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AQUATIC ENHANCEMENT PROFESSIONALS
9353 Hill Road, Swartz Creek, Mi 48473 810 635-4400 810 635-4404 www.lakeproinc.com

Orange Lake

Oakland County

Test Date: May 9th, 2011

Water Quality Test Results

Parameter	West End	East End	Target Range
Temperature	64.0 ˚F	64.4 ˚F	Less Than 80 ˚F
Transparency	6.4 feet	3.5 feet (Water too shallow for complete measurement)	More than 6.5 Feet
pH	8.92	9.15	7.0 – 10.0 S.U.
Total Dissolved Solids	624 ppm	616 ppm	0 – 1,000 ppm
Conductivity	862 µS	856 µS	0 – 1,500 µS
Alkalinity	185.5 ppm as $CaCO_3$	188.0 ppm as $CaCO_3$	0 – 250 ppm
Hardness	204.0 ppm as $CaCO_3$	209.5 ppm as $CaCO_3$	100 – 300 ppm
Salinity	364 ppm	372 ppm	0 – 500 ppm
Dissolved Oxygen – Concentration	8.6 mg/L	8.9 mg/L	4.0 – 12.0 mg/L
Phosphate	39.0 ppb	42.0 ppb	0 – 100 ppb
Nitrate	268.0 ppb	274.0 ppb	0 – 1,000 ppb
E. coli	None Detected	None Detected	0 – 300 CFU / 100 mL
Trophic State Index – Transparency	50	Water too shallow for complete measurement	Oligotrophic: 0 - 40 Mesotrophic: 40 – 50 Eutrophic: 50 – 70 Hypereutrophic: 70+
Trophic State Index – Phosphate	57	58	

Discussion

These results show that the water at Orange Lake remains healthy and suitable to support natural wildlife. As there are no signs of pollution, the water is safe for recreational uses, such as fishing and swimming.

The **pH, Total Dissolved Solids, Conductivity, Alkalinity, and Hardness** readings have varied slightly since last fall. These variations are the results of large amounts of runoff entering the lake. As the rains slow and the lake settles, these parameters will also settle to their natural levels.

The **Salinity** concentration has also decreased since the fall. Usually during the winter and spring, excess road salt accumulates in the lake. However, the large amount of rain that has fallen is diluting the salts within the lake, slightly decreasing the salinity result.

The **Dissolved Oxygen** is at adequate levels and show that the water remains suitable for a healthy fish population to survive. As water warms, it is able to hold less oxygen than at cooler temperatures. It is important to ensure the water is well oxygenated during the warmest summer months.

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The concentrations of **Nitrates and Phosphates** continue to remain at very low levels, continuing to prove that the large decreases since 2009 were not seasonal fluctuations. These results confirm that the Biological Augmentation is consuming enough nutrients to improve and maintain the health of the lake.

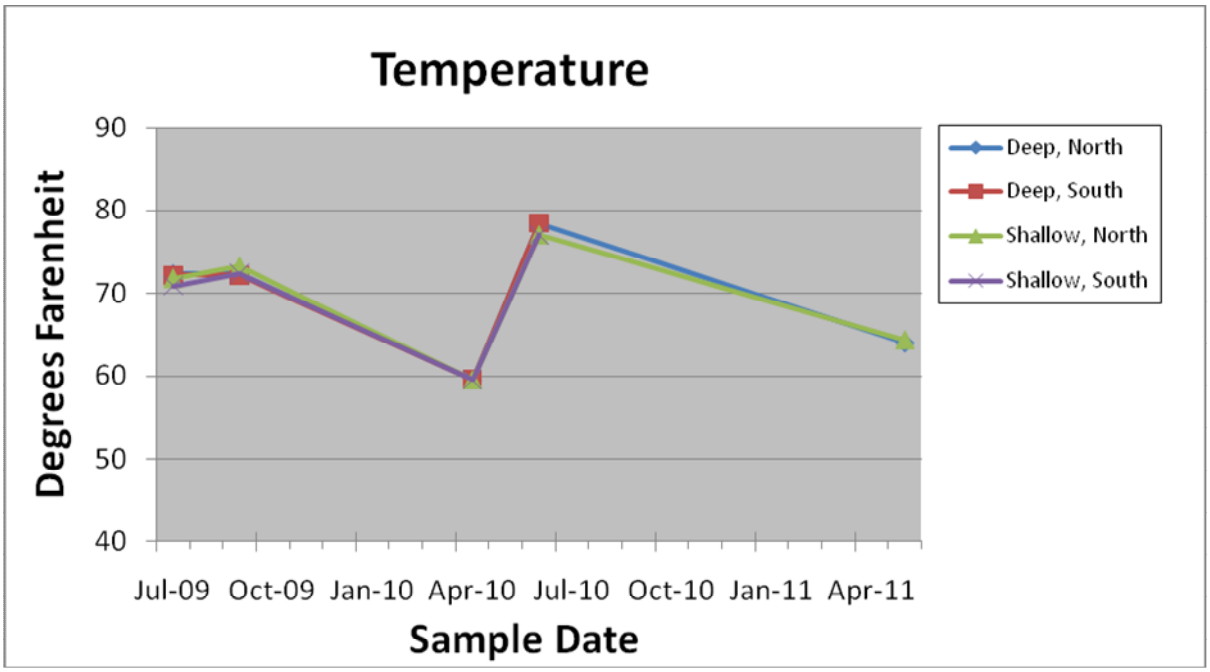
No ***E. coli*** were detected in the water samples collected. *E. coli* are very sparse in the open water. Also, the cooler temperatures and absence of waterfowl help reduce the amount of *E. coli* living in the water.

The **Trophic State Indices** show that the lake is moderately productive. TSI – Transparency uses the water clarity to approximate the amount of algae that clouds the water, but does not take into account other factors that may decrease transparency. The TSI – Phosphate indicate the amount of nutrients available to support nuisance algae growth.

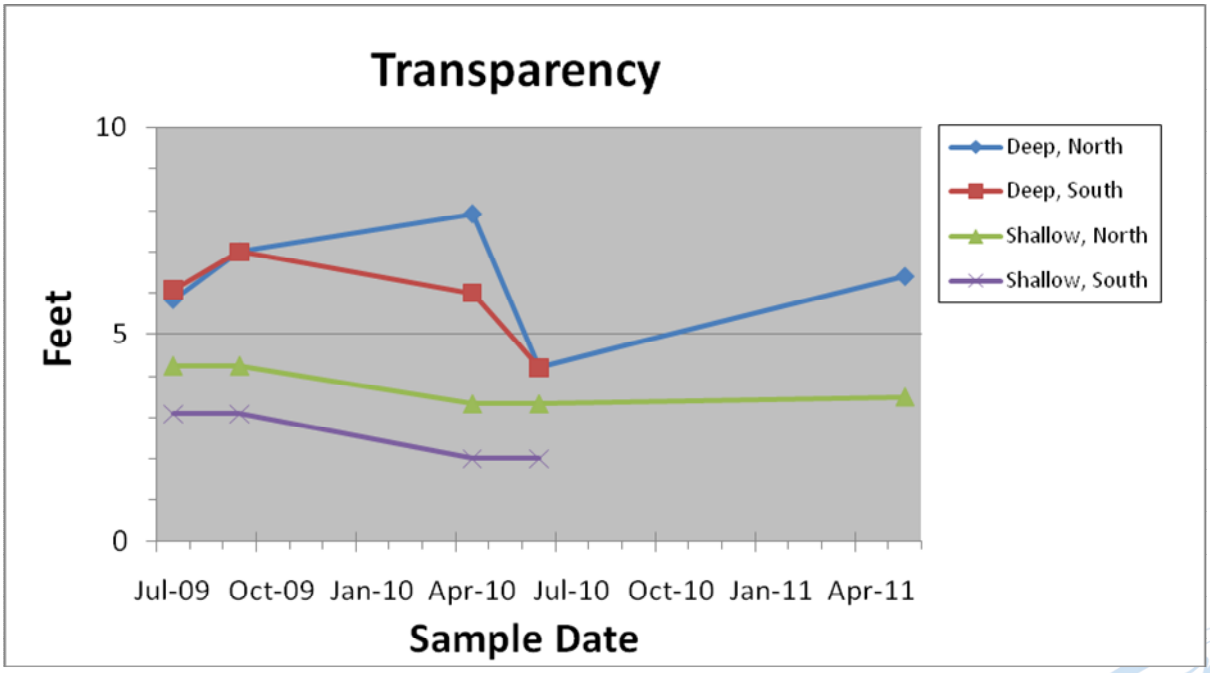
Water samples were taken on 5/9/2011 at 12:00 PM. Water tests were completed on 5/10/2011 at 7:00 AM. This report describes conditions at the time the samples were taken. The quality of the water was tested only to the parameters listed above.

Completed and Certified by: _____ Date: May 17th, 2011
Peter Filpansick , B.S.

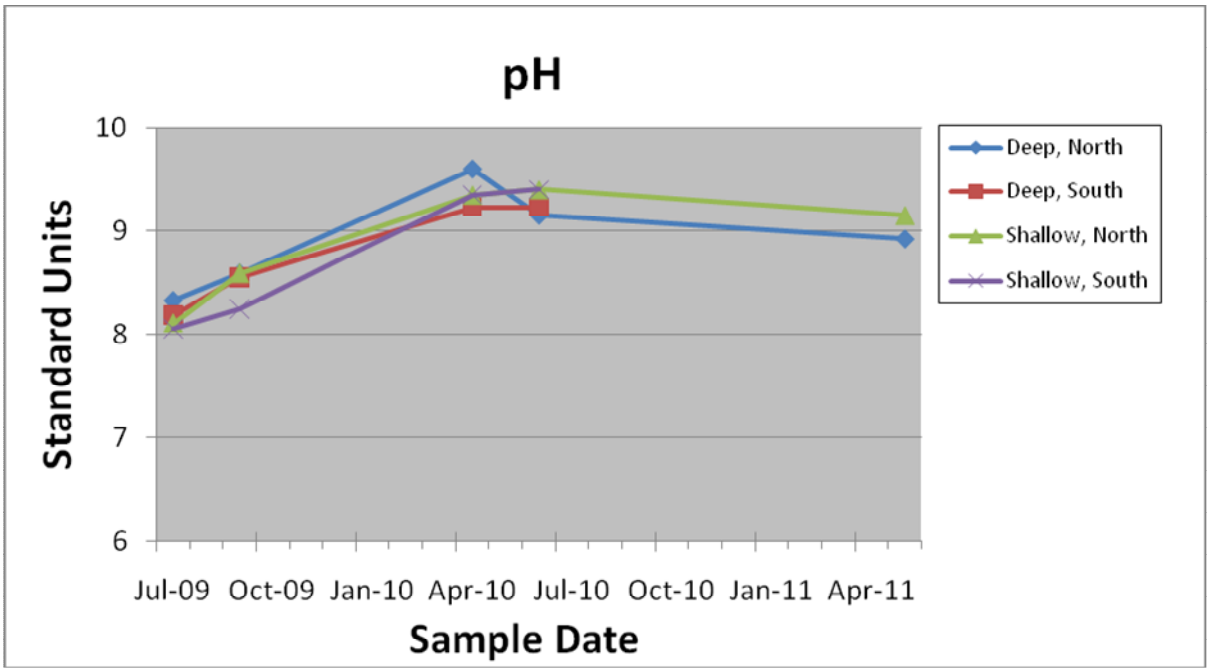
Reviewed and Approved by: _____ Date: May 17th, 2011
Paul Dominick, B.A.



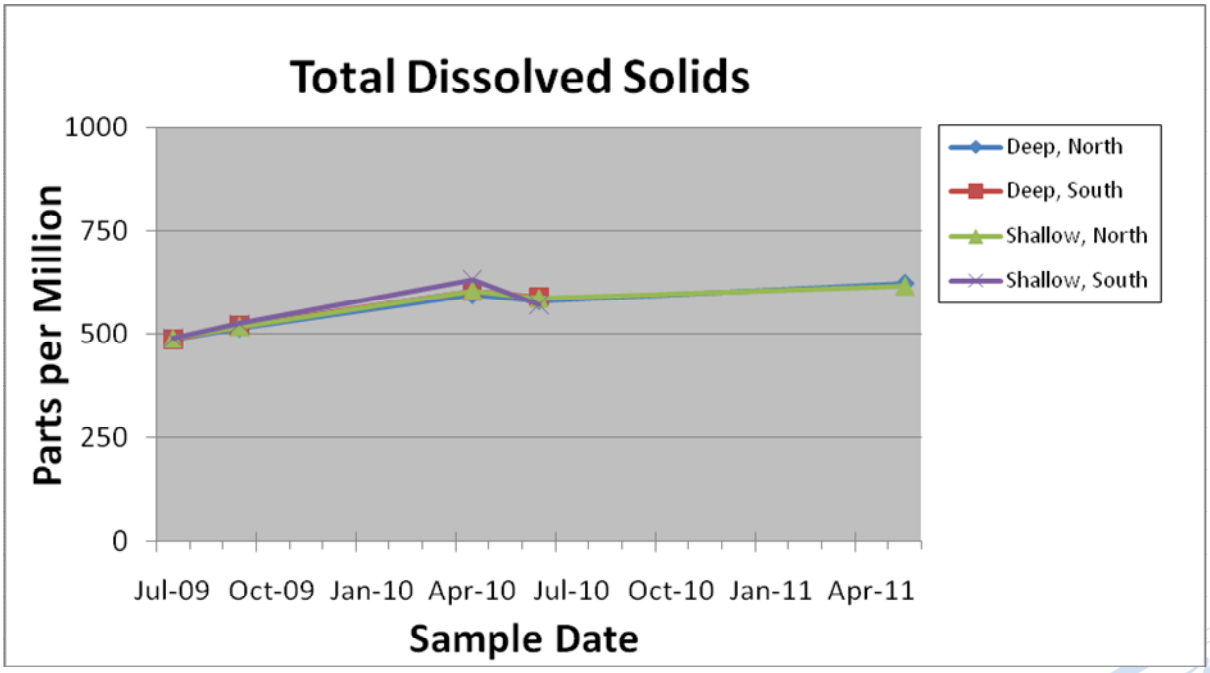
Target Range: Less Than 80 ˚F



Target Range: More than 6.5 Feet



Target Range: 7.0 – 10.0 S.U.



Target Range: 0 – 1,000 ppm

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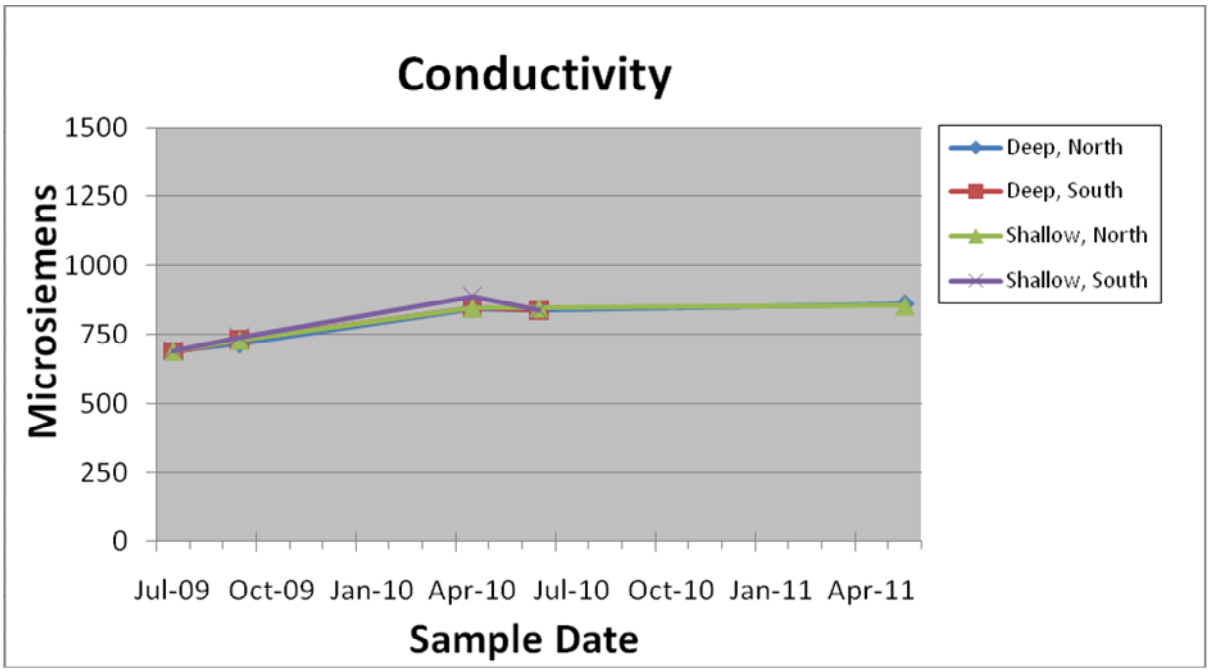
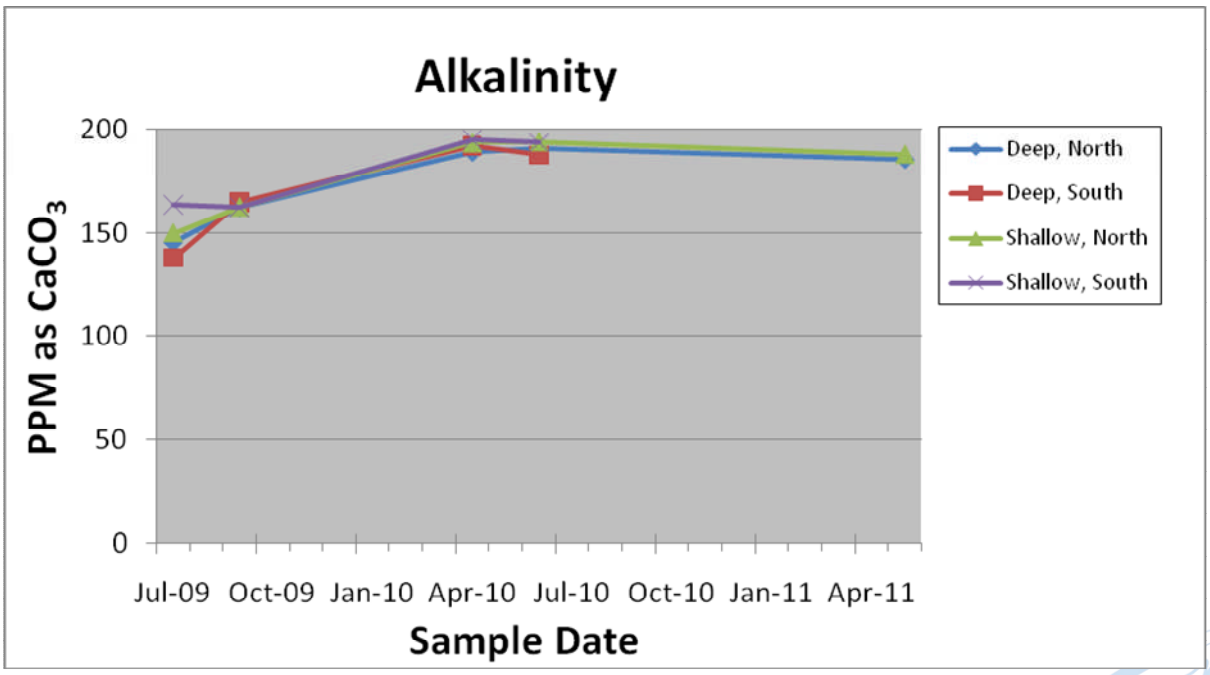
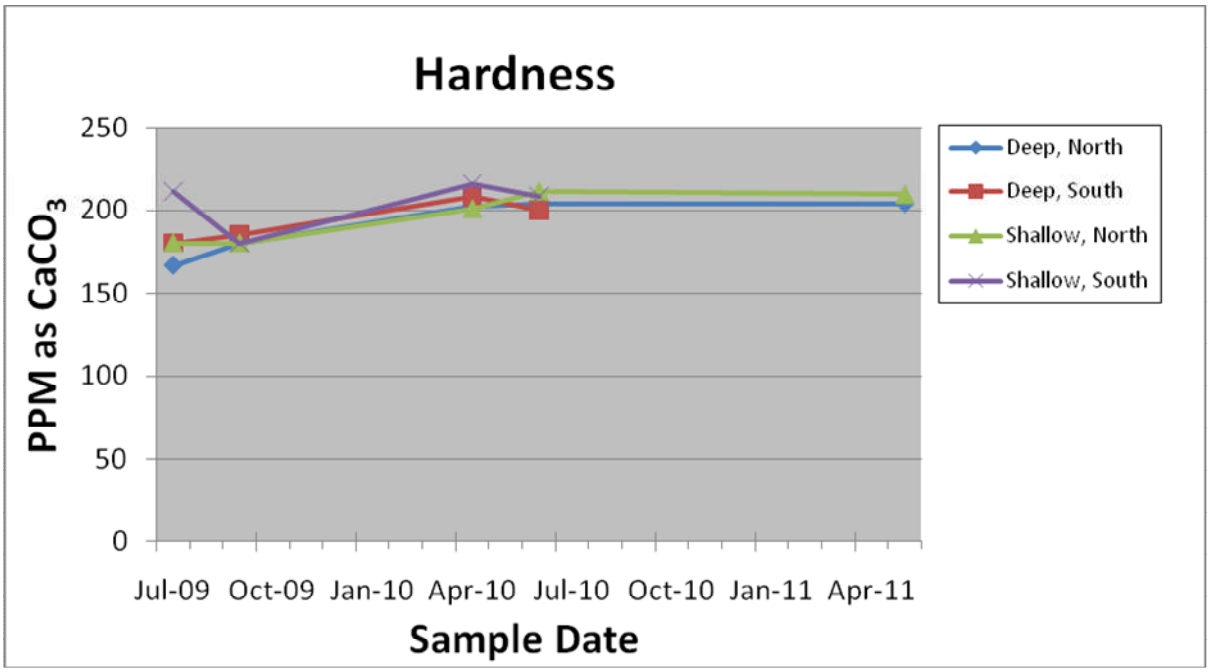


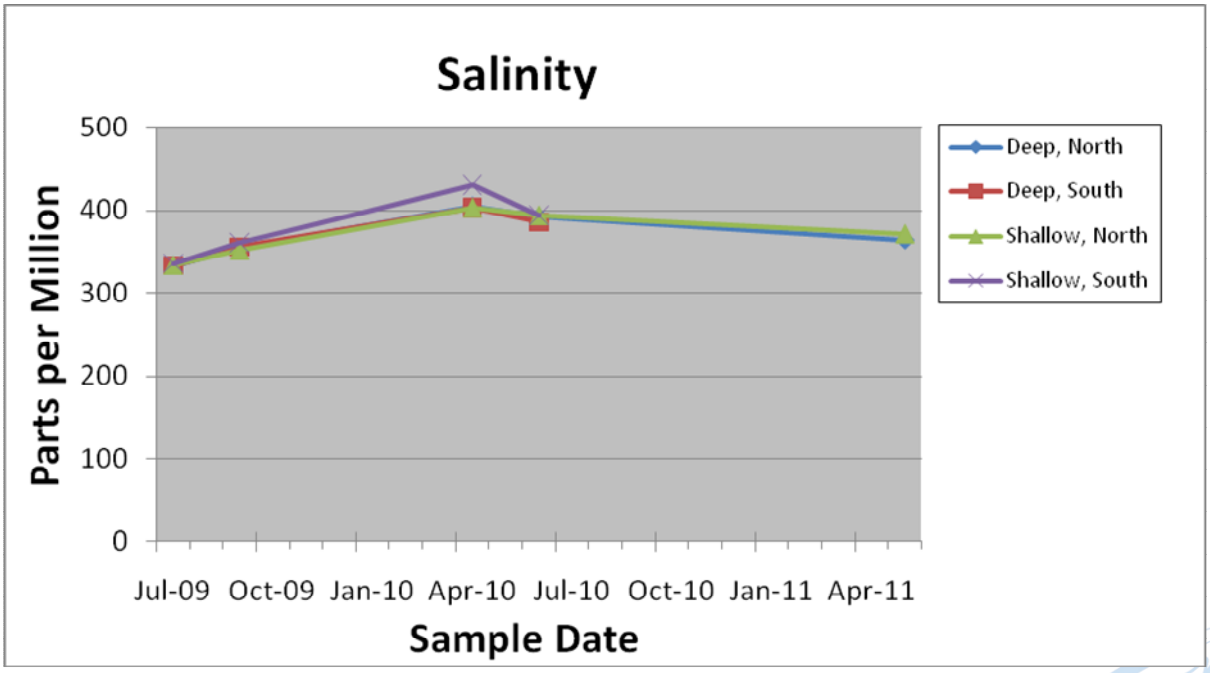
Target Range: 0 – 1,500 µS



Target Range: 0 – 250 ppm



Target Range: 100 – 300 ppm



Target Range: 0 – 500 ppm

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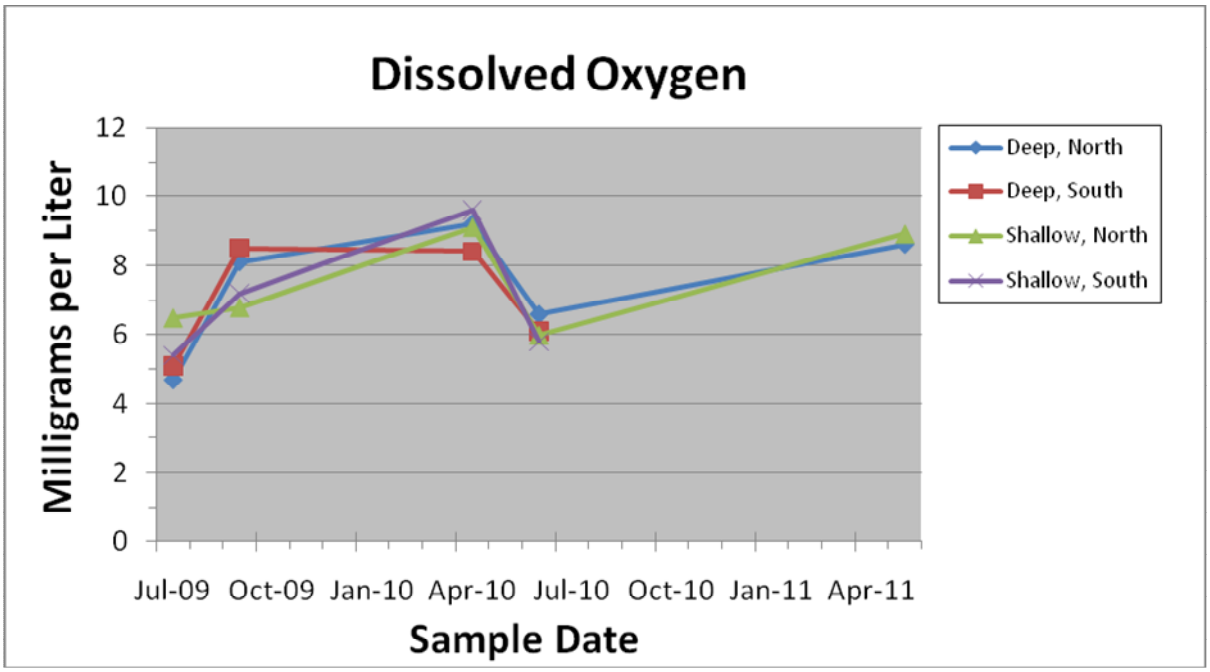
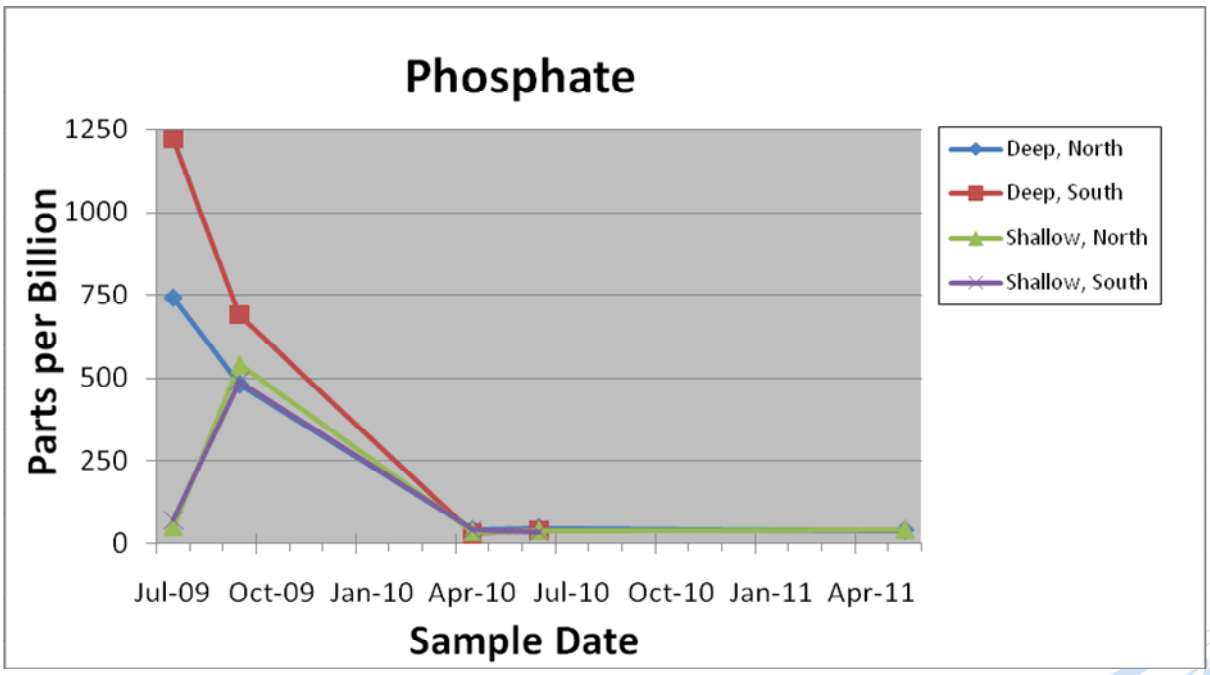
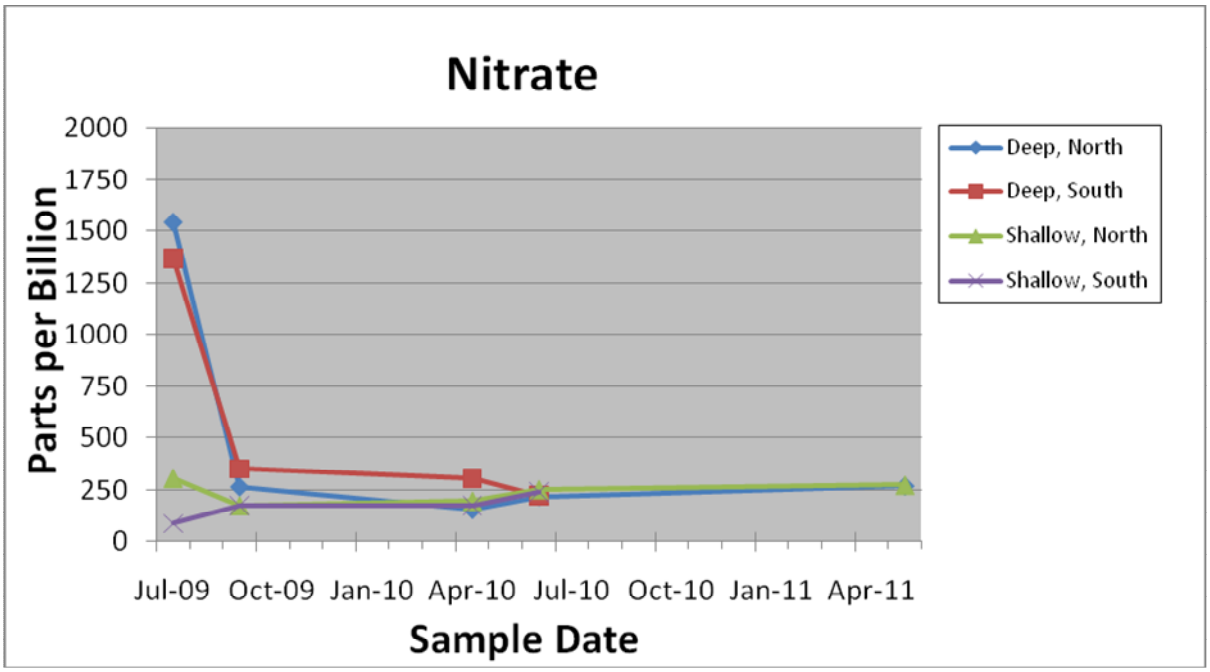


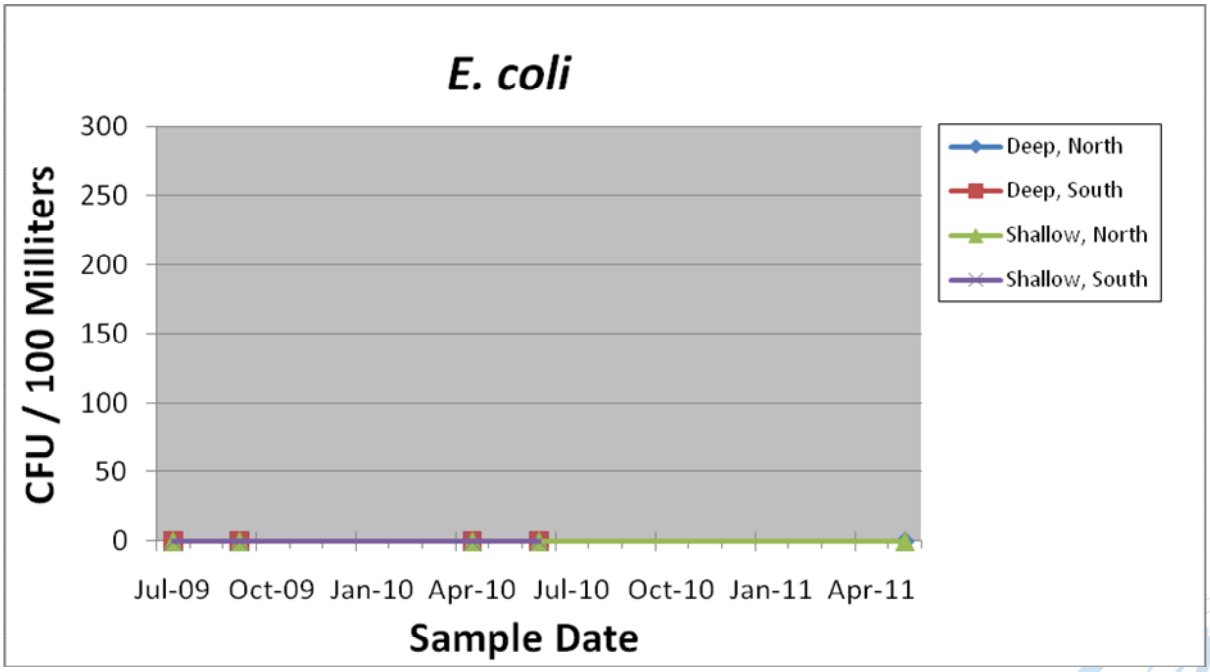
Target Range: 6 – 12 mg/L



Target Range: 0 – 100 ppm



Target Range: 0 – 1,000 ppm



Target Range: 0 – 300 CFU / 100 mL

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Analysis Information

Temperature:	The water temperature directly affects the amount of oxygen that is able to dissolve into the water. The temperature of surface waters is not indicative of the entire water column.
Transparency:	The ability of light to penetrate the water column is determined by the amount of dissolved and suspended particles in the water. Although aesthetically desirable, transparent water allows increased light to reach the lake bottom and may result in vegetation growth.
pH:	pH is a measure of acidity or alkalinity. pH is a general measure of lake health and can roughly indicate the range of other measurements such as alkalinity and hardness.
TDS:	Total Dissolved Solids is the amount of all organic and inorganic substances in the water in a molecular or ionized state. Higher values generally indicate richer and more productive water. Lower values usually indicate cleaner and less productive water.
Conductivity:	Conductivity is a measure of the ability of water to conduct electricity. Dissolved ions in the water increase conductivity, thus TDS and Conductivity are closely related.
Alkalinity:	Alkalinity refers to the ability of the water to neutralize acids, mainly through the hydrogenation of carbonate ions. This is why the alkalinity is expressed as "ppm as $CaCO_3$". However, other basic molecules in the water can also contribute to alkalinity.
Hardness:	Hardness is very closely related to alkalinity. It is a measure of the dissolved salts and metals in the water, including but not limited to $CaCO_3$.
Salinity:	Salinity is the measure of the dissolved salt content of water. Salinity influences the types of organisms that are able to survive in the water. Salinity also affects the chemistry of the water, and including conductivity and potability.
Dissolved Oxygen:	D.O. is a measure of the amount of oxygen dissolved in the water. This oxygen is available to fish and other animals for respiration. Vegetation generally increases DO, particularly during the day and early evening. Animals and other respiring organisms consume the oxygen, mostly during the day. Oxygen is also added to the lake through wave action, rain, fountains and aerators.
Phosphates:	Phosphorus is an essential nutrient for plant growth. Phosphate is the form of phosphorous that is most readily available to plants and algae.
Nitrate:	Nitrogen is also essential for plant growth. Nitrate is the predominant form of nitrogen in water. Excessive nitrate concentrations may also result in pollution and increased vegetation.
Fecal Coliforms:	Non-fecal coliforms are naturally found as soil organisms. Fecal Coliforms, such as *E. coli*, are coliforms found in the intestines of warm-blooded animals and humans. The presence of fecal coliforms indicates contamination from either animals or humans.

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Trophic States

Oligotrophic:	Water is very clear. Nutrient levels are generally low. Plant and algae productivity is also low. Sufficient dissolved oxygen in the bottom, cooler waters allows cold-water fish to survive, such as salmon and trout.
Mesotrophic:	Water is moderately clear. Nutrient levels are slightly elevated. Plant and algae productivity is present, but generally not a nuisance. Oxygen and temperature in the lower portion of the lake allow walleye and perch to survive.
Eutrophic:	Water is not clear due to high nutrients levels, increased turbidity, and excessive algal growth. There is no oxygen in the bottom, cooler waters, restricting the lake to warm water species, such as bass and bluegill.
Hypereutrophic:	Nutrient levels are extremely high, promoting very high algae productivity. Blue-green algae blooms are likely. High turbidity and algae growth make the water opaque. Little plant growth is restricted to invasive plants. The only fish that can survive this environment are rough fish, such as carp, catfish, and mudminnows.