LAKE CHECK — Water Quality Monitoring Report

Customer	Waterbody	Sample Information
West Lake (Muskegon)	West Lake	Date: 4/30/2018
		Site: deep hole

On-Site Results

Depth (m)	Temperature (degrees C)	Dissolved Oxygen mg/L	Dissolved Oxygen %
0	10.2	12.7	113
1	10.1	12.5	111
2	10.1	12.3	109
3	10.0	12.4	110
4	9.9	12.4	110
5	9.8	12.4	110
6	9.3	12.6	109
7	6.7	12.7	104
8	6.6	12.3	102
9	6.4	12.2	101
10	6.3	12.1	100
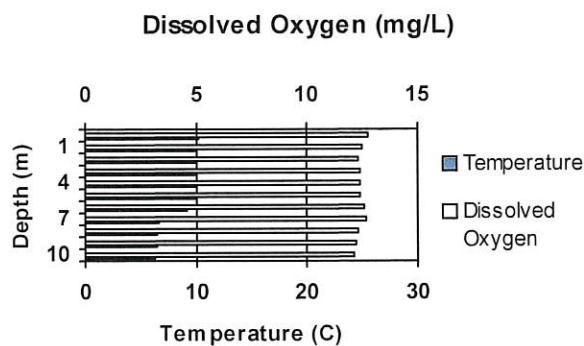
Secchi Disk Depth   4.5 meters

Thermocline Depth   6 meters

Dissolved Oxygen (mg/L)

Analytical Results

Parameter	Result	Units	Interpretation
Fecal Bacteria (E. coli		CFU/100 mL	N/A
Conductivity	124	uS/cm	Low concentration of dissolved salts
Total Dissolved Solids	80	mg/L	
pH	7.9	S.U.	Water is slightly alkaline
Alkalinity	36	mg CaCO3/L	Water is very soft
Total Phosphorus	11	ug/L	Moderately phosphorus enriched
Nitrates	200	ug/L	Not nitrogen enriched
Chlorophyll	N/A		

Trophic State Evaluation

	TSI	Trophic Status
Based on Secchi Disk Depth	38	mesotrophic
Based on Total Phosphorus	34	meso-oligotrophic
Based on Chlorophyll	N/A	

Conclusions

🟢 Conditions are good for fish growth.

🟢 Minimum dissolved oxygen is adequate for good fish production.

🟢 pH is within acceptable limits.

🟡 Sample is somewhat phosphorus enriched. Create natural buffer between lawn & lakeshore.

🟢 Repeat LakeCheck in Fall.

🔴 WARNING. condition requires immediate attention.

🟡 CAUTION. condition requires further evaluation.

🟢 OK. condition within acceptable limits.

⚫ NEUTRAL. condition neither good nor bad.

Notes

Report describes conditions at the time the sample was collected.

Approved by *Jaimee Conroy*

Mrs. Jaimee Conroy, Technical Services Manager

Date 10/23/2018

FROM YOUR **WQ PRO** DEALER

PLM Lake & Land Management Corp
P.O. Box 132
Caledonia   MI   49316-

Phone: (616) 891-1294

LAKE CHECK
Water Quality Monitoring Report

Customer	Waterbody	Sample Information
West Lake (Muskegon)	West Lake	Date: 9/14/2018
		Site: Deep Hole

On-Site Results

Depth (m)	Temperature (degrees C)	Dissolved Oxygen mg/L	%
0	23.9	8.0	83
1	22.7	8.3	85
2	22.5	8.4	85
3	22.5	8.3	85
4	22.4	7.9	81
5	22.3	7.7	77
6	22.1	7.4	74
7	21.3	5.0	56
8	17.8	0.7	7
9	14.2	0.5	5
10	13.8	0.4	4
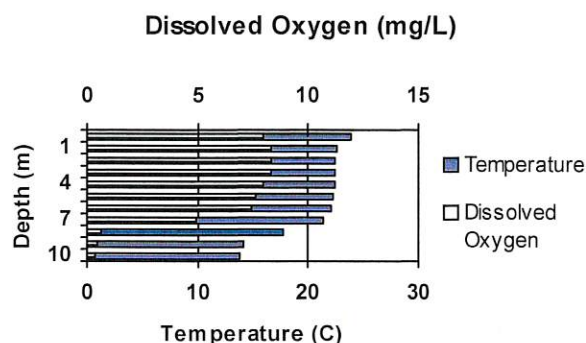
Secchi Disk Depth   4.8 meters

Thermocline Depth   7 meters

Dissolved Oxygen (mg/L)

Analytical Results

Parameter	Result	Units	Interpretation
Fecal Bacteria (E. coli		CFU/100 mL	N/A
Conductivity	125	uS/cm	Low concentration of dissolved salts
Total Dissolved Solids	81	mg/L	
pH	8.1	S.U.	Water is slightly alkaline
Alkalinity	54	mg CaCO3/L	Water is very soft
Total Phosphorus	7	ug/L	Slightly phosphorus enriched
Nitrates	200	ug/L	Not nitrogen enriched
Chlorophyll	N/A		

Trophic State Evaluation

	TSI	Trophic Status
Based on Secchi Disk Depth	38	meso-oligotrophic
Based on Total Phosphorus	28	oligotrophic
Based on Chlorophyll	N/A	

Conclusions

- 🟡 Conditions for fish growth are FAIR. (see cautions/warnings below)
- 🟡 Minimum dissolved oxygen is nearly low enough to adversely affect sensitive fish.
- 🟡 Bottom water is deoxygenated, preventing fish from living in cooler water at bottom of lake.
- 🟢 pH is within acceptable limits.
- 🟢 Phosphorus and Nitrogen are within acceptable limits.
- 🟢 REPEAT LakeCheck NEXT YEAR!

- 🔴 WARNING. condition requires immediate attention.
- 🟡 CAUTION. condition requires further evaluation.
- 🟢 OK. condition within acceptable limits.
- ⚫ NEUTRAL. condition neither good nor bad.

Notes

Report describes conditions at the time the sample was collected.

Approved by *Jaimee Conroy*

Date 10/23/2018

Mrs. Jaimee Conroy, Technical Services Manager

FROM YOUR **WQ PRO** DEALER

PLM Lake & Land Management Corp
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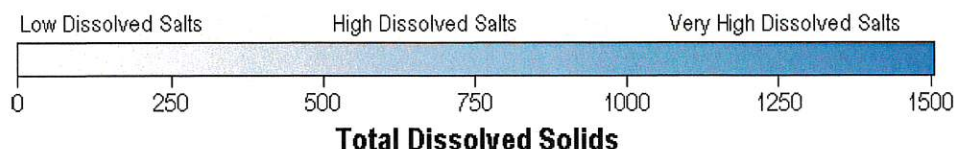Phone: (616) 891-1294

BEACH CHECK
Bacteria Sampling Report

Waterbody: West Lake (Muskegon)

West Lake (Muskegon)

Date Sampled:

7/19/2018

Location	E. coli	Total Coliforms	Interpretation
#1	1.0	56	● Water meets bacteriological standards for safe swimming.
#2	1.0	48	● Water meets bacteriological standards for safe swimming.
#3	4.0	100	● Water meets bacteriological standards for safe swimming.

Bacterial counts are expressed as the number of Colony Forming Units per 100 milliliters (CFU/100mL).

For full body contact recreation (including swimming) counts of E. coli should not exceed 130 (CFU/100mL) as a monthly geometric mean of at least five samples per the State of Michigan standard, or single samples should not exceed 298 (CFU/100mL) [235 CFU/100mL in a designated bathing beach area] per Federal (EPA) guidelines.

Current recreational water quality standards do not rely on Total Coliform counts.

Approved by _____   Date   23-Jul-18
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LAKE ✓CHECK WATER QUALITY MEASUREMENTS

Conductivity and **Total Dissolved Solids (TDS)** measure the total amount of material dissolved in the water. Higher values indicate potentially richer, more productive water, whereas lower values indicate potentially cleaner, less productive water. Localized increases in conductivity and TDS may indicate inputs of groundwater or other nutrient-enriched water. [Note: Human activities that result in nutrient pollution (e.g., fertilizer runoff) can increase the productivity of algae and other organisms without raising conductivity/total dissolved solids very much. If nutrient pollution is occurring, the total phosphorus concentration is a much better indicator of potential productivity.]

Low Dissolved Salts		High Dissolved Salts		Very High Dissolved Salts	

| 0	250	500	750	1000	1250	1500

Total Dissolved Solids

pH describes the balance between acids and bases in the water. Neutral values of pH (between 6 and 9) are desirable. Low pH values typically result either from the growth of bog vegetation (such as peat moss), acid precipitation ("acid rain"), or acid runoff (as in acid mine drainage). Excessive growth of certain plants and algae can raise pH values above 9.0 or 10.0.

Too Acidic	Neutral	Too Alkaline

| 2	4	6	9	10.5	12

pH
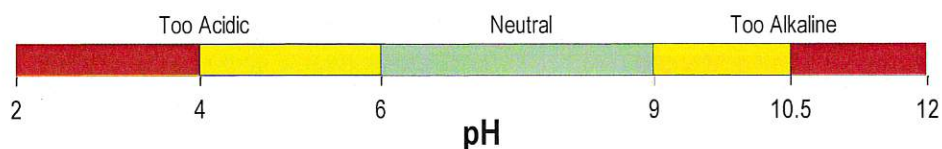
Alkalinity measures the concentration of carbonates and bicarbonates in the water. These compounds and other ions associated with them make water "hard". High alkalinity lakes are hardwater lakes, while low alkalinity lakes are softwater lakes. Different kinds of plants, algae, and other aquatic organisms live in hardwater than in softwater. Alkalinity also influences the effectiveness of some herbicides and algicides. Alkalinity is a basic characteristic of water, but is neither inherently good nor bad.

Soft Water			Hard Water	

| 0	50	100	150	200	250

Alkalinity
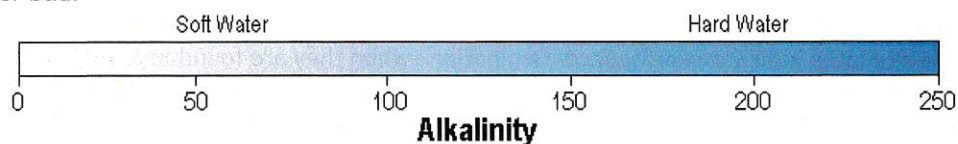
Total Phosphorus measures the total (organic and inorganic, dissolved and particulate) amount of phosphorus in the water. Phosphorus is usually the plant nutrient (i.e., fertilizer) that controls the amount of algal growth in lakes and ponds. Most Midwestern lakes have more phosphorus and more algae than is desirable, so lower values are generally better, though very unproductive water bodies typically support little fish production.

Not Enriched	Slightly Enriched	Enriched	Highly Enriched

| 0	10	30	50	more than 50

Total Phosphorus
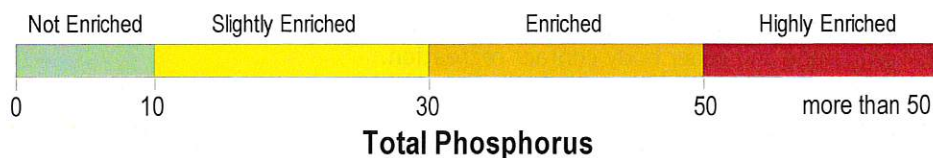
Nitrate measures the total inorganic amount of nitrogen in the water. Nitrogen is the plant nutrient (i.e., fertilizer) most likely to control the amount of rooted plant growth in lakes and ponds. Most Midwestern lakes have more nitrogen and more rooted plant growth than is desirable, so lower values are generally considered better

Not Enriched	Slightly Enriched	Enriched	Highly Enriched

0	500	1000	1500	2000

Nitrates
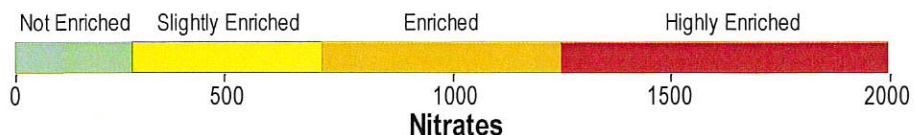
Trophic State Indices calculate the trophic status of the waterbody. Waterbodies are classified as oligotrophic, mesotrophic, eutrophic or hypereutrophic depending on the overall amount of plants, algae and other organisms the waterbody supports. Lakes of different trophic states vary in a number of chemical characteristics and support different types of organisms (see the enclosure "Lake Trophic States and Eutrophication"). Thus the trophic state of a waterbody provides a wealth of information concerning the types of organisms living in the waterbody, the processes likely to occur there and the kinds of problems to be expected. Trophic State Index values can be calculated from a number of variables. LakeScan calculates Carlson's Trophic State Index (TSI) from total phosphorus, Secchi disk depth and chlorophyll (separate TSI values are calculated for each of the variables that was measured as part of your LakeCheck package).

Oligotrophic	Mesotrophic	Eutrophic	Hypereutrophic

0   20   40   60   80   100
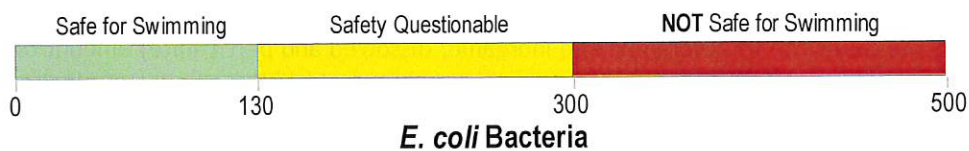
Trophic State Index (TSI)
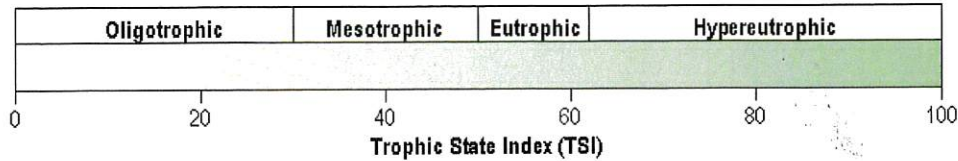
Dissolved Oxygen is a measure of the amount of oxygen dissolved in the water. Oxygen is needed by fish and other aquatic organisms to allow them to "breath" underwater. Plants and algae produce oxygen by photosynthesizing during the day and use oxygen for respiration at night.

Dangerously Low   Low   Adequate

0   2   4   6   8   10   12

Dissolved Oxygen
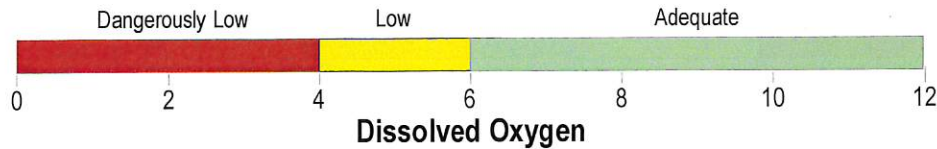
Temperature provides information about the kinds of fish that can grow in a lake, information necessary for interpretation of other parameters, and information about the extent to which a lake is stratified into layers having water of different temperatures. If the lake is stratified, the **thermocline depth** tells how deep the surface layer of warm water is.

Fecal Indicator Bacteria (*E. coli*) measurements count the number of live fecal indicator bacteria in the sample. These bacteria are considered reliable indicators of fecal contamination—when they are found in a pond or lake, it is very likely that the water is being contaminated by animal feces. Contamination can potentially be derived from a number of sources, including failed septic systems, agricultural runoff, or waterfowl or wildlife droppings.

Safe for Swimming   Safety Questionable   **NOT** Safe for Swimming

0   130   300   500

E. coli **Bacteria**

- *E. coli* counts of 300 (CFU/100 mL) and above in a single sample are considered to represent conditions that are **UNSAFE** for swimming and other body contact recreation.
- *E. coli* counts of 130 (CFU/100 mL) and above averaged (using a geometric mean) over measurements made during a 30-day period are considered to represent conditions that are UNSAFE for swimming and other body contact recreation. When values of 130 (CFU/100 mL) or higher but less than 300 are encountered, LakeCheck rates the safety of the water for swimming as questionable.
- *E. coli* counts below 130 are considered safe for swimming and other body-contact recreation

We recommend prompt retesting whenever Fecal Indicator Bacteria counts exceed 100 (CFU/100 mL) to determine whether contamination is an ongoing problem. If frequent contamination is detected, steps to identify and eliminate the source of contamination are highly recommended.