OTTER LAKE LANDOWNERS ASSOCIATION
2006 WATER QUALITY REPORT

This report is made possible through the financial support of OLLA and by the volunteer time donated generously by its directors and members.

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INTRODUCTION:

The 2006 Water Quality Report summarizes the data collected from May to November 2006. This report follows a similar OLLA report in 2005 and previous reports issued by the Rideau Valley Conservation Authority and the Centre for Sustainable Watersheds. It is the intent to maintain a consistent testing protocol so data will indicate meaningful trends in water quality over time and provide a useful database for future custodians of the lake environment.

The Rideau Valley Conservation Authority contributed data from three testing regimes over the course of the season. This data was included with the five testing regimes completed by OLLA and averaged over the common testing locations. The RVCA data is available on their website or from the OLLA Lake Steward.

ABSTRACT:

Water levels returned to a level consistent with long-term readings in 2006 after the low levels recorded in 2005. This may have influenced the critical phosphorus levels that were reduced although still higher than the readings recorded 10 and 30 years ago. The relationship between phosphorus loading and water level is not well established in research circles however the nutrient levels recorded since 2003 are more consistent with a Mesotrophic lake status. (Lakes containing nutrients that stimulate production of algae). Prior to 2003 Otter Lake was more consistent with an Oligotrophic status that is associated with deep cold lakes that have few nutrients.

The oxygen content in the deep trench at one of the two test locations indicates a greater depletion rate than previously recorded. Noted by both OLLA and RVCA equipment, the deep hypolimnion is virtually void of oxygen by mid-summer which would create severe stress on all fish in this area. No explanations have been found yet to explain the decline first noted in 2005.

Coliform bacteria were noted at most sites although all were within provincial guidelines for recreational use. Three sites were noted as being elevated for E.coli and these readings were posted on the OLLA website. Two of the sites were also noted as being elevated in 2005.

BACKGROUND:

Water quality testing is an important diagnostic tool to help residents of Otter Lake determine the health of the lake. By systematic testing and monitoring over time, it is possible to

evaluate if water quality is improving or declining. By selective testing at strategic sites water quality indicators can help determine the source or cause of contamination.

Otter Lake is located on a limestone plain which lies on the Canadian Shield. So there are features around the lake that show the hard igneous rocks typical of the shield and also the soft light brown limestone typical of the area. Plant and animal life are quite sensitive to changes in acid levels and limestone tends to buffer the effects of acid rain which drifts in from the industrial areas of the US and Canada to the southwest.

Otter Lake is about 1700 acres in size and is central in an elongated drainage basin of about 10,000 acres. The shoreline length is about 20 km. The lake is approximately 124 meters above mean sea level and is part of the Rideau River drainage basin. There are several parent streams flowing into Otter Lake and one primary outlet, which is Otter Creek, which flows about 33 km into the Rideau River.

The chemistry and health of a lake is influenced heavily by the nature of the drainage basin through which the parent streams flow. Otter Lake is also fed by springs although little is known about the volume or source of these springs. Recent Canadian research has indicated that some lakes receive an amount through springs that is approximately the amount received through actual precipitation directly onto the lake. In other words not counting the additional amount received from surface drainage from the watershed. This would amount to about 20-30 inches annually. Springs are usually charged by wetland areas at higher elevations from the discharge area. So healthy wetlands in the basin are important for keeping Otter Lake healthy and free of contamination.

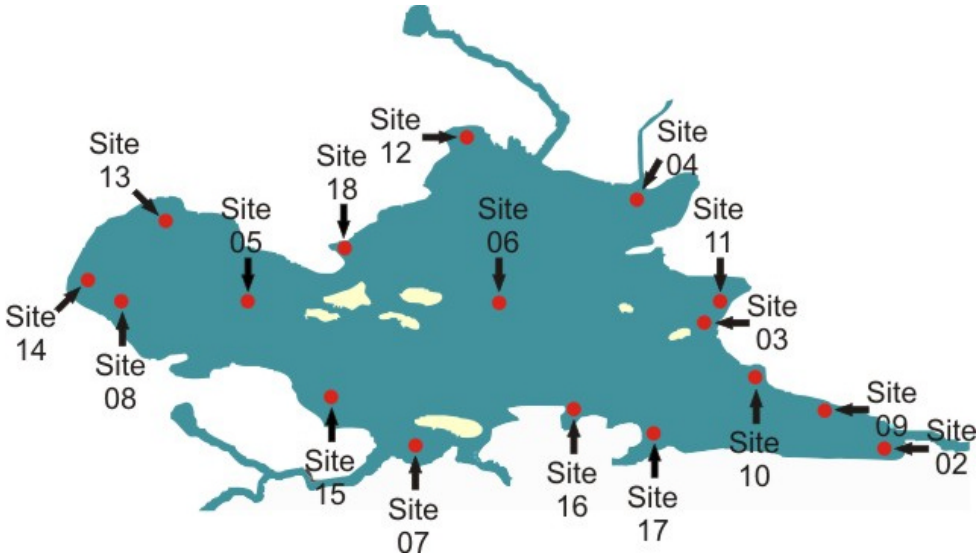
Otter Creek is a second order stream which means that there are two branches which feed into the stream, one from Otter Lake and one which has headwaters west of Lombardy at Pegg Road. These two branches merge about 1000 meters upstream from the village of Lombardy before flowing north through the Lombard Glen Golf Course and then northeast of Smiths Falls where it broadens out considerably before joining the Rideau River.

The trophic status of a lake is an assessment of the enrichment levels in the water. Oligotrophic lakes are clear and deep with few nutrients. Eutrophic lakes are laden with nutrients which stimulate algae and plant growth. Mesotrophic lakes are in between these two extremes. Otter Lake generally exhibits the characteristics of a Mesotrophic lake although the deep bathymetry (the underwater topography) of the central and southern areas of the lake is more typical of an Oligotrophic lake.

The development pressure is relatively high on Otter Lake with approximately 330 cottages, homes and commercial properties. As it relates to shoreline length, this is a much higher rate than the Rideau Lakes area and indicates that factors such as septic system leaching, fertilizer application and shoreline erosion can have a greater collective impact.

RESULTS:

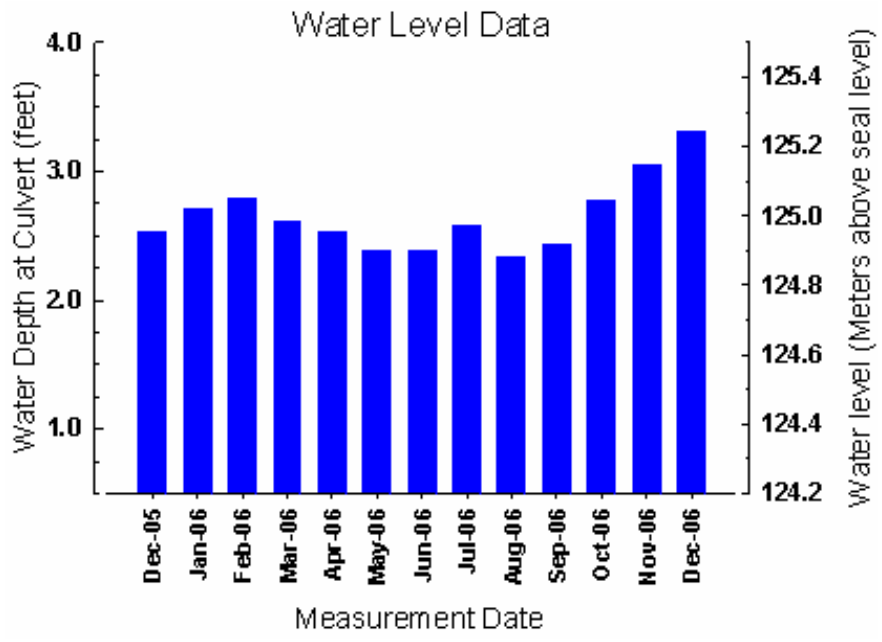
The Otter lake map following has been recreated to provide a clearer indication of the test site locations. Six test sites are routinely tested and the balance are tested periodically with an effort made to test each location at least once during the year. If a particular reading at any site is of a concern to the committee, additional testing may occur at that location.

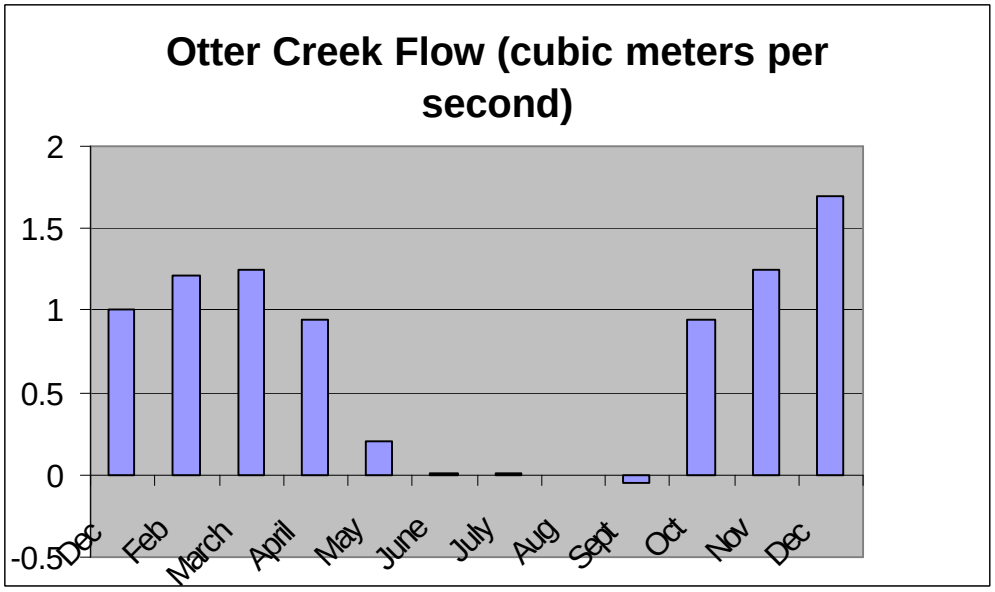


Water Level and Otter Creek Flow:

Water levels returned to a more “normal” level in 2006 after the 2005 levels that had not been seen since the mid 60’s. Rainfall for the area was above average and this contributed to recharging the dry wetlands in the Otter Lake basin and the surface runoff eventually began to overcome the deficit from the previous year. Recent research at the University of Waterloo would suggest that water supplies from springs would largely cease during a very dry year as we experienced in 2005. It would take some time for the water deficit to be overcome as the soil and subsoil must recharge in the upland areas that are sources for springs in the lake. At the same time, in dry seasons, there may be a net loss by lake water recharging other springs that flow in the subsoil and bedrock to downstream locations.

Otter Creek was flowing freely through the spring and in June the flow was reduced and then halted by a beaver dam located in “position 1” near the culvert. This in fact caused a slight negative flow (water was draining back into the lake) for several days in September. The heavy precipitation in September and through the fall created heavy flow conditions again in the creek as the water level increased.





Water Quality Data:

This table is organized in a way unlike last year. Hopefully the data is easier to absorb and understand. The table lists the key water quality indicators at the test locations that can be viewed on the lake map on page 4. Please note that tests sites 4A and 5A were initiated nearby sites 4 and 5 respectively as temporary test sites at the request of adjacent landowners in 2006.

Water clarity continues to increase as indicated by Secchi depth. Anecdotal evidence from property owners indicates that the Zebra Mussel population is waning in some areas and this should lead eventually to a decrease in water clarity over time. Increased water clarity may cause increased algae growth especially as nutrient levels increase in the lake water.

Phosphorus levels are less than last year but above the long-term average. It is generally accepted that levels above 10 micrograms per litre are representative of the more productive Mesotrophic lakes. Nitrogen levels are also higher by about 20% over 2005 levels and in the Mesotrophic range.

With the combination of clear water and higher nutrient levels there exists the possibility of increasing habitat for algae growth as light penetrates to greater depths.

Phosphorus levels were varied but on average less than 2005 readings. It was evident that TP readings were higher later in the season and this is consistent with the increased rainfall in late summer and fall. Rainfall can carry nutrients from the soil and septic system leaching beds into the lake.

Nitrogen levels were higher than 2005 but may not have any detrimental effect on algae growth since Phosphorus is the limiting nutrient element. Dissolved oxygen was varied but within an acceptable range for most fish species.

Total coliform bacteria levels were higher in more areas in 2006. At OLLA 2, 4 and 7 the readings were higher than in 2005. OLLA 10 continued to show high readings as seen in 2005. E.coli levels were low as were fecal coliform bacteria. The low levels indicate that there

is some septic or wildlife pollution but the readings indicate that it is well below provincial standards for recreational use.

WATER QUALITY DATA 2006

Location	Date	Phos	Nitrogen	Oxygen	E.coli	Fecal Bac	Total Coliform
OLLA 2	May-08	4	400	11.7			
	Jun-25	8	390	9.4	2		
	Aug-02	10	440		1	1	24
	Sep-10	12	370	8.7	1	1	10
	Oct-23	7					
OLLA 4	May-08	5	410	9.6			
	Jun-25	2		10.7	4		
	Aug-08	11			1	1	42
	Sep-10	10		9	2	1	10
	Oct-23	6					
OLLA 4A	Oct-23	4					
OLLA 5	May-08	7	480	9.6			
	Jun-25	10	430	7.3	1	1	2
	Aug-08	8	370	4.3	1	1	6
	Sep-10	12	310	2.7			
	Oct-23	80					
OLLA 5A	Oct-23	3					
OLLA 6	May-08	5	410	10.6	1	1	8
	Jun-25	8	370	7.6			
	Aug-08	9	350	7.5	1		
	Sep-10	12	300	5.1			
	Oct-23	6					
OLLA 7	May-08	24	720	10.6	1		20
	Jun-25	6		9.8			
	Aug-08	8		9.5			
	Sep-10	10		9.2	1		
	Oct-23	6					
OLLA 8	May-08	5	430	12	1		
	Jun-25	5		9.1			
	Aug-08	8		10.2			
	Sep-10	10		6.8			
OLLA 10	Aug-08				1	1	34
	Sep-10				1	1	10
OLLA 11	Jun-25	11	390		2		
	Aug-08	12	420		2		
	Sep-10	14	380		2		
OLLA 18	Jun-25	12	410		2		
	Aug-08	13	420		10		
	Sep-10	13	370		2		

Thermocline Data:

The temperature and oxygen levels in the water column taken from the top of the lake to the bottom are very useful in determining the three main temperature stratification layers in the lake and the characteristics of the water in these layers.

The temperature quickly moved to the 20 degree level possibly due to the early ice-out date recorded. The June and August readings were lower in oxygen levels compared to previous years and there was a precipitous oxygen drop in the deep hypolimnion in June at site #6 as well as #5. This could be due to organic material falling from above and the resulting bacterial decay causing oxygen depletion. The oxygen level depletion is concerning for all inhabitants of the deep water levels.

OLLA 6 THERMOCLINE DATA 2006

	Jun-22		Aug-01		Sep-10		
Depth (m)	Temp	Oxygen	Temp	Oxygen	Temp	Oxygen	Lake Stratification
1	21.5	5.1	26.4	6.4	17.5	10.8	
2	21.4	5.1	26.3	6.4	17.1	10.3	
3	21.3	5.1	26.1	6.4	17.2	10.2	
4	21.1	5.1	25.8	6.4	17.1	10.2	
5	21.1	5.1	25.7	6.4	17	10.2	Epilimnion
6	20.8	5.1	25.3	6.4	17	10.1	
7	18.5	5.1	24.5	6.1	16.9	10	
8	16.8	5.1	21.1	5.3	16.9	9.9	
9	15.4	4.8	18.6	5.1	16.8	9.6	
10	11.6	4.9	13.3	5	16.8	8.9	
11	9.8	4.9	12.1	4.7	13	4.8	
12	9.3	5	11.1	4.7	10.8	3.9	Thermocline
13	9	5	9.8	4.8	9.4	3.9	
14	8.5	5	8.8	4.9	8.8	4	
15	8.2	5	8.5	5	8.6	4	
16	8.3	5.1	8.3	5.1	8.3	4.1	
17	7.9	5.1	8.2	5.2	8.2	4.2	
18	7.9	5.1	8.1	5.2	8.1	4.3	
19	7.8	5.1	8.1	5.2	8	4.3	
20	7.7	5.1	8	5.2	8.1	4.4	Hypolimnion
21	7.7	5	7.9	5	7.8	4.4	
22	7.6	5	7.8	5.1	7.8	4.4	
23	7.5	5	7.8	5.1	7.8	4.3	
24	7.5	5	7.8	5.1	7.8	4.3	
25	7.5	5	7.8	5.1	7.7	4.2	
26	7.4	4.9	7.7	5.1	7.7	4.2	
27	7.4	4.9	7.7	5	7	4.1	
28	7.4	4	7.7	5	7.7	4	
29	7.4	2.2	7.7	5	7.7	3.9	
30	7.4	2	7.7	5	7.6	3.9	
31	7.3	2	7.7	5	7.6	3.9	
32	7.3	0.4	7.7	5	7.6	3.8	
33	7.3	0.2	7.7	5			
34	7.3	0.1	7.7	5.1			
35	7.3	0.2	7.7	5.1			

Key Indicator Comparisons 1975-2006:

COMPARISON OF KEY QUALITY INDICATORS 1975-2006

	Phosphorus	Nitrogen	Secchi Depth	Trophic Status
	ug/litre	ug/litre	meters	
1975	7.5		3.8	
1996	8.1		3.5	**Oligotrophic**
2003	9.1	440	5.1	
2004	10.1		5.1	
2005	13.9	290	6.6	**Mesotrophic**
2006	10.5	390	7.3	

Notes: Oligotrophic status is associated with deep, cold lakes supporting Trout.
Mesotrophic status is more productive, warmer, and supporting fish like Bass and Perch.

Phosphorus is considered a key indicator in assessing the trophic status of a lake. Water bodies with levels in excess of 10 ug/litre are usually considered to be Mesotrophic because Phosphorus, an important growth element, stimulates algae growth at this concentration. The lake becomes more “productive” and the change in habitat causes a shift in the population of fish, insects, aquatic plants, and algae. Readings taken over 30 years would indicate that Otter Lake is becoming more productive due to higher Phosphorus levels.

CONCLUSIONS:

The data produced by RVCA nicely supplemented OLLA data and produced an abundance of information for the season. The main concerns from this year’s data set are continuing water clarity and high Phosphorus levels relative to previous decades. These two factors will contribute to higher growth rates for algae and aquatic plant growth. An aggravating factor in this can be the shortened life of lake ice that can lead to higher water temperatures that can stimulate further growth.

Bacteria levels, while evident, are not problematic for recreational use. Residents who are drawing drinking water from the lake are cautioned to filter, or treat the water accordingly and test routinely for pathogens. Coliform bacteria are only one class of pathogens that are considered to be “indicators” of the presence of other harmful organisms originating from pollution sources such as septic systems and livestock manure handling systems.

Dissolved oxygen levels can vary due to the relative activity of algae and aquatic plants. While growing actively they can contribute to oxygen levels but once they die and decompose, they are consumers of oxygen. Much of the floating algae descends to the deeper water as it dies and once in the hypolimnion, the organic matter consumes oxygen and since the cold deep layers do not mix with the surface water during the summer, there is no opportunity to reoxygenate. This is one possibility for the low readings at the 30 m depth of OLLA 5 and 6.

WATER QUALITY TESTING PLANS FOR 2007:

At the January OLLA board meeting, the 2007 plan and budget was approved and consists of the following activities and changes:

1. OLLA will perform two complete testing regimes while Rideau Valley Conservation Authority will execute another three. This will be a reduction from 2006 but consistent with testing frequency from the previous years.
2. One testing regime for Mercury. The OLLA board is not aware of any previous tests for Mercury and this test is designed to detect elevated levels of this element in fish or sediments. Elevated levels of Mercury have been detected in other cottage areas north of Toronto.
3. Bacteria testing at all routine sites and repeat tests as needed if the initial test indicated a reading over 10 per 100 ml.
4. One deep sediment column sample for Diatoms. These are unique algae, which forms a silica shell, and once dead the silica shell persists for many years. The shells are species specific and therefore a sediment sample can determine what species lived in Otter Lake hundreds of years ago. Since Diatoms live in a very narrow range of acidity, temperature, and nutrient levels, some conclusions can be drawn about the health of the lake then and now.
5. Water level and Otter Creek flow a minimum of 6 times over the course of the season. This data is reported to RVCA.

Cost is expected to be $1600, plus any additional testing fees for bacteria monitoring. OLLA members are encouraged to bring any specific water quality concerns to the attention of the Lake Steward or to the RVCA.

A special invitation is offered to any students who wish to assist in water quality monitoring. Volunteer work for OLLA may be recognized for fulfilling the requirements for community volunteer activities for high school completion. Please contact any OLLA director if you are interested.

Submitted by Karl Fiander
OLLA Lake Steward
January 29, 2007