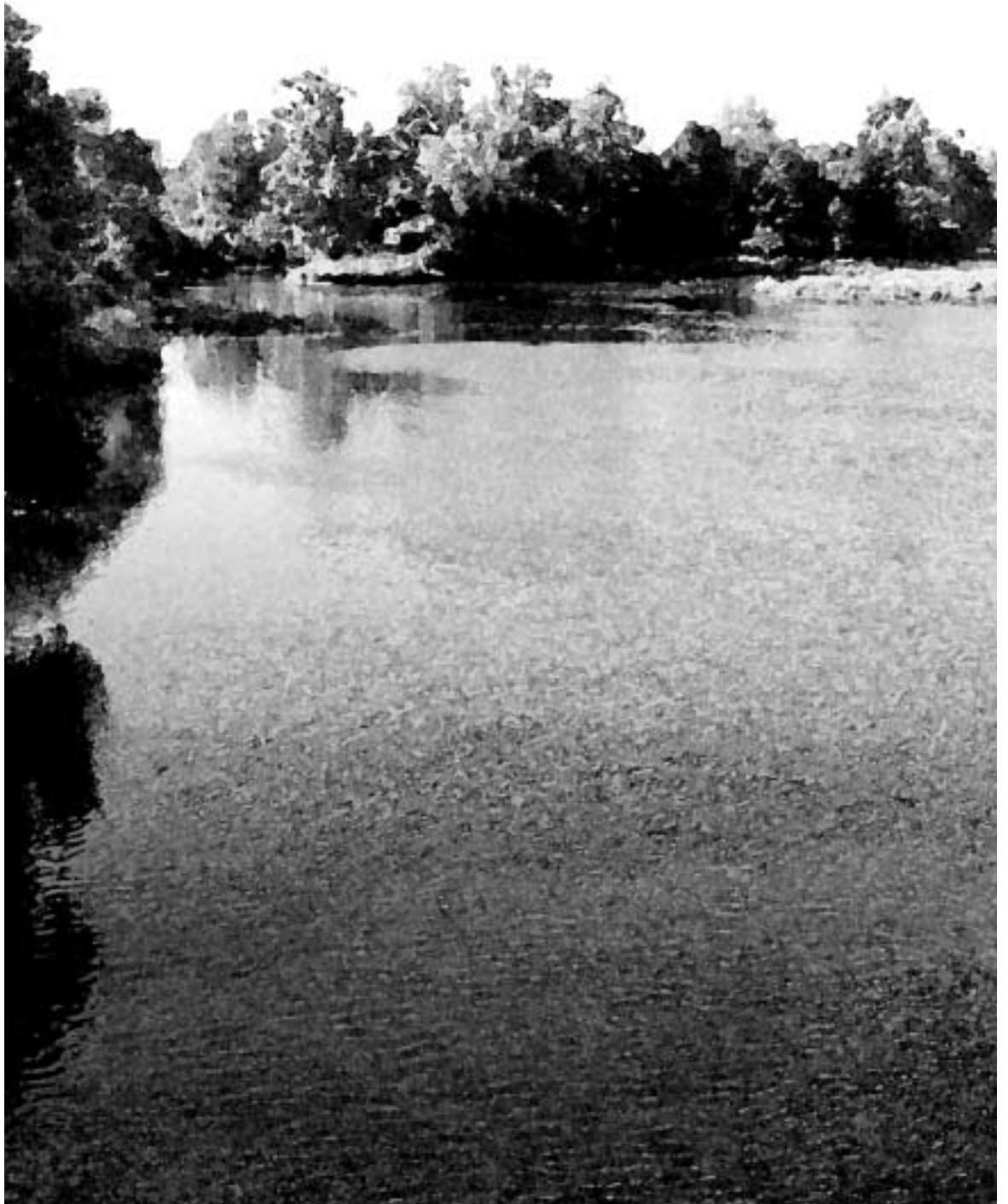

Pike Lake 2005

published 2005



PIKE LAKE - 2005

LOCATION:	Townships of Tay Valley and Rideau Lakes - part of the headwaters of Grants Creek, a major tributary of the Tay River
ELEVATION:	lake surface approximately 145 metres above mean sea level
DIMENSIONS:	perimeter: 24.2 kilometres; maximum depth: 32.6 metres.; area: 331.7 hectares
LAKE WATERSHED:	drainage area: 6,315 hectares; land use: 64.3% shield forest, 10.6% lake, 9.9% pasture, 8.6% wetlands, 3.7% crops, 2.8% successional lands, 0.1% mesic mixed hardwood
FISHERY:	warm water fishery - northern pike, walleye, bass.
DEVELOPMENT LEVEL:	230 cottages, 30 homes, two resorts (as of last count in mid 1990's)
BACKGROUND DATA:	Ministry of Environment Self-Help and Lake Partner Programs (1975-1999); Ministry of Environment Recreational Lakes Program (1975, 1983) - total phosphorus, chlorophyll <u>a</u> , secchi disk, dissolved oxygen profiles

The sampling component of the Watershed Watch program consisted of the following:

SITES:	one site at deepest point of lake, eight around shoreline adjacent to cottage groupings; three sites at access points (see map)
TOTAL PHOSPHORUS (TP):	a composite sample taken in the euphotic zone (layer which light penetrates – twice the secchi disk depth) at deepest point and one metre above the bottom; at shoreline sites at approximately half metre depth in one metre of water - Phosphorus comes from soaps, detergents, fertilizers and pesticides and is the main nutrient contributing to the growth of algae. The PWQO for lakes is to keep total phosphorus levels below 20 µg/L of water to avoid excess algae and aquatic plant growth
TOTAL KJELDAHL NITROGEN (TKN):	a composite sample at deepest point and one metre above the bottom; at shoreline sites at half metre depth in one metre of water - Nitrogen contributes to the growth of algae and aquatic plants. Some of its forms can be toxic to aquatic animals in excess quantity. Nitrogen comes from fertilizers, pesticides and human and animal waste. There is no PWQO for Total Kjeldahl Nitrogen but a generally accepted guideline is that TKN levels less than 100 and greater than 500 µg/L can have harmful effects on the aquatic environment (some nitrogen is required hence the lower limit of the range)
SECCHI DISK:	at deepest point – measurement is depth where disk can no longer be seen - The Secchi disk reading is a measurement of water clarity. The greater the depth that the disk remains visible indicates correspondingly lower quantities of suspended soil, debris and micro-organisms.
DISSOLVED OXYGEN/TEMPERATURE (DO/Temp):	at deepest point readings taken at intervals from surface to bottom - Oxygen and temperature measurements throughout the water column give an indication of how much of the lake depth is habitable for fish and other plant and animal aquatic species.
CHLOROPHYLL <u>a</u> (Chl <u>a</u>):	a composite sample at deepest point – not done in 2004 - Chlorophyll a is the green pigment in microscopic algae that live in water. A concentration of more than 5 micrograms of Chl <u>a</u> in a litre of lake water indicates an excessive quantity of algae is present which will negatively affect the clarity and oxygen content of the lake.
ESCHERICHIA COLI (E. coli):	at shoreline sites at approximately half metre depth in one metre of water - E.coli bacteria is used to indicate the presence of harmful disease-causing organisms (bacteria, pathogens). It is present in human and animal waste. The PWQO for drinking water is 0 CFU/100 mL which means that using untreated lake water as a drinking water source is not recommended. The PWQO for swimming is 100 CFU/100 mL
INVASIVE SPECIES (IS):	one near the public boat launch at the west end, one at the deep point and one toward the east end; samples for zebra mussel veligers and spiny water flea - Invasive species can significantly alter the lake character. They are typically very aggressive and tend to overwhelm native species in various ways reducing the biodiversity throughout the food chain.

How Pike Lake measured up in 2005:

The Rideau Valley Conservation Authority and the Pike Lake Property Owners Association have collaborated since 2001 to monitor the water quality of Pike Lake. There are two what can reasonably be called drought years in the record now with markedly different characteristics. Dry conditions should bring decreased inflow and lower water levels. Such was the case in both 2001 and 2005 but the result in 2001 was far different than in 2005. As the table below shows, concentrations of both Total Phosphorus (TP) and Total Kjeldahl Nitrogen (TKN), the primary nutrients for aquatic plant growth, exceeded thresholds in 52% and 87% of samples respectively. In all subsequent years, including 2005, the number of exceedances were a small proportion of those in 2001. Why was there an almost constant algae bloom in 2001 but not in 2005? The answer is complex to do with conditions and productivity the previous year, winter temperatures, spring runoff and temperature and precipitation pattern through the spring and into the summer. Detailed study might give a more precise answer. Unfortunately, the historical record (see table 5, below) shows that Pike Lake can have elevated nutrient concentrations in excess of the PWQO but not always with the extreme algae production as occurred in 2001.

Table 1: Exceedances of guidelines as Percentages of Number of Samples

		EC	TKN	TP
# surface samples:	2005	31	36	36
	2004	40	45	45
	2003	40	45	45
	2002	48	54	45
	2001	47	53	54
	total	206	233	225
exceedances:	2005	5	3	3
	2004	8	6	4
	2003	10	7	6
	2002	5	12	7
	2001	1	46	28
	total	29	74	48
percentage:	2005	16%	8%	8%
	2004	20%	13%	9%
	2003	25%	16%	13%
	2002	10%	22%	16%
	2001	2%	87%	52%
	total	14%	32%	21%

Site "D", which is where the "worst" results have come from over the five years of sampling, continued to have relatively high concentrations of both TP and TKN in 2005 but only one of the three exceedances was from there. which should be the case when the inflow stream that feeds the site has decreased flow as a result of drought conditions. Sites "C" and "F" had the other two exceedances but the rest of the samples had good results.

The RVCA has used E.Coli sample results with counts persistently above 10 as an early warning guide for excessive bacteria in lakes. The exceedances listed in the table above are based on 10 counts. The provincial water quality objective (PWQO) is for waters used for recreational body contact activities with no more than 100 counts per 100 millilitres of sample, above which health problems can be expected. Counts have fluctuated over the five years, up to 25% of samples in excess of the early warning guide, but there has been only one exceedance of the PWQO at site "C" (see map on last page) in the five year period (198 counts, 2003). If the counts were persistently above 10 and tending toward 100 in several locations, there would be cause for concern. What is indicated is that there is animal activity on and in the lake that provides a low level of bacteria but it is not a health threat. Many of the elevated counts have occurred at site "F" at the mouth of the inflow stream from Little Crosby Lake and at site "A", in the outlet stream at the northeast end of the lake where little swimming is done.

Dissolved Oxygen/Temperature profiles were done twice in 2005. The temperature exceeded 25° in the July profile in the surface two metres but temperatures and oxygen concentrations were good for fish to 23 metres. By the September profile, conditions had changed drastically with only the surface 7 metres suitable for fish.

Sampling for invasive species again was negative in 2005 with no Zebra Mussel veligers or Spiny Water Fleas found.

As in the previous three such reports, the indication is that Pike Lake was in reasonably good shape in 2005 despite or, to some extent, because of dry conditions. Results at site "D" continue to be higher than at other locations but were better than in previous years likely as a direct result of decreased inflow. Some further investigation of the source will be done in 2006. Again we reiterate that stewardship efforts must be continued to protect the lake both from invasive species and nutrient loadings.

Table 2: Total Phosphorus (microgram/litre (µg/L)) – 2001 - 2005

date/site	A	B	C	D	E	F	G	H	DP1	average
31-May-01									9	9
11-Jul-01	23	18	16	20	18	20	19	16	17	19
30-Jul-01	21	21	21	22	22	20	20	20	20	21
7-Aug-01	25	31	28	40	22	21	20	20	25	26
21-Aug-01	18	18	20	31	19	17	17	15	15	19
26-Sep-01	20	20	24	21	18	17	17	17	17	19
17-Oct-01	17	19	14	17	16		15	18	28	18
10-Jun-02	6	7	9	13	18	14	12	6	12	11
3-Jul-02	5	5	5	24	7	13	9	7	10	9
17-Jul-02	14	14	14	34	31	19	17	14	15	19
12-Aug-02	9	10	15	24	34	15	20	9	9	16
28-Aug-02	11	10	10	22	24	16	12	9	11	14
16-Sep-02	7	5	5	8	9	13	10	16	9	9
26-Jun-03	12	12	16	26	20	20	15	11	8	16
22-Jul-03	15	13	13	22	16	15	14	9	14	15
19-Aug-03	13	8	25	39	12	10	13	9	8	15
16-Sep-03	11	10	10	14	19	11	15	8	7	12
6-Oct-03	13	11	12	14	13	12	11	11	11	12
19-May-04	12	9	12	23	10	10	10	12	9	12
22-Jun-04	15	10	12	13	11	14	9	9	10	11
14-Jul-04	11	9	11	31	9	9	9	9	9	12
11-Aug-04	14	10	10	16	11	13	11	8	9	11
15-Sep-04	11	9	10	15	9	11	11	10	11	11
25-May-05	11	10	38	18	12	24	10	9	11	16
13-Jul-05	13	12	12	21	12	12	11	9	10	12
24-Aug-05	14	9	8	12	11	10	16	10	13	11
15-Sep-05	9	9	8	16	9	8	8	8	8	9
average	13	12	15	21	16	15	14	12	12	14
# samples	26	26	26	26	26	25	26	26	27	
# exceed	4	3	6	15	6	5	3	2	3	
percent	15%	12%	23%	58%	23%	20%	12%	8%	11%	
average '05	12	10	17	17	11	14	11	9	11	

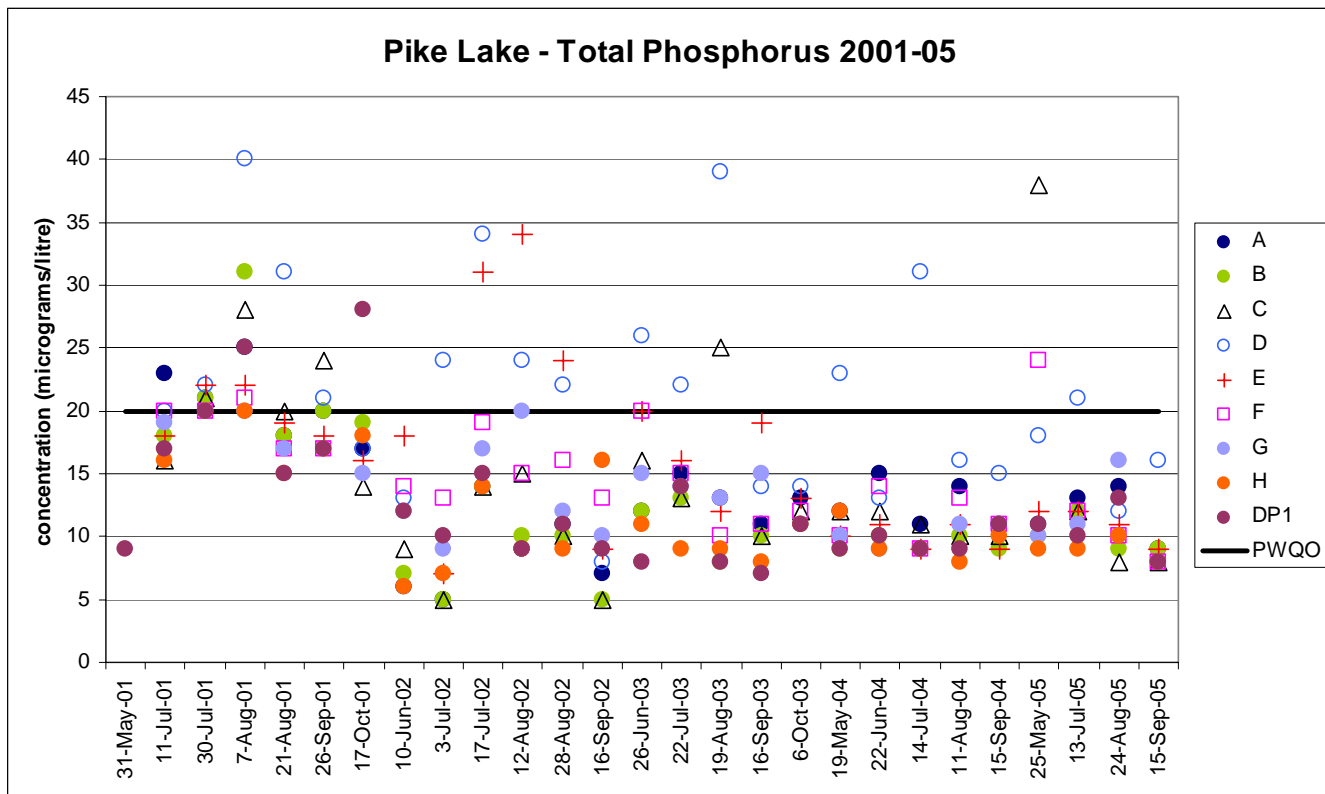


Table 3: Total Kjeldahl Nitrogen ($\mu\text{g/L}$) – 2001 - 2005

date/site	A	B	C	D	E	F	G	H	DP1	average
11-Jul-01	900	570	530	530	510	540	530	510	520	571
30-Jul-01	710	660	700	640	650	640	650	660	660	663
7-Aug-01	710	940	790	880	690	640	720	670	720	751
21-Aug-01	590	560	550	630	550	490	540	500	520	548
26-Sep-01	660	680	740	580	580	570	590	590	600	621
17-Oct-01	530	480	420	420	410		410	470	530	459
10-Jun-02	390	370	390	440	500	460	400	400	480	426
3-Jul-02	380	400	380	600	380	450	390	380	430	421
17-Jul-02	470	460	450	700	570	470	460	440	430	494
12-Aug-02	430	430	480	570	640	670	620	440	440	524
28-Aug-02	450	450	420	620	540	570	460	420	410	482
16-Sep-02	430	370	380	540	390	490	430	420	400	428
26-Jun-03	400	460	480	940	480	560	450	430	350	506
22-Jul-03	410	400	400	750	430	420	390	380	390	441
19-Aug-03	470	420	610	1150	450	440	470	440	450	544
16-Sep-03	450	470	410	440	510	410	580	390	410	452
6-Oct-03	440	430	470	490	450	450	460	440	440	452
19-May-04	400	360	380	530	370	380	400	400	370	399
22-Jun-04	460	420	440	500	450	500	440	430	430	452
14-Jul-04	460	450	460	860	450	450	450	450	450	498
11-Aug-04	460	400	420	630	450	510	430	430	410	460
15-Sep-04	430	410	450	490	420	450	470	400	450	441
25-May-05	320	320	310	390	350	680	330	320	330	372
13-Jul-05	430	420	420	550	410	430	420	420	400	433
24-Aug-05	410	410	400	450	390	420	420	530	430	429
15-Sep-05	360	360	370	430	350	360	370	370	360	370
average	483	465	471	606	476	498	472	451	454	486
#samples	26	26	26	26	26	25	26	26	26	

exceed	6	5	6	17	10	10	7	5	6
percent	23%	19%	23%	65%	38%	40%	27%	19%	23%
average '05	380	378	375	455	375	473	385	410	380

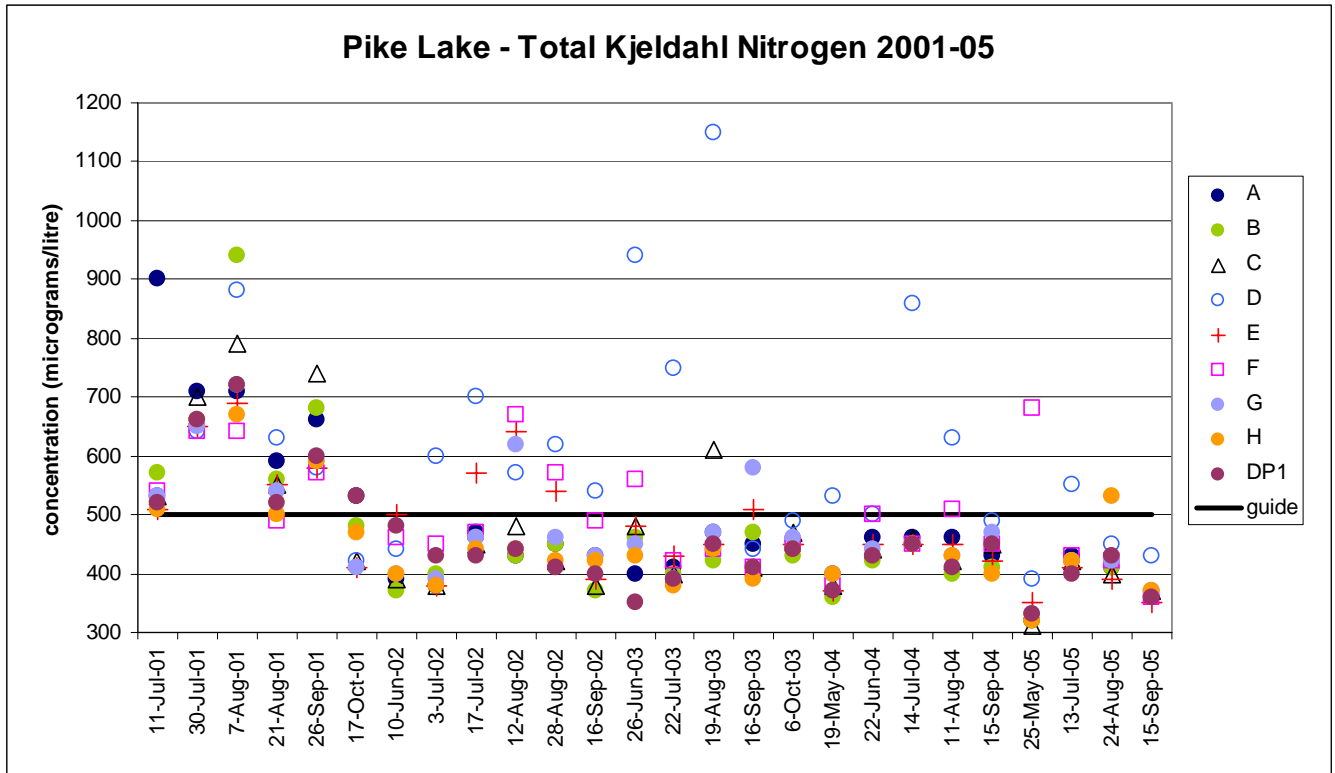
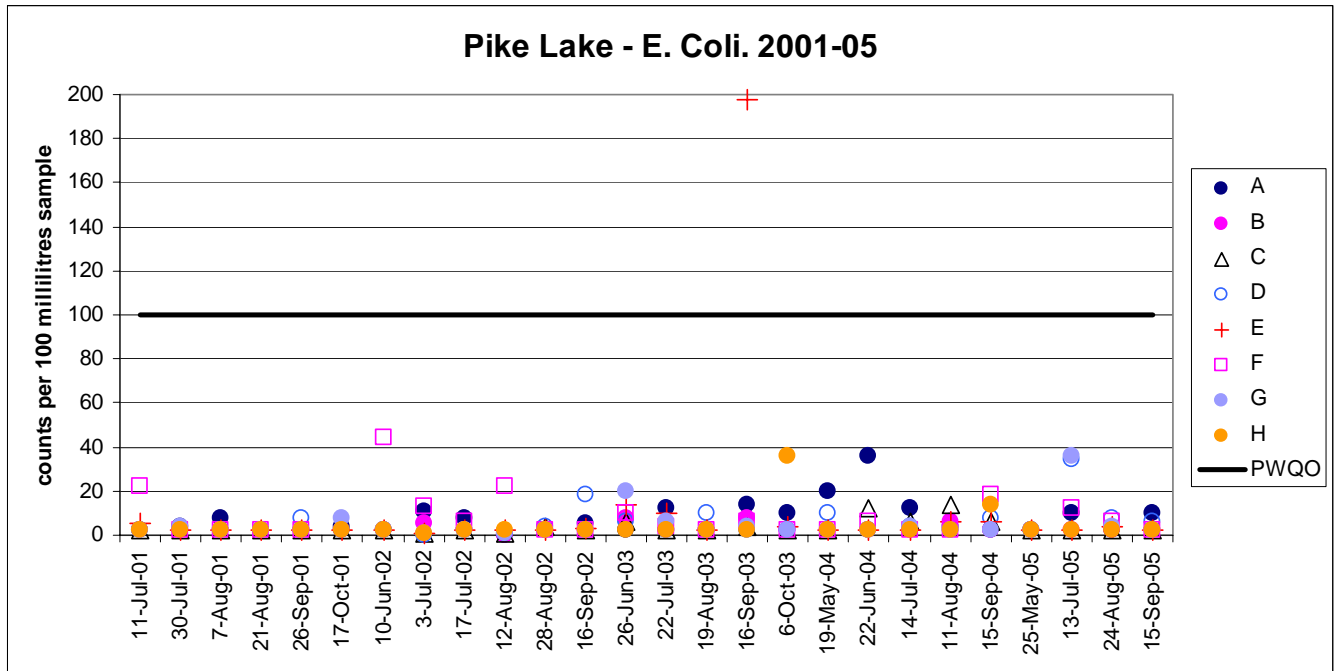


Table 4: *Escherichia Coliform* (counts per 100 millilitres of sample) – 2001 – 2005

date/site	A	B	C	D	E	F	G	H	average
11-Jul-01	2	2	2	2	5	22	2	2	5
30-Jul-01	4	2	2	2	2	2	4	2	3
7-Aug-01	8	2	2	2	2	2	2	2	3
21-Aug-01	2	2	2	2	2	2	2	2	2
26-Sep-01	2	2	2	8	2	2	2	2	3
17-Oct-01	4	2	2	2	2		8	2	3
10-Jun-02	2	2	2	2	2	44	2	2	7
3-Jul-02	11	5	1	0	1	13	1	1	4
17-Jul-02	8	2	2	2	2	6	2	2	3
12-Aug-02	0	0	1	1	2	22	1	2	4
28-Aug-02	2	2	4	4	2	2	2	2	3
16-Sep-02	5	2	2	18	3	2	2	2	5
26-Jun-03	2	8	6	6	14	10	20	2	9
22-Jul-03	12	2	2	2	10	4	6	2	5
19-Aug-03	2	2	2	10	2	2	2	2	3
16-Sep-03	14	8	4	2	198	6	4	2	30
6-Oct-03	10	2	2	2	4	2	2	36	8
19-May-04	20	2	2	10	2	2	2	2	5
22-Jun-04	36	2	12	2	2	6	2	2	8
14-Jul-04	12	2	6	4	2	2	4	2	4
11-Aug-04	4	6	14	2	6	2	2	2	5
15-Sep-04	2	2	6	8	6	18	2	14	7
25-May-05	2	2	2	2	2		2	2	2
13-Jul-05	10	2	2	34	2	12	36	2	13

24-Aug-05	2	2	2	8	4	6	4	2	4
15-Sep-05	10	2	2	6	2	2	2	2	4
average	7	3	3	6	11	8	5	4	6
#samples	26	26	26	26	26	24	26	26	
exceed	0	0	0	0	1	0	0	0	
average '05	4	2	3	13	4	12	11	5	



Dissolved Oxygen/Temperature - 2005

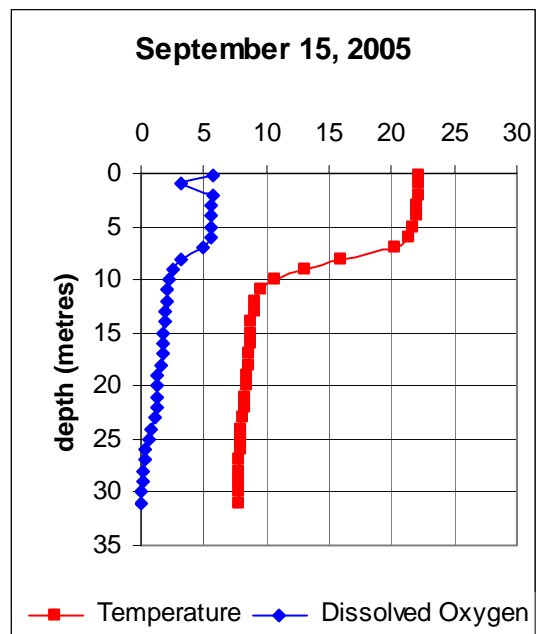
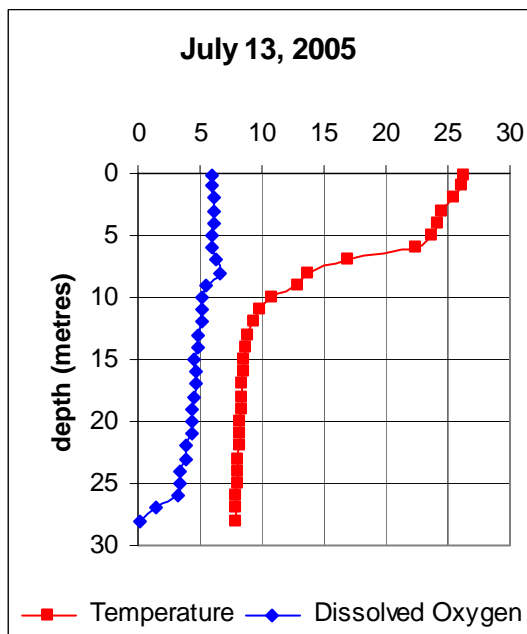
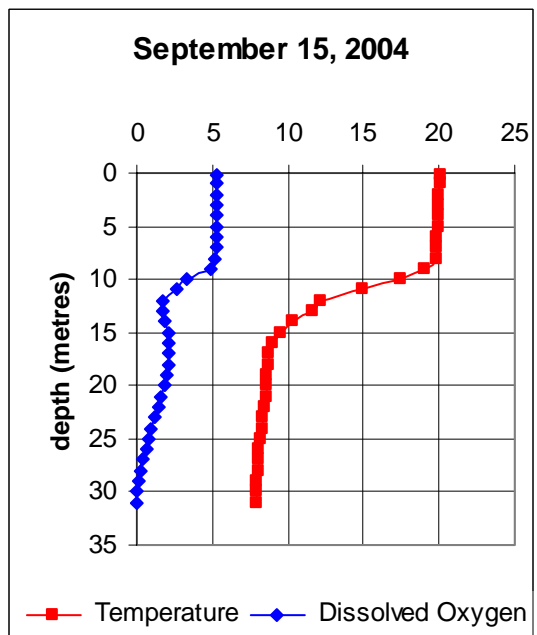
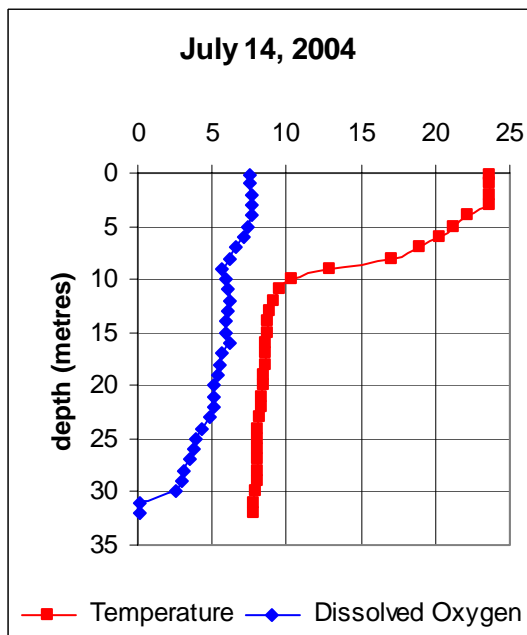
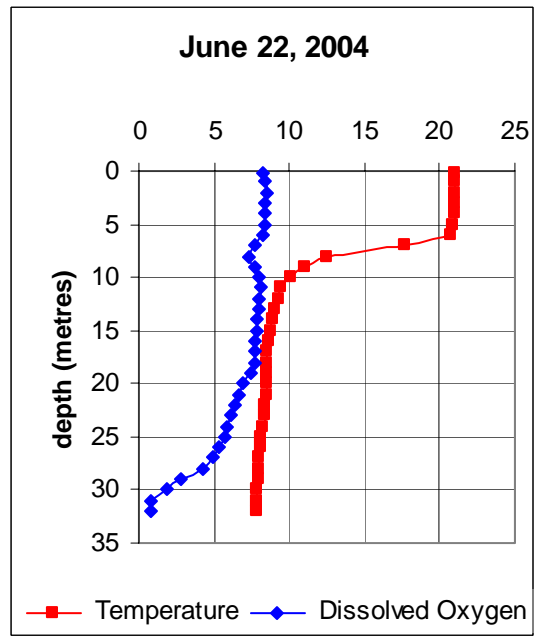
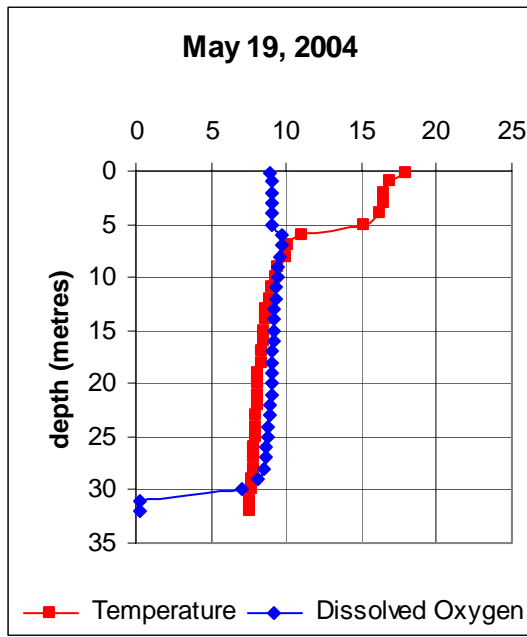


Table 5: Historical Annual Averages, 1975 - 2004, Deep Point of Lake

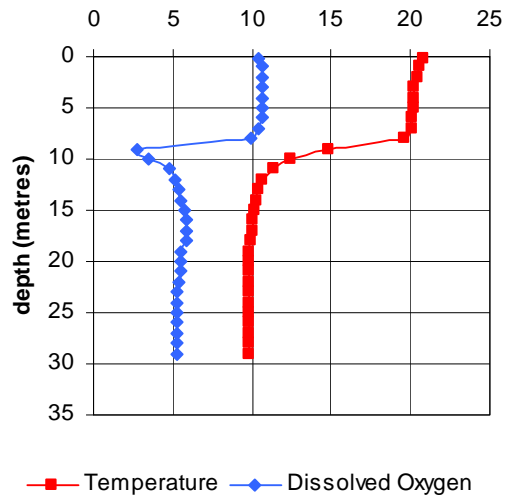
Sample Year	Secchi Disk [Metres]	Total Phosphorus ($\mu\text{g/L}$)	Total Phosphorus bottom ($\mu\text{g/L}$)	Chlorophyll a ($\mu\text{g/L}$)
1975	3.9	20	23	4.7
1976	2.4			6.6
1977	3.1			6.0
1978	4.2			4.3
1979	3.7			6.0
1980	3.8			6.5
1981	3.7			5.4
1982	2.5			5.4
1983	4.3	47	80	2.2
1984	3.0			7.6
1985	2.6			5.5
1986	3.2			6.8
1987	3.2			7.4
1988	5.5			2.0
1989	4.5			
1990	4.1			4.0
1991	5.1			2.7
1992	4.3			2.6
1993	2.9	52		6.0
1994	2.5	17		5.3
1996	5.2	54		
1997	4.0	10		
1998	3.9	9		
1999	5.0	9		
2000	4.2	19		
2001	2.7	19	40	7.7
2002	5.0	13	58	
2003	5.5	14	44	
2004		13	66	
2005	5.9	12	92	
Number	28	14	7	20
Minimum	2.4	9	23	2.0
Maximum	5.5	54	92	7.7
Mean	3.9	22	58	5.2

*Includes MOE 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 chlorophyll a concentrations by 35%.

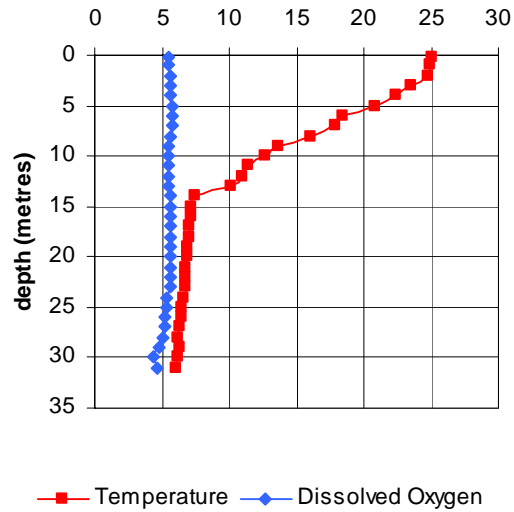
Dissolved Oxygen /Temperature Profiles, 2002 - 2004



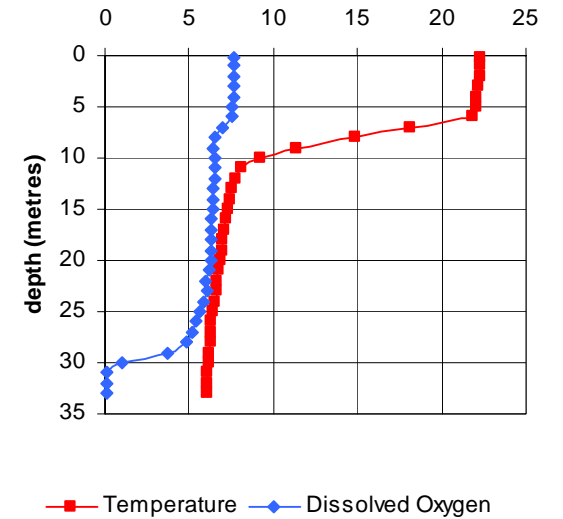
**Pike Lake - D.O./Temp. Profile
(16 Sept., 2002)**



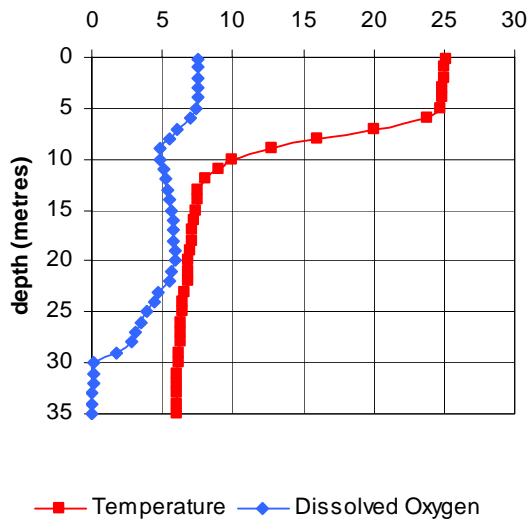
**Pike Lake - D.O./Temp. Profile
(26 June, 2003)**



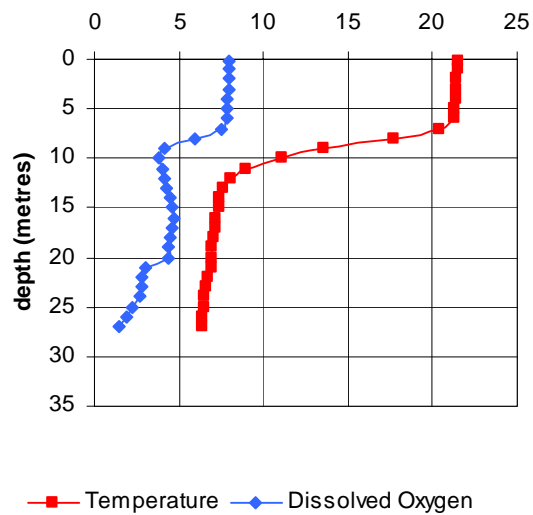
**Pike Lake - D.O./Temp.
(22 July, 2003)**



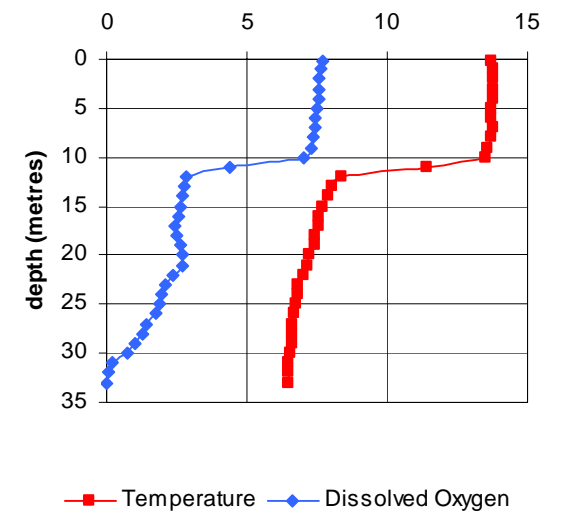
**Pike Lake - D.O./Temp.
(19 Aug., 2003)**



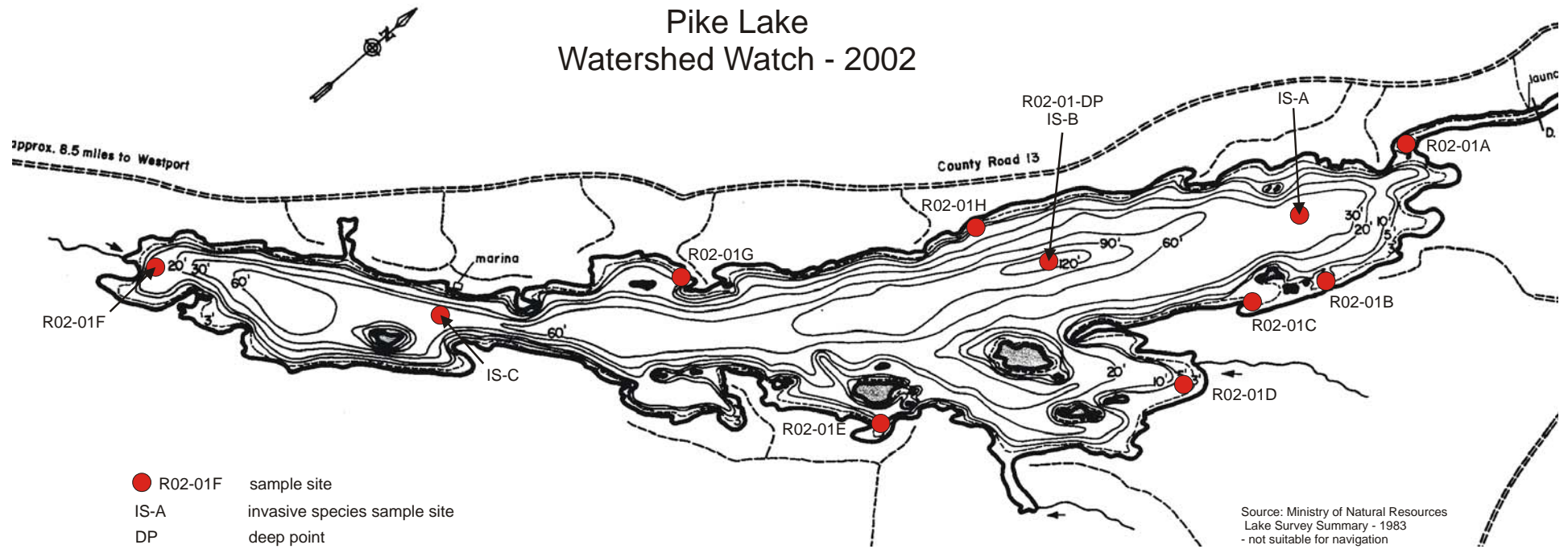
**Pike Lake - D.O./Temp.
(16 Sept., 2003)**



**Pike Lake - D.O./Temp.
(7 Oct., 2003)**



Pike Lake Watershed Watch - 2002



- R02-01F sample site
- IS-A invasive species sample site
- DP deep point

Source: Ministry of Natural Resources
Lake Survey Summary - 1983
- not suitable for navigation