Turtle Lake Water Quality Report
2004 – 2007

Prepared for
The Turtle Lake Watershed Inc.

Monitoring and Assessment Branch
Stewardship Division
April 2008

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Acknowledgements

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1.0 Introduction and Background

1.1 General Description, Geography and Hydrogeology of Turtle Lake

Turtle Lake is approximately 21 kilometres long, 5 kilometres wide and located in mid-western Saskatchewan approximately 120 kilometres northwest North Battleford and 35 kilometres north of Glaslyn. It is a popular recreational lake with many attractions including: boating, fishing, swimming and other outdoor activities. There are approximately 12 small communities surrounding the lake including, the Turtle Lake Lodge, several Hamlets, the RM of Mervin and Thunderchild First Nation. Approximately 23% of the shoreline is characterized by residential and commercial development (Liaw 1999).

Water levels in Turtle Lake are influenced by surface water inflow, precipitation and evaporation. The water levels on Turtle Lake are controlled by a small control structure across the outlet on the south end. Though the structure was put in place approximately 20 years ago, it has provided sufficient control of the lake's water levels, meeting the expectation of the majority of lake residents.

The lake's surface area is approximately 64 square kilometres (depending on water level), its mean depth is approximately 6 metres and its maximum depth is approximately 14 metres. Volume for Turtle Lake was calculated by Sawchyn in 1967 and estimated to be approximately 403,690 decametres cubed. There are three small island located at the northern terminus of the lake.

1.2 Lake Stewardship & the Turtle Lake Watershed Inc.

The Turtle Lake Watershed Inc. (TLWI) has participated in Saskatchewan Watershed Authority's *Lake Stewardship Program* from October 2003 until April 2008. This program focused on supporting activities, projects and public education at lakes with stewardship groups and volunteers. As part of the *Lake Stewardship Program*, Saskatchewan Watershed Authority assisted in the water quality monitoring program by providing technical support and interpreting water quality measurements to the TLWI.

The TLWI volunteers are important advocates on behalf of the health of Turtle Lake and its upland area. The group has been incorporated as a non-profit organization for four years and continues to take part in activities and projects which promote education and awareness regarding the aquatic and terrestrial health of Turtle Lake. Active in the communities and resort areas around the lake, the TLWI aims to inform the public about the water quality of Turtle Lake and ways that human activities can positively or negatively impact its water quality. The mission of the TLWI is to … "understand, protect and manage the water resources within the watershed which will help conserve for future generations, the natural landscape of the lake and surrounding shoreline riparian buffers."

2.0 Water Quality Sampling

Water quality monitoring of Turtle Lake began in 2003 through the cooperation of Saskatchewan Watershed Authority and the TLWI. Water quality sampling allows background (normal or average) water quality values for Turtle Lake baseline to be established. Once adequate water quality information has been recorded for a lake's water quality, water sampling can become less frequent. Though water quality sampling through the Lake Stewardship Program ceases in 2008, the baseline data collected on Turtle Lake will be of great service to all parties interested in understanding their lake's water quality or to make more informed decisions on the management or activities in and around the lake.

2.1 Water Quality Sampling Sites

The standard lake sampling schedule for Saskatchewan Watershed Authority's *Lake Stewardship Program* includes two winter (January to March) and four summer samples (May to October) per year. Samples sites are divided into *Baseline Stations* and *Shoreline Stations* (Figure 1).

Baseline Station: Baseline stations are generally deep, centrally located sites chosen to represent typical water quality conditions in the lake. Certain parameters (i.e. dissolved oxygen and temperature) are recorded at intervals throughout the depth of the site. Baseline stations are sampled on all six sample dates during the year. Water quality results from baseline stations are used to calculate the Water Quality Index (WQI) score.

Shoreline Stations: Shoreline stations are monitored to determine the effects of local influences on water quality. The locations of shoreline stations were chosen by volunteers from the stewardship group in consultation with Saskatchewan Watershed Authority (Figure 1). They are sampled on summer sample dates only. The water quality results for these shoreline stations are compared to Saskatchewan's *Surface Water Quality Objectives for Recreation and Aesthetics* (Interim Edition, July 2006).

2.2 Water Quality Index: Assessing General Water Quality

The Water Quality Index (WQI) provides a means of assessing the overall quality of lake water in Saskatchewan. To calculate the WQI, analytical results of the water quality sampling are compared to provincial objectives for specific water uses such as irrigation and the protection of aquatic life. The WQI combines key chemical and biological aspects of water quality (including major ions, nutrients, heavy metals, herbicides, bacteria, dissolved oxygen and pH) to define overall water quality and summarize these parameters in a single score.

A single score for each year allows easy comparison of general water quality trends over time and identifies parameters considered important to overall lake health. The WQI score is adjusted for each parameter that exceeds its objective, taking into account the

magnitude and frequency of exceedances. Deviation from objective values does not necessarily indicate poor lake health or that water quality is worsening. Certain parameters (*i.e.* arsenic, chloride and pH) may naturally exceed the WQI objectives in Saskatchewan lakes due to geological and hydrological history. The WQI does not differentiate 'natural-source deviation' or exceedances which are a result of human influences. As such, it is important to examine lake water quality over time in order to assess if human activity may be impacting lake water quality. [1]

[1] For a more complete explanation about the Water Quality Index (WQI) or the parameters used to determine WQI scores, please refer to the "Lake Stewardship Water Quality Guide" online at www.swa.ca.

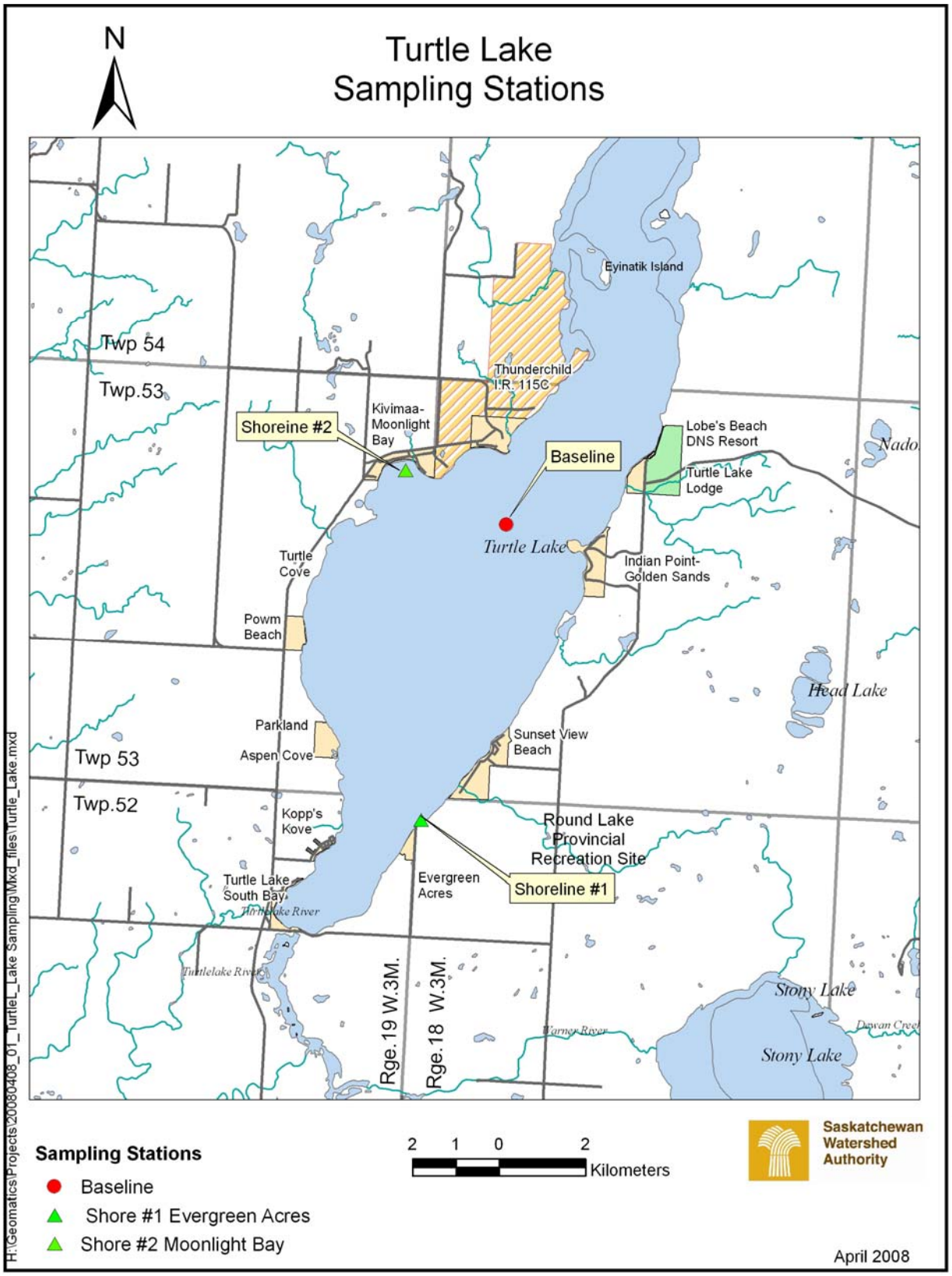

Figure 1 Map of Turtle Lake 2004 - 2007 sampling stations.

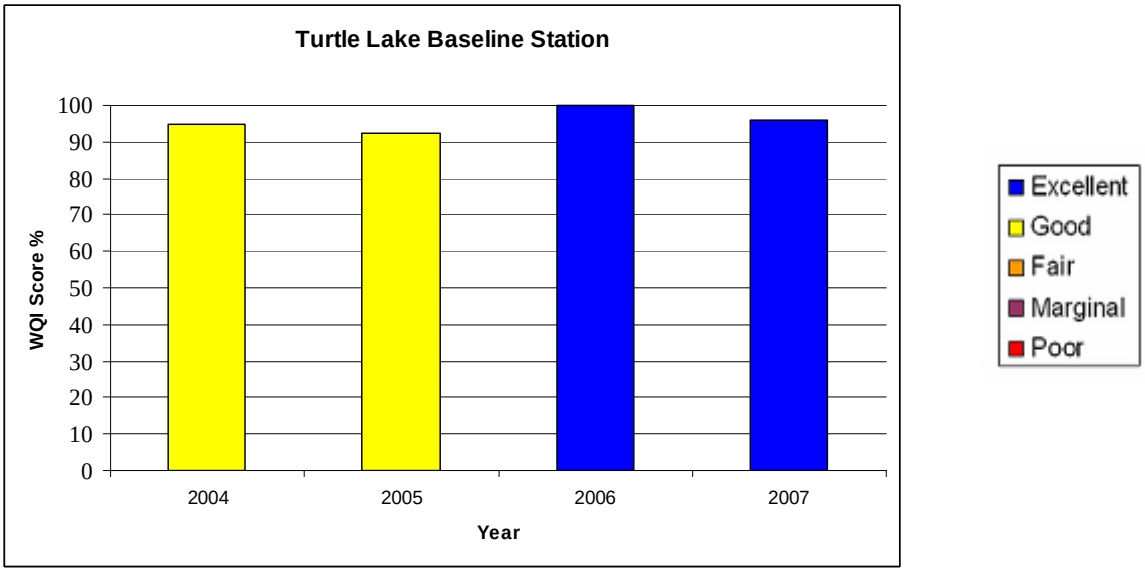

Figure 2 Water Quality Index (WQI) scores for Turtle Lake - Baseline Station from 2004 - 2007
Note: only one sample was taken in 2003, therefore the data contributing to the WQI starts in 2004.

3.0 Water Quality Results and Discussion

3.1 Baseline Station Summary

The WQI scores for Turtle Lake Baseline Station (centre of the lake) appear consistent over the sample period from 2004 – 2007 (Figure 2). Turtle Lake's baseline station has WQI scores categorized as *good* to *excellent* within the rating of the WQI. The consistency in both the frequency and magnitude of the parameters identified as "exceeding" the WQI index indicates that these exceedances may not be due to human influences, but rather to natural processes, and may not impair the ecology of Turtle Lake. Only two parameters (pH and chromium) exceeded objectives in the WQI.

3.2 Parameters that Exceeded WQI Objectives

pH

pH is an important water quality parameter that affects chemical and biological reactions within lakes. Extremes in pH or rapid changes in pH can negatively impact aquatic life. Saskatchewan lakes demonstrate a variety of pH levels from basic to acidic. Not atypical to other lakes in the province Turtle Lake is considered a slightly alkaline lake (see also CanNorth 2004). The pH is the only parameter which consistently exceeds the WQI objective of pH 6.5-9.0. Since sampling was initiated in 2003, Turtle Lake's baseline pH ranges seasonally from pH 8.6-9.4 with higher values observed during the winter and fall months.

A study conducted in 1967 (Sawchyn) by the Department of Natural Resources, indicated a pH range of 8.5-8.7 which appears lower than values found today; however, the pH values collected in the 1967 study represent only summer pH values and utilized a older method of testing than that used by Saskatchewan Watershed Authority today.

Metals

It is difficult to trace the source of metals in surface water since there are many natural and human sources. Given that Saskatchewan is rich in many minerals, it is not unusual to find these minerals in surface water. Arsenic, mercury, chromium and aluminum are natural elements found in soil and bedrock. They may enter surface water supplies through natural rock weathering, discharge of industrial wastewater, agricultural pollution, and dissolution in rain, snow or groundwater.

Sampling results from 2004-2007 showed no arsenic, mercury or aluminum exceedances at Turtle Lake baseline; however, chromium was exceeded on one occasion. The chromium value on August 22nd, 2005, was only slightly higher than the WQI objective of 0.001 mg/L. Due to its low frequency of occurrence and the small magnitude of exceedance, it is not considered this a negative influence on the water quality of Turtle Lake. The remaining concentration of these trace metals appear consistent within the short time they have been monitored, it is possible that these metals are from natural sources.

3.3 Remaining Parameters Measured for the WQI

Parameters which contribute to the water quality of Turtle Lake but did not exceed the WQI objectives include: Arsenic, chloride, mercury, total ammonia, dissolved oxygen, sodium, herbicides (2'4-D, MCPA), aluminum, sulphate, fecal coliform bacteria, total phosphorus, dissolved nitrate, total dissolved solids and Chlorophyll *a*. For a complete description of each parameter and their contribution to water quality see the Lake Stewardship Water Quality Guide, which you can find on our website www.swa.ca.

3.4 Field Measurements

Surface water quality parameters measured at the baseline station include five important field measurements which contribute to a complete assessment and better understanding of Turtle Lake's water quality. Some of these parameters also contributed to the calculation of the WQI. These five parameters include: dissolved oxygen (DO), temperature, specific conductivity, turbidity, and Secchi disk depth.

Dissolved Oxygen

Dissolved oxygen concentrations are variable based on time, weather, and temperature. Dissolved oxygen is affects both chemical processes within the lake and biological organisms. For example, certain fish species are sensitive to low levels of dissolved oxygen and may experience stress or death due to lack of dissolved oxygen in the water. For the WQI, the objective is 5.5mg/L of dissolved oxygen for the protection of aquatic life. Both surface and profile measurements for dissolved oxygen in Turtle Lake indicate that it is well oxygenated throughout the year.

Temperature
This parameter is measured because of the influence it has on other parameters such as dissolved oxygen and specific conductivity. Temperature can influence the spatial distribution of fish (i.e. cold water vs. warm water species) and plant growth. Temperature values observed at baseline in Turtle Lake from 2004-2007 ranged from 0.2 to 21.3°C.

Specific Conductivity
Specific conductivity is a measure of waters ability to conduct an electrical current, which depends on the concentration of dissolved ions in solution. It is affected by the concentration of specific ions and the lake temperature. Influenced by the watershed geology and soil composition, Turtle Lake's specific conductivity is averages 712 µS/cm (taken between 2005-2007).

Turbidity
Turbidity is a measure of water clarity. A reduction in water clarity may be caused by solids suspended in the water, including: sediment (e.g. during lake turnover) and plankton (small plants and animals). Other sources which may be seen closer to shore include shoreline erosion (due to ice scour or wave action from wind or boat traffic), waste discharge, urban runoff, algal growth, sediment disruption from human activities or bottom feeding organisms. A decrease in turbidity may affect fish habitat, light penetration, plant growth, water temperature and dissolved oxygen concentrations. For recreational purposes, the surface water objective for turbidity is less than 50 NTU. Turbidity is low (meaning good light penetration) in Turtle Lake with values between 0.3-2.5 NTU.

Secchi Disk Depth
Secchi disk depth is a measure of water transparency which is affected by suspended sediment, plankton and water colour. A similar but slightly coarser measurement than turbidity the Secchi disk depth can be measured easily with a marked disk and measured rope. At Turtle Lake baseline, the Secchi disk reading ranged from 1.5-3.5 m. Historical measurements made by Sawchyn (1967) and Rawson & Moore (1944) recorded Secchi disk depths of 3.0 m and 4.1 m respectively. There is no indication that there has been a decrease or increase in Secchi disk depth since 1944 as the readings are highly variable and dependant on season, time of day, natural lake cycles and perception of the individual sampling.

3.5 Shoreline Stations

Turtle Lake has two shoreline stations chosen for summer monitoring. Turtle Lake's shoreline stations are located at Evergreen Acres and Moonlight Bay (Figure 1). Water quality measurements at shoreline sampling stations are compared to Saskatchewan's *Surface Water Quality Objectives for Recreation and Aesthetics* (2006). There are numeric objectives for clarity (Secchi depth), E. coli and turbidity. Chlorophyll *a* values are compared to the Saskatchewan Watershed Authority target value.

Secchi Disk Depth

The Saskatchewan *Surface Water Quality Objectives* (2006), state that for bathing waters the Secchi disk depth should be at least 1.2 m. Water clarity (Secchi depth) was not always measured at shoreline stations of Turtle Lake because the bottom of the lake was visible. Affected by the same factors mentioned in section 2.6 Field Measurements, water clarity tends to decrease throughout the summer and is affected by factors such as wave action, suspended particles (sediment or algae) and the amount of coloured organic material in the water. Factors decreasing the Secchi disk depth can be more pronounced near shore, due to increased wave action, increased temperature and influences from upland activities (i.e. runoff and human activities).

Bacteria

Escherichia coli are species of bacteria normally found in the lower intestines of animals and people. *Escherichia coli* are commonly detected in surface water because people, pets, livestock, birds and wild animals come into contact with the water. Shoreline samples from Turtle Lake commonly show some level of *E. coli*; however, levels often remain less than 10 counts/100mL. Regardless of the origin, it is always helpful for humans to take steps to minimize contamination (i.e. proper septic tank maintenance and keeping pets out of the water). From 2004-2007, neither of the shorelines exceeded the surface water guideline for contact recreation.

Turbidity

For recreational purposes, the surface water objective for turbidity is less than 50 NTU. Ranging from 1.0-8.9 NTU, neither shoreline exceeded the objective set for recreation from 2004-2007. Similar to water clarity, turbidity is influenced by water movement, wind, suspended particles and organic matter.

Chlorophyll *a*

The relative amount of algae in surface water is assessed by measuring Chlorophyll *a* (the primary pigment that plants and algae use to convert sunlight into energy for growth). Chlorophyll *a* is an indicator of the productivity of the lake. Lakes high in nutrients tend to have more algae growth. Turtle Lake's shoreline stations ranged from 1.78-12.67 µg/L and were therefore far below the <50 µg/L objective for Chlorophyll *a*. In general, shoreline stations tend to have higher algae concentrations than baseline stations due to factors such as wind and wave action as well as warmer temperatures.

When compared to the objectives used to calculate the WQI, the shoreline sampling stations at Turtle Lake have similar water quality to the baseline stations. Phosphorous exceeded the objective once in late summer while pH exceeds it occasionally. A WQI index score is not calculated for shoreline stations because some parameters needed for the index (*i.e.*, metals) are not measured at shoreline stations. Secondly, shoreline water quality is much more indicative of the local conditions than water quality of the entire lake.

4.0 Recommendations

Turtle Lake has been sampled through the Lake Stewardship Program for four years. Though the program has ceased in 2008, the information collected thus far provides lake users, residents, managers and other interested parties with important baseline information on the water quality. Saskatchewan Watershed Authority encourages the group to continue educating themselves and other lake users about the water quality of Turtle Lake and how to protect it.

To maintain the water quality of Turtle Lake, it is recommended that recreational users and upstream stakeholders minimize nutrient additions to the lake. Fertilizer use and disruption of natural vegetation and shoreline should be kept to a minimum. Enhancement of shoreline buffer zones to slow erosion and slow the flow of surface runoff to Turtle Lake will help reduce the amount of nutrients and other contaminants entering the lake.

The Saskatchewan Watershed Authority encourages the continuation of public education and outreach by the *Turtle Lake Watershed Inc.* to teach lake users and stakeholders to follow healthy shoreline living practices such as those outlined in *On the Living Edge – Your Handbook for Waterfront Living* (Kipp & Gallaway 2003).

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Data Tables

2004 - 2007

Turtle Lake Baseline Surface Field Data, 2003	
Field Data	**October 15**
Surface Parameters	
Air Temperature (ºC)	na
Water Temperature (ºC)	9.4
Dissolved Oxygen (mg/L)	9.55
pH (pH units)	9.17
Conductivity (µS/cm)	660
Secchi Disk (meters)	1.9
Turbidity (NTU)	3.04

Turtle Lake Baseline Surface Field Data, 2004				
Field Data	**March 1**	**June 9**	**July 13**	**Aug 10**
Surface Parameters				
Air Temperature (ºC)	na	na	20	na
Water Temperature (ºC)	3.2	12.5	19.6	18.0
Dissolved Oxygen (mg/L)	10.12	9.47	7.44	7.24
pH (pH units)	9.38	9.01	8.88	8.83
Conductivity (µS/cm)	671	672	659	602
Secchi Disk (meters)	2.0	2.0	3.10	1.6
Turbidity (NTU)	1.36	1.62	1.25	1.49

Turtle Lake Baseline Station Dissolved Oxygen, Temperature and Conductivity Profile, 2003				
Date (d/m/y)	**Depth (m)**	**Dissolved Oxygen (mg/L)**	**Water Temperature (ºC)**	**Conductivity (µS/cm)**
15/10/03	0	9.55	9.4	660
	1	8.62	9.5	657
	2	8.19	9.6	659
	3	8.02	9.6	660
	4	7.93	9.6	662
	5	7.94	9.6	663
	6	7.77	9.6	664
	7	7.75	9.6	665
	8	7.81	9.6	667
	9	7.95	9.6	668
	10	8.00	9.8	668
	11	2.10	9.8	656

Turtle Lake Baseline Station Dissolved Oxygen, Temperature and Conductivity Profile, 2004				
Date (d/m/y)	**Depth (m)**	**Dissolved Oxygen (mg/L)**	**Water Temperature (ºC)**	**Conductivity (µS/cm)**
1/3/04	0	10.12	3.2	671
	1	8.40	3.1	670
	2	7.97	3.2	670
	3	7.76	3.3	668
	4	7.45	3.3	668
	5	7.38	3.4	667
	6	7.61	3.5	667
	7	7.50	3.7	668
	8	7.36	4.0	666
	9	7.16	4.1	667
	10	1.10	3.9	667
9/6/04	0	9.47	12.5	672
	1	9.50	12.4	670
	2	9.49	12.4	674
	3	9.45	12.3	674
	4	9.35	12.3	674
	5	9.36	12.3	674
	6	9.29	12.2	674
	7	9.28	12.2	674
	8	9.27	12.2	674
	9	9.25	12.2	675
	10	8.77	12.1	675
	11	8.24	11.7	675

Turtle Lake Baseline Station Dissolved Oxygen, Temperature and Conductivity Profile, 2004				
Date (d/m/y)	**Depth (m)**	**Dissolved Oxygen mg/L**	**Water Temperature (ºC)**	**Conductivity (µS/cm)**
13/7/04	0	7.44	19.6	659
	1	7.42	18.5	657
	2	7.92	17.9	663
	3	7.89	17.4	669
	4	7.75	17.0	670
	5	7.41	16.9	670
	6	7.54	16.8	672
	7	7.27	16.6	672
	8	5.76	16.0	670
	9	5.67	15.6	667
	10	4.63	15.0	672
	11	0.50	14.7	698
10/8/04	0	7.24	18.0	602
	1	7.2	18.0	617
	2	7.17	18.0	616
	3	7.18	18.0	616
	4	7.12	18.0	616
	5	7.15	17.9	617
	6	7.09	17.9	617
	7	7.07	17.8	617
	8	7.09	17.8	618
	9	7.00	17.8	618
	10	7.01	17.8	618
	11	7.03	17.8	618
	12	6.94	17.8	620
	13	6.67	17.7	619
	14	4.87	17.2	661

Turtle Lake Surface Baseline Parameters, 2003 and 2004					
Parameters	**Oct 15 2003**	**March 1 2004**	**June 9 2004**	**July 13 2004**	**Aug 10 2004**
Nutrients (mg/L)					
Dissolved Organic Carbon	18.0	22.0	93.6	19.1	18.6
Nitrate, as Nitrogen	0.11	0.14	<0.04	<0.04	0.16
Ammonia, as Nitrogen	0.02	0.04	0.03	0.02	0.04
Total Kjedahl Nitrogen	1.4	1.4	1.3	1.2	1.3
Total Phosphorous	0.07	0.06	0.05	0.04	0.05
Ortho-Phosphate, as P	0.05	0.05	0.03	0.03	0.04
Solids (mg/L)					
Dissolved, Total	584	750	583	576	583
Suspended, Fixed	2	<1	1	<1	1
Suspended, Volatile	4	2	3	2	4
Suspended, Total	6	2	4	3	5
Bacteria (orgs/100 mL)					
Fecal Coliform	<10	<2	<10	<10	<10
Fecal Streptococci	<10	230	<10	<10	<10
Total Coliform	10	4	<10	<10	<10
Major Ions (mg/L)					
Alkalinity, Total	366	458	361	359	362
Alkalinity, Phenol	26	na	24	25	26
Bicarbonate	383	559	382	377	378
Calcium	20	23	21	21	22
Carbonate	31.2	na	28.8	30.0	31.2
Chloride	2.0	4.0	3.7	3.4	4.4
Hardness, Total	260	300	271	267	273
Magnesium	51	59	53	52	53
Potassium	11	13	11	11	11
Sodium	58	67	56	55	57
Sulphate	28.0	25.0	27.4	26.7	26.0
Other					
Chlorophyll *a* (µg/L)	7.54	1.90	5.11	2.30	6.04
Conductivity (µS/cm)	674	707	669	662	673
pH (pH units)	8.80	9.38	8.80	8.80	8.90
Turbidity (NTU)	2.2	0.6	1.5	0.98	1.3
Biochemical Oxygen Demand (mg/L)	1.8	<2.0	<2.0	<2.0	<2.0
Chemical Oxygen Demand (mg/L)	51.4	56.4	51.8	50.0	51.4
Metals					
Preserved Mercury (µg/L)	na	na	<0.02	<0.02	<0.02
Aluminum (mg/L)	na	na	<0.02	<0.02	<0.02
Arsenic (mg/L)	na	na	0.001	0.001	0.001

Turtle Lake Surface Baseline Field Data, 2005						
Field Data	**Feb 1**	**Mar 15**	**June 13**	**July 12**	**Aug 22**	**Sept 14**
Surface Parameters						
Air Temperature (ºC)	na	-10.0	17.0	20.0	19.5	7.5
Dissolved Oxygen (mg/L)	11.34	8.24	10.15	8.59	9.30	8.65
pH (pH units)	9.03	9.02	8.77	8.88	8.60	8.92
Conductivity (µS/cm)	383.5	329.9	539.0	630	645	620
Secchi Disk (meters)	3.0	6.5	2.0	3.5	2.5	2.0
Turbidity (NTU)	0.69	0.50	1.38	0.84	1.18	2.40

Turtle Lake Baseline Station Dissolved Oxygen, Temperature and Conductivity Profile, 2005					
Date (d/m/y)	**Depth (m)**	**Dissolved Oxygen**		**Water Temperature (ºC)**	**Conductivity (µS/cm)**
		(mg/L)	**(% sat.)**		
01/02/05	0	11.34	76.9	0.5	383.5
	1	10.48	72.6	0.5	382.1
	2	10.23	71.9	0.5	383.2
	3	10.08	69.3	0.5	383.5
	4	9.97	70.5	0.7	384.9
	5	9.90	70.0	0.9	387.4
	6	9.36	65.4	0.9	396.7
	7	9.52	67.5	1.1	498.5
	8	9.36	64.1	1.3	401.0
	9	8.72	62.6	1.5	403.8
	10	5.88	60.6	1.7	407.4
	10.8	3.45	29.7	2.1	406.3
15/03/05	0	8.24	57.8	0.5	329.9
	1	8.14	60.5	0.9	331.7
	2	8.07	56.8	1.0	332.9
	3	7.05	49.9	1.1	336.9
	4	6.74	48.9	1.2	343.1
	5	6.70	49.0	1.3	347.2
	6	6.68	48.0	1.6	353.1
	7	6.79	46.1	1.8	356.5
	8	5.20	41.1	2.1	675
	9	4.79	14.2	2.5	642
	10	1.72	9.8	2.6	649
	10.5	4.58	9.3	2.6	655

*cells lightly shaded grey in conductivity column represent specific conductivity values

Turtle Lake Baseline Station Dissolved Oxygen, Temperature and Conductivity Profile, 2005					
Date (d/m/y)	**Depth (m)**	**Dissolved Oxygen**		**Water Temperature (ºC)**	**Conductivity (µS/cm)**
		(mg/L)	**(% sat.)**		
13/06/05	0	10.15	99.1	14.0	539
	1	10.01	97.2	13.9	578
	2	10.04	97.0	13.7	619
	3	10.05	96.8	13.6	624
	4	10.02	93.2	13.4	626
	5	10.06	96.3	13.4	638
	6	9.87	93.9	13.1	650
	7	9.86	94.1	13.0	651
	8	9.79	93.1	13.0	652
	9	9.75	92.8	12.9	658
	10	9.40	89.1	12.7	660
	11	7.53	73.1	12.5	660
	12	6.04	56.8	11.8	665
12/07/05	0	8.59	94.1	19.6	630
	1	8.52	95.1	19.5	634
	2	8.53	93.1	19.4	637
	3	8.60	93.4	19.3	637
	4	8.48	92.4	19.2	638
	5	8.40	91.4	19.2	638
	6	8.05	86.9	19.1	639
	7	7.68	83.8	19.0	639
	8	6.95	73.7	18.6	641
	9	6.42	68.3	18.0	642
	10	5.46	57.1	17.1	643
	11	5.16	51.1	17.0	644
	12	4.11	42.4	16.3	646
	13	2.32	24.4	15.9	649

Turtle Lake Baseline Station Dissolved Oxygen, Temperature and Conductivity Profile, 2005					
Date (d/m/y)	**Depth (m)**	**Dissolved Oxygen**		**Water Temperature (ºC)**	**Conductivity (µS/cm)**
		(mg/L)	**(% sat.)**		
22/08/05	0	9.30		16.4	645
	1	9.34		16.4	646
	2	9.33		16.4	646
	3	9.32		16.3	646
	4	9.32		16.2	646
	5	9.31		16.3	646
	6	9.25		16.2	646
	7	9.21		16.2	646
	8	9.23		16.2	646
	9	9.17		16.1	646
	10	9.11		16.1	646
	11	9.04		16.1	646
14/09/05	0	8.65		13.6	620
	1	8.65		13.7	620
	2	8.63		13.7	619
	3	8.79		13.7	619
	4	8.71		13.7	619
	5	8.75		13.7	619
	6	8.76		13.7	619
	7	8.77		13.7	619
	8	8.75		13.7	619
	9	8.75		13.7	618
	10	8.89		13.7	617
	11	8.80		13.5	615
	12	8.60		13.5	615
	13	8.20		13.5	616

Turtle Lake Surface Baseline Parameters, 2005						
Parameters	**Feb 01**	**Mar 15**	**June 13**	**Jul 12**	**Aug 22**	**Sept 14**
Nutrients (mg/L)						
Dissolved Organic Carbon	20.0	19.8	21.4	19.3	19.3	17.4
Nitrate, as Nitrogen	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
Ammonia, as Nitrogen	0.07	0.05	0.04	<0.02	0.02	<0.02
Total Kjedahl Nitrogen	1.4	1.3	1.2	1.1	1.2	1.3
Total Phosphorous	0.06	0.06	0.04	0.03	0.04	0.07
Ortho-Phosphate, as P	0.06	0.06	0.04	0.03	0.04	0.04
Solids (mg/L)						
Total Dissolved	643	648	574	568	553	566
Suspended, Fixed	<1	<1	1	1	1	1
Suspended, Volatile	1	1	3	3	4	6
Suspended, Total	1	1	4	4	5	7
Bacteria (orgs/100 mL)						
Fecal Coliform	<10	<10	<10	<10	10	<10
Total Coliform	<10	<10	60	<10	30	<10
Major Ions (mg/L)						
Alkalinity, Total	390	392	352	350	354	348
Alkalinity, Phenol	20	20	20	22	24	22
Bicarbonate	427	429	381	373	373	371
Calcium	24	24	22	22	24	23
Carbonate	24.0	24.0	24.0	26.4	28.8	26.4
Chloride	3.8	3.9	3.8	3.5	3.8	3.6
Fluoride	0.31	0.27	na	na	0.24	na
Hardness, Total	299	303	261	261	278	263
Magnesium	58	59	50	50	53	50
Potassium	12	13	11	11	11	11
Sodium	62	64	54	54	57	54
Sulphate	31.7	31.4	28.6	27.9	2.7	27.3
Other						
Chlorophyll *a* (µg/L)	1.70	1.78	4.00	2.31	4.68	5.85
Conductivity (µS/cm)	725	737	656	654	659	651
pH (pH units)	8.7	8.7	8.7	8.8	8.8	8.8
Turbidity (NTU)	0.58	0.51	1.50	1.10	1.8	2.0
Biochemical Oxygen Demand (mg/L)	<2	<2	<2	<2	<2	<2
Chemical Oxygen Demand (mg/L)	53.3	51.0	46.0	62.8	49.0	52.0

*sulphate result on August 22nd was checked but may be incorrect value from the lab.

Turtle Lake Bottom Baseline Parameters, 2005		
Parameters	**February 1**	**March 15**
Nutrients (mg/L)		
Dissolved Organic Carbon	19.9	19.9
Nitrate, as Nitrogen	<0.04	0.04
Ammonia, as Nitrogen	0.09	0.04
Total Kjedahl Nitrogen	1.4	1.3
Total Phosphorous	0.06	0.06
Ortho-Phosphate, as P	0.06	0.06
Solids (mg/L)		
Dissolved, Total	657	654
Suspended, Fixed	2	<1
Suspended, Volatile	<1	1
Suspended, Total	1	1
Bacteria (orgs/100 mL)		
Total Coliform	<10	<10
Fecal Coliform	<10	<10
Major Ions (mg/L)		
Alkalinity, Total	396	396
Alkalinity, Phenol	18	18
Bicarbonate	439	439
Calcium	25	24
Chloride	3.8	3.9
Fluoride	0.29	0.27
Hardness, Total	305	299
Magnesium	59	58
Potassium	12	12
Sodium	64	64
Sulphate	32.4	31.5
Other		
Chlorophyll *a* (µg/L)	2.82	2.30
Conductivity (µS/cm)	736	744
pH (pH units)	8.7	8.7
Turbidity (NTU)	0.64	0.73
Biochemical Oxygen Demand (mg/L)	<2	<2
Chemical Oxygen Demand (mg/L)	48	50

Turtle Lake Surface Baseline Metal Parameters, 2005				
Parameters	**June 13**	**July 12**	**Aug 22**	**Sept 14**
Metals (mg/L)				
Mercury (µg/L)	<0.05	<0.05	<0.05	<0.05
Aluminum	<0.005	<0.005	<0.005	<0.005
Arsenic (µg/L)	2.2	2.1	2.4	2.7
Barium	0.021	0.021	0.022	0.022
Beryllium	<0.001	<0.001	<0.001	<0.001
Boron	0.16	0.16	0.17	0.17
Cadmium	<0.001	<0.001	<0.001	<0.001
Chromium	<0.001	<0.001	0.002	<0.001
Cobalt	<0.001	<0.001	<0.001	<0.001
Copper	<0.001	<0.001	<0.001	<0.001
Iron	0.003	0.003	0.004	0.005
Lead	<0.002	<0.002	<0.002	<0.002
Manganese	0.002	0.004	0.006	0.007
Molybdenum	0.001	0.001	<0.001	<0.001
Nickel	<0.001	<0.001	<0.001	<0.001
Phosphorous	0.01	<0.01	0.01	0.02
Silicon, Soluble	2.7	2.7	3.8	4.1
Silver	<0.001	<0.001	<0.001	<0.001
Strontium	0.18	0.17	0.18	0.18
Titanium	<0.001	<0.001	<0.001	<0.001
Vanadium	<0.001	<0.001	<0.001	<0.001
Zinc	<0.005	<0.005	<0.005	<0.005
Zirconium	<0.001	<0.001	<0.001	<0.001
Herbicides (µg/L)				
2,4,5-T	<0.5	<0.5	<0.5	<0.5
2,4,5-TP (silvex)	<0.5	<0.5	<0.5	<0.5
2,4-D	<0.5	<0.5	<0.5	<0.5
Bromoxynil (Buctril)	<0.5	<0.5	<0.5	<0.5
Dicamba (Banvel)	<0.5	<0.5	<0.5	<0.5
Diclofop-methyl (HoeGrass)	<1	<1	<1	<1
MCPA	<0.5	<0.5	<0.5	<0.5
Picloram (Tordon)	<1	<1	<1	<1

Turtle Lake Evergreen Acres – Shoreline #1 2005 Surface Parameters				
Parameters	**June 13**	**July 12**	**Aug 22**	**Sept 14**
Nutrients (mg/L)				
Dissolved Organic Carbon	20.3	19.0	18.7	17.3
Nitrate, as Nitrogen	<0.04	<0.04	<0.04	<0.04
Ammonia, as Nitrogen	0.04	0.03	0.02	<0.02
Total Kjedahl Nitrogen	1.2	1.2	1.5	1.2
Total Phosphorous	0.04	0.04	0.04	0.06
Ortho-Phosphate, as P	0.04	0.04	0.03	0.04
Solids (mg/L)				
Suspended, Fixed	1	2	2	1
Suspended, Volatile	3	3	6	5
Suspended, Total	3	7	7	6
Bacteria (orgs/100 mL)				
Fecal Coliform	<10	30	<10	<10
Total Coliform	<10	90	<10	<10
Other				
Chlorophyll *a* (µg/L)	2.82	3.26	2.37	1.94
Turbidity (NTU)	1.6	1.7	2.5	3.5
Biochemical Oxygen Demand (mg/L)	<2	<2	<2	<2
Chemical Oxygen Demand (mg/L)	44.6	53.7	53.3	53.9
Field Data				
Air Temperature (°C)	17	23	na	na
Cloud Cover (%)	80-100	10	5-10	100
Wind Speed (km/hr)	30	5	20-30	5
Wave Height (cm)	15	na	na	ripples
pH (pH units)	8.74	8.83	8.48	8.87
Turbidity (NTU)	1.00	1.15	2.07	2.07
Secchi Disk Transparency (m)	na	na	na	1.90
Water Temperature (°C)	15.5	20.8	16.9	12.5
Conductivity (µS/cm)	647	643	651	613
Dissolved Oxygen (mg/L)	10.67	8.90	9.82	9.65
Dissolved Oxygen (% sat.)	101.5	na	na	na

Turtle Lake Moonlight Bay – Shoreline #2 2005 Surface Parameters				
Parameters	**June 13**	**July 12**	**Aug 22**	**Sept 14**
Nutrients (mg/L)				
Dissolved Organic Carbon	20.7	22.6	20.3	17.3
Nitrate, as Nitrogen	<0.04	<0.04	<0.04	<0.04
Ammonia, as Nitrogen	0.07	0.02	<0.02	<0.02
Total Kjedahl Nitrogen	1.6	1.3	1.5	1.4
Total Phosphorous	0.07	0.05	0.05	0.06
Ortho-Phosphate, as P	0.04	0.04	0.03	0.04
Solids (mg/L)				
Suspended, Fixed	17	1	2	2
Suspended, Volatile	9	2	6	6
Suspended, Total	27	4	8	7
Bacteria (orgs/100 mL)				
Fecal Coliform	<10	<10	<10	<10
Total Coliform	30	<10	<10	<10
Other				
Turbidity (NTU)	5.2	1.6	2.6	2.6
Biochemical Oxygen Demand (mg/L)	<2	<2	<2	<2
Chemical Oxygen Demand (mg/L)	52.9	61.3	52.6	45.9
Field Data				
Air Temperature (°C)	17.0	25.0	19.5	7.5
Cloud Cover (%)	80-100	10	5-10	100
Wind Speed (km/hr)	30	5	20-30	5-10
Wave Height (cm)	15	na	na	choppy
pH (pH units)	8.77	8.88	8.23	8.94
Turbidity (NTU)	1.25	1.18	2.65	2.89
Secchi Disk Transparency (m)	na	na	0.50	1.75
Water Temperature (°C)	15.9	22.6	18.0	na
Conductivity (µS/cm)	618	665	655	617
Dissolved Oxygen (mg/L)	10.66	7.78	8.91	9.24
Dissolved Oxygen (% sat.)	100.9	na	na	na

Turtle Lake Surface Baseline Field Data, 2006						
Field Data						
Time	13:20	13:30	11:20	17:05	10:40	13:53
Air Temperature (ºC)	-10	-4	31	20	18	12
pH (pH units)	8.940	8.950	8.675	8.874	8.844	8.931
Secchi Disk (meters)	2.0	2.5	3.5	3.0	2.5	1.5
Turbidity (NTU)	1.36	1.27	0.74	0.94	2.16	2.47
Cloud Cover (%)	100	0	0	15	70	2
Wind Speed (km/h)	10	25-30	5	10-15	15-20	2-5
Ice Depth (cm)	50	90	0	0	0	0

Turtle Lake Baseline Station Dissolved Oxygen, Temperature and Conductivity Profile 2006					
Date (d/m/y)	**Depth (m)**	**Dissolved Oxygen**		**Water Temperature (ºC)**	**Conductivity (µS/cm)**
		mg/L	**% sat.**		
17/01/06	0.0	10.35	65.8	0.5	378.4
	1.0	10.66	73.6	0.5	378.7
	2.0	10.65	74.0	0.5	378.9
	3.0	10.60	73.9	0.6	378.9
	4.0	10.50	73.7	0.6	378.8
	5.0	9.90	69.9	0.7	340.1
	6.0	9.50	68.3	0.8	384.2
	7.0	8.50	50.4	1.0	386.2
	8.0	8.84	51.7	1.0	387.9
	9.0	9.23	65.6	1.2	390.5
	10.0	8.89	64.2	1.4	393.1
	11.0	8.00	58.6	1.6	398.5
21/03/06	0.0	13.61	92.0	0.2	354.7
	1.0	14.06	97.3	0.3	354.1
	2.0	13.84	97.1	0.7	356.7
	3.0	13.75	96.8	0.9	357.4
	4.0	13.40	95.5	1.0	358.9
	5.0	12.90	92.1	1.2	361.3
	6.0	12.37	88.3	1.2	365.0
	7.0	11.67	84.0	1.4	366.6
	8.0	10.67	77.3	1.6	369.0
	9.0	10.19	74.4	1.7	371.4
	10.0	9.63	69.6	1.9	375.4
	11.0	9.24	68.1	2.1	na

Turtle Lake Baseline Station Dissolved Oxygen, Temperature and Conductivity Profile 2006					
Date (d/m/y)	**Depth (m)**	**Dissolved Oxygen**		**Water Temperature (ºC)**	**Conductivity (µS/cm)**
		(mg/L)	**(% sat.)**		
05/07/06	0.0	7.05	na	21.3	614.0
	1.0	7.23		21.2	637.0
	2.0	7.22		21.1	635.0
	3.0	7.35		21.0	632.0
	4.0	7.46		20.8	631.0
	5.0	7.49		20.6	628.0
	6.0	7.44		20.6	627.0
	7.0	7.48		20.4	623.0
	8.0	7.27		20.5	624.0
	9.0	7.34		20.2	619.0
	10.0	7.45		20.2	619.0
	11.0	7.46		20.6	628.0
02/08/06	0.0	6.61	na	20.0	618.0
	1.0	6.46		20.0	622.0
	2.0	6.43		20.0	621.0
	3.0	6.40		20.0	621.0
	4.0	6.32		20.0	621.0
	5.0	6.32		20.0	621.0
	6.0	6.13		19.9	621.0
	7.0	6.08		19.9	621.0
	8.0	6.08		19.9	621.0
	9.0	6.07		19.9	621.0
	10.0	5.94		19.9	620.0
	11.0	5.92		19.8	619.0
	12.0	5.60		19.7	617.0

Turtle Lake Baseline Station Dissolved Oxygen, Temperature and Conductivity Profile 2006					
Date	**Depth**	**Dissolved Oxygen**		**Water Temperature**	**Conductivity**
(d/m/y)	**(m)**	**mg/L**	**% sat.**	**(ºC)**	**(µS/cm)**
23/08/06	0.0	8.72	na	19.0	582.0
	1.0	8.76		19.0	582.0
	2.0	8.71		19.0	582.0
	3.0	8.77		19.0	582.0
	4.0	8.70		19.0	582.0
	5.0	8.70		18.9	582.0
	6.0	8.70		18.9	582.0
	7.0	8.66		18.9	582.0
	8.0	8.61		18.9	582.0
	9.0	8.42		18.8	580.0
	10.0	7.65		18.8	580.0
	11.0	7.57		18.6	580.0
	12.0	6.93		18.6	579.0
	13.0	5.84		18.5	580.0
03/10/06	0.0	9.87	na	11.8	466.0
	1.0	9.79		11.8	473.0
	2.0	9.63		11.8	473.0
	3.0	9.36		11.7	472.0
	4.0	9.22		11.6	470.0
	5.0	9.33		11.5	469.0
	6.0	8.81		11.4	468.0
	7.0	8.90		11.4	468.0
	8.0	8.87		11.4	467.0
	9.0	8.71		11.3	467.0
	10.0	8.55		11.3	467.0
	11.0	8.28		11.3	466.0
	12.0	8.65		11.3	470.0
	12.5	8.23		11.3	471.0

Turtle Lake Surface Baseline Parameters, 2006						
Parameters	**Jan 17**	**Mar 21**	**July 5**	**Aug 2**	**Aug 23**	**Oct 3**
Nutrients (mg/L)						
Dissolved Organic Carbon	20.5	22.1	17.8	17.2	18.3	19.0
Nitrate, as Nitrogen	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
Ammonia, as Nitrogen	0.03	0.04	<0.02	0.03	0.02	<0.02
Total Kjedahl Nitrogen	1.2	1.2	1.0	2.1	1.1	1.3
Total Phosphorous	0.05	0.05	0.04	0.04	0.09	0.06
Ortho-Phosphate, as P	0.05	0.05	0.03	0.03	0.04	0.05
Solids (mg/L)						
Dissolved, Total	616	632	558	564	558	589
Suspended, Fixed	1	<1	1	<1	<1	1
Suspended, Volatile	1	2	2	6	5	5
Suspended, Total	2	2	2	6	5	6
Bacteria (orgs/100 mL)						
E. Coli	<1	<1	<1	<1	<10	<10
Total Coliform	<1	<1	1	26	31	10
Major Ions (mg/L)						
Alkalinity, Total	374	384	346	350	350	348
Alkalinity, Phenol	18	18	20	22	26	na
Bicarbonate	412	425	373	373	364	425
Calcium	24	25	23	24	23	23
Carbonate	21.6	21.6	24.0	26.4	31.2	na
Chloride	4.1	4.0	3.6	3.6	3.8	3.6
Fluoride	0.26	0.28	0.23	0.22	0.24	0.25
Hardness, Total	278	285	247	262	255	255
Magnesium	53	54	46	49	48	48
Potassium	11	11	10	10	10	10
Sodium	57	57	50	52	51	52
Sulphate	33.4	33.9	28.1	26.3	26.7	27.0
Other						
Chlorophyll *a* (µg/L)	3.50	2.89	4.07	6.81	8.30	6.41
Conductivity (µS/cm)	716	723	651	634	637	657
pH (pH units)	8.7	8.6	8.8	8.8	8.8	8.8
Turbidity (NTU)	1.50	0.78	0.84	1.30	1.50	2.40
Biochemical Oxygen Demand (mg/L)	<2	<2	<2	<2	<2	<2
Chemical Oxygen Demand (mg/L)	53.2	53.0	50.7	51.4	48.9	50.4

Turtle Lake Baseline Surface Metal Parameters, 2006						
Parameters	**Jan 17**	**Mar 21**	**July 5**	**Aug 2**	**Aug 23**	**Oct 3**
Metals (mg/L)						
Mercury (µg/L)	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Aluminum	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Arsenic (µg/L)	2.9	3.0	2.8	2.6	2.6	2.8
Barium	0.022	0.023	0.009	0.024	0.022	0.021
Beryllium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Boron	0.18	0.17	0.16	0.16	0.16	0.16
Cadmium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Chromium	0.11	<0.001	<0.001	<0.001	<0.001	<0.001
Cobalt	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Copper	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Iron	0.003	0.006	<0.001	0.007	0.007	0.005
Lead	0.006	<0.002	<0.002	<0.002	<0.002	<0.002
Manganese	0.002	0.001	<0.001	0.010	0.010	0.006
Molybdenum	0.002	<0.001	0.005	0.002	<0.001	<0.001
Nickel	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Phosphorous	0.02	0.02	0.01	0.01	0.01	0.01
Silicon, Soluble	4.3	4.4	3.3	4.0	4.5	4.8
Silver	<0.001	<0.001	0.001	<0.001	<0.001	<0.001
Strontium	0.19	0.19	0.16	0.17	0.17	0.17
Titanium	<0.001	<0.001	0.001	<0.001	<0.001	<0.001
Vanadium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Zinc	0.008	<0.005	<0.005	<0.005	<0.005	<0.005
Zirconium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Herbicides (µg/L)						
2,4,5-T	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
2,4,5-TP (silvex)	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
2,4-D	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Bromoxynil (Buctril)	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Dicamba (Banvel)	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Diclofop-methyl (HoeGrass)	<1	<1	<1	<1	<1	<1
MCPA	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Picloram (Tordon)	<1	<1	<1	<1	<1	<1

Turtle Lake Evergreen Acres – Shoreline #1 2006 Surface Parameters				
Parameters	**July 5**	**Aug 2**	**Aug 23**	**Oct 3**
Nutrients (mg/L)				
Dissolved Organic Carbon	18.6	17.8	18.2	18.8
Nitrate, as Nitrogen	<0.04	<0.04	<0.04	<0.04
Ammonia, as Nitrogen	<0.02	0.03	<0.02	0.02
Total Kjedahl Nitrogen	1.2	1.3	1.1	1.3
Total Phosphorous	0.07	0.04	0.08	0.06
Ortho-Phosphate, as P	0.03	0.03	0.04	0.04
Solids (mg/L)				
Suspended, Fixed	2	1	<1	1
Suspended, Volatile	2	3	5	5
Suspended, Total	4	4	5	6
Bacteria (orgs/100 mL)				
E. Coli	6	5	<10	84
Total Coliform	548	573	733	132
Other				
Chlorophyll *a* (µg/L)	4.07	3.40	6.92	2.56
Turbidity (NTU)	1.7	1.4	1.9	2.0
Biochemical Oxygen Demand (mg/L)	2.1	<2.0	<2.0	<2.0
Chemical Oxygen Demand (mg/L)	50.1	51.5	47.6	48.9
Field Data				
Air Temperature (°C)	31.0	18.0	23.0	12.1
pH (pH units)	8.714	8.962	8.888	8.997
Turbidity (NTU)	1.49	1.17	2.27	2.63
Water Temperature (°C)	22.1	20.1	18.8	11.9
Conductivity (µS/cm)	642	612	570	458
Dissolved Oxygen (mg/L)	7.26	7.80	9.58	10.61
Cloud Cover (%)	0	100	85	5
Wind Speed (km/hr)	5-10	5	10	5-10

Turtle Lake Moonlight Bay – Shoreline #2 2006 Surface Parameters				
Parameters	**July 5**	**Aug 2**	**Aug 23**	**Oct 3**
Nutrients (mg/L)				
Dissolved Organic Carbon	18.9	17.0	18.0	20.0
Nitrate, as Nitrogen	<0.04	<0.04	<0.04	<0.04
Ammonia, as Nitrogen	0.02	0.03	0.02	<0.02
Total Kjedahl Nitrogen	1.9	1.3	1.5	1.3
Total Phosphorous	0.23	0.05	0.11	0.06
Ortho-Phosphate, as P	0.03	0.03	0.04	0.05
Solids (mg/L)				
Suspended, Fixed	13	2	7	2
Suspended, Volatile	9	3	9	4
Suspended, Total	22	5	16	6
Bacteria (orgs/100 mL)				
E. Coli	69	1	63	<10
Total Coliform	5,475	326	1,872	110
Other				
Chlorophyll *a* (mg/L)	12.67	5.11	8.39	3.35
Turbidity (NTU)	6.1	1.6	4.6	2.1
Biochemical Oxygen Demand (mg/L)	3.2	<2.0	<2.0	<2
Chemical Oxygen Demand (mg/L)	58.1	57.4	54.5	51.0
Field Data				
Air Temperature (°C)	31	19	23	12
pH (pH units)	8.665	8.965	8.786	8.975
Turbidity (NTU)	8.46	2.07	5.19	2.88
Water Temperature (°C)	24.8	20.7	19.6	10.2
Conductivity (µS/cm)	696	604	591	466
Dissolved Oxygen (mg/L)	6.79	8.55	9.88	10.33
Cloud Cover (%)	75	100	85	0
Wind Speed (km/hr)	15	5	10	0

Turtle Lake Baseline Surface Field Data, 2007						
Field Data	**Feb 20**	**Mar 21**	**June 6**	**July 9**	**Aug 27**	**Sept 19**
Surface Parameters						
Time Sampled	11:00	9:30	12:30	13:10	10:30	11:00
Air Temperature (ºC)	-12	-4	12	14	16	2
pH (pH units)	9.049	9.219	8.600	8.710	8.876	9.098
Secchi Disk (meters)	0.0	0.0	2.0	3.0	2.5	1.9
Turbidity (NTU)	0.32	0.83	1.80	1.56	1.15	1.55
Ice Thickness (cm)	67	84	0	0	0	0
Wind Speed (km/hr)	8-10	10-15	25-30	20	5-10	5-10
Cloud Cover (%)	100	10	35	95	90	25

Turtle Lake Baseline Station Dissolved Oxygen, Temperature and Conductivity Profile 2007					
Date (d/m/y)	**Depth (m)**	**Dissolved Oxygen**		**Water Temperature (ºC)**	**Conductivity (µS/cm)**
		(mg/L)	**(% sat.)**		
20/02/07	0	na	na	0.8	na
	1	11.30		0.2	363.9
	2	10.98		0.6	369.2
	3	10.45		0.8	370.3
	4	9.95		1.0	371.9
	5	9.23		1.3	374.5
	6	8.38		1.3	377.7
	7	8.30		1.4	382.9
	8	8.27		1.5	389.3
21/03/07	0	na	na	0.5	na
	1	11.02		0.1	114.6
	2	10.34		0.6	370.5
	3	9.45		0.8	369.8
	4	9.34		1.0	370.7
	5	9.34		1.1	376.5
	6	7.61		1.2	378.6
	7	6.86		1.4	381.6
	8	6.69		1.5	386.4
	9	3.92		1.4	397.3
	10	1.45		1.4	414.0

Turtle Lake Baseline Station Dissolved Oxygen, Temperature and Conductivity Profile 2007					
Date (d/m/y)	**Depth (m)**	**Dissolved Oxygen**		**Water Temperature (ºC)**	**Conductivity (µS/cm)**
		(mg/L)	**(% sat.)**		
06/06/07	0	9.06	83.1	11.4	585.0
	1	9.36	85.2	11.3	591.0
	2	9.68	88.0	11.3	592.0
	3	9.76	88.7	11.3	592.0
	4	9.81	89.3	11.3	592.0
	5	9.83	91.7	11.4	592.0
	6	9.74	89.1	11.4	592.0
	7	9.31	89.9	11.3	593.0
	8	8.91	83.6	11.2	593.0
	9	8.72	78.9	11.0	594.0
	10	8.79	78.6	10.5	597.0
	11	9.40	88.3	11.1	594.0
09/070/07	0	7.99	85.8	19.3	843
	1	7.90	86.1	19.3	849
	2	7.79	86.2	19.3	849
	3	7.88	85.0	19.3	849
	4	7.69	85.3	19.3	848
	5	7.67	83.3	19.3	848
	6	7.80	84.6	19.3	848
	7	7.81	84.5	19.3	849
	8	7.77	83.5	19.3	848
	9	7.35	79.4	18.8	850
	9.5	7.25	79.3	17.7	846

Turtle Lake Baseline Station Dissolved Oxygen, Temperature and Conductivity Profile 2007					
Date (d/m/y)	**Depth (m)**	**Dissolved Oxygen**		**Water Temperature (ºC)**	**Conductivity (µS/cm)**
		(mg/L)	**(% sat.)**		
27/08/07	0	8.95	na	15.8	536.0
	1	8.41		15.8	536.0
	2	7.86		15.8	536.0
	3	7.86		15.7	535.0
	4	7.50		15.7	535.0
	5	7.52		15.7	535.0
	6	7.17		15.7	535.0
	7	7.09		15.6	534.0
	8	7.14		15.6	534.0
	9	7.33		15.5	531.0
	10	7.05		15.4	530.0
	11	7.21		15.4	530.0
	11.25	na		15.4	552.0
19/09/07	0	8.33	na	13.0	630
	1	9.25		13.0	632
	2	8.64		13.2	631
	3	8.60		13.2	631
	4	8.43		13.2	630
	5	8.65		13.2	630
	6	8.75		13.1	630
	7	8.70		13.1	629
	8	8.71		13.0	629
	9	8.75		12.9	629
	10	8.77		12.8	628
	11	8.80		12.8	629

Turtle Lake Surface Baseline Parameters, 2007						
Parameters	**Feb 20**	**Mar 21**	**June 6**	**July 9**	**Aug 27**	**Sept 19**
Nutrients (mg/L)						
Dissolved Organic Carbon	21.3	20.9	na	33.7	21.0	19.6
Nitrate, as Nitrogen	0.04	0.07	<0.04	<0.04	<0.04	<0.04
Ammonia, as Nitrogen	0.04	<0.02	<0.02	<0.02	<0.02	<0.02
Total Kjedahl Nitrogen	1.3	1.4	1.2	1.1	1.2	1.2
Total Phosphorous	0.06	0.10	0.06	0.06	0.05	0.05
Ortho-Phosphate, as P	0.06	0.05	0.06	0.04	0.04	0.05
Solids (mg/L)						
Total Dissolved	634	633	565	555	553	556
Suspended, Fixed	<1	<1	<1	<1	<1	<1
Suspended, Volatile	1	1	4	3	3	3
Suspended, Total	1	1	4	3	3	3
Bacteria (orgs/100 mL)						
E. Coli	<1	<1	<10	<10	<10	<10
Total Coliform	<1	<1	<10	10	20	31
Major Ions (mg/L)						
Alkalinity, Total	382	382	344	341	346	343
Alkalinity, Phenol	18.0	18.0	17.0	21.0	28.0	23.9
Bicarbonate	422	422	378	365	354	360
Calcium	26	26	25	25	24	25
Carbonate	21.6	21.6	20.0	25.0	34.0	29.0
Chloride	4.2	3.9	3.6	3.5	3.6	3.6
Fluoride	0.29	0.29	0.28	0.26	0.25	0.26
Hardness, Total	296	291	264	260	253	264
Magnesium	56	55	49	48	47	49
Potassium	12	12	10	10	11	10
Sodium	60	60	52	52	53	53
Sulphate	32.1	32.2	26.9	26.9	25.9	25.9
Other						
Chlorophyll *a* (µg/L)	<0.20	5.19	12.67	na	8.00	6.13
Conductivity (µS/cm)	709	710	646	630	631	642
pH (pH units)	8.6	8.6	8.7	8.7	8.8	8.8
Turbidity (NTU)	0.78	1.70	2.06	1.15	1.60	1.70
Biochemical Oxygen Demand (mg/L)	<2	<2	<2	<2	<2	<2
Chemical Oxygen Demand (mg/L)	51.1	51.4	50.6	49.3	52.5	48.4

Turtle Lake Bottom Baseline Parameters, 2007	
Parameters	**July 9**
Nutrients (mg/L)	
Dissolved Organic Carbon	33.7
Nitrate, as Nitrogen	<0.04
Ammonia, as Nitrogen	<0.02
Total Kjedahl Nitrogen	1.0
Total Phosphorous	0.07
Ortho-Phosphate, as P	0.04
Solids (mg/L)	
Dissolved, Total	557
Suspended, Fixed	<1
Suspended, Volatile	2
Suspended, Total	2
Bacteria (orgs/100 mL)	
E. Coli	<10
Total Coliform	10
Major Ions (mg/L)	
Alkalinity, Total	0.07
Alkalinity, Phenol	0.04
Bicarbonate	368
Calcium	27.0
Chloride	3.5
Fluoride	0.28
Hardness, Total	258
Magnesium	48
Potassium	10
Sodium	52
Sulphate	27.0
Other	
Chlorophyll *a* (µg/L)	na
Conductivity (µS/cm)	629
pH (pH units)	8.7
Turbidity (NTU)	1.34
Biochemical Oxygen Demand (mg/L)	<2
Chemical Oxygen Demand (mg/L)	44.9

Turtle Lake Baseline Surface Metal Parameters, 2007						
Parameters	**Feb 20**	**Mar 21**	**June 6**	**July 9**	**Aug 27**	**Sept 19**
Metals (mg/L)						
Mercury (µg/L)	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Aluminum	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Arsenic (µg/L)	2.7	2.8	2.6	2.6	2.6	3.0
Barium	0.024	0.024	0.022	0.023	0.027	0.025
Beryllium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Boron	0.18	0.16	0.15	0.15	0.16	0.21
Cadmium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Chromium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Cobalt	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Copper	<0.001	<0.001	<0.001	<0.001	0.001	0.001
Iron	0.003	0.002	0.006	0.003	0.005	0.006
Lead	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Manganese	0.002	0.002	0.004	0.004	0.011	0.006
Molybdenum	0.001	<0.001	<0.001	<0.001	<0.001	0.008
Nickel	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Phosphorous	0.01	<0.01	0.01	<0.01	0.01	0.01
Silicon, Soluble	5.4	5.3	4.9	4.4	4.7	4.7
Silver	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Strontium	0.19	0.19	0.18	0.18	0.19	0.18
Titanium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Vanadium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Zinc	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Zirconium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Herbicides (µg/L)						
2,4,5-T	<0.5	<0.5	<0.5	na	na	na
2,4,5-TP (silvex)	<0.5	<0.5	<0.5	na	na	na
2,4-D	<0.5	<0.5	<0.5	na	na	na
Bromoxynil (Buctril)	<0.5	<0.5	<0.5	na	na	na
Dicamba (Banvel)	<0.5	<0.5	<0.5	na	na	na
Diclofop-methyl (HoeGrass)	<1	<1	<1	na	na	na
MCPA	<0.5	<0.5	<0.5	na	na	na
Picloram (Tordon)	<1	<1	<1	na	na	na

Turtle Lake Evergreen Acres – Shoreline #1 2007 Surface Parameters				
Parameters	**June 6**	**July 9**	**Aug 27**	**Sept 19**
Nutrients (mg/L)				
Dissolved Organic Carbon	na	33.7	19.8	19.4
Nitrate, as Nitrogen	<0.04	<0.04	<0.04	<0.04
Ammonia, as Nitrogen	0.14	<0.02	<0.02	<0.02
Total Kjedahl Nitrogen	1.3	1.0	1.2	1.2
Total Phosphorous	0.12	0.05	0.06	0.05
Ortho-Phosphate, as P	0.06	0.04	0.05	0.06
Solids (mg/L)				
Dissolved, Total	na	544	561	555
Suspended, Fixed	27	1	<1	1
Suspended, Volatile	10	3	3	3
Suspended, Total	37	4	3	4
Bacteria (orgs/100 mL)				
E. Coli	187	63	<10	<10
Total Coliform	565	379	52	52
Other				
Chlorophyll *a* (µg/L)	11.49	na	4.00	5.34
Conductivity (µS/cm)	na	629	635	642
pH (pH units)	na	8.8	8.7	8.8
Turbidity (NTU)	9.16	2.15	2.00	2.00
Biochemical Oxygen Demand (mg/L)	3.7	<2.0	<2.0	<2.0
Chemical Oxygen Demand (mg/L)	59.2	46.0	55.5	55.3
Field Data				
Time Sampled	14:00	13:00	9:30	12:00
Air Temperature (°C)	12	12	14	3
Water Temperature (°C)	13.6	20.1	15.1	11.8
Cloud Cover (%)	35	75	80	30
Wind Speed (km/hr)	25-30	25-30	5	10
pH (pH units)	8.97	8.950	8.725	9.112
Turbidity (NTU)	8.93	1.91	1.32	1.86
Conductivity (µS/cm)	587	619	490	628
Dissolved Oxygen (mg/L)	9.34	7.15	9.52	9.12
Dissolved Oxygen (% sat.)	98.8	78.9	na	na

Turtle Lake Moonlight Bay – Shoreline #2 2007 Surface Parameters				
Parameters	**June 6**	**July 9**	**Aug 27**	**Sept 19**
Nutrients (mg/L)				
Dissolved Organic Carbon	na	631	20.6	19.6
Nitrate, as Nitrogen	<0.04	<0.04	<0.04	<0.04
Ammonia, as Nitrogen	<0.02	<0.02	<0.02	<0.02
Total Kjedahl Nitrogen	1.3	1.1	1.2	1.2
Total Phosphorous	0.06	0.06	0.06	0.05
Ortho-Phosphate, as P	0.06	0.04	0.04	0.05
Solids (mg/L)				
Dissolved, Total	na	556	555	557
Suspended, Fixed	4	1	<1	<1
Suspended, Volatile	6	2	3	3
Suspended, Total	10	3	3	3
Bacteria (orgs/100 mL)				
E. Coli	20	<10	<10	<10
Total Coliform	243	187	108	20
Other				
Chlorophyll *a* (µg/L)	9.70	na	5.78	4.64
Conductivity (µS/cm)	na	631	636	643
pH (pH units)	na	8.7	8.8	8.8
Turbidity (NTU)	3.92	1.68	2.30	2.30
Biochemical Oxygen Demand (mg/L)	2.1	<2.0	<2.0	<2.0
Chemical Oxygen Demand (mg/L)	54.5	47.8	57.5	58.0
Field Data				
Time Sampled	14:20	13:50	12:30	13:00
Air Temperature (°C)	12	16	19	4
Water Temperature (°C)	15.4	19.6	16.3	12.9
Cloud Cover (%)	35	90	95	10
Wind Speed (km/hr)	25-30	10	<5	5
pH (pH units)	8.71	8.670	9.304	9.570
Turbidity (NTU)	5.08	1.07	2.59	1.80
Conductivity (µS/cm)	594	621	546	630
Dissolved Oxygen (mg/L)	9.51	7.55	10.55	8.24
Dissolved Oxygen (% sat.)	95.3	81.3	na	na