



Mississippi Valley Conservation

*State of the Lake
Environment Report
December 2002
Mississippi Lake*



Mississippi Lake

Mississippi Lake is situated in portions of Drummond, Beckwith and Mississippi Mills townships, in Lanark County. It is the last in a series of lakes in the Mississippi Valley watershed before the Mississippi river reaches the Ottawa River and is one of the largest inland lakes in South-Eastern Ontario. Mississippi Lake is at an elevation of 134.4 metres above sea level. The lake perimeter is approximately 55.9 kilometres and the deepest point is 9.2 metres. Mississippi Lake supports a warm water fishery. Common species include Walleye, Northern Pike, Smallmouth and Largemouth Bass. At last count in 1983, there were 16 resorts, 1498 cottages and 259 permanent houses on the lake.



Residents of Mississippi Lake have formed a highly active Lake Association, and have appointed a Lake Steward, who is a member of the Mississippi Valley Lake Stewardship Network and Steering Committee. This individual has volunteered his time in the past, to provide water quality testing, through the Ministry of the Environment (MOE) Self Help Program from 1968 and Lake Partner Program since 1996. This data is extremely valuable; the data provides a general picture of water quality conditions for the past 34 years. Comprehensive testing in 2002 through Mississippi Valley Conservation's (MVC) *Watershed Watch Program*

provides for a comparison between water quality conditions as they exist now, to results obtained 27 years ago through the MOE Recreational Lakes Program.

In general, the water quality in Mississippi Lake is improving. There are two sampling stations at the deepest points in the Big and Second Lakes. Each station was sampled eight times for 2002. You will find graphs which follow, that water clarity, as measured by Secchi Disk readings, were observed as good. The average for the two stations for 2002 is 3.64 metres indicating that Mississippi Lake is a moderately enriched (some nutrients) or mesotrophic lake. Compared to 27 years ago, the average was 2.5 metres and a eutrophic lake environment (enriched, high levels of nutrients).

Directly related to water clarity is the amount of nutrients, in particular phosphorus, entering the lake. The Provincial Objective for phosphorus levels in shield lakes is a maximum of 20 micrograms per litre ($\mu\text{g/L}$). In 2002, the mean for the two stations in the euphotic zone (depth at which sunlight can penetrate or two times the secchi disk depth) was 15.3 $\mu\text{g/L}$. The mean for the samples taken one metre off the bottom was 14.6 $\mu\text{g/L}$. Twenty-seven years ago, the average phosphorus level was 26.4 $\mu\text{g/L}$ in the euphotic zone and 26.0 $\mu\text{g/L}$ one metre off the bottom of the lake, both over the Provincial Objective. Mississippi Lake decreased its average phosphorus levels by more than 10 $\mu\text{g/L}$, changing its trophic status from a eutrophic lake environment (enriched, high levels of nutrients) to a moderately enriched lake (some nutrients) and putting it well below the Provincial Objective.

Chlorophyll *a* is a measure of the algal density in the lake. The average chlorophyll *a* density for the two sampling stations was 2.95 $\mu\text{g/L}$, indicating a moderate algal density for Mississippi Lake in 2002. In 1975, chlorophyll *a* levels were extremely high at 13.7 $\mu\text{g/L}$, almost five times higher than 2002.

Plants and animals are a direct reflection of their environment. The most critical time of year for conducting dissolved oxygen and temperature profiles is after August 31. Profiles are generally conducted at this time of year and at the deepest point in the lake. Aquatic vegetation and algae that has grown over the summer, has died off and settled on the bottom, using the available oxygen necessary to sustain aquatic life in the lower portion of the lake or the hypolimnion. Two other profiles were conducted in

2002, one in May and one in July, in order to generate a more concise picture of the oxygen content of the lake.

The dissolved oxygen and temperature data, measured at the deepest points in the Big Lake and Second Lake, indicate adequate levels all the way to the bottom for most of the ice-out season. However, data collected in late June, revealed that the oxygen concentrations in both Big Lake and Second Lake were depleted near the bottom. Warm water fish species, such as pike and bass, were squeezed into the upper five to seven metres of the lake during this time. This could be explained by the flood conditions that occurred in June. The flood conditions brought with it higher levels of phosphorus from runoff, which in turn produced higher algal and weed growth. This resulted in a depletion of oxygen in the last two metres of Big Lake and one metre of Second Lake. By the end of the summer, the oxygen levels improved and were indicating adequate levels all the way to the bottom of both Big and Second Lakes. Therefore, residents and users of Mississippi Lake cannot afford to be complacent. Every effort should be made to reduce nutrient loading into the lake from land use activities.



Mississippi Lake was also tested for invasive species in 2002, in particular, for zebra mussels and spiny water flea, in partnership with the Ontario Federation of Anglers and Hunters. Mississippi Lake did *not* have spiny water flea present but zebra mussel veligers (larvae) and adults were detected. Residents and property owners need to ensure that all access points to the lake have posted signs indicating the presence of zebra mussels and the precautions they can take to avoid the spread of invasive species to other lakes.

Residents and users of Mississippi Lake should continue a stewardship approach to limit the amount of nutrients entering the lake. There are helpful tips throughout this report to help reduce your impact on Mississippi Lake. Additional water quality data, current and historic, is available for Mississippi Lake and many other lakes in the Mississippi Valley watershed. Contact MVC for more information on how you can become a good lake steward for your lake.

FIVE EASY STEPS TO IMPROVE WATER QUALITY



1. Build at least 30 metres away from the shoreline.
2. Keep your lot well treed and preserve or replant native vegetation along the shoreline.
3. Pump out your septic tank every three to five years.
4. Reduce water use and use phosphate free soaps and detergents.
5. Keep the size of your lawn to a minimum; do not use fertilizers, herbicides or pesticides.

LOW PHOSPHORUS LIFESTYLE	Amount of Phosphorus (grams)	HIGH PHOSPHORUS LIFESTYLE	Amount of Phosphorus (grams)
Human waste	535	Human waste	535
No dishwasher	0	Dishwasher using powdered detergent once per day	650
No fertilizer	0	Lawn fertilized once/year	1960
Trees not cut down	20	Lot cleared of trees	30
Uses phosphate-free products	20	Uses products with phosphate	180
TOTAL	575 grams	TOTAL	3355 grams

How Does Mississippi Lake Measure Up?

1973 – 2002 Water Quality Results – Second Lake

Sample Year	Secchi Disk Depth [Metre]	Total Phosphorus Euphotic Zone [Micrograms/Litre]	Total Phosphorus 1 Metre off Bottom [Micrograms/Litre]	Chlorophyll a Composite [Micrograms/Litre]
1968	2.1			
1969	3.8			
1973	4.3			3.30
1974	3.7			3.00
**1975	2.5	26.4	26.0	13.70
1977	3.4			2.70
1978	4.1			3.00
1979	3.9			3.20
1980	2.7			4.50
1981	2.5			7.40
1982	2.6			5.40
1983	2.8			2.40
1984	3.1			5.80
1985	3.3			4.20
1986	3.0			3.00
1992	3.5			3.90
1994	3.3			3.20
1995	2.2			9.80
1996	3.1	13.0		
1997	3.3	22.0		
1998	3.3	14.0		
1999	3.5	8.0		
*2001	3.9			
2002	3.9	13.6	13.6	3.38
n	25	6	2	17
Minimum	2.1	8.0	13.6	2.40
Maximum	4.3	26.4	26.0	13.70
Mean	3.3	16.2	19.8	4.80
Standard Deviation	0.601270	6.734290	8.768124	2.988271

*Mean based on less than 6 measurements **Includes Recreational Lakes Program Data
Chlorophyll a data prior to 1985 has been adjusted to reflect new lab procedures in filtering, resulting in an increase in chl_a concentrations by 35%.

How to protect or restore a shoreline depends on the conditions of the site and the energy and resources of the owner. There are four main strategies to choose from:

① PRESERVATION – When purchasing a lakefront property, a natural shoreline is retained and access to the lake is designed to avoid shoreline damage.

② NATURALIZATION – Degraded shorelines are left alone to return to their natural state.

③ ENHANCEMENT – Native species are planted and non-native species are removed.

④ RESTORATION – Cleared areas are planted with native species.



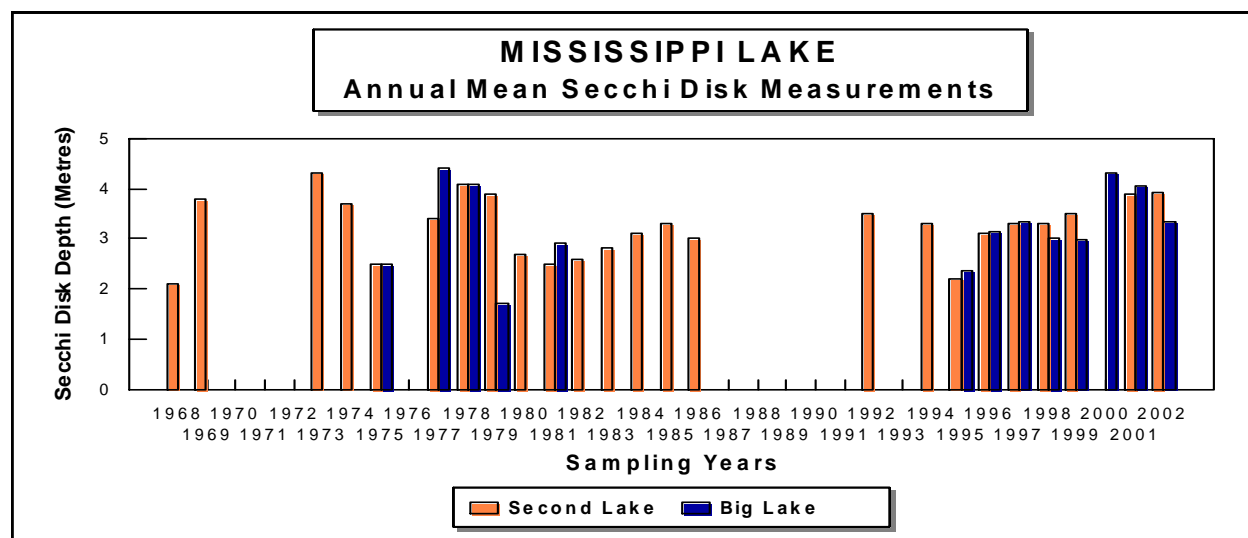
1976-2002 Water Quality Results – Big Lake

Sample Year	Secchi Disk Depth [Metres]	Total Phosphorus Euphotic Zone [Micrograms/litre]	Total Phosphorus 1 Metre off Bottom [Micrograms/litre]	Chlorophyll a Composite [Micrograms/Litre]
**1975	2.5			13.70
1977	4.4			2.40
1978	4.1			3.00
1979	1.7			11.20
1981	2.9			7.60
1995	2.4			9.87
1996	3.2	17.0		
1997	3.3			
1998	3.0	20.0		
1999	3.0	12.0		
*2000	4.3	40.0		
*2001	4.1	13.0		
2002	3.3	17.0	15.5	3.83
n	13	6	1	7
Minimum	1.7	12.0	15.5	2.40
Maximum	4.4	40.0	15.5	13.70
Mean	3.2	19.8	15.5	7.40
Standard Deviation	0.806303	10.303721	N/A	4.423326

*Mean based on less than 6 measurements **Includes Recreational Lakes Program Data
Chlorophyll a data prior to 1985 has been adjusted to reflect new lab procedures in filtering, resulting in an increase in chla concentrations by 35%.

Evaluating Secchi Disk Readings:

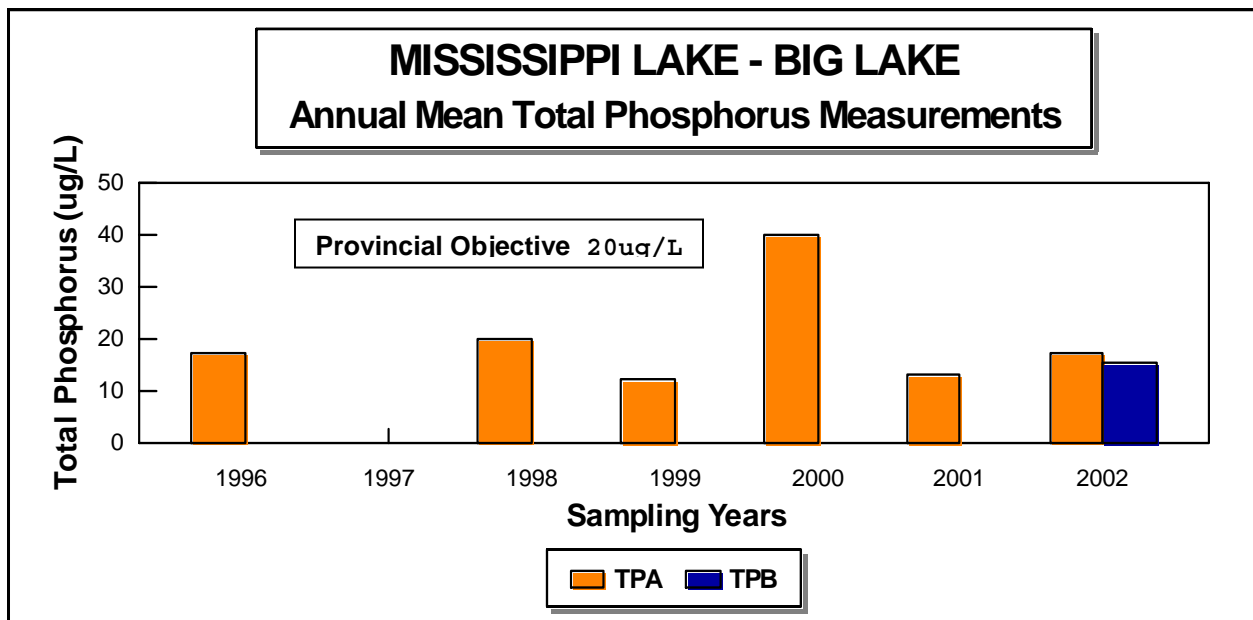
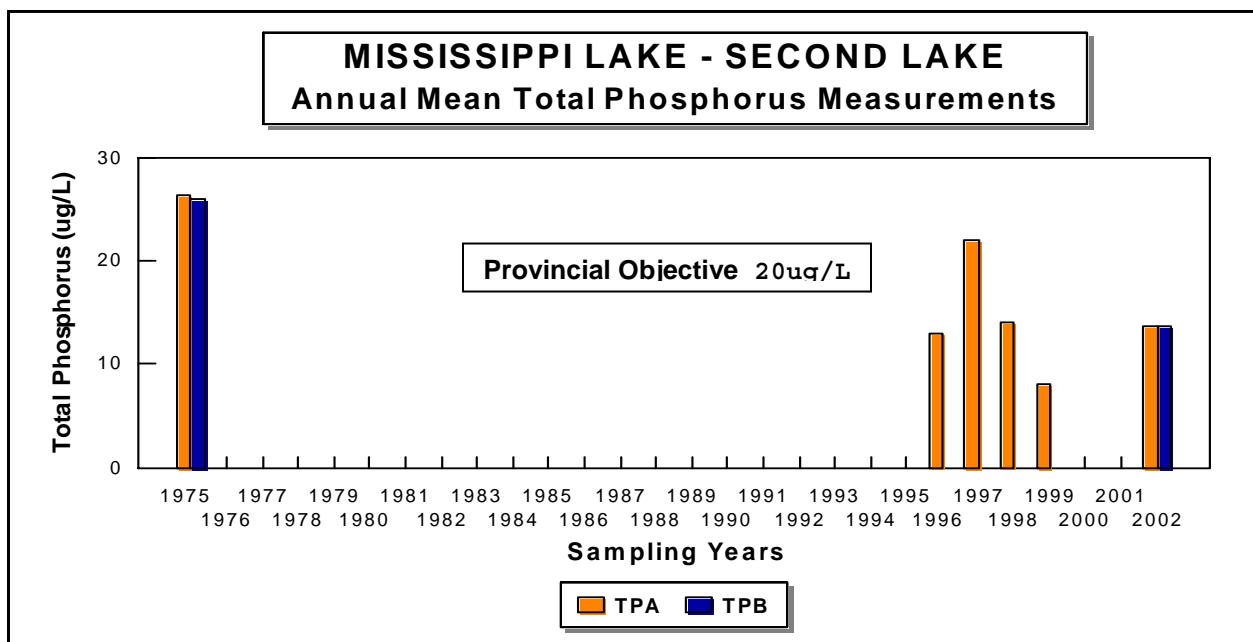
INTERPRETING YOUR SECCHI DISC RESULTS	
Secchi Reading	Lake Nutrient Status
Over 5 metres	Oligotrophic - unenriched, few nutrients
3.0 to 4.9 metres	Mesotrophic – moderately enriched, some nutrients
Less than 2.9 metres	Eutrophic – enriched, higher levels of nutrients



Evaluating Total Phosphorus Results:

Phosphorus is the nutrient that controls the growth of algae in most Ontario lakes. For this reason any increase in phosphorus in the lake will increase the quantity of algae that can grow. High levels of phosphorus can lead to algal blooms and in some cases affect the habitat of cold water fish such as lake trout. A general guideline exists to characterize your lake based on the total phosphorus that is measured.

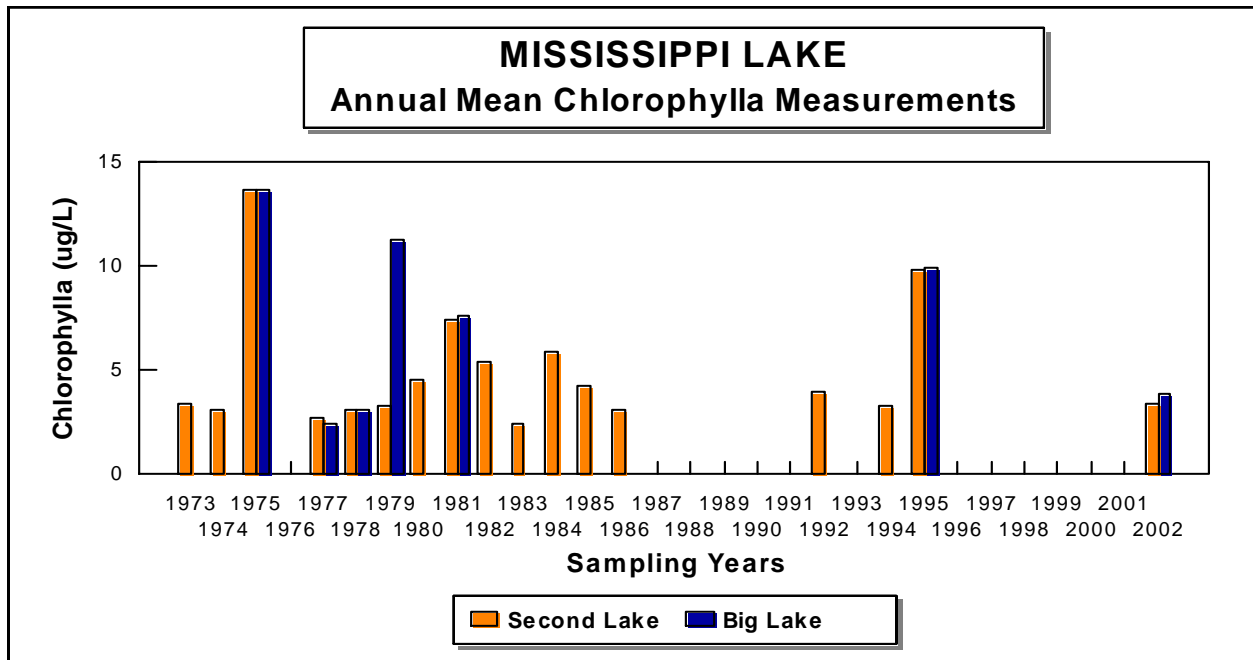
INTERPRETING YOUR TOTAL PHOSPHORUS RESULTS	
Total Phosphorus	Lake Nutrient Status
10ug/L or less	Oligotrophic - unenriched, few nutrients
11 to 20ug/L	Mesotrophic – moderately enriched, some nutrients
21ug/L or more	Eutrophic – enriched, higher levels of nutrients



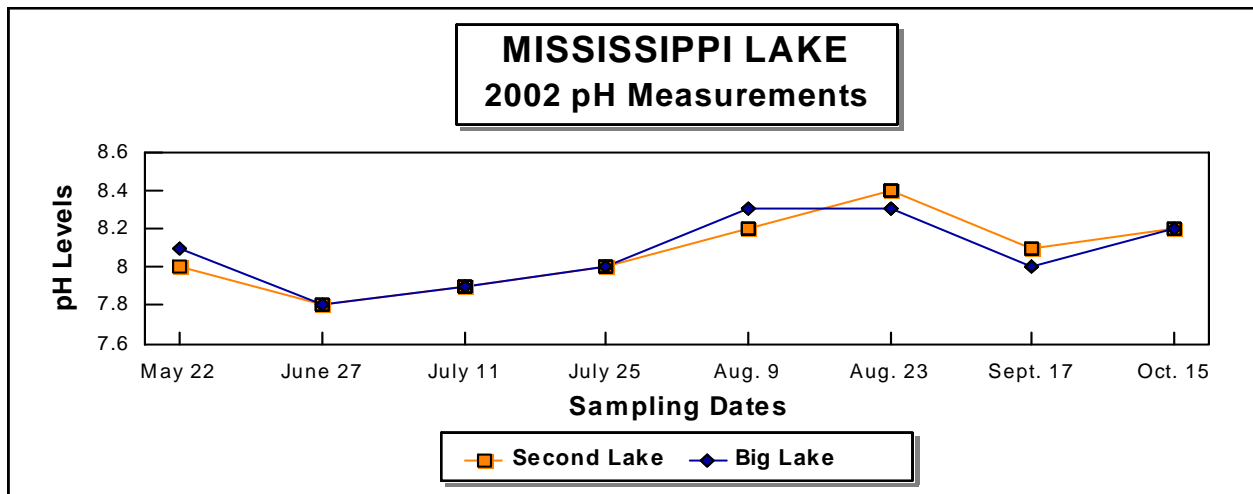
Evaluating your Chlorophylla Results:

The lower the chlorophylla density in your lake, the clearer your lake is. Chlorophylla is directly affected by the amount of total phosphorus in your lake. The more phosphorus there is in the water, the more algal growth will occur.

INTERPRETING YOUR CHLOROPHYLLA RESULTS	
Secchi Reading	Lake Nutrient Status
Up to 2 ug/L - low algal density	Oligotrophic - unenriched, few nutrients
2-4 ug/L - moderate algal density	Mesotrophic - moderately enriched, some nutrients
More than 4 ug/L- high algal density	Eutrophic - enriched, higher levels of nutrients



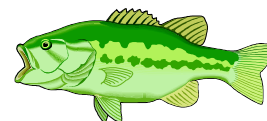
Evaluating your pH Results: Lakes with pH levels at 7.3 or higher are vulnerable to zebra mussels invasive.



MISSISSIPPI LAKE – Big Lake

DISSOLVED OXYGEN/TEMPERATURE PROFILES

MOE Rec. Lks. Station # 19-3430-735-01, MVC Station # 02-10




Date: June 27, 2002

Depth: 9.2 Metres

Euphotic Zone (Penetration of Light) = 4.0 Metres

Depth [Metres]	Temperature [Degrees Celsius]	Dissolved Oxygen [Milligrams/Litre]	Percent % Saturation	Thermal Stratification
0.1	22.0	6.8	74	
1.0	22.0	6.7	73	
2.0	22.0	6.8	74	Epilimnion
3.0	21.9	6.8	73	
4.0	21.8	6.8	73	
5.0	21.8	6.8	73	
6.0	18.4	4.5	47	
7.0	17.9	4.2	42	
8.0	17.7	4.0	40	
9.0				Bottom


 Warm Water Fisheries Habitat (Bass, Walleye, Pike and Perch) defined as Dissolved Oxygen Concentrations greater than 4 mg/L at Temp. less than 25°C

Date: July 25, 2002

Depth: 9.2 Metres

Euphotic Zone (Penetration of Light) = 8.0 Metres

Depth [Metres]	Temperature [Degrees Celsius]	Dissolved Oxygen [Milligrams/Litre]	Percent % Saturation	Thermal Stratification
0.1	23.1	7.4	83	
1.0	23.1	7.4	83	
2.0	23.1	7.4	83	Epilimnion
3.0	23.1	7.4	83	
4.0	23.1	7.4	83	
5.0	23.0	7.4	82	
6.0	23.0	7.2	80	
7.0	23.0	7.3	81	
8.0	23.0	7.0	80	
9.0				Bottom

 Warm Water Fisheries Habitat (Bass, Walleye, Pike and Perch) defined as Dissolved Oxygen Concentrations greater than 4 mg/L at Temp. less than 25°C

MISSISSIPPI LAKE – Big Lake continued...

Date: September 17, 2002

Depth: 9.2 Metres

Euphotic Zone (Penetration of Light) = 8.0 Metres

Depth [Metres]	Temperature [Degrees Celsius]	Dissolved Oxygen [Milligrams/Litre]	Percent % Saturation	Thermal Stratification
0.1	19.4	8.6	90	
1.0	19.5	8.5	89	
2.0	19.6	8.6	90	Epilimnion
3.0	19.6	8.6	90	
4.0	19.6	8.6	90	
5.0	19.5	8.6	91	
6.0	19.5	8.6	91	
7.0	19.4	8.6	90	
8.0	19.4	8.5	89	
9.0				Bottom

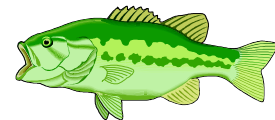


Warm Water Fisheries Habitat (Bass, Walleye, Pike and Perch) defined as Dissolved Oxygen Concentrations greater than 4 mg/L at Temp. less than 25°C

MISSISSIPPI LAKE – Second Lake

DISSOLVED OXYGEN/TEMPERATURE PROFILES

Self-Help Station # 19-3430-014-01, MVC Station # 02-11



Date: June 27, 2002

Depth: 7.0 Metres

Euphotic Zone (Penetration of Light) = 8.0 Metres

Depth [Metres]	Temperature [Degrees Celsius]	Dissolved Oxygen [Milligrams/Litre]	Percent % Saturation	Thermal Stratification
0.1	22.0	7.3	80	
1.0	22.0	7.1	77	
2.0	21.9	7.1	76	Epilimnion
3.0	21.8	7.1	75	
4.0	21.5	6.9	74	
5.0	20.5	6.9	57	
6.0	18.7	5.4	34	Thermocline
7.0				Bottom



Warm Water Fisheries Habitat (Bass, Walleye, Pike and Perch) defined as Dissolved Oxygen Concentrations greater than 4 mg/L at Temp. less than 25°C


MISSISSIPPI LAKE – Second Lake continued...

Date: July 25, 2002

Depth: 7.0 Metres

Euphotic Zone (Penetration of Light) = 7.0 Metres

Depth [Metres]	Temperature [Degrees Celsius]	Dissolved Oxygen [Milligrams/Litre]	Percent % Saturation	Thermal Stratification
0.1	23.4	7.2	81	
1.0	23.4	7.3	82	
2.0	23.5	7.4	83	Epilimnion
3.0	23.5	7.2	80	
4.0	23.3	6.7	75	
5.0	23.2	6.9	76	
6.0	23.2	6.9	76	
7.0				Bottom


 Warm Water Fisheries Habitat (Bass, Walleye, Pike and Perch) defined as Dissolved Oxygen Concentrations greater than 4 mg/L at Temp. less than 25°C

Date: September 17, 2002

Depth: 7.0 Metres

Euphotic Zone (Penetration of Light) = 7.0 Metres

Depth [Metres]	Temperature [Degrees Celsius]	Dissolved Oxygen [Milligrams/Litre]	Percent % Saturation	Thermal Stratification
0.1	19.2	8.4	89	
1.0	19.3	8.5	90	
2.0	19.3	8.5	90	Epilimnion
3.0	19.3	8.5	90	
4.0	19.3	8.5	90	
5.0	19.3	8.5	90	
6.0	19.3	8.5	90	
7.0				Bottom

 Warm Water Fisheries Habitat (Bass, Walleye, Pike, and Perch) defined as Dissolved Oxygen Concentrations greater than 4 mg/L at Temp. less than 25°C

The Watershed Watch program was made possible thanks to the generous support of the Ministry of Environment, Lake Associations, area Stewardship Councils, the Lake Stewardship Network and concerned citizens. Special Thanks to Peter Elliott (Pretties Island) and Ed Carew (Ebbs Bay) for volunteering their time and resources to this program.

For more information regarding Watershed Watch or for free advice on how you can help protect or enhance your lake environment, contact Melissa Dakers, Water Quality Technician, Mississippi Valley Conservation at (613) 259-2421 or mdakers@mvc.on.ca