

2014 MONITORING SUMMARY

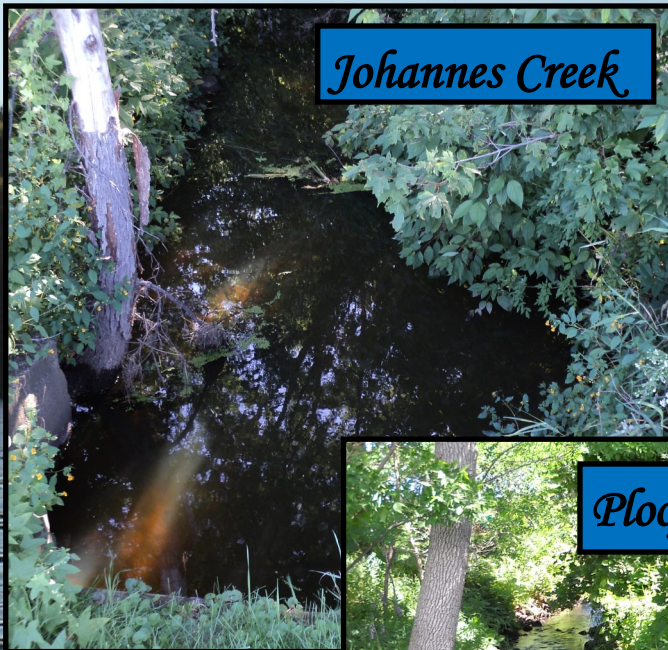
Grand Lake, Ploof's Creek, and Johannes Creek

Introduction

Since the 2012 monitoring season, the Grand Lake Improvement District and the Sauk River Watershed District have worked together to implement a monitoring plan designed to evaluate the water quality of Ploof's Creek and Johannes Creek. Knowing the water quality of these creeks will assist the Grand LID with their goal of improving the water quality of Grand Lake through best management practice (BMP) project implementation.

"We would like to measure our creeks to determine if we should help fund projects along the creeks with the ultimate goal of improving Grand Lake's water quality."

- Scott Palmer - Grand LID
President



Johannes Creek



Ploof's Creek South

"It is the vision of the Sauk River Watershed District to protect and enhance our natural resources by increasing public awareness and involvement....The District will be wise stewards of our natural resources and will work alongside our partners to leave the water quality better for future generations."

Grand Lake

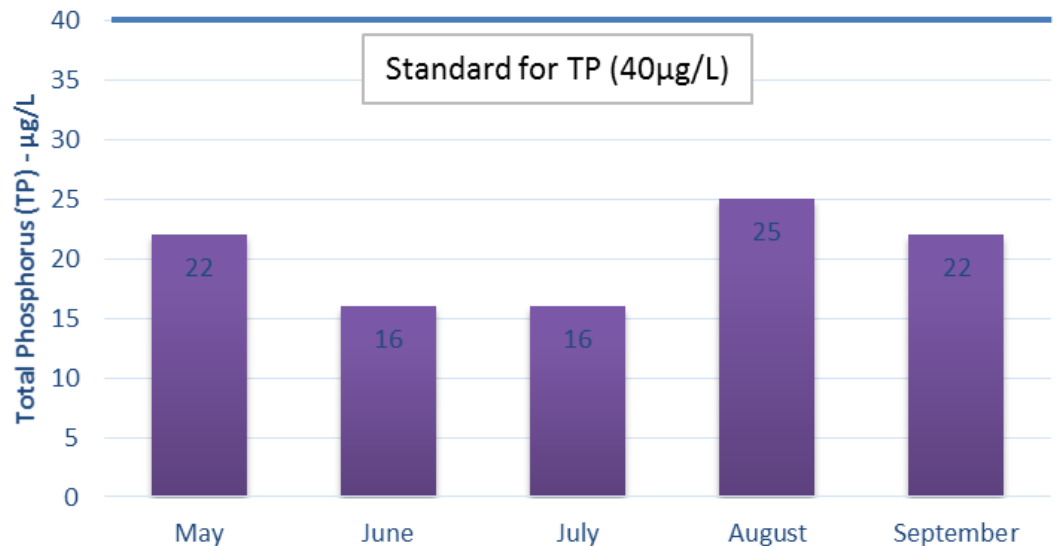
Total Phosphorus (TP)

Total phosphorus is made up of both organic and inorganic (ortho-phosphorus) materials. It can be found suspended in the water or in the bottom materials of the lake. The MPCA's ecoregion standard level for phosphorus in deep lakes (max depth greater than 15 feet) is 40 µg/L.

The figure to the right shows that all TP samples taken in Grand Lake during the 2014 season are below the standard.

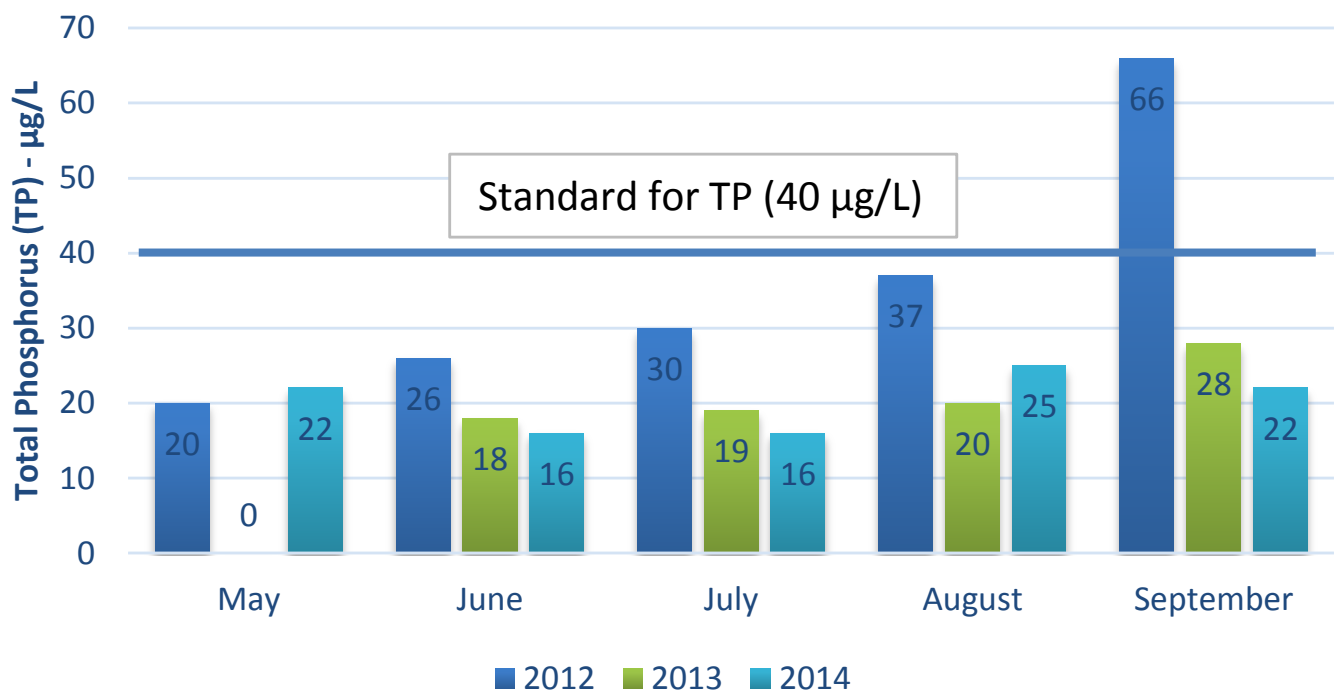
The table to the right and the chart below it display the TP results from the last three monitoring seasons, where only one sample exceeds the standard.

Total Phosphorus (TP) - Grand Lake - 2014



Total Phosphorus (µg/L)	May	June	July	August	September
2012	20	26	30	37	66
2013	NA	18	19	20	28
2014	22	16	16	25	22

Total Phosphorus - Grand Lake - 2012-2014



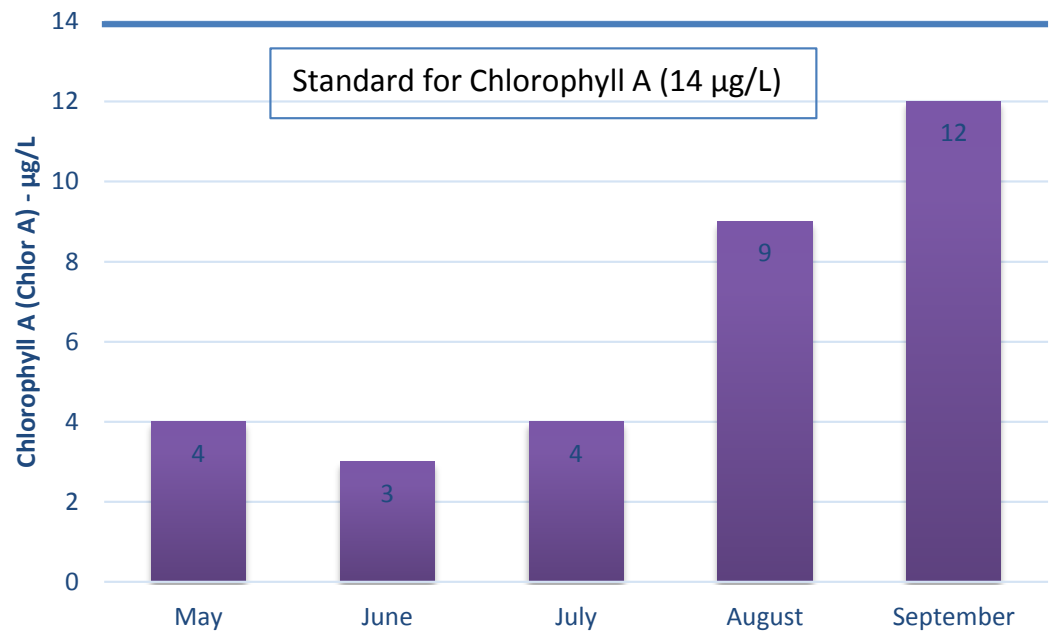
Grand Lake

Chlorophyll A (Chlor-A)

Chlorophyll A samples are used to measure the amount of algae in the water. Algae grows as the water warms and the amount of growth is dependent on the amount of phosphorus available. Other environmental factors such as wind and water temperature can impact the amount of algae growth as well.

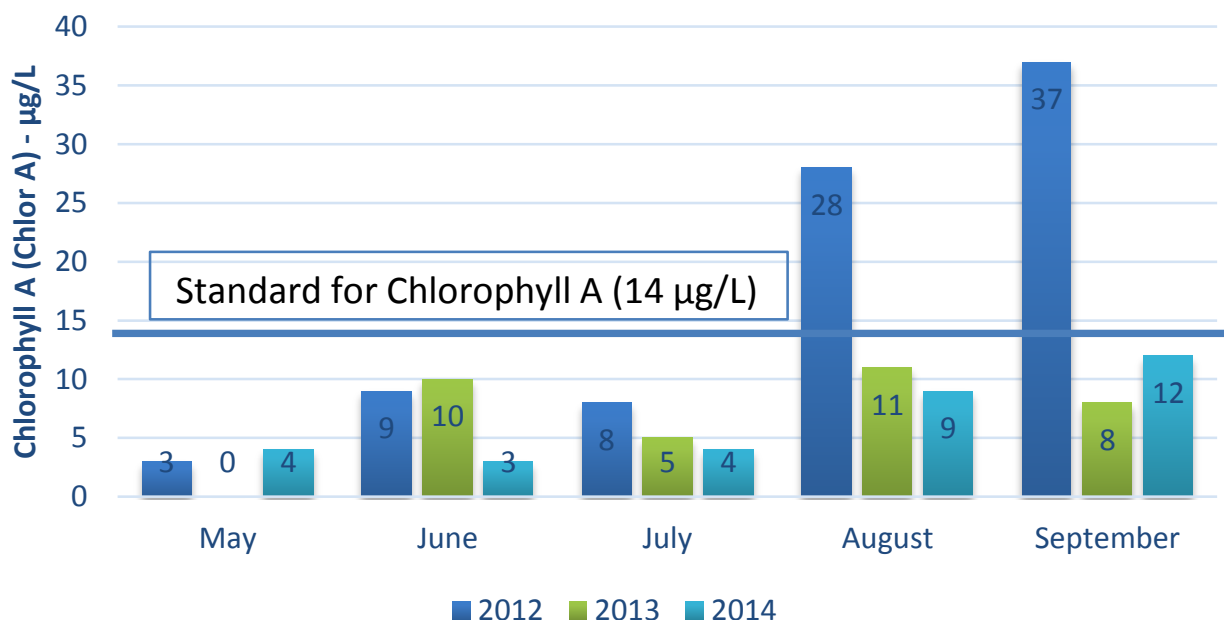
The ecoregion standard for Chlorophyll A is 14 µg/L (micrograms/liter). As shown in the figure to the right, the Chlorophyll A samples taken in Grand Lake in 2014 were within the ecoregion standard. The table to the right and chart below show the results for the last three monitoring seasons, with only two samples exceeding the standard, both in 2012.

Chlorophyll A (Chlor A) - Grand Lake - 2014



Chlorophyll A (µg/L)	May	June	July	August	September
2012	3	9	8	28	37
2013	NA	10	5	11	8
2014	4	3	4	9	12

Chlorophyll A - Grand Lake - 2012-2014



Secchi Disk

Water clarity is measured using a transparency disk (secchi disk) that is lowered into the water on the shaded side of the boat until it can no longer be seen. Clarity is measured every time the lake is sampled. This data, along with phosphorus and chlorophyll a data, is used to assess the water quality of a lake.

The ecoregion standard for secchi disk readings is greater than 1.4 meters (which is equal to about 4.6 feet). The figure to the lower right shows the secchi disk readings taken on Grand Lake during 2014, all of which are within the ecoregion standard.

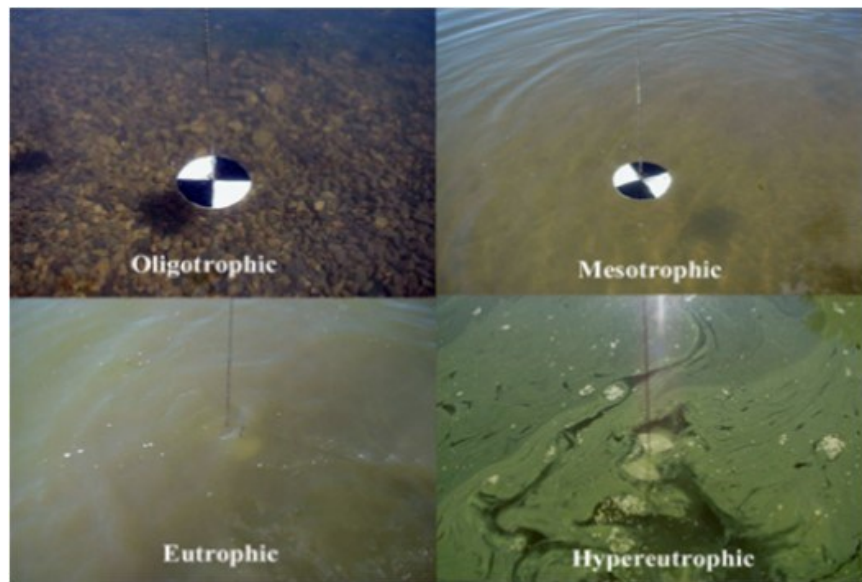


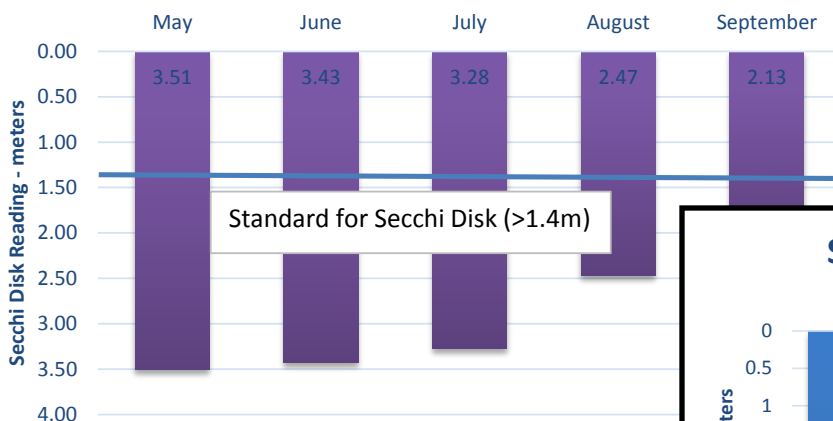
Photo Courtesy of the Minnesota Pollution Control Agency (MPCA)

The above photo provides examples of what the four main lake classifications (according to Carlson's Trophic Status Index/TSI) would look like during a secchi disk reading. Phosphorus samples, chlorophyll-a samples, and clarity/secchi disk readings are used to determine the TSI for a lake.

The four stages of lake classification are oligotrophic (clean, clear), mesotrophic (temporary algal and aquatic plant problems), eutrophic (persistent algal blooms and aquatic plant problems), and hypereutrophic (extreme nuisance algal blooms and aquatic plant problems).

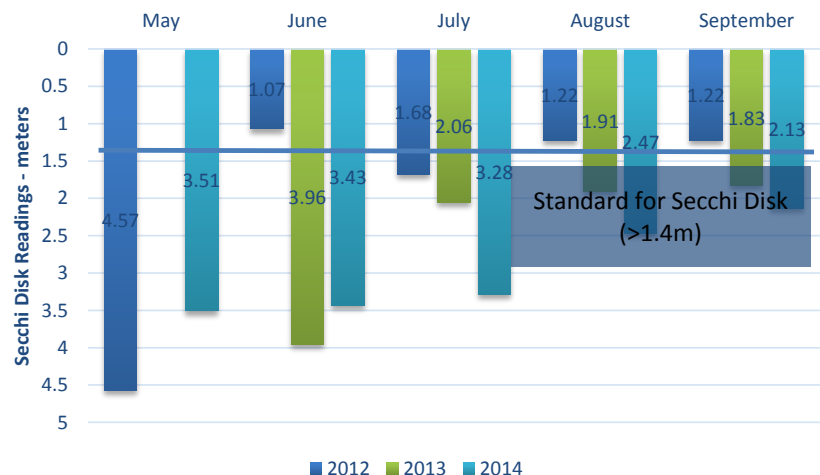
Secchi Disk (meters)	May	June	July	August	September
2012	4.57	1.07	1.68	1.22	1.22
2013	NA	3.96	2.06	1.91	1.83
2014	3.51	3.43	3.28	2.47	2.13

Secchi Disk - Grand Lake - 2014

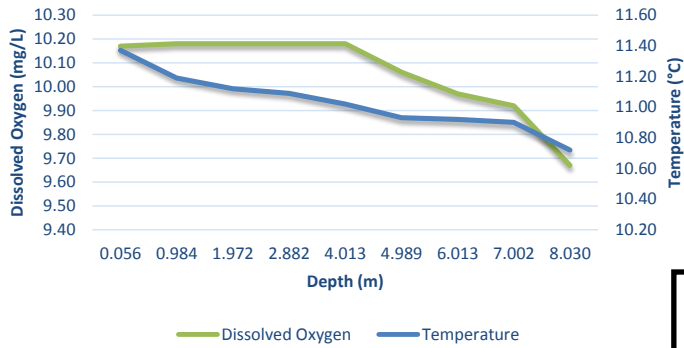


The figure below shows the secchi disk readings collected in Grand Lake from 2012-2014. Three of these readings had clarity levels below the standard, all in 2012.

Secchi Disk - Grand Lake - 2012-2014



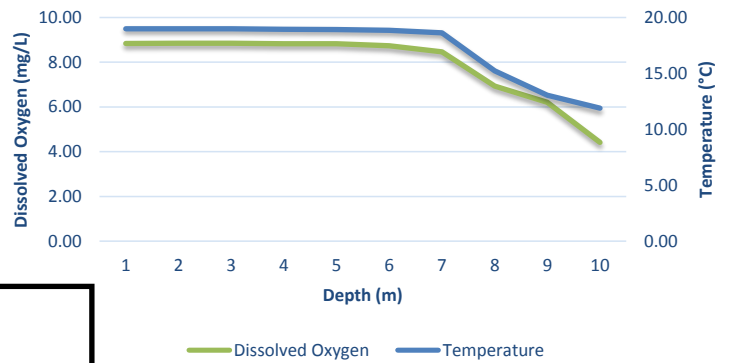
Dissolved Oxygen and Temperature - Grand Lake - May 20th, 2014



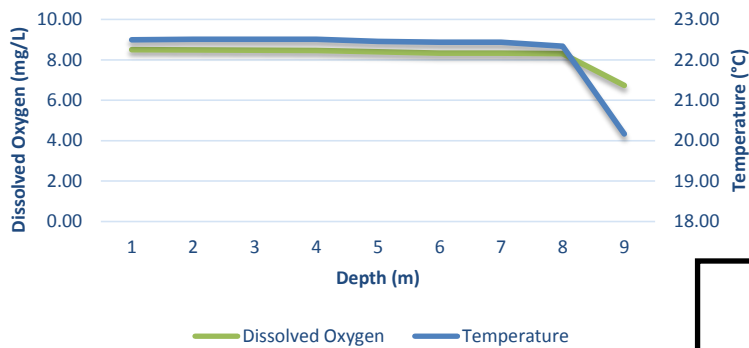
Dissolved Oxygen and Temperature - Grand Lake

Dissolved oxygen is the amount of oxygen dissolved in the water that is readily available for fish and other aquatic organisms. Temperature can directly influence the amount of dissolved oxygen present.

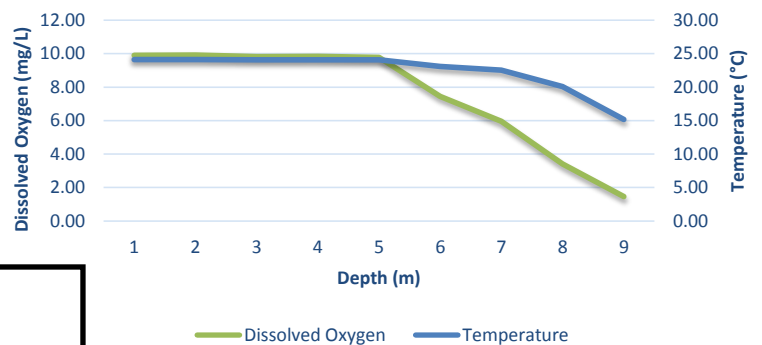
Dissolved Oxygen and Temperature - Grand Lake - June 16th, 2014



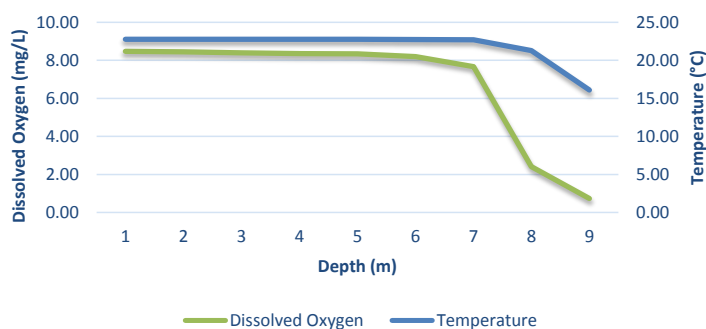
Dissolved Oxygen and Temperature - Grand Lake - July 8th, 2014



Dissolved Oxygen and Temperature - Grand Lake - August 5th, 2014



Dissolved Oxygen and Temperature - Grand Lake - September 2nd, 2014



Summary of Grand Lake

Shoreland Buffer Zone Option for Water Quality Protection

In 2012, the SRWD conducted a shoreline assessment of Grand Lake. Recommendations for protecting the water quality of Grand Lake were included in the final report, and could be expanded upon if requested.

One recommendation included in the report is to restore the manicured lakeshores into buffer zones with native vegetation. Creating a restored buffer zone provides several benefits such as offering a buffer between the affects of human activity and the lake, enhancing the amount and quality of habitat for both aquatic and terrestrial organisms, and stabilize the shorelines to decrease the amount of erosion occurring.

The final report on the shoreline assessment conducted in 2012, as well as additional documentation and recommendations from this project, are available upon request through the Sauk River Watershed District.

Based on the data that was collected by the Sauk River Watershed District during the 2014 monitoring season, Grand Lake is meeting state and ecoregion standards for the parameters tested. These results support the data posted on the MPCA website (Grand Lake ID: 73-0055-00). Additional data on Grand Lake can be found using the lake and stream search tool under the surface water section of the waters portions of the MPCA website (www.pca.state.mn.us). This site includes data on the overall condition of the lake, water clarity, and recreational use.

The Grand Lake Improvement District has signed a contract with the Sauk River Watershed District to continue water quality monitoring through the 2015 season. The same sites will be monitored on Grand Lake, Ploof's Creek, and Johannes Creek.

Volunteer Boat Drivers

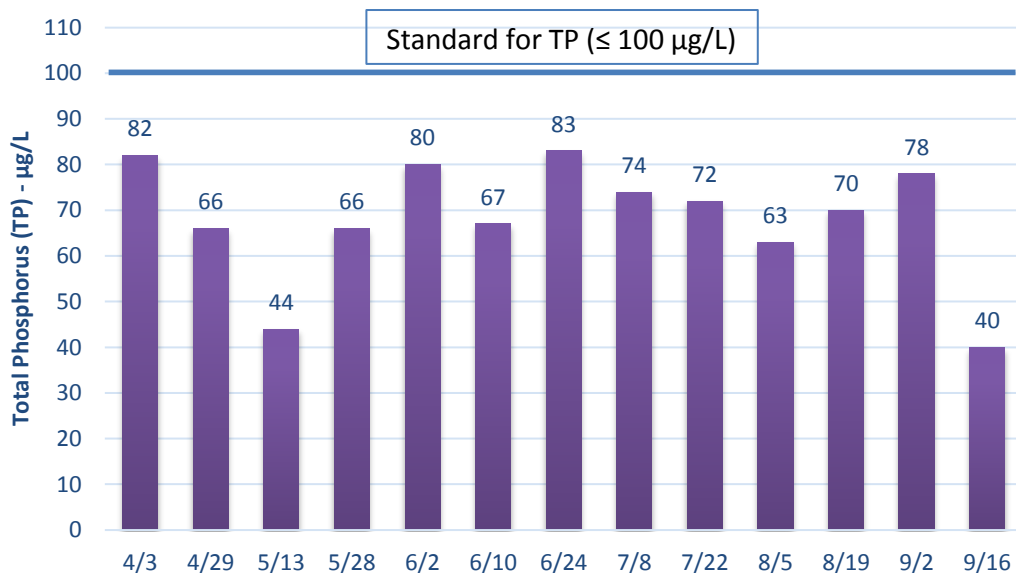
Volunteer boat drivers assisted the SRWD staff during the 2013 and 2014 monitoring seasons, allowing them to take advantage of a hands-on learning experience. The SRWD would like to continue working with volunteer boat drivers to collect data on Grand Lake, as it saves some time and energy for the SRWD, while also saving the Grand LID money.

The SRWD would like to thank the 2014 volunteer boat drivers, and to invite anyone who may be interested in volunteering for the 2015 season to contact Sarah Jo at the office using the contact information found on the back of this report.

Volunteers must have a boat or pontoon on the lake that they would be willing to let SRWD staff sample from. Volunteers should be available for approximately 30-40 minutes before 9am Tuesday-Thursday.

Ploof's Creek South

Total Phosphorus (TP) - Ploof's Creek South - 2014



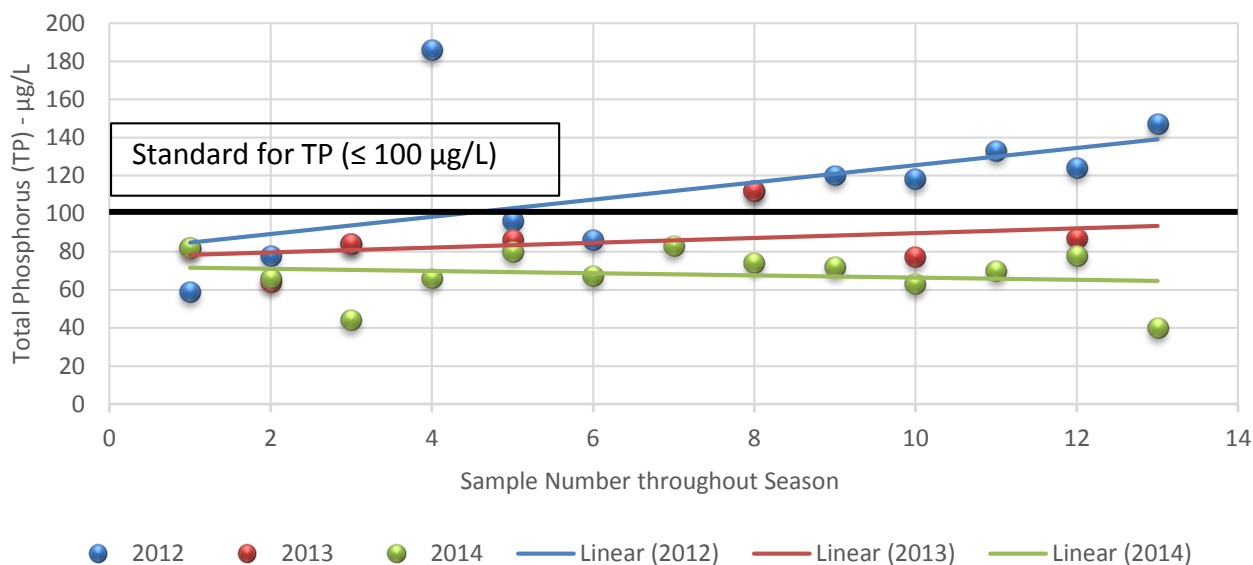
Total Phosphorus (TP)

The new standard for total phosphorus in the Central River Nutrient Region is $\leq 100 \mu\text{g/L}$.

The 2014 total phosphorus data from Ploof's Creek South (shown in the figure to the left) was all below the standard.

The figure below shows the total phosphorus data for Ploof's Creek South from 2012 through 2014. Looking at the linear trend lines for each year, the amount of total phosphorus showed an increasing trend in 2012, a slightly increasing trend in 2013, and a decreasing trend in 2014. In 2012, several samples exceeded the standard for total phosphorus, in 2013 one sample did, and in 2014 none of the samples did.

Total Phosphorus (TP) - Ploof's Creek South - 2012-2014

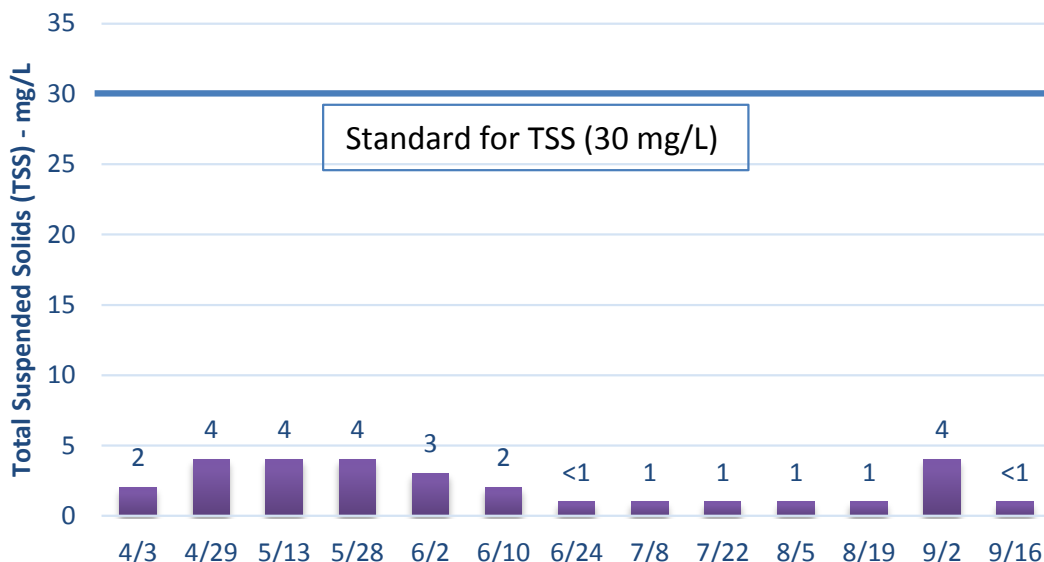


Ploof's Creek South

Total Suspended Solids (TSS)

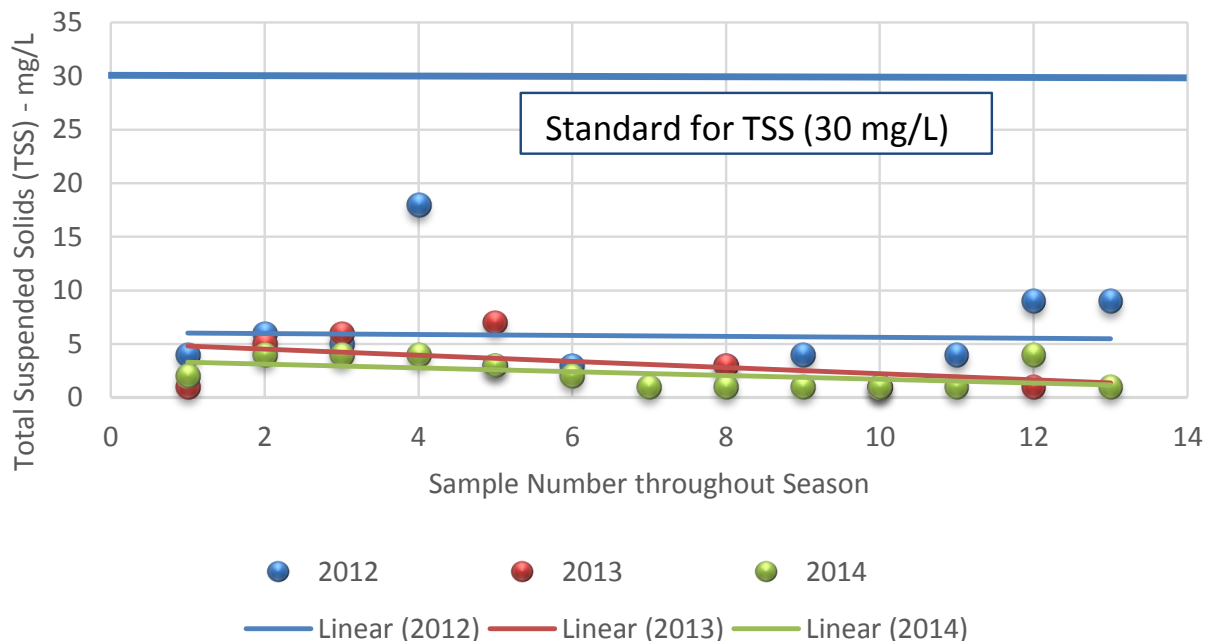
The new TSS standard for the Central River Nutrient Region is 30 mg/L. This is the standard shown in the figure to the right. All of the TSS samples collected from Ploof's Creek South in 2014 had values below the standard.

Total Suspended Solids (TSS) - Ploof's Creek South - 2014



The figure below shows the total suspended solids data for Ploof's Creek South from 2012 through 2014. Looking at the linear trend lines for each year, the amount of total suspended solids is showing a slightly decreasing trend. None of the samples analyzed for total suspended solids have exceeded the standard.

Total Suspended Solids (TSS) - Ploof's Creek South - 2012-2014



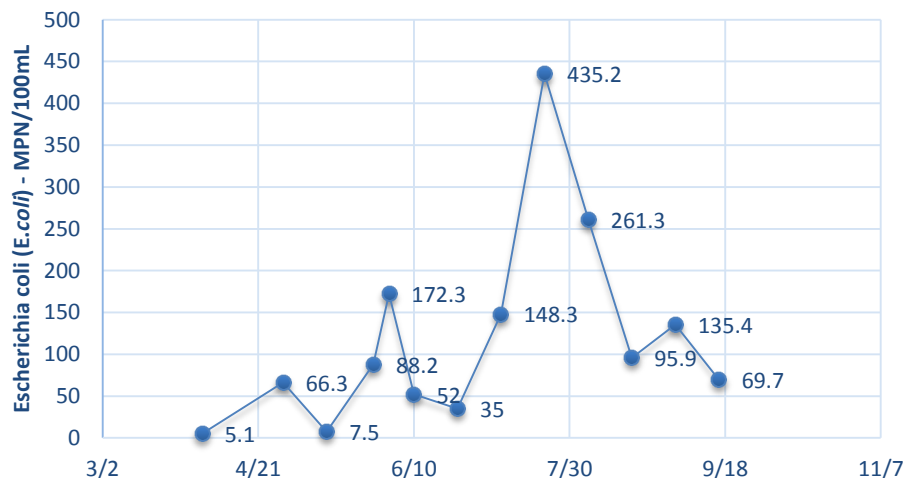
Ploof's Creek South

Escherichia Coli (E.Coli)

E.Coli is a bacteria found in surface waters that can be toxic to humans. It is found in human and animal waste and contaminates surface waters through direct surface runoff during rain events, snow melt, leaking septic systems, and manure spills. Due to the variety of ways it can contaminate surface waters, it is considered a "flashy" parameter and a large number of data points must be present to draw accurate conclusions regarding the data.

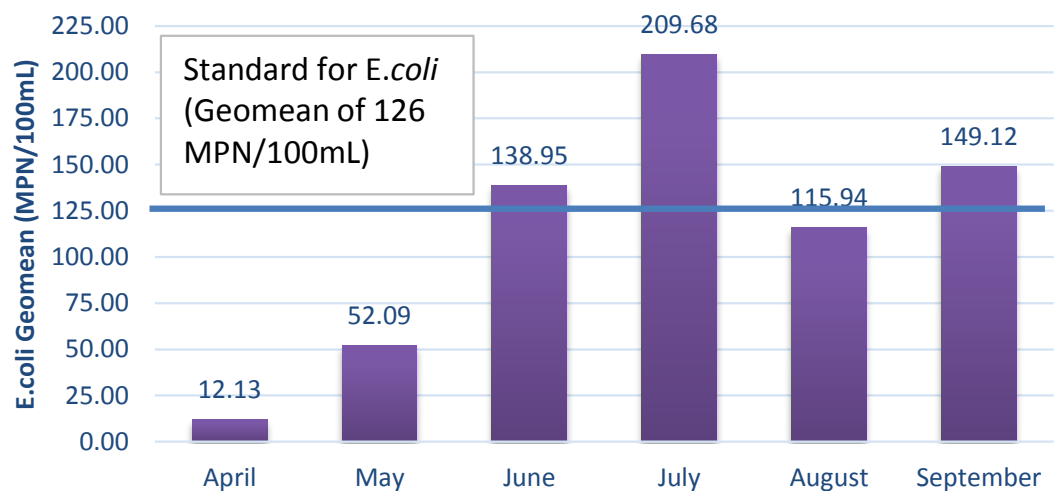
To establish a geometric mean for *E.Coli* data (which is the standard process for evaluating the data) 5 samples need to be collected over a 30 day (one month) time frame (these samples can be collected over multiple years). If the geometric mean of those samples is greater than 126 MPN/100mL, or if 10% of the samples are greater than 1260 MPN/100mL then the site would not meet state standards.

Escherichia coli (E.coli) - Ploof's Creek South - 2014



The figure below shows the *E.coli* geomeans (geometric means) of the samples collected at Ploof's Creek South over the last three years. Of the six months that sampling occurs, three of them exceed the standard. This indicates that an *E.coli* impairment is likely in Ploof's Creek. However, since this is such a flashy parameter, there is a second standard that is looked at. That standard pertains to individual samples exceeding 1,260 MPN/100mL, which would imply that illness could occur upon exposure. Since Ploof's Creek does not have any samples exceeding this standard, the likelihood of getting sick from a one time exposure are minimal.

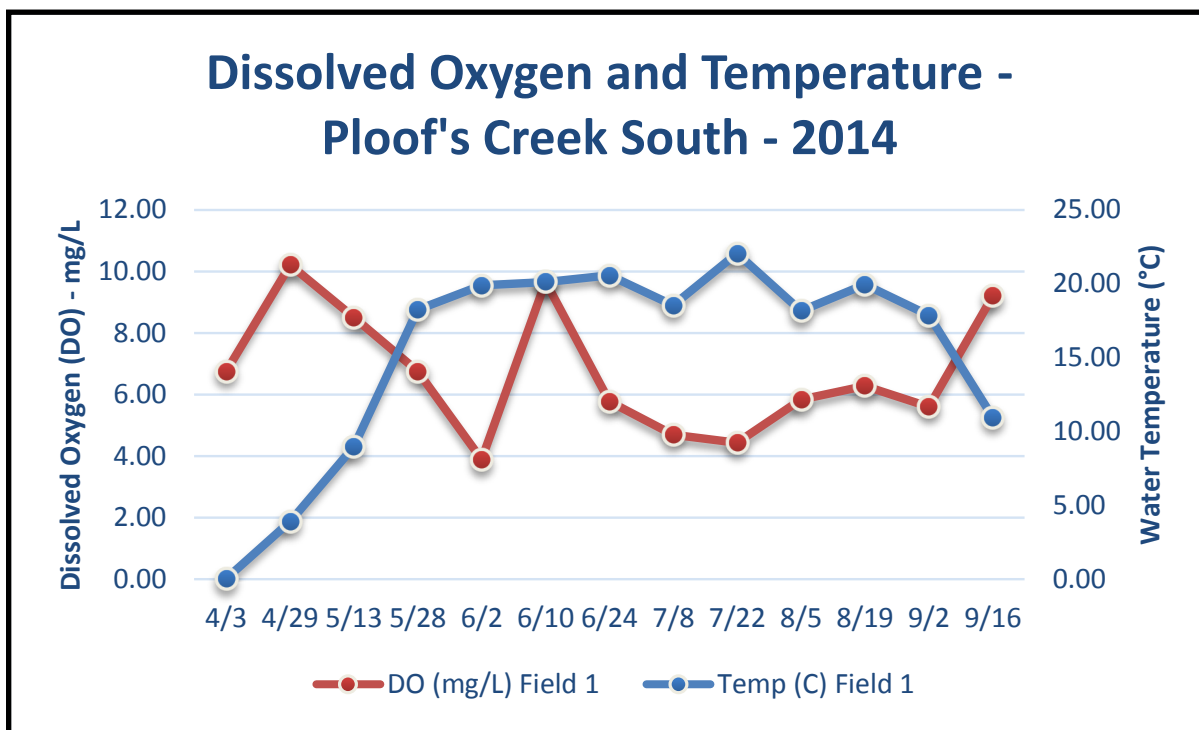
E.coli Monthly Geomeans - Ploof's Creek South - 2012-2014



Summary of Ploof's Creek South

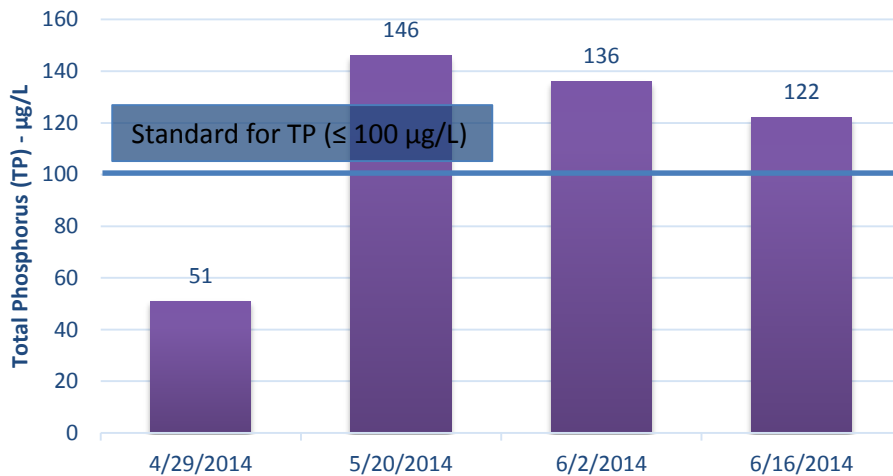
Based on the data collected in the 2014 monitoring season, Ploof's Creek South is meeting the standards for water quality for two of the three parameters analyzed. As explained previously, the geomeans calculated for the *E. Coli* sampling results indicate a possible impairment. For additional information regarding the *E. coli* status in Ploof's Creek, please contact Sarah Jo at the Sauk River Watershed District.

Below is a graph showing the dissolved oxygen and temperature readings collected at Ploof's Creek South. Dissolved oxygen is the amount of oxygen dissolved in the water that is readily available for fish and other aquatic organisms. Temperature can directly influence the amount of dissolved oxygen present.



Johannes Creek

Total Phosphorus (TP) - Johannes Creek - 2014



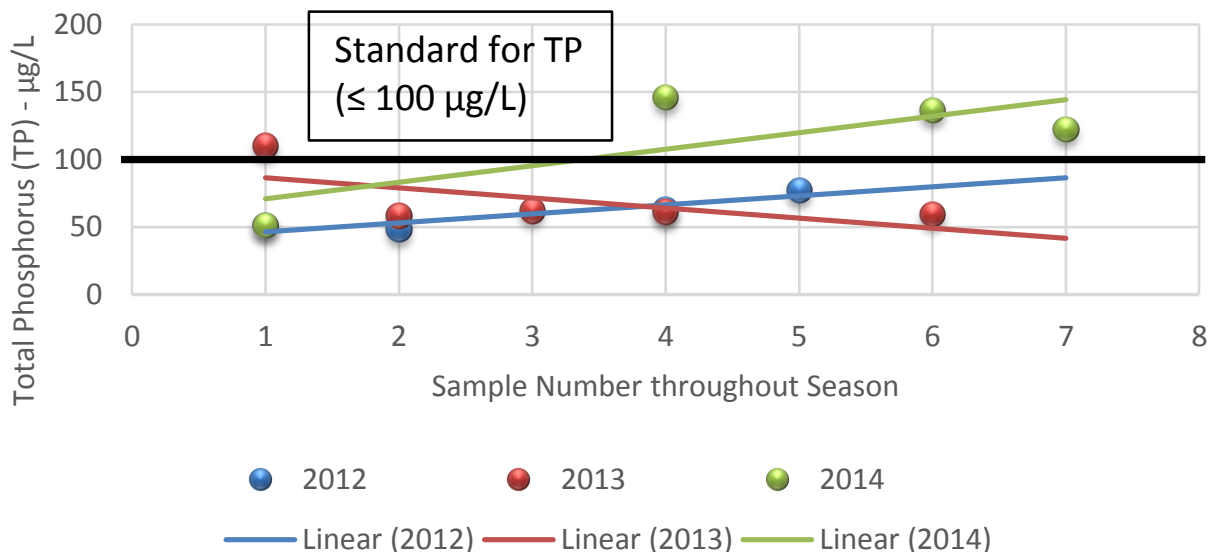
The figure below shows the total phosphorus data for Johannes Creek from 2012 through 2014. Looking at the linear trend lines for each year, two of the three years show an increasing trend in total phosphorus. In 2012, none of the samples exceeded the standard for total phosphorus, in 2013 one sample did, and in 2014 three of them did.

Total Phosphorus (TP)

The new standard for total phosphorus in the Central River Nutrient Region is $\leq 100 \mu\text{g/L}$.

Of the four samples collected on Johannes Creek in 2014, three of them exceeded the standard. While this is a concern, it is difficult to draw conclusions due to the limited size of the dataset. Expansion of the dataset has been challenging due to a lack of flow in the creek throughout the majority of the season.

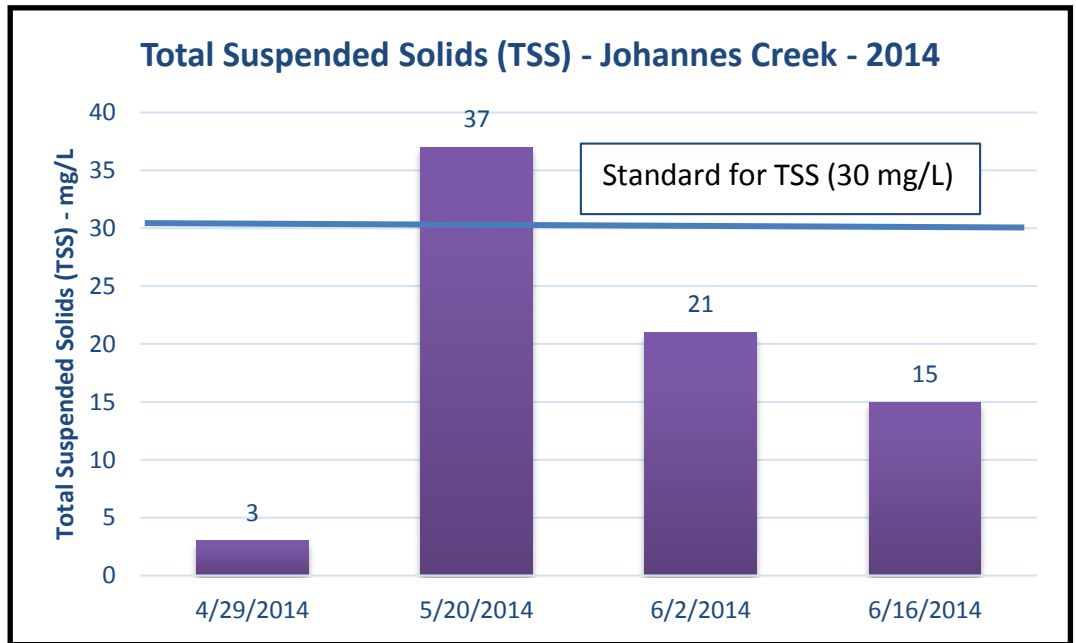
Total Phosphorus (TP) - Johannes Creek - 2012-2014



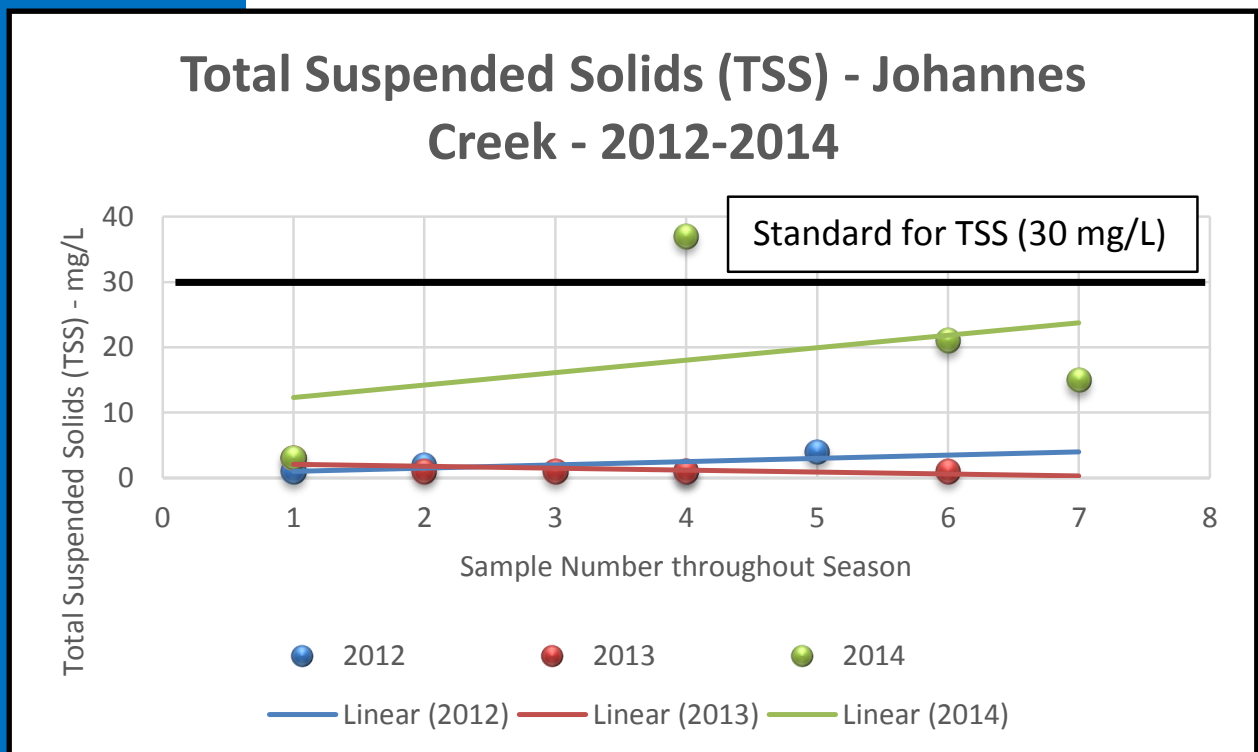
Johannes Creek

Total Suspended Solids (TSS)

The new TSS standard for the Central River Nutrient Region is 30 mg/L. This is the standard shown in the figure to the right. In 2014, one of the TSS samples collected in Johannes Creek exceeded the standard.



The figure below shows the total suspended solids data for Johannes Creek from 2012 through 2014. Looking at the linear trend lines for each year, the amount of total suspended solids is showing an increasing trend for two of the three years, with several samples exceeding the standard. While this trend is concerning, it is difficult to draw conclusions due to the limited size of the dataset. Expansion of the dataset has been challenging due to a lack of flow in the creek throughout the majority of the season.



Johannes Creek

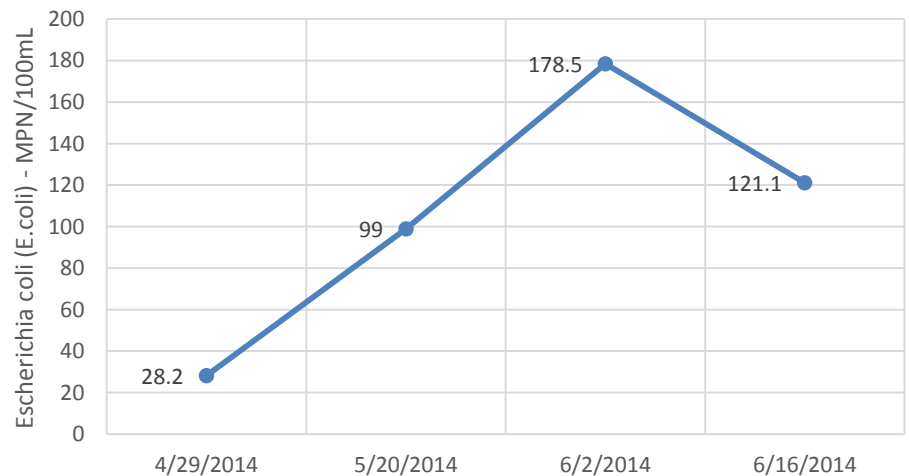
Escherichia Coli (*E.Coli*)

E. Coli is a bacteria found in surface waters that can be toxic to humans. It is found in human and animal waste and contaminates surface waters through direct surface runoff during rain events, snow melt, leaking septic systems, and manure spills. Due to the variety of ways it can contaminate surface waters, it is considered a “flashy” parameter and a large number of data points must be present to draw accurate conclusions regarding the data.

To establish a geometric mean for *E. Coli* data (which is the standard process for evaluating the data) 5 samples need to be collected over a 30 day (one month) time frame (these samples can be collected over multiple year). If the geometric mean of those samples is greater than 126 MPN/100mL, or if 10% of the samples are greater than 1260 MPN/100mL then the site would not meet state standards.

With the data collected from 2012-2014, there were only enough data points in April to complete a geometric mean for *E. Coli* in Johannes Creek. That geomean is 11.00 MPN/100mL, which is well below the standard. Looking at the *E.coli* results from other months, it is likely that the geomeans calculated in 2015 will be higher.

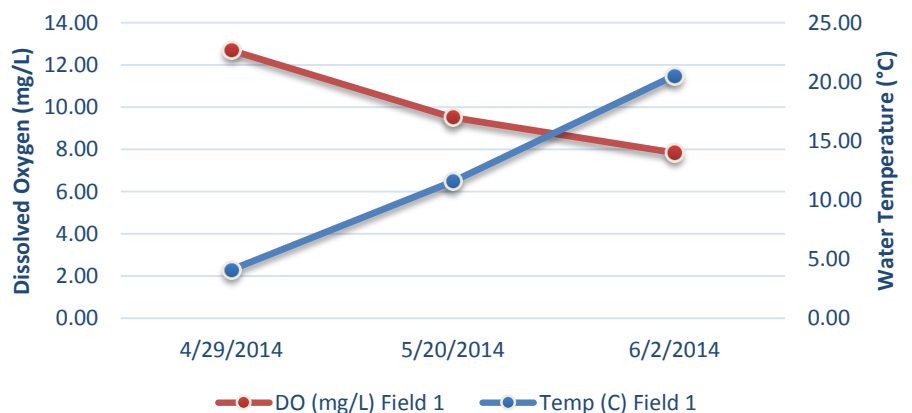
Escherichia coli (E.coli) - Johannes Creek - 2014



The above graph shows the *E. Coli* sample results for Johannes Creek in 2014. The large variation between sample results and the fact that staff was unable to collect samples for a large portion of the season due to stagnant water makes it difficult to draw conclusions based on this small data set.

Below is a graph showing the dissolved oxygen and temperature readings collected on Johannes Creek. Dissolved oxygen is the amount of oxygen dissolved in the water that is readily available for fish and other aquatic organisms. Temperature can directly influence the amount of dissolved oxygen present.

Dissolved Oxygen and Temperature - Johannes Creek - 2014



Summary of Johannes Creek

Based on the data collected in the 2014 monitoring season, Johannes Creek has several samples that exceeded the standards for water quality for total phosphorus, and one for total suspended solids. As explained previously, *E. Coli* is a sensitive parameter to analyze, so more data points will be needed to provide analysis on those samples.

Despite the fact that Johannes Creek has several samples that exceed standards, it is difficult to draw conclusions due to the lack of flow, and thus lack of samples, for the majority of the monitoring season.

Recommendations for Future Monitoring

- Continue sampling for chlorophyll a and total phosphorus on Grand Lake.
- Keep the rest of the monitoring plan for Grand Lake the same.
- Continue sampling for total phosphorus, total suspended solids, and *E. Coli* on Ploof's Creek South and Johannes Creek.
- Designate volunteers to be trained by SRWD staff to take samples during rain events. This will increase the likelihood of these samples being collected as it has been difficult for SRWD staff to get to these sites during the initial flush of a rain event.
- Continue discharge/flow measurements when conditions allow.

Contact Us

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IMPORTANT REMINDERS

THE DATA AND RECOMMENDATIONS INCLUDED IN THIS REPORT ARE BASED ON THE 2012-2014 MONITORING SEASONS. IT IS IMPORTANT TO REMEMBER THAT THIS DATASET IS NOT A COMPLETE PICTURE OF ALL CONDITIONS.

PLEASE CONTACT SARAH JO, MONITORING COORDINATOR AT THE SAUK RIVER WATERSHED DISTRICT, WITH ANY QUESTIONS OR CONCERNS REGARDING THE INFORMATION PRESENTED IN THIS REPORT.