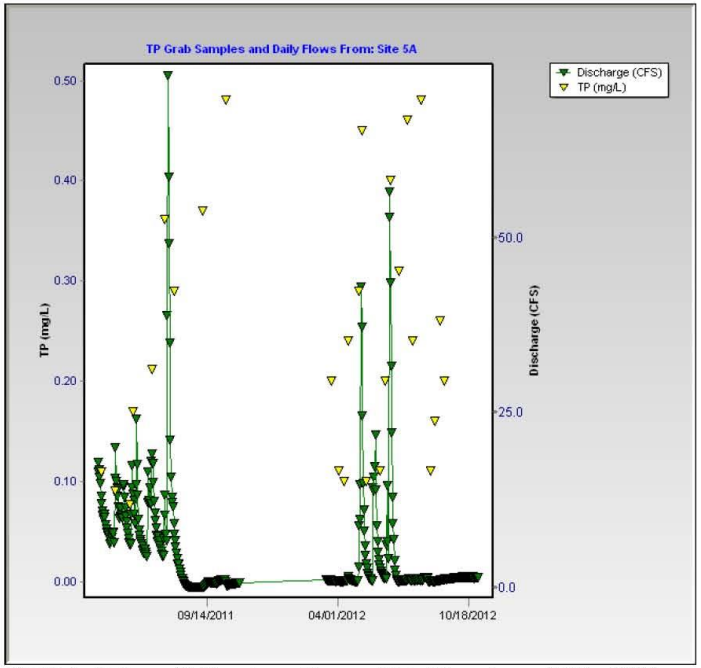

Figure 5. Highway 13 Crossing – Flow and Total Phosphorus, 2011 - 2012

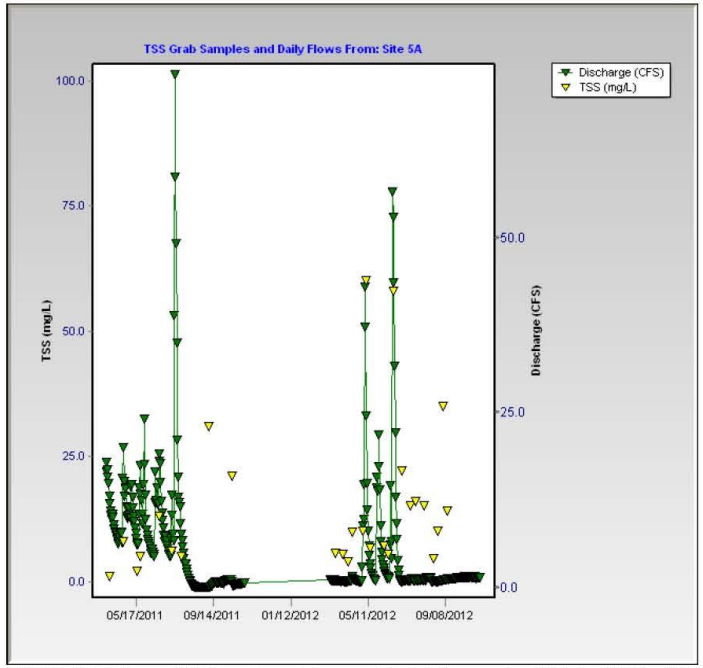

Figure 6. Highway 13 Crossing – Flow and Total Suspended Solids, 2011 - 12

Site 7 (CD2): Upstream Side of Ferric Chloride System

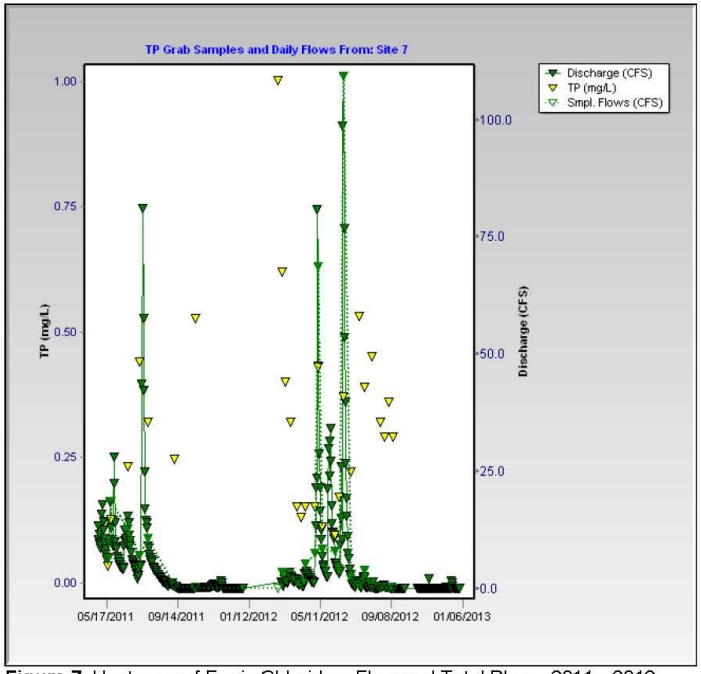

Figure 7. Upstream of Ferric Chloride – Flow and Total Phos., 2011 - 2012

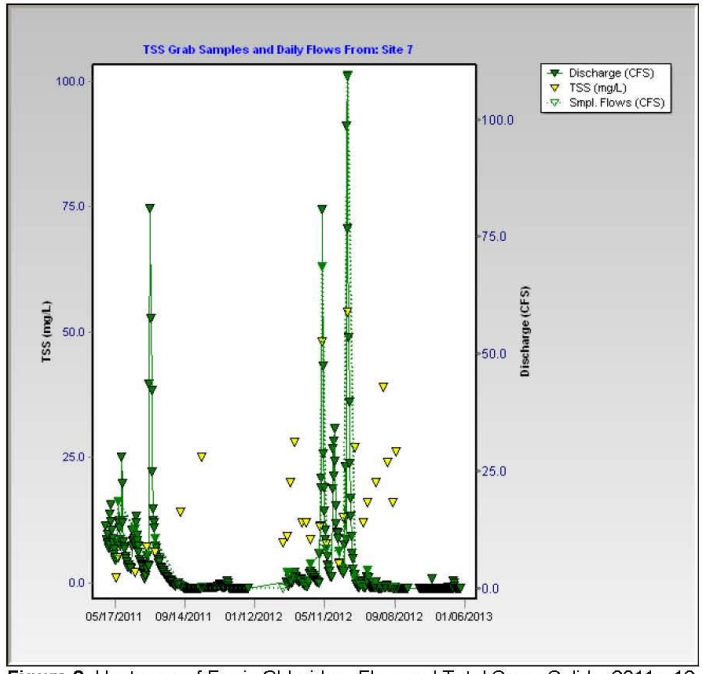

Figure 8. Upstream of Ferric Chloride – Flow and Total Susp. Solids, 2011 - 12

Site 7A (CD3): Downstream Side of Ferric Chloride System

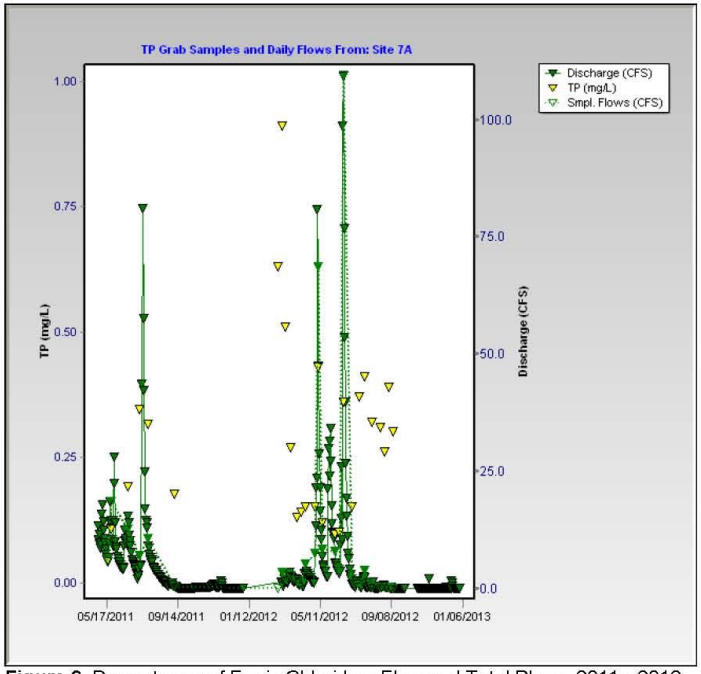

Figure 9. Downstream of Ferric Chloride – Flow and Total Phos., 2011 - 2012

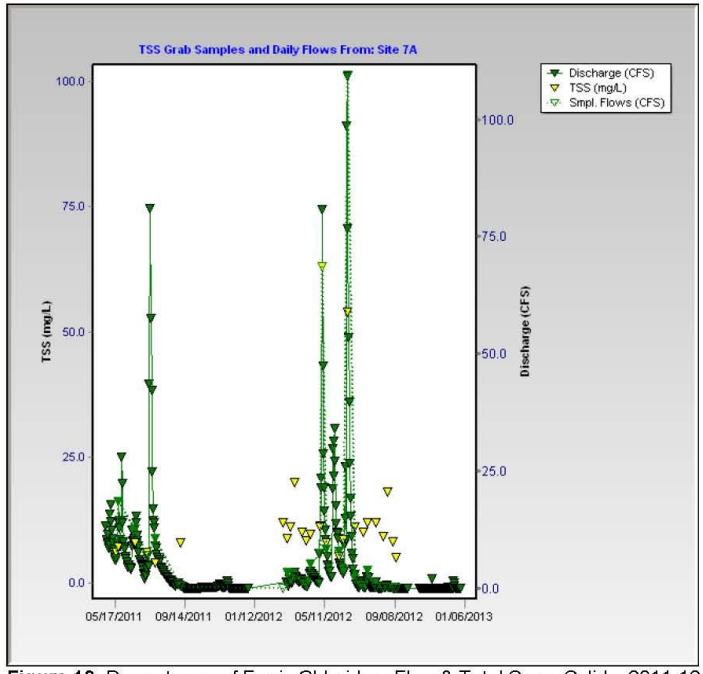

Figure 10. Downstream of Ferric Chloride – Flow & Total Susp. Solids, 2011-12

Site 8: Fish Lake Outlet

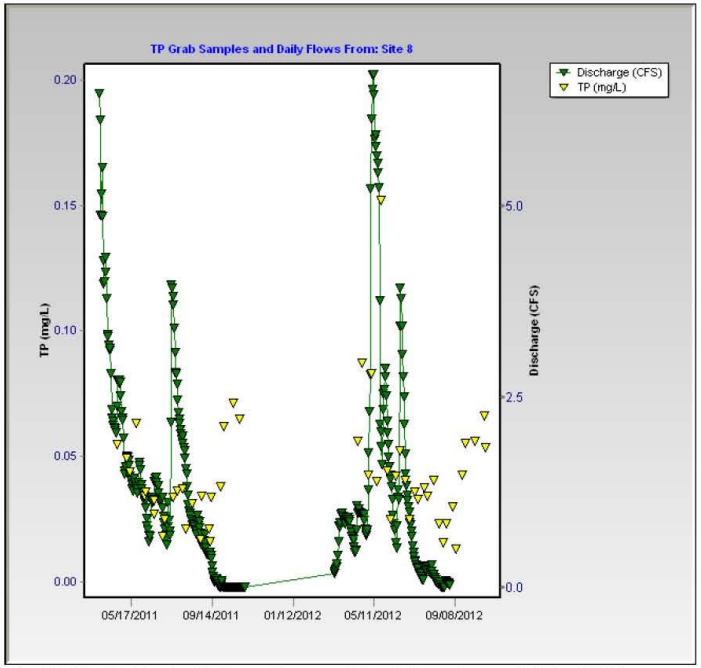

Figure 11. Fish Lake Outlet – Flow and Total Phosphorus, 2011 - 2012

Site 11: Buck Lake Inlet

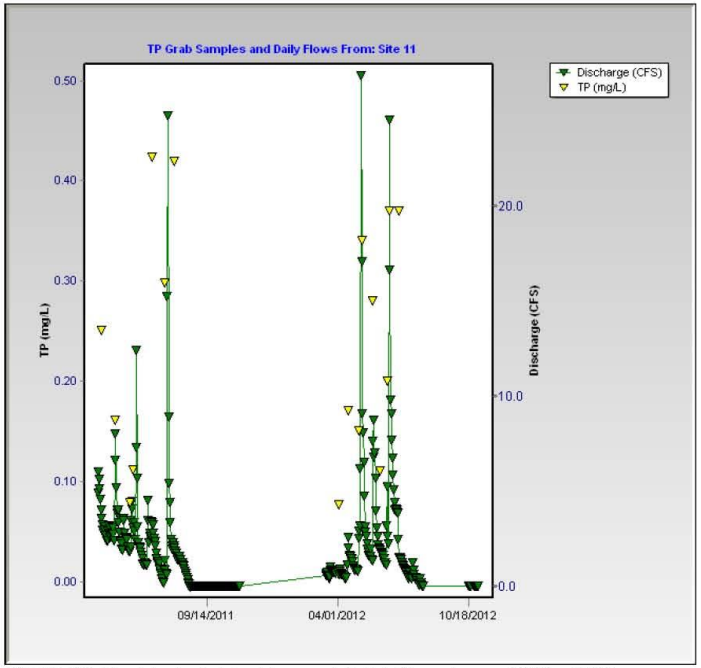

Figure 12. Buck Lake Inlet – Flow and Total Phosphorus, 2011 - 2012

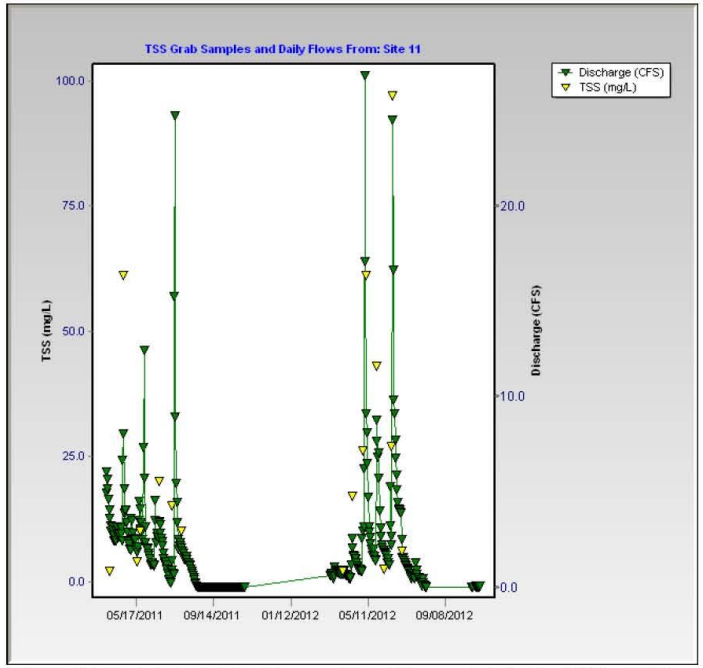

Figure 13. Buck Lake Inlet – Flow and Total Suspended Solids, 2011 - 2012

Site 14: Buck Lake Outlet

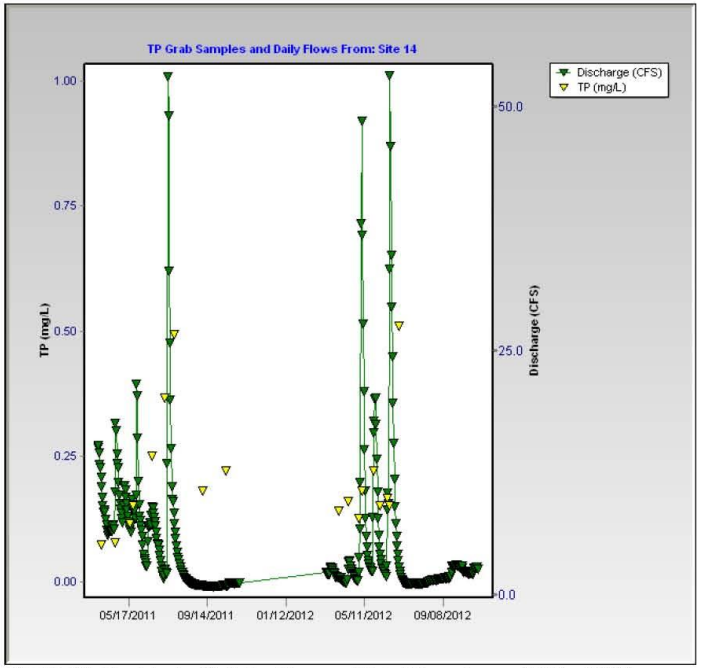

Figure 14. Buck Lake Outlet – Flow and Total Phosphorus, 2011 - 2012

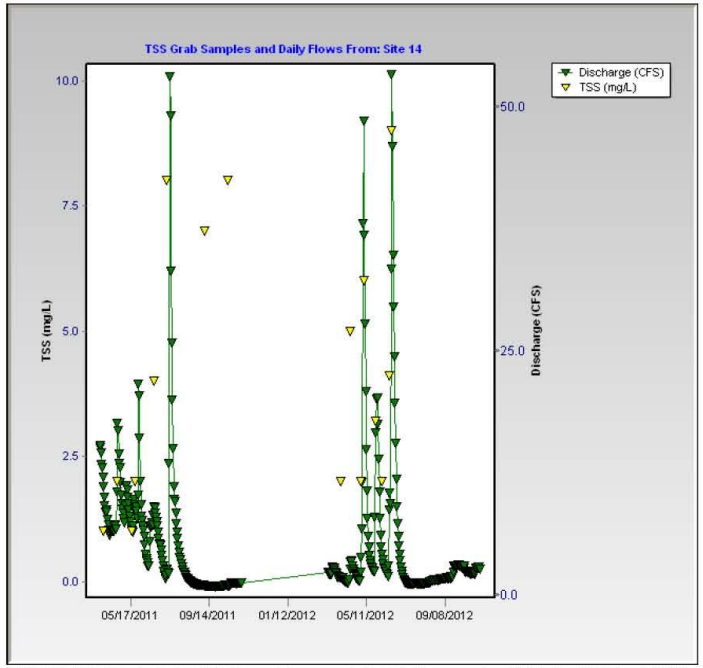

Figure 15. Buck Lake Outlet – Flow and Total Suspended Solids, 2011 - 2012

Site 17: Spring Lake Circle Crossing

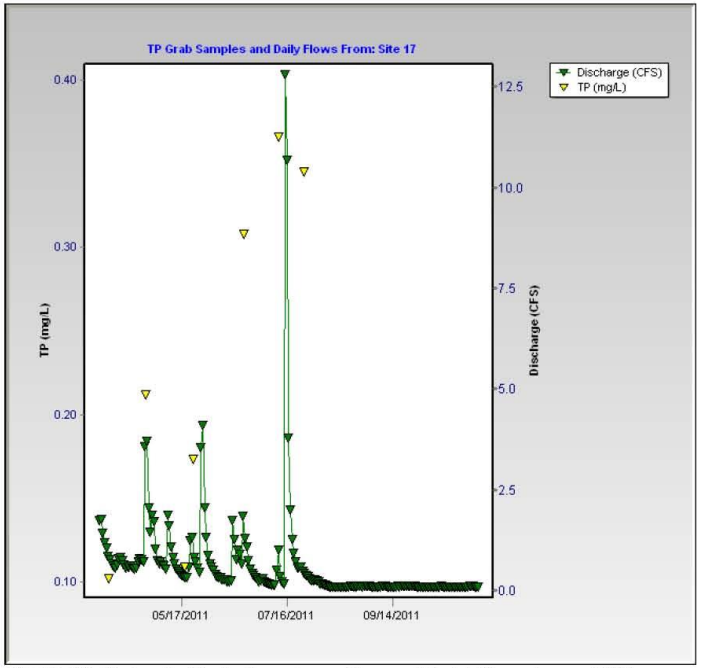

Figure 16. Spring L. Circle Crossing – Flow and Total Phosphorus, 2011

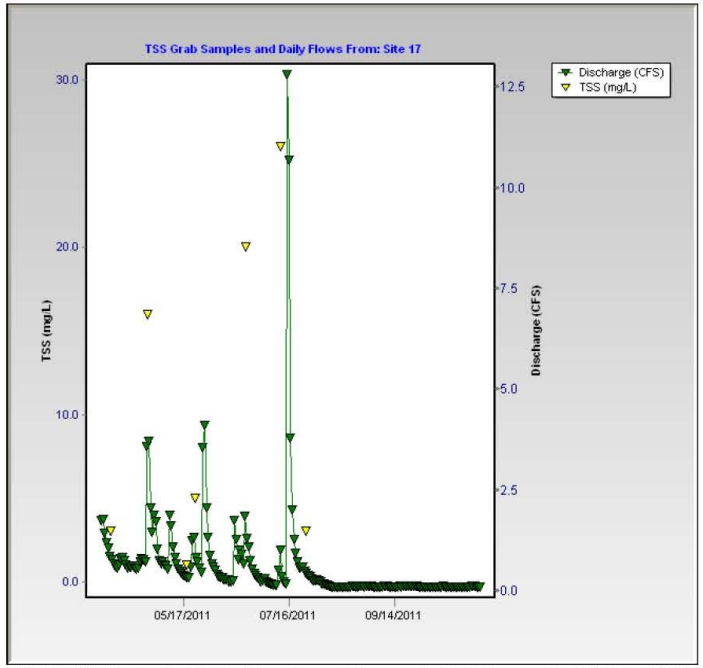

Figure 17. Spring L. Circle Crossing – Flow and Total Suspended Solids, 2011

Site 19: Marschall Road

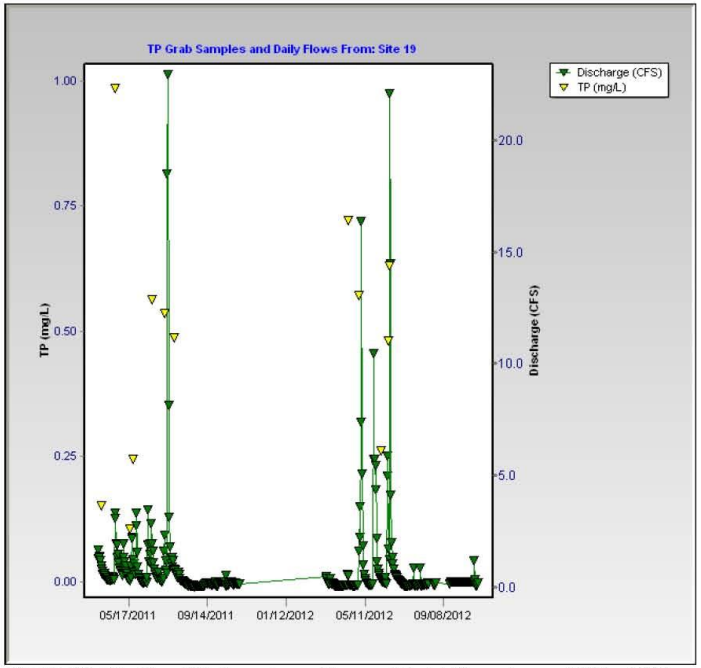

Figure 18. Cty Road 17 Crossing – Flow and Total Phosphorus, 2011 - 2012

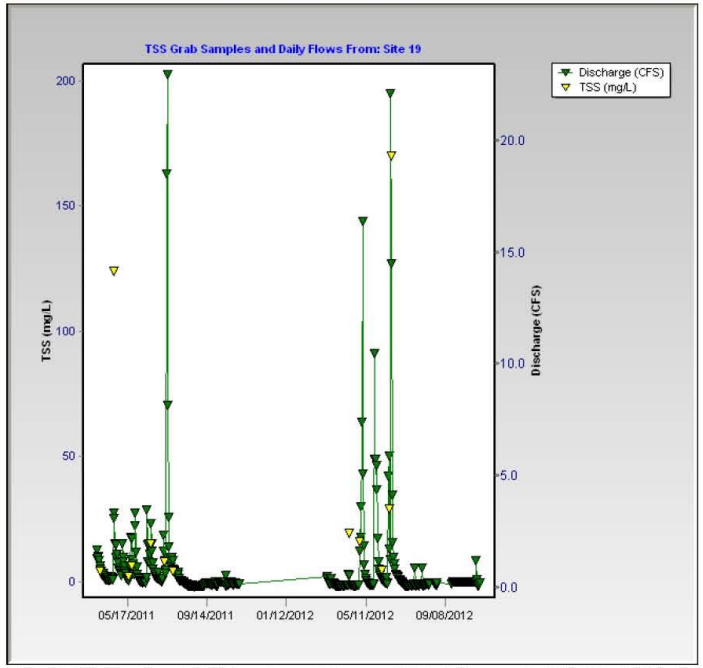

Figure 19. Cty Road 17 Crossing – Flow and Total Suspended Solids, 2011 -12

Site 21: Spring Lake Outlet

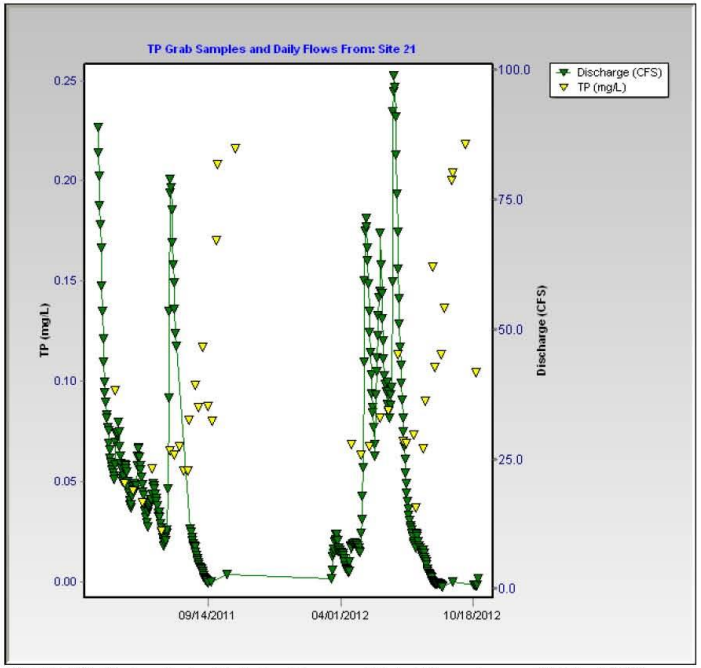

Figure 20. Spring Lake Outlet – Flow and Total Phosphorus, 2011 - 2012

Site 26A: Pike Lake Inlet

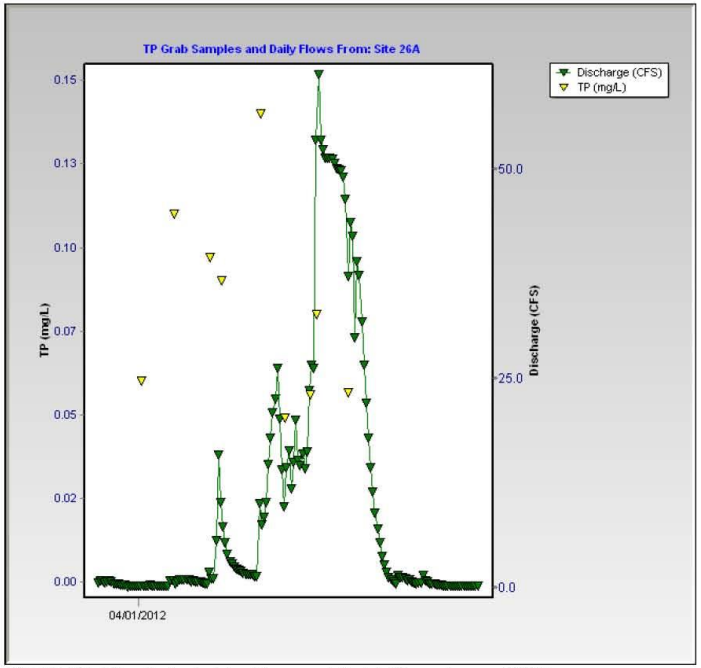

Figure 21. Pike Lake Inlet – Flow and Total Phosphorus, 2012

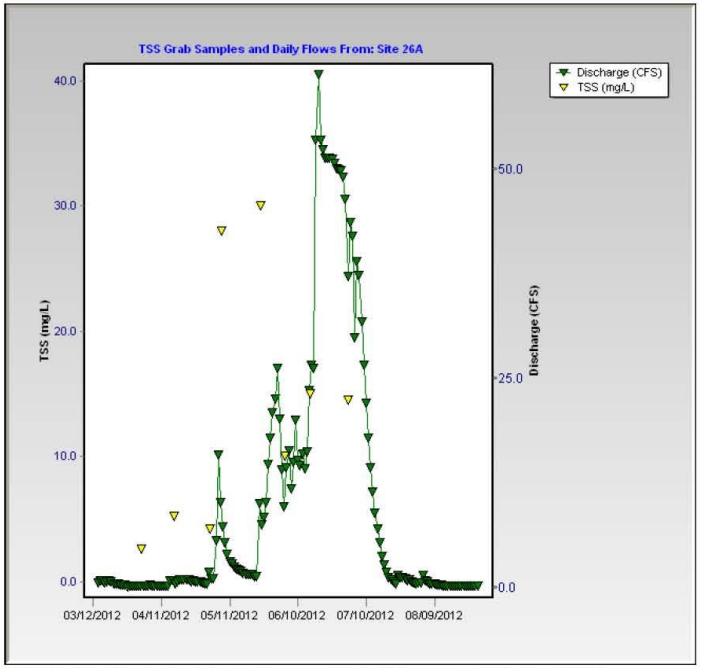

Figure 22. Pike Lake Inlet – Flow and Total Suspended Solids, 2012

Site 45: Crystal Lake Outlet

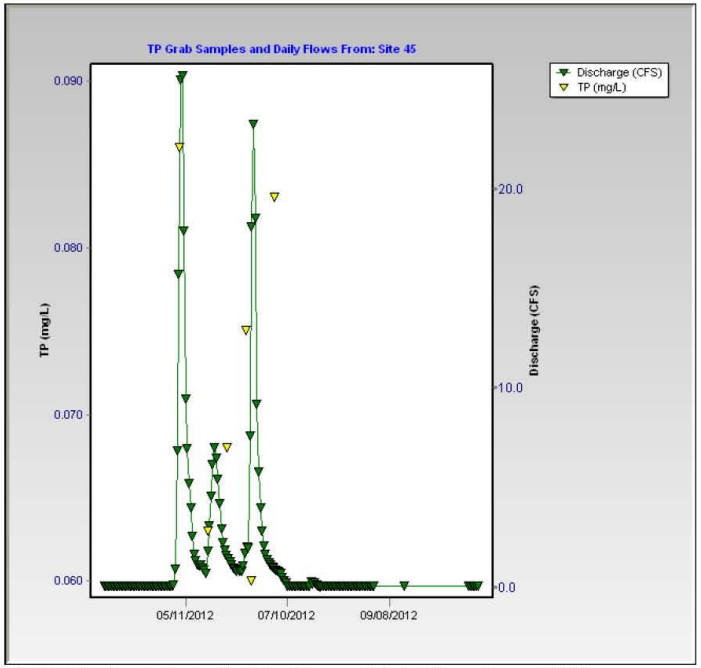

Figure 23. Crystal Lake Outlet – Flow and Total Phosphorus, 2012

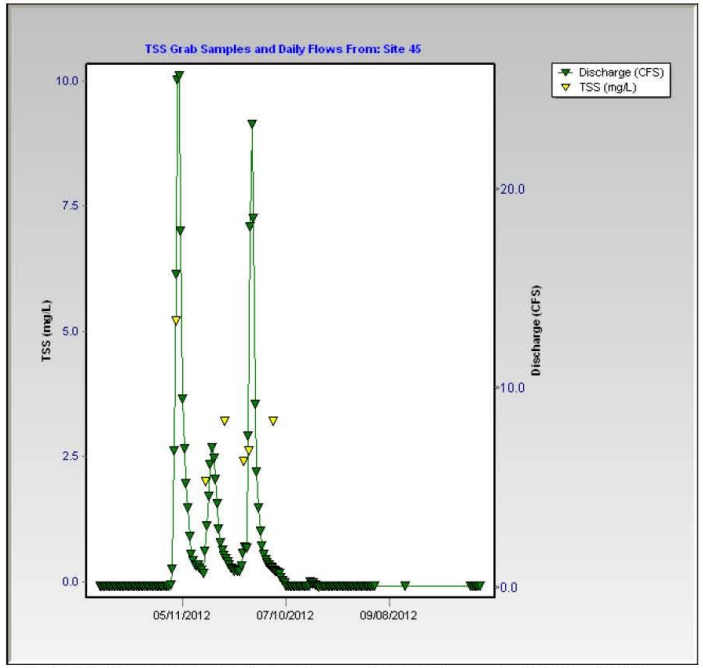

Figure 24. Crystal Lake Outlet – Flow and Total Suspended Solids, 2012

APPENDIX E - PRE-SETTLEMENT WATER QUALITY AND ALGAL CHANGE IN SPRING LAKE

St. Croix Watershed Research Station

Pre-settlement water quality and algal change in Spring Lake, Scott Co., MN

Science Museum of Minnesota

Highlights

- Two hundred years ago Spring Lake was nutrient rich and cyanobacteria algae were common.
- The current total phosphorus (TP) standard under the 2011 TMDL Plan (40 ppb) is lower than historical TP concentrations.
- A more appropriate historical TP concentration is 60 ± 5 ppb.
- Spring Lake experienced significant algal blooms during the Dust Bowl era.

Study Objectives

The goals of this study were to establish the site-specific historical (pre-settlement) total phosphorus (TP) concentrations of Spring Lake, Scott Co. In addition, our aim was to determine if there was any evidence of cyanobacteria blooms prior to settlement in the watershed. To achieve these goals we analyzed sediment deposits at the bottom of Spring Lake for algal fossils (physical and biochemical).

Key Findings

Lake sediments accumulate annually and undisturbed at the bottom of lakes. Using radioisotopic techniques we can date these deposits and uncover the history of the lake. We were able to establish reliable dates for the sediments we collected from Spring Lake. At our sample location 58 cm of sediment has accumulated since 1900, and 10cm since 2000. Sampling the sediment core at different depths (representing time), we inspected the sediments using a microscope for the remains of algae known as diatoms (Bacillariophyceae; see photo). This type of algae is responsive to changes in water quality (e.g. TP) and the community structure will change over time favoring different species at different nutrient concentrations. We found that species that do well under nutrient-rich conditions

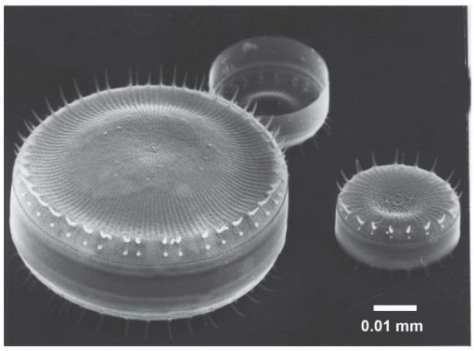

Photo: Scanning electron microscope image of *Stephanodiscus niagarae*, one of the dominant diatom species in Spring Lake. Image taken by M. Edlund, SCWRS.

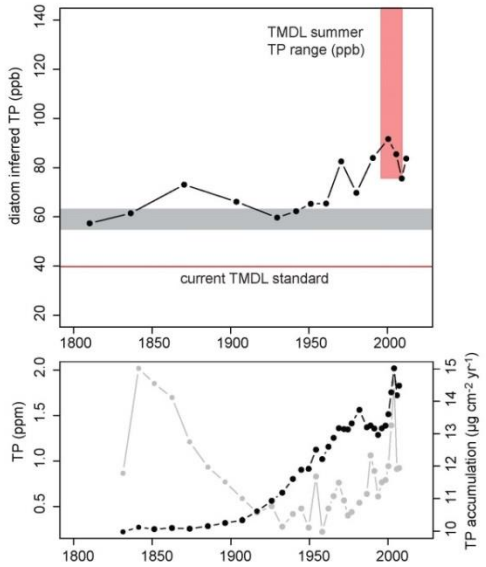

Figure 1: (upper) diatom modeled TP concentrations for Spring Lake over the last ~ 200 years. The current TMDL standard is shown by the red line and the range of measured modern summer TP concentrations in Spring Lake from 1996-2006 is shown as the red shaded area. The suggested pre-settlement TP levels shown as the grey shaded area. (lower) TP concentrations measured in the sediments (grey, left axis) and TP accumulation (black, right axis) in Spring Lake sediments near the deepest part of the lake.

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have dominated the diatom communities over the last 200 years. In addition to these observations, we are able to model historical TP based on our extensive knowledge of the modern environments these algae inhabit (Ramstack et al., 2003). When we modeled the diatom communities over the last 200 years from Spring Lake (Figure 1), we found that the modern estimates fell well within the range of observed summer TP concentrations collected from 1996-2006 (TMDL, 2011). Prior to settlement in the area (~ pre-1850) the lake water TP concentration was ~ 60 (± 5) ppb (Figure 1). While this is considerably less than today it does suggest that the lake was historically nutrient-rich. This finding is similar to previous results of a different sediment core from the same location suggesting that the accumulation of TP directly bound to the sediments has been increasing steadily since ~1920 when growth and development of the town of Prior Lake really accelerated (Figure 1).

An additional method to detect changes in algae over time from lake sediments is to use the biochemical remains of the pigments (chlorophylls and carotenoids) that algae use during photosynthesis. In Spring Lake we were particularly interested whether the nuisance and potentially toxic types of algae known as cyanobacteria were present historically. When we looked at the pigment remains in the lake sediment record we found that cyanobacteria have been common in Spring Lake over the last 200 years (Figure 2). Cyanobacteria generally grow well in very nutrient-rich water, particularly phosphorus-rich waters. Therefore, this finding complements our earlier result that Spring Lake has long been a nutrient-rich lake. The pigment data also show that there were some significant algae blooms during the 1920s through the 1930s (Figure 2). It is possible that these blooms were encouraged by both the development activities of Prior Lake and the drier climate during this 'Dust Bowl' era.

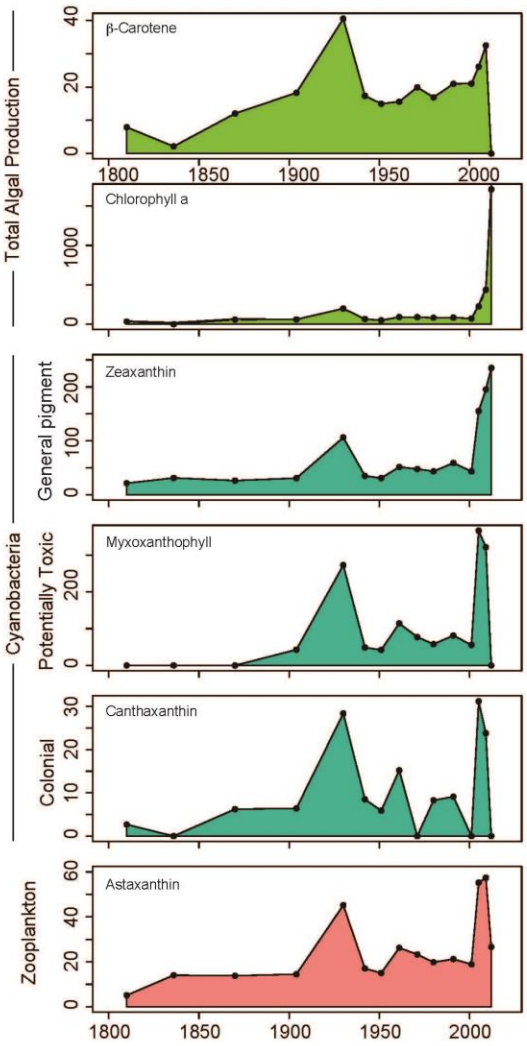

Figure 2: Pigment (chlorophylls and carotenoids) concentrations (μg g^{-1}organic matter) in the sediments of Spring Lake over the last ~ 200 years. Total algal production (green), cyanobacteria production (blue-green), and zooplankton biomass (red) are recorded. Time is on the x-axis.

References

Ramstack JM, Fritz SC, Engstrom DR, Heiskary SA. 2003. The application of a diatom-based transfer function to evaluate regional water-quality trends in Minnessota since 1970. Journal of Paleolimnology 29:79–94.

TMDL – Spring Lake and Upper Prior Lake. 2011. Wenck Associates, MN Pollution Control Agency, and Prior Lake-Spring Lake Watershed District. Wenck report: 1242-53.

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