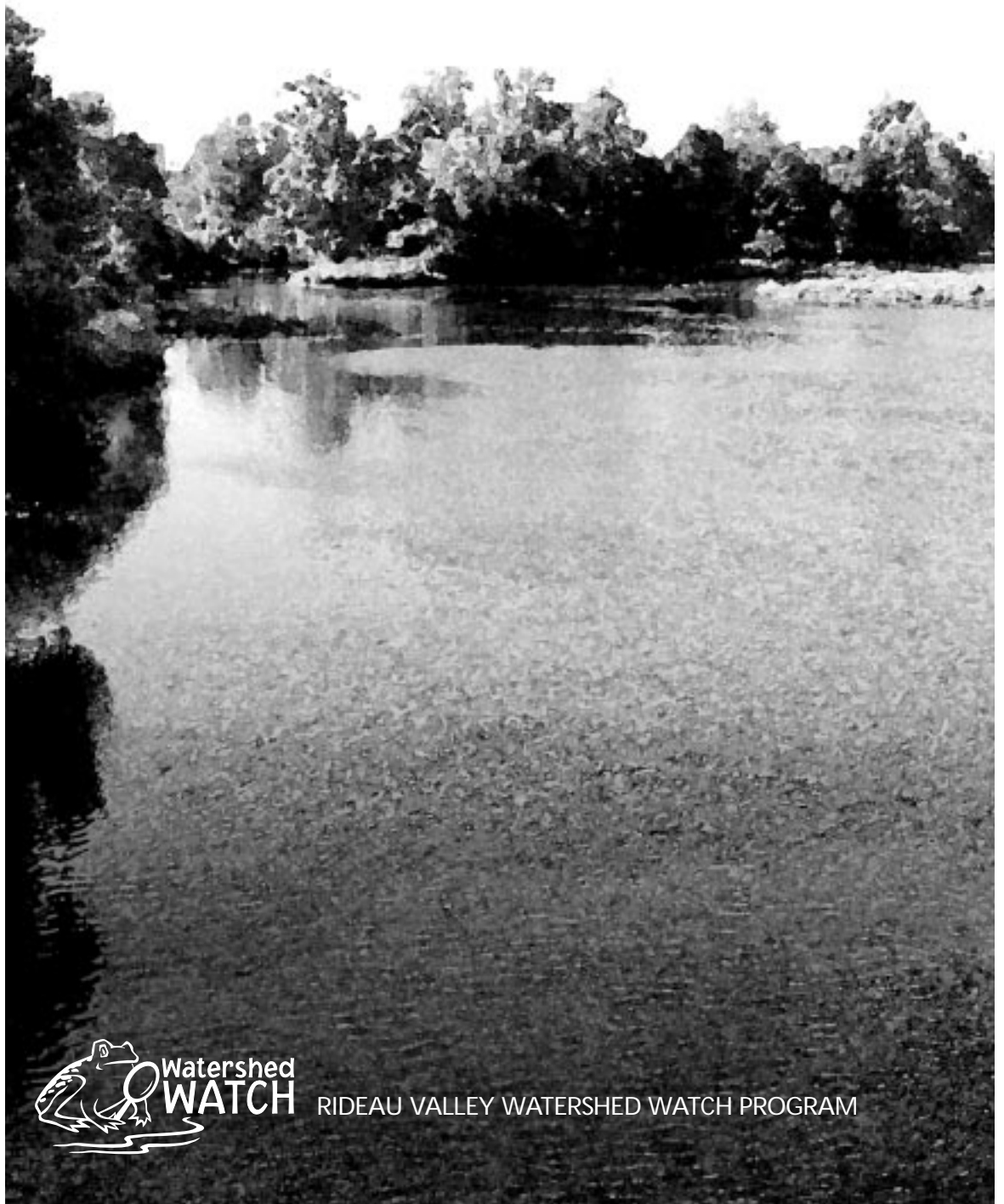


STATE OF THE
**LAKE
ENVIRONMENT
REPORT-2001**



Watershed
WATCH

RIDEAU VALLEY WATERSHED WATCH PROGRAM



THE ONTARIO TRILLIUM FOUNDATION
LA FONDATION TRILLIUM DE L'ONTARIO

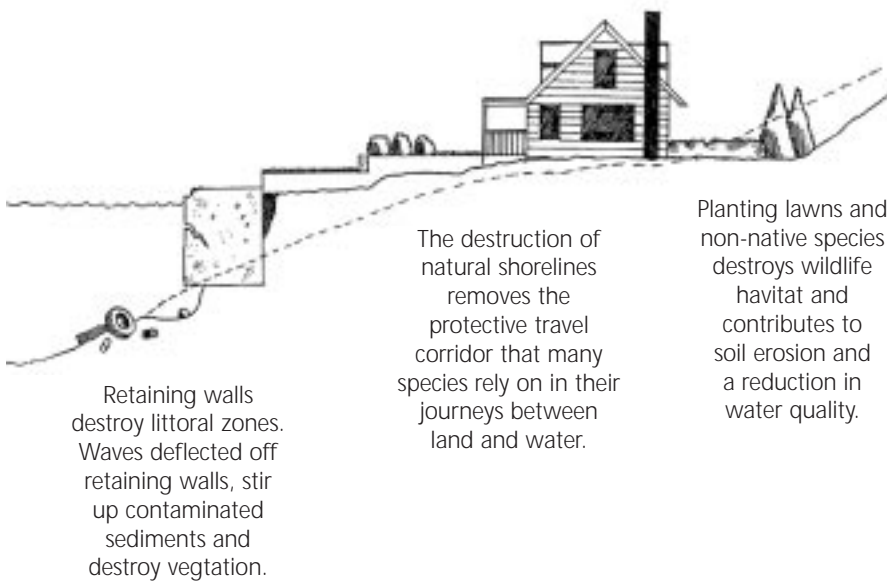
FENDOCK



- ▶ Alliance of Rideau Lakes Associations
 - ▶ Big Rideau Lake Association
 - ▶ Farren Lake Property Owners Association
 - ▶ Rideau Valley Conservation Foundation and its many donors
 - ▶ Township of Bathurst Burgess Sherbrooke
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"The Ribbon of Life" Where the Land Meets the Water

Water quality is affected by many things: natural processes of erosion and runoff accelerated by clearing of shorelines, the use of artificial fertilizers and leachate from sewage disposal systems. All result in too many nutrients reaching the lake.



Retaining walls destroy littoral zones. Waves deflected off retaining walls, stir up contaminated sediments and destroy vegetation.

The destruction of natural shorelines removes the protective travel corridor that many species rely on in their journeys between land and water.

Planting lawns and non-native species destroys wildlife habitat and contributes to soil erosion and a reduction in water quality.

Too many nutrients causes profuse weed and algae growth which affects the aquatic animal species makeup by altering habitat and food sources and by reducing oxygen and light penetration.

The shallow waters and first ten metres of shoreland area form a "Ribbon of Life" around lakes. This ribbon- where the land meets the water - is where much of the lake life is born, raised and fed. Many landowners, unaware of the importance of this area, have cleared the shorelines of native vegetation and replaced it with lawns, non-native ornamental vegetation, retaining walls and boathouses. This has a negative effect on fish and wildlife habitat and water quality. Natural vegetation retained or restored along the shoreline helps prevent erosion and improves water quality by binding nutrients before they can enter the lake.

The Rideau Valley Conservation Authority has long recognized the recreational and aesthetic value of lakes within the watershed and is committed to maintaining and protecting water quality and fish habitat. The Conservation Authority has joined together with volunteer Lake Stewards throughout the watershed to take steps to protect and restore water quality by launching the Watershed Watch program. Watershed Watch is an environmental monitoring and awareness program. The objectives of the program are to collect reliable environmental data to document current water quality conditions and use the data as an essential educational tool to encourage shoreline residents, both seasonal and permanent, to become personal stewards of their lake and to adopt sound stewardship practices aimed at preserving and protecting water quality. By taking an active role in restoring and enhancing their shoreline, they can help to maintain water quality and a healthy lake environment.

Recreational water quality can be expressed in terms of how clear the water appears. Water clarity is influenced by the amount of soil sediment and phytoplankton, or microscopic algae, present in the water. Clarity is measured by a simple visual test using a **Secchi Disk**, a 20 centimetre black and white disk attached to a measured line that is lowered into the lake until it is no longer visible. Analysis of water samples for **chlorophyll a**, which provides the green pigment in phytoplankton, gives a more specific measure of the abundance of small creatures in the water. Another perspective is gained through analysis of samples for nutrients, particularly **phosphorus** but also **nitrogen**, which tells how much food is available for the algae and aquatic plants. In the late summer when the algae drops to the bottom of the lake, its decomposition uses oxygen so, to find out how much oxygen is available for fish and other aquatic animals, **dissolved oxygen and temperature** profiles are done.

These tests combine to give an indication of the Age@ of a lake and what can be expected. An Aold@ or **eutrophic** lake will have profuse plant growth and relatively few fish species

because of the lack of open water and the competition for oxygen. A middle-aged or mesotrophic lake will support the greatest diversity of fish species with a variety of habitats and sufficient oxygen available. A young or **oligotrophic** lakes have very little or no vegetation and are usually well oxygenated but will have relatively few fish species.

While lake users are interested in how weedy a lake is and what kind of fishing stories they can experience, they also want to know if the water is safe for drinking and swimming. *Escherichia coli* (**E.coli.**) are in a family of fecal coliform bacteria common to warm-blooded mammals. A few members of the family are harmful themselves but E.coli. are also a good

indicator of the presence of pathogenic or other hazardous bacteria because where there is E.coli., the others will usually be present. Analysis of water samples for E.coli., which is relatively more abundant and easier to count than the other organisms, gives an indication of problems with leaking septic systems or other sources of contamination.

Through WATERSHED WATCH, lakes in the watershed will be monitored for these key water quality indicators. Knowing what is in the water will assist the lake stewards when devising a strategy to protect the Ribbon of Life which will reduce the human impact on the aging process and ensure that our lakes will endure for future generations to enjoy.

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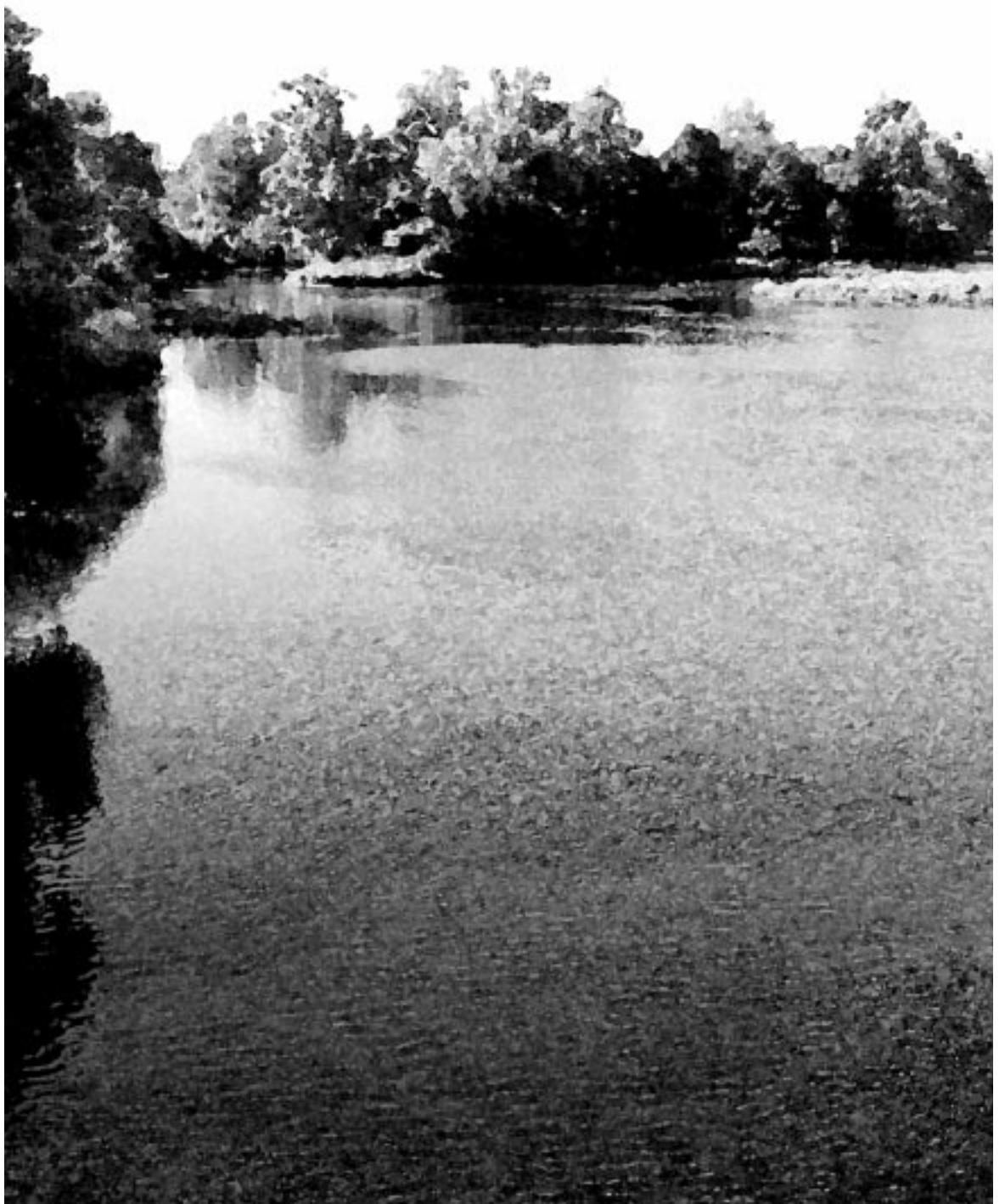
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Crosby Lake



CROSBY LAKE - 2001

LOCATION:	Township of Rideau Lakes (North Crosby) – the uppermost of three lakes in the headwaters of Grants Creek, a major tributary of the Tay River
ELEVATION:	lake surface approximately 146 metres above mean sea level
DIMENSIONS:	perimeter: 15.2 kilometres; maximum depth: 19.2 metres.; area: 271.6 hectares
LAKE WATERSHED:	drainage area: 3020.4 hectares
FISHERY:	warm water fishery - northern pike, yellow pickerel, smallmouth bass.
DEVELOPMENT LEVEL:	172 cottages, 4 permanent residences, 6 trailers (shoreline survey 1993)
BACKGROUND DATA:	Ministry of Environment Self-Help and Lake Partner Programs (1974-2001); Ministry of Environment Recreational Lakes Program (1974, 1975) - 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; one site toward east end of lake
TOTAL PHOSPHORUS (TP):	samples from deepest point at the surface and one metre above the bottom; at eight shoreline sites at approximately half metre depth in one metre of water
TOTAL KJELDAHL NITROGEN (TKN):	samples from deepest point at the surface and one metre above the bottom; at eight shoreline sites at half metre depth in one metre of water
SECCHI DISK:	at deepest point – measurement is depth where disk can no longer be seen
DISSOLVED OXYGEN/TEMPERATURE (DO/Temp):	at deepest point readings taken at intervals from surface to bottom and back up
CHLOROPHYLL <u>a</u> (Chl):	a composite sample taken in the euphotic zone (layer which light penetrates – twice the secchi disk depth) at deepest point
ESCHERICHIA COLI (E. coli):	at eight shoreline sites at approximately half metre depth in one metre of water
INVASIVE SPECIES (IS):	near the two public boat launches and one near the inlet stream; samples for zebra mussel veligers and spiny water flea

How Crosby Lake measured up in 2001:

Grading Scheme:

TP	TKN	Secchi	DO	Chl	E.coli	IS	Score
.005 - .009	.1 - .2	> 5	> 5	0 - 0.00125	0 - 10	No	4
.009 - .013	.2 - .3	4 - 5	4 - 5	0.00125 - 0.0025	10 - 40		3
.013 - .017	.3 - .4	3 - 4	3 - 4	0.0025 - 0.00375	40 - 70		2
.017 - 0.02	.4 - .5	2 - 3	2 - 3	0.00375 - 0.005	70 - 100		1
> 0.02	< .1, > .5	< 2	< 2	> 0.005	> 100	Yes	0

Overall Grading	
Score Range	Grade
> 3.5	A
2.6 - 3.5	B
1.6 - 2.5	C
0.5 - 1.5	D
< 0.5	F

The scores in Table 2 below come from Table 1: Grading Scheme, above. The result or average value of sample results for 2001 for a particular parameter is compared to the range under that parameter in Table 1. Once the appropriate range is found, move in that row horizontally to the score column. For example, a value for TKN of .36 is in the range .3 - .4 for which the score is 2. The overall grade shown at the bottom of Table 2 is found by taking the average of the scores, finding the Score Range in Table 1 to get the grade from the right hand column e.g. an average score of 2.75 is in the range 2.6 - 3.5 which yields a grade of B.

This scoring/grading is not a scientifically rigorous scheme. It is based on schemes used by others but was derived specifically for this report to provide an indication of the overall status of the lake based on all the aspects included in the Rideau Valley Watershed Watch sampling program in 2001. The elements being compared here are not all directly related e.g. the presence of spiny flea has no direct bearing on the amount of TP in the lake and vice versa. Most of the scores are related to an accepted benchmark. The failing score of zero is given for anything above or below the benchmark, depending on the particular parameter, such as 0.02 for TP which is the concentration, expressed in milligrams per litre, used as the Provincial Water Quality Objective (PWQO) above which a marked impact can be expected. In the case of Invasive Species, IS, the presence or absence is what is important and only two scores are needed.

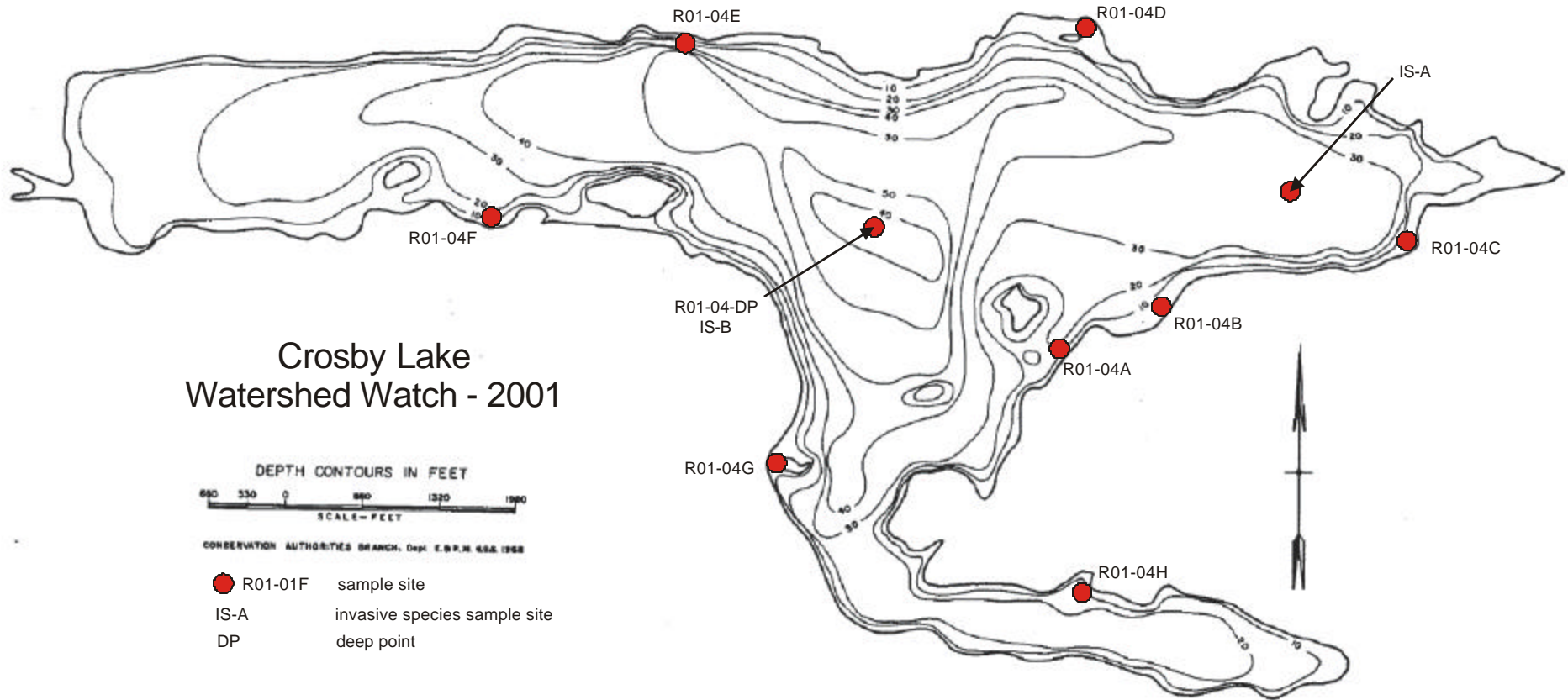
Table 2: Scoring

Parameter	Result	Score	
TP (milligrams/ Litre (mg/L))	0.011	3	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 0.02 mg per litre of water to avoid excess algae and aquatic plant growth
TKN (mg/L)	0.43	1	Nitrogen contributes to the growth of algae and aquatic plants. Some of its forms can be toxic to aquatic animals in excess quantity and/or when an imbalance occurs. 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 0.1 and greater than 0.5 mg/L can have harmful effects on the aquatic environment (some nitrogen is required hence the lower limit of the range)
Secchi (metres (m))	5.8	4	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.
DO/Temp (mg/L)	3.78	2	Result is the average of the DO >4 mg/L at <25 and >10 degrees Celsius multiplied by the percentage of the depth of the lake with those conditions e.g. a lake 30 metres deep has oxygen concentrations that meet the conditions in 10 metres or 30% of the total depth.
Chl (mg/L)	0.003	2	Chlorophyll a is the green pigment in microscopic algae which live in water. More than 0.005 milligrams of Chl 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.
E.coli (coliform units/ 100 millilitres (CFU/100 mL))	2.15	4	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	No	4	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.
average score		2.86	Overall Grade: B

Crosby Lake had a moderate total phosphorus load, typical nitrogen loading for the area, elevated chlorophyll a concentration, no significant bacteria counts and no invasive animal species in 2001 that rates an overall grade of B. This grade indicates that Crosby Lake is healthy and falls within the mesotrophic category of lake "age". Care still needs to be taken to reduce the human impacts (nutrient loading) to slow that aging process. In particular, inputs of nitrogen need to be controlled so as to avoid adding to the naturally elevated condition. There will have been some

algae growth during the sample period but excessive nutrient loading usually brings large persistent blooms throughout the summer which was not the case on Crosby Lake. The nearshore sample sites were located near cottage groups to get an indication of whether or not there were any sources of bacterial pollution. More definitive tests for leaking septic systems or grey water sources might be useful and septic systems should be periodically pumped out and inspected but it appears that there is no bacterial pollution occurring. Finally, tests showed that zebra mussels and spiny water flea have not yet made it into the lake but lake users need to take precautions to prevent infestations..

A special thank-you to Ross Rutherford who volunteered his time and his boat to the Watershed Watch crew for the 2001 sampling season



Crosby Lake Watershed Watch - 2001

CROSBY LAKE – 2001

Looking a little deeper:

The basic characteristics of a lake depend on the physical properties (dimensions and geology) and climate. Six processes or actions further define an individual lake:

- Precipitation directly onto the lake surface deposits phosphorus and other chemicals and runoff from the lake watershed carry bacteria and pathogens, plant debris and soil particles, which bear phosphorus and other chemical elements, into the water ;
- Use by aquatic plants of the nutrients (phosphorus, etc.) has two impacts:
 - plant communities develop in the lake becoming profuse over time which limits the development and diversity of other plants and aquatic animals, and
 - along with plant debris and sediment from the shoreline, dead phytoplankton and other plants settle to the lake bottom where it decomposes using up oxygen and releasing nutrients;
- Each spring and fall temperature changes in the lake cause a mixing or turnover of the waters which can bring phosphorus from bottom waters to the surface to be available for aquatic plant and microorganism growth;
- A “sink” of phosphorus is created by settling of phosphorus-bearing sediment and the decay process at the bottom of all lakes with the phosphorus either held adsorbed to the lake bed soil particles when dissolved oxygen levels are high or in solution when the dissolved oxygen levels decline.
- After the spring turnover, the lake warms and stratification occurs creating a warmer surface layer (epilimnion), a transition zone (metalimnion) and colder deep waters (hypolimnion). As water warms, the ability to hold dissolved oxygen decreases. While the warm waters of the epilimnion can hold less the air/water contact and wave action ensures that there is a constant supply. As the deep waters of the hypolimnion warm, there is no mechanism to get new oxygen. The demand for oxygen for the decay process can cause the hypolimnion to become anoxic (no dissolved oxygen);
- Lakeshore development affects the shoreline runoff/erosion characteristics which usually leads to increased sediment, bacterial and nutrient loading of lake waters by changes to the vegetation composition, hardening the surface (buildings, roads, retaining walls, etc.) and installation and sometimes poor maintenance of septic facilities;

There are several methods of measuring the impacts of these processes or actions. The common ones are:

- measurement of water clarity using a Secchi disk,
- dissolved oxygen (DO)/Temperature profiles to show what the extents of the aquatic habitat are (most fish species inhabit the warmer, oxygenated surface waters),
- analysis of samples for nutrients: Total Phosphorus (TP) - the limiting nutrient for plant and microorganism growth, and/or
- presence or concentration of phytoplankton indicated by the amount of chlorophyll a, a pigment in phytoplankton

Added for the Watershed Watch program were:

- Total Kjeldahl Nitrogen (TKN), a secondary nutrient, to see if the high counts found elsewhere in the watershed occur in the lakes, and
- Eschericia Coliform (E.Coli) sampling around the lake nearshore to check for bacterial pollution problems.

An obstacle to assessing the condition of lakes is the length of the historical data record. Compared to what is available for some lakes, there is a long dataset for Crosby Lake (Table 1, below). However, the general nature of the parameters does not allow a detailed analysis of Crosby Lake so what follows is a set of observations about the available data which should be of assistance in setting goals for future lake management.

Table 1: 1974 - 2001, Deep Point of Lake

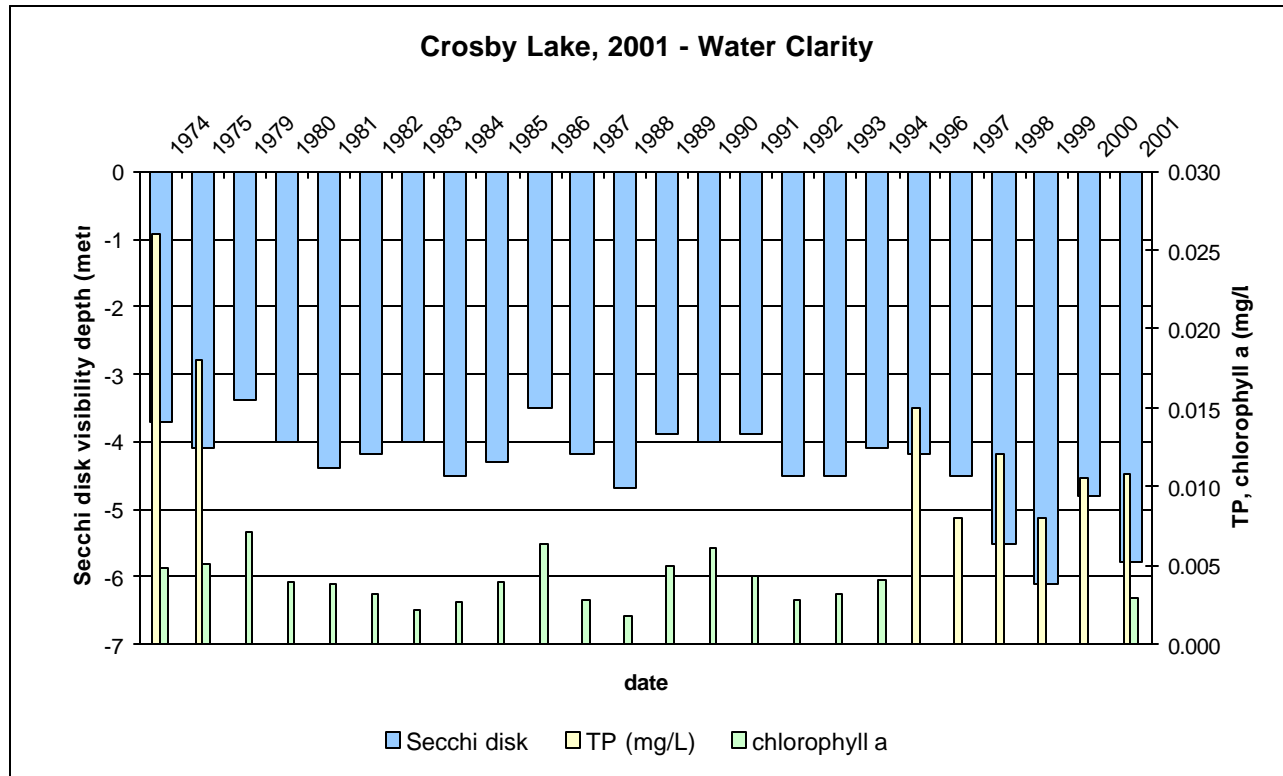
Sample Year	Secchi Disk [Metres]	Total Phosphorus Surface Sample [mg/L]	Total Phosphorus Bottom Sample [mg/L]	Chlorophyll a [mg/L]
1974	3.7	0.026	0.094	0.0048
1975	4.1	0.018	0.045	0.0051
1976				
1977				
1978				
1979	3.4			0.0071
1980	4			0.0039
1981	4.4			0.0038
1982	4.2			0.0032
1983	4			0.0022
1984	4.5			0.0027
1985	4.3			0.0039
1986	3.5			0.0063
1987	4.2			0.0028
1988	4.7			0.0018
1989	3.9			0.0050
1990	4			0.0061
1991	3.9			0.0044
1992	4.5			0.0028
1993	4.5			0.0032
1994	4.1			0.0040
1995				
1996	4.2	0.015		
1997	4.5	0.008		
1998	5.5	0.012		
1999	6.1	0.008		
2000	4.8	0.012		
2001	5.8	0.011	0.039	0.0030
n	24	8	3	19
Minimum	3.4	0.008	0.039	0.0018
Maximum	6.1	0.026	0.094	0.0071
Mean	4.4	0.014	0.059	0.0040

Chlorophyll a was used as the primary indicator of lake trophic state (age or nutrient level) until 1994 when it was replaced by total phosphorus because sampling and analysis for TP has been shown to be more reliable and more economical. The relationship between the two is that chlorophyll a is one of the pigments found in phytoplankton and phosphorus is the primary nutrient affecting the proliferation of phytoplankton. For comparison with the historical data, analysis for chlorophyll a was included in the Watershed Watch sampling in 2001. The reference concentration of chlorophyll a to designate the degree of eutrophication of a lake varies depending on the area and particular lake. 0.006 milligrams per litre has been used for Muskoka lakes. 0.004 has been used in the Mississippi Valley Watershed Watch program. In at least one case in the Rideau Watershed, 0.005 mg/L was judged to be the maximum tolerable concentration. No specific concentration has been found in reference material for Crosby Lake so 0.005 mg/L is used here.

When chlorophyll a concentrations are high, it should be expected that there is an excess quantity of phytoplankton growing. In turn, water clarity should be reduced. For Crosby Lake, there has been a relatively close correspondence between the two (correlation coefficient = 0.81). That is to say that, for example, when chlorophyll a readings were high, the Secchi disk depth was usually correspondingly shallow. However, as indicated by the average **Secchi disk** depths for the twenty-four years of record, Crosby Lake has usually been

moderately clear and the trend has been toward improved clarity (Figure 1, below). In other words, elevated chlorophyll a concentrations have meant reduced clarity in some years but not to critical levels which suggests that large prolonged and dense algae blooms, the obvious sign of excess nutrient loading, have not been prevalent on Crosby Lake over the period of record. Secchi disk measurements (Watershed Watch and Lake Partners Program) in 2001 indicated that there was good water clarity throughout the year and chlorophyll a concentrations were also mainly quite good. The one instance of elevated concentration did not appear to have any impact on clarity with one of the best measurements for the year recorded on that date (Figure 2, Table 2, below).

Figure 1



There is usually a more obvious relationship between water clarity and chlorophyll a concentration than between **Total Phosphorus** and clarity since TP represents the potential for growth or what is available but not necessarily used (correlation coefficient TP:Secchi disk = 0.12). Elevated TP results in 1974 above the Provincial Water Quality Objective have given way to moderate concentrations in the mesotrophic category. .

TP concentrations at the bottom of the lake (Table 1) are limited but what there is indicates that there has been a decline corresponding to the concentrations in the surface waters. The quantity is, however, still above the PWQO. The data in Table 2 in column three, TP DP – B, shows the course of TP over the summer in bottom samples. The increase in August is likely due to the lack of oxygen in the deeper water that would have caused phosphorus to go into solution from the bottom sediments. Why there was the sharp decline in bottom TP in September is not obvious since oxygen conditions had not changed significantly.

Figure 2

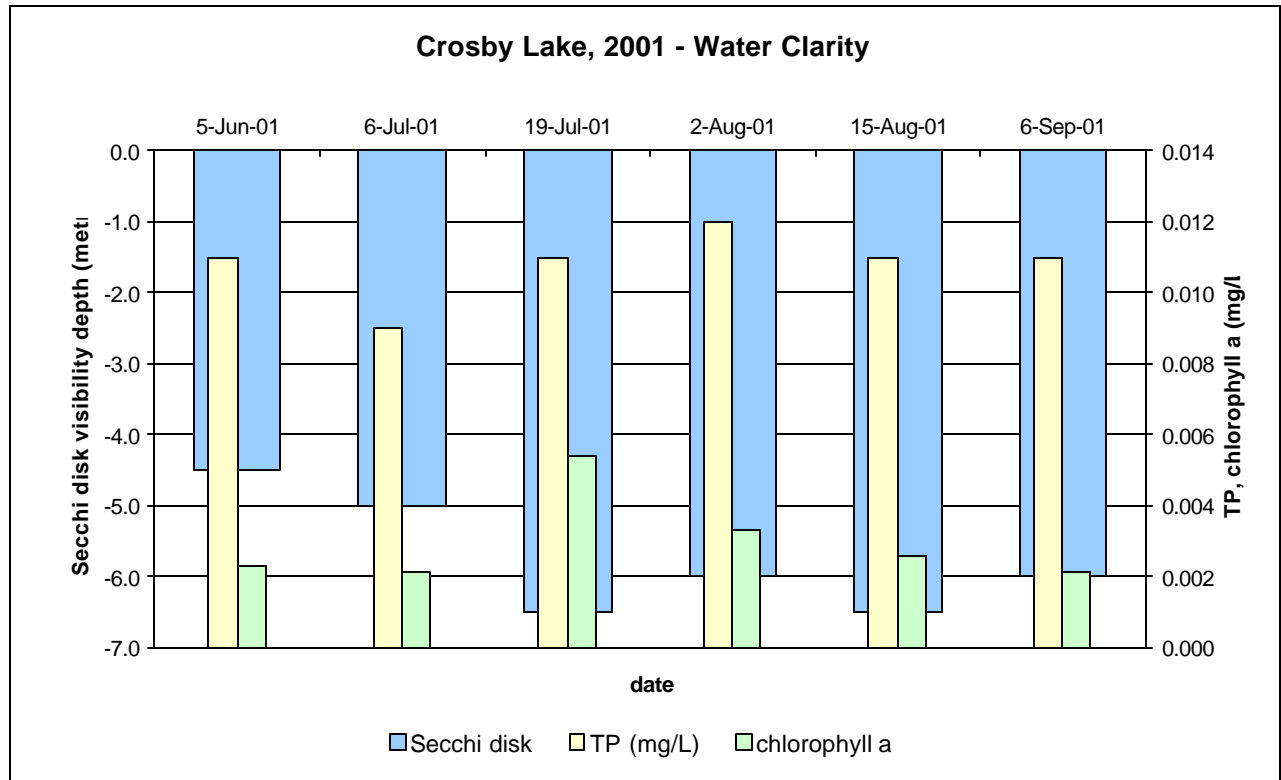


Table 2: Crosby Lake, 2001 - Deep Point

	TP DP-S (mg/L)	TP DP-B (mg/L)	Chl a (mg/L)	Secchi (metres)
5-Jun-01	0.011	0.030	0.0023	-4.5
6-Jul-01	0.009	0.031	0.0021	-5.0
19-Jul-01	0.011	0.022	0.0054	-6.5
2-Aug-01	0.012	0.042	0.0033	-6.0
15-Aug-01	0.011	0.095	0.0026	-6.5
6-Sep-01	0.011	0.015	0.0021	-6.0
average	0.0108	0.0392	0.0030	-5.8

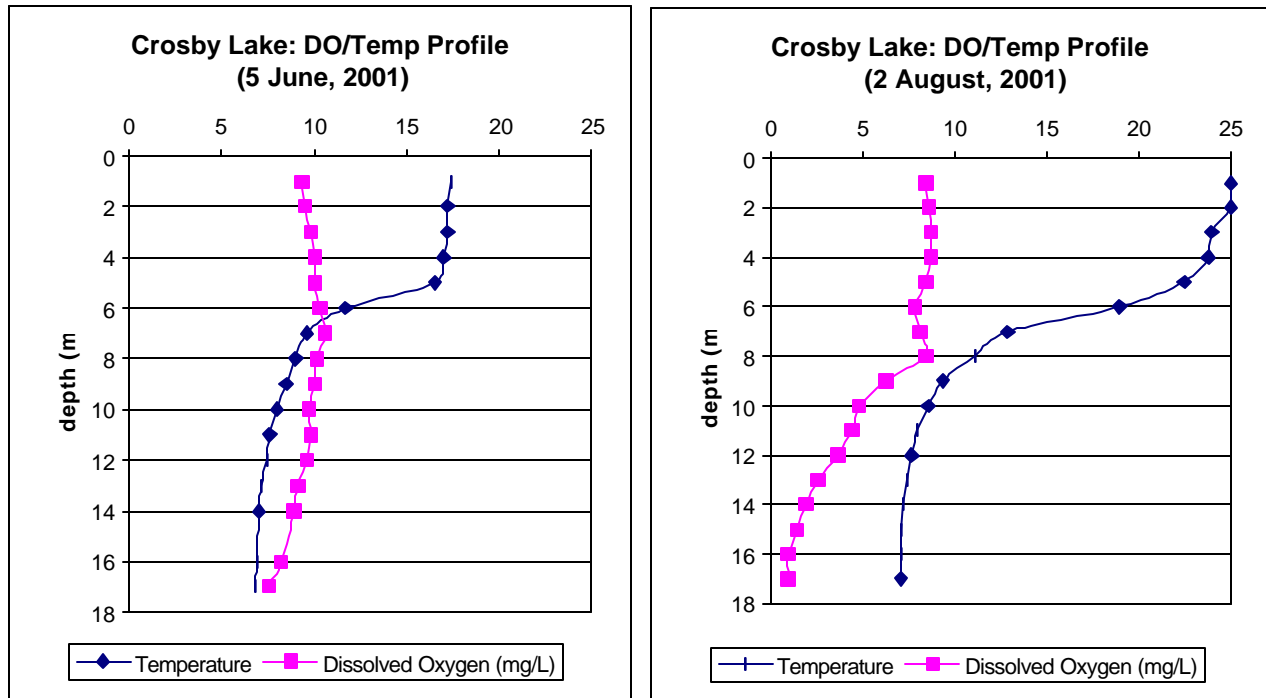
Note: TP DP-S and TP DP-B refer to the total phosphorus sample at the surface (S) and bottom (B) taken at the deep point (DP)

Table 3: Crosby Lake, 2001 – Deep Point, Dissolved Oxygen/Temperature – 6 September

Depth [Metres]	Temperature [degrees Celsius]	Dissolved Oxygen [mg/L]	Percent Saturation [%]	Lake Stratification
1	20.8	8.0	86	Epilimnion
2	20.8	8.1	89	
3	20.7	8.2	90	
4	20.7	8.2	90	
5	20.6	8.2	90	
6	20.6	8.2	90	
7	19.2	5.8	62	
8	13.4	4.6	44	Metalimnion or Thermocline
9	10.1	3.9	34	
10	8.6	2.5	18	
11	7.8	1.6	13	

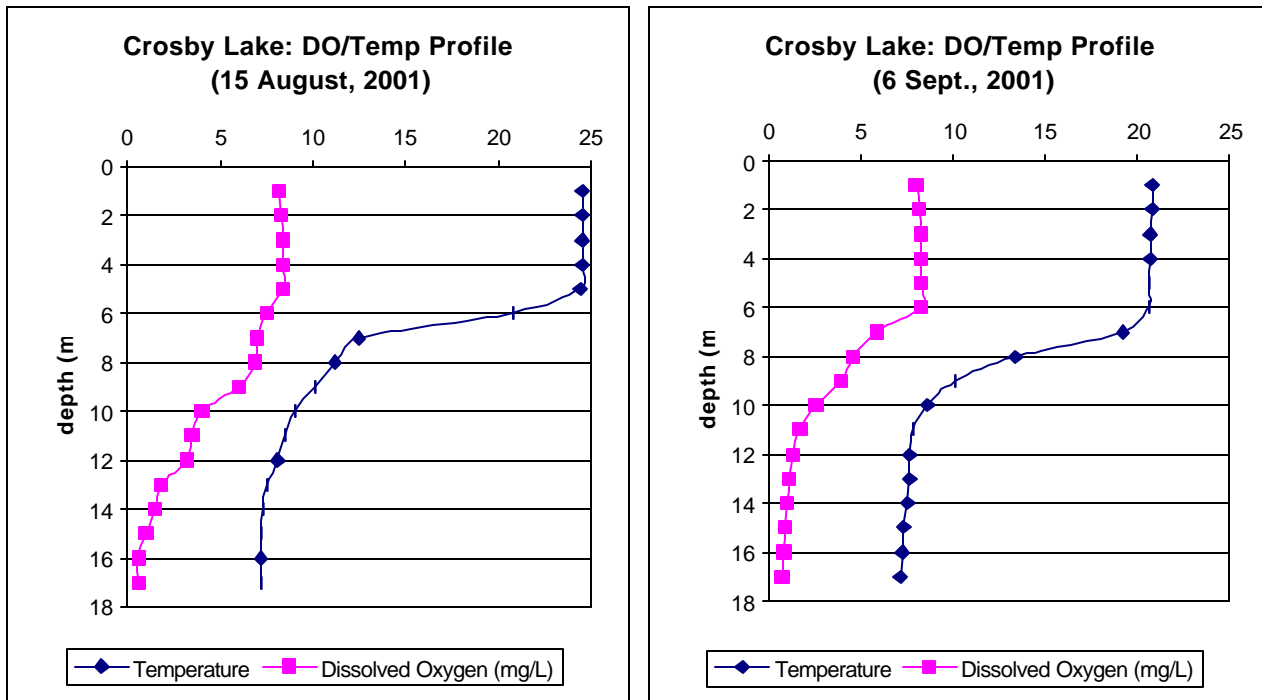
12	7.6	1.3	10	Hypolimnion
13	7.6	1.1	9	
14	7.5	1.0	8	
15	7.3	0.9	7	
16	7.2	0.8	6	
17	7.1	0.7	5	
- warm water fisheries habitat (bass, pickerel, pike) defined as Dissolved Oxygen concentrations greater than 4 mg/L at Temp. less than 25 Degrees Celsius.				

Figure 3, 4



Dissolved oxygen and temperature profiling is important for all lakes because both parameters affect all aquatic organisms and the chemistry of the lake environment. As oxygen levels are lowered, phosphorus in the bottom sediments are more readily soluble adding to the loading available for plant growth. At the beginning of June, spring turnover was complete and stratification had occurred. Oxygen concentrations were fairly uniform throughout the water column. Two months later the temperature in the top two to three metres of the lake had become inhospitable to fish rising above 25 degrees. By the middle of August, surface temperatures had decreased and fish would have had about nine metres of comfortable water. At the last profile on September 6, surface water temperatures had decreased but fish were confined to the top seven metres because of lower oxygen. The bottom waters were nearly anoxic by at least early August. As previously discussed, this would have caused TP concentrations to increase but it isn't clear what caused the loss of oxygen. Temperatures did not change significantly in the lower eight metres and, with relatively low phytoplankton production as shown by chlorophyll a data, there would not have been a lot of die-off and decay to deplete the oxygen supply that early in the year. Farren Lake experiences a similar early low oxygen condition.

Figures 5, 6



Near the shore:

In addition to sampling at the deep point in the lake, the Watershed Watch program included sampling at a number of sites near the shore. The objectives were:

- a) to look at the phosphorus and nitrogen distribution around the lake.
- b) to do general sampling for bacterial pollution (E.Coli) in proximity to the larger groupings of cottages to see if there was a problem with septic and grey water entering the lake.

Table 4: TP - Crosby Lake, 2001

SITE	5-Jun-01	21-Jun-01	6-Jul-01	19-Jul-01	2-Aug-01	15-Aug-01	6-Sep-01	average
DP-B	0.030		0.031	0.022	0.042	0.095	0.015	0.039
DP-S	0.011		0.009	0.011	0.012	0.011	0.011	0.011
A		0.014	0.013	0.009	0.009	0.008	0.007	0.010
B		0.009	0.010	0.008	0.008	0.010	0.009	0.009
C		0.010	0.009	0.008	0.007	0.006	0.009	0.008
D		0.009	0.010	0.010	0.009	0.008	0.013	0.010
E		0.008	0.008	0.008	0.008	0.008	0.009	0.008
F		0.008	0.008	0.009	0.008	0.008	0.010	0.009
G		0.009	0.011	0.008	0.011	0.008	0.008	0.009
H		0.011	0.008	0.009	0.012	0.008	0.010	0.010
							average	0.009

TP was fairly evenly distributed around the lake during the sampling period. Statistically, 12 of 54 of the surface data equaled or exceeded one standard deviation above the average and 3 of the 12 exceeded two standard deviations. Of most importance is the overall average for the summer of 0.009 mg/L which is well below the PWQO. Of lesser import is that the concentrations were higher at the deep point of the lake on all but one sample date. Otherwise, there was no particular pattern of distribution such as upstream to downstream movement or elevated concentrations in bays.

Table 5: TKN – Crosby Lake, 2001

SITE	5-Jun-01	21-Jun-01	6-Jul-01	19-Jul-01	2-Aug-01	15-Aug-01	6-Sep-01	average
DP-B	0.40		0.59	0.44	0.46	0.53	0.43	0.48
DP-S	0.41		0.43	0.46	0.46	0.42	0.44	0.44
A		0.48	0.51	0.42	0.46	0.42	0.42	0.46
B		0.39	0.44	0.39	0.42	0.44	0.43	0.42
C		0.57	0.43	0.41	0.41	0.40	0.44	0.44
D		0.42	0.44	0.40	0.42	0.40	0.53	0.42
E		0.43	0.47	0.41	0.45	0.40	0.43	0.43
F		0.41	0.45	0.43	0.43	0.40	0.43	0.42
G		0.47	0.51	0.41	0.47	0.39	0.43	0.45
H		0.43	0.45	0.40	0.43	0.40	0.43	0.42
							average	0.43

The upper end of the range of the provincial guideline for concentration of **Total Kjeldahl Nitrogen** is 0.50 mg/L above which a significant increase in phytoplankton growth would be expected. The prevalence of elevated TKN concentrations as occurred in Crosby Lake in 2001 have been found throughout the Tay River Watershed system which suggests that there is a naturally occurring background level. Similar concentrations were found in the Lakes Surveys of Crosby Lake in 1974 and '75. While only four out of fifty-four surface samples exceeded the guideline through the sampling period (Table 5), only a minor increase in nitrogen inputs could cause the guideline to be persistently exceeded and lead to a dramatic increase in phytoplankton growth as well as an increased risk of nitrogen toxicity for aquatic animals

The limited amount of data for the lake bottom shows that TP concentrations are typically higher in the deeper waters than at the surface. TKN concentrations do not always follow that pattern which suggests that there is not the same “sink” effect as with TP and TKN is not adsorbed to the bottom sediments. In Crosby Lake, the TKN concentration at the bottom was comparatively high twice but similar to the surface sites in the other four samples.

Table 6: E.Coli - Crosby Lake, 2001

SITE	21-Jun-01	6-Jul-01	19-Jul-01	2-Aug-01	15-Aug-01	6-Sep-01	average	
A	2	2	2	2	2	2	2.00	
B	2	2		2	2	2	2.00	
C	2	2	2	2	2	2	2.00	
D	2	2	2	2	2	2	2.00	
E	2		2	2	2	2	2.00	
F	2	5	2	2	2	2	2.50	
G	2	2	2	2	2	2	2.00	
H	2	2	2	6	2	2	2.67	
							average	2.15

Escherichia coliform (E.Coli) is used as an indicator of the potential presence of other harmful bacteria and pathogens in water. The main sources of bacteria are animal (decay of dead animals, defecation near and in the water) and human waste (septic systems, grey water). Levels above the PWQO of 100 counts/100 mL can mean that the water is unsafe for swimming. As a general precaution, lakes should not be used as the primary drinking water source and use for washing and cooking should be limited.

The results for Crosby Lake indicate that there are very low levels of E.Coli bacteria in the water. While all parts of the lake were not sampled, the E.Coli results can be considered to reasonably indicate that the waters of Crosby Lake did not pose a health concern for cottagers and residents for swimming and other water contact recreational use in 2001.

(Note: Not all bacteria are harmful. Some can be a food source for macroscopic aquatic invertebrates. Also, what is commonly referred to as blue-green algae, is a bacteria which shares many characteristics with algae and can be toxic to aquatic species as well as cause reactions in humans).

Crosby Lake was also tested for **invasive species** in 2001, in particular, for zebra mussels and spiny water flea, in partnership with the Ontario Federation of Anglers and Hunters (www.invadingspecies.com for further information). Neither species was found in Crosby Lake or upstream in Crosby or Little Crosby Lakes. Residents need to take precautions to avoid bringing in invasive species as well as to ensure that all access points to the lake have posted signs indicating what boaters can do to avoid infesting the lake.

In conclusion:

The historical data and the results of Watershed Watch sampling through the summer of 2001 indicate that nitrogen inputs to Crosby Lake is the most pressing issue. Nitrogen in all forms (fertilizers, septic system effluent, pesticides) should to be controlled as much as possible. Specific sampling might be done to determine what the proportions of the forms of nitrogen (ammonia, nitrites, nitrates) are.

Of the six things in the list on the first page of this section of processes and actions that affect the character of a lake, the first point has to be addressed by society as a whole. The amount of phosphorus reaching lakes by airborne deposition can be reduced by controlling the amount that gets into the air from industrial and other emissions. It is the last point in that list which is entirely the responsibility of those who own property around the lake to act on. The objectives should be to limit the human impact on lake aging and to maintain the present degree of biodiversity which means no net increase in loading of any kind (nutrients, bacteria, invasive species).

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 and have the tank and tile field inspected periodically.
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		HIGH PHOSPHORUS LIFESTYLE	
HUMAN WASTE	535 g	HUMAN WASTE	535 g
NO DISHWASHER	0 g	DISHWASHER USING POWDERED DETERGENT ONCE PER DAY	650 g
NO FERTILIZER	0 g	LAWN FERTILIZED ONCE/YEAR	1,960 g
TREES NOT CUT DOWN	20 g	LOT CLEARED OF TREES	30 g
USES PHOSPHATE-FREE PRODUCTS	20 g	USES PRODUCTS WITH PHOSPHATES	180 g
TOTAL	575 g		3,355 g

For more information regarding *Watershed Watch* or for free advice on how you can help protect or enhance your lake environment, contact the Landowner Resource Centre at (613) 692-2390 or Irc@rideauvalley.on.ca