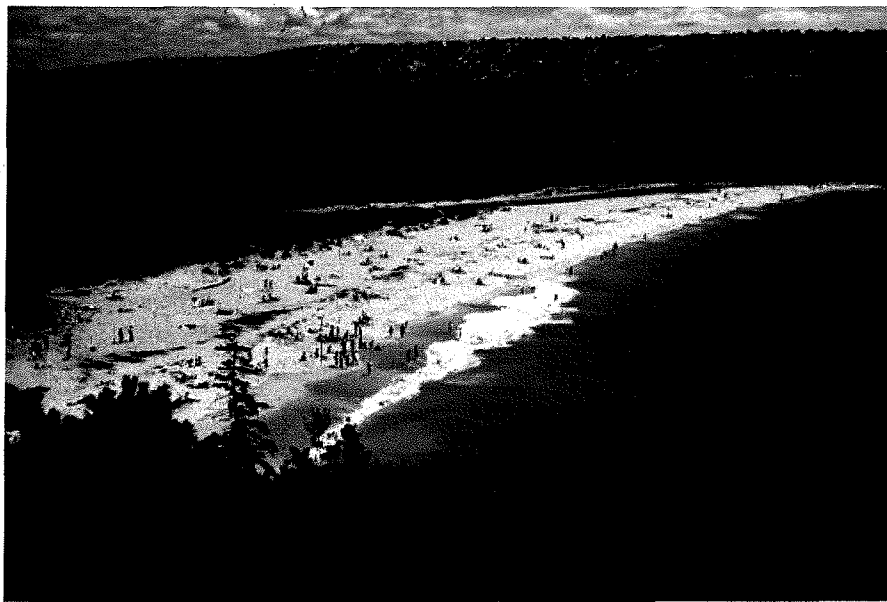


Acadia National Park



Swim Beach Bacterial Monitoring Report Acadia National Park, 2002



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SUMMARY

Monitoring of bacterial densities at selected recreational swim beaches within Acadia National Park was re-instituted in 2002, closely following a similar program conducted by park staff in the mid-1990's (Breen, 1995). The bacterial sampling program was conducted in accordance with National Park Service (NPS) Director's Order #83: Public Health, to reduce the risk to park visitors of contracting a waterborne disease. Freshwater beaches sampled included the "life-guarded" beach at Echo Lake and the unguarded beach at Lakewood; marine waters were sampled at the guarded beach at Sand Beach and in the ephemeral lagoon area at the east-end of Sand Beach. Freshwater samples were analyzed for *Escherichia coli*, marine and estuarine waters for *Enterococci* bacteria. The Health and Environmental Testing Laboratory, Maine Department of Human Services performed sample analysis. Sampling was conducted weekly from late May to mid-September. Bacterial levels at all locations remained within United States Environmental Protection Agency acceptable levels throughout the sampling season, except for a single sample exceedance at Sand Beach lagoon on July 29.

INTRODUCTION

Director's Order #83: Public Health (National Park Service, 1999) requires that bacterial monitoring be conducted at all designated bathing beaches. A designated beach is defined as any beach identified by the park (signs, brochures, maps etc.) as "available to the public for contact recreational water activities." Designated bathing beaches at Acadia National Park (ANP) are Sand Beach and Echo Lake Beach. DO #83 states that the operation, maintenance and monitoring of bathing beaches should be in accordance with applicable state or local regulations, or in the absence of state regulations follow NPS policy. The Maine Department of Human Services (MDHS) has responsibility for protecting human health and establishing bathing beach monitoring standards in the state. At the present time Maine does not have an approved policy for bacterial monitoring at state bathing beaches (John Chandler, MDHS, personal communication). Therefore, the policy and guidance outlined in DO #83 were used to develop the bacterial monitoring program adopted in 2002.

Specific bacterial monitoring requirements outlined in DO #83 include:

- (a) Conducting a sanitary survey;
- (b) Preparing a bathing beach monitoring protocol;
- (c) Sampling for enterococcus or *Escherichia coli*; and
- (d) Issuing swimming advisories when bathing beach waters exceed bacterial standards.

Prior to beginning the monitoring program, park resource management staff prepared a standard operating procedure for bacterial monitoring, and conducted a sanitary survey of each beach to be monitored. The procedures and sanitary survey were reviewed by the Regional Public Health Consultant and approved by the Superintendent (Acadia National Park, 2002). The approved monitoring procedures identify *enterococci* as the bacterial indicator to be analyzed for at marine

beaches (Sand Beach and the Lagoon), and *E. coli* the indicator at freshwater beaches (Echo Lake, Lake Wood). From 1993-95, Acadia National Park conducted bacterial monitoring at the same swim beaches monitored in 2002 using essentially the same monitoring procedures (Breen, 1995).

BACTERIAL STANDARDS

The following bacterial indicators and standards, recommended by DO #83 as well as the MDHS and USEPA, have been adopted in the Acadia National Park bacterial monitoring program:

1. Marine Water Bathing Beaches
 - a. Enterococci
 - 1) **35 colonies/100 ml.** (Geometric Mean)
Or
 - 2) **104 colonies/100 ml.** (Not to be exceeded by any one sample).
2. Freshwater Bathing Beaches
 - a. Enterococci
 - 1) **33 colonies/100 ml.** (Geometric Mean)
Or
 - 2) **61 colonies/100 ml.** (Not to be exceeded by any one sample).
 - b. *E. coli*
 - 1) **126 colonies/100 ml.** (Geometric Mean).
Or
 - 2) **235 colonies/100 ml.** (Not to be exceeded by any one sample).

METHODS

Bacterial monitoring procedures implemented in 2002 are outlined in detail in the Acadia National Park standard operating procedure for "Bacterial Monitoring of Recreational Bathing Beaches" (Acadia National Park, 2002).

Water samples were collected from the park's two designated bathing beaches, Echo Lake and Sand Beach, and from the non-designated beach at Lake Wood (figure 1.). Sampling was also conducted at the Sand Beach lagoon when there was enough water present to justify sampling. The lagoon is an ephemeral pond that forms along an intermittent stream that flows into the ocean at the east-end of Sand Beach. The lagoon forms when beach accretion builds up and plugs the stream outlet. The lagoon often dries up in late summer due to drought. Two samples were collected each week at Sand Beach and Echo Lake, and one sample at Lake Wood and Sand Beach lagoon.

Bacterial monitoring was conducted weekly from May 28 through September 9, following designated sample collection procedures (Figure 2.). Samples were collected Monday or Tuesday (if Monday was a holiday) morning using sample bottles provided by the Health and Environmental Testing Laboratory (HETL) at the Maine Department of Human Services. The HETL is the state's primary health testing lab and is certified to conduct bacterial analysis in compliance with US Environmental Protection Agency methods (USEPA, 1986).

Samples were collected by wading into the water approximately thigh deep and submerging the sample bottle about one foot below the surface. Care was taken to keep fingers from touching the lid or inside of the sample bottle thus avoiding contamination. The date, time of sampling, location, weather conditions and surface water temperature were recorded. In addition, rainfall data (taken from ANP National Atmospheric Deposition Program rain gage) for 24 and 72 hours prior to sampling were also recorded.

Samples were mailed to the lab the same day using special mailing labels provided by the HETL. Test results were generally faxed back to the park by the following Friday.

RESULTS

Bacterial results for 2002 are presented in Table 1. Echo Lake, Lakewood and Sand Beach all remained below EPA bacterial standards throughout the summer. The highest single sample *E. coli* densities at Echo Lake and Lakewood respectively were counts of 100 and 96 colonies per 100 milliliters. The highest single *enterococci* density at Sand Beach was a count of less than 10, which was the minimum detection limit. Sand Beach Lagoon had an *enterococci* count of 140 colonies/100ml on July 29, which exceeded the EPA standard for a single sample of 104. However, there was less than 6 inches of water at the time of sampling, and the lagoon was dry by the time the results were obtained and remained dry for the rest of the summer. The Regional Public Health Consultant was notified of the exceedance but because the lagoon area remained dry no public health advisory was issued. The second highest single sample density at the lagoon was 50 colonies/100ml on July 8. The highest geometric means for Sand Beach (>10), Echo Lake (12.1), Lake Wood (9.7), and the lagoon (19.5) were all less than EPA standards.

DISCUSSION

The bacterial monitoring program conducted in 2002 successfully met all program objectives. Resource management staff, with assistance from park life-guards, were able to collect water samples and mail them to the state lab each week without any contamination, mailing delays, or other major problems. Results were faxed promptly to the park by the HETL lab so that notification, if necessary, of unhealthful conditions could have been initiated.

The results of monitoring conducted in 2002 indicate that bacterial densities at all ANP areas sampled were within DO #83 and EPA bacterial guidelines, except for the single sample exceedance at Sand Beach lagoon on July 29. The park plans to continue bacterial sampling at these swim beach areas in 2003 and 2004.

LITERATURE CITED

Acadia National Park. 2002. Standard Operating Procedure: Bacterial Monitoring of Recreational Bathing Beaches. Bar Harbor, ME.

Breen, R., 1995. Bacterial Monitoring of Recreational Swim Beaches. Acadia National Park. Acadia National Park Resources Report 95-2.

National Park Service, 1999. Director's Order #83: Public Health. U.S. Department of Interior. National Park Service, Washington D.C.

United States Environmental Protection Agency. 1986. Ambient Water Quality Criteria for Bacteria. EPA440-5-84-002. Office of Water Regulations and Standards, Criteria and Standards Division, Washington, D.C.

Figure 1.

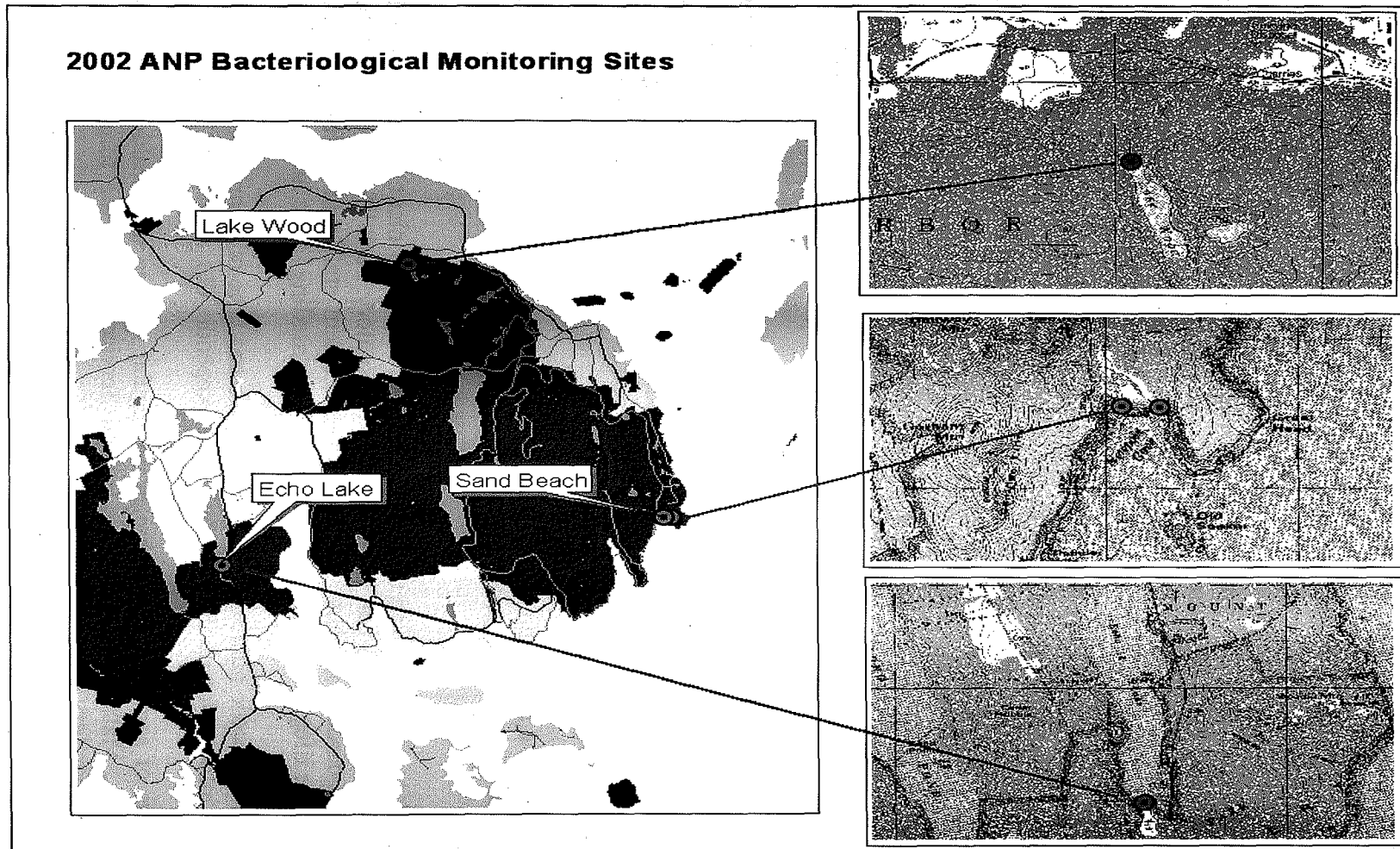


Figure 2.

RECOMMENDED SAMPLING PROCEDURES

1. Collect samples on Monday morning (or Tuesday, if Monday is a Holiday) using bottles provided by the Maine DHS laboratory.
2. Collect samples as early as possible in the morning before visitors begin using the beach at the following locations (see figure 1.):
 - Sand Beach (east and west), 2 samples, approximately 1/3 and 2/3 the length of beach
 - Sand Beach Lagoon, 1 sample, near center of lagoon area
 - Echo Lake (east and west), 2 samples approximately 1/3 and 2/3 the length of beach
 - Lake Wood, 1 sample, near center of beach at north end of lake.
3. Wade out into the surf/lake about thigh deep and face into the current/wind.
4. Collect the water sample from an incoming wave, taking care to avoid getting sediment or debris into the sample.
5. The object is to avoid capturing surface water, and to collect from at least 1-foot depth. Grasp the bottle near the base with one hand and remove the cap with the other. Be careful to avoid touching the inside of the cap or rim of the bottle. Rotate your wrist so the mouth of the bottle is pointing downward at about a 45-degree angle. Rapidly plunge the bottle to a depth of about one foot. Rotate your wrist so the mouth of the bottle points up, loses its air bubble, and fills with water. Replace the cap while still underwater.
6. Lift the capped bottle out of the water. Remove the cap and carefully pour out enough water to leave a 1/2 inch air space. Replace the cap. Be careful to not touch the inside of the bottle or the inside of the cap.
7. Immediately place the bottle in an upright position in a covered cooler containing sufficient ice to keep the samples cool until they can be mailed to the laboratory. Park lifeguards will collect of the water samples at guarded beaches. Resource Management staff will collect samples at Lake Wood, and from the lifeguards, then prepare samples for mailing to the lab.
8. Record the sample bottle number, station name, date and time of sampling, sampler's name and other appropriate information on the field data sheet (Appendix C.).
9. Within 6 hours of sampling mail samples via regular mail to the Health and Environmental Testing Laboratory, Maine Department of Human Services, using the form and mailing label provided by the Laboratory (Appendix D.).

Table 1. Swim Beach Bacterial Monitoring Results, 2002

SAMPLE #	SITE	DATE	COLLECTOR	TIME	TEMP	Rain (24h)	Rain (72h)	LAB	ECOLI	ENT
02E-WTR-07352	Echo Lake East	5/28/02	Dumais	1030	13	0	0	DHS	2	
02E-WTR-07354	Echo Lake West	5/28/02	Dumais	1030	13	0	0	DHS	0	
02E-WTR-07360	Lake Wood	5/28/02	Breen	1000		0	0	DHS	1	
02E-WTR-07365	Sand Beach East	5/28/02	Dumais	0918		0	0	DHS		0
02E-WTR-07374	Sand Beach Lagoon	5/28/02	Breen	0917	13.1	0	0	DHS		0
02E-WTR-07373	Sand Beach West	5/28/02	Breen	0920	7.9	0	0	DHS		0
02E-WTR-07358	Echo Lake East	6/3/02	Dumais	1042	14.7	0.08	0.17	DHS	11	
02E-WTR-07356	Echo Lake West	6/3/02	Dumais	1042	14.7	0.08	0.17	DHS	4	
02E-WTR-07353	Lake Wood	6/3/02	Dumais	1000	16.1	0.15	0	DHS	2	
02E-WTR-07365	Sand Beach East	6/3/02	Dumais	0915	7.9	0.08	0.17	DHS		0
02E-WTR-07375	Sand Beach Lagoon	6/3/02	Dumais	0910	10.7	0.08	0.17	DHS		6
02E-WTR-07367	Sand Beach West	6/3/02	Dumais	0919	7.9	0.08	0.17	DHS		0
02E-WTR-07355	Echo Lake East	6/10/02	Dumais	1056	14.8	0.15	0	DHS	100	
02E-WTR-07349	Echo Lake West	6/10/02	Dumais	1054	14.8	0.15	0	DHS	50	
02E-WTR-07348	Lake Wood	6/10/02	Dumais	1007	16.7	0.15	0	DHS	2	
02E-WTR-07369	Sand Beach East	6/10/02	Dumais	0921	8.7	0.15	0	DHS		0
02E-WTR-07372	Sand Beach Lagoon	6/10/02	Dumais	0918	13	0.15	0	DHS		34
02E-WTR-07364	Sand Beach West	6/10/02	Dumais	0925	8.2	0.15	0	DHS		0

Table 1. (page 2.)

SAMPLE #	SITE	DATE	COLLECTOR	TIME	TEMP	Rain (24h)	Rain (72h)	LAB	ECOLI	ENT
02E-WTR-07346	Echo Lake East	6/17/02	Dumais	1053	15.2	0.1	0.5	DHS	1	
02E-WTR-07357	Echo Lake West	6/17/02	Dumais	1050	15.2	0.1	0.5	DHS	1	
02E-WTR-07359	Lake Wood	6/17/02	Dumais	0959	16.1	0.1	0.5	DHS	1	
02E-WTR-07363	Sand Beach East	6/17/02	Dumais	0913	10.1	0.1	0.5	DHS		0
02E-WTR-07371	Sand Beach Lagoon	6/17/02	Dumais	0907	12.1	0.1	0.5	DHS		7
02E-WTR-07366	Sand Beach West	6/17/02	Dumais	0918	10.1	0.1	0.5	DHS		0
02E-WTR-07351	Echo Lake East	6/24/02	Dumais	1037	17.6	0.14	0	DHS	20	
02E-WTR-07347	Echo Lake West	6/24/02	Dumais	1035	17.6	0.14	0	DHS	84	
02E-WTR-07350	Lake Wood	6/24/02	Dumais	1107	18.8	0.14	0	DHS	0	
02E-WTR-07361	Sand Beach East	6/24/02	Dumais	0935	9	0.14	0	DHS		0
02E-WTR-07368	Sand Beach Lagoon	6/24/02	Dumais	0930	17.1	0.14	0	DHS		3
02E-WTR-07370	Sand Beach West	6/24/02	Dumais	0940	9	0.14	0	DHS		0
02E-WTR-09541	Echo Lake East	7/1/02	Dumais	1102		0	0	DHS	3	
02E-WTR-09540	Echo Lake West	7/1/02	Dumais	1100		0	0	DHS	1	
02E-WTR-09544	Lake Wood	7/1/02	Dumais	1019	23.5	0	0	DHS	0	
02E-WTR-09556	Sand Beach East	7/1/02	Dumais	0937	12.7	0	0	DHS		0
02E-WTR-09555	Sand Beach Lagoon	7/1/02	Dumais	0930	19.7	0	0	DHS		4
02E-WTR-09554	Sand Beach West	7/1/02	Dumais	0943	12.3	0	0	DHS		1

Table 1. (page 3.)

SAMPLE #	SITE	DATE	COLLECTOR	TIME	TEMP	Rain (24h)	Rain (72h)	LAB	ECOLI	ENT
02E-WTR-09545	Echo Lake East	7/8/02	Dumais	1117	22.3	0	0.2	DHS	10	
02E-WTR-09542	Echo Lake West	7/8/02	Dumais	1114	22.3	0	0.2	DHS	2	
02E-WTR-09539	Lake Wood	7/8/02	Dumais	1026	23.3	0	0.2	DHS	2	
02E-WTR-09557	Sand Beach East	7/8/02	Dumais	0925	14	0	0.2	DHS		10
02E-WTR-09563	Sand Beach Lagoon	7/8/02	Dumais	0921	19.7	0	0.2	DHS		50
02E-WTR-09558	SandBeach West	7/8/02	Dumais	931	14	0	0.2	DHS		10
02E-WTR-09547	Echo Lake East	7/15/02	Dumais	1106		0.05	0	DHS	12	
02E-WTR-09546	Echo Lake West	7/15/02	Dumais	1102		0.05	0	DHS	6	
02E-WTR-09550	Lake Wood	7/15/02	Dumais	1022	24.6	0.05	0	DHS	2	
02E-WTR-09567	Sand Beach East	7/15/02	Dumais	0928	14.4	0.05	0	DHS		10
02E-WTR-09562	Sand Beach Lagoon	7/15/02	Dumais	0923	20.1	0.05	0	DHS		10
02E-WTR-09568	Sand Beach West	7/15/02	Dumais	0932	14.4	0.05	0	DHS		10
02E-WTR-09551	Echo Lake East	7/22/02	Gawley	1140	21.1	0	0.39	DHS	2	
02E-WTR-09548	Echo Lake West	7/22/02	Gawley	1143	21.1	0	0.39	DHS	2	
02E-WTR-09543	Lake Wood	7/22/02	Gawley	1039	22.6	0	0.39	DHS	2	
02E-WTR-09560	Sand Beach East	7/22/02	Gawley	0955	13.2	0	0.39	DHS		10
02E-WTR-09565	Sand Beach Lagoon	7/22/02	Gawley	0957	20.3	0	0.39	DHS		10
02E-WTR-09561	Sand Beach West	7/22/02	Gawley	0952	13.2	0	0.39	DHS		10

Table 1. (page 4.)

SAMPLE #	SITE	DATE	COLLECTOR	TIME	TEMP	Rain (24h)	Rain (72h)	LAB	ECOLI	ENT
02E-WTR-09549	Echo Lake East	7/29/02	Dumais		19.6	0.05	0.07	DHS	2	
02E-WTR-09552	Echo Lake West	7/29/02	Dumais	1000	19.6	0.05	0.07	DHS	2	
02E-WTR-09553	Lake Wood	7/29/02	Dumais	0957	21.5	0.05	0.07	DHS	2	
02E-WTR-09566	Sand Beach East	7/29/02	Dumais	0917	13	0.05	0.07	DHS		10
02E-WTR-09559	Sand Beach Lagoon	7/29/02	Dumais	0913	16.6	0.05	0.07	DHS		140
02E-WTR-09564	Sand Beach West	7/29/02	Dumais	0920	13	0.05	0.07	DHS		10
02E-WTR-11702	Echo Lake East	8/5/02	Dumais	1145		0	0	DHS	21	
02E-WTR-11689	Echo Lake West	8/5/02	Dumais	1144		0	0	DHS	9	
02E-WTR-11698	Lake Wood	8/5/02	Dumais	1013		0	0	DHS	37	
02E-WTR-11717	Sand Beach East	8/5/02	Dumais	0920	15.6	0	0	DHS		10
02E-WTR-11716	Sand Beach West	8/5/02	Dumais	0924	15.6	0	0	DHS		10
02E-WTR-11692	Echo Lake East	8/12/02	Dumais	1448	24	0	0	DHS	73	
02E-WTR-11700	Echo Lake West	8/12/02	Dumais	1445	24	0	0	DHS	2	
02E-WTR-11695	Lake Wood	8/12/02	Dumais		24.8	0	0	DHS	96	
02E-WTR-11713	Sand Beach East	8/12/02	Dumais	1340	15.5	0	0	DHS		10
02E-WTR-11714	Sand Beach West	8/12/02	Dumais	1347	15.5	0	0	DHS		10

Table 1. (page 5.)

SAMPLE #	SITE	DATE	COLLECTOR	TIME	TEMP	Rain (24h)	Rain (72h)	LAB	ECOLI	ENT
02E-WTR-11706	Echo Lake East	8/19/02	Dumais	1138		0	0	DHS	7	
02E-WTR-11697	Echo Lake West	8/19/02	Dumais	1134	26.8	0	0	DHS	10	
02E-WTR-11693	Lake Wood	8/19/02	Dumais	1049	26.8	0	0	DHS	5	
02E-WTR-11710	Sand Beach East	8/19/02	Dumais	1007	13.8	0	0	DHS		10
02E-WTR-11715	Sand Beach West	8/19/02	Dumais	1010	13.8	0	0	DHS		10
02E-WTR-11696	Echo Lake East	8/26/02	Dumais			0.25	0.3	DHS	1	
02E-WTR-11690	Echo Lake West	8/26/02	Dumais			0.25	0.3	DHS	2	
02E-WTR-11704	Lake Wood	8/26/02	Dumais	1031		0.25	0.3	DHS	0	
02E-WTR-11719	Sand Beach East	8/26/02	Dumais	0938	13.7	0.25	0.3	DHS		10
02E-WTR-11723	Sand Beach West	8/26/02	Dumais	940		0.25	0.3	DHS		10
02E-WTR-11701	Echo Lake East	9/3/02	Dumais	1103	20	0	0.35	DHS	7	
02E-WTR-11691	EchoLake West	9/3/02	Dumais	1100	20	0	0.35	DHS	4	
02E-WTR-11694	Lake Wood	9/3/02	Dumais	1020	24.5	0	0.35	DHS	5	
02E-WTR-11707	Sand Beach East	9/3/02	Dumais	0936	13.5	0	0.35	DHS		10
02E-WTR-11721	Sand Beach West	9/3/02	Dumais	0934	13.5	0	0.35	DHS		10
02E-WTR-11705	Echo Lake	9/9/02	Dumais	1108	23.8	0	0	DHS	6	
02E-WTR-11703	Lake Wood	9/9/02	Dumais	1035	22.8	0	0	DHS	4	
02E-WTR-11708	Sand Beach East	9/9/02	Dumais	0954	13.6	0	0	DHS		10
02E-WTR-11712	Sand Beach West	9/9/02	Dumais	0950	13.6	0	0	DHS		10