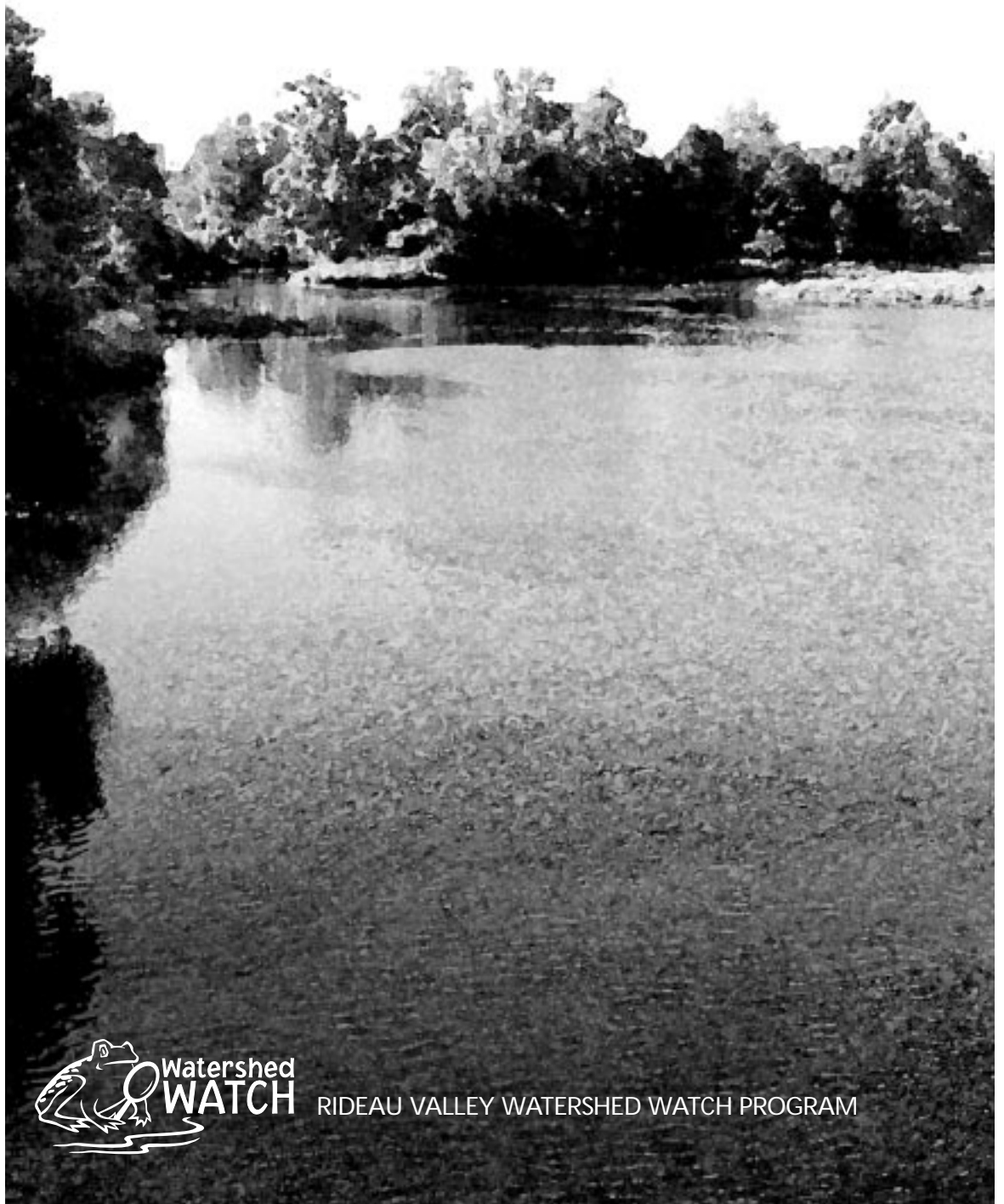


STATE OF THE
**LAKE
ENVIRONMENT
REPORT-2001**



Watershed
WATCH

RIDEAU VALLEY WATERSHED WATCH PROGRAM



THE ONTARIO TRILLIUM FOUNDATION
LA FONDATION TRILLIUM DE L'ONTARIO

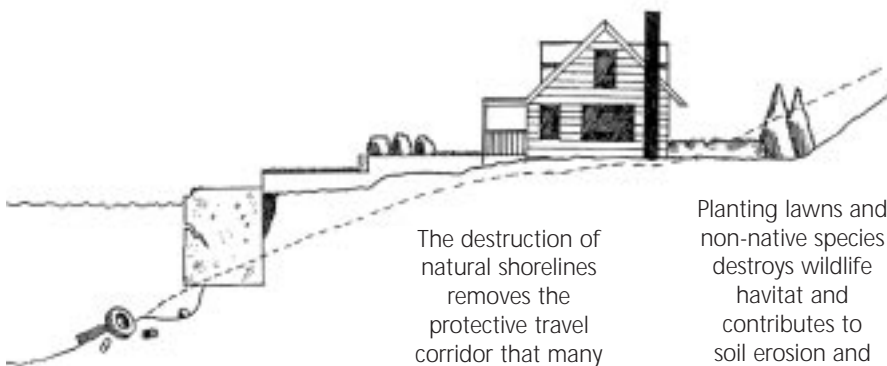
FENDOCK



- ▶ 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
-

"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

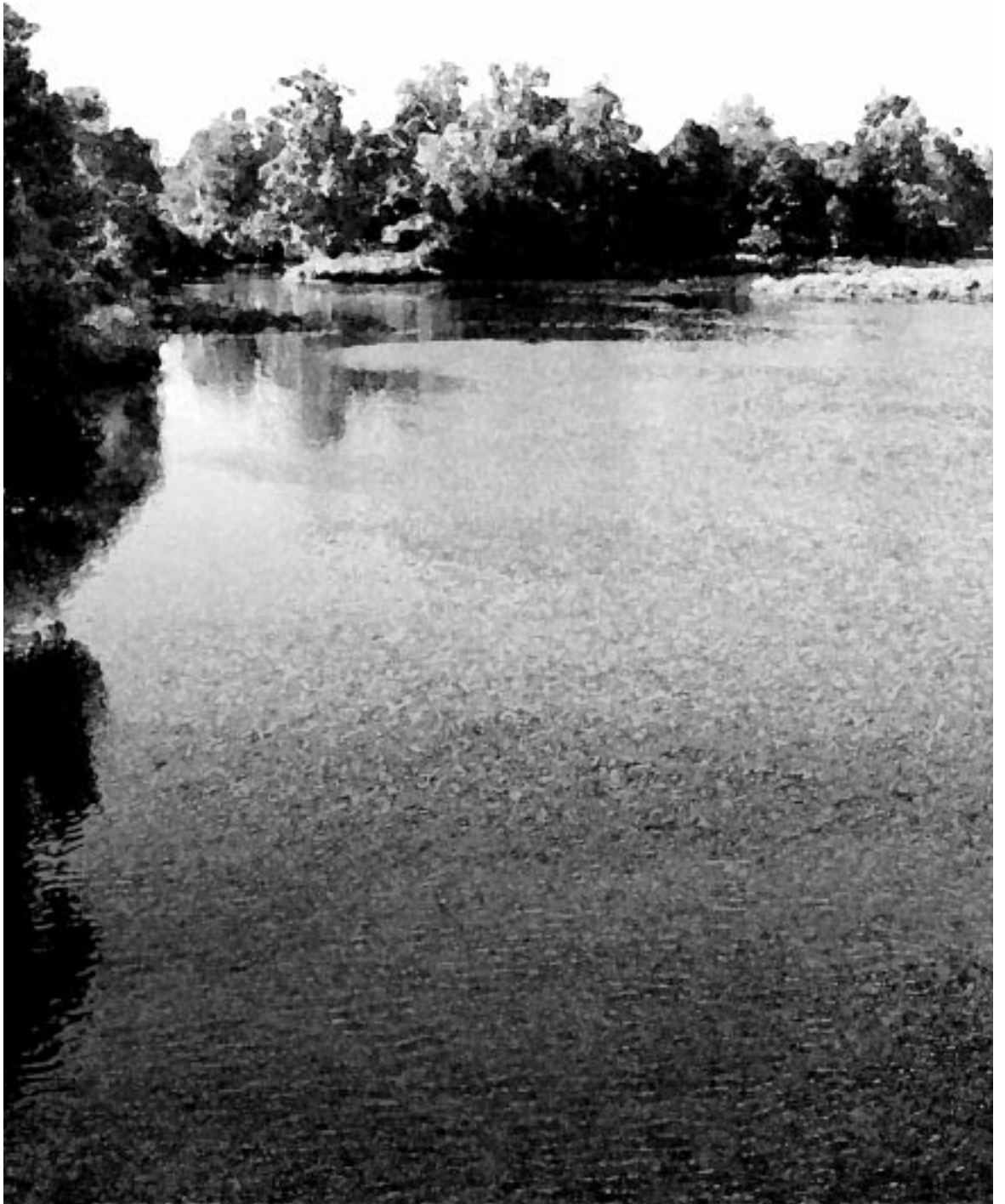
because of the lack of open water and the competition for oxygen. A middle-aged or mesotrophic lake will support the greatest diversity of fish species with a variety of habitats and sufficient oxygen available. A young or **oligotrophic** lakes have very little or no vegetation and are usually well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

Little Silver Lake



LITTLE SILVER LAKE - 2001

LOCATION:	Township of Bathurst Burgess Sherbrooke – drains to the Tay River upstream of Christie Lake
ELEVATION:	lake surface approximately 182 metres above mean sea level
DIMENSIONS:	perimeter: 10.5 kilometres; maximum depth: 12.2 metres.; area: 85.9 hectares
LAKE WATERSHED:	drainage area: 1068.5 hectares
FISHERY:	warm water fishery – largemouth and smallmouth bass, yellow perch.
DEVELOPMENT LEVEL:	71 cottages
BACKGROUND DATA:	Ministry of Environment Self-Help and Lake Partner Programs (1976-1999); Ministry of Environment Recreational Lakes Program (1977, 1979) - 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 each of two deep points of lake, six around shoreline adjacent to cottage groupings; three sites at access points (see map)
TOTAL PHOSPHORUS (TP):	samples from deep points at the surface and one metre above the bottom; at six shoreline sites at approximately half metre depth in one metre of water
TOTAL KJELDAHL NITROGEN (TKN):	samples from deep points at the surface and one metre above the bottom; at six shoreline sites at half metre depth in one metre of water
SECCHI DISK:	at deep points – measurement is depth where disk can no longer be seen
DISSOLVED OXYGEN/TEMPERATURE (DO/Temp):	at deep points readings taken at intervals from surface to bottom and back up
CHLOROPHYLL <u>a</u> (Chl a):	a composite sample taken in the euphotic zone (layer which light penetrates – twice the secchi disk depth) at deep points
ESCHERICHIA COLI (E.Coli):	at six shoreline sites at approximately half metre depth in one metre of water
INVASIVE SPECIES (IS):	toward the west end and at the deep point; samples for zebra mussel veligers and spiny water flea

How Little Silver Lake measured up in 2001:

Table 1: Grading Scheme:

TP	TKN	Secchi	DO	Chl a	E.Coli	IS	Score
.005 - .009	.1 - .2	> 5	> 5	0.001 - 0.00175	0 - 10	No	4
.009 - .013	.2 - .3	4 - 5	4 - 5	0.00175 - 0.0025	10 - 40		3
.013 - .017	.3 - .4	3 - 4	3 - 4	0.0025 - 0.00325	40 - 70		2
.017 - 0.02	.4 - .5	2 - 3	2 - 3	0.00325 - 0.004	70 - 100		1
> 0.02	< .1, > .5	< 2	< 2	> 0.004	> 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. Once the 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 grading in the two right hand columns of Table 1 comes from the average of the scores for all of the parameters 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

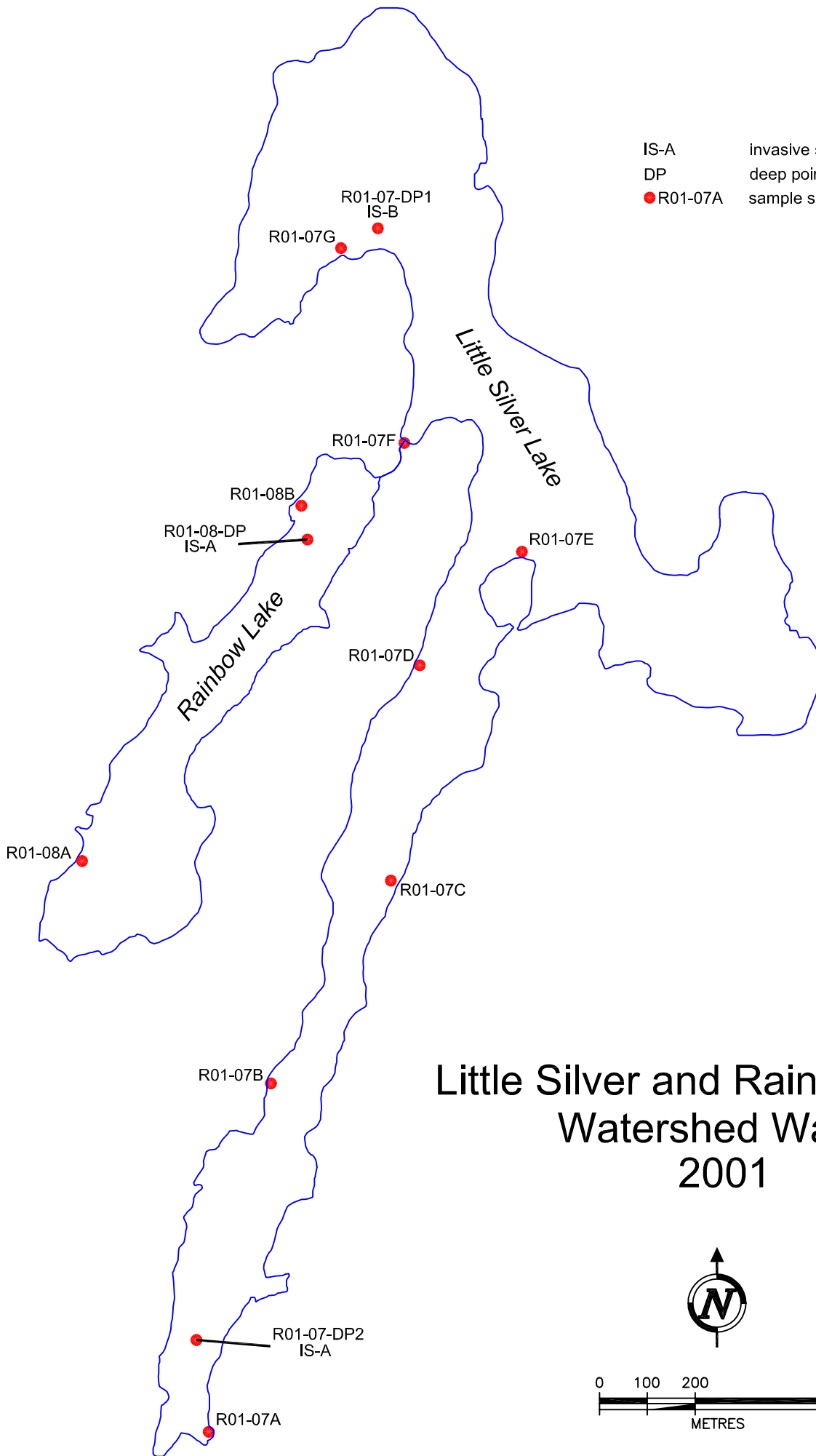
the Rideau Valley Watershed Watch sampling program in 2001. The elements being compared here are not all directly related e.g. the presence of spiny flea has no direct bearing on the amount of TP in the lake and vice versa. Most of the scores are related to an accepted benchmark. The failing score of 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

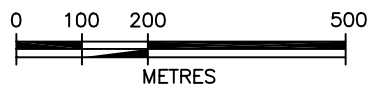
Parameter	Result	Score	Table 2: Scoring
TP (milligrams/ Litre (mg/L))	0.014	2	Phosphorus comes from soaps, detergents, fertilizers and pesticides and is the main nutrient contributing to the growth of algae. The PWQO for lakes is to keep total phosphorus levels below 0.02 mg per litre of water to avoid 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))	4.4	3	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 and greater light penetration.
DO/Temp (mg/L)	3.5	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 a(mg/L)	0.0064	0	Chlorophyll a is the green pigment in microscopic algae that live in water. More than 0.004 milligrams of Chl a 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))	2.68	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	Yes	0	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		1.43	Overall Grade: D

The results listed above are averages for each parameter of the results for the two basins of the lake. The north basin is relatively deep and could be expected to function like other such lakes with seasonal turnover and thermal stratification. The south basin is long and narrow with a maximum depth of about six metres and no stratification and probably no turnover. The average nutrient concentrations in the surface waters were generally below the PWQO (TP) and guideline (TKN) but chlorophyll a results were elevated for both basins, particularly the south. Not included in the scoring in Table 2 are nutrient concentrations at the bottom. The concentrations were persistently and drastically above the PWQO and guideline – as much as 15 times the objective for TP. It appears that there has not been a significant impact on surface waters to date but it remains a risk for at least the north part of the lake. The overall average Secchi disk reading was fair but the south basin water clarity decreased progressively through the sample period probably due to algae blooms. It is difficult to assign an age or trophic status to Little Silver Lake because of the different conditions throughout. It is tending towards being eutrophic. With such high concentrations of nutrients in the bottom waters, it is fortunate to not already be well into “old age”. There were no significant bacteria counts found in Little Silver but there were zebra mussel veligers found. It remains to be seen what the full impact of the mussels will be. Water clarity will improve dramatically allowing greater light penetration which could mean a major increase in weed growth, particularly in the shallower waters of the south arm of the lake. Care will

- IS-A invasive species sample site
- DP deep point
- R01-07A sample site



Little Silver and Rainbow Lakes Watershed Watch 2001



LITTLE SILVER 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 Little Silver Lake (Table 1, below). However, the general nature of the parameters does not allow a detailed analysis of Little Silver 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: 1976 - 2001, North 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]
1976	3.7			0.0025
1977	4.1	0.016	0.154	0.0066
1978	5.3			0.0039
1979	3.6	0.014	0.073	0.0069
1980				
1981				
1982	4.4			0.0032
1983	4.3			0.0021
1984	3.9			0.0041
1985	3.9			0.0042
1986	3.6			0.0036
1987	3.6			0.0032
1988	4.3			0.0026
1989	4.4			0.0024
1990	4.6			0.0031
1991	4.7			0.0018
1992	4.4			0.0013
1993	4.9			0.0018
1994	5.2			0.0025
1995				
1996				
1997				
1998	4.5	0.004		
1999	4.8	0.014		
2000	4.0	0.006		
2001	4.5	0.026	0.242	0.0057
n	21	6	3	18
Minimum	3.6	0.004	0.073	0.0013
Maximum	5.3	0.026	0.242	0.0069
Mean	4.3	0.013	0.156	0.0034

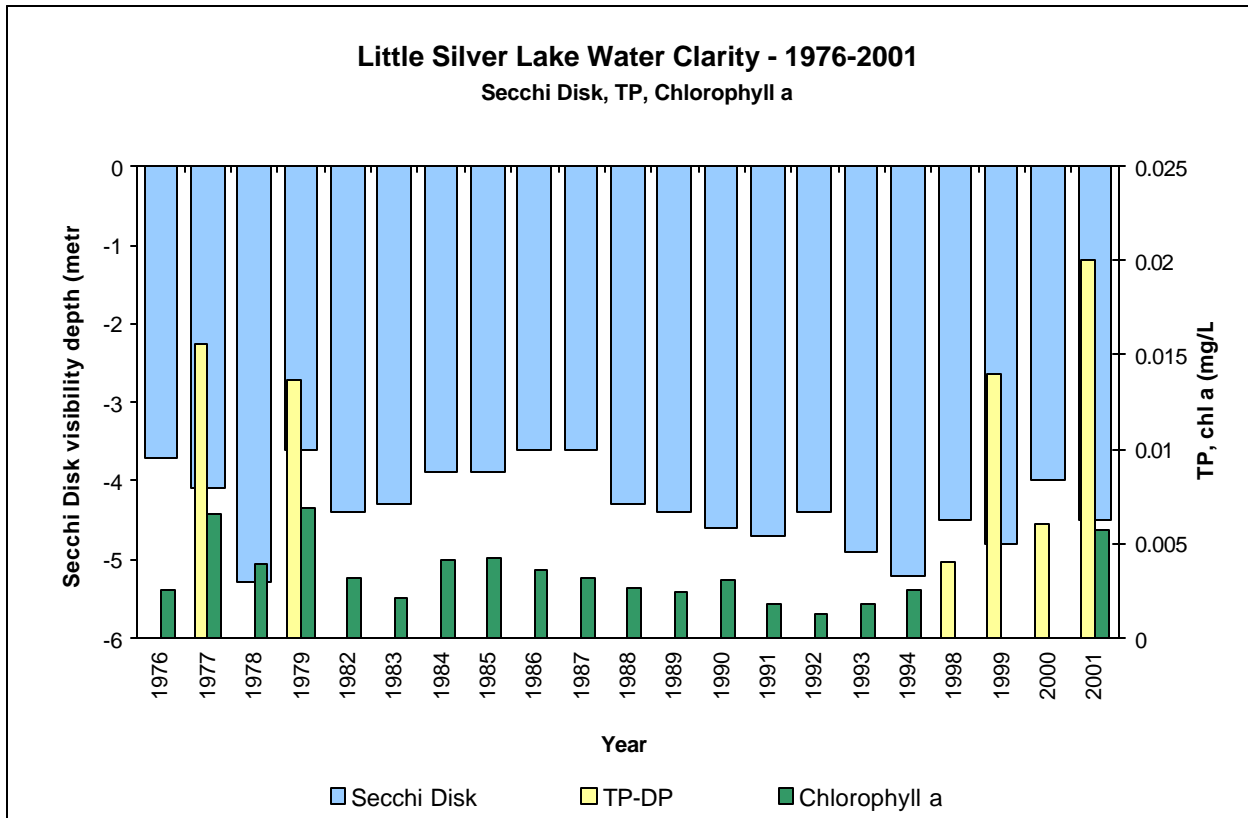
*Includes MOE Recreational Lakes Program Data. Chlorophyll a data prior to 1985 has been adjusted to reflect new lab procedures in filtering resulting in an increase in chlorophyll a concentrations by 35%.

Little Silver Lake has two distinct basins – north and south. The north basin was where sampling was done under the Recreational Lakes Program (Table 1). The north basin is the deeper of the two with a maximum depth of about 12 metres. The south basin is about 2 kilometers long by a maximum of 0.2 km wide and has a maximum depth of about 6 metres. While the north basin functions like most lakes with a seasonal turnover and thermal stratification, there are some difference in temperature and oxygen concentration in the south basin in the spring but both become relatively uniform vertically by July.

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 Little Silver Lake so 0.005 mg/L is used here.

When chlorophyll a concentrations are high, it indicates that there is an excess quantity of phytoplankton growing. In turn, water clarity should be reduced. In the north basin of Little Silver Lake, that has not usually been the case. In the two years of chlorophyll a concentrations above the reference of 0.005 mg/L in the seventeen years of record to 1994, average **Secchi disk** depth was not less than 3.5 metres (Figure 1). Interestingly, the Secchi disk reading for the sample date with the highest concentration in 2001 was the best recorded in the sampling period (Table 2). No anecdotal evidence has been recorded about the occurrence of algae blooms in the north basin.

Figure 1



Chlorophyll a was measured in the south basin in 2001. There was a sharp increase in concentration in the early August sample from the previous date. It remained high for the rest of the sampling period (Table 2, below). There was an impact on water clarity that leads to the conclusion, again in the absence of any recorded observations, that there was an algae bloom in all or part of the south basin from late August into October.

Phosphorus in the surface waters does not appear to have been the reason for the high chlorophyll a concentrations in the south basin. Bottom TP concentrations exceeded the PWQO in the sample in late July and the water was clear enough that light was reaching the bottom (Figure 2, below - right hand descending bars for 4 and 24 July) which may have triggered the phytoplankton growth. In the north basin, despite two elevated TP sample results, one 4 times the PWQO, which probably caused the increased chlorophyll a production, there was only one date in September when the Secchi measurement decreased that might be indicative of an algae bloom. Lake Surveys done in 1977 and 1979 showed a similar pattern of increased chlorophyll a concentrations through the summer but corresponding Secchi disk data showed depths shallower than 3 metres that indicate that profuse algae concentrations did occur at that time.

The average for TP at the bottom in the south basin was at the PWQO as a result of two slightly elevated concentrations. The average TP concentration for the bottom waters of the north basin was ten times the PWQO. There are bottom data for only two years prior to 2001 in Lake Surveys done in 1977 and 1979. In both cases, the concentrations were also high although not as high as in 2001. High concentrations of nitrogen were also found in the course of those surveys and in 2001 so that it appears that there is a nutrient sink in the depths

of Little Silver Lake. What has caused this accumulation and how it affects the surface waters are questions that would be answered by detailed investigation and analysis.

Figure 2

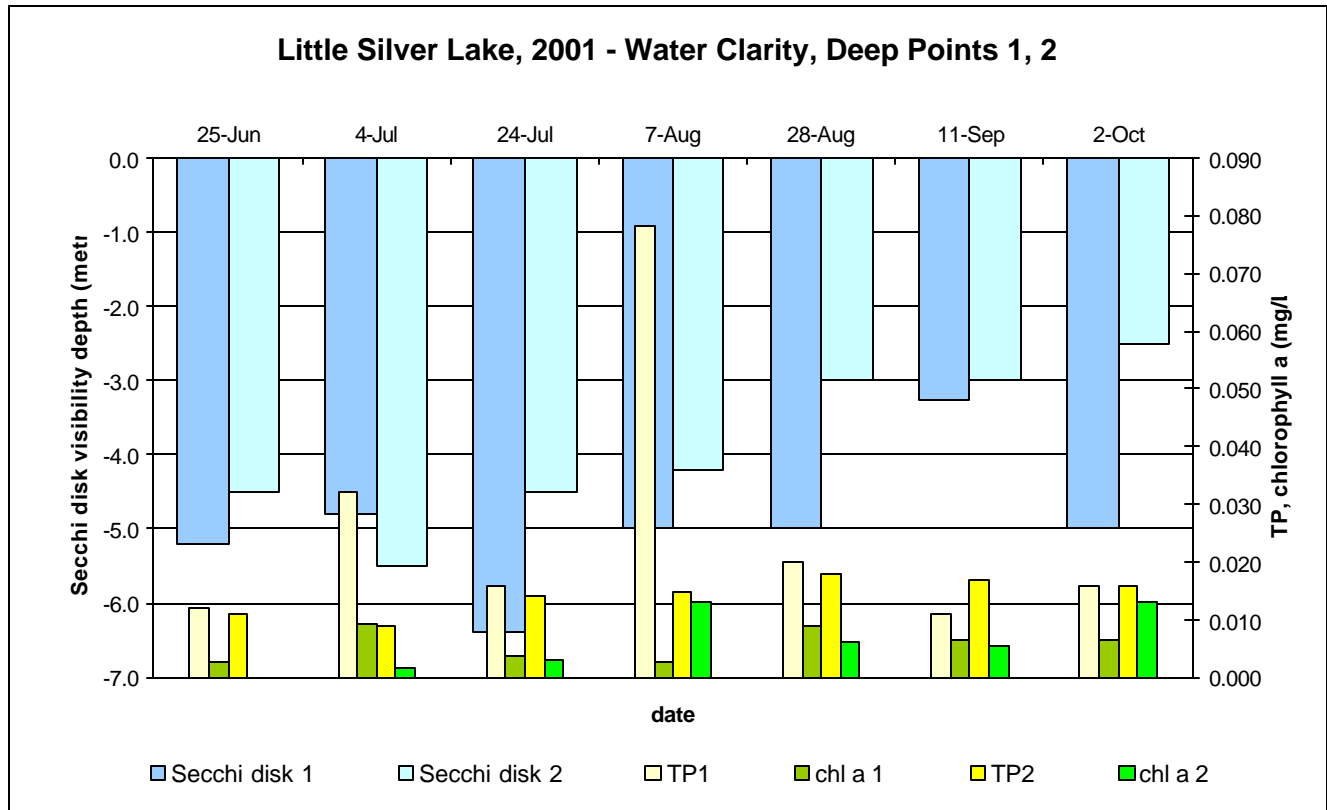


Table 2: Little Silver Lake, 2001 - Deep Point

	TP DP1-S (mg/L)	TP DP1-B (mg/L)	Chl a 1 (mg/L)	Secchi (metres)	TP DP2-S (mg/L)	TP DP2-B (mg/L)	Chl a 2 (mg/L)	Secchi (metres)
25-Jun	0.012	0.103	0.0026	-5.2	0.011	0.010		-4.5
4-Jul	0.032	0.230	0.0091	-4.8	0.009	0.014	0.0015	-5.5
24-Jul	0.016	0.132	0.0038	-6.4	0.014	0.036	0.0029	-4.5
7-Aug	0.078	0.380	0.0027	-5.0	0.015	0.033	0.0130	-4.2
28-Aug	0.020	0.350	0.0088	-5.0	0.018	0.018	0.0062	-3.0
11-Sep	0.011	0.230	0.0066	-3.3	0.017	0.020	0.0055	-3.0
2-Oct	0.016	0.270	0.0064	-5.0	0.016	0.015	0.0130	-2.5
average	0.0264	0.2421	0.0057	-5.0	0.0143	0.0209	0.0070	-3.9

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)

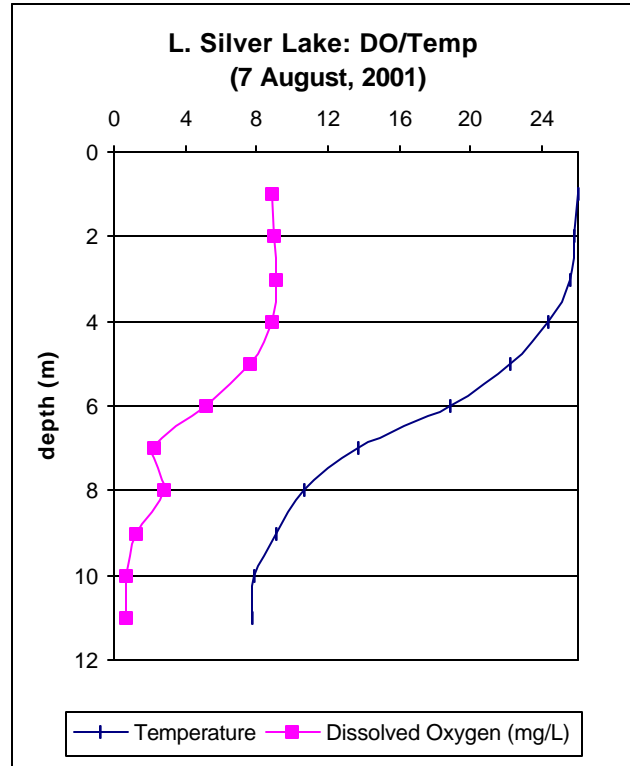
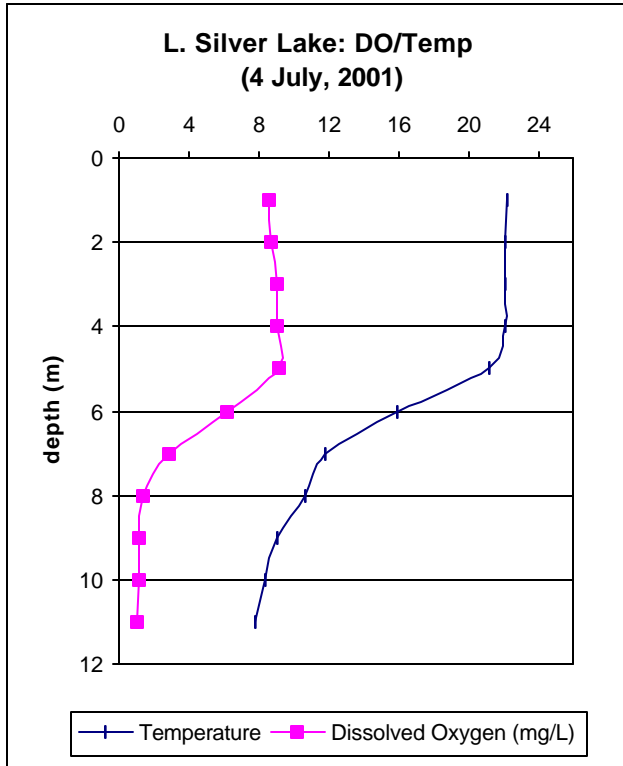
Table 3: Little Silver Lake, 2001 – Deep Point, Dissolved Oxygen/Temperature – 11 September

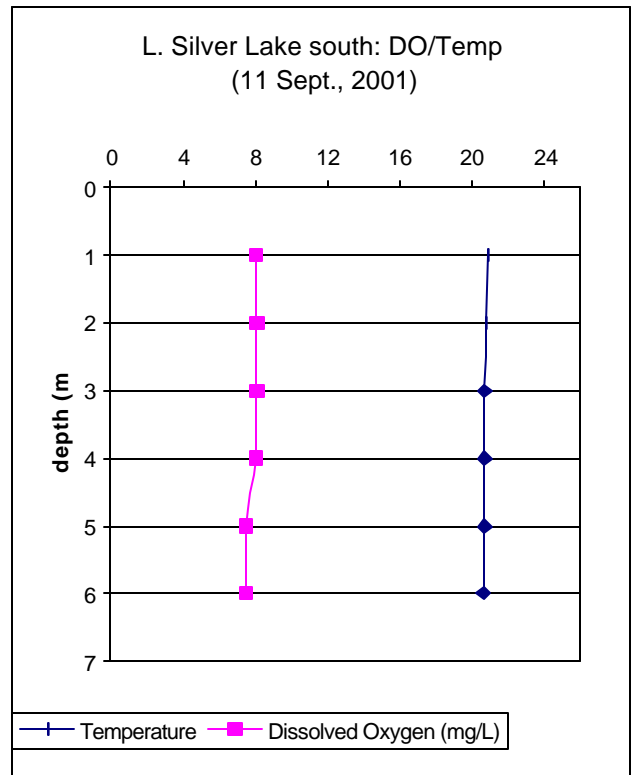
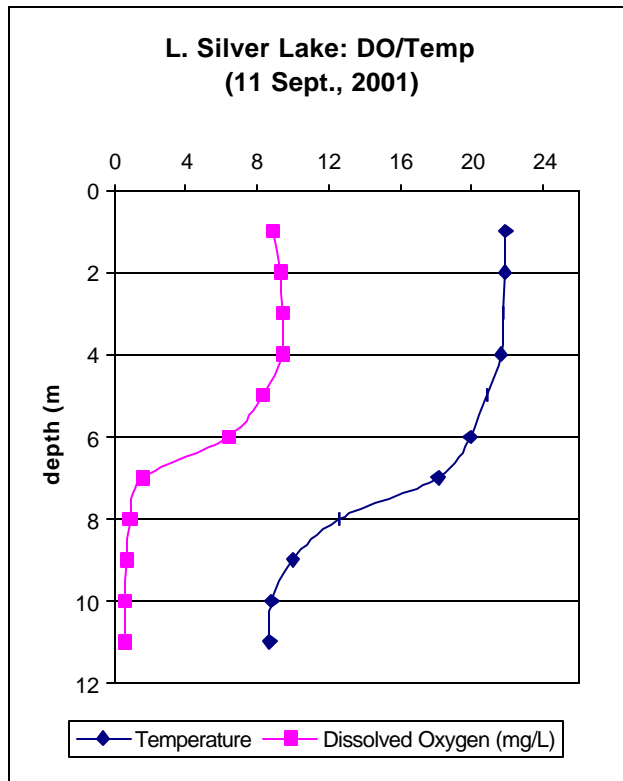
Depth [Metres]	Temperature [Degrees Celcius]	Dissolved Oxygen [Milligrams/Litre]	Percent Saturation [%]	Lake Stratification
1	21.9	8.9	99	Epilimnion
2	21.8	9.3	105	
3	21.7	9.4	105	
4	21.6	9.4	105	
5	20.8	8.3	90	
6	19.9	6.4	69	
7	18.1	1.6	17	Metalimnion
8	12.6	0.9	8	

9	10.0	0.7	6	or Thermocline
10	8.8	0.6	5	
11	8.7	0.6	5	Hypolimnion

- 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, 5, 6





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.

Throughout the summer, sufficient oxygen and suitable water temperatures were available in the upper 6 metres of the north basin. Through August, fish would have been confined to the volume between 3.5 and 6 metres as temperatures in the top 3 metres exceeded 25 degrees. Some of the explanation for the high concentrations of TP in the bottom waters is that dissolved oxygen concentrations decrease rapidly in the bottom waters after spring turnover so that more phosphorus goes into solution. As shown in Figure 5, above, by September there was very little oxygen in the bottom 4 metres of the north basin. There was only one profile done in the south basin (Figure 6, above) and, as discussed at the outset, the temperature (line on the left with diamond symbols) and oxygen were nearly uniform through the water column. Profiles done in the Lake Surveys in the 70s in the early part of the season showed some variation in temperatures and oxygen concentrations with the lower 3 metres having lower temperature and oxygen. Both tended toward uniformity through the summer.

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 - Little Silver Lake, 2001

SITE	25-Jun	4-Jul	24-Jul	7-Aug	28-Aug	11-Sep	2-Oct	average
DP1-B	0.103	0.23	0.132	0.38	0.35	0.23	0.27	0.242
DP2-B	0.010	0.014	0.036	0.033	0.018	0.020	0.015	0.021
DP1-S	0.012	0.032	0.016	0.078	0.02	0.011	0.016	0.026
DP2-S	0.011	0.009	0.014	0.015	0.018	0.017	0.016	0.014
A	0.009	0.011	0.011	0.011	0.017	0.015	0.015	0.013
B	0.008	0.009	0.008	0.007	0.014	0.012	0.018	0.011
C	0.009	0.009	0.008	0.007	0.012	0.012	0.014	0.010
D	0.009	0.013	0.007	0.007	0.011	0.012	0.019	0.011
E	0.007	0.009	0.007	0.006	0.010	0.039	0.015	0.013
F	0.009	0.024	0.008	0.007	0.011	0.011	0.015	0.012
G			0.007	0.008	0.010	0.011	0.016	0.010
							average	0.0136

TP concentrations in the nearshore area of Little Silver Lake were similar over the summer with higher concentrations at the deep points until September when distribution was fairly even around the lake. Statistically, only 4 of 47 of the nearshore data were equal to or greater than one standard deviation above the average of concentrations at nearshore sites and 1 of the 4 exceeded two standard deviations and 1 exceeded 3 standard deviations. The latter two high concentrations were both above the PWQO. TKN was also higher at the same time and place and it is likely that bird or animal droppings were to blame. Generally, TP concentrations around the shore were fairly good.

Table 5: TKN – Little Silver Lake, 2001

SITE	25-Jun	4-Jul	24-Jul	7-Aug	28-Aug	11-Sep	2-Oct	average
DP1-B	0.8	1.1	0.95	1.62	1.49	1.23	1.38	1.22
DP2-B	0.38	0.42	0.57	0.49	0.48	0.51	0.52	0.48
DP1-S	0.46	0.5	0.38	0.61	0.48	0.44	0.43	0.47
DP2-S	0.48	0.36	0.45	0.38	0.47	0.47	0.50	0.44
A	0.34	0.42	0.41	0.52	0.49	0.47	0.51	0.45
B	0.34	0.37	0.33	0.35	0.46	0.51	0.57	0.42
C	0.34	0.37	0.37	0.33	0.42	0.45	0.45	0.39
D	0.43	0.44	0.41	0.35	0.42	0.47	0.52	0.43
E	0.35	0.37	0.39	0.35	0.43	0.61	0.44	0.42
F	0.32	0.60	0.39	0.44	0.44	0.42	0.44	0.44
G			0.36	0.38	0.41	0.45	0.47	0.41
							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. High TKN concentrations have been noted in surface waters throughout the Tay River watershed which suggests that there is a naturally occurring background level. Concentrations of TKN in the surface waters were generally in keeping with that condition. Of the 59 surface samples, only 8, or about 14%, equaled or exceeded the guideline. Similar concentrations were found in the Lakes Surveys of Little Silver Lake in 1977 and '79. As discussed previously, very high concentrations of TKN at the bottom of the north basin appear to be the normal condition

Table 6: E.Coli – Little Silver Lake, 2001

SITE	25-Jun	4-Jul	24-Jul	7-Aug	28-Aug	11-Sep	2-Oct	average
A	2	2	3	2	2	6	12	4.14
B	2	2	2	2	2	2	6	2.57
C	2	2	2	2	6	2	10	3.71
D	2	2	2	4	4	6	2	3.14
E	2	2	2	2	2	4	4	2.57
F	2		2	2	2	2	2	2.00
G	2		2	2	10	2	2	3.33
							average	2.68

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 Little Silver 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 Little Silver 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).

Little Silver 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. No water fleas were found in Little Silver Lake but there were zebra mussel veligers present. It remains to be seen how prolific the mussels will be and what their full impact will be. The first thing that will be noticed is that the lake will become much clearer as the mussels feed and filter the water. As the lake becomes clearer, light will be able to penetrate deeper. This can be expected to cause increased weed growth particularly in the relatively shallow waters of the south arm of the lake. There is a possibility that the nutrients concentrated at the bottom in the north part of the lake may be affected to some degree.

In conclusion:

With two basins that have distinct characteristics, relatively low surface water concentrations of nutrients but elevated concentrations of chlorophyll a in both basins, fair to good water clarity in the north basin and fair clarity in the south basin and a large sink of nutrients in the north basin, it is difficult to categorize Little Silver Lake. The nutrient levels in the bottom of the north basin and chlorophyll a concentrations in both basins suggest that the lake is eutrophic. However, the influence on surface concentrations of phosphorus is not evident and the overall average of surface TP concentrations falls in the mid-mesotrophic. Surface TKN concentrations tend to be toward the late mesotrophic. A detailed study of the bathymetry, circulation patterns, forms of the nutrients and broader water chemistry of the lake might be appropriate to determine more precisely how the lake works and how significant the nutrient sink really is. In the short term, all lake residents and users need to work to minimize their impact on the lake. Lake users also need to take precautions to avoid taking zebra mussels to other lakes attached to their boats or in bait buckets and live wells. Signs should be posted at public access points notifying users that zebra mussels have been found in the lake. (<http://www.invadingspecies.com/> for more information)

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		3,355 g	
575 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