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Emerald Lakes Village, Oakland County *January 8th, 2018*

Walker Lake - Water Quality Report

The goal of this testing protocol was to monitor various water quality parameters of the lake, compare results to historical data, and identify any potential risks to the health of Walker Lake. Water samples were taken from the middle of the lake and tested for various parameters. Field tests and water samples were taken on July 19th, 2017. This report describes conditions at the times the samples were taken. The quality of the water was tested only to the parameters listed below.

Parameter	July 19th, 2017	Target Range
Temperature	80.2 ˚F	Less than 75 ˚F
Dissolved Oxygen	6.6 mg/L	4.0 – 12.0 mg/L
Total Phosphorus	100 ppb	0 – 100 ppb
Phosphate	40 ppb	0 – 100 ppb
Nitrate	352 ppb	0 – 1,000 ppb
Chlorophyll-α	5.7 ppb	0 – 7.3 ppb
Transparency	2.5 feet	More than 6.5 feet
pH	7.9	7.0 – 9.0 S.U.
Total Dissolved Solids	324 ppm	0 – 1,000 ppm
Conductivity	639 µS	0 – 1,500 µS
Alkalinity	124 ppm	0 – 250 ppm
Hardness	157 ppm	100 – 300 ppm
Total Salinity	270 ppm	0 – 500 ppm
Chloride	117 ppm	0 – 230 ppm
Trophic State Index – Total Phosphorus	71	Oligotrophic: 0 - 40 Mesotrophic: 40 – 50 Eutrophic: 50 – 70 Hypereutrophic: 70+
Trophic State Index – Chlorophyll-α	48	
Trophic State Index – Transparency	64	

Depth (ft.)	Temperature Profile(˚F)	Dissolved Oxygen Profile (mg/L)	Salinity Profile (ppm)
0	80.2	6.6	270
3	79.2	6.0	270
6	78.7	5.8	270
9	78.1	5.6	280
12	76.8	5.5	280

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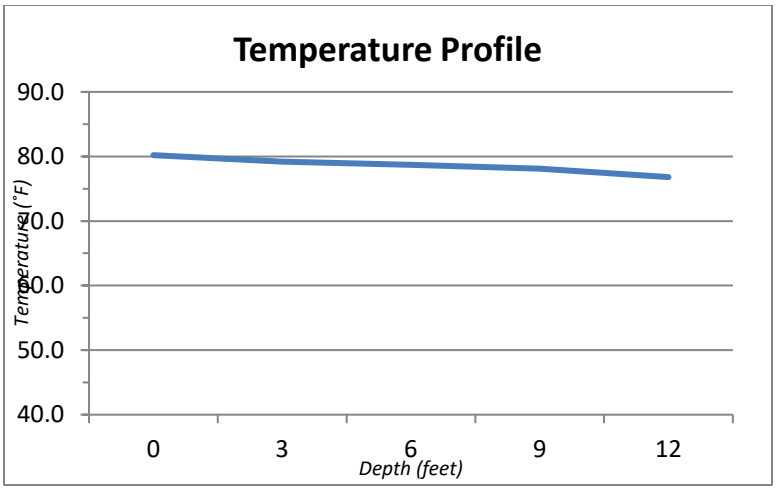

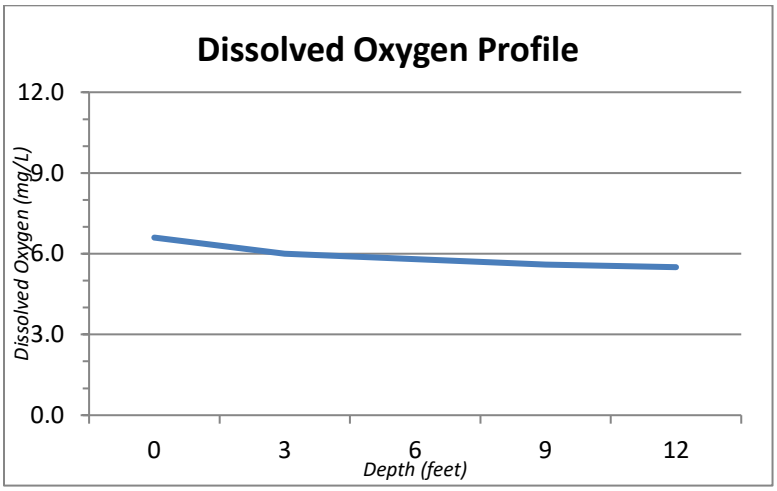

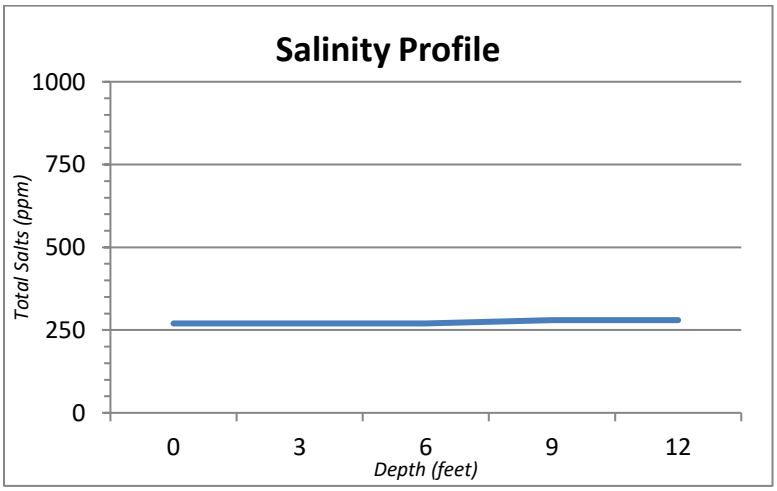

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Discussion

2017 air temperatures were above average with low precipitation. These factors increased the water temperature in Walker Lake. The warmer water was great for swimming, but it also couldn't hold as much oxygen as cold water. Despite the warmer temperature, the dissolved oxygen was abundant from surface to bottom. There was plenty of oxygen for a healthy ecosystem, including the fishes.

Phosphorus, phosphates, and nitrates were all within the target ranges. Keeping these nutrients low will help keep plants and algae from growing worse. To ensure more nutrients do not enter the lake, residents should examine their need for fertilizers, use a liquid fertilizer, and leave a buffer zone of unfertilized lawn along the lake edge.

Chlorophyll, which indicates plant production, was within its target range. The transparency of the lake was lower than the target range, due mostly to the turbidity in Walker Lake.

Trophic State Indices are used to standardize water quality data as an aid to the comparison and categorization of lakes. The three most common indices are calculated using total phosphorus, chlorophyll, and transparency. Each index is unique and they should never be averaged. Rather, the relationship between these three indices can provide insight to the condition of the lake.

The TSI for phosphorus showed the lake as being highly productive, because of the amount of nutrients available in the water column. However, the TSI for chlorophyll showed the lake to have moderate productivity, based on the actual concentrations of chlorophyll. Furthermore, the TSI for transparency confirmed the lake was not as productive as the nutrients suggested. The transparency was worse than the chlorophyll indicated, but this was most likely due to the turbidity of the water and not plant production.

To summarize, the lake was in very good condition regarding plant production, but has the potential to be worse because of the availability of nutrients. Without an aggressive management program, the algae and plant growth in the lake would most likely worsen.

The water chemistry parameters were all within their target ranges. These results indicated there were no major issues with the water quality. Instead, the results showed that despite a highly developed watershed, Walker Lake remained in excellent condition in 2017.

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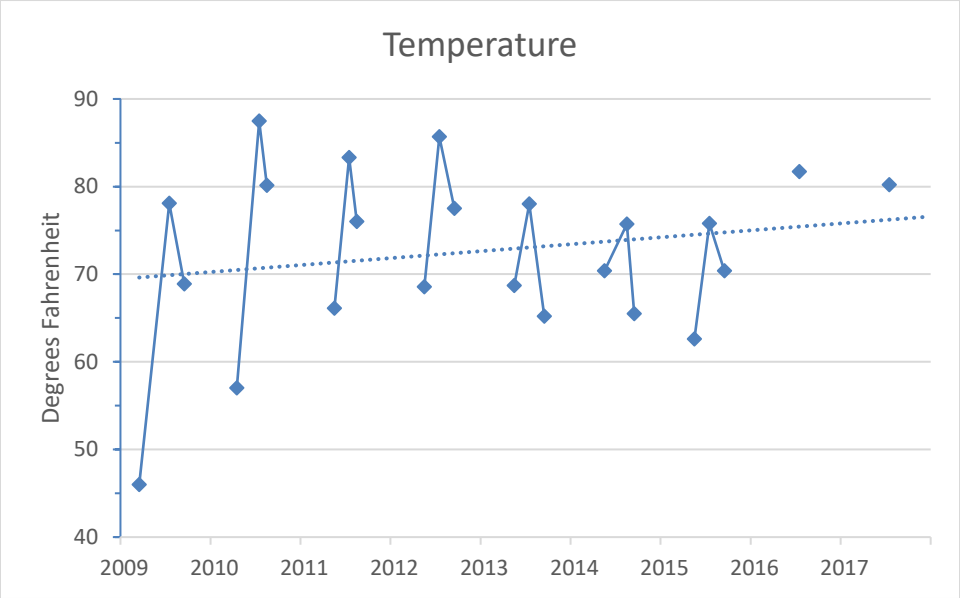
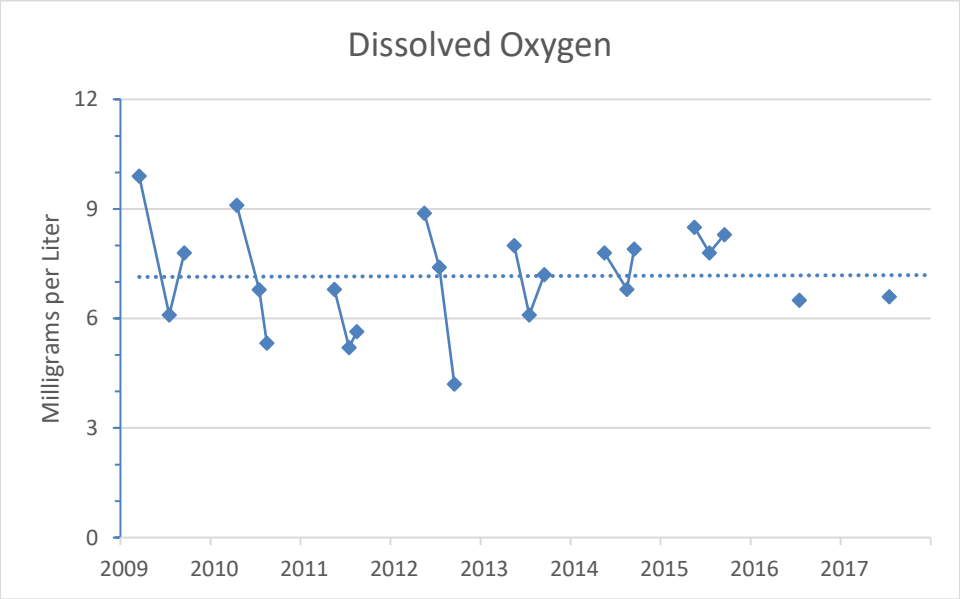
Long-Term Results

Last year, the water quality testing was reduced to a single testing event in the middle of summer. Over time, this change will affect the trends in the following graphs. For example, the water temperature is lower in spring and fall, so using only the summer water temperature will pull the trend upward faster than before.



The temperature increased slowly since our testing began in 2009. The main concern with warmer water is lower oxygen solubility, which decreases as temperature does up.



Despite increasing temperatures (and decreasing solubility), the dissolved oxygen remained steady over the testing history, showing that the ecosystem maintained enough oxygen to support the aquatic biota.

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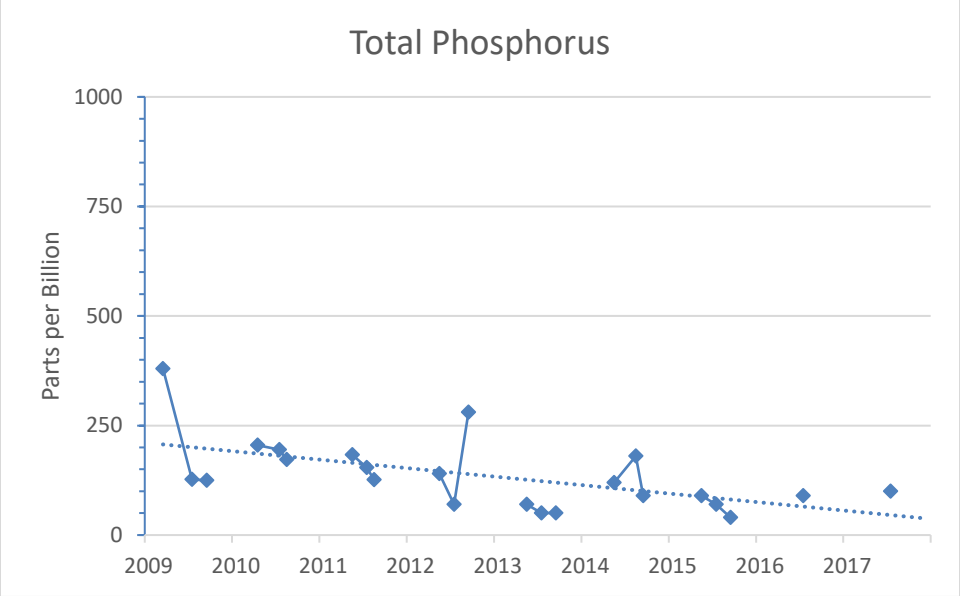
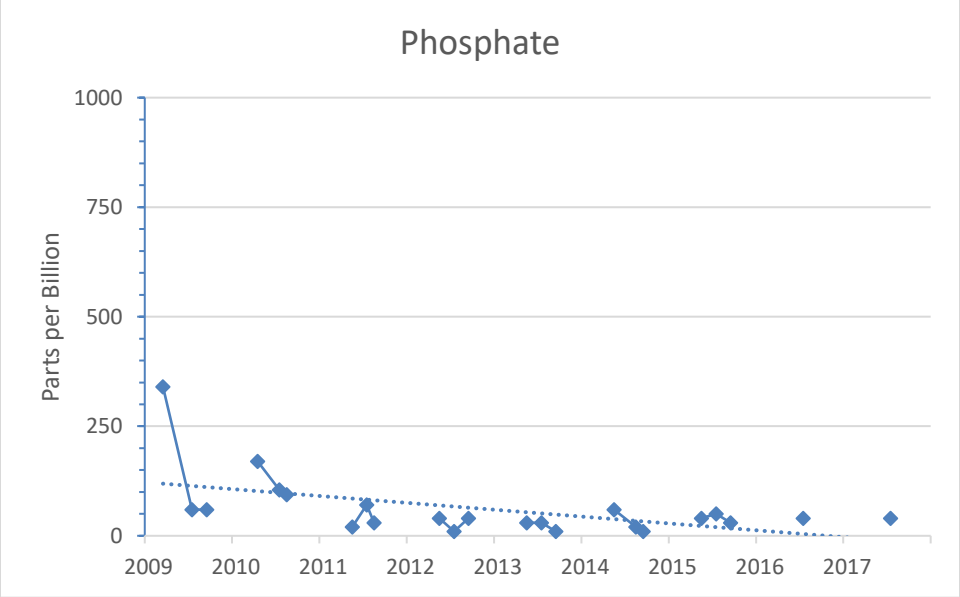


The long term trend for phosphorus is downward. The state law banning phosphorus fertilizers, proper maintenance of catch basins and storm drains, and active plant management all helped decrease the phosphorus load of the lake.



Phosphate is the form of phosphorus that is usable to aquatic plants. The concentration of this nutrient showed the same pattern as the total phosphorus and approached minimal levels in the lake.

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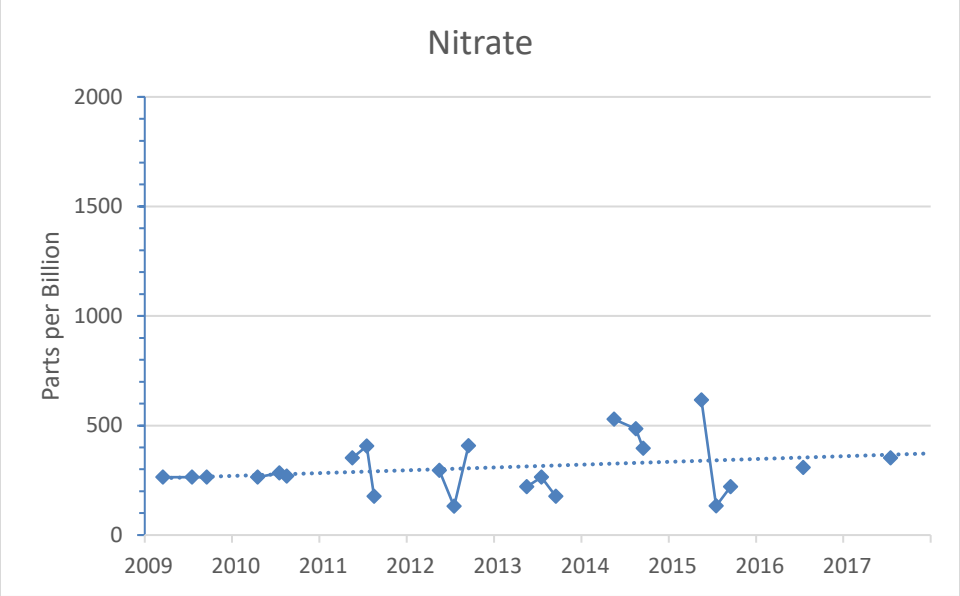
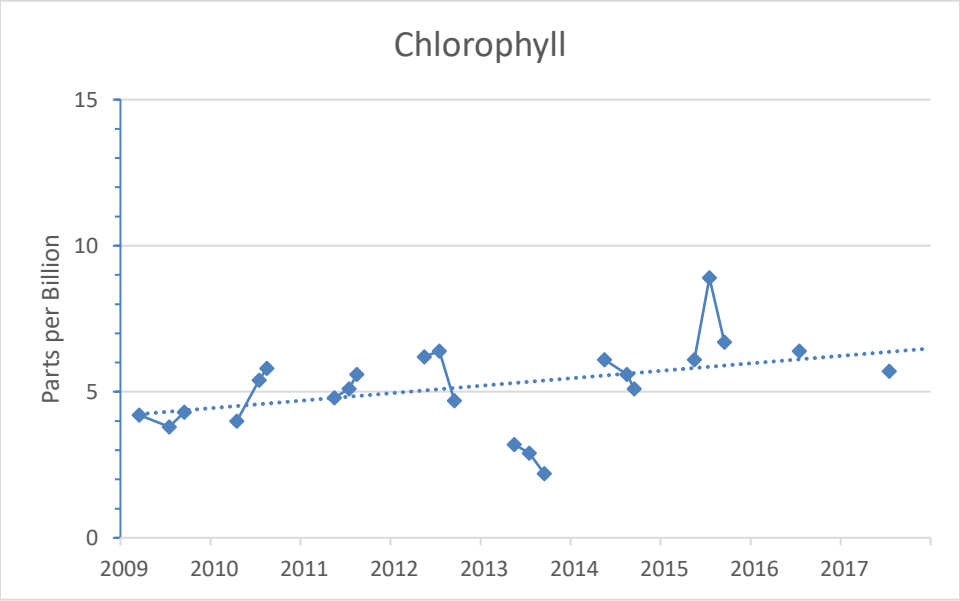


Nitrate is another vital nutrient for the growth of aquatic plants and the most abundant nutrient in lawn fertilizers. The long term trend is slightly upward. It is important that all residents in the watershed responsibly fertilize to minimize the possibility of more nitrates reaching the lake.



Chlorophyll indicates the plant production in the lake. In Walker Lake, microscopic algae and rooted planted both contribute to chlorophyll in the water. The algae grows throughout the summer and is controlled by LakePro's algicide treatments, so the chlorophyll concentrations also depend on the testing date compared to the most recent algicide application. The concentration increased over the testing history, showing the plant growth is following the nitrate concentrations. Lake vegetation surveys showed the rooted plants are also starting to grow to nuisance levels and the herbicide treatments are utilized to keep the plants below nuisance levels.

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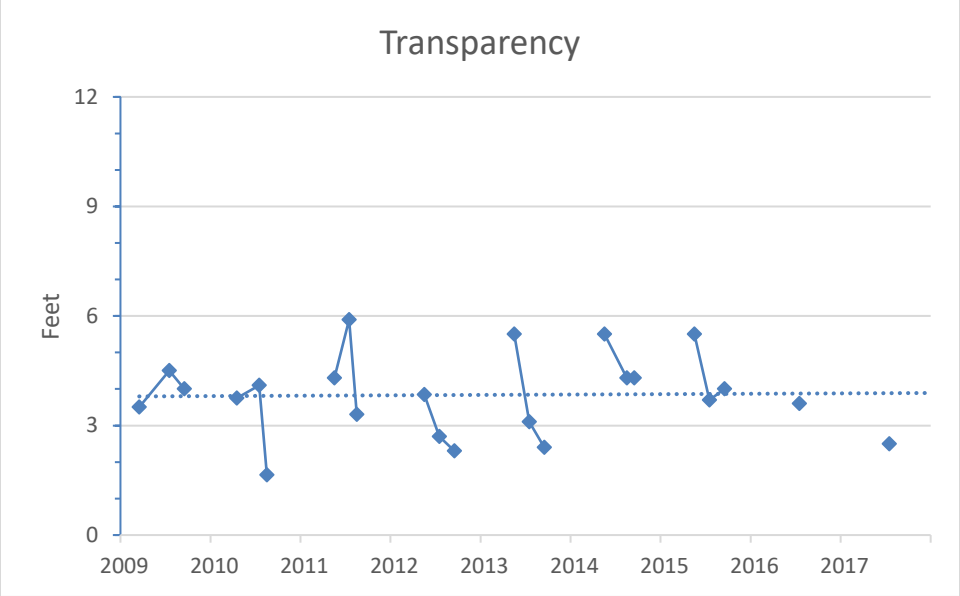
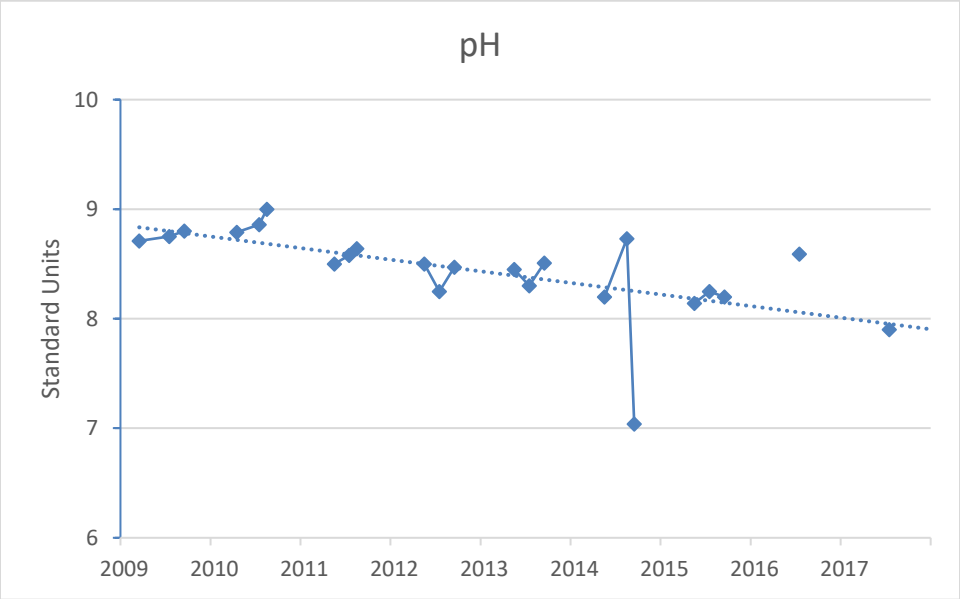


Transparency was affected by different factors including total dissolved solids, total suspended solids, algae growth, blue water dye, and rainfall. Overall, the transparency of the lake remained steady over the testing history, because it is limited due to the lake turbidity, which remains fairly constant.



The pH decreased over the testing history, but it stayed in the target range of 7 to 9. We will monitor this parameter for any further decrease and investigate if the pH drops below 7.

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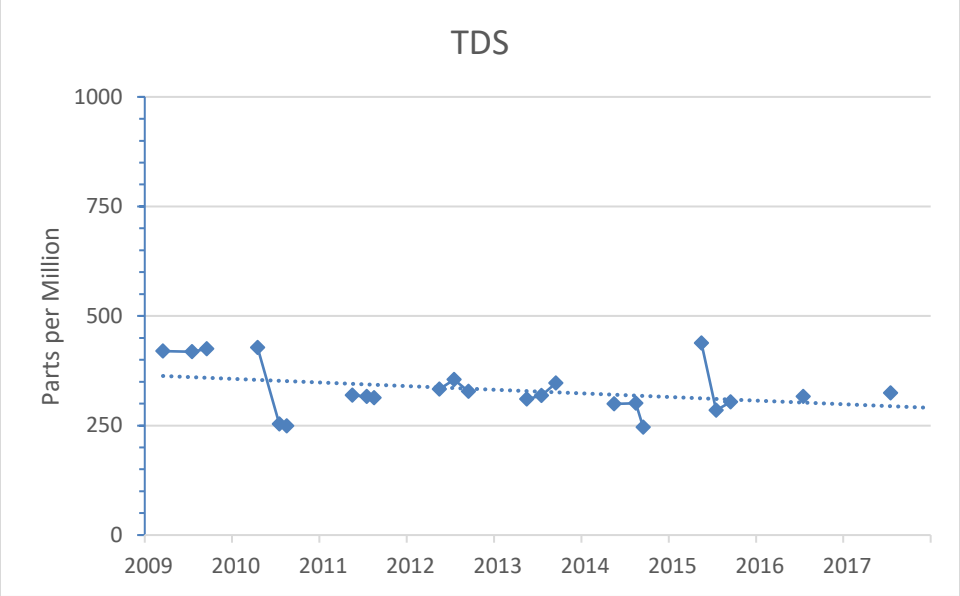
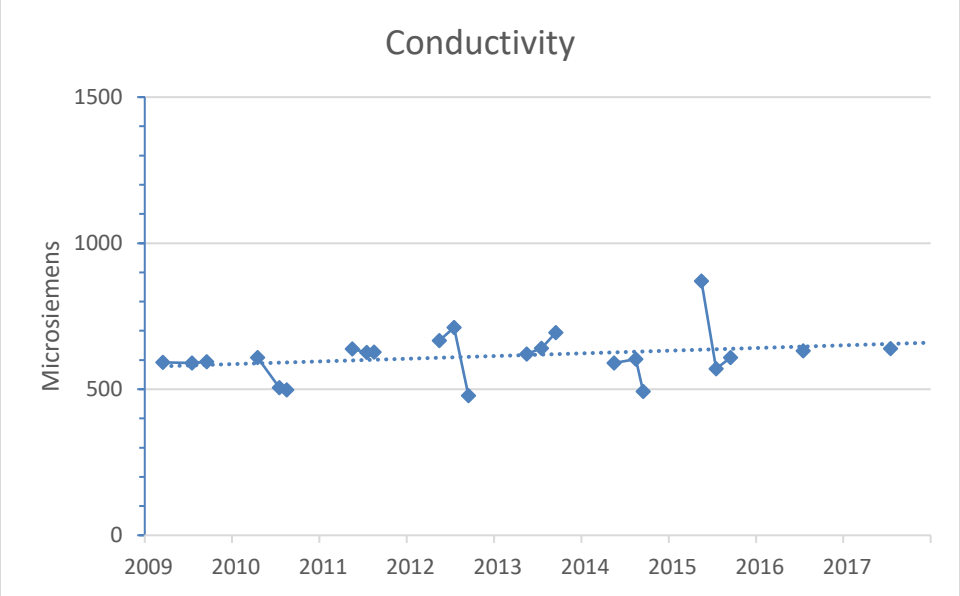


The Total Dissolved Solids decreased overall since testing began. This was a positive trend for the lake and showed that excess molecules were flushed from the lake and are being prevented from reaching the lake. The trend is starting to flatten, showing the lake is reaching a stable level of dissolved solids.



The conductivity showed a slight increase over the years of testing, with no major changes in the past four years. Compared to decreasing TDS, this shows the dissolved substances in the water are more ionic, such as salts.

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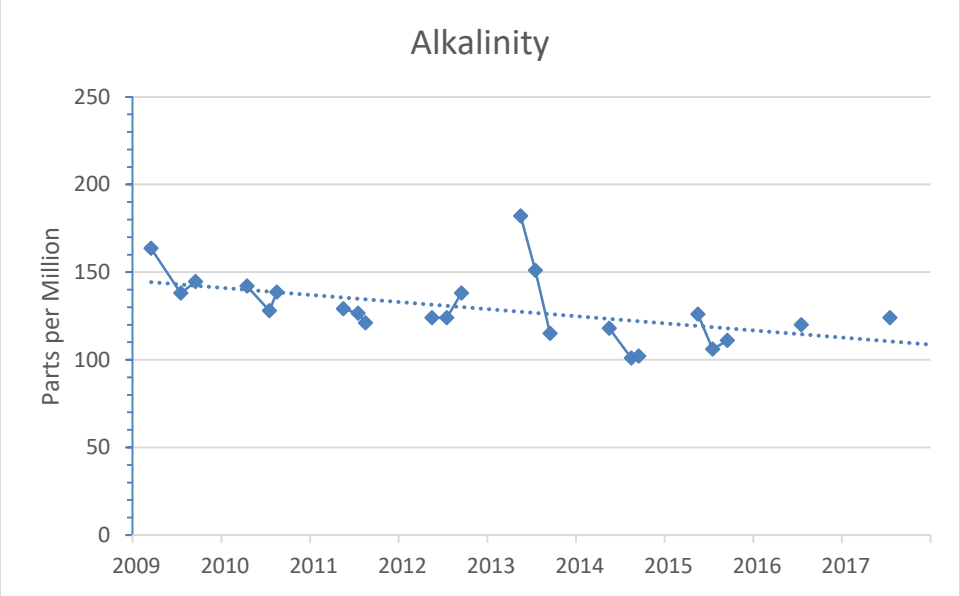
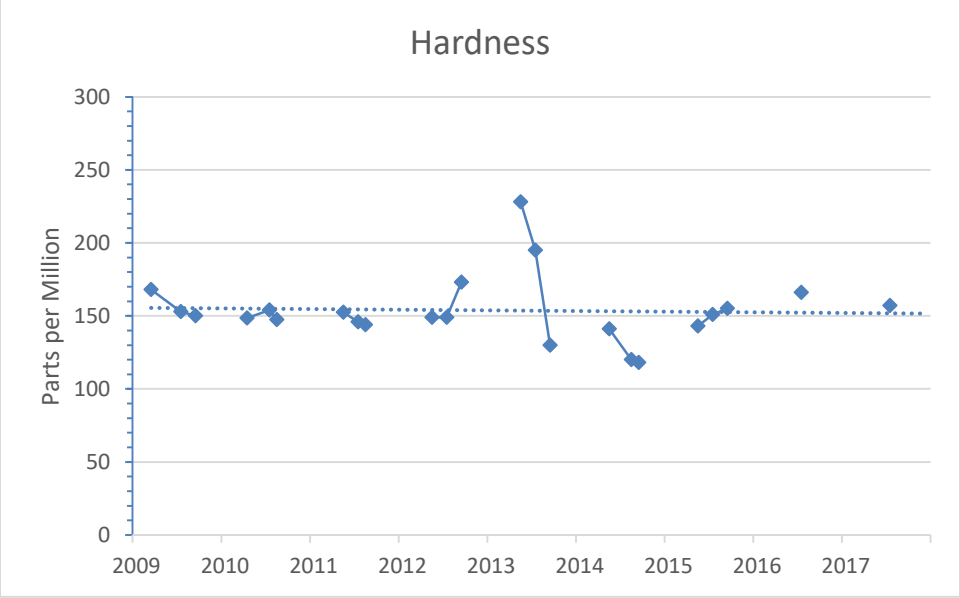
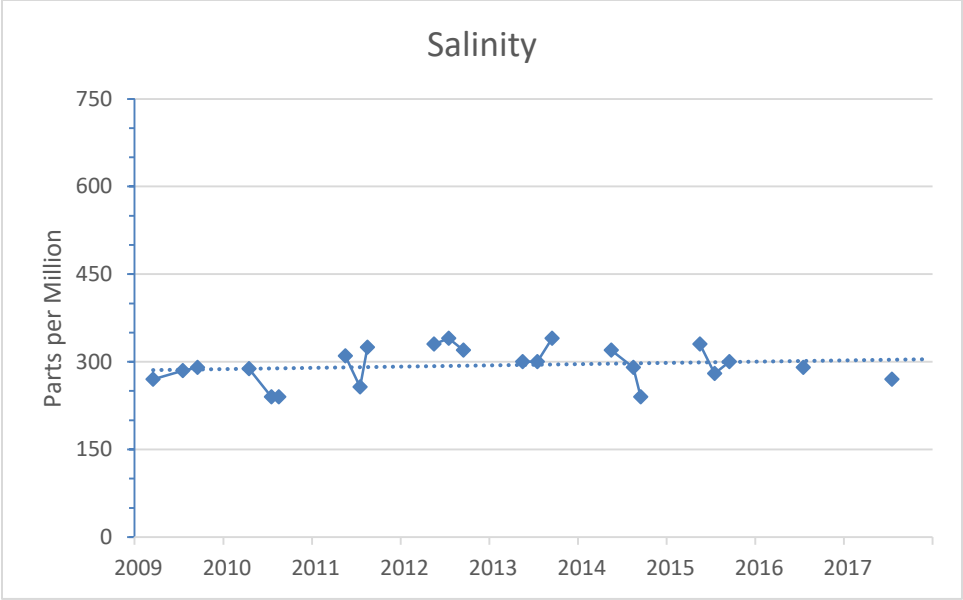


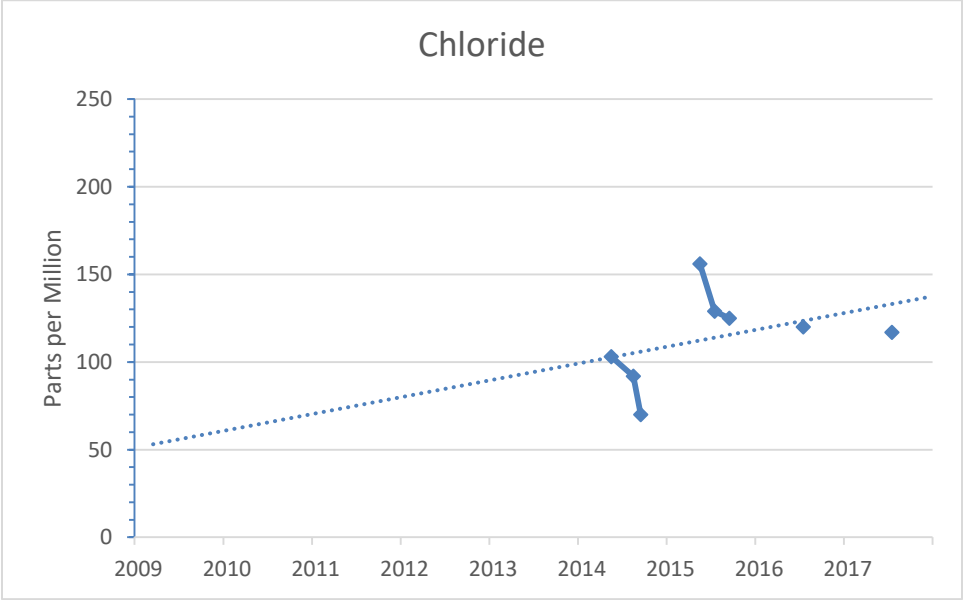
The alkalinity decreased slightly over the testing history, but remained near the middle of the target range. Alkalinity works as a buffer to stabilize the pH when foreign substances enter the lake, such as acidic rainwater.



While alkalinity measures the acid neutralizing capacity, mainly in the form of carbonate, hardness measures the polyvalent cations, such as calcium ions. Since one of the most commons salts in the water is Calcium Carbonate, hardness generally followed alkalinity.



The salinity increased since testing began, following the conductivity. This raises a question as to the additional salts and their source. The primary salt of concern is road salt, which contains chloride, and can be harmful to the aquatic ecosystem.



Chloride is the anion component of many different salts, the most common of which is Sodium Chloride. Some chloride will be present in ground and surface water, but elevated levels are indicators of pollution. One source of Chloride loading is road salt, which enters the lake in the spring as the snow and ice melts off the roads and drainage ditches. For that reason, Chloride is usually highest in the spring and decreases throughout the summer as it is flushed from the lake. Chloride increased slightly over the four years of testing, but remained within the target range.

Walker Lake is in the only lake in ELV that shows an increase of chloride, potentially because of road salts. As we gather more data in future years, we will see if the increase is sustained and needs to be addressed.

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Summary & Conclusion

The water quality of Walker Lake was very good this summer. The only parameters not in the target range were temperature and transparency. The temperature was of little consequence, because the dissolved oxygen remained healthy. The transparency remained low due to the turbidity. Due to the low water clarity, swimmers should be very cautious because they may not be able to accurately judge depth or see underwater obstructions.

The graphs and included trend lines above show that the overall water quality of the lake improved since testing began. The temperature has trended upward creating concerns about oxygen solubility. The temperature cannot be manipulated and, despite the increase, the dissolved oxygen remained steady over the same time.

The phosphorus and phosphate showed long-term decreases, which was great for the lake. The nitrate increased over the testing history, followed by the chlorophyll concentrations. Despite the increasing chlorophyll, the transparency remained steady, limited only by the turbidity.

Finally, the water chemistry parameters were all within their target ranges. The conductivity, salinity, and chloride showed long term increases, raising a concern about increasing road salts entering the lake. We will continue to monitor the chloride for further increases.

Despite a highly developed watershed, Walker Lake is a valuable water resource with great water quality. There will always be areas that the quality of the water could improve, but Walker remains among the best that we test. Emerald Lakes Village should take pride in this lake and continue your hard work in improving it.

Completed and Certified by: _____ Date: January 8th, 2018

Peter Filpansick, B.S.
Aquatic Biologist