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Orange Lake

Oakland County

Test Dates: ***May 13th, 2013***
August 5th, 2013

Water Quality Test Results

Parameter	May 13th, 2013		August 5th, 2013		Target Range
	Deep	Shallow	Deep	Shallow	
Temperature	48.2 ˚F	55.7 ˚F	77.4 ˚F	78.6 ˚F	Less Than 80 ˚F
Transparency	7.1 feet	3.6 feet	6.2 feet	2.8 feet	More than 6.5 Feet
pH	8.63	8.42	8.24	8.05	7.0 – 10.0 S.U.
Total Dissolved Solids	336 ppm	325 ppm	297 ppm	311 ppm	0 – 1,000 ppm
Conductivity	670 µS	652 µS	587 µS	619 µS	0 – 1,500 µS
Alkalinity	174 ppm	163 ppm	131 ppm	129 ppm	0 – 250 ppm
Hardness	211 ppm	201 ppm	163 ppm	155 ppm	100 – 300 ppm
Salinity	290 ppm	290 ppm	260 ppm	270 ppm	0 – 500 ppm
Dissolved Oxygen – Concentration	9.4 mg/L	8.2 mg/L	5.3 mg/L	4.5 mg/L	4.0 – 12.0 mg/L
Dissolved Oxygen – Saturation	81.0 %	77.4 %	63.9 %	55.6 %	> 40 %
Phosphate	20 ppb	40 ppb	10 ppb	50 ppb	0 – 100 ppb
Nitrate	176 ppb	176 ppb	220 ppb	308 ppb	0 – 1,000 ppb
E. coli	0 CFU / 100 mL	0 CFU / 100 mL	0 CFU / 100 mL	0 CFU / 100 mL	0 – 300 CFU / 100 mL

Discussion

The results of this year's testing indicate that the water of Orange Lake remains very healthy. The results show that the aquatic environment is very suitable to support natural wildlife. Also, the lake is safe for recreational uses, such as swimming, boating, fishing, etc., as there are no signs of pollution.

The weather so far in 2013 has been unusually cool with above average rainfall. The rainwater, whether it entered the lake as runoff or through groundwater, caused a variety of changes to your lake's water quality that are present in the results of this year's tests.

Water coming into the lake, as rain, runoff, or groundwater, cooled the lake down. Paired with the cooler temperatures, the water **Temperature** was very cool in early-May and was lower than normal in August. Generally, lower water temperatures and increased water movement lead to lesser algae growth in the lake. Also, with the cooler water temperatures, the **Dissolved Oxygen** remains at very healthy concentrations throughout the lake and can easily maintain a healthy fish population and withstand any oxygen depletion from algicide & herbicide treatments.

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The **Transparency** did not change significantly from previous years. The rainwater coming into the lake will help flush excess substances, but will also cause some sediment to mix in the lake from shoreline erosion or bottom turbulence. The transparency remains at a healthy depth for the lake.

In general, rainwater entering the lake can flush excess substances, cleaning the lake out. However, if the shoreline and surrounding land holds excess molecules, the rain can deiver these extra substances into the lake, worsening the problem. At Orange Lake, the **Total Dissolved Solids**, **Conductivity**, and **Salinity** decreased from last year. This shows that any water entering the lake as runoff is not delivering outside materials to the water.

The **Alkalinity** and **Hardness** both increased from last year. The increased concentrations also drove the **pH** slightly higher than previous years. Alkalinity and hardness increase when more calcium carbonate is in the water. The rise in these values shows that more groundwater is coming into the lake, bringing dissolved calcium carbonate from the water table. Ultimately, we can conclude that most of the rainwater this year has infiltrated the ground and enters the lake as groundwater as opposed to runoff coming over the lawns. This will help protect the lake from erosion and nutrient loading.

A major concern with heavy rainfall and developed watersheds is the greater potential of nutrients to enter the lake. This year's results show insignificant changes in **Phosphate** concentration and a slight increase in **Nitrates**. Again this shows that runoff after heavy rain is a minor contribution to the lake and the lake is not receiving major amounts of either nutrient from the watershed.

To reduce the amount of nutrients reaching the water, homeowners should continue their "lake safe" practices that may include:

- Using phosphorus-free fertilizer (it's the law!)
- Not fertilizing the 10 feet of lawn closest to the water
- Testing the lawn to confirm the fertilizer needed
- Mulching or collecting yard waste so it doesn't blow into the lake
- Collecting pet waste from the lawn
- Washing cars on the grass

E. coli were not present in the water samples collected, so the water is *safe* from fecal contamination.

Water samples were taken on May 13th and August 5th, 2013. Water tests were completed on the same day or preserved as necessary. 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: August 16th, 2013
Peter Filpansick, B.S.

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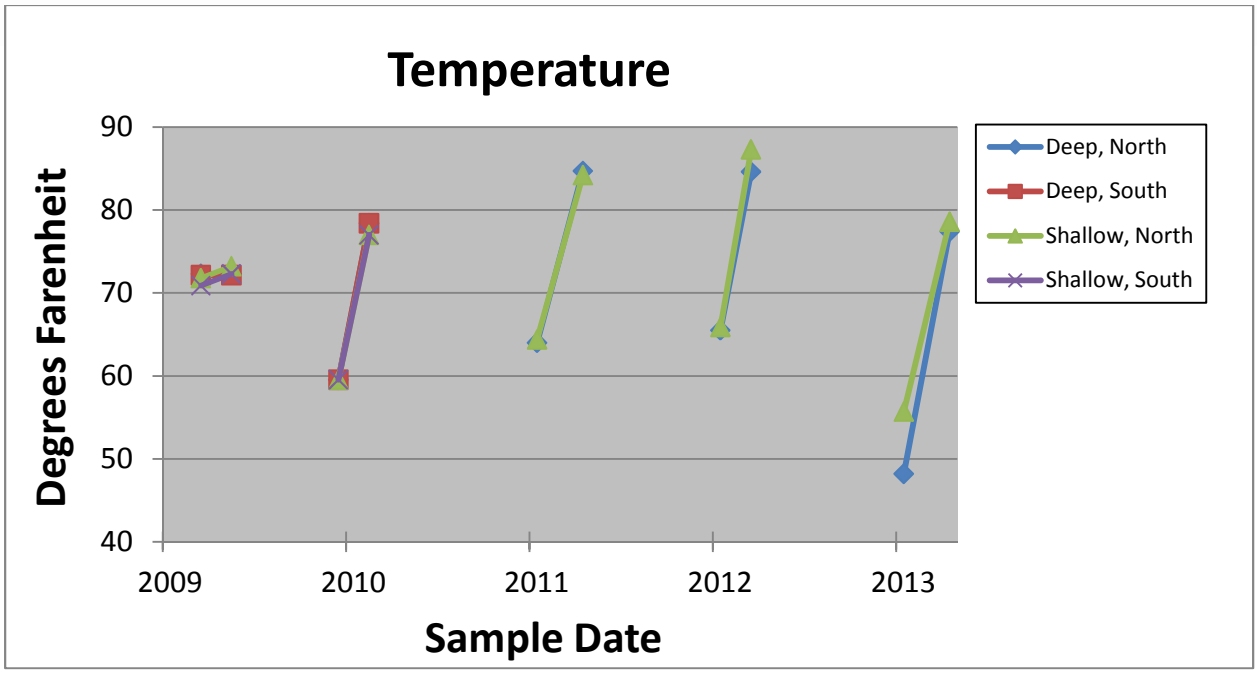
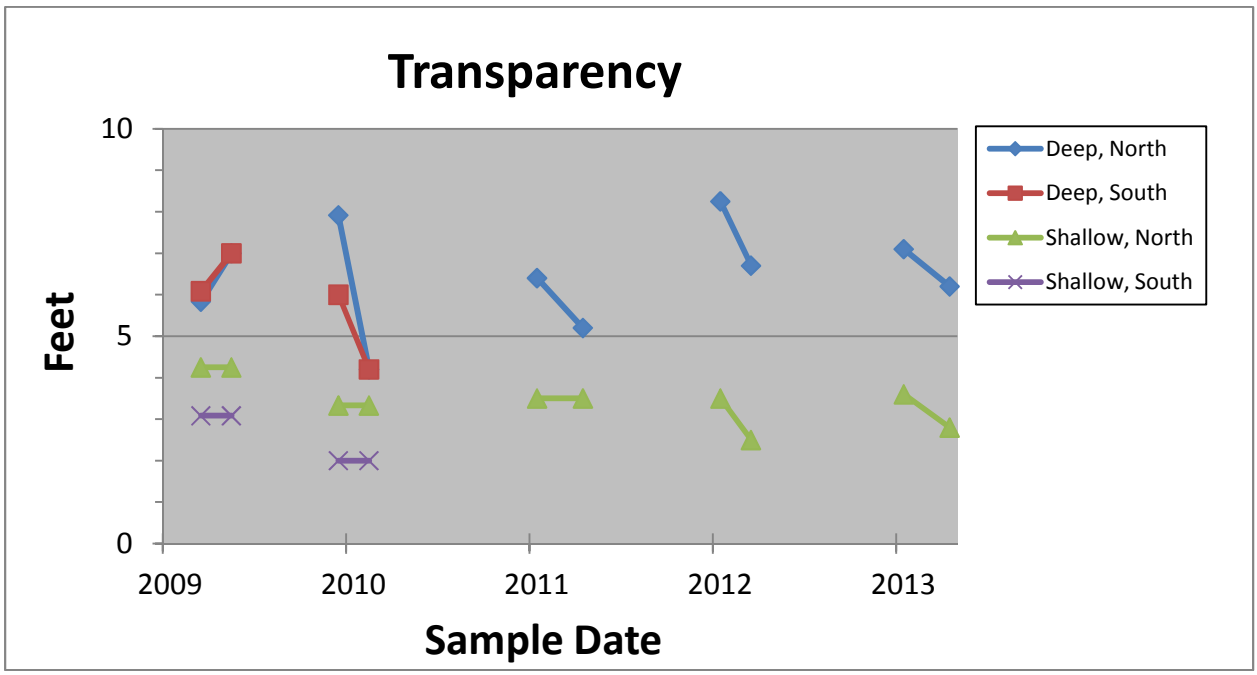


Target Range: Less Than 80 ˚F



Target Range: More than 6.5 Feet

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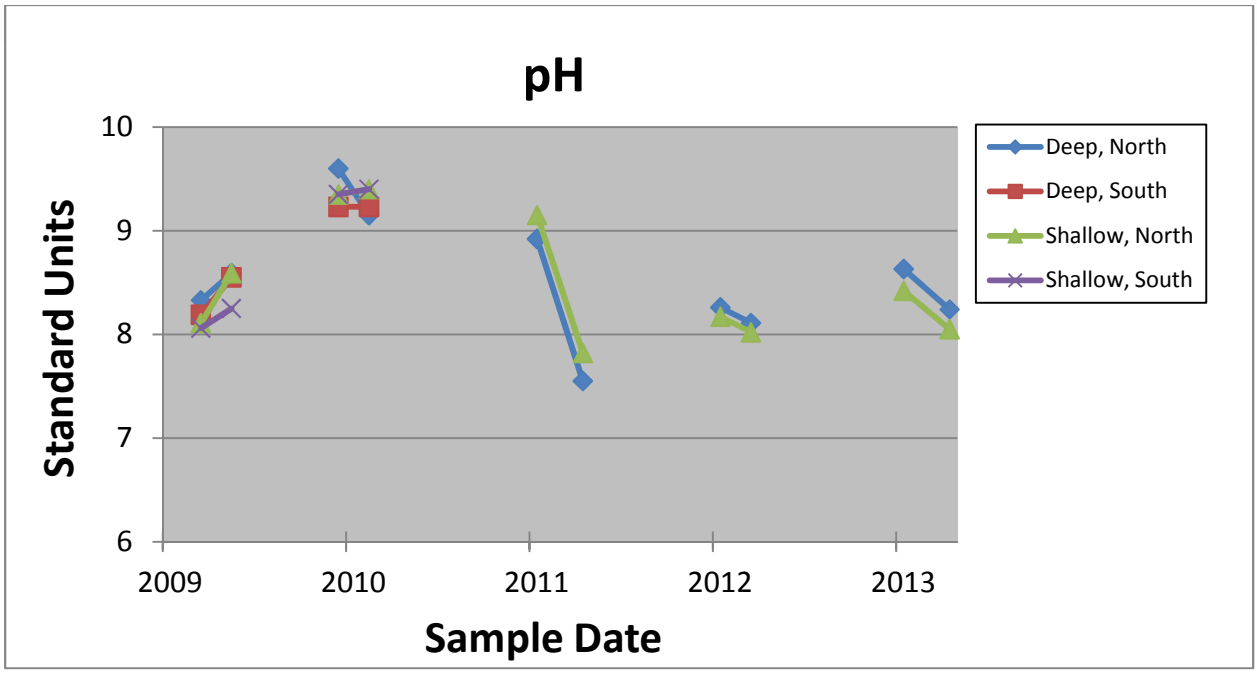
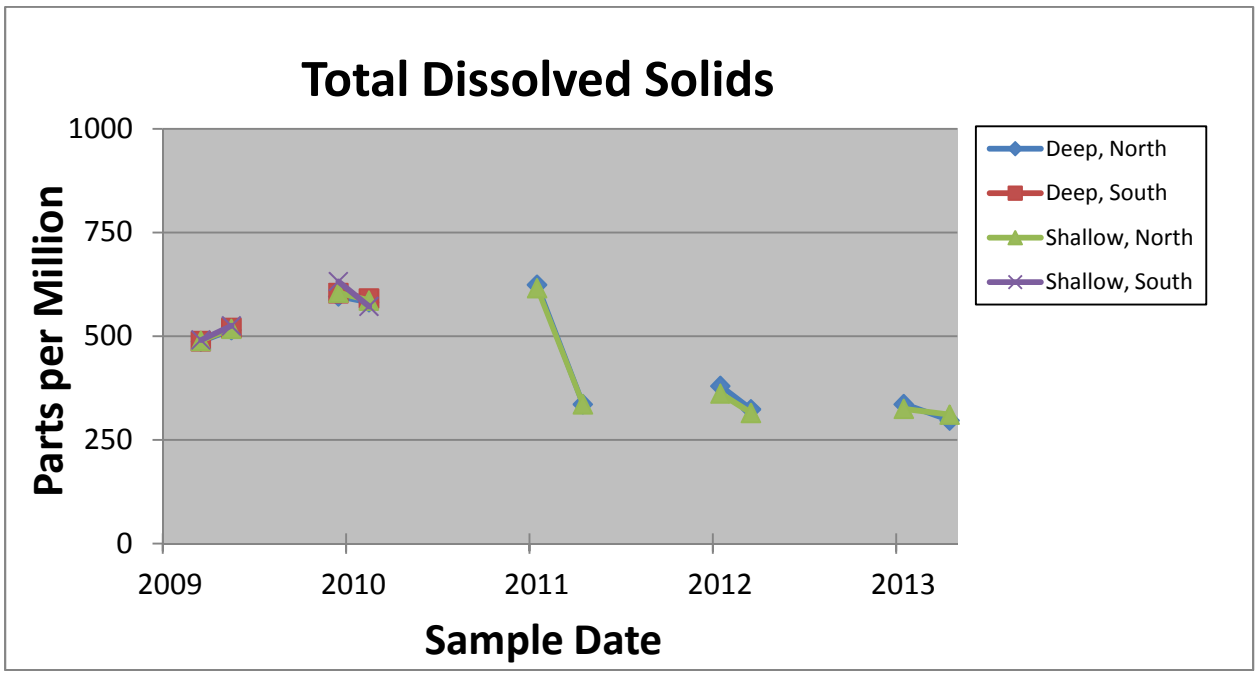


Target Range: 7.0 – 10.0 S.U.



Target Range: 0 – 1,000 ppm

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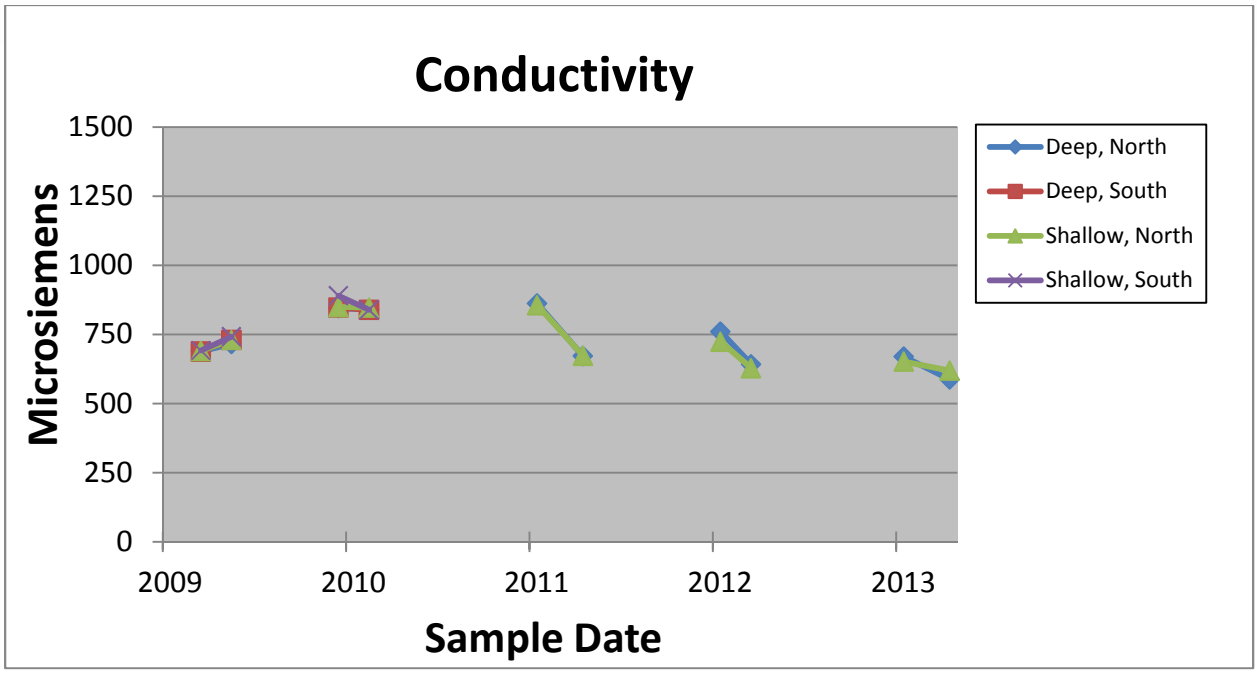
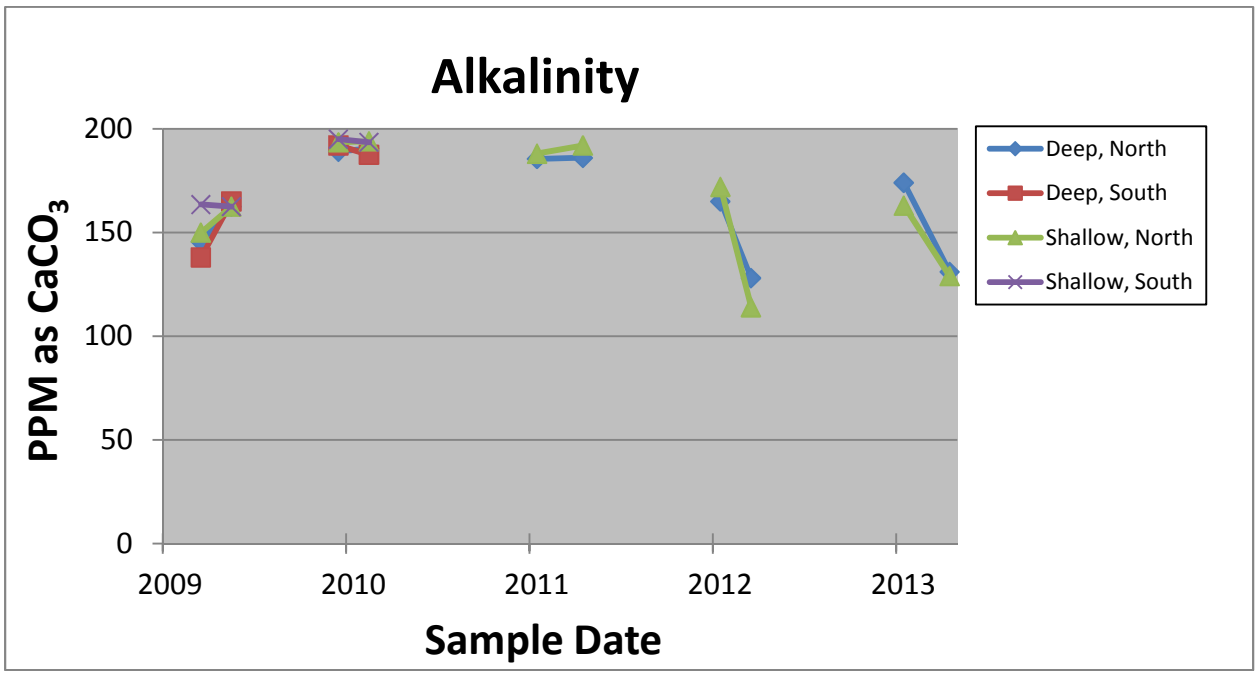


Target Range: 0 – 1,500 µS



Target Range: 0 – 250 ppm

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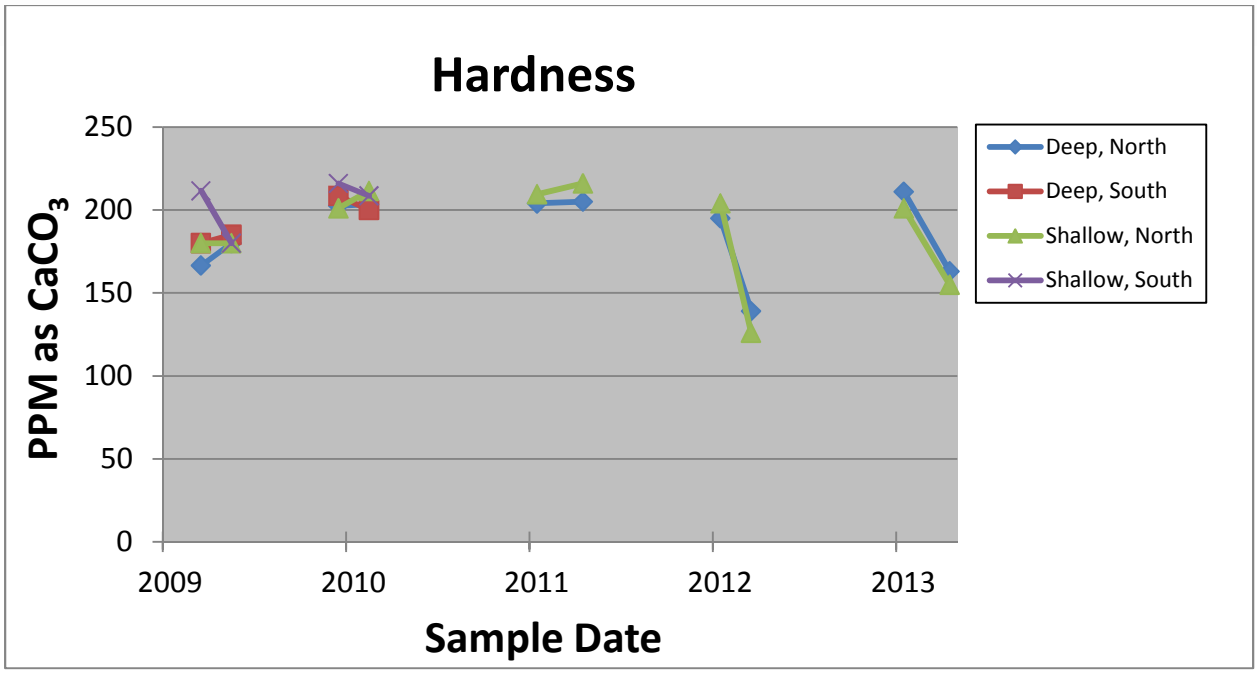
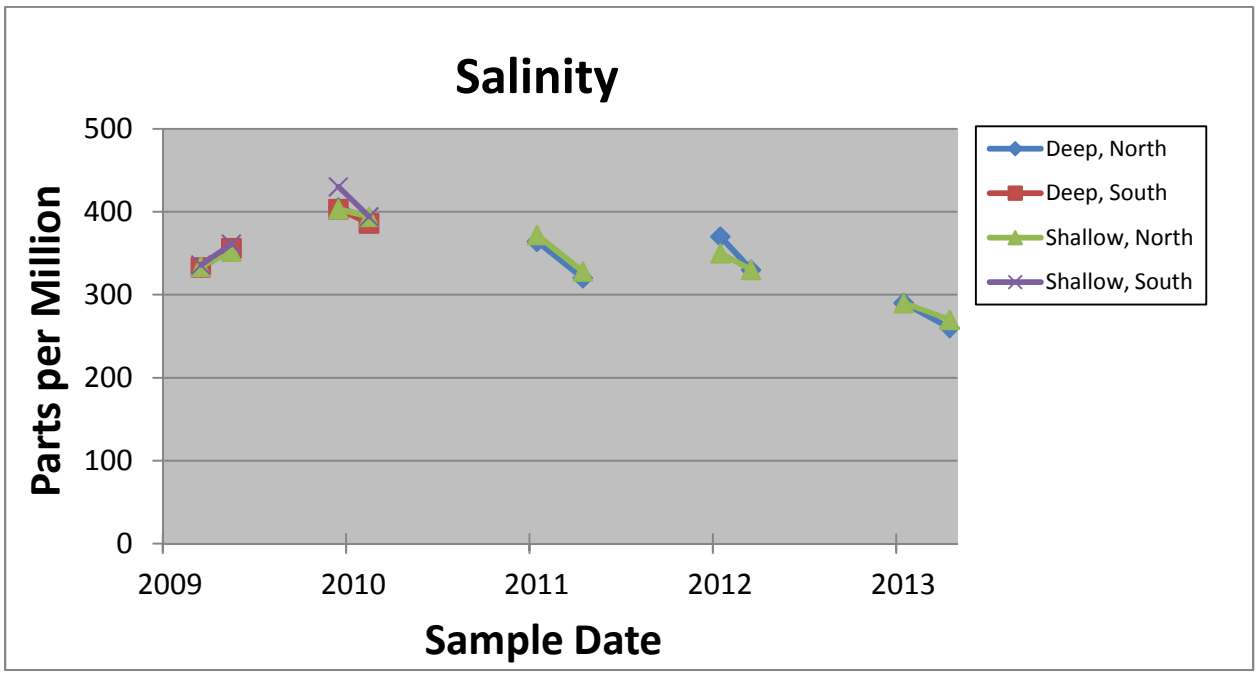


Target Range: 100 – 300 ppm



Target Range: 0 – 500 ppm

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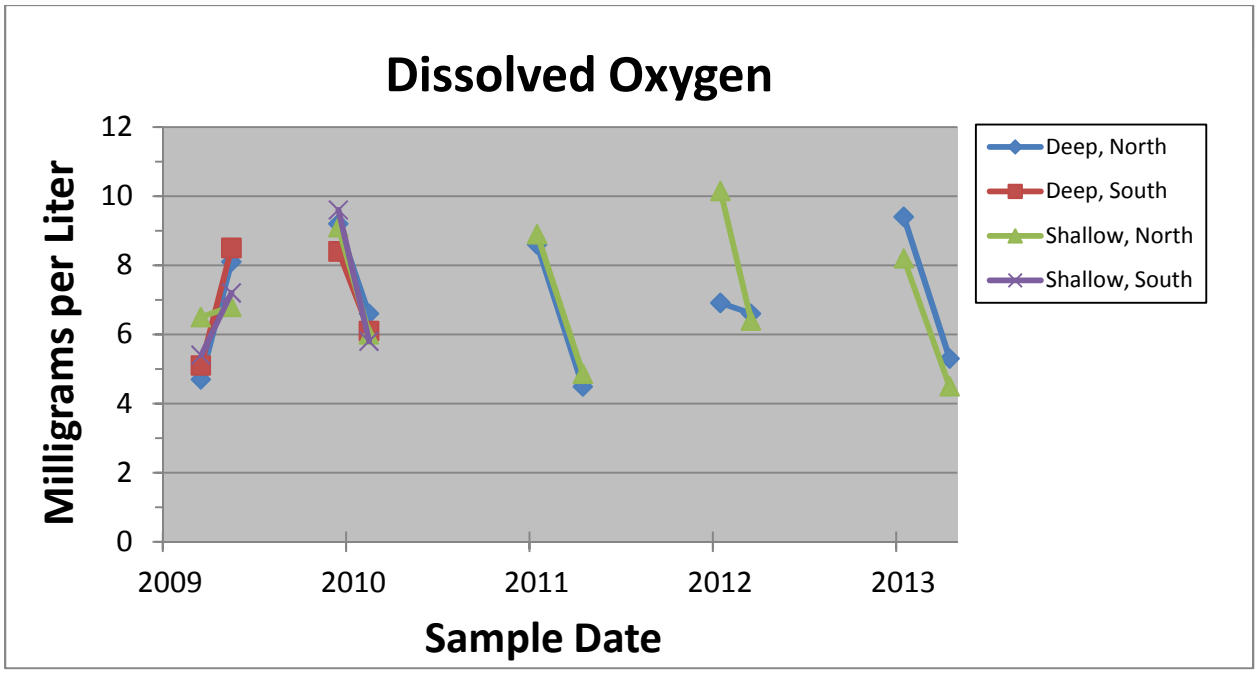
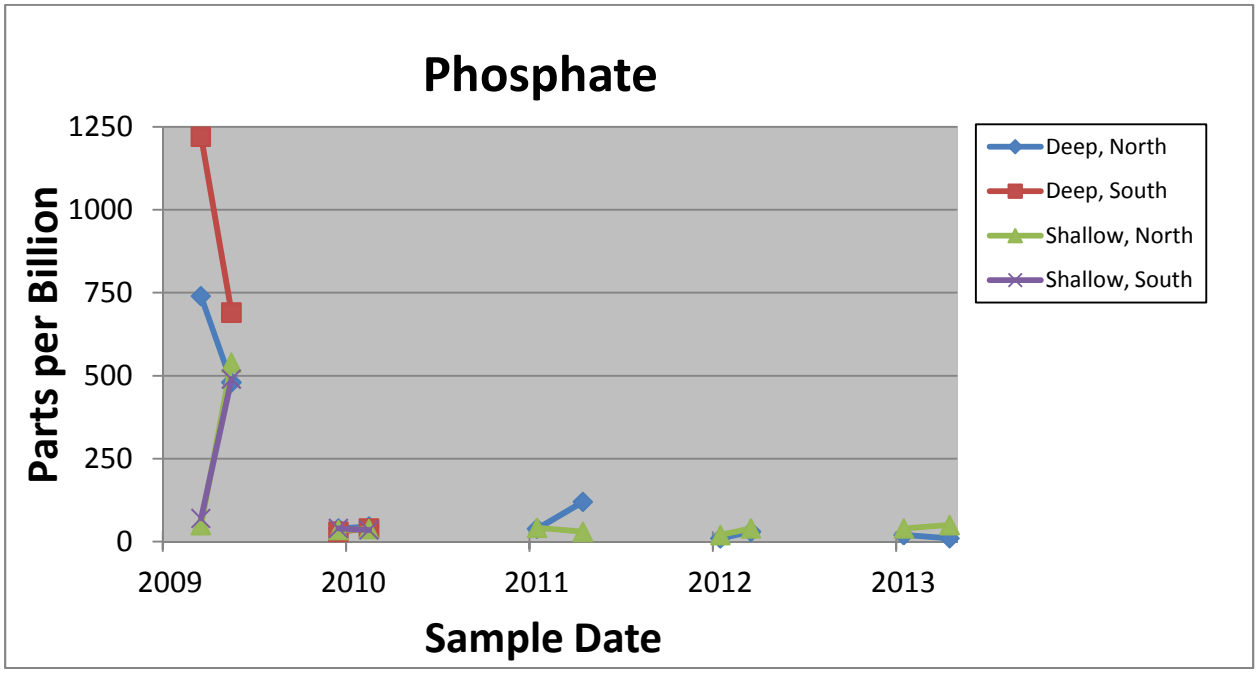


Target Range: 4 – 12 mg/L



Target Range: 0 – 100 ppm

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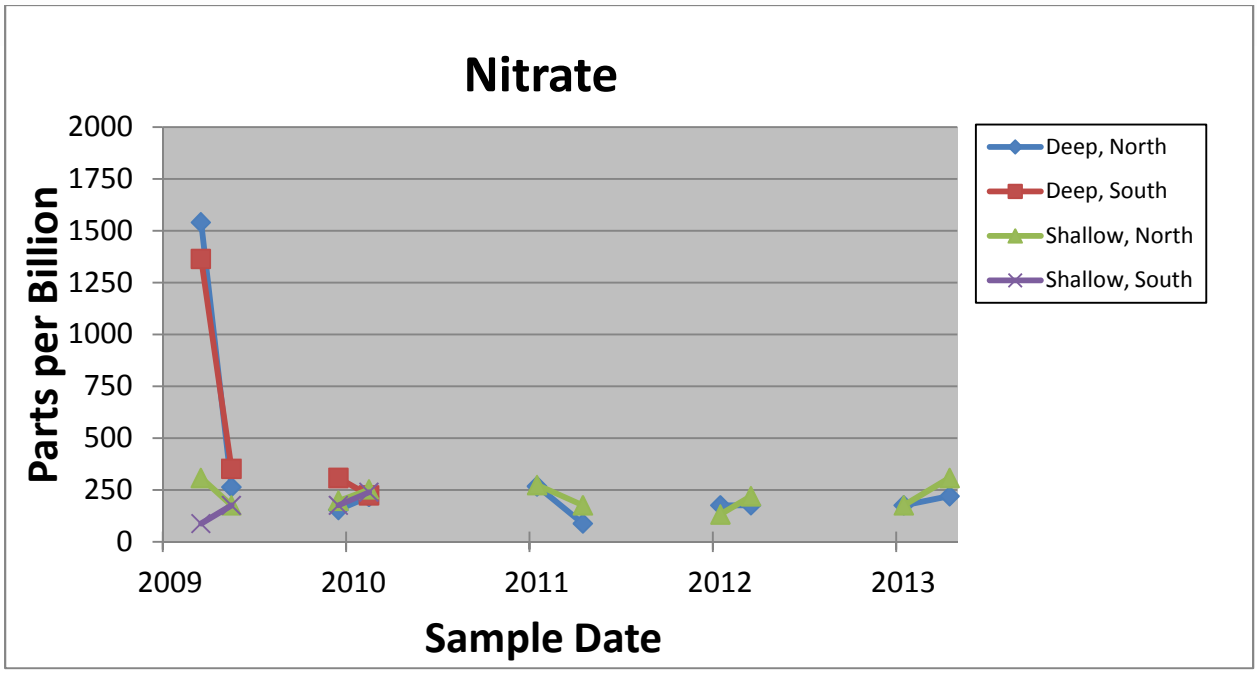
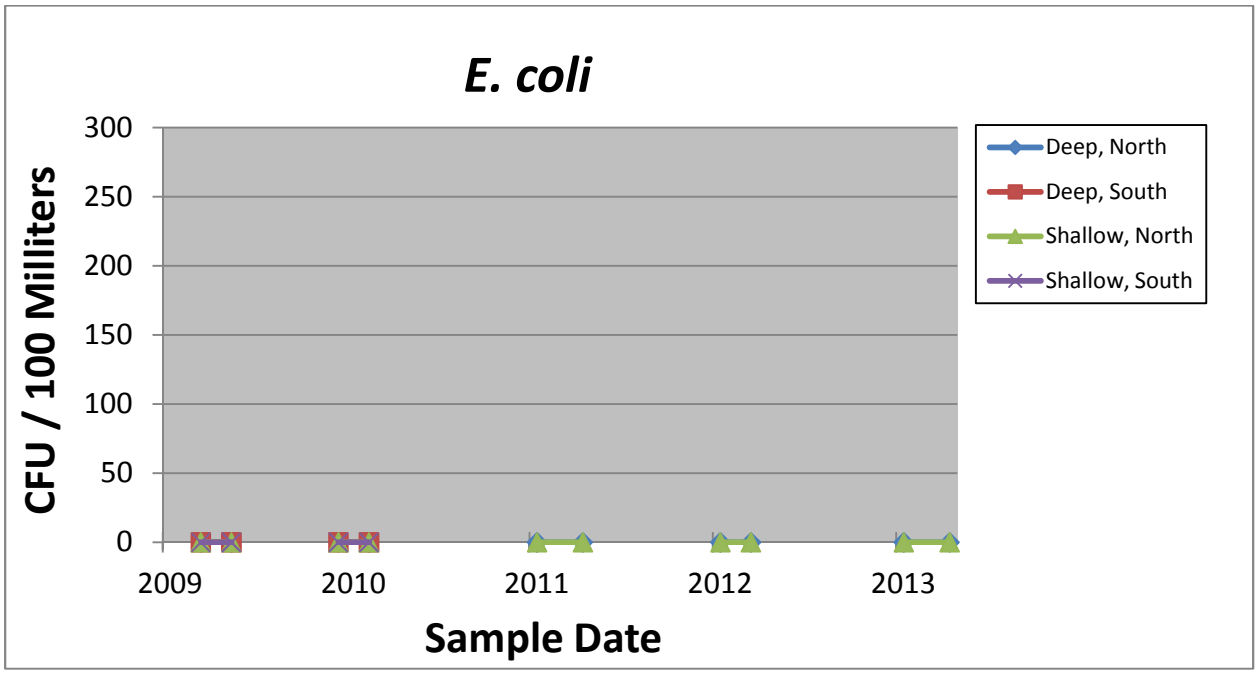


Target Range: 0 – 1,000 ppm



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.