Lake Tahoe Water Quality Investigations

Algal Bioassay • Phytoplankton • Atmospheric Nutrient Deposition • Periphyton

Final Report:

July 1, 2004 – June 30, 2007

Agreement No. 04-022-160-0

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Submitted by:

Tahoe Environmental Research Center
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Project Overview

The following document is our Final Report for work completed July 1, 2004 to June 30, 2007) for Agreement No. 04-022-160-0: Lake Tahoe Water Quality Investigations by the U.C. Davis – Tahoe Environmental Research Center (TERC).

Under terms of this contract TERC is to provide the SWRCB with the following services: to "conduct long-term water quality research and monitoring at Lake Tahoe in support of the Lake Tahoe Interagency Monitoring Program".

The objective of this project is to continue monitoring critical ongoing long-term water quality parameters in Lake Tahoe. The primary research and monitoring tasks addressed in this project include:

Algal growth bioassay tests to assess nutrient limitation (Task 3). The purpose of this task is to determine the nutrient or nutrients which limit phytoplankton growth. These findings have been very important in current efforts toward lake restoration. They have highlighted the need for an expanded erosion control strategy. Bioassays are to be done six times per year using Lake Tahoe Water containing natural phytoplankton, collected at the TERC's Index station along the west shore.

Enumeration and identification of phytoplankton algae (Task 4). The purpose of this task is to provide ongoing information on phytoplankton species present in the water column, cell numbers and biovolume. This task is particularly critical since changes in the biodiversity of these algae are both indicators of pollution and affect food-chain structure. Implementation of this task allows TRG to determine if new and undesirable species are colonizing the lake. In addition, the size and composition of particles, including phytoplankton cells in the water, have a significant effect on light transmittance, and hence affect the famed clarity of Lake Tahoe. Characterization of phytoplankton dynamics in Lake Tahoe fills a critical knowledge gap, allowing for more informed management decisions. Phytoplankton samples are to be collected at the Index station about every 10-14 days and are to include a composite sample down to the Secchi depth, and a composite sample from the surface to 105m. Once a month additional samples will be collected from discreet depths (5,20,40,60,75 and 90 meters). Phytoplankton analysis is to include species present, cell numbers and biovolume measurements. Note, the scope of work for this task also provides for collection and archiving of zooplankton samples. Samples are collected from vertical tows (0-150 meters) every 10-14 days at the Index station and about monthly at the Mid-lake station. Samples are preserved, and archived for future analysis when needed.

Atmospheric deposition of nitrogen and phosphorus (Task 5). The purpose of this task is to provide ongoing information on nutrient loading via this important source to the lake. The historical TRG data shows that atmospheric deposition of nitrogen, and to a lesser extent phosphorus, is an important source of nutrients to the lake. Data collected from collectors located on buoys on the lake has proved valuable in providing estimates of N

and P loading directly to the lake. Data from the lower Ward Valley station is partitioned into wet and dry deposition components, and allows assessment of loading from these two components of atmospheric deposition along the west shore. This monitoring has proved valuable in support of ongoing Lake Tahoe atmospheric deposition TMDL program work. Atmospheric deposition samples are to be collected from three primary sites: Ward Lake Level, Mid-lake (TB-1) and an additional buoy (TB-4) site, additional samples will be collected from the Upper Ward Valley station. Approximately 35 dry bucket samples and 30 wet samples are to be collected over the year at Ward Lake level, 30 dry-bulk samples and 15-30 snow tube samples are to be collected at the mid-lake station, and 30 dry-bulk samples are to be collected at an additional lake buoy station i.e. TB-4. Samples are to be analyzed for NO3-N, NH4-N, TKN, SRP, and TP.

Monitoring of attached algae or periphyton along the shoreline (Task 6). The purpose of this monitoring is to assess levels of nearshore attached algae (periphyton) growth around the lake. The rate of periphyton growth is an indicator of local nutrient loading and long-term environmental changes. Monitoring trends in periphyton growth is important in assessing local and lake-wide nutrient loading trends, and may be used as a secondary indicator of the success of nutrient load reductions arising from environmental projects and future maximum clarity load (TMDL) implementation. Ten sites are to be monitored for periphyton biomass a minimum of eight times per year in this project. Six of the samplings are to be done between January to August when attached algae growth in the eulittoral zone (0.5m) is greatest; the remaining two samplings are to be done between September – December. Duplicate biomass samples will be taken from natural substrate at each site for a total of 160 samples per year. Biomass is to be reported as chlorophyll *a* and Ash Free Dry Weight (AFDW). On an annual basis during the spring, the relative level of growth at 39 additional sites will be assessed through AFDW and chlorophyll *a* biomass measurements, visual observations of filament length and % cover.

The additional tasks associated with this project include: Project management (Task 1), quality assurance (Task 2), and reporting of data (Task 3).

The summary of % work completed (based on a 3 year granting period) through June 30, 2007 for each task is listed below:

Task	**% Completion** (for full 3 yr granting period)
1 – Project Management	100%
2 – Quality Assurance	100%
3 – Algal Growth Bioassays	100%
4 – Phytoplankton Analysis	100%
5 – Atmospheric Deposition of Nutrients	100%
6 – Periphyton	100%
7 - Reporting	100%

Task 1. Project Management and Administration

1.1. Project oversight – Entailed sampling coordination, overall project coordination, discussions with staff, assist in data evaluation, interfacing with agency staff, and incorporation of data into other Basin research/monitoring projects.

1.2. Quarterly invoicing – Entailed ensuring that contract requirements were met through completion of quarterly status reports and that reports were submitted to the SWRCB Project Representative on schedule. Ensure that invoicing is properly carried out.

Task 2. Project Quality Assurance

Standardized QA/QC practices for components were followed as specified in the TRG QA/QC Manual (Janik et al., 1990) For QA/QC applied to periphyton monitoring see Appendix entitled "Periphyton Quality Assurance Project Plan" in: (Hackley et al., 2004). For QA/QC applied to bioassays see Appendix 7 of this report.

Task 3. Algal Growth Bioassays

The response of Lake Tahoe water to nitrogen and phosphorus enrichment has been tested using algal bioassays since the 1960s. The long record of bioassays for Lake Tahoe, using a consistent method, has proved extremely useful for evaluating long-term changes. When combined with lake chemistry data, and information on atmospheric and watershed nutrient loading ratios, these simple enrichment bioassays have provided valuable complementary evidence on the temporal dynamics of lake nutrient limitation.

In a typical bioassay, lake water is collected from the upper photic zone (0-20 m water was used for these bioassays), pre-filtered through 80 µm mesh netting to remove the larger zooplankton and returned to the lab. The water is distributed among experimental flasks to which small amounts of N (20 µg N/L) or P (at two different levels: 2 µg P/L and 10 µg P/L) or the combination of both N and P are added. One set of flasks is left as a "control" in which no nutrients are added and all treatments are replicated in triplicate. The flasks are then placed in a laboratory incubator under fluorescent lighting at ambient lake temperature and day length, and growth response of phytoplankton is measured over a period of six days. Relative growth was assessed by measuring changes in algal biomass (i.e. fluorescence or chlorophyll *a*). Treatments are "stimulatory" if the mean growth response exceeds the control at the $p \leq 0.05$ level of significance. (See Appendix 7 for a more detailed description of the bioassay method).

Summary of Results 2004-2007

In this summary we present the results for all bioassay experiments done during the period July 1 2004 to June 30, 2007. Eighteen total bioassays were done on a schedule of approximately one bioassay every other month. The results of each of the individual bioassays are presented in Table 1(a-r). The results for all bioassays done during the period 2002-2007 are summarized in Table 2.

Overall, the bioassay results showed that phosphorus (P) limitation was much more prevalent than nitrogen (N) limitation during the period of study and the combination of N and P added together always increased phytoplankton growth. Phosphorus added alone (at least one of the P2 or P10 treatments) was stimulatory in 13 of 18 (or 72%) of the bioassays. Nitrogen added alone was only stimulatory in 1 of 18 (or 6%) of the bioassays. The N+P treatments were stimulatory in all 18 (or 100%) of the bioassays.

Some seasonal patterns of nutrient limitation were apparent during 2004-2007. Phosphorus limitation was typically prevalent during the mid-winter to spring period (Jan. to April). All seven bioassays done during this period showed P stimulation. N and P colimitation was prevalent in the summers of 2004 and 2005. In summer bioassays done in 2006 and 2007 some bioassays showed significant responses to P alone, however the greatest response was to the addition of N+P together. In fall bioassays, the greatest response was again to the combination of N+P added together, P alone was also slightly stimulatory in 2004 and 2005.

The data for all bioassays done during the period 2002-2007 is summarized in Table 2. Patterns for winter, spring and fall nutrient limitation have been relatively consistent over the period. P limitation was generally prevalent during winter and spring periods during 2002-2007. In fall bioassays, the greatest response was typically to the combination of N+P added together, P alone was also slightly stimulatory in 2002, 2004 and 2005.

Summer nutrient limitation showed some variability over this period. In the summers of 2002, 2004 and 2005, N+P colimitation was prevalent, with neither N nor P alone causing significant stimulation of growth. However, during the summer of 2003, N added alone was stimulatory indicating presence of N limitation and the combination of N+P added together was even more stimulatory. In the summers of 2006 and 2007 P alone caused slight stimulation in some bioassays, but the greatest increases in growth were caused by the combination of N and P added together. In all (100%) of the bioassay experiments covering all times of the year, a combination of N+P was stimulatory reinforcing the fact that Lake Tahoe phytoplankton are still nutrient deficient and that controls of N and P inputs are important.

Table 1.a. Bioassay done using 2,5,8,11,14,17,20m lake water collected 8/20/04.

Treatment	Day 6 Mean Fluorescence	Std. Dev.	n	Day 6 Mean Fluorescence as % of Control	Statistically Signif. ($p \leq .05$) Response ="*"
Control	0.241	0.025	3		
N(20)	0.269	0.008	3	112	
P(2)	0.244	0.030	3	101	
P(10)	0.271	0.022	3	112	
N(20)P(2)	0.507	0.123	3	210	*
N(20)P(10)	0.597	0.039	2	248	*

Table 1.b. Bioassay done using 2,5,8,11,14,17,20m lake water collected 10/28/04.

Treatment	Day 6 Mean Fluorescence	Std. Dev.	n	Day 6 Mean Fluorescence as % of Control	Statistically Signif. ($p \leq .05$) Response ="*"
Control	0.348	0.006	3		
N(20)	0.361	0.009	3	104	
P(2)	0.359	0.032	3	103	
P(10)	0.396	0.020	3	114	*
N(20)P(2)	0.441	0.002	3	127	*
N(20)P(10)	0.645	0.008	3	185	*

Table 1.c. Bioassay done using 2,5,8,11,14,17,20m lake water collected 12/11/04.

Treatment	Day 6 Mean Fluorescence	Std. Dev.	n	Day 6 Mean Fluorescence as % of Control	Statistically Signif. (p≤.05) Response =“*”
Control	0.310	0.008	3		
N(20)	0.306	0.008	3	99	
P(2)	0.414	0.016	3	134	*
P(10)	0.464	0.022	3	150	*
N(20)P(2)	0.498	0.008	3	161	*
N(20)P(10)	0.535	0.013	3	173	*

Table 1.d. Bioassay done using 2,5,8,11,14,17,20m lake water collected 2/16/05.

Treatment	Day 6 Mean Fluorescence	Std. Dev.	n	Day 6 Mean Fluorescence as % of Control	Statistically Signif. (p≤.05) Response =“*”
Control	0.306	0.007	3		
N(20)	0.302	0.006	3	99	
P(2)	0.371	0.004	3	121	*
P(10)	0.373	0.012	3	122	*
N(20)P(2)	0.375	0.005	3	123	*
N(20)P(10)	0.390	0.018	3	127	*

Table 1.e. Bioassay done using 2,5,8,11,14,17,20m lake water collected 4/15/05.

Treatment	Day 6 Mean Fluorescence	Std. Dev.	n	Day 6 Mean Fluorescence as % of Control	Statistically Signif. (p≤.05) Response =“*”
Control	0.338	0.006	3		
N(20)	0.327	0.007	3	97	
P(2)	0.651	0.040	3	193	*
P(10)	0.789	0.012	3	233	*
N(20)P(2)	0.723	0.020	3	214	*
N(20)P(10)	0.813	0.032	3	241	*

Table 1.f. Bioassay done using 2,5,8,11,14,17,20m lake water collected 6/10/05.

Treatment	Day 6 Mean Fluorescence	Std. Dev.	n	Day 6 Mean Fluorescence as % of Control	Statistically Signif. (p≤.05) Response =“*”
Control	0.256	0.009	3		
N(20)	0.278	0.004	3	109	
P(2)	0.254	0.021	3	99	
P(10)	0.270	0.032	3	105	
N(20)P(2)	0.451	0.011	3	176	*
N(20)P(10)	0.613	0.013	3	239	*

Table 1.g. Bioassay done using 2,5,8,11,14,17,20m lake water collected 8/15/05.

Treatment	Day 6 Mean Fluorescence	Std. Dev.	n	Day 6 Mean Fluorescence as % of Control	Statistically Signif. (p≤.05) Response =“*”
Control	0.312	0.002	3		
N(20)	0.327	0.009	3	105	
P(2)	0.340	0.020	3	109	
P(10)	0.328	0.019	3	105	
N(20)P(2)	0.553	0.004	3	177	*
N(20)P(10)	0.805	0.041	3	258	*

Table 1.h. Bioassay done using 2,5,8,11,14,17,20m lake water collected 10/20/05.

Treatment	Day 6 Mean Fluorescence	Std. Dev.	n	Day 6 Mean Fluorescence as % of Control	Statistically Signif. (p≤.05) Response =“*”
Control	0.322	0.003	3		
N(20)	0.351	0.006	3	109	
P(2)	0.353	0.017	3	110	
P(10)	0.389	0.036	3	121	*
N(20)P(2)	0.460	0.011	3	143	*
N(20)P(10)	0.622	0.010	3	193	*

Table 1.i. Bioassay done using 2,5,8,11,14,17,20m lake water collected 12/15/05.

Treatment	Day 6 Mean Fluorescence	Std. Dev.	n	Day 6 Mean Fluorescence as % of Control	Statistically Signif. (p≤.05) Response =“*”
Control	0.379	0.011	3		
N(20)	0.430	0.005	3	113	*
P(2)	0.388	0.007	3	102	
P(10)	0.410	0.027	3	108	*
N(20)P(2)	0.616	0.014	3	162	*
N(20)P(10)	0.722	0.020	3	190	*

Table 1.j. Bioassay done using 2,5,8,11,14,17,20m lake water collected 2/21/06.

Treatment	Day 6 Mean Fluorescence	Std. Dev.	n	Day 6 Mean Fluorescence as % of Control	Statistically Signif. (p≤.05) Response =“*”
Control	0.268	0.006	3		
N(20)	0.262	0.005	3	98	
P(2)	0.485	0.038	3	181	*
P(10)	0.573	0.015	3	214	*
N(20)P(2)	0.522	0.010	3	195	*
N(20)P(10)	0.536	0.015	3	200	*

Table 1.k. Bioassay done using 2,5,8,11,14,17,20m lake water collected 4/12/06.

Treatment	Day 6 Mean Fluorescence	Std. Dev.	n	Day 6 Mean Fluorescence as % of Control	Statistically Signif. ($p \leq .05$) Response ="*"
Control	0.388	0.013	3		
N(20)	0.380	0.003	3	98	
P(2)	0.603	0.029	3	155	*
P(10)	0.628	0.027	3	162	*
N(20)P(2)	0.600	0.018	3	155	*
N(20)P(10)	0.624	0.014	3	161	*

Table 1.l. Bioassay done using 2,5,8,11,14,17,20m lake water collected 6/19/06.

Treatment	Day 6 Mean Fluorescence	Std. Dev.	n	Day 6 Mean Fluorescence as % of Control	Statistically Signif. ($p \leq .05$) Response ="*"
Control	0.335	0.023	3		
N(20)	0.326	0.002	3	84	
P(2)	0.331	0.015	3	85	
P(10)	0.353	0.059	3	91	
N(20)P(2)	0.594	0.014	3	153	*
N(20)P(10)	0.982	0.061	3	253	*

Table 1.m. Bioassay done using 2,5,8,11,14,17,20m lake water collected 8/9/06.

Treatment	Day 6 Mean Fluorescence	Std. Dev.	n	Day 6 Mean Fluorescence as % of Control	Statistically Signif. ($p \leq .05$) Response ="*"
Control	0.202	0.028	3		
N(20)	0.236	0.019	3	117	
P(2)	0.229	0.027	3	113	
P(10)	0.285	0.023	3	141	*
N(20)P(2)	0.243	0.067	3	120	
N(20)P(10)	0.349	0.001	2[a]	173	*

Notes- a) one anomalously high N20P10 treatment replicate value (0.762) was not used.

Table 1.n. Bioassay done using 2,5,8,11,14,17,20m lake water collected 10/31/06.

Treatment	Day 6 Mean Fluorescence	Std. Dev.	n	Day 6 Mean Fluorescence as % of Control	Statistically Signif. ($p \leq .05$) Response ="*"
Control	0.232	0.011	3		
N(20)	0.226	0.004	3	98	
P(2)	0.232	0.033	3	100	
P(10)	0.262	0.042	3	113	
N(20)P(2)	0.312	0.007	3	135	*
N(20)P(10)	0.632	0.020	3	273	*

Table 1.o. Bioassay done using 2,5,8,11,14,17,20m lake water collected 1/9/07.

Treatment	Day 6 Mean Fluorescence	Std. Dev.	n	Day 6 Mean Fluorescence as % of Control	Statistically Signif. (p≤.05) Response =“*”
Control	0.387	0.008	3		
N(20)	0.385	0.008	3	99	
P(2)	0.551	0.019	3	142	*
P(10)	0.552	0.014	3	143	*
N(20)P(2)	0.553	0.012	3	143	*
N(20)P(10)	0.564	0.015	3	146	*
P(10)a	0.543	0.008	3	140	*

Table 1.p. Bioassay done using 2,5,8,11,14,17,20m lake water collected 3/2/07.

Treatment	Day 6 Mean Fluorescence	Std. Dev.	n	Day 6 Mean Fluorescence as % of Control	Statistically Signif. (p≤.05) Response =“*”
Control	0.434	0.012	3		
N(20)	0.436	0.019	3	100	
P(2)	0.485	0.007	3	112	*
P(10)	0.488	0.016	3	112	*
N(20)P(2)	0.519	0.013	3	120	*
N(20)P(10)	0.512	0.013	3	118	*

Table 1.q. Bioassay done using 2,5,8,11,14,17,20m lake water collected 4/13/07.

Treatment	Day 6 Mean Fluorescence	Std. Dev.	n	Day 6 Mean Fluorescence as % of Control	Statistically Signif. (p≤.05) Response =“*”
Control	0.580	0.012	3		
N(20)	0.563	0.022	3	97	
P(2)	0.759	0.013	3	131	*
P(10)	0.787	0.035	3	136	*
N(20)P(2)	0.801	0.023	3	138	*
N(20)P(10)	0.786	0.026	3	136	*

Table 1.r. Bioassay done using 2,5,8,11,14,17,20m lake water collected 6/12/07.

Treatment	Day 6 Mean Fluorescence	Std. Dev.	n	Day 6 Mean Fluorescence as % of Control	Statistically Signif. (p≤.05) Response =“*”
Control	0.266	0.012	3		
N(20)	0.266	0.005	3	100	
P(2)	0.301	0.011	3	113	*
P(10)	0.247	0.001	3	93	*
N(20)P(2)	0.385	0.006	3	145	*
N(20)P(10)	0.469	0.016	3	176	*

Table 2. Summary of N and P bioassay treatment responses as % of control done in: (a) 2002, (b) 2003, (c) 2004, (d) 2005, (e) 2006, (f) 2007. Treatment responses statistically significantly different from the control at the $p \leq .05$ level are indicated with borders and shading.

(a) 2002 Bioassays

	2/7/02	4/1/02	6/12/02	8/30/02	10/28/02	12/30/02
Control	100	100	100	100	100	100
N20	104	97	101	101	93	117
P2	154	-	-	108	-	113
P10	135	157	104	100	113	141
N20P2	139	-	-	157	151	120
N20P10	138	178	180	231	238	173

(b) 2003 Bioassays

	1/30/03	2/26/03	4/8/03	5/21/03	6/16/03	7/10/03	8/29/03	10/20/03	12/3/03
Control	100	100	100	100	100	100	100	100	100
N20	101	98	102	138	116	141	129	101	107
P2	112	129	168	101	99	100	100	100	98
P10	114	134	181	98	104	106	105	106	104
N20P2	141	136	178	253	248	221	196	187	124
N20P10	159	147	190	264	297	317	280	334	142

(c) 2004 Bioassays

	1/5/04	4/23/04	8/20/04	10/28/04	12/11/04
Control	100	100	100	100	100
N20	100	97	112	104	99
P2	133	112	101	103	134
P10	135	122	112	114	150
N20P2	132	153	210	127	161
N20P10	134	202	248	185	173

(d) 2005 Bioassays

	2/16/05	4/15/05	6/10/05	8/15/05	10/20/05	12/15/05
Control	100	100	100	100	100	100
N20	99	97	109	105	109	113
P2	121	193	99	109	110	102
P10	122	233	105	105	121	108
N20P2	123	214	176	177	143	162
N20P10	127	241	239	258	193	190

(e) 2006 Bioassays

	2/21/06	4/12/06	6/19/06	8/9/06	10/31/06
Control	100	100	100	100	100
N20	98	98	84	117	98
P2	181	155	85	113	100
P10	214	162	91	141	113
N20P2	195	155	153	120	135
N20P10	200	161	253	173	273

(f) 2007 Bioassays

	1/9/07	3/2/07	4/13/07	6/12/07
Control	100	100	100	100
N20	99	100	97	100
P2	142	112	131	113
P10	143	112	136	93
N20P2	143	120	138	145
N20P10	146	118	136	176

Task 4. Enumeration and Identification of Phytoplankton

Phytoplankton play a central role in the cross-over between the biological, chemical and physical limnetic processes. Plants are the primary producers. Everything that impacts the plant populations will ultimately be reflected in higher trophic levels. Since phytoplankton are small, with high turnover rates, they are very responsive to physical and chemical changes in the lake. These changes are reflected through phytoplankton growth rates, abundance and composition.

This report includes results from the ongoing monitoring in Lake Tahoe for July 2004 – April 2007. During this period nearly 400 phytoplankton samples have been collected and assayed. This consistent monitoring has yielded valuable data in the analysis of possible long-term trends, including climate change.

Phytoplankton samples were collected and counted at least once a month. Samples were taken from six discrete depths above 100M and one composite sample of various euphotic zone depths. A deep water composite (150-450M) was collected once a month.

There were fewer samples collected in the past year. This reduced sampling for phytoplankton was planned after a review of the monitoring program. Most notable was the absence of a secchi composite which was previously collected in the top 20M. The frequency of sampling was also reduced from once every 10 days to once a month, for index sampling, and once a month for the mid-lake station.

Results

Cell numbers (abundance) are the most obvious result from counting and identification of samples. Cellular concentrations give a visual image of the impact of those populations. The phytoplankton abundance for the years 2004-2007 is found in Figure 1 (a-c). Viewing all three graphs, collectively, it is clear that each year has been different in community group composition. The groups that are typically the most abundant are diatoms and Chrysophytes. In 2004 and 2005 the green algae was also a strong community member. However, the green algae in 2006 was present in low numbers. The year 2007 also stands out in an atypical manner (Fig. 1c). The two most abundant groups have been Chrysophytes and Bluegreen algae and they've been present in very high numbers. Diatoms have been, by comparison, relatively rare.

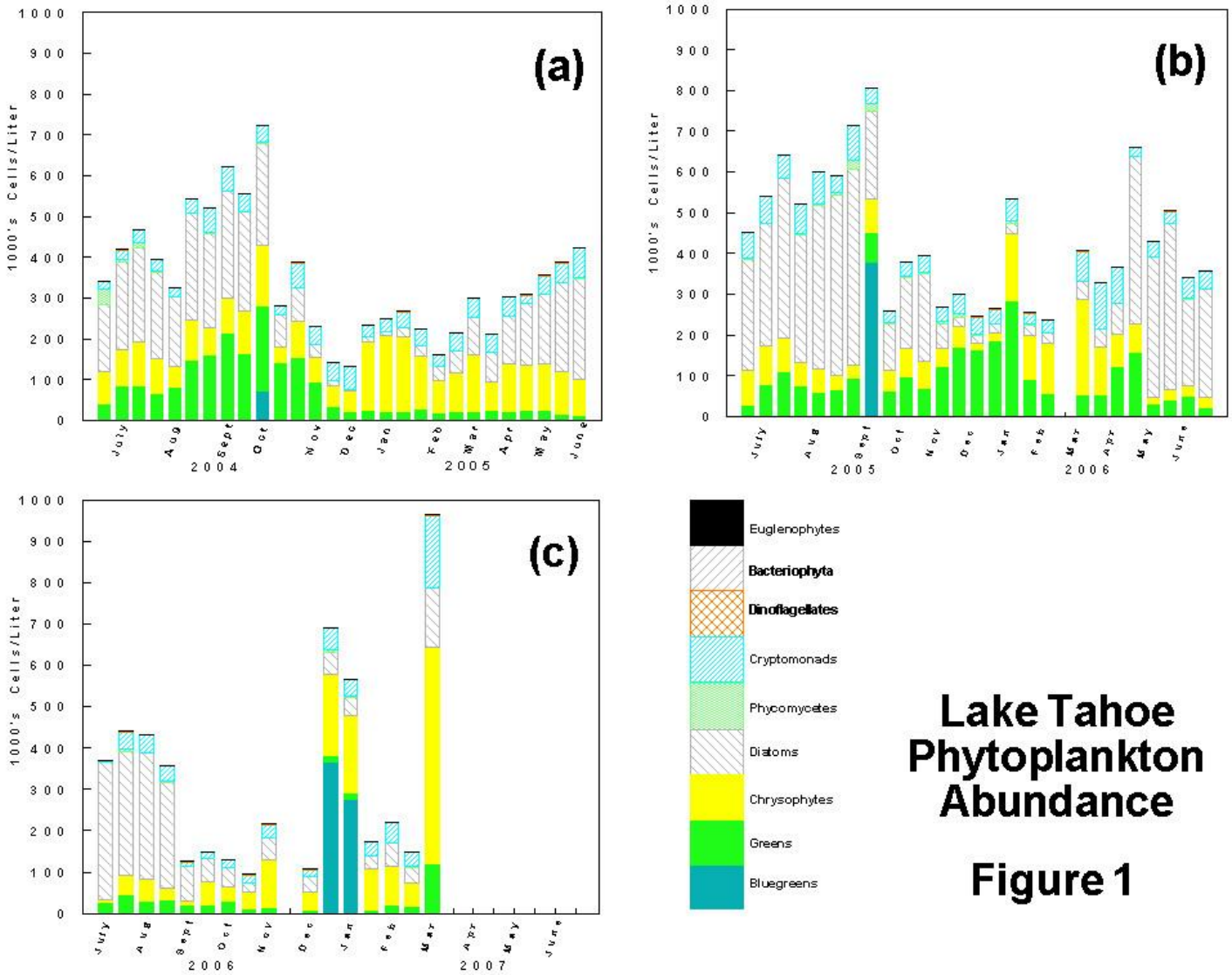
In addition to the community composition it is also useful to look at annual abundance peaks. The timing and magnitude of the annual population peaks has also been variable. In 2007, the peak abundance was seen in March. This contrasts with the autumnal peaks in 2004 and 2005.

Using cell abundance as the sole method to describe phytoplankton community dynamics can be somewhat misleading because small numerous cells are given unwarranted weight in this analysis. Another complementary analysis is algal cell bio-volume. The metabolic potential of cellular function is linked to cell size. Additionally, the contribution of large, less abundant cells can be acknowledged. Bio-volume analysis is the most useful parameter for studies of primary productivity, nutrient recycling and algal resource limitations.

The phytoplankton bio-volume for the years 2004-2007 is shown in Figure 2 (a-c). Bio-volume has been more consistent between years than cellular abundance. Diatoms have been the bio-volume dominants throughout the time period. Nevertheless, other algal groups, most notably the green algae and the Cryptophyte algae, have been variable. The timing of the bio-volume peaks and valleys have been fairly consistent with seasonal trends.

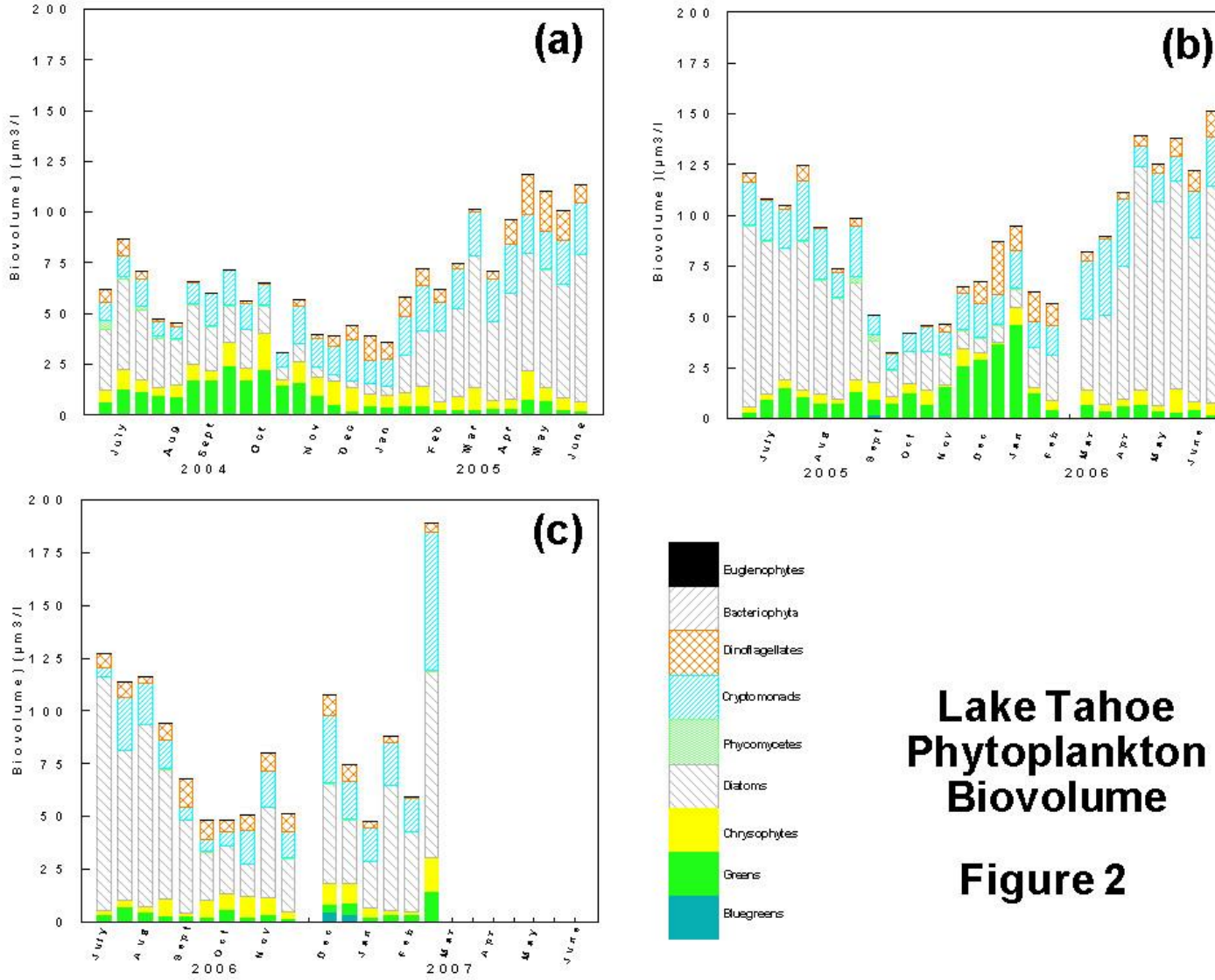
The largest bio-volume and abundance occurred in March 2007 (Fig 2c). The phytoplankton community was also very diverse (species richness = 41). Diatoms and cryptophytes were the bio-volume dominants while Chrysophytes were the most abundant group. This community was seen throughout the euphotic zone because the water column was mixed and did not have any thermal stratification. The timing and magnitude of this peak was unusual. However, the bloom could be a reflection of the turbulence and turn-over in the lake, which would have provided an infusion of nutrients to the euphotic zone.

Looking at specific species in the phytoplankton community has helped us to understand their compatibility and resource division. Diatoms have been dominants in the community. It is common to identify 10 or more different diatom species in each sample. It is important to note, however, that only one or two diatom species create the bio-volume dominance. These dominants may survive for several months in the water column. Eventually, as the year progresses, another diatom will replace the earlier species, which could be viewed as seasonal succession. Sometimes the species changes are season to season, sometimes year to year. For example, in June 2006 the centric diatom, *Cyclotella ocellata*, and the small pennate, *Achnanthes microcephala*, were the bio-volume dominants. One year prior, in 2005, the dominants were *Stephanodiscus alpina* and *Cyclotella ocellata*. It is not possible to predict the one or two dominant species prior to their population increases, however, there are only about 5 diatom species that consistently compete for that role.



Lake Tahoe Phytoplankton Abundance

Figure 1



Lake Tahoe Phytoplankton Biovolume

Figure 2

A second group, Cryptophytes, have been consistently performing well. The two most abundant species in this group are *Rhodomonas lacustris* and *Cryptomonas sp.* These species are flagellates and have the ability to be strong swimmers in the water column. They are typically found in the deeper euphotic zone (>60M), below the thermocline, during the time of thermal stratification. Their peak abundance and growth, however, is during the winter and early spring when the water column is mixed and nutrients are more plentiful.

The last two annual reports (Hackley et al., 2005, Hackley et al., 2006) focused on the performance of the Chlorophytes (green algae) and the implications of their presence in the community. In 2004 and 2005 this algal group did exceptionally well compared to the previous decade of phytoplankton community composition. Increases in the green algae have been interpreted, in the literature, as a decline in water quality or as a indicator of trophic change. Upon closer examination, however, the performance of the green algae was linked to only one or two species. During 2004 there was only one species which was controlling the peak abundances, *Ankistrodesmus spiralis*. In 2005 there was also one species which performed well, *Carteria sp.* but *Ankistrodesmus spiralis* was virtually absent. Then in 2006, the green algae returned to a more typical yearly performance with none of the individual species being standouts. This inter-annual variability was a reflection of the fragile balance in the community between species and the resources which fueled their populations.

Summary

The phytoplankton community in Lake Tahoe is continually in transition. The seasonal transitions are sometimes referred to as seasonal succession. Just as there are four seasons to the climate, there are also four distinctive communities that match the physical changes occurring in the lake. Many of these community changes are expected and sometimes predicted, based on the stability of thermal stratification.

The community transition between years (inter-annual variation) has been, and continues to be, the least understood and possibly the greatest key to climate and nutrient trends in the lake. Typical components of productivity change, such as total biomass, abundance and diversity indexes, have not been very helpful in analyzing Tahoe's algae. Yet, if you look at the phytoplankton community from year to year or decade to decade, it is easy to see that there have been massive changes in the community composition. This is not typical for a mature, temperate lake with predictable weather patterns.

The community composition is a reflection of change. It could be change in nutrient availability. There is a fragile balance between low nutrient concentrations and the nutrient which is most limiting. Lake Tahoe has been switching between nitrogen and phosphorus limitation for several years. However, lakes typically have concurrent changes in total biomass, abundance and diversity when there are changes in the nutrient loading. We have not seen significant changes in any of these algal components.

The phytoplankton community changes could also be driven by water column stability and an overall trend of climate change. It is indicative of what C.S. Reynolds (1997) termed as **progressive environmental change**. Algal cells are impacted by thermal conditions of the water column. The continual shift in species composition may be the result of increasing water-column stability reported for Lake Tahoe (Coats et al. 2006).

Thermal stratification is a physical barrier to mixing. Some phytoplankton depend on turbulence for their survival. When cells are physically entrapped within a niche they become subject to its conditions (nutrient concentrations, temperatures, and light limitations). The longevity of this entrapment will determine what species are able to survive and prosper (Winder & Hunter, submitted). Cell size may be a key factor to a species success. Also, the ability to move (flagellates) as well as the ability to adapt to various light limitations could be favorable for survival.

What makes Lake Tahoe so complex is that the available niches for algal growth are plentiful because light penetrates so deep. In addition to the inevitable patchiness of horizontal distribution, there is 100M below the surface which could easily support phytoplankton growth. There is so little known about the auto-ecology of individual species that Lake Tahoe becomes an in-situ laboratory to teach us about the needs of phytoplankton.

The phytoplankton work is essential to understanding biological processes in the lake. However, I think an even greater attribute of Tahoe phytoplankton is its spatial complexity. If, as researchers, we could understand phytoplankton distributions and resource requirements, it would be helpful beyond the confines of Lake Tahoe. The scientific knowledge would benefit the fields of aquatic sciences and ecology.

Task 5. Atmospheric Deposition of Nitrogen and Phosphorus

Monitoring of atmospheric deposition is crucial to an understanding of its role in degradation of the lake and for use in watershed management. Atmospheric deposition contributes nitrogen, phosphorus and fine particles which all impact lake clarity. Preliminary estimates in the nutrient and sediment budget for Lake Tahoe produced as part of the Tahoe TMDL project indicate that atmospheric deposition contributes about 55% of the Total Nitrogen, 15% of the Total Phosphorus and 15% of the Total Fine (<20μm) particles to the lake. A significant portion of the nitrogen, phosphorus and fine particles in the atmospheric deposition is thought to originate in the basin. Control of air pollutants generated within the basin is therefore potentially a tool for watershed managers to reduce pollutants which impact the clarity of the lake. The atmospheric deposition monitoring program of TERC provides basic information on nutrient loading from this source (atmospheric deposition both in the watershed on land and directly to the lake surface), as well as on precipitation timing and amounts. The data also provides information on past and current trends in atmospheric deposition.

The current contract provides for atmospheric monitoring at 3 primary stations: the lower Ward Lake Level station, and two stations located on the lake: the Mid-lake buoy station (TB-1) and an additional lake buoy (buoy station TB-4). Monitoring at an additional station in Upper Ward Valley was done as "extra" monitoring by TERC to continue the long record (30+ years) of atmospheric deposition data from this site.

Stations and Methods

Lower Ward Valley Lake Level Station

This station is located slightly south of the Ward Creek mouth on an estate, approximately 75-100 m back from the lake edge. It consists of a NovaLynx electrically-heated 8 inch diameter tipping bucket gage (TBG) located approximately 8 feet above the ground on a tower. The TBG was modified so that precipitation could also be caught for measurement. A datalogger connected to the TBG records each 0.01 inch of precipitation. This station also has an Aerochem Metrics model 301 wet/dry deposition sampler. This sampler contains two deposition collection buckets and moveable lid, which automatically covers one, or the other bucket depending on whether precipitation is detected by a sensor. A 3 ½ gallon standard HDPE plastic bucket is used in the Wet-side of the sampler. This "Wet bucket" is covered by the lid during dry periods and exposed when wet precipitation is detected during a storm event. The Dry-side contains a modified HDPE bucket with reduced side-wall height, filled with 4 liters of deionized water, (and contains a heater in winter). This "Dry-bucket" is exposed during dry periods and covered by the lid when precipitation is detected. Wet samples are collected from this station also on an event basis, or as wet buckets fill with snow. Dry samples are collected about every 7-10 days and collection is usually coordinated with lake buoy Dry-Bulk sample collection.

Mid-lake Buoy Station

This station is located in the northern middle portion of the lake. The station was located on a large anchored PVC spar buoy in earlier studies. During the current study the station was located on a large buoy (TB-1) in the north central portion of the lake (coordinates 39° 09.180 N and 120° 00.020 W). The collector consists of a HDPE plastic bucket similar to the Aerochem Metrics modified dry collector. It is filled with 4 liters of deionized water when placed out. However, the bucket also contains plastic baffles to dampen splash from the bucket. Unlike the Dry bucket, this collector collects both wet and dry deposition and therefore is called a Dry-Bulk collector. The station also contains a Snow Tube for collection of wet precipitation and a small basic rain gage for verification of precipitation amounts. Sample collection from this station is done as much as possible on a regular basis (7-10 days if possible), however, lake conditions and weather govern frequency to a large extent. The raft/buoy also has a variety of scientific instrumentation for NASA's studies on the lake in addition to the atmospheric deposition collectors.

Northwest Lake (TB-4) Station

Station TB-4 (coordinates 39° 09.300 N and 120° 04.330 W) was located between the mid-lake (TB-1) station and Tahoe City. This was desirable since it provided a second collection site to compare with Mid-lake data. The station contained a Dry-Bulk sampler similar to that used on the Mid-lake station. Samples were collected on the same frequency as the Mid-lake samples. The station was supported on a large buoy (TB-4). The buoy has a variety of scientific instrumentation for NASA's studies on the lake in addition to the atmospheric deposition collectors. (Note for more detailed methods at the different stations see the TERC's Standard Operating Procedures for precipitation monitoring).

Upper Ward Valley Bench Station

This station is located in the north bowl of Ward Valley at 2200m elevation. It consists of a Snow Tube (ST) affixed to one pole of the tower. The Snow Tube consists of an approximately 4 1/2 foot length of 8 inch diameter PVC pipe, with a 8 inch diameter cap, and clean plastic liner bag is inserted to allow collection of precipitation. Samples were usually collected from this station on an event-basis (i.e. after each storm). However some samples collected, caught multiple events or consisted of dry deposition samples into a dry Snow Tube after one or more weeks. Chemical analysis was done on samples collected through early January 2007, after which only information on precipitation amount was collected.

Results

Data collected for this task include information on atmospheric deposition concentrations, nutrient loading, precipitation amounts and timing. Appendices 1-6 presents summary tables for precipitation amounts, concentrations and nutrient loading from 7/1/04 through 6/30/07.

During July 1, 2004-June 30, 2007, 428 samples were collected from the 3 primary stations (103 dry bucket and 97 wet bucket samples from the Ward Lake Level station, 82 dry-bulk samples from each of the lake buoy stations and 64 Mid-lake snow tube samples). 81 additional samples were collected from the Upper Ward Valley station. Samples were analyzed for ammonium (NH4-N), nitrate (NO3-N), total Kjeldahl nitrogen (TKN), soluble reactive phosphorus (SRP) and total phosphorus (TP). In addition all samples were analyzed for total dissolved phosphorus (DP) and pH was analyzed in wet precipitation and lake buoy Dry-bulk samples.

The period of study included two relatively wet years July 2004- July 2006 followed by a dry year ending July 2007. Figure 3 gives an indication of the distribution of precipitation during the 3-year period (it shows the precipitation amounts measured at the Lower Ward Lake Level station during wet bucket sample collection periods).

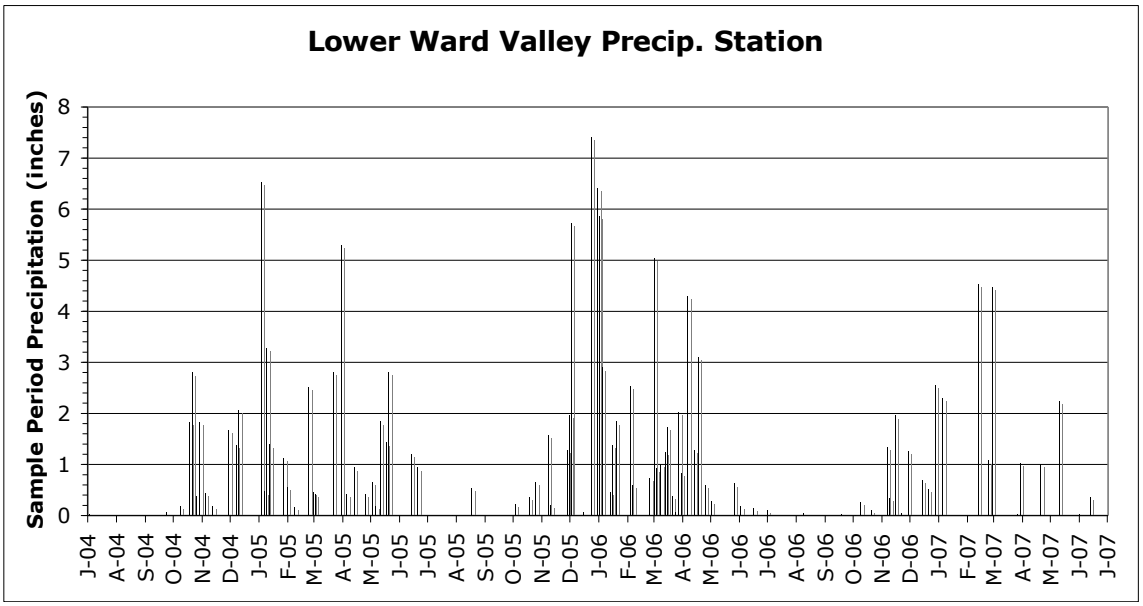


Figure 3. Chart showing precipitation amounts occurring at the Ward Valley Lake Level station during sample collection periods 7/1/04-6/30/07. Each vertical bar corresponds to the total amount of precipitation which occurred during a particular collection period, in some cases two or more wet buckets were combined in a collection period, (the date under each bar is the final collection date of the sample(s)).

Each year had certain distinguishing precipitation events or precipitation patterns which characterized it. July 1, 2004 - June 30, 2005 was characterized by significant precipitation, heavy mid-winter snow storms, and significant late-season precipitation. A total of 78.32 inches of precipitation fell at the Upper Ward Station and 48.73 inches at the Lower Ward Station during July 1, 2004 – June 30, 2005. Significant precipitation occurred throughout the period from October 2004 through June 2005. The long duration of the precipitation in that year was in contrast to a more "average" year when monthly precipitation often tapers off in April and May.

The following year, July 1, 2005 - June 30, 2006 was characterized by the large amount of precipitation, significant rain in late November/early December, a series of heavy rainstorms near the end of December 2005 and the steady progression of storms which occurred throughout March and the first half of April 2006. Over 92.73 inches of precipitation fell at the Upper Ward Station and 66.67 inches at the Lower Ward Station during July 1, 2005 – June 30, 2006. Total Water Year 2006 (note a Water Year runs from October 1 to September 30) precipitation was one of the highest years since LTIMP monitoring began with 92.12 inches at the Upper Ward Station and 65.97 inches at the lower Ward. A memorable series of drenching rain storms occurred at the end of December 2005. During the period 12/21/05-1/4/06 an incredible 22.61 inches of precipitation, much of it as rain occurred at the Lower Ward Valley station and 24.54 inches of precipitation as rain and snow at the Upper Ward Station. The last and most potent of the storms brought steady moderate to heavy rain Dec. 30 into Dec. 31 and

resulted in the highest west shore stream flows since the 1997 flood. The subtropical moisture associated with this storm originated in the Philippines and Indonesia (CA-NV River Forecast Center, 2006). In March and the first half of April 2006, a steady progression of early spring storms contributed to a large spring snowpack which in turn led to a very significant spring runoff which lasted well into June.

The year July 1, 2006 – June 30, 2007 may be characterized as unusually dry. The frequency of storms was much less than the two previous years and there was an absence of extremely large rain events. There were also dry periods which lasted for several weeks in January and early Feb. and again in March. As a consequence both total precipitation and snowpack was much reduced in this year. Only 26.29 inches of precipitation occurred at the Lower Ward Valley station and over 47.63 inches at the Upper Ward Station during the year. Two significant snowstorms did occur during Feb. 24-27 which left between 4-5 feet of new snow at the Lower Ward Valley station. However, these storms did not significantly boost the overall precipitation totals for the year.

There were some significant hydrological impacts associated with the heavy precipitation in 2005-06. These included significant peaks in the LTIMP stream flows and likely significant nutrient and sediment loading, and stream channel erosion associated with the December 2005 storms. The lake also rose extremely rapidly in December as a result of all the runoff. The large accumulated snowpack from storms during 2005-2006 also resulted in a very significant spring runoff. Stream flows were very high throughout most of May and much of June 2006. This runoff resulted in a continuous rise in lake level which ultimately filled the lake to maximum reservoir capacity. The frequency of storms also resulted in many days with cloud cover, frequent precipitation to the lake surface and usually wind associated with the storms.

The extremely dry year which followed likely will also have significant hydrological impacts. The absence of significant rain storms and the relatively small spring snow melt resulted in relatively low annual flows from basin streams. The low flows will likely result in low annual inputs of sediments and nutrients from streams. Extremely dry conditions in the watershed have resulted from the low precipitation year. The basin experienced a tragic wildfire at the end of June 2007 in the Angora Creek watershed. This fire resulted in the loss of many homes and the burning of a portion of the forest in this watershed which is part of the larger Upper Truckee River watershed. The ultimate impact of the burned portion of this watershed on water quality will be looked at closely.

All sample data available is presented in Appendices 1-6. Note a portion of the data later in 2007 was not yet available as of writing of this report. The dry and dry-bulk deposition data from monitoring over the past three years was first assessed to see how individual sample loads compared with the last multi-year assessment done in May 2002-Feb. 2004. The data in Appendices 3, 5 and 6 for all individual samples collected July 2004 – June 2007 was used to determine overall sample mean and median values by station and type of collector; data from the period May 2002 to Feb. 2004 are presented along side (Table 3).

Table 3. Comparison of mean and median daily loading rates for Dry or Dry-Bulk deposition for study periods May 2002-Feb. 2004 and July 2004 - June 2007. Daily load (g/ha/day) was calculated by dividing the load by the number of sample days the collector sat out. The means or medians for all individual sample values for a site were then calculated.

	NO3	NO3	NH4	NH4	TKN	TKN	SRP	SRP	DP	DP	TP	TP
Collection Period	5/02-2/04	7/04-6/07	5/02-2/04	7/04-6/07	5/02-2/04	7/04-6/07	5/02-2/04	7/04-6/07	5/02-2/04	7/04-6/07	5/02-2/04	7/04-6/07
Mean												
L. Ward (Dry)	1.02 (66)	0.84 (90)	0.74 (65)	1.09 (78)	12.69 (54)	13.16 (90)	0.22 (67)	0.22 (86)	0.49 (62)	0.58 (82)	1.22 (63)	1.20 (87)
TB-1 (D-Bulk)	4.24 (50)	2.92 (74)	3.43 (50)	2.73 (68)	7.49 (40)	5.17 (71)	0.07 (51)	0.10 (73)	0.15 (46)	0.21 (67)	0.43 (48)	0.41 (67)
TB-4 (D-Bulk)	4.00 (33)	2.83 (75)	3.67 (33)	3.00 (71)	7.95 (21)	5.47 (74)	0.06 (28)	0.07 (76)	0.12 (32)	0.17 (72)	0.40 (29)	0.29 (67)
Medians												
L. Ward (Dry)	0.82	0.64	0.62	0.69	7.14	8.21	0.11	0.12	0.29	0.43	0.66	0.82
TB-1 (D-Bulk)	3.22	2.56	2.40	2.11	4.92	4.34	0.05	0.05	0.14	0.14	0.28	0.28
TB-4 (D-Bulk)	3.20	2.46	2.26	1.98	7.33	4.41	0.04	0.04	0.10	0.11	0.22	0.26

Comparing values for 2004-2007 with 2002-2004, a few general observations may be made on the data. Generally only small differences were seen in median N and P loading values for individual samples between the two recent summary periods. For loading to the surface of the lake, at buoys TB-1 and TB-4, the median values for Dry-bulk NO3-N, NH4-N and TKN loading in 2004-2007 were slightly less than those in 2002-2004. The median values for Dry-Bulk SRP, DP, TP loading, were very similar during the two periods at the two buoys. At the Lower Ward station, median NO3-N showed a slight decrease in Dry deposition, while NH4-N and TKN showed slight increases. SRP, DP and TP in dry deposition showed slight increases in 2004-2007 at the Lower Ward station.

One of the most important results of the atmospheric deposition monitoring has been to provide estimates annual N and P loading by Water Year from atmospheric deposition in the watershed and over the lake. The data collection periods for this report encompassed the end of Water Year 2004, and complete Water Years in 2005 and 2006. Table 4 presents preliminary estimates for Water Year 2005 and 2006 precipitation and loading rates for N and P as well as precipitation amounts at the Ward Valley stations.

Table 4. Comparisons of loading rates (grams/ hectare/ day) of N and P at the Upper and Lower Ward Valley and buoy stations TB-1 and TB-4 during Water Years 2005 and 2006. To determine dry deposition loading rate, the load for analyzed dry samples was divided by the total number of sampling days represented by analyzed samples. To determine a daily loading rate for Wet or Wet/Bulk precipitation samples, the annual total load for a nutrient was first extrapolated by dividing the load total for samples analyzed (some samples did not have data for all analyses) by the proportion of total precipitation analyzed (amount of precipitation analyzed for a nutrient/ total annual precipitation). This number was divided by 365 days to give the estimate of daily loading rate. Note this data was updated from previous reports to include all available chemistry data.

	Precip.	**NO3-N**	**NH4-N**	**TKN**	**SRP**	**DP**	**TP**
	(in)	**g/ha/d**	**g/ha/d**	**g/ha/d**	**g/ha/d**	**g/ha/d**	**g/ha/d**
Upper Ward ST (Bulk) WY'05	78.73	3.01	3.71	6.37	0.09	0.30	0.59
Upper Ward ST (Bulk) WY'06	92.12+	2.53	3.44	5.84	0.09	0.36	0.70
Lower Ward (Wet) WY'05	49.40	1.92	1.89	3.95	0.10	0.21	0.36
Lower Ward (Wet) WY'06	65.99	1.59	1.56	2.83	0.06	0.24	0.42
Lower Ward (Dry) WY'05		0.84	1.39	12.73	0.23	0.64	1.16
Lower Ward (Dry) WY'06		0.89	1.00	11.94	0.17	0.51	1.31
Lower Ward (Wet+Dry) WY'05		2.76	3.28	16.68	0.33	0.85	1.52
Lower Ward (Wet+Dry) WY'06		2.48	2.57	14.78	0.23	0.75	1.73
TB-4 (Dry-Bulk) WY'05		3.26	3.30	5.54	0.08	0.16	0.29
TB-4 (Dry-Bulk) WY'06		1.81	2.10	3.51	0.05	0.14	0.24
Mid-lake TB-1 (Dry-Bulk) WY'05	NA*	3.23	3.03	5.96	0.13	0.22	0.36
Mid-lake TB-1 (Dry-Bulk) WY'06	NA*	2.05	1.88	4.06	0.09	0.21	0.45

Notes: "+" - precipitation was underestimated, not all precipitation was captured for year; "*" - There were not enough successful snow tube measurements during 2005-06 and 2006-07 to estimate mid-lake precipitation.

Loading of nitrogen in Ward Valley precipitation in WY 2006 was slightly less for most N fractions despite there being significantly more precipitation in WY 2006. Loading rates for NO3-N, NH4-N and TKN were all slightly less in Bulk precipitation at Upper Ward in WY 2006 compared to WY 2005. For Wet precipitation at lower Ward the pattern was similar except TKN was significantly less in WY 2006: NO3-N, NH4-N, TKN. The fact that nitrogen loading was slightly less in WY 2006 despite greater precipitation is not particularly unusual based on the historical data. Nitrogen loading has shown a range of values at higher levels of precipitation. For example, DIN (NO3-N + NH4-N) loading has ranged from near 3 – 5 g/ha/yr at the Lower Ward site for WY precipitation between 45 and 73 inches (Figure 4).

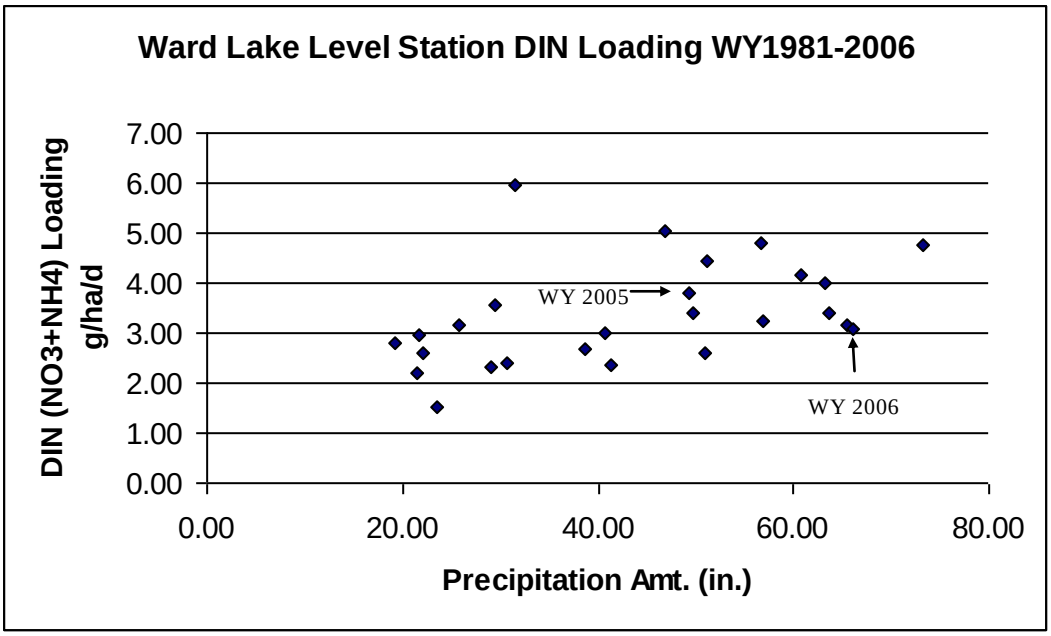


Figure 4. DIN (NH4-N + NO3-N) loading (g/ha/day) in Wet deposition and precipitation amount (inches) for Water Years 1981-2006 at the Lower Ward Valley precipitation station.

The large rainstorms that occurred in WY 2006 contributed only modest amounts of N loading relative to the high precipitation. Examination of the Ward Lake Level Station data shows that although the series of storms at the end of December (Dec. 21, 2005 – Jan. 4, 2006) contributed about 34% of the WY 2006 precipitation, they only contributed 16%, 5%, and 14% of the WY2006 loads of NO3-N, NH4-N and TKN respectively.

Loading of phosphorus was fairly similar for DP and TP in WY 2005 and 2006. SRP loading was the same in both years at the Upper Ward station and less in WY 2006 at the Lower Ward station. DP and TP were slightly higher in WY 2006 at both stations. Loading was significantly less for SRP at the lower Ward Station in WY 2006 and also low relative to past water years (Figure 5). However, there have been other relatively high precipitation years with similarly low SRP loading.

Loading of N and P in Dry deposition at the Lower Ward Station was relatively similar in WY 2005 and 2006. Loading for NH4-N, TKN, SRP and DP was slightly less in WY 2006 while loading of NO3-N and TP was slightly more in WY 2006.

Loading of nitrogen was reduced in deposition caught in the Buoy Dry-bulk buckets in WY 2006 while phosphorus deposition was relatively similar in both years. Loading of NO3-N, NH4-N and TKN was significantly less at TB-1 and TB-4 in WY 2006. SRP and DP loads were slightly less in both years at the two stations. TP was slightly less at buoy TB-4 and slightly more at TB1 in WY 2006 (see Table 4).

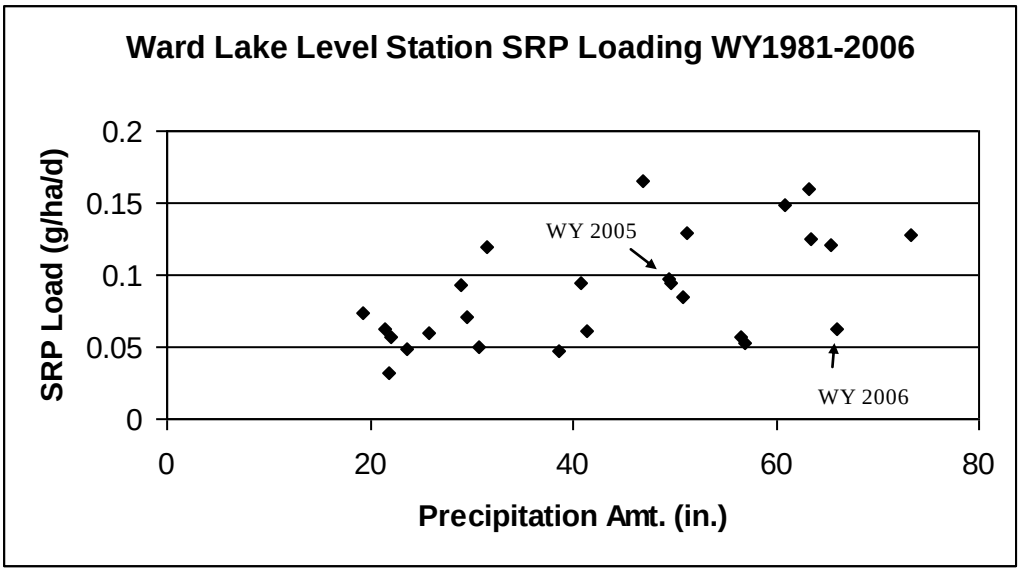


Figure 5. SRP loading (g/ha/day) in Wet deposition and precipitation amount (inches) for Water Years 1981-2006 at the Lower Ward Valley precipitation station.

Looking at combined Wet + Dry deposition at the Lower Ward site and comparing this with Dry-bulk deposition at the mid-lake sites a couple of interesting patterns are observed for these two water years. Loading of NO3-N + NH4-N in Dry-bulk deposition collected from buoys near the middle of the lake was relatively close to the combined Wet + Dry loading of NO3-N and NH4-N collected at the Ward Lake Level station in WY 2005 and slightly less in WY2006. Combined Wet + Dry loads of TKN, SRP, DP, and TP however were all significantly higher at the Lower Ward Station than out on the buoys (See Table 4).

Ultimately the WY loading and concentration data above will be assimilated into the long-term data set to allow comparisons of loading at the stations from Water Year to Water Year and assessment for trends. The long-term data-set was recently updated for the Ward Lake Level Wet Deposition data through WY 2006. Figures 6 and 7 present the WY 1981-2006 data for Dissolved Inorganic Nitrogen (DIN) and Soluble Reactive Phosphorus respectively in Wet precipitation.

A couple of patterns in the 1981-2006 historical DIN and SRP data are notable. First, there appears to be a general negative association between WY precipitation and DIN concentration, e.g. in a "dry" year with little precipitation the average annual DIN concentration is relatively high, while in a wet year, the average annual DIN concentration tends to be low. From both Figures 4 and 6 it is apparent that the DIN load does not always vary consistently with WY precipitation. Second, for SRP there appears some relationship between WY precipitation and SRP loading in wet deposition. Higher annual SRP loads are often associated with higher WY precipitation. However, there are some years which are exceptions in which precipitation is relatively high yet SRP loads are not similarly high. Such was the case in WY 2006.

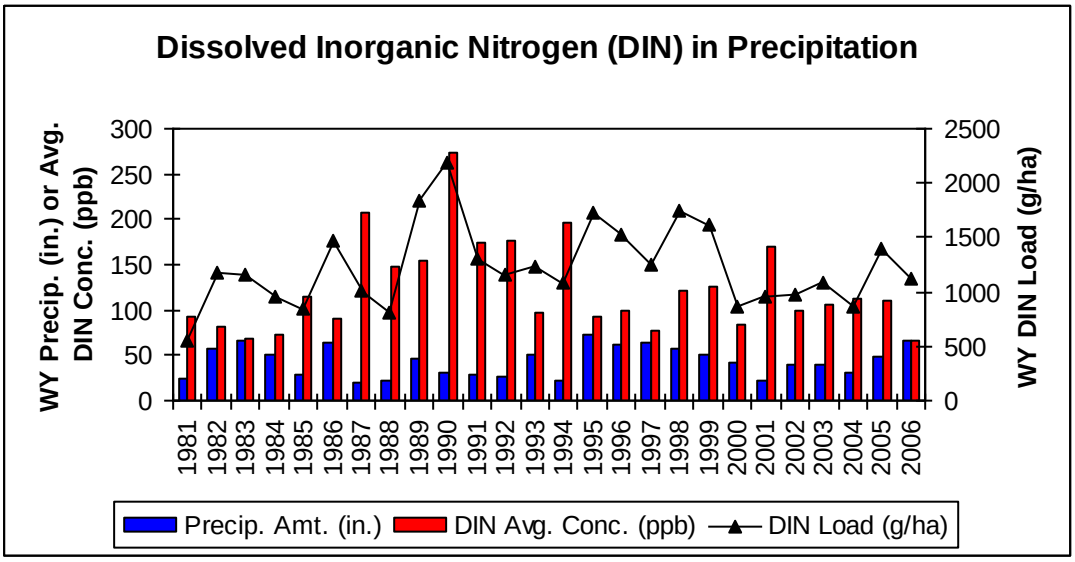


Figure 6. Summary plot of Water Year (WY) total precipitation (inches), average Dissolved Inorganic Nitrogen (DIN) concentration (ppb), and extrapolated annual DIN load (g/ha/yr) in Wet Deposition at the Ward Valley Lake Level station for WY 1981-2006. A Water Year begins Oct. 1 and ends Sept. 30 (i.e. WY 1981 ended Sept. 30, 1981).

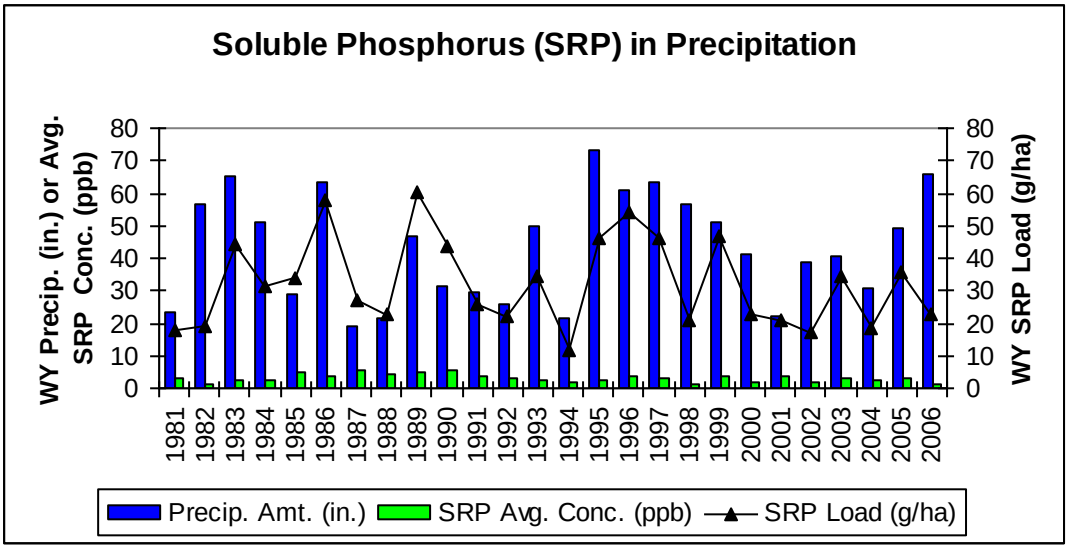


Figure 7. Summary plot of Water Year (WY) total precipitation (inches), average Soluble Reactive Phosphorus (SRP) concentration (ppb), and extrapolated annual SRP load (g/ha/yr) in Wet Deposition at the Ward Valley Lake Level station for WY 1981-2006.

Task 6. Periphyton

The purpose of the periphyton monitoring task is to assess the levels of nearshore attached algae (periphyton) growth around the lake. As for phytoplankton, nutrient availability plays a large role in promoting periphyton growth. The amount of periphyton growth can be an indicator of local nutrient loading and long-term environmental changes.

Periphyton grows in the littoral (shore) zone of Lake Tahoe, which may be divided into the eulittoral zone and the sublittoral zone, each with distinct periphyton communities. The eulittoral zone is the shallow area between the low and high lake level and is significantly affected by wave activity. It represents only a very small (<1%) of the total littoral area. Substrata within this region desiccate as the lake level declines, and periphyton must recolonize this area when lake level rises. The sublittoral zone extends from the bottom of the eulittoral to the maximum depth of the photoautotrophic growth. The sublittoral zone remains constantly submerged and represents the largest littoral benthic region of Lake Tahoe.

The eulittoral zone community is typically made up of filamentous green algae i.e. *Ulothrix zonata* and stalked diatom species i.e. *Gomphoneis herculeana*. The attached algae in the eulittoral zone display significant growth allowing for rapid colonization. These algae are able to take advantage of localized soluble nutrients, and can establish a thick coverage over the substrate within a matter of months. Similarly, as nutrient concentrations diminish and shallow nearshore water temperatures warm with the onset of summer, this community rapidly dies back. The algae can slough from the substrate and disperse into the open water, as well as be washed ashore. In areas where biomass is high the slimy coating over rocks and sloughed material accumulated along shore can be a nuisance. The eulittoral zone periphyton plays an important roll in the aesthetic, beneficial use of the shorezone. It is the rapid growth ability of the eulittoral periphyton in response to nutrient inputs that lend particular value to monitoring this community as an indicator of localized differences in nutrient loading.

The sublittoral zone is made up of different algal communities down through the euphotic zone. Cyanophycean (blue-green) algal communities make up a significant portion of the uppermost sublittoral zone. These communities are slower growing and more stable than the filamentous and diatom species in the eulittoral zone.

Stations and Methods

Ten routine stations were monitored during July 2004-June 2007 (Rubicon Pt., Sugar Pine Pt., Pineland, Tahoe City, Dollar Pt., Zephyr Pt., Deadman Pt., Sand Pt., Incline Condominium, Incline West). These ten sites are located around the lake (Table 5) and represent a range of backshore disturbance levels from relatively undisturbed land (Rubicon Point and Deadman Point) to a developed urban center (Tahoe City).

Table 5. Locations of Routine Periphyton Monitoring Stations

SITE NAME	LOCATION
Rubicon	N38 59.52; W120 05.60
Sugar Pine Point	N39 02.88; W120 06.62
Pineland	N39 08.14; W120 09.10
Tahoe City	N39 10.24; W120 08.42
Dollar Point	N39 11.15; W120 05.52
Zephyr Point	N39 00.10; W119 57.66
Deadman Point	N39 06.38; W11957.68
Sand Point	N39 10.59; W119 55.70
Incline Condominiums	N39 14.90; W119 59.63
Incline West	N39 14.83; W119 59.75

A detailed description of the sample collection and analysis procedures is given in Hackley et al. (2004). Briefly, the method entails collection while snorkeling of duplicate samples of attached algae from a known area of natural rock substrate at a depth of 0.5m, using a syringe and toothbrush sampler. These samples are transported to the laboratory where the samples are processed and split, with one portion of the sample analyzed for Ash Free Dry Weight (AFDW) and the other portion frozen for later analysis of Chlorophyll *a* concentration (both AFDW and chlorophyll *a* are used as measures of algal biomass). We also measure average filament length, % algal coverage, and estimate the visual score in field observations. The visual score is a subjective ranking (1-5) of the level of algal growth viewed underwater (as well as above water for a portion of the data) where 1 is least offensive appearing (usually natural rock surface with little or no growth) and 5 is the most offensive condition with very heavy growth.

Results

Monitoring at Routine Sites

In this report we summarize the data collected from July 2004-June 2007. The ten routine sampling sites were sampled approximately monthly from January through June (the period of most active growth) and two additional samples were taken during July to Dec. Difficult weather and sampling conditions caused some alteration from these schedules.

Table 6 presents the results for chlorophyll *a*, AFDW and field observations of visual score, average filament length and percent algal coverage at the ten routine periphyton sites for the period July 2004-June 2007. Figures 8a-8k present the results for chlorophyll *a* biomass through time at each site graphically.

Table 6. Summary of eulittoral periphyton chlorophyll a (Chlor. a), Ash Free Dry Weight (AFDW), visual score, average filament length and % algal coverage for routine periphyton monitoring sites during July 2004-June 2007. Note for chlorophyll a and AFDW, n=2 unless otherwise indicated. Visual score is a subjective ranking of the aesthetic appearance of algal growth (viewed underwater) where 1 is the least offensive and 5 is the most offensive. "na" = not available or not collected; "nes" = not enough sample for analysis.

Site	Date	Depth (m)	Chlor. *a* (mg/m^2)	Std Dev (mg/m^2)	AFDW (g/m^2)	Std Dev (g/m^2)	U/W Visual Score	Fil. Length (cm)	Algal Coverage (%)
Rubicon Pt.	11/2/2004	0.5	52.20	13.41	39.23	6.97	na	na	na
	1/5/2005	0.5	18.49	8.32	18.22	7.55	na	na	na
	3/3/2005	0.5	64.10	1.93	43.07	3.61	na	na	na
	3/30/2005	0.5	64.18	6.39	53.89	0.19	na	na	na
	4/21/2005	0.5	19.03	0.90	20.89	1.82	3	1.5	80%
	6/15/2005	0.5	3.87	1.59	5.24	1.45	2	1	50%
	6/15/2005	0.8	na	na	na	na	3	1.75	70%
	6/29/2005	0.5	5.40	na (n=1)	4.56	1.39	2	0.7	40%
	8/23/2005	0.5	2.68	na (n=1)	nes	nes	1	0	0%
	11/18/2005	0.5	14.80	0.36	13.70	3.67	3	0.8	60%
	12/16/2005	0.5	9.62	0.86	12.47	1.32	3	1.1	60%
	1/20/2006	0.5	3.90	1.02	nes	nes	2	0.1	80%
	2/23/2006	0.5	nes	nes	0.18	0.26	2	0.2	60%
	3/21/2006	0.5	4.98	1.14	4.90	2.39	3	1.5	40%
	4/20/2006	0.5	19.11	1.55	7.29	2.12	4	1.6	80%
	6/14/2006	0.5	3.31	0.77	4.65	na (n=1)	2	0.7	50%
	6/28/2006	0.5	5.91	0.05	7.18	0.04	3	0.6	60%
	12/4/2006	0.5	8.29	0.80	3.15	0.23	2	0.4	80%
	1/26/2007	0.5	26.97	12.93	7.21	2.86	3	0.5	70%
	2/15/2007	0.5	63.37	12.16	16.68	4.02	3	1.2	80%
	3/14/2007	0.5	59.69	na (n=1)	15.66	na (n=1)	4	2.4	90%
	4/5/2007	0.5	31.96	9.87	17.76	3.70	4	2.2	na
	5/17/2007	0.5	43.06	14.81	34.49	8.52	4	2.9	30%
	6/14/2007	0.5	na	na	5.01	0.36	3	1.8	40%
Sugar Pine Pt.	11/2/2004	0.5	17.73	1.87	14.82	1.01	na	na	na
	1/5/2005	0.5	14.11	4.39	14.24	3.68	na	na	na
	3/3/2005	0.5	35.51	9.06	31.94	9.00	na	na	na
	3/30/2005	0.5	11.20	2.95	11.43	3.32	na	na	na
	4/21/2005	0.5	5.79	2.94	10.93	na (n=1)	2	0.4	50%
	6/15/2005	0.5	2.41	0.48	nes	nes	2	0.3	60%
	6/15/2005	0.8	na	na	na	na	3	0.8	70%
	6/29/2005	0.5	nes	nes	nes	nes	2	0.2	20%
	8/23/2005	0.5	nes	nes	0.75	na (n=1)	1	0	0%
	11/18/2005	0.5	6.96	5.19	7.05	na (n=1)	2	0.1	80%
	12/16/2005	0.5	4.65	1.07	nes	nes	2	0.1	80%
	1/20/2006	0.5	nes	nes	nes	nes	1	0.0	0%
	2/23/2006	0.5	nes	nes	3.02	na (n=1)	2	0.1	50%

Site	Date	Depth (m)	Chlor. *a* (mg/m^2)	Std Dev (mg/m^2)	AFDW (g/m^2)	Std Dev (g/m^2)	U/W Visual Score	Fil. Length (cm)	Algal Coverage (%)
Sugar Pine Pt.	3/21/2006	0.5	1.92	0.40	nes	nes	2	0.5	80%
	4/20/2006	0.5	12.54	na (n=1)	4.63	na (n=1)	2	0.7	70%
	6/14/2006	0.5	11.93	8.43	12.21	7.49	3	1.0	80%
	6/28/2006	0.5	2.88	1.10	3.84	0.25	3	0.4	50%
	12/4/2006	0.5	2.79	2.03	nes	nes	1	<0.1	0%
	1/26/2007	0.5	13.37	3.44	1.61	0.88	3	<0.1	90%
	2/15/2007	0.5	6.74	1.74	2.42	0.17	3	0.5	100%
	3/14/2007	0.5	37.18	12.29	14.03	2.95	4	1.6	80%
	4/5/2007	0.5	12.94	1.09	7.48	0.52	3	0.7	80%
	5/17/2007	0.5	9.60	1.58	7.09	0.94	3	0.6	70%
	6/14/2007	0.5	na	na	2.31	0.30	2	0.4	50%
Pineland	11/2/2004	0.5	33.54	6.18	32.39	1.82	na	na	na
	1/5/2005	0.5	26.44	9.95	19.64	5.37	na	na	na
	3/3/2005	0.5	42.09	5.53	29.04	9.92	na	na	na
	3/30/2005	0.5	79.06	1.06	59.47	7.43	na	na	na
	4/21/2005	0.5	87.46	55.19	33.80	23.69	4	2	90%
	6/15/2005	0.5	9.37	1.50	14.01	0.46	3	0.8	75%
	6/15/2005	0.8	24.30	3.90	39.64	1.48	4	2.8	90%
	6/29/2005	0.5	1.66	0.29	3.55	1.47	3	0.3	40%
	8/23/2005	0.5	3.15	na (n=1)	1.52	1.61	2	0.2	50%
	11/18/2005	0.5	53.18	19.81	43.87	3.94	2	0.5	70%
	12/16/2005	0.5	36.98	3.71	28.19	3.51	3	0.4	50%
	1/20/2006	0.5	7.98	na (n=1)	4.11	3.34	3	0.6	70%
	2/23/2006	0.5	31.26	10.78	24.95	6.45	4	2.5	80%
	3/21/2006	0.5	47.80	27.82	34.92	9.97	5	2.6	90%
	4/19/2006	0.5	6.65	0.21	6.62	0.65	2	0.3	60%
	5/31/2006	0.5	17.58	3.52	22.08	6.55	3	0.5	70%
	6/28/2006	0.5	2.60	0.49	4.26	0.55	2	<0.1	30%
	12/4/2006	0.5	24.25	5.97	13.23	na (n=1)	2	0.2	80%
	1/26/2007	0.5	94.57	42.01	25.09	11.19	3	0.5	60%
	2/15/2007	0.5	91.38	35.58	29.13	0.35	2	0.6	50%
	3/14/2007	0.5	89.22	34.44	39.96	14.46	3	1.5	60%
	4/5/2007	0.5	79.74	17.42	44.58	10.33	3	1.6	60%
	5/17/2007	0.5	15.51	2.00	15.99	1.42	3	0.7	60%
	6/14/2007	0.5	na	na	9.52	0.34	2	0.3	80%
Tahoe City	11/2/2004	0.5	8.41	5.84	11.10	9.36	na	na	na
	1/5/2005	0.5	18.95	1.56	23.07	1.63	na	na	na
	3/4/2005	0.5	33.36	2.45	34.78	0.82	na	na	na
	3/31/2005	0.5	132.25	25.04	75.17	11.65	na	na	na
	4/21/2005	0.5	48.81	5.51	38.39	9.14	4	2.1	90%
	6/13/2005	0.5	17.58	4.10	29.94	4.69	3	0.7	60%
	6/13/2005	0.77	na	na	na	na	na	1.35	60%
	7/5/2005	0.5	8.10	0.07	13.77	0.54	3	0.6	30%

Site	Date	Depth (m)	Chlor. *a* (mg/m^2)	Std Dev (mg/m^2)	AFDW (g/m^2)	Std Dev (g/m^2)	U/W Visual Score	Fil. Length (cm)	Algal Coverage (%)
Tahoe City	8/23/2005	0.5	nes	nes	0.49	0.69	2	0.2	50%
	11/18/2005	0.5	12.72	6.79	2.16	na (n=1)	2	0.1	50%
	12/16/2005	0.5	5.24	0.34	8.82	1.41	na	0.2	50%
	1/25/2006	0.5	19.46	0.62	37.68	8.98	2	0.3	70%
	2/23/2006	0.5	39.85	17.33	76.67	21.63	3	0.7	90%
	3/21/2006	0.5	111.48	30.31	203.86	37.54	5	2.3	90%
	4/21/2006	0.5	86.98	0.61	124.01	2.37	na	na	na
	5/31/2006	0.5	10.42	2.43	19.16	5.13	2	0.1	70%
	6/28/2006	0.5	5.74	1.94	5.87	1.45	2	<0.1	70%
	12/4/2006	0.5	19.40	14.31	13.76	11.14	2	0.2	80%
	1/26/2007	0.5	53.58	na (n=1)	26.44	na (n=1)	3	0.6	50%
	2/15/2007	0.5	57.48	1.03	47.99	14.96	2	0.6	50%
	3/14/2007	0.5	202.09	13.26	117.98	25.27	4	2.0	90%
	4/6/2007	0.5	94.75	9.19	82.71	20.89	4	1.7	na
	5/17/2007	0.5	11.77	0.47	13.47	0.26	3	0.3	50%
	6/14/2007	0.5	na	na	10.07	6.28	2	0.1	60%
Dollar Pt.	11/2/2004	0.5	39.70	4.46	25.39	5.58	na	na	na
	1/5/2005	0.5	63.40	8.86	36.29	9.40	na	na	na
	3/3/2005	0.5	101.79	24.44	47.14	8.98	na	na	na
	3/30/2005	0.5	21.96	5.29	20.80	2.68	na	na	na
	4/21/2005	0.5	23.97	15.01	19.07	10.68	4	1.3	90%
	6/13/2005	0.5	5.98	2.87	nes	nes	2	0.7	50%
	6/13/2005	0.7	na	na	na	na	3	1.35	50%
	7/5/2005	0.5	11.41	3.78	13.12	4.84	2	0.8	25%
	8/23/2005	0.5	8.47	1.67	6.65	na (n=1)	2	0.1	70%
	11/18/2005	0.5	12.50	8.68	15.60	9.94	2	0.1	50%
	12/16/2005	0.5	3.52	1.46	4.33	1.55	2	0.1	80%
	1/20/2006	0.5	6.83	0.81	5.00	0.04	2	0.2	80%
	2/23/2006	0.5	19.84	0.37	21.02	6.13	3	1.4	90%
	3/21/2006	0.5	30.97	na (n=1)	24.54	na (n=1)	4	1.1	100%
	4/19/2006	0.5	43.65	25.09	32.30	11.35	4	1.1	100%
	5/31/2006	0.5	27.35	5.29	30.86	2.44	3	0.6	80%
	6/29/2006	0.5	10.54	1.78	14.71	1.91	3	0.4	70%
	12/4/2006	0.5	17.26	3.82	8.08	0.91	2	<0.1	70%
	1/26/2007	0.5	18.00	1.48	3.38	1.03	2	0.1	70%
	2/15/2007	0.5	61.06	10.06	29.21	6.01	2	0.2	60%
	3/14/2007	0.5	70.89	3.01	33.45	7.50	3	0.7	80%
	3/28/2007	0.5	56.43	0.53	39.54	9.72	3	0.9	80%
	5/17/2007	0.5	10.46	4.70	8.60	1.70	3	0.4	40%
	6/14/2007	0.5	na	na	20.30	2.70	2	<0.1	40%
Incline West	10/22/2004	0.5	33.46	7.11	44.19	8.88	na	na	na
	1/20/2005	0.5	51.77	25.00	55.53	23.12	na	na	na
	3/3/2005	0.5	40.67	4.10	48.03	9.14	na	na	na
	3/30/2005	0.5	38.79	17.44	46.63	23.07	na	na	na
	4/29/2005	0.5	40.12	0.88	53.43	2.45	3	0.5	70%

Site	Date	Depth (m)	Chlor. *a* (mg/m^2)	Std Dev (mg/m^2)	AFDW (g/m^2)	Std Dev (g/m^2)	U/W Visual Score	Fil. Length (cm)	Algal Coverage (%)
Incline West	6/13/2005	0.5	7.41	0.66	9.64	2.08	3	0.8	80%
	6/13/2005	0.77	na	na	na	na	3	1.75	80%
	6/29/2005	0.5	3.64	1.16	3.82	1.31	2	0.5	70%
	8/23/2005	0.5	7.63	0.82	6.85	0.29	2	0.2	40%
	11/18/2005	0.5	21.55	3.10	77.36	12.20	3	0.3	90%
	12/16/2005	0.5	38.82	5.50	42.91	6.19	3	0.5	90%
	1/25/2006	0.5	11.77	4.31	7.44	2.47	3	0.7	90%
	2/23/2006	0.5	4.67	0.02	2.46	0.12	3	0.9	90%
	4/7/2006	0.5	10.89	4.76	6.08	1.20	4	1.7	70%
	4/28/2006	0.5	19.84	1.30	12.68	0.38	4	1.6	80%
	5/31/2006	0.5	6.47	1.32	4.50	2.02	3	0.9	70%
	6/29/2006	0.5	4.12	0.18	5.33	0.39	2	0.8	50%
	12/4/2006	0.5	13.36	3.87	6.04	1.15	2	0.1	70%
	1/26/2007	0.5	15.62	1.02	3.72	1.00	2	0.2	50%
	2/15/2007	0.5	14.94	0.12	5.98	0.61	3	0.6	70%
	3/15/2007	0.5	14.01	3.22	9.16	0.50	3	0.8	60%
	5/25/2007	0.5	13.93	0.83	8.75	0.48	4	0.6	100%
	6/14/2007	0.5	na	na	7.14	2.44	3	0.6	70%
Incline Condo	10/22/2004	0.5	10.60	0.51	10.24	1.75	na	na	na
	1/20/2005	0.5	67.94	24.95	68.96	21.80	na	na	na
	3/3/2005	0.5	27.64	4.30	33.95	7.24	na	na	na
	3/30/2005	0.5	32.53	4.80	36.69	4.82	na	na	na
	4/29/2005	0.5	22.61	0.42	31.74	2.76	3	1.2	90%
	6/13/2005	0.5	6.96	1.46	7.86	0.39	3	1	80%
	6/13/2005	0.77	na	na	na	na	3	1.5	30%
	6/29/2005	0.5	3.78	0.10	3.91	0.80	3	0.7	90%
	8/23/2005	0.5	4.87	1.08	7.01	1.16	2	0.2	80%
	11/18/2005	0.5	5.73	1.81	41.31	14.76	2	0.2	65%
	12/16/2005	0.5	40.03	15.67	70.70	16.46	2	0.5	80%
	1/25/2006	0.5	6.34	na (n=1)	3.12	na (n=1)	3	0.6	80%
	2/23/2006	0.5	20.86	5.21	11.82	0.53	3	1.2	70%
	4/7/2006	0.5	27.29	5.52	16.22	1.90	4	1.5	100%
	4/28/2006	0.5	31.90	0.12	17.25	1.01	5	2.6	100%
	5/31/2006	0.5	11.36	1.92	16.29	5.30	3	0.9	70%
	6/29/2006	0.5	8.42	2.15	11.35	2.99	3	1.4	80%
	12/4/2006	0.5	5.77	0.66	2.94	na (n=1)	2	<0.1	70%
	1/26/2007	0.5	14.23	2.25	4.36	1.75	2	0.2	70%
	2/15/2007	0.5	15.41	2.75	6.96	1.51	3	0.4	90%
	3/15/2007	0.5	14.76	4.98	5.80	0.24	3	0.4	70%
	5/25/2007	0.5	5.24	2.06	2.46	0.67	3	0.6	90%
	6/14/2007	0.5	na	na	8.65	1.03	3	0.4	50%
Sand Point	10/22/2004	0.5	29.91	6.16	34.11	5.52	na	na	na
	1/20/2005	0.5	55.80	3.57	67.84	2.94	na	na	na
	3/3/2005	0.5	47.89	8.63	59.84	6.04	na	na	na
	3/30/2005	0.5	30.50	8.80	43.27	7.84	na	na	na
	4/29/2005	0.5	38.97	3.94	66.47	19.52	3	0.4	80%

Site	Date	Depth (m)	Chlor. *a* (mg/m^2)	Std Dev (mg/m^2)	AFDW (g/m^2)	Std Dev (g/m^2)	U/W Visual Score	Fil. Length (cm)	Algal Coverage (%)
Sand Point	6/13/2005	0.5	1.82	0.89	nes	nes	2	0.1	25%
	6/13/2005	0.77	62.81	12.21	71.27	na (n=1)	4	0.8	80%
	6/29/2005	0.5	7.85	4.59	4.93	0.71	2	0.3	60%
	8/23/2005	0.5	6.08	1.06	4.13	1.89	2	0.1	30%
	11/18/2005	0.5	17.67	0.87	31.68	2.40	3	0.4	60%
	12/16/2005	0.5	36.39	23.75	46.97	17.09	2	0.9	50%
	1/25/2006	0.5	2.42	2.03	nes	nes	1	0.0	0%
	2/23/2006	0.5	nes	nes	1.02	1.45	2	0.5	80%
	4/7/2006	0.5	1.45	0.17	nes	nes	3	0.2	100%
	4/28/2006	0.5	2.72	0.20	0.80	0.05	3	1.1	90%
	6/14/2006	0.5	5.13	1.06	4.22	0.70	3	0.7	60%
	6/29/2006	0.5	11.19	na (n=1)	8.16	4.28	3	1.1	90%
	12/4/2006	0.5	3.72	0.23	nes	nes	1	<0.1	50%
	1/26/2007	0.5	11.15	3.69	2.37	0.22	2	0.1	80%
	2/15/2007	0.5	8.11	0.45	3.50	0.10	3	0.5	95%
	3/15/2007	0.5	7.54	0.38	4.24	0.89	3	0.4	80%
	5/25/2007	0.5	8.93	1.80	5.37	0.91	3	0.8	90%
	6/14/2007	0.5	na	na	5.63	0.36	3	0.8	50%
Deadman Pt.	10/22/2004	0.5	47.21	12.38	59.02	3.69	na	na	na
	1/20/2005	0.5	66.92	6.49	69.50	0.47	na	na	na
	3/3/2005	0.5	47.61	5.57	57.80	3.08	na	na	na
	3/30/2005	0.5	49.33	22.52	49.67	20.72	na	na	na
	4/29/2005	0.5	46.23	10.76	65.22	13.07	3	0.5	60%
	5/31/2005	0.5	nes	nes	nes	nes	1	0.1	40%
	5/31/2005	0.77	85.43	39.85	102.21	1.28	3	1.7	80%
	6/29/2005	0.5	2.06	2.15	nes	nes	1	0	0%
	8/23/2005	0.5	nes	nes	0.57	na (n=1)	1	0	0%
	11/18/2005	0.5	11.79	na (n=1)	29.15	14.44	3	0.3	65%
	12/16/2005	0.5	17.56	5.20	32.28	0.75	2	0.4	40%
	1/25/2006	0.5	nes	nes	nes	nes	1	0.0	0%
	2/23/2006	0.5	nes	nes	nes	nes	1	0.0	10%
	4/7/2006	0.5	2.01	0.43	nes	nes	2	0.1	70%
	4/28/2006	0.5	1.94	0.72	nes	nes	2	0.2	60%
	6/14/2006	0.5	1.92	0.04	nes	nes	2	0.2	40%
	6/29/2006	0.5	4.01	0.13	2.74	0.34	2	0.4	60%
	12/4/2006	0.5	2.77	1.27	nes	nes	1	<0.1	40%
	1/26/2007	0.5	9.67	0.24	3.28	0.49	2	0.1	70%
	2/15/2007	0.5	8.24	1.11	4.71	0.62	2	0.3	70%
	3/15/2007	0.5	8.83	0.35	6.33	1.13	2	0.4	90%
	5/15/2007	0.5	8.91	na (n=1)	8.73	na (n=1)	4	0.7	80%
	6/14/2007	0.5	na	na	11.82	0.51	3	0.8	50%
Zephyr Point	10/22/2004	0.5	10.86	1.44	12.64	0.06	na	na	na
	1/20/2005	0.5	28.10	8.61	28.95	4.34	na	na	na
	3/3/2005	0.5	28.77	12.59	22.93	6.63	na	na	na
	3/30/2005	0.5	29.38	4.01	34.53	1.02	na	na	na

Site	Date	Depth (m)	Chlor. *a* (mg/m^2)	Std Dev (mg/m^2)	AFDW (g/m^2)	Std Dev (g/m^2)	U/W Visual Score	Fil. Length (cm)	Algal Coverage (%)
Zephyr Point	4/29/2005	0.5	35.22	4.36	47.24	0.94	3	0.8	75%
	5/31/2005	0.5	18.23	0.54	15.75	1.36	3	0.6	95%
	5/31/2005	0.7	na	na	na	na	4	2.3	na
	6/29/2005	0.5	16.55	3.05	17.11	5.71	3	1.5	70%
	8/23/2005	0.5	9.07	2.97	7.30	1.08	2	0.1	60%
	11/18/2005	0.5	15.92	3.63	26.60	11.35	2	0.1	70%
	12/16/2005	0.5	10.75	4.48	13.87	3.64	2	0.1	40%
	1/25/2006	0.5	6.66	2.41	nes	nes	2	0.1	50%
	2/23/2006	0.5	3.81	na (n=1)	2.52	0.41	2	<0.5	na
	4/7/2006	0.5	19.63	3.51	10.19	2.56	3	1.3	80%
	4/28/2006	0.5	19.05	4.56	11.78	1.13	3	1.0	90%
	6/14/2006	0.5	9.65	1.66	8.18	0.73	3	0.7	na
	6/29/2006	0.5	3.63	0.15	4.22	0.37	2	1.0	30%
	12/4/2006	0.5	5.49	0.09	nes	nes	2	<0.1	80%
	1/26/2007	0.5	7.05	0.70	1.34	na (n=1)	2	0.1	60%
	2/15/2007	0.5	9.88	0.57	6.29	2.67	3	0.1	80%
	3/15/2007	0.5	26.83	1.48	11.33	1.41	3	0.6	80%
	5/15/2007	0.5	11.51	0.26	8.86	0.29	3	0.5	70%
	6/14/2007	0.5	na	na	8.07	0.05	3	0.4	70%

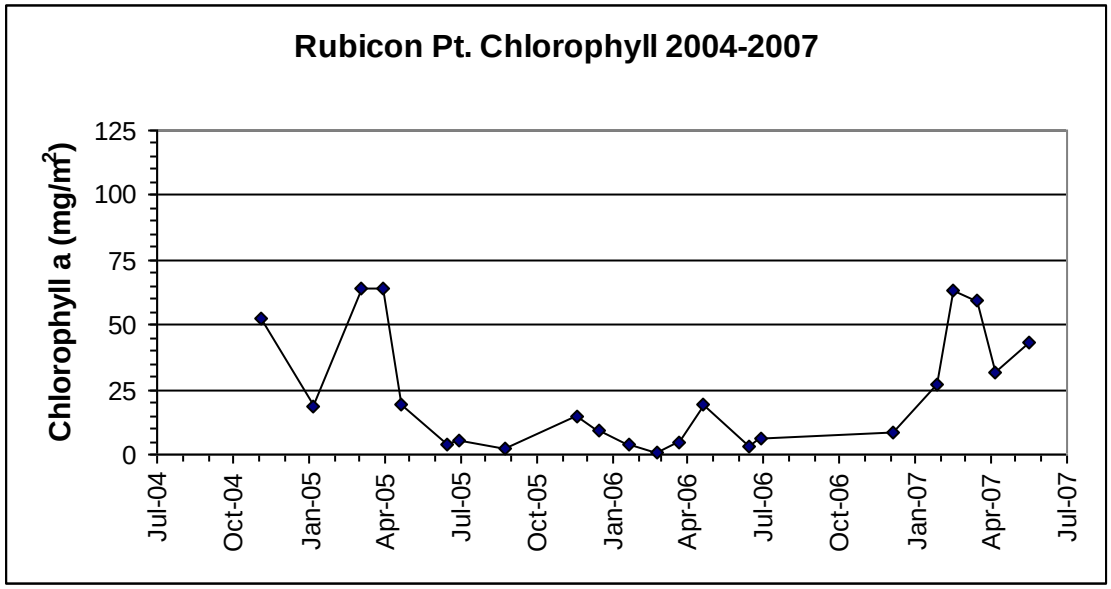


Figure 8 a. Rubicon Pt. periphyton biomass (chlorophyll *a*) 2004-2007.

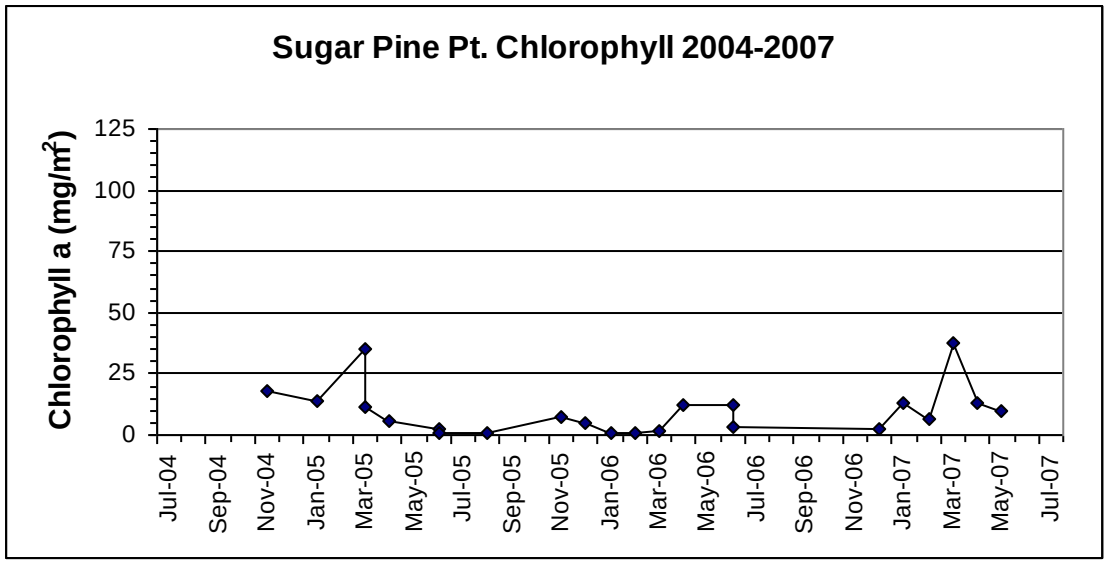


Figure 8 b. Sugar Pine Pt. periphyton biomass (chlorophyll *a*) 2004-2007.

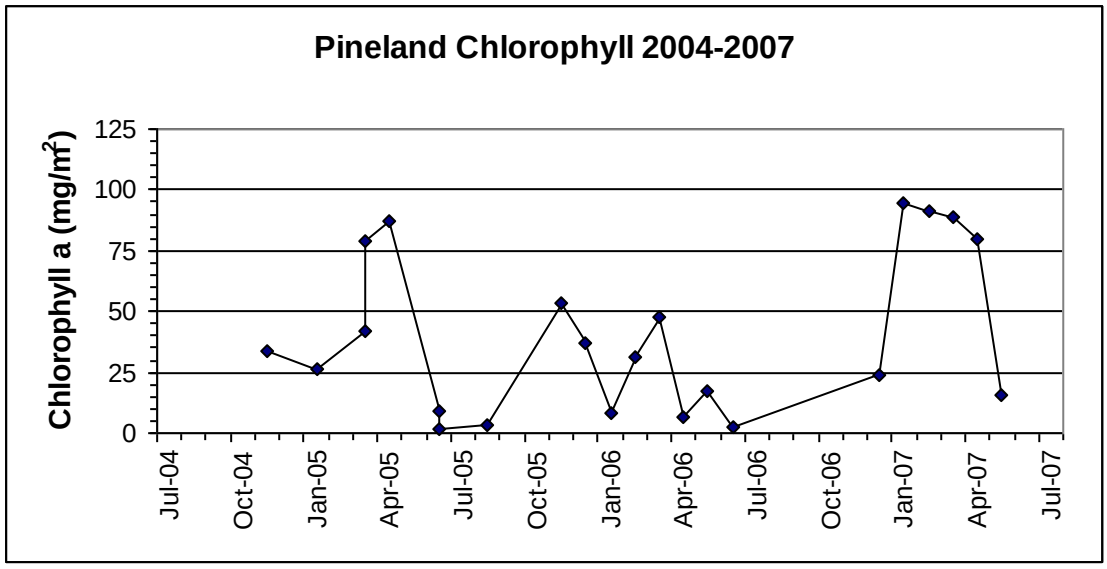


Figure 8 c. Pineland periphyton biomass (chlorophyll *a*) 2004-2007.

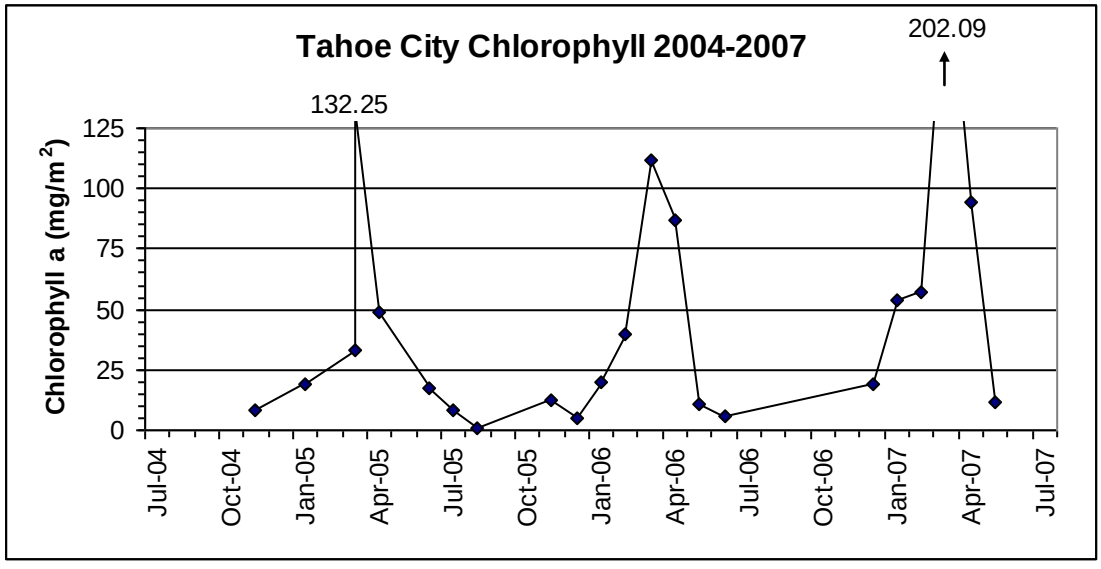


Figure 8 d. Tahoe City periphyton biomass (chlorophyll *a*) 2004-2007.

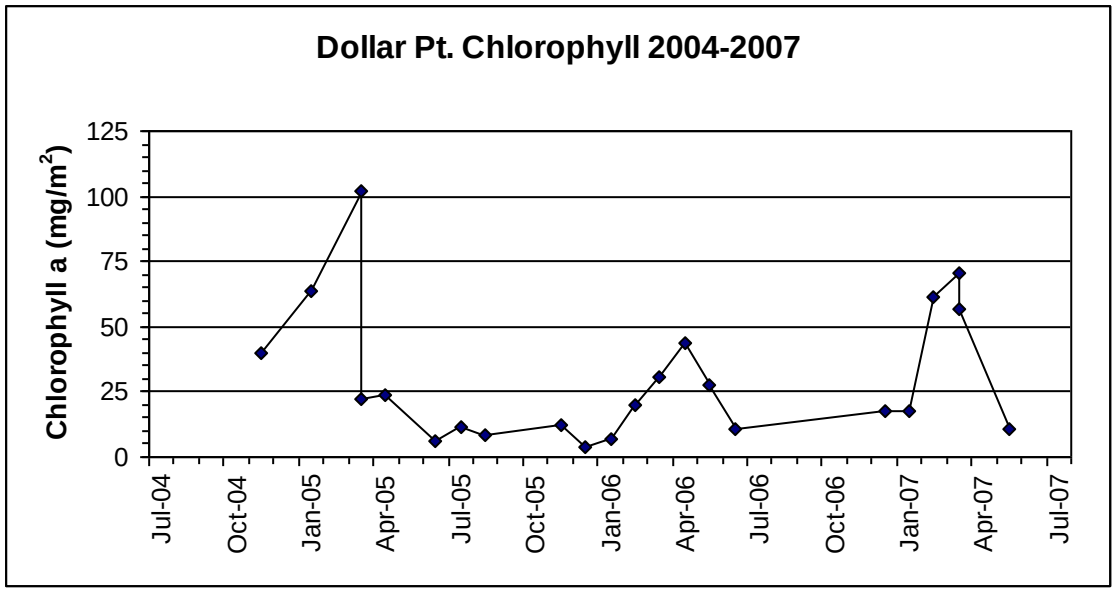


Figure 8 e. Dollar Pt. periphyton biomass (chlorophyll *a*) 2004-2007.

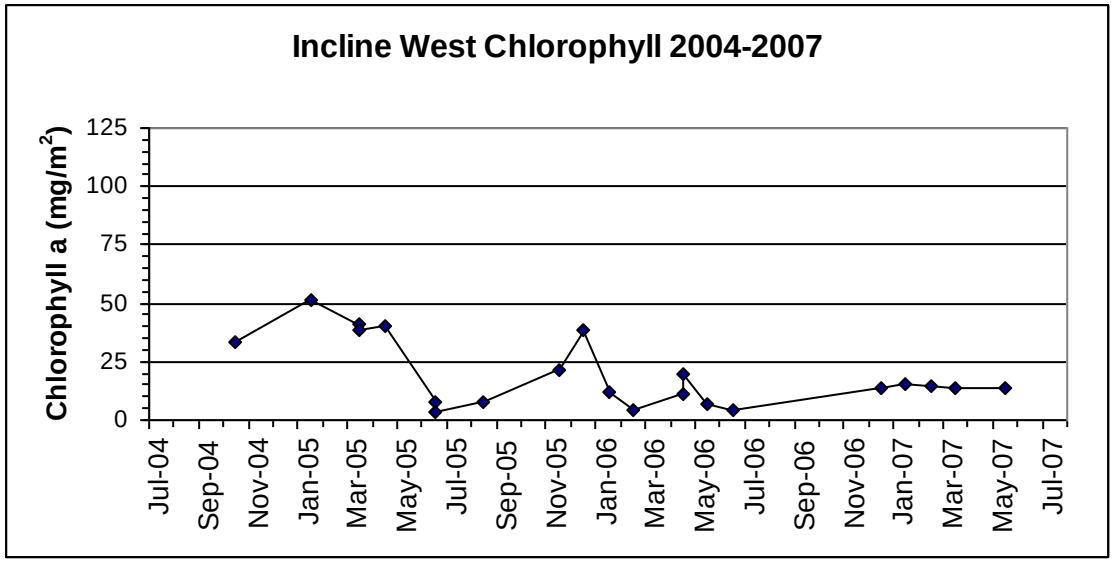


Figure 8 g. Incline West periphyton biomass (chlorophyll *a*) 2004-2007.

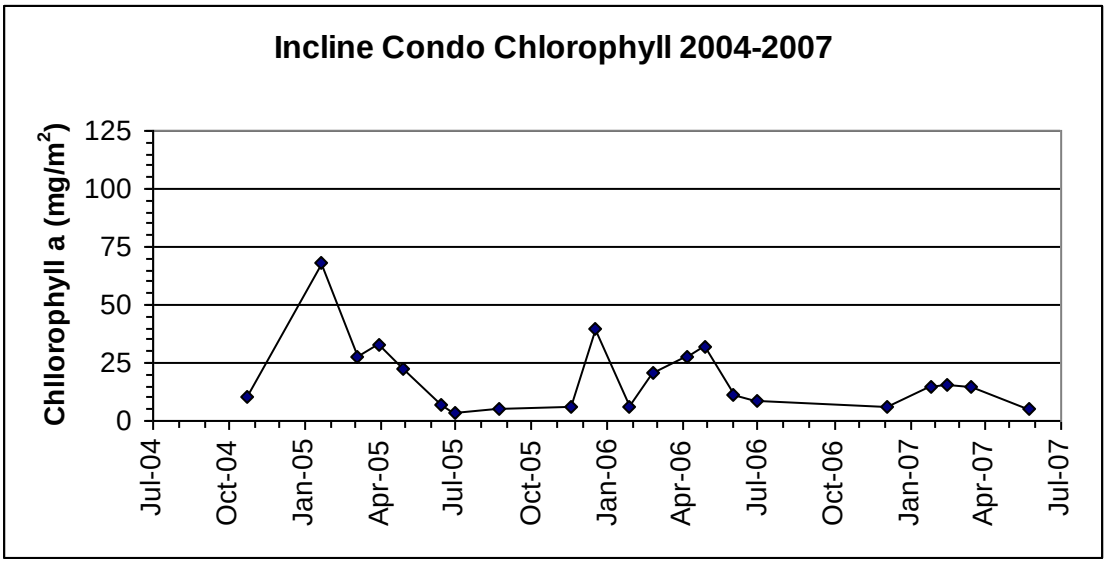


Figure 8 h. Incline Condo periphyton biomass (chlorophyll *a*) 2004-2007.

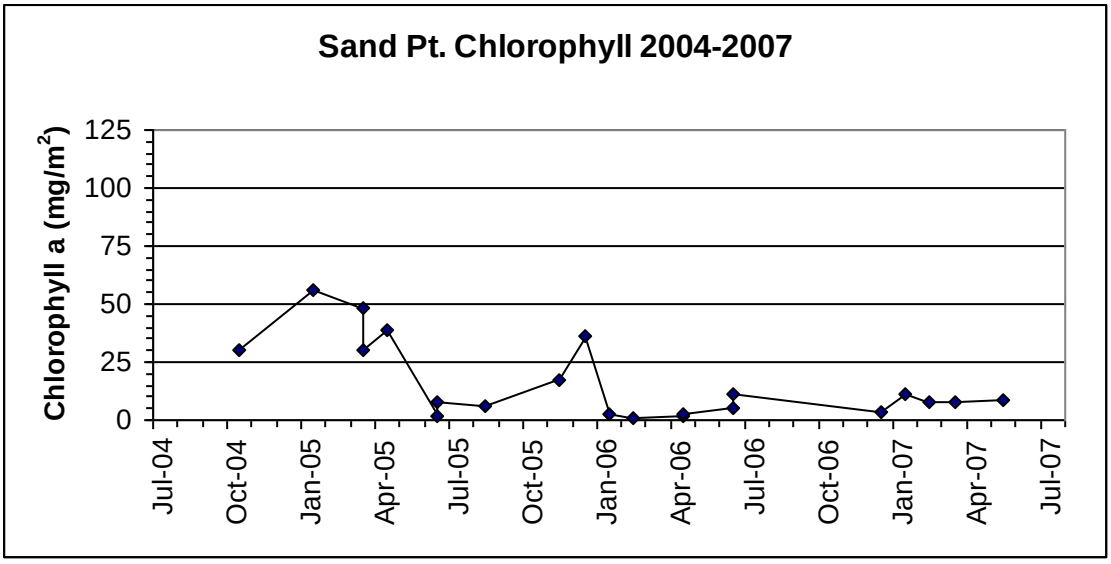


Figure 8. i. Sand Pt. periphyton biomass (chlorophyll *a*) 2004-2007.

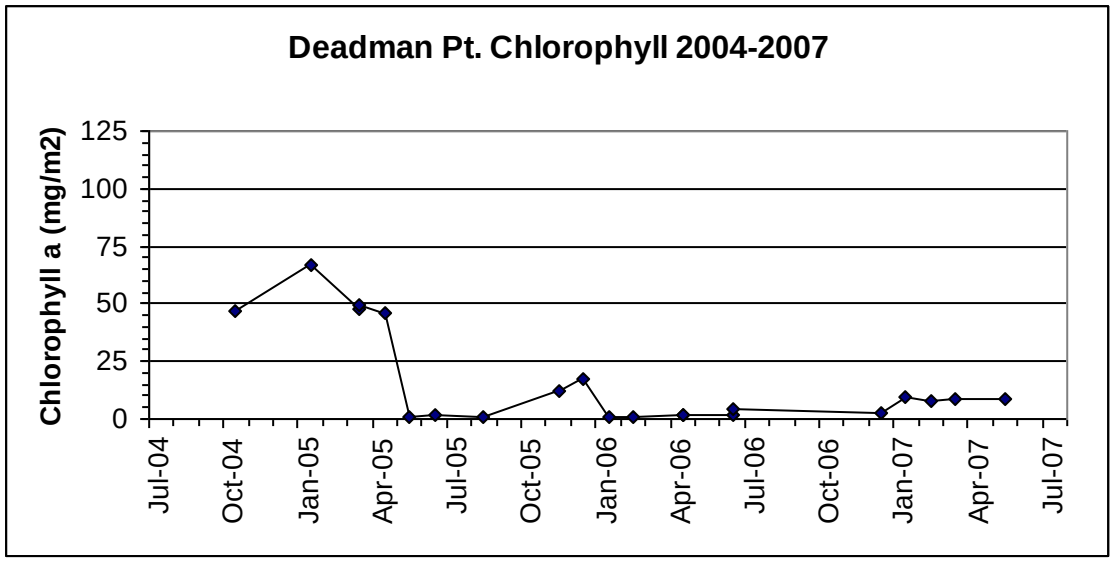


Figure 8.j. Deadman Pt.. periphyton biomass (chlorophyll *a*) 2004-2007.

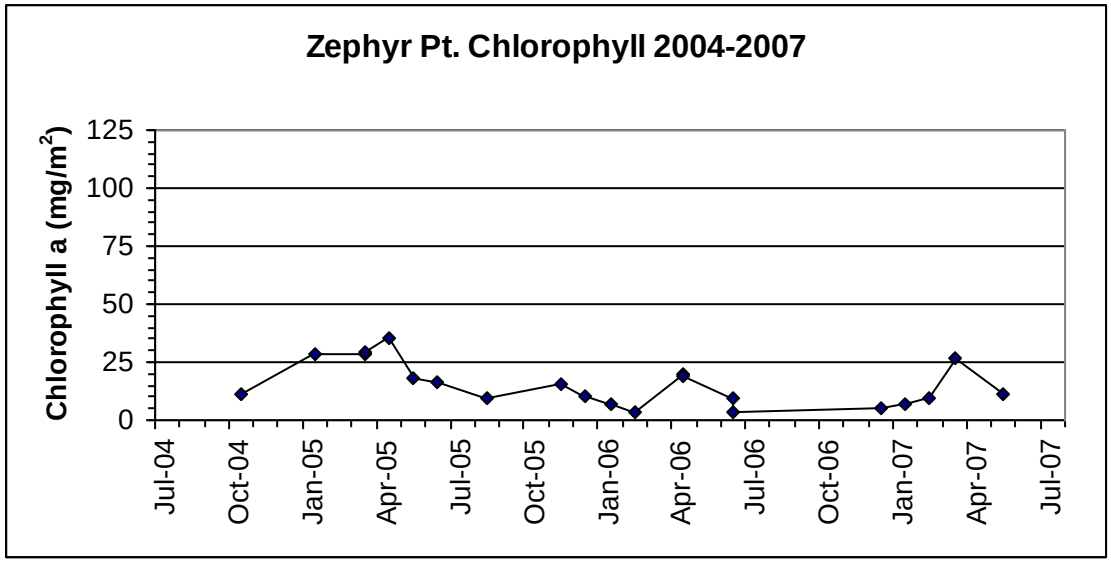


Figure 8.k. Zephyr Pt.. periphyton biomass (chlorophyll *a*) 2004-2007.

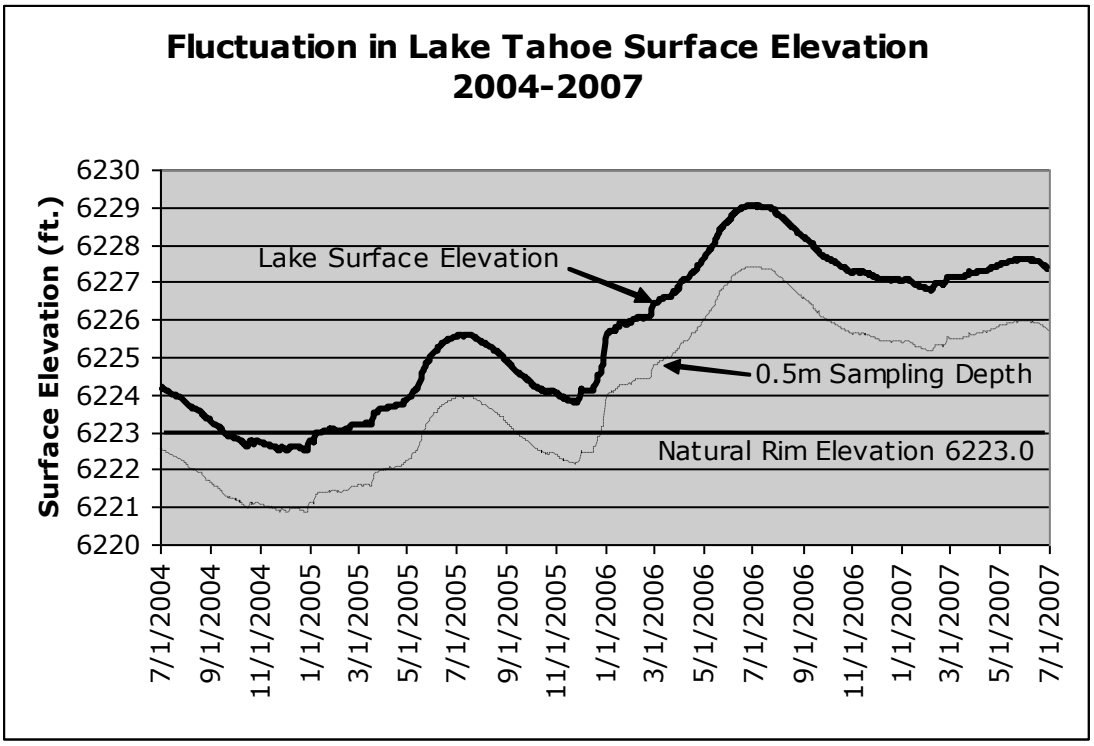


Figure 9. Fluctuation in Lake Tahoe surface elevation 7/1/04-7/1/07. Periphyton samples were collected during the period at a depth of 0.5m below the surface on natural rock substrata. The 0.5m sampling depth (shown as a dotted line) fluctuates with the lake surface elevation. The depth of the natural rim of Lake Tahoe is 6223 ft., the lake falls below this level only infrequently.

Seasonal and Interannual Distribution of Periphyton Biomass

Routine Monitoring Results WY 2005

The lake surface elevation fluctuated significantly during much of the study period (Figure 9) and these fluctuations in surface elevation played a significant role in the biomass patterns observed. The July 1, 2004 to June 30, 2005 period was characterized by unusually low lake levels early in the year. In early winter the lake surface elevation was drawn down below the natural rim. As a consequence, the algae communities sampled at 0.5m were more characteristic of the sublittoral zone at many sites, with a large blue-green algae component and moderately high biomass. The growth of these blue-greens was particularly luxuriant at Incline West, Sand Pt. and Deadman Pt which is reflected in the moderately high biomass levels seen at these sites through April. Rubicon Pt. also had a significant amount of blue-green algae on rock surfaces at 0.5m. The level of blue-green algal growth appeared to be less at other sites but still comprised a significant part of the algal community. A rapid increase in lake level in May caused rock substrata that had been desiccated above water earlier in the year to be submerged below the 0.5m sampling depth. The result of this was that samples collected from 0.5m

from late May on, contained only low amounts of biomass associated with newly colonized algae.

The typical seasonal pattern with a peak in periphyton growth in the spring was observed at the five sites along the west shore of the lake in WY 2005. The growth of periphyton at 0.5m peaked in either March or April at Rubicon Pt., Sugar Pine Pt., Pineland, Tahoe City, and Dollar Pt. The peak biomass values measured were: Rubicon Pt. (Chl a and AFDW respectively) (64 mg/m^2 and 53.9 g/m^2), Sugar Pine Pt. (35.5 mg/m^2 and 31.9 g/m^2), Pineland (87.5 mg/m^2 and 59.5 g/m^2), Tahoe City (132.3 mg/m^2 and 75.2 g/m^2), Dollar Pt. (101.8 mg/m^2 and 47.1 g/m^2). Spatial patterns of biomass for these sites were similar to those seen in past monitoring. The peak biomass was highest at the Tahoe City site, and was also high at Pineland and Dollar Pt. Lowest growth was at Sugar Pine Pt. Rubicon Pt. growth was moderately high. The spring peaks in biomass for west shore sites resulted from increased growth of green filamentous species and/or *Gomphoneis herculeana* over blue-green algae species.

In contrast, at Incline West, Sand Point, and Deadman Pt. a distinct spring peak in biomass was not apparent in WY 2005. Rather biomass levels remained relatively consistent and moderately high during much of the early winter and spring at these sites. Chlorophyll *a* and AFDW ranges respectively through April were: Incline West (33.5 to 51.8 mg/m^2 and 19.1 to 47.1 g/m^2); at Sand Pt. (29.9 to 55.8 mg/m^2 and 34.1 to 67.8 g/m^2); at Deadman Pt (47.2 to 66.9 mg/m^2 and 49.7 to 69.5 g/m^2). Zephyr Pt. showed a pattern similar to the other east shore sites except biomass levels were less: chlorophyll a ranged from 10.9 to 35.2 mg/m^2 and AFDW ranged from 12.6 to 47.2 g/m^2. At Incline Condo, a significant peak occurred early in the year in January (Chl a) 67.9 mg/m^2 and (AFDW) 69.0 g/m^2. The relatively consistent biomass levels for these east and north shore sites is likely a consequence of the stable blue-green algal community. The absence of a significant peak in green filamentous species or diatoms over the blue-greens may be an indication that nutrient loading was less for these sites during the period than that occurring along the west shore.

Routine Monitoring Results WY 2006

During WY 2006 biomass was elevated at the majority of sites both during November-December 2005 and during the spring period 2006. Chlorophyll *a* and AFDW biomass were elevated in Nov. and Dec. at all sites at 0.5m. Then in January, the levels of biomass markedly declined. Tahoe City was an exception as biomass increased steadily from a low in November and December, 2005, to a peak in March 2006. In Nov. - Dec. 2005 levels of chlorophyll *a* at 0.5m were actually the highest measured for the year at Pineland, Incline West, Incline Condo, Sand Pt. and Deadman Pt. All sites except Deadman Pt. showed a second peak in spring 2006.

Different factors were at play in producing the early winter 2005 versus the spring 2006 peaks in growth. In the early winter 2005, a very low lake level once again brought blue green algae with associated moderately high biomass within the 0.5m sampling range. The elevated biomass during this early winter period at many sites was attributable to these blue green algae. At the end of December a series of strong rain events caused the

lake level to rise rapidly, submerging shore zone substrate that had been previously been exposed. As a result, the January sampling at 0.5m occurred on newly submerged substrate that had had little opportunity for periphyton colonization. Biomass levels were very low at all sites (except Tahoe City). Lake level rose only slightly in January and February which provided time for Gomphoneis to colonize and grow on the newly submerged substrate at 0.5m. As the spring progressed, significant storms occurred in March and early April which resulted in additional lake level increases and shifted the 0.5m sampling sites "upwards" to recently submerged rock surfaces continually throughout the spring. The periphyton biomass measured between January and June consisted predominantly of the rapid colonizer *Gomphoneis* at the sites and differences in levels of biomass at many sites may largely reflect differences in nutrient availability from various sources.

Spring peaks in biomass were observed in March and April 2006 at most of the sites and heaviest growth was again in the northwest portion of the lake near Tahoe City. Peak levels of chlorophyll measured during March and April were: Tahoe City (111.48 mg/m^2), Pineland (47.80 mg/m^2), Dollar Pt. (43.65 mg/m^2), Incline Condo (31.90 mg/m^2), Incline West (19.84 mg/m^2), Rubicon Pt. (19.11 mg/m^2) and Sugar Pine Pt. (12.54 mg/m^2). Sand Pt. and Deadman Pt. biomass remained very low throughout most of the spring and was only slightly elevated by the end of June (peak chlorophyll *a* at Sand Pt. was 11.19 mg/m^2 and the Deadman Pt. chlorophyll *a* peak was 4.01 mg/m^2).

Routine Monitoring Results WY 2007

During WY 2007 significant late winter/early spring peaks were observed at many west shore sites. Biomass for most east shore sites was slightly elevated without a significant spring peak. Peak levels of chlorophyll *a* and month of occurrence for west shore sites included: Rubicon Pt. (63.37 mg/m^2 in February); Sugar Pine Pt. (37.18 mg/m^2 in March); Pineland (94.57 mg/m^2 in January but remained high into April), Tahoe City (202.09 mg/m^2 in March); Dollar Pt. (70.89 mg/m^2 in March). Only Zephyr Pt. on the east exhibited a spring peak in biomass (26.83 mg/m^2 in March). Growth at other east shore and north shore routine sites during late winter into spring was slightly elevated over much of the period. During January to May chlorophyll ranges for sites included: Incline West (13.36- 15.62 mg/m^2), Incline Condo (5.24-15.41 mg/m^2), Sand Pt. (7.54-11.15 mg/m^2), Deadman (Pt. 8.24-9.67 mg/m^2).

Lake surface elevations again likely had a significant impact on periphyton biomass patterns observed in WY 2007. During late fall 2006 into summer 2007 lake levels remained relatively constant and high with only a small (<1 ft) increase in elevation due to the spring runoff. A consequence of relatively high lake levels with small fluctuation was that rocks at 0.5m had remained submerged for a long period prior to spring 2007. The initial colonization phase of the rock may have occurred much earlier than winter/spring 2007. This may have allowed for significant accumulation of biomass throughout the late winter-early spring period. Precipitation was also very low during this Water Year. A consequence of this was that there were several stretches of several weeks with little storm activity. This may also have been favorable for biomass accumulation. (Conversely, very strong storms typically bring significant wave activity which can cause

sloughing of algae from the rocks.) In the absence of strong storms, when sufficient nutrients were available, periphyton may have experienced a long growing period with few periods of potential sloughing due to wave activity. By the end of spring 2007 lake level conditions had been stable enough that some blue green algae growth was actually observed at some sites.

Annual Maximum Chlorophyll *a* Levels

Annual maximum chlorophyll *a* values for the three Water Years are presented in figure 10. Note that WY 2007 data was partial and included chlorophyll values through May. The maximum chlorophyll *a* levels however, are not expected to change (based on historical patterns where chlorophyll is often low during the summer. Maximum annual biomass levels occurred in the northwest portion of the lake (Pineland, Tahoe City and Dollar Pt.) during all three WY. High biomass associated with blue green algae at most of the north and east shore sites in WY 2005, accounted for the high annual maximums for those sites in that year. During WY2007, the north shore and east shore monitoring sites all had low annual maximums in during the spring.

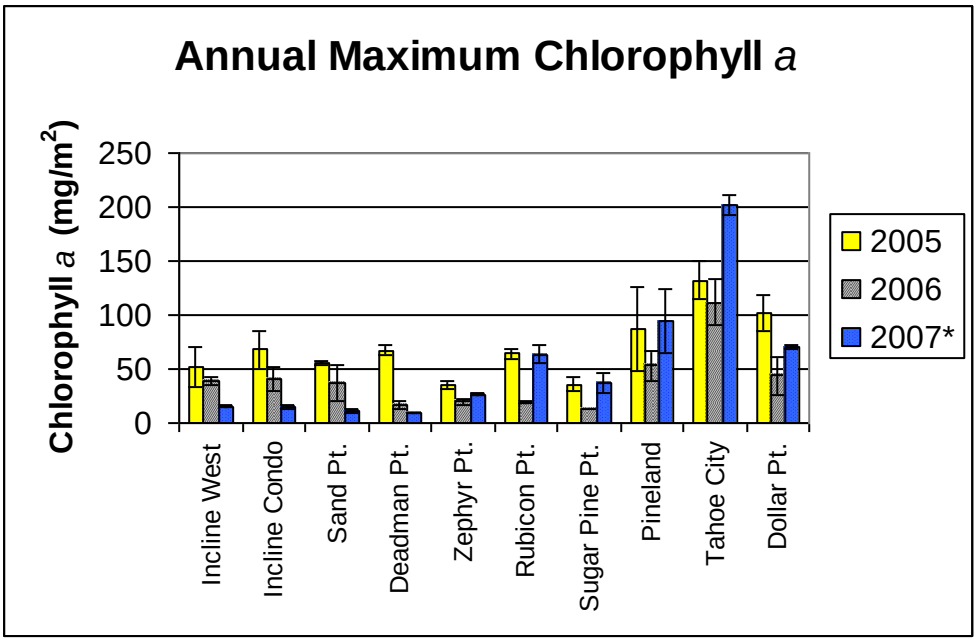


Figure 10. Annual maximum chlorophyll a during Water Years 2005, 2006 and 2007at the routine periphyton monitoring sites at 0.5m. * - Note WY 2007 periphyton data was for partial year (through May 2007). Since chlorophyll concentration typically decreases in the summer, it is likely the peaks presented here will be the overall peaks for WY2007.

Some of the more significant observations and findings from the routine periphyton monitoring done during 2004-2007 include:

1) During 2004-2007 heaviest growth was again in the northwest portion of the lake near Tahoe City. Pineland, Tahoe City and Dollar Pt. typically had the highest spring periphyton biomass during this period.

2) Lake level fluctuations can play a significant role in levels of periphyton biomass observed in the eulittoral zone.

3) During years when lake surface elevation is very low, biomass associated with the stable blue-green algal communities may be brought near the surface. This can result in heavy biomass near the surface at many sites. This heavy biomass is not necessarily a consequence of high nutrient availability but rather is a consequence of the lowering lake level.

4) Discernment of long-term trends in periphyton growth is complicated by significant interannual fluctuations in lake surface elevation. Blue green algae made a significant contribution to the biomass in WY 2005 and a portion of WY 2006 due to very low lake levels. Gomphoneis (a stalked diatom) and green filamentous algae made significant contributions to biomass in spring of WY 2006 and WY 2007 when the lake surface elevation was very high. When trying to assess trends for periphyton growth in the eulittoral zone, we have typically excluded years with significant blue green algal biomass because the biomass patterns seen in such years may be more closely associated with the low lake levels rather than nutrient loading.

5) Periods of significant lake level fluctuation created challenges for representing eulittoral zone biomass based on fixed depth sampling (at 0.5m). In some periods the lake level rose so rapidly that layers of heavy algae growth were submerged deeper that 0.5m and newly submerged bare rock was found at 0.5m. The question then was whether to sample the heavier biomass deeper in the water column. A possible alternative to fixed depth monitoring we are looking at is one in which the primary focus is simply tracking the heaviest observable periphyton growth within the eulittoral zone at each site rather than at a constant depth. This monitoring would focus on tracking the maximum annual growth at the monitoring sites.

6) We have observed significant growth of bright green filamentous algae deeper in the eulittoral zone and extending into the sublittoral zone, in the spring in many areas in recent years. This growth often occurred over the blue green algae in the sublittoral zone. In historical monitoring this zone was typically noted to consist predominantly of blue-green algae so the growth of green filamentous algae in this zone is of interest. It would be desirable to know whether a change in the algal community has indeed occurred recently in this zone and its significance.

Expanded Monitoring 2004-2007

While the ten routine sampling sites provide data from many different regions around the lake with differing levels of backshore development and disturbance, the limited number of these sites does not provide enough resolution to determine periphyton biomass on a whole-lake scale. For this reason synoptic samplings were done in the spring in which 40 additional sites along with the 10 routine sites were monitored for level of periphyton growth. Table 7 presents the names and locations of these synoptic sites. This synoptic monitoring was timed as much as possible to correspond to peak periphyton growth in each region of the lake. During WY 2005 biomass samples were collected from 19 of the sites, and at all 40 sites measurements of filament length, % coverage and visual ranking were made. During WY 2006 and 2007 biomass measurements were made at all 40 sites where measurable periphyton growth was found, along with the measures of filament length, % coverage and visual ranking.

Table 7. Periphyton expanded monitoring locations.

SITE DESIGNATION	SITE NAME	LOCATION
	WEST SHORE	
A	Cascade Creek	N38 57.130; W120 04.615
B	S. of Eagle Point	N38 57.607; W120 04.660
C	E.Bay/Rubicon	N38 58.821; W120 05.606
D	Gold Coast	N39 00.789; W120 06.796
E	S. Meeks Point	N39 01.980; W120 06.882
F	N. Meeks Bay	N39 02.475; W120 07.194
G	Tahoma	N39 04.199; W120 07.771
H	S. Fleur Du Lac	N39 05.957; W120 09.774
I	Blackwood Creek	N39 06.411; W120 09.424
J	Ward Creek	N39 07.719; W120 09.304
K	N. Sunnyside	N39 08.385; W120 09.135
L	Tavern Point	N39 08.806; W120 08.628
TCT	Tahoe City Tributary	(adjacent to T.C. Marina)
M	TCPUD Boat Ramp	N39 10.819; W120 07.177
N	S. Dollar Point	N39 11.016; W120 05.888
O	S. Dollar Creek	N39 11.794; W120 05.699
P	Cedar Flat	N39 12.567; W120 05.285
Q	Garwood's	N39 13.486; W120 04.974
R	Flick Point	N39 13.650; W120 04.155
S	Stag Avenue	N39 14.212; W120 03.710
T	Agatam Boat Launch	N39 14.250; W120 02.932
	EAST SHORE	
E1	South side of Elk Point	N38 58.965; W119 57.399
E2	North Side of Elk Point	N38 59.284; W119 57.341
E3	South Side of Zephyr Point	N38 59.956; W119 57.566
E4	North Zephyr Cove	N39 00.920; W119 57.193
E5	Logan Shoals	N39 01.525; W119 56.997
E6	Cave Rock Ramp	N39 02.696; W119 56.935
E7	South Glenbrook Bay	N39 04.896;W119 56.955
E8	South Deadman Point	N39 05.998; W119 57.087
E9	Skunk Harbor	N39 07.856; W119 56.597
E10	Chimney Beach	N39 09.044; W119 56.008
E11	Observation Point	N39 12.580; W119 55.861
	NORTH SHORE	
E12	Hidden Beach	N39 13.263; W119 55.832
E13	Burnt Cedar Beach	N39 14.680; W119 58.132
E14	Stillwater Cove	N39 13.789; W120 00.020
E15	North Stateline Point	N39 13.237; W120 00.193
E16	Brockway Springs	N39 13.560; W120 00.829
E17	Kings Beach Ramp Area	N39 14.009; W120 01.401
	SOUTH SHORE	
S1	Tahoe Keys Entrance	N38 56.398; W120 00.390
S2	Kiva Point	N38 56.555; W120 03.203

WY 2005 Synoptic Results

Results for chlorophyll *a*, AFDW, % algal coverage, filament length and visual ranking are presented in Table 8. During WY 2005 synoptic sampling it was not possible to monitor all sites during peak growth. Sites from Cascade Cr to TCPUD boat ramp were sampled on 4/22/05 which was near the peak observed along the west shore at Pineland. Sites from S. Dollar Pt. to Agatam boat launch on the northwest shore, were not sampled until 5/17/05 due to a series of weather delays. The data from 4/22/05 and 5/17/05 do correspond to periods of elevated growth and do provide information that shows differences in growth. Due to difficulties associated with weather delays we were not able to continue expanded monitoring until late May 2005 along the east shore. By this time the rapidly rising lake level had created a band of previously desiccated fresh rock substrate from the surface to about 0.8m. We decided to continue expanded sampling of 0.5m depths at the east and north shore sites during June. The data for late May and early June do not represent maximum biomass levels, but instead represent levels of newly colonized algal growth.

The data do show some site to site differences also which might be attributable to nutrient loading. The WY 2006 synoptic chlorophyll a data indicate a broad area of elevated algal biomass along the west and northwest shores from site H (South Fleur du Lac) to site P (Cedar Flat). The results of monitoring at routine sites also showed highest levels of growth within this area at the Pineland, Tahoe City, and Dollar Pt sites. The expanded monitoring appears to show that the area of heavy growth extends south of Pineland to near Blackwood Cr. and north of Dollar Pt. to near Cedar Flat. Chlorophyll *a* levels for sites in this region included site H 92.53 mg/m^2, site L (Tavern Pt.) 58.04 mg/m^2, site TCT (Tahoe City Tributary) 113.8 mg/m^2, Site M (TCPUD Boat Ramp) 44.95 mg/m^2, site P 69.4 mg/m^2. Several potential nutrient sources exist in this region including: tributary inflow from Blackwood and Ward Creeks; direct runoff and urban runoff; ground water; and development present in the Sunnyside, Tahoe City and Dollar Pt. areas. These factors and a shallow shelf off of Tahoe City may all interact to create high nutrient availability for periphyton in this area. The highest chlorophyll *a* value of 113 mg/m^2 was observed near the mouth of a tributary which passes through Tahoe City (Site TCT). The high level of biomass seen here likely is a result of nutrient loading from this tributary.

Expanded sampling along the east shore and north shores in WY 2005 found generally low levels < 6 $mg/m^2$of new growth at most sites. Many of the samples were collected late in June and may reflect low nutrient availability. Exceptions were Logan Shoals which was collected at the end of May and had a slightly elevated chlorophyll *a* of 18.3 mg/m^2 and Chimney Beach collected 6/23/05 which had a slightly elevated chlorophyll *a* value of 9.2 mg/m^2. A small tributary enters near the Chimney Beach site which may contribute some nutrient loading here. Most of the visual scores were low (1 or 2) for the east and north shore sites and are consistent with the low biomass results.

Table 8. Summary of 0.5m periphyton chlorophyll *a*, Ash Free Dry Weight (AFDW), visual score, avg. filament length and % algal coverage for expanded periphyton monitoring sites during April 21 – July 6, 2005. Note for chlorophyll *a* and AFDW, n=2 unless otherwise indicated. Visual score is a subjective ranking of the aesthetic appearance of algal growth (viewed underwater) where 1 is the least offensive and 5 is the most offensive. "na" = not available or not collected; "nes" = not enough sample for analysis.

Site	Date	Chl a (mg/m^2)	Std Dev (mg/m^2)	AFDW (g/m^2)	Std.Dev (g/m^2)	U/W Visual Score	Fil. Length (cm)	Algal Coverage %
A	4/22/2005	na	na	na	na	2	0.6	40%
B	4/22/2005	14.14	3.97	16.77	0.64	3	0.6	70%
C	4/22/2005	na	na	na	na	4	1.1	90%
D	4/22/2005	na	na	na	na	4	1.3	80%
E	4/22/2005	34.47	10.87	35.68	12.83	4	1.3	90%
F	4/22/2005	na	na	na	na	3	1.5	90%
G	4/22/2005	na	na	na	na	2	0.2	70%
H	4/22/2005	92.53	53.95	74.44	56.03	4	1.8	90%
I	4/22/2005	na	na	na	na	3	1.2	60%
J	4/22/2005	na	na	na	na	5	4.2	40%
K	4/22/2005	na	na	na	na	4	1.9	70%
L	4/22/2005	58.04	7.52	55.51	15.38	3	1.7	50%
TCT	4/21/2005	113.77	19.21	63.47	6.12	5	2.6	100%
M	4/22/2005	44.95	15.04	56.68	13.89	4	1.1	80%
N	5/17/2005	na	na	na	na	4	1.8	90%
O	5/17/2005	na	na	na	na	4	1.8	80%
P	5/17/2005	69.4	0.77	65.8	9.07	3	1	80%
Q	5/17/2005	na	na	na	na	3	0.7	70%
R	5/17/2005	21.15	4.63	29.63	4.98	3	1	60%
S	5/17/2005	na	na	na	na	3	0.8	60%
T	5/17/2005	9.2	3.11	15.31	3.33	4	1.2	70%
E1	6/29/2005	5.62	0.64	4.59	0.22	3	0.4	50%
E2	6/29/2005	na	na	na	na	3	0.8	40%
E3	5/31/2005	na	na	na	na	3	1	75%
E4	5/31/2005	na	na	na	na	2	0.2	90%
E5	5/31/2005	18.27	11.23	15.69	1.98	3	0.6	70%
E6	5/31/2005	na	na	na	na	2	0.3	70%
E7	5/31/2005	4.38	0.07	7.19	1.77	2	0.2	70%
E8	5/31/2005	na	na	na	na	2	0.7	70%
E9	5/31/2005	na	na	na	na	2	0.5	50%
E10	6/23/2005	9.21	1.8	7.37	1.72	3	0.7	60%
E11	6/23/2005	2.99	3.94	nes	nes	1	0	0%
E12	6/29/2005	na	na	na	na	2	0.3	40%
E13	6/23/2005	3.3	0.56	nes	nes	2	0.2	30%
E14	6/29/2005	na	na	na	na	2	1	50%
E15	6/23/2005	3.52	0.64	nes	nes	2	0.2	30%
E16	6/23/2005	na	na	na	na	2	0.8	50%
E17	6/23/2005	3.98	3.54	7.96	6.69	3	0.3	35%
S1	7/6/2005	1.75	0.22	nes	nes	2	0.2	40%
S2	7/6/2005	1.24	0.73	1.77	1.48	2	0.1	50%

WY 2006 Synoptic Results

WY 2006 synoptic sampling was done in a concentrated period of two weeks between April 19 and May 2, 2006. For the first time we were able to sample biomass at all 50 sites (10 routine sites + 40 synoptic sites) as well as make measurements of visual score, filament length and % coverage. Results for chlorophyll a, AFDW, % algal coverage, filament length and visual ranking are presented in Table 9. This data provided much more "resolution" of spatial patterns of periphyton growth during the WY 2006 maximum spring growth period.

Figures 11 and 12 present the WY 2006 periphyton synoptic results graphically. The individual chlorophyll *a* data are presented in Figure 11. The individual data were ultimately used to prepare a map which estimates the whole-lake distribution of chlorophyll *a* biomass during the 2006 spring peak (Figure 12). To estimate regional distribution of biomass between discreet sampling points individual site values for chlorophyll *a* were extrapolated to occur along shore half the distance to the next site on either side. This was done for all ten regular sites combined with the synoptic sampling locations. With the exception of the South Lake Tahoe shoreline, where substrate limits sampling locations, the synoptic survey provides appropriate spatial resolution to characterize whole lake periphyton biomass.

Quite a range of chlorophyll *a* biomass was observed along the shoreline at 0.5m with particularly high level observed in the northwest portion of the lake and in localized sites along the southwest and southeast shorelines. Along the east shore from Incline Village to Zephyr Cove peak periphyton biomass, as measured by chlorophyll *a*, was low (<12 mg/m^2) with only one site nearing 20 mg/m^2 (Cave Rock). There is little development along this stretch of shoreline as most of the land is managed by Nevada State Parks. From Zephyr Cove around the south end of the lake to D.L. Bliss State Park, slightly higher biomass was recorded with chlorophyll *a* concentrations between 20 and 50 mg/m^2. One site with very high chlorophyll *a* was found in this section, the South Side of Zephyr Pt. had a chlorophyll level of 105.65 mg/m^2. The south shore region of the lake has a greater degree of development, but broad statements about the regional distribution of periphyton growth in this area are difficult to make as much of the submerged substrate is sand, limiting available sampling locations. From D.L. Bliss State Park up the west shore to North Sunnyside, peak periphyton biomass was highly variable. Measured values ranged from a low of 2 mg/m^2 at North Sunnyside to an incredibly high 426 mg/m^2 at Gold Coast. It is unclear what caused the exceptionally high biomass at Gold Coast as this site is not adjacent to a large urban area or stream. Periphyton growth in this area occurred on isolated boulders surrounded largely by sandy substrate. It is possible substrate characteristics and natural lake dynamics (this area is near an area that might be favorable for upwelling of nutrients) favor periphyton growth at this location, or an unknown source of soluble nutrients is affecting localized conditions.

Table 9. Summary of 0.5m periphyton chlorophyll *a*, Ash Free Dry Weight (AFDW), visual score, avg. filament length and % algal coverage for expanded periphyton monitoring sites April 19, 2006- May 2, 2006. Note for chlorophyll *a* and AFDW, n=2 unless otherwise indicated. Visual score is a subjective ranking of the aesthetic appearance of algal growth (viewed underwater) where 1 is the least offensive and 5 is the most offensive. "na" = not available or not collected; "nes" = not enough sample for analysis.

Site	Date	Chl a (mg/m^2)	Std Dev (mg/m^2)	AFDW (g/m^2)	Std.Dev (g/m^2)	U/W Visual Score	Fil. Length (cm)	Algal Coverage %
A	4/20/2006	33.16	0.67	14.05	0.61	4	1.8	100%
B	4/20/2006	20.19	0.97	9.52	1.37	4	1.2	90%
C	4/20/2006	49.02	3.41	24.20	4.69	5	3.8	100%
D	4/20/2006	426.74	103.69	134.87	47.08	5	3.5	100%
E	4/20/2006	14.66	7.16	9.68	5.04	4	2.2	80%
F	4/20/2006	85.73	19.80	32.06	6.85	3.5	1.8	80%
G	4/20/2006	8.81	2.73	6.35	1.31	3	1.0	60%
H	4/19/2006	45.80	2.72	37.98	10.47	4	1.7	90%
I	4/19/2006	5.25	0.20	nes	nes	3	0.3	60%
J	4/19/2006	11.54	1.81	5.78	1.65	3	0.5	50%
K	4/19/2006	2.54	1.59	1.10	na (n=1)	2	0.1	40%
L	4/19/2006	37.77	3.89	42.96	3.54	4	1.4	100%
TCT	4/21/2006	191.64	13.22	192.67	53.23	5	3.9	100%
M	4/19/2006	206.91	148.93	242.45	137.38	5	3.5	100%
N	4/19/2006	11.09	1.00	15.44	6.38	2	0.6	50%
O	4/19/2006	114.37	40.53	43.92	15.44	5	2.4	100%
P	4/19/2006	28.59	2.47	17.97	1.92	3	0.9	100%
Q	4/19/2006	117.98	48.71	71.29	26.19	4	1.7	80%
R	4/27/2006	40.69	9.66	20.78	8.80	3	1.2	90%
S	4/27/2006	63.59	17.68	25.65	8.02	4	2.2	100%
T	4/27/2006	5.19	0.98	nes	nes	2	0.2	40%
E1	5/2/2006	49.44	19.69	23.50	8.78	4	2.1	80%
E2	5/2/2006	11.73	na (n=1)	7.01	na (n=1)	2	0.3	70%
E3	5/2/2006	105.65	41.72	54.45	6.47	4	2.6	60%
E4	5/2/2006	11.24	7.38	8.12	5.04	3	0.8	80%
E5	5/2/2006	8.88	0.36	5.95	0.97	3	1.0	80%
E6	5/2/2006	19.11	8.08	9.68	3.41	4	1.5	100%
E7	5/2/2006	4.54	1.02	3.08	1.90	3	0.6	90%
E8	4/28/2006	8.55	2.98	5.62	na (n=1)	na	na	na
E9	4/28/2006	4.34	1.04	4.83	na (n=1)	2	0.6	80%
E10	4/28/2006	11.84	1.73	5.66	0.72	3	0.5	90%
E11	4/28/2006	2.34	0.14	nes	nes	2	0.5	100%
E12	4/28/2006	3.29	1.44	nes	nes	3	0.4	95%
E13	4/28/2006	16.88	2.25	9.72	0.48	3	0.8	75%
E14	4/28/2006	2.85	2.69	3.28	na (n=1)	3	1.3	80%
E15	4/28/2006	8.90	0.12	5.21	1.11	4	0.7	90%
E16	4/27/2006	47.67	3.53	27.70	1.31	4	1.5	100%
E17	4/27/2006	64.88	2.47	97.86	31.12	4	1.9	100%
S1	4/20/2006	35.58	5.26	na	3.87	4.5	1.6	80%
S2	4/20/2006	23.07	5.13	32.73	3.69	4	1.0	80%

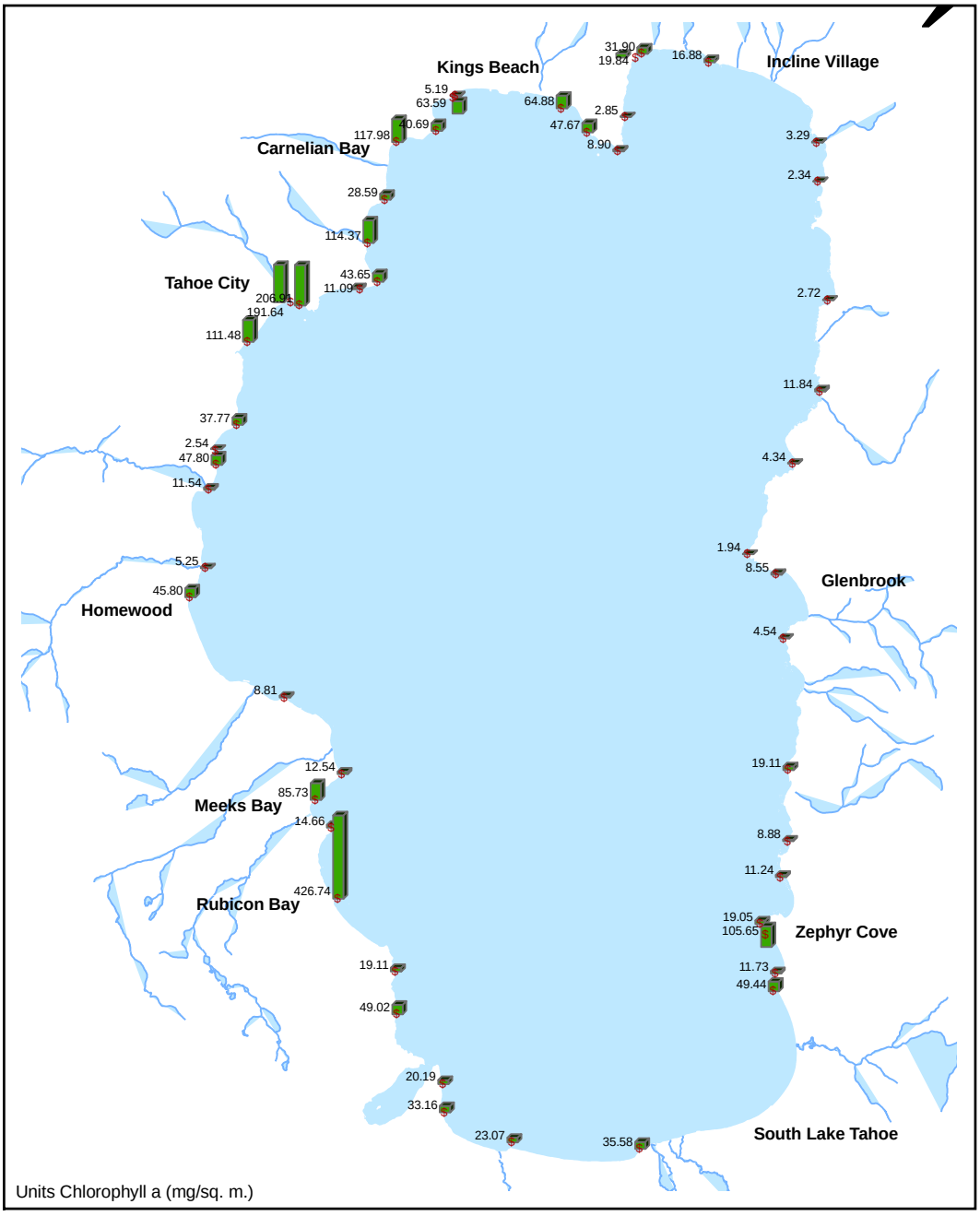


Figure 11. Levels of periphyton biomass as chlorophyll *a* at synoptic and routine sampling sites during the peak growth period, Spring 2006. Note the data for the majority of sites was collected during 19 April -2 May, 2006 while data for Tahoe City and Pineland were collected during the spring peak at these sites in late March.

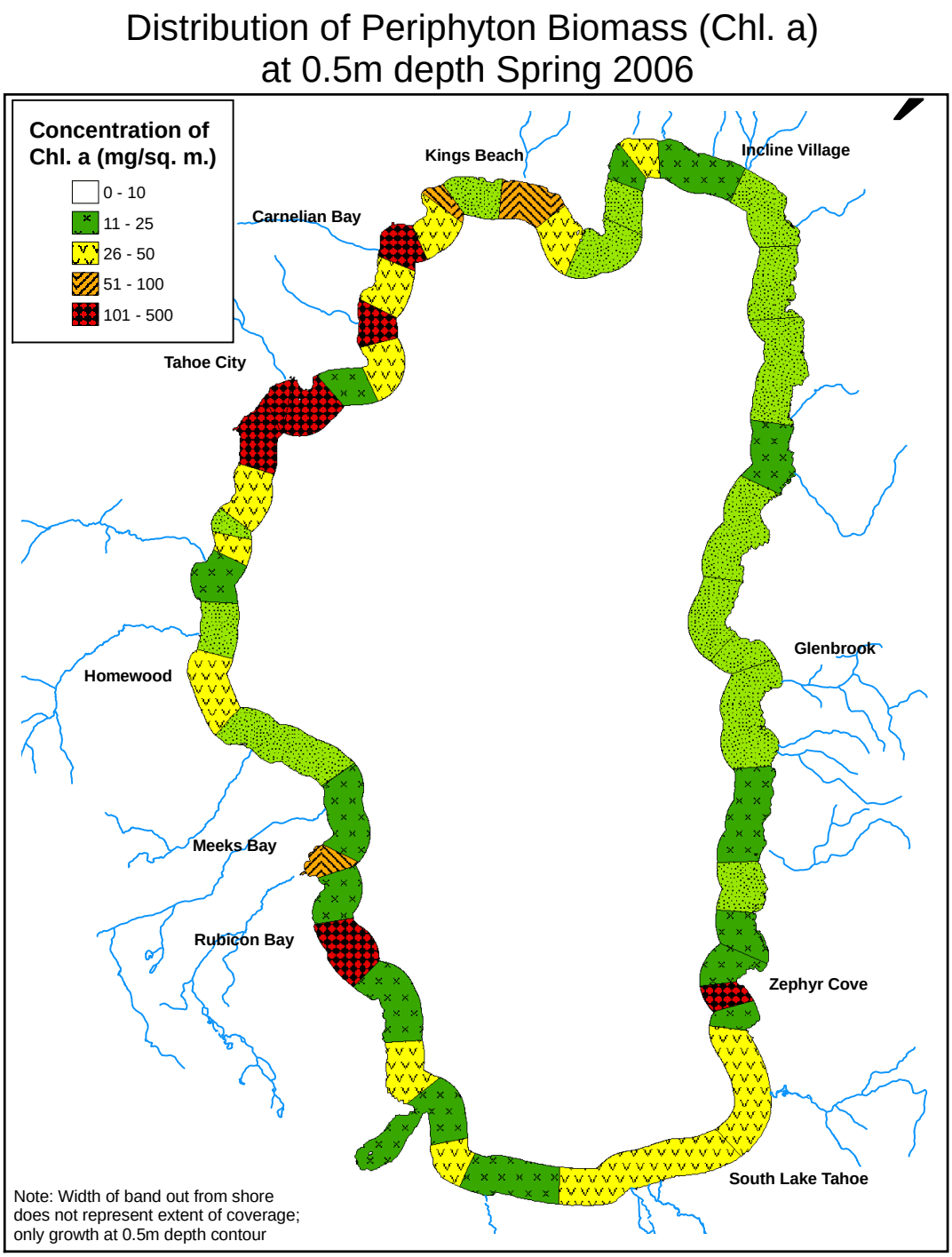


Figure 12. Extrapolated regional distribution of periphyton biomass as Chlorophyll *a* at 0.5m during the 2006 spring peak growth period.

Interestingly low growth was observed at the time of the synoptic in much of the area between Sugar Pine Pt. to North Sunnyside, with an exception being an area south of Fleur Du Lac (45.80 mg/m^2). Pineland chlorophyll *a* biomass at the time of the synoptic was 6.65 mg/m^2 and Tahoe City 86.98 mg/m^2. Based on the high level of growth observed earlier in March at Pineland, we feel it is likely peak growth had already occurred in much of this region earlier in March, and had partially sloughed associated with storms and wave activity later in March. Therefore in the mapping of spring growth (Figs 11,12), we included the higher values from late March at Pineland (47.80 mg/m^2) and Tahoe City (111.48) as representative of peak spring biomass values. We feel this gives a more representative whole-lake picture of spring peak growth.

Significant growth was found between Tavern Pt and up along most of the northwest shoreline to near Stateline. Moderate to very heavy chlorophyll a biomass was observed between Tavern Pt (37.77 mg/m^2) and the Tahoe City PUD Boat ramp (206.91 mg/m^2). Significant biomass extended along much of the rest of the northwest shoreline up to Brockway Springs. Two areas with particularly high growth in this stretch were South Dollar Cr. (114.37 mg/m^2) and Garwoods (117.98 mg/m^2) where runoff from a small drainage was entering the lake. The northeast section of the lake from North Stateline to the east shore had low to moderate growth.

The intensive synoptic done provides essentially a "snapshot view" of the periphyton distribution during the spring peak period. We hope to further examine this data for information which may help further identify factors potentially impacting growth in various regions. It is clear factors controlling the growth of periphyton in any one area or region can be complex.

WY 2007 Synoptic Results

WY 2007 synoptic monitoring was done during the period March 28 to May 25, 2007. Results for chlorophyll *a*, AFDW, % algal coverage, filament length and visual ranking are presented in Table 10. Synoptic sampling done in late March and early April was near the spring peak for biomass along the west shore and northwest shores of Lake Tahoe. Synoptic sampling along the north, east and south shores was done in mid- to late May. The routine monitoring data shows that periphyton biomass was relatively constant at many sites along the north and east shores during this period. The southeast shore biomass may have been slightly after the peak, we believe the south shore samples also may have been slightly past the peak growth. Figure 13 presents the estimated whole-lake distribution of chlorophyll a biomass during the 2007 spring peak based on individual samples.

Table 10. Summary of 0.5m periphyton chlorophyll a, Ash Free Dry Weight (AFDW), visual score, avg. filament length and % algal coverage for expanded periphyton monitoring sites March 28, 2007 - May 25, 2007. Note for chlorophyll *a* and AFDW, n=2 unless otherwise indicated. Visual score is a subjective ranking of the aesthetic appearance of algal growth "Above" (viewed above water), "U/W" (viewed underwater) where 1 is the least offensive and 5 is the most offensive. "na" = not available or not collected; "nes" = not enough sample for analysis.

Site	Date	Chl a (mg/m^2)	Std Dev (mg/m^2)	AFDW (g/m^2)	Std.Dev (g/m^2)	Above Visual Score	U/W Visual Score	Fil. Length (cm)	Algal Coverage %
A	4/5/07	5.28	1.00	4.09	0.03	4	3	0.6	80%
B	4/5/07	16.99	3.87	8.19	0.87	3	3	1.0	80%
C	4/5/07	8.20	0.68	5.71	0.46	3	3	0.5	90%
D	4/5/07	38.69	7.38	26.61	1.18	5	4	3.0	95%
E	4/5/07	194.19	173.76	67.40	53.24	4	5	3.5	100%
F	4/5/07	47.85	0.33	21.95	0.39	3	4	2.5	95%
G	4/5/07	30.68	5.71	13.06	3.08	3	3	1.4	80%
H	3/28/07	9.05	2.96	6.62	1.21	na	3	0.6	40%
I	3/28/07	14.35	2.79	8.72	4.35	na	2	0.35	40%
J	3/28/07	148.99	41.16	69.52	4.28	na	4	2.8	90%
K	4/5/07	nes	nes	8.87	11.74	1	1	<0.1	<10%
L	4/5/07	124.17	10.50	145.91	80.20	3	3	1.5	80%
TCT	4/6/07	158.72	28.66	47.33	9.19	4	4	1.2	95%
M	3/28/07	178.09	65.80	99.31	53.14	3	4	2.5	80%
N	4/5/07	52.04	29.14	117.38	104.73	3	4	2.3	100%
O	4/5/07	141.56	75.83	58.50	30.02	4	5	3.5	90%
P	4/5/07	16.21	1.95	7.04	0.32	na	2	1.1	60%
Q	3/28/07	120.45	62.03	40.07	11.97	2	3	1.8	70%
R	4/5/07	12.48	0.24	6.00	0.25	2	2	0.6	60%
S	3/28/07	34.95	7.60	13.88	1.18	2	2	0.8	60%
T	3/28/07	31.87	0.79	12.86	0.70	2	2	1.3	40%
E1	5/15/07	36.79	3.10	14.78	2.45	na	4	0.8	85%
E2	5/15/07	9.48	0.13	5.78	0.48	na	3	0.6	85%
E3	5/15/07	28.14	3.60	15.83	0.95	4	4	1.0	90%
E4	5/15/07	10.33	0.70	5.80	0.35	2	3	0.5	70%
E5	5/15/07	3.72	0.54	4.67	0.63	na	na	0.6	90%
E6	5/15/07	43.01	17.03	23.54	5.84	4	4	1.5	90%
E7	5/15/07	8.99	1.10	5.48	0.09	3	3	0.5	70%
E8	5/15/07	16.36	0.41	10.94	0.85	3	3	1.0	90%
E9	5/25/07	17.43	4.31	9.85	1.91	na	4	1.2	90%
E10	5/25/07	14.86	3.89	10.09	1.19	4	3	1.5	60%
E11	5/21/07	16.42	2.63	10.39	0.38	4	3	1.1	80%
E12	5/25/07	8.41	1.10	6.30	0.13	2	3	0.4	70%
E13	5/21/07	44.26	10.43	20.17	4.34	2	3	0.5	70%
E14	5/25/07	11.45	2.79	5.19	1.02	2	3	1.0	70%
E15	5/25/07	6.73	0.44	4.28	1.03	3	3	0.8	80%
E16	5/25/07	17.58	0.13	13.99	0.25	2	3	0.7	40%
E17	5/21/07	10.84	5.35	6.89	2.07	na	3	0.3	60%
S1	5/21/07	16.59	1.84	12.43	0.92	4	3	0.6	90%
S1	5/21/07	2.01	na	2.38	1.58	na	2	0.2	40%

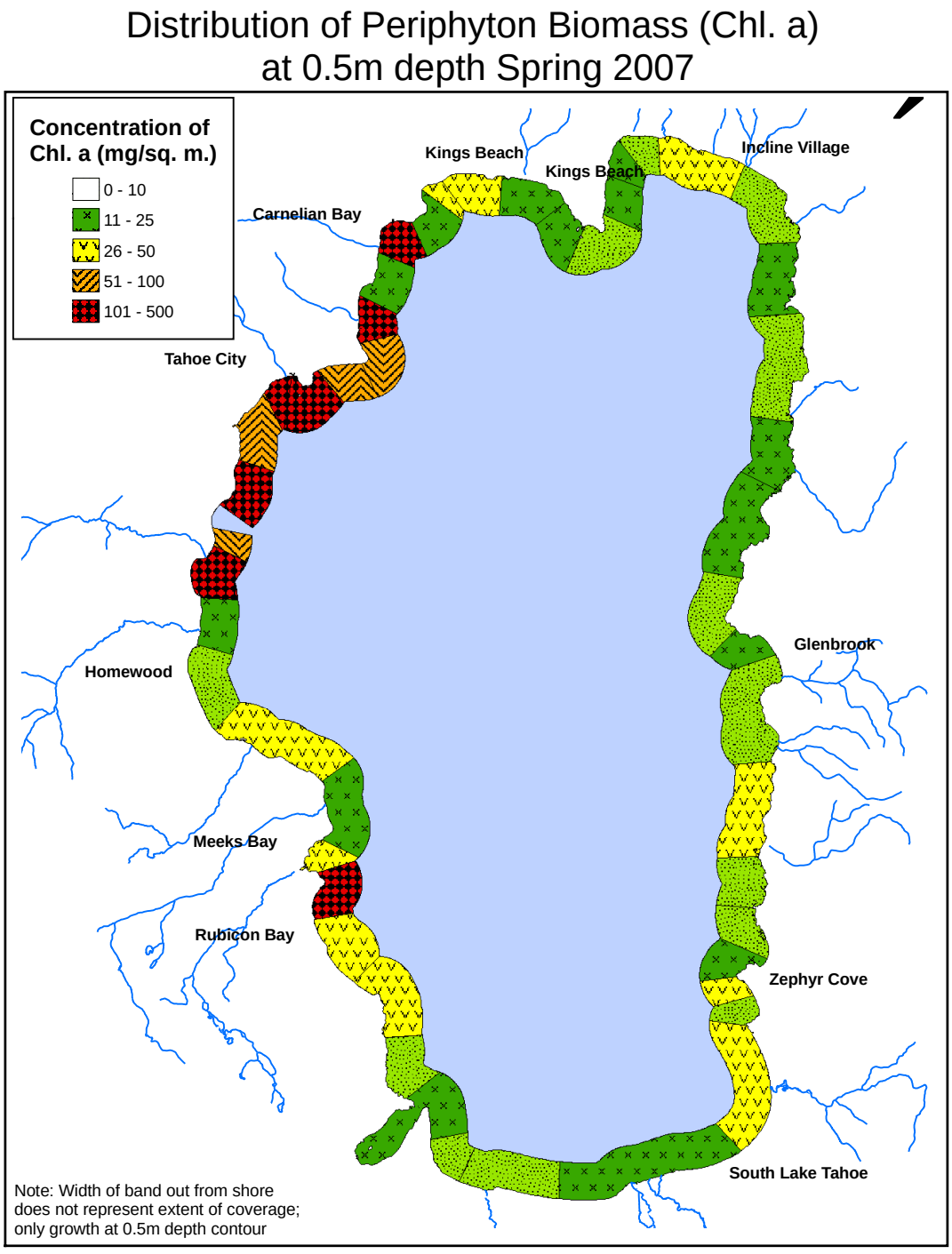


Figure 13. Extrapolated regional distribution of periphyton biomass as Chlorophyll *a* at 0.5m during the 2007 spring peak growth period.

High levels of growth were found along the Northwest portion of the lake from Ward Cr. to Carnelian Bay. The growth of *Gomphoneis* was very heavy at many sites along this stretch of the lake. The highest levels of chlorophyll *a* measured in this region were: Ward Cr. (148.99 mg/m^2); Tahoe City Tributary (158.72 mg/m^2); TCPUD boat ramp (178.09 mg/m^2) and South Dollar Cr. (141.56 mg/m^2). Note that this northwest region also had more sites in the biomass categories above 50 mg/m^2 than for 2006 sampling.

Other areas of fairly high growth were found in the southwest and southeast portions of the lake during WY 2007. A very heavy growth of *Gomphoneis* was found at South Meeks Pt. (194.19 mg/m^2) along the southwest shoreline. Moderate levels of biomass with chlorophyll between 26-50 mg/m^2 were found at many sites between Gold Coast in Rubicon Bay to Tahoma in the southwest portion of the lake. Moderate levels were also found at several sites along the southeast shore, i.e.: South Elk Pt., South Zephyr Pt., Cave Rock Boat ramp. Again, most of the biomass was attributable to *Gomphoneis*.

There was noticeable growth of *Gomphoneis* along much of the east and north shores during WY 2007. Several sites had chlorophyll levels in the 11-25 mg/m^2 range. The number of sites within this range of biomass along the east shore appeared higher than for the WY 2006 synoptic. A greater number east shore sites appeared to be in the lowest biomass range (0-10 mg/m^2) in WY 2006.

Overall, there appeared to be generally higher levels of periphyton biomass around the lake in WY 2007 compared to WY 2006. When comparing the WY 2006 chlorophyll map (Figure 12) with WY 2007 (Figure 13) a greater portion of the shoreline appears to have had higher biomass in WY 2007. The higher level of growth in WY 2007 is particularly interesting since WY 2007 was a very dry year and WY 2006 was an extremely wet year. We might have expected to see generally light growth in WY2007 associated with light nutrient inputs from runoff. It may be that with relatively stable lake levels in WY 2007 (Figure 9), frequent periods without storms (sunny calm periods), and the long period over which the substrate had been previously submerged (the substrate likely already had been colonized by algae), growth of *Gomphoneis* was able to become quite heavy where sufficient nutrients were available (particularly along the west and northwest shores). Along the east shore growth appeared slightly higher than in WY 2006 but was still generally light.

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Appendix Table 1.a. N, P, and H concentrations in bulk deposition at the Upper Ward Valley Station 7/1/04-6/30/07.

Samp. No.	Upper Ward V. Collection Date-Time	ST Precip. (in.)	Precip. Form	Collector Type	pH	H+ (µg/l)	(Conc.) NO3-N (µg/l)	NH4-N (µg/l)	TKN (µg/l)	SRP (µg/l)	DP (µg/l)	TP (µg/l)	Notes
1	8/9/2004 16:35	T	R+DF	ST	NA	NA	145.60	365.27	4819.50	3.00	144.86	350.60	1
2	9/9/2004 14:30	0.00	DF	ST	NA	NA	37.58	64.19	650.81	25.94	40.18	80.27	2
3	9/23/2004 14:45	0.22	S	ST	NA	NA	C	C	C	C	C	C	199
4	10/8/2004 14:55	0.05	R	ST	NA	NA	99.52	152.20	571.65	3.64	12.48	24.33	3
5	10/14/2004 15:00	0.00	DF	ST	NA	NA	6.34	12.69	56.30	0.68	1.56	5.30	2
6	10/18/2004 13:30	3.18	RS	ST	5.09	8.13	48.86	85.73	93.09	1.14	4.37	5.61	
7	10/21/2004 15:10	3.15	RS	ST	5.15	7.08	14.97	14.45	49.70	0.07	2.21	19.91	
8	10/29/2004 15:30	2.68	S	ST	5.10	7.94	40.55	48.23	205.26	0.91	3.48	24.02	
9	11/4/2004 15:30	0.59	RS	ST	4.90	12.59	284.00	182.47	134.51	1.82	4.42	27.81	
10	11/12/2004 12:15	0.40	RS	ST	4.72	19.05	107.90	164.92	243.94	1.14	4.74	17.07	
11	11/22/2004 12:45	0.01	NA	ST	NA	NA	6.68	12.09	323.40	0.23	5.07	7.61	
12	11/29/2004 12:25	2.48	S	ST	5.19	6.46	22.85	11.45	44.87	0.46	5.07	7.29	
13	12/10/2004 10:40	6.70	RS	ST	5.22	6.03	34.10	12.30	58.09	1.14	5.27	9.19	13
14	12/27/2004 11:55	0.02	S	ST	NA	NA	7.16	23.42	62.46	1.12	4.75	8.87	29
15	1/3/2005 16:15	10.40	S	ST CORE	5.22	6.03	19.22	37.05	80.96	2.24	4.75	8.55	30
16	1/12/2005 16:10	9.90	S	TBG	5.50	3.16	18.67	18.47	92.02	0.00	5.40	10.84	31
17	1/27/2005 14:50	1.25	RS	ST	4.68	20.89	182.30	166.31	160.81	1.16	5.58	9.29	
18	1/31/2005 13:55	1.01	S	ST	5.20	6.31	14.39	14.77	36.62	0.46	4.96	15.48	
19	2/8/2005 16:25	0.70	S	ST	5.18	6.61	178.72	280.17	126.18	1.62	11.44	14.62	
20	2/23/2005 12:40	3.95	RS	ST	4.91	12.30	83.76	112.91	109.15	0.23	5.27	7.75	
21	2/28/2005 16:35	0.73	S	ST	5.20	6.31	36.86	36.47	39.68	0.69	5.58	7.59	
22	3/2/2005 14:15	0.70	S	ST	NA	NA	16.79	31.29	62.58	0.23	5.27	6.96	32
23	3/9/2005 11:00	T	S+DF	ST	NA	NA	1.84	8.61	36.83	0.46	1.58	3.46	33
24	3/21/2005 18:00	4.22	S	ST	4.22	60.26	30.85	33.23	58.22	2.31	5.05	5.53	
25	3/30/2005 16:50	6.40	S	ST	5.08	8.32	30.56	33.62	54.08	0.46	4.42	6.00	34
26	4/5/2005 14:10	0.81	S	ST	4.88	13.18	140.81	125.49	197.13	4.16	9.47	15.15	

Samp. No.	Upper Ward V. Collection Date-Time	ST Precip. (in.)	Precip. Form	Collector Type	pH	H+ (µg/l)	(Conc.) NO3-N (µg/l)	NH4-N (µg/l)	TKN (µg/l)	SRP (µg/l)	DP (µg/l)	TP (µg/l)	Notes
27	4/13/2005 16:30	1.90	S	ST	5.00	10.00	58.80	65.68	92.78	0.23	5.36	7.26	
28	4/25/2005 15:40	0.64	RS	ST	4.93	11.75	394.28	478.52	524.14	11.57	16.10	30.98	
29	5/2/2005 15:35	1.09	RS	ST	4.70	19.95	253.70	456.52	471.67	4.63	13.35	16.85	
30	5/6/2005 17:30	0.65	RS	ST	4.60	25.12	108.32	110.17	174.71	2.32	3.81	15.26	
31	5/11/2005 16:50	3.04	RS	ST	5.20	6.31	47.91	96.00	132.20	1.62	3.49	13.99	
32	5/17/2005 17:05	2.95	RSG	ST	5.00	10.00	77.19	82.19	105.92	1.62	3.33	6.66	
33	5/20/2005 15:25	4.26	R	ST	5.10	7.94	119.98	222.65	213.76	2.55	3.81	4.13	
34	6/13/2005 17:45	2.88	RS	ST	5.01	9.77	35.74	24.59	102.59	3.92	10.02	20.14	
35	6/20/2005 13:00	1.36	RS	ST	4.91	12.30	97.86	97.84	213.85	5.77	11.89	NA	
36	7/27/2005 13:15	0	DF	ST	NA	NA	C	C	C	C	C	C	70
37	8/17/2005 10:15	0.12	R+DF	ST	4.70	19.95	C	C	C	C	C	C	71
38	9/6/2005 16:15	0	DF	ST	NA	NA	24.68	28.54	118.53	5.91	10.02	NA	72
39	10/3/2005 11:45	0.51	R+DF	ST	4.71	19.50	C	C	C	C	C	C	94
40	10/18/2005 17:10	0.3	R+S+DF	ST	NA	NA	211.03	222.84	413.58	18.86	19.41	48.79	
41	10/25/2005 16:15	0.38	R+DF	ST	4.65	22.39	145.82	157.26	274.30	4.12	11.21	23.88	
42	11/7/2005 11:45	4.34	R+S+DF	ST	5.10	7.94	68.14	104.02	154.22	0.46	3.43	14.27	
43	11/17/2005 16:50	0.92	R+DF	ST	5.10	7.94	48.67	43.26	141.98	1.14	3.78	4.05	95
44	11/28/2005 11:30	1.61	R+S+DF	ST	5.00	10.00	49.77	44.09	71.19	1.60	4.72	8.41	
45	11/30/2005 13:40	3.9	R+S+DF	ST	5.30	5.01	9.92	2.06	116.18	0.23	4.09	3.74	
46	12/6/2005 16:30	6.1	R+S+DF	ST	5.20	6.31	16.16	6.43	32.82	0.23	5.67	11.48	
47	12/15/2005 15:00	0.19		ST	NA	NA	8.82	11.42	41.75	0.23	4.72	12.41	
48	12/23/2005 13:15	7.79	R+S+DF	ST	NA	NA	20.20	5.47	8.53	0.23	5.04	2.51	
49	1/4/2006 15:00	16.75+	R+S+DF	ST	5.50	3.16	6.80	4.35	10.42	0.23	4.41	2.67	96
50	1/17/2006 12:15	3.6		ST	NA	NA	41.51	27.73	69.42	2.32	5.00	19.19	113
51	1/19/2006 14:00	2.92	S	ST	5.69	2.04	22.49	22.79	47.30	1.85	4.69	16.99	
52	2/3/2006 15:25	6.83	R+S	ST	5.02	9.55	34.21	32.90	50.38	2.32	5.00	21.40	
53	2/6/2006 14:45	0.85	R+S	ST	4.99	10.23	37.50	31.57	44.92	0.91	0.32	20.77	
54	2/24/2006 12:45	0.86	S	ST	4.80	15.85	139.45	167.30	154.84	4.10	3.80	24.23	114
55	3/1/2006 13:00	5.61	R+S	ST	5.40	3.98	13.65	16.12	36.73	1.37	3.77	18.88	

Samp. No.	Upper Ward V. Collection Date-Time	ST Precip. (in.)	Precip. Form	Collector Type	pH	H+ (µg/l)	(Conc.) NO3-N (µg/l)	NH4-N (µg/l)	TKN (µg/l)	SRP (µg/l)	DP (µg/l)	TP (µg/l)	Notes
56	3/8/2006 11:50	4.57	S	ST	5.17	6.76	33.55	55.05	101.07	1.37	3.14	1.86	
57	3/13/2006 14:30	3.04	S	ST	5.01	9.77	52.80	45.16	74.28	1.37	3.77	1.24	
58	3/15/2006 16:30	1.77	S	ST	5.09	8.13	41.20	32.58	93.46	1.82	3.45	2.79	
59	3/27/2006 8:35	2.51	R+S	ST	5.19	6.46	51.48	53.76	96.80	2.51	3.77	3.10	
60	3/30/2006 11:15	1.17	S	ST	5.10	7.94	66.12	82.15	117.20	2.51	4.08	4.65	
61	4/6/2006 16:00	6.26	R+S	ST	4.89	12.88	32.81	39.49	49.55	1.39	6.55	1.24	
62	4/13/2006 14:30	3.28	R+S	ST	5.10	7.94	43.64	69.38	66.98	1.62	7.17	3.10	
63	4/17/2006 14:30	2.85+	S	ST	5.00	10.00	114.68	284.69	312.64	2.78	8.10	5.58	130
64	4/25/2006 10:20	0.99	R	ST	4.60	25.12	266.21	287.33	323.78	5.56	12.16	17.35	
65	5/1/2006 15:45	0.36	R	ST	4.62	23.99	176.87	227.99	243.10	5.10	13.72	16.30	
66	6/2/2006 11:40	1.87	R	ST	5.11	7.76	135.91	277.32	785.49	2.06	21.85	85.48	131
67	6/16/2006 16:40	0.48	R	ST	4.87	13.49	341.79	1209.64	1457.20	9.33	83.36	170.96	132
68	7/11/2006 16:15	0.004	DF	ST	NA	NA	C	C	C	C	C	C	140
69	8/8/2006 15:00	0	DF	ST	NA	NA	C	C	C	C	C	C	141
70	9/18/2006 16:15	0.02	SG	ST	NA	NA	C	C	C	C	C	C	142
71	10/3/2006 10:55	NA	R	NA	NA	NA	NA	NA	NA	NA	NA	NA	181
72	10/9/2006 16:10	0.24	RH	ST	NA	NA	276.41	403.89	545.47	1.14	3.99	83.08	
73	10/20/2006 16:10	0.33	RS	ST	NA	NA	153.24	176.52	NA	7.27	18.70	85.37	
74	11/6/2006 12:45	2.46	RS	ST	5.21	6.17	27.57	26.79	280.31	0.91	4.60	12.55	182
75	11/9/2006 10:15	1	RS	ST	5.20	6.31	30.79	26.92	NA	NA	2.76	5.94	
76	11/15/2006 14:10	5.16	RS	ST	4.90	12.59	31.15	28.98	44.31	1.59	3.07	4.28	
77	11/22/2006 10:30	0.18	R	ST	NA	NA	200.51	218.62	NA	5.22	12.20	NA	
78	11/29/2006 12:15	2	S	ST	5.16	6.92	51.44	58.07	104.44	7.71	10.53	24.14	183
79	12/20/2006 15:20	5.25	RS	ST	NA	NA	21.34	18.80	96.26	6.44	3.37	17.05	
80	12/28/2006 12:10	3.18	RS	ST	5.00	10.00	14.29	NA	167.13	4.37	3.06	25.43	
81	1/8/2007 9:10	3.14+	RS	ST	5.30	5.01	13.05	NA	14.18	9.66	3.98	21.09	166
	2/23/2007 16:15	7.08+	RS	ST	NA	NA	NA	NA	NA	NA	NA	NA	167
	3/8/2007 9:45	8.9 e	S	ST	NA	NA	NA	NA	NA	NA	NA	NA	168
	3/26/2007 9:40	0.4e	S	ST	NA	NA	NA	NA	NA	NA	NA	NA	169

Samp. No.	Upper Ward V. Collection Date-Time	ST Precip. (in.)	Precip. Form	Collector Type	pH	H+ (µg/l)	(Conc.) NO3-N (µg/l)	NH4-N (µg/l)	TKN (µg/l)	SRP (µg/l)	DP (µg/l)	TP (µg/l)	Notes
	4/2/2007 10:35	1.33+	S	ST	NA	NA	NA	NA	NA	NA	NA	NA	184
	4/20/2007 9:40	2.39	RS	ST	NA	NA	NA	NA	NA	NA	NA	NA	
	5/18/2007 12:50	3.74		ST	NA	NA	NA	NA	NA	NA	NA	NA	
	6/1/2007 10:45	0.04		ST	NA	NA	NA	NA	NA	NA	NA	NA	
	6/11/2007 14:30	0.79	RS	ST	NA	NA	NA	NA	NA	NA	NA	NA	

Appendix Table 1.b. N, P, and H loads in bulk deposition at the Upper Ward Valley Station 7/1/04-6/30/07.

Samp. No.	Upper Ward V. Collection Date-Time	ST Precip. (in.)	Precip. Form	Collector Type	H+ (g/ha)	NO3-N (g/ha)	(Load) NH4-N (g/ha)	TKN (g/ha)	SRP (g/ha)	DP (g/ha)	TP (g/ha)	Notes
1	8/9/2004 16:35	T	R+DF	ST	NA	22.44	56.30	742.81	0.46	22.33	54.04	1
2	9/9/2004 14:30	0.00	DF	ST	NA	5.79	9.89	100.31	4.00	6.19	12.37	2
3	9/23/2004 14:45	0.22	S	ST	NA	C	C	C	C	C	C	199
4	10/8/2004 14:55	0.05	R	ST	NA	15.34	23.46	88.11	0.56	1.92	3.75	3
5	10/14/2004 15:00	0.00	DF	ST	NA	0.98	1.96	8.68	0.10	0.24	0.82	2
6	10/18/2004 13:30	3.18	RS	ST	6.57	39.47	69.25	75.19	0.92	3.53	4.53	
7	10/21/2004 15:10	3.15	RS	ST	5.66	11.98	11.56	39.76	0.06	1.77	15.93	
8	10/29/2004 15:30	2.68	S	ST	5.41	27.60	32.83	139.72	0.62	2.37	16.35	
9	11/4/2004 15:30	0.59	RS	ST	1.89	42.56	C	20.16	0.27	0.66	4.17	
10	11/12/2004 12:15	0.40	RS	ST	1.94	10.96	16.76	24.78	0.12	0.48	1.73	
11	11/22/2004 12:45	0.01	NA	ST	NA	1.03	1.86	49.84	0.04	0.78	1.17	
12	11/29/2004 12:25	2.48	S	ST	4.07	14.39	7.21	28.26	0.29	3.19	4.59	
13	12/10/2004 10:40	6.70	RS	ST	10.25	58.03	20.93	98.86	1.94	8.97	15.64	13
14	12/27/2004 11:55	0.02	S	ST	NA	1.10	3.61	9.63	0.17	0.73	1.37	29
15	1/3/2005 16:15	10.40	S	ST CORE	15.92	50.77	97.87	213.86	5.92	12.55	22.59	30
16	1/12/2005 16:10	9.90	S	TBG	7.95	46.95	46.44	231.39	0.00	13.58	27.26	31
17	1/27/2005 14:50	1.25	RS	ST	6.63	57.88	52.80	51.06	0.37	1.77	2.95	
18	1/31/2005 13:55	1.01	S	ST	1.62	3.69	3.79	9.39	0.12	1.27	3.97	
19	2/8/2005 16:25	0.70	S	ST	1.17	31.78	C	22.43	0.29	2.03	2.60	
20	2/23/2005 12:40	3.95	RS	ST	12.34	84.04	113.28	109.51	0.23	5.29	7.78	
21	2/28/2005 16:35	0.73	S	ST	1.17	6.83	6.76	7.36	0.13	1.03	1.41	
22	3/2/2005 14:15	0.70	S	ST	NA	2.99	5.56	11.13	0.04	0.94	1.24	32
23	3/9/2005 11:00	T	S+DF	ST	NA	0.28	1.33	5.68	0.07	0.24	0.53	33
24	3/21/2005 18:00	4.22	S	ST	64.59	33.07	35.62	62.40	2.48	5.41	5.93	
25	3/30/2005 16:50	6.40	S	ST	13.52	49.68	54.65	87.91	0.75	7.19	9.75	34
26	4/5/2005 14:10	0.81	S	ST	2.71	28.97	25.82	40.56	0.86	1.95	3.12	

Samp. No.	Upper Ward V. Collection Date-Time	ST Precip. (in.)	Precip. Form	Collector Type	H+ (g/ha)	NO3-N (g/ha)	NH4-N (g/ha)	TKN (g/ha)	SRP (g/ha)	DP (g/ha)	TP (g/ha)	Notes
27	4/13/2005 16:30	1.90	S	ST	4.83	28.38	31.70	44.78	0.11	2.59	3.50	
28	4/25/2005 15:40	0.64	RS	ST	1.91	64.09	77.79	85.20	1.88	2.62	5.04	
29	5/2/2005 15:35	1.09	RS	ST	5.52	70.24	126.39	130.59	1.28	3.70	4.67	
30	5/6/2005 17:30	0.65	RS	ST	4.15	17.88	18.19	28.84	0.38	0.63	2.52	
31	5/11/2005 16:50	3.04	RS	ST	4.87	36.99	74.13	102.08	1.25	2.69	10.80	
32	5/17/2005 17:05	2.95	RSG	ST	7.49	57.84	61.58	79.37	1.21	2.50	4.99	
33	5/20/2005 15:25	4.26	R	ST	8.59	129.82	240.92	231.30	2.76	4.12	4.47	
34	6/13/2005 17:45	2.88	RS	ST	7.15	26.14	17.99	75.05	2.87	7.33	14.73	
35	6/20/2005 13:00	1.36	RS	ST	4.25	33.80	33.80	73.87	1.99	4.11	NA	
36	7/27/2005 13:15	0.00	DF	ST	NA	C	C	C	C	C	C	70
37	8/17/2005 10:15	0.12	R+DF	ST	3.08	C	C	C	C	C	C	71
38	9/6/2005 16:15	0.00	DF	ST	NA	3.80	4.40	18.27	0.91	1.54	NA	72
39	10/3/2005 11:45	0.51	R+DF	ST	2.53	C	C	C	C	C	C	94
40	10/18/2005 17:10	0.30	R+S+DF	ST	NA	16.08	16.98	31.51	1.44	1.48	3.72	
41	10/25/2005 16:15	0.38	R+DF	ST	2.16	14.07	15.18	26.48	0.40	1.08	2.30	
42	11/7/2005 11:45	4.34	R+S+DF	ST	8.76	75.11	114.67	170.01	0.51	3.78	15.73	
43	11/17/2005 16:50	0.92	R+DF	ST	1.86	11.37	10.11	33.18	0.27	0.88	0.95	95
44	11/28/2005 11:30	1.61	R+S+DF	ST	4.09	20.35	18.03	29.11	0.65	1.93	3.44	
45	11/30/2005 13:40	3.90	R+S+DF	ST	4.96	9.83	2.04	115.09	0.23	4.05	3.70	
46	12/6/2005 16:30	6.10	R+S+DF	ST	9.78	25.04	9.96	50.85	0.36	8.79	17.79	
47	12/15/2005 15:00	0.19		ST	NA	0.43	0.55	2.01	0.01	0.23	0.60	
48	12/23/2005 13:15	7.79	R+S+DF	ST	NA	39.97	10.82	16.88	0.46	9.97	4.97	
49	1/4/2006 15:00	16.75+	R+S+DF	ST	13.45	28.93	18.51	44.33	0.98	18.76	11.36	96
50	1/17/2006 12:15	3.60		ST	NA	37.96	25.36	63.48	2.12	4.57	17.55	113
51	1/19/2006 14:00	2.92	S	ST	1.51	16.68	16.90	35.08	1.37	3.48	12.60	
52	2/3/2006 15:25	6.83	R+S	ST	16.57	59.35	57.08	87.40	4.02	8.67	37.13	
53	2/6/2006 14:45	0.85	R+S	ST	2.21	8.10	6.82	9.70	0.20	0.07	4.48	
54	2/24/2006 12:45	0.86	S	ST	3.46	30.46	36.55	33.82	0.90	0.83	5.29	114
55	3/1/2006 13:00	5.61	R+S	ST	5.67	19.45	22.97	52.34	1.95	5.37	26.90	

Samp. No.	Upper Ward V. Collection Date-Time	ST Precip. (in.)	Precip. Form	Collector Type	H+ (g/ha)	NO3-N (g/ha)	NH4-N (Load) (g/ha)	TKN (g/ha)	SRP (g/ha)	DP (g/ha)	TP (g/ha)	Notes
56	3/8/2006 11:50	4.57	S	ST	7.85	38.94	63.90	117.32	1.59	3.64	3.64	
57	3/13/2006 14:30	3.04	S	ST	7.55	40.77	34.87	57.36	1.06	2.91	2.91	
58	3/15/2006 16:30	1.77	S	ST	3.65	18.52	14.65	42.02	0.82	1.55	1.55	
59	3/27/2006 8:35	2.51	R+S	ST	4.12	32.82	34.27	61.71	1.60	2.40	2.40	
60	3/30/2006 11:15	1.17	S	ST	2.36	19.65	24.41	34.83	0.75	1.21	1.38	
61	4/6/2006 16:00	6.26	R+S	ST	20.48	52.17	62.79	78.79	2.21	10.41	1.97	
62	4/13/2006 14:30	3.28	R+S	ST	6.62	36.36	57.80	55.80	1.35	5.97	2.58	
63	4/17/2006 14:30	2.85+	S	ST	7.24	83.02	206.09	226.32	2.01	5.86	4.04	130
64	4/25/2006 10:20	0.99	R	ST	6.32	66.94	72.25	81.42	1.40	3.06	4.36	
65	5/1/2006 15:45	0.36	R	ST	2.19	16.17	20.85	22.23	0.47	1.25	1.49	
66	6/2/2006 11:40	1.87	R	ST	3.69	64.55	131.72	373.09	0.98	10.38	40.60	131
67	6/16/2006 16:40	0.48	R	ST	1.64	41.67	147.48	177.66	1.14	10.16	20.84	132
68	7/11/2006 16:15	0.00	DF	ST	C	C	C	C	C	C	C	140
69	8/8/2006 15:00	0.00	DF	ST	C	C	C	C	C	C	C	141
70	9/18/2006 16:15	0.02	SG	ST	C	C	C	C	C	C	C	142
71	10/3/2006 10:55	NA	R	NA	NA	NA	NA	NA	NA	NA	NA	181
72	10/9/2006 16:10	0.24	RH	ST	NA	16.85	24.62	33.25	0.07	0.24	5.06	
73	10/20/2006 16:10	0.33	RS	ST	NA	12.84	14.80	NA	0.61	1.57	7.16	
74	11/6/2006 12:45	2.46	RS	ST	3.86	17.23	16.74	175.15	0.57	2.87	7.84	182
75	11/9/2006 10:15	1.00	RS	ST	1.60	7.82	6.84	NA	NA	0.70	1.51	
76	11/15/2006 14:10	5.16	RS	ST	16.50	40.83	37.98	58.07	2.08	4.02	5.61	
77	11/22/2006 10:30	0.18	R	ST	NA	9.17	10.00	NA	0.24	0.56	NA	
78	11/29/2006 12:15	2.00	S	ST	3.52	26.13	29.50	53.06	3.92	5.35	12.26	183
79	12/20/2006 15:20	5.25	RS	ST	NA	28.46	25.07	128.36	8.59	4.49	22.74	
80	12/28/2006 12:10	3.18	RS	ST	8.08	11.54	NA	134.99	3.53	2.47	20.54	
81	1/8/2007 9:10	3.14+	RS	ST	4.00	10.41	NA	11.31	7.70	3.17	16.82	166
	2/23/2007 16:15	7.08+	RS	ST	NA	NA	NA	NA	NA	NA	NA	167
	3/8/2007 9:45	8.9 e	S	ST	NA	NA	NA	NA	NA	NA	NA	168
	3/26/2007 9:40	0.4e	S	ST	NA	NA	NA	NA	NA	NA	NA	169

Samp. No.	Upper Ward V. Collection Date-Time	ST Precip. (in.)	Precip. Form	Collector Type	H+ (g/ha)	NO3-N (g/ha)	NH4-N (g/ha)	TKN (g/ha)	SRP (g/ha)	DP (g/ha)	TP (g/ha)	Notes
	4/2/2007 10:35	1.33+	S	ST	NA	NA	NA	NA	NA	NA	NA	184
	4/20/2007 9:40	2.39	RS	ST	NA	NA	NA	NA	NA	NA	NA	
	5/18/2007 12:50	3.74		ST	NA	NA	NA	NA	NA	NA	NA	
	6/1/2007 10:45	0.04		ST	NA	NA	NA	NA	NA	NA	NA	
	6/11/2007 14:30	0.79	RS	ST	NA	NA	NA	NA	NA	NA	NA	

Appendix Table 2.a. Precipitation amounts and N, P and H concentrations in wet deposition at the Ward Valley Lake Level Station 7/1/04-6/30/07.

Samp. No.	Ward Valley Wet Collection Date-Time	Precip. (in)	Precip. Form	Collector Type	Wet Amt. (in.)	pH	H+ (µg/l)	(Conc.) NO3-N (µg/l)	NH4-N (µg/l)	TKN (µg/l)	SRP (µg/l)	DP (µg/l)	TP (µg/l)	Notes
1	7/2/2004 11:10	0.02	R	WET	0.02	NA	NA	1391.91	1953.63	NA	3.7	15.39	NA	
2	9/23/2004 15:15	0.06	S	WET	0.06	NA	NA	153.9	68.13	NA	8.82	17.89	NA	
3	10/8/2004 15:30	0.18	R	WET	0.18	NA	NA	346.7	273.4	929.93	1.59	2.5	23.07	
4	10/14/2004 15:35	0.01	R	WET	0.01	NA	NA	511.2	211.52	NA	NA	NA	NA	
5	10/18/2004 16:30	1.83	RS	WET	1.83	5.25	5.62	37.86	4.58	242.69	3.18	9.98	19.96	
6	10/21/2004 15:50	2.8	RS	WET	2.8	5.21	6.17	16.88	16.86	33.74	0.68	2.85	5.85	
7	10/25/2004 11:30	0.38	R	WET	0.38	5.2	6.31	30.71	10.94	207.05	1.14	3.48	5.37	
8	10/29/2004 16:15	1.83	S	WET	1.83	5.15	7.08	33.51	43.4	280.79	2.27	1.9	7.59	
9	11/4/2004 16:00	0.44	RS	WET	0.44	5.02	9.55	148.6	143.64	161.81	1.82	4.74	7.9	
10	11/12/2004 11:20	0.19	RS	WET	0.19	4.88	13.18	65.01	65.99	72.2	1.14	6.32	7.27	
11	11/29/2004 12:55	1.67	S+DF	WET-BULK	1.67	5.21	6.17	21.76	13.14	61.52	1.14	5.7	13.3	16
12	12/7/2004 11:20	1.38	S+DF	WET-BULK	1.38	5.2	6.31	32.1	14.83	57.46	0.68	5.38	8.87	17
13	12/10/2004 11:15	2.06	RS	WET-BULK	0.46	4.9	12.59	62.39	19.48	74.08	4.57	7.29	15.52	18
14	1/3/2005 17:15	6.53	S+DF	WET-BULK	3.08	5.2	6.31	21.34	34.42	75.62	1.68	4.43	8.87	35
15	1/7/2005 16:45	0.47	RS	WET	0.47	5.3	5.01	29.21	17.81	69.04	1.97	5.38	8.87	
16	1/9/2005 11:55	3.29	S+DF	WET-BULK	2.22	5.25	5.6	14.73	15.83	63.93	1.31	4.44	8.08	36
17	1/12/2005 15:15	1.39	RS	WET-BULK	0.67	5.4	3.98	NA	NA	NA	NA	NA	NA	37
18	1/27/2005 15:15	1.12	RS	WET	1.12	4.8	15.85	208.8	171.96	146.08	1.16	4.42	3.71	
19	1/31/2005 14:30	0.56	S	WET	0.56	4.88	13.18	13.93	19.55	70.56	0.69	3.16	5.88	
20	2/8/2005 16:55	0.17	S	WET	0.17	5.25	5.62	167.12	176.18	294.72	2.09	12.08	19.07	
21	2/23/2005 13:20	2.51	RS	WET-BULK	2.09	4.89	12.88	76.51	56.24	81.05	0.92	5.89	8.86	38
22	2/28/2005 17:05	0.46	SDF	WET	0.46	5.35	4.47	15.59	13.18	19.92	0.46	2.22	7.91	39
23	3/2/2005 14:50	0.43	S	WET	0.43	5.34	4.57	16.29	18.98	168.32	NA	4.96	7.59	
	3/7/2005 14:10	T	NA	WET	T	NA	NA	NA	NA	NA	NA	NA	NA	
24	3/21/2005 18:30	2.81	S	WET-BULK	1.04	5.08	8.32	27.33	28.7	43.37	1.39	2.21	5.05	40

Samp. No.	Ward Valley Wet Collection Date-Time	Precip. (in)	Precip. Form	Collector Type	Wet Amt. (in.)	pH	H+ (µg/l)	(Conc.) NO3-N (µg/l)	NH4-N (µg/l)	TKN (µg/l)	SRP (µg/l)	DP (µg/l)	TP (µg/l)	Notes
25	3/30/2005 17:20	5.29	RS	WET	5.29	5.2	6.31	27.27	29.88	44.06	8.54	12.63	7.89	
26	4/5/2005 15:45	0.42	S	WET	0.42	5	10.00	114.03	133.84	234.11	3	8.2	19.25	
27	4/13/2005 17:00	0.94	R?S	WET	0.94	5.1	7.94	57.64	65.26	123.88	1.85	6	10.73	
28	4/25/2005 16:10	0.42	RS	WET	0.42	5.32	4.79	234.57	281	387.04	3.01	5.37	15.49	
29	5/2/2005 16:10	0.66	R	WET	0.66	5.1	7.94	227.08	375.57	389.44	4.75	10.81	14.94	
30	5/6/2005 18:00	0.18	R	WET	0.18	4.8	15.85	169.05	162.08	182.64	2.55	14.3	20.03	
31	5/11/2005 17:15	1.84	RS	WET	1.84	5.2	6.31	33.46	89.49	117.07	1.39	12.4	12.72	
32	5/17/2005 17:35	1.43	RSG	WET	1.43	NA	NA	86.18	80.98	126.09	16.23	2.86	9.2	
33	5/20/2005 16:00	2.81	R	WET	2.81	5.2	6.31	143.9	167.27	222.58	2.21	3.49	4.76	
34	6/13/2005 18:05	1.21	RS	WET	1.21	5.2	6.31	57.01	22.4	55.21	0.46	3.13	NA	
35	6/20/2005 13:25	0.94	RS?	WET	0.94	4.9	12.59	93.26	86.88	113.92	3.69	5.32	NA	
36	7/27/2005 13:45	0.00	R	WET	0.00	NA	NA	30.29	31.83	79.18	3.11	4.69	12.28	73
37	8/17/2005 10:45	0.53	R	WET	0.53	4.35	44.67	319.95	19.33	560.17	NA	32.55	150.67	
38	10/3/2005 12:15	0.22	R	WET	0.22	4.89	12.88	136.15	37.76	131.55	0.80	5.01	12.91	
39	10/18/2005 17:40	0.36	R+S	WET	0.36	4.89	12.88	114.45	59.68	99.31	7.72	11.27	17.00	
40	10/25/2005 16:40	0.66	R	WET	0.66	4.82	15.14	141.60	195.13	300.76	2.75	8.41	21.40	
41	11/7/2005 12:15	1.58	R+S	WET	1.58	5.83	1.48	34.44	1.44	246.84	1.37	2.80	31.33	97
42	11/10/2005 11:10	0.21	R	WET	0.21	5.22	6.03	47.38	2.48	62.14	1.83	7.48	7.79	
43	11/28/2005 12:00	1.29	R+S	WET	1.29	5.20	6.31	51.79	45.34	92.69	0.46	3.46	5.92	
44	11/30/2005 16:05	1.97	R+S	WET	1.97	5.30	5.01	10.84	1.85	27.87	1.37	4.72	7.64	
45	12/2/2005 18:00	5.72	R	WET	5.72	5.00	10.00	18.37	2.68	13.62	0.46	9.23	10.55	98
46	12/15/2005 15:35	0.07	R+S	WET	0.07	NA	NA	10.47	14.75	16.88	<MDL	4.41	10.55	99
47	12/23/2005 17:15	7.42	R	WET	7.42	NA	NA	18.00	3.90	10.59	0.92	4.41	4.24	
48	12/30/2005 17:10	6.42	R+S	WET	6.42	5.30	5.01	23.14	7.27	42.85	1.14	4.57	5.79	
49	1/1/2006 16:15	5.87	R+S+DF	WET	5.87	5.11	7.76	9.00	3.22	26.74	0.46	3.78	4.71	100
50	1/4/2006 17:00	2.90	R+S+DF	WET	2.90	5.49	3.24	13.04	6.37	14.19	0.69	3.15	4.40	100
51	1/13/2006 17:30	0.46	S	WET	0.46	NA	NA	68.63	18.15	86.21	3.71	6.88	15.63	
52	1/15/2006 11:45	1.38	S	WET	1.38	NA	NA	25.12	29.31	62.15	2.32	4.69	15.42	115
53	1/19/2006 14:40	1.84	S+DF	WET	1.84	NA	NA	18.02	15.59	36.09	2.09	4.69	15.42	116

Samp. No.	Ward Valley Wet Collection Date-Time	Precip. (in)	Precip. Form	Collector Type	Wet Amt. (in.)	pH	H+ (µg/l)	(Conc.) NO3-N (µg/l)	NH4-N (µg/l)	TKN (µg/l)	SRP (µg/l)	DP (µg/l)	TP (µg/l)	Notes
54	2/3/2006 14:45	2.54	R+S	WET	2.54	4.89	12.88	31.31	22.94	40.64	1.60	1.58	17.62	
55	2/6/2006 15:15	0.60	R+S	WET	0.60	5.00	10.00	34.95	24.11	39.46	0.68	0.63	21.40	
56	2/24/2006 13:15	0.73	S	WET	0.73	5.20	6.31	NA	NA	NA	NA	NA	NA	
57	3/1/2006 13:30	5.05	R+S	WET	5.05	5.38	4.17	19.24	10.96	24.80	0.91	3.45	16.99	
58	3/3/2006 15:55	0.92	S	WET	0.92	5.23	5.89	30.43	54.19	98.12	1.14	3.46	20.45	117
59	3/8/2006 12:30	1.00	S	WET	1.00	4.91	12.30	38.16	43.22	72.54	1.37	4.08	11.96	
60	3/13/2006 15:00	1.25	S	WET	0.15	NA	NA	106.58	71.61	177.78	2.28	4.08	14.56	118
	3/15/2006 17:00	1.73	S	WET	T	NA	NA	NA	NA	NA	NA	NA	NA	119
61	3/20/2006 12:10	0.39	R+S+DF	DRY	0.39	NA	NA	103.78	106.08	194.52	2.96	4.08	32.54	120
62	3/24/2006 12:15	0.07		WET	0.07	NA	NA	98.52	85.37	NA	5.01	7.85	NA	
63	3/27/2006 9:15	2.03	R+S	WET	2.03	5.20	6.31	24.84	29.46	62.71	2.28	3.45	1.24	
64	3/30/2006 11:45	0.83	R+S	WET	0.83	5.17	6.76	60.03	69.67	101.98	3.64	5.34	4.96	
65	4/6/2006 14:45	4.30	R+S	WET	4.30	5.21	6.17	26.74	20.37	38.96	2.32	8.73	2.79	
66	4/13/2006 15:00	1.28	R+S	WET	1.28	5.19	6.46	138.15	65.20	59.82	2.32	8.73	3.41	
67	4/17/2006 15:00	3.11	S	WET	2.89	5.30	5.01	57.26	146.30	138.11	2.32	7.48	4.96	
68	4/25/2006 10:50	0.59	R	WET	0.59	4.80	15.85	275.72	288.65	274.02	3.94	9.35	13.33	
69	5/1/2006 16:15	0.29	R	WET	0.29	5.08	8.32	130.11	133.12	143.31	1.85	8.42	7.19	
70	5/26/2006 14:35	0.63	R	WET	0.63	NA	NA	193.78	499.30	518.45	0.23	8.74	11.60	
71	6/2/2006 12:10	0.19	S	WET	0.19	4.70	19.95	47.74	29.22	114.35	NA	9.99	9.19	
72	6/16/2006 17:10	0.14	R	WET	0.14	NA	NA	NA	634.03	924.17	1.14	10.30	NA	
73	6/30/2006 17:40	0.10	R	WET	0.10	NA	NA	656.19	789.61	1479.20	13.22	14.36	NA	
74	8/8/2006 16:00	0.04	R	WET	0.04	NA	NA	64.12	34.84	87.21	0.23	4.97	5.59	143
75	9/18/2006 16:50	0.03	SG	WET	0.03	NA	NA	27.99	26.10	49.12	1.15	NA	10.52	144
76	10/3/2006 11:25	0.01	R	WET	0.01	NA	NA	6.09	13.73	60.15	0.45	5.52	7.85	151
77	10/9/2006 15:35	0.27	RS	WET	0.27	NA	NA	213.03	183.68	468.01	1.59	6.74	20.00	
78	10/20/2006 17:45	0.10	R	WET	0.10	NA	NA	147.69	93.93	NA	0.68	3.37	8.57	
79	11/6/2006 13:20	1.34	R	WET	1.34	5.60	2.51	25.06	7.42	54.02	0.91	4.60	3.98	
80	11/9/2006 11:00	0.35	R	WET	0.35	5.69	2.04	NA	NA	47.50	NA	NA	4.28	
81	11/15/2006 14:35	1.96	RS	WET	1.96	4.98	10.47	36.16	28.98	282.51	6.36	7.36	11.01	152

Samp. No.	Ward Valley Wet Collection Date-Time	Precip. (in)	Precip. Form	Collector Type	Wet Amt. (in.)	pH	H+ (µg/l)	(Conc.) NO3-N (µg/l)	NH4-N (µg/l)	TKN (µg/l)	SRP (µg/l)	DP (µg/l)	TP (µg/l)	Notes
82	11/22/2006 11:00	0.05	R	WET	0.05	NA	NA	257.19	127.63	NA	0.91	4.27	NA	
83	11/29/2006 12:50	1.27	S	WET	1.27	5.30	5.01	47.38	48.86	128.62	7.49	10.68	17.33	
84	12/14/2006 16:35	0.70	RS	WET	0.70	5.11	7.76	22.93	NA	65.27	5.75	4.29	8.06	
85	12/20/2006 15:50	0.52	RS	WET	0.52	NA	NA	32.54	NA	282.21	6.33	4.90	8.37	
86	12/28/2006 12:45	2.55	RS	WET	2.55	5.31	4.90	12.52	5.22	98.21	5.49	3.68	8.05	
87	1/5/2007 17:30	2.30	RS	WET	2.30	5.10	7.94	10.58	NA	30.38	12.66	3.68	9.30	
88	2/12/2007 17:30	4.54	RS	WET	4.54	5.20	6.31	18.96	6.07	48.68	2.28	NA	7.07	
89	2/23/2007 11:00	1.08		WET	1.08	NA	NA	61.20	NA	137.67	3.43	NA	9.83	
90	2/27/2007 13:45	4.47+	S	WET	2.81	NA	NA	19.22	NA	40.55	NA	NA	9.52	170
91	3/2/2007 9:30	0.01	S	WET	0.01	NA	NA	NA	NA	NA	NA	NA	NA	171
92	3/26/2007 9:40	0.03	S	WET	0.03	NA	NA	24.34	NA	59.52	0.23	NA	5.24	172
93	3/29/2007 17:20	1.02	S	WET	1.02	5.23	5.89	32.10	NA	91.15	1.03	NA	10.17	
94	4/20/2007 10:10	1.00	S	WET	1.00	NA	NA	64.08	NA	163.99	NA	8.70	10.95	
95	5/10/2007 14:00	2.25	S	WET	2.25	5.20	6.31	54.23	NA	94.92	0.23	NA	6.57	
96	6/1/2007 10:15	0.03	S	WET	0.03	NA	NA	36.59	NA	97.12	NA	NA	8.45	198
97	6/12/2007 12:40	0.37	RS	WET	0.00	NA	NA	NA	NA	NA	NA	NA	NA	185

Appendix Table 2.b. Precipitation loads of N, P and H in wet deposition at the Ward Valley Lake Level Station 7/1/04-6/30/07.

Samp. No.	Ward Valley Wet Lake Level Station Collection Date-Time	Precip. (in)	Precip. Form	Collector Type	Precip. Amt. (in) used for Loading	(Load) H+ (g/ha)	NO3-N (g/ha)	NH4-N (g/ha)	TKN (g/ha)	SRP (g/ha)	DP (g/ha)	TP (g/ha)	Notes
1	7/2/2004 11:10	0.02	R	WET	0.02	NA	7.07	9.92	NA	0.02	0.08	NA	
2	9/23/2004 15:15	0.06	S	WET	0.06	NA	2.35	1.04	NA	0.13	0.27	NA	
3	10/8/2004 15:30	0.18	R	WET	0.18	NA	15.85	12.50	42.52	0.07	0.11	1.05	
4	10/14/2004 15:35	0.01	R	WET	0.01	NA	1.30	0.54	NA	NA	NA	NA	
5	10/18/2004 16:30	1.83	RS	WET	1.83	2.61	17.60	2.13	112.81	1.48	4.64	9.28	
6	10/21/2004 15:50	2.8	RS	WET	2.8	4.39	12.01	11.99	24.00	0.48	2.03	4.16	
7	10/25/2004 11:30	0.38	R	WET	0.38	0.61	2.96	1.06	19.98	0.11	0.34	0.52	
8	10/29/2004 16:15	1.83	S	WET	1.83	3.29	15.58	20.17	130.52	1.06	0.88	3.53	
9	11/4/2004 16:00	0.44	RS	WET	0.44	1.07	16.61	16.05	18.08	0.20	0.53	0.88	
10	11/12/2004 11:20	0.19	RS	WET	0.19	0.64	3.14	3.18	3.48	0.06	0.31	0.35	
11	11/29/2004 12:55	1.67	S+DF	WET-BULK	1.67	2.62	9.23	5.57	26.10	0.48	2.42	5.64	16
12	12/7/2004 11:20	1.38	S+DF	WET-BULK	1.38	2.21	11.25	5.20	20.14	0.24	1.89	3.11	17
13	12/10/2004 11:15	2.06	RS	WET-BULK	0.46	1.47+	7.29+	2.28+	8.66+	0.53+	0.85+	1.81+	18
14	1/3/2005 17:15	6.53	S+DF	WET-BULK	6.53	10.47e	35.39e	57.09e	125.42e	2.79e	7.35e	14.71e	35
15	1/7/2005 16:45	0.47	RS	WET	0.47	0.60	3.49	2.13	8.24	0.24	0.64	1.06	
16	1/9/2005 11:55	3.29	S+DF	WET-BULK	3.29	4.68e	12.31e	13.23e	53.42e	1.09e	3.71e	6.75e	36
17	1/12/2005 15:15	1.39	RS	WET-BULK	0.67	0.68+	NA	NA	NA	NA	NA	NA	37
18	1/27/2005 15:15	1.12	RS	WET	1.12	4.51	59.40	48.92	41.56	0.33	1.26	1.06	
19	1/31/2005 14:30	0.56	S	WET	0.56	1.88	1.98	2.78	10.04	0.10	0.45	0.84	
20	2/8/2005 16:55	0.17	S	WET	0.17	0.24	7.22	7.61	12.73	0.09	0.52	0.82	
21	2/23/2005 13:20	2.51	RS	WET-BULK	2.09	6.84+	40.62+	29.86+	43.03+	0.49+	3.13+	4.70+	38
22	2/28/2005 17:05	0.46	SDF	WET	0.46	0.52	1.82	1.54	2.33	0.05	0.26	0.92	39
23	3/2/2005 14:50	0.43	S	WET	0.43	0.50	1.78	2.07	18.38	NA	0.54	0.83	
	3/7/2005 14:10	T	NA	NA	T	NA	NA	NA	NA	NA	NA	NA	
24	3/21/2005 18:30	2.81	S	WET-BULK	1.04	2.20+	7.22+	7.58+	11.46+	0.37+	0.58+	1.33+	40
25	3/30/2005 17:20	5.29	RS	WET	5.29	8.48	36.64	40.15	59.20	11.47	16.97	10.60	
26	4/5/2005 15:45	0.42	S	WET	0.42	1.07	12.16	14.28	24.97	0.32	0.87	2.05	

Samp. No.	Ward Valley Wet Collection Date-Time	Precip. (in)	Precip. Form	Collector Type	Precip Amt (in) used for Loading	(Load) H+ (g/ha)	NO3-N (g/ha)	NH4-N (g/ha)	TKN (g/ha)	SRP (g/ha)	DP (g/ha)	TP (g/ha)	Samp. No.
27	4/13/2005 17:00	0.94	R?S	WET	0.94	1.90	13.76	15.58	29.58	0.44	1.43	2.56	
28	4/25/2005 16:10	0.42	RS	WET	0.42	0.51	25.02	29.98	41.29	0.32	0.57	1.65	
29	5/2/2005 16:10	0.66	R	WET	0.66	1.33	38.07	62.96	65.29	0.80	1.81	2.50	
30	5/6/2005 18:00	0.18	R	WET	0.18	0.72	7.73	7.41	8.35	0.12	0.65	0.92	
31	5/11/2005 17:15	1.84	RS	WET	1.84	2.95	15.64	41.82	54.71	0.65	5.80	5.94	
32	5/17/2005 17:35	1.43	RSG	WET	1.43	NA	31.30	29.41	45.80	5.90	1.04	3.34	
33	5/20/2005 16:00	2.81	R	WET	2.81	4.50	102.71	119.39	158.86	1.58	2.49	3.40	
34	6/13/2005 18:05	1.21	RS	WET	1.21	1.94	17.52	6.88	16.97	0.14	0.96	NA	
35	6/20/2005 13:25	0.94	RS?	WET	0.94	3.01	22.27	20.74	27.20	0.88	1.27	NA	
36	7/27/2005 13:45	0.00	R	WET	0.00	NA	2.36	2.48	6.17	0.24	0.37	0.96	73
37	8/17/2005 10:45	0.53	R	WET	0.53	6.01	43.07	2.60	75.41	NA	4.38	20.28	
38	10/3/2005 12:15	0.22	R	WET	0.22	0.72	7.61	2.11	7.35	0.04	0.28	0.72	
39	10/18/2005 17:40	0.36	R+S	WET	0.36	1.18	10.47	5.46	9.08	0.71	1.03	1.55	
40	10/25/2005 16:40	0.66	R	WET	0.66	2.54	23.74	32.71	50.42	0.46	1.41	3.59	
41	11/7/2005 12:15	1.58	R+S	WET	1.58	0.59	13.82	0.58	99.06	0.55	1.12	12.57	97
42	11/10/2005 11:10	0.21	R	WET	0.21	0.32	2.53	0.13	3.31	0.10	0.40	0.42	
43	11/28/2005 12:00	1.29	R+S	WET	1.29	2.07	16.97	14.86	30.37	0.15	1.13	1.94	
44	11/30/2005 16:05	1.97	R+S	WET	1.97	2.51	5.42	0.93	13.95	0.69	2.36	3.82	
45	12/2/2005 18:00	5.72	R	WET	5.72	14.53	26.69	3.89	19.79	0.67	13.41	15.33	98
46	12/15/2005 15:35	0.07	R+S	WET	0.07	NA	0.82	1.15	1.32	0.00	0.34	0.82	99
47	12/23/2005 17:15	7.42	R	WET	7.42	NA	33.92	7.35	19.96	1.73	8.31	7.99	
48	12/30/2005 17:10	6.42	R+S	WET	6.42	8.17	37.73	11.86	69.87	1.86	7.45	9.44	
49	1/1/2006 16:15	5.87	R+S+DF	WET	5.87	11.57	13.42	4.80	39.87	0.69	5.64	7.02	100
50	1/4/2006 17:00	2.90	R+S+DF	WET	2.90	2.38	9.61	4.69	10.45	0.51	2.32	3.24	100
51	1/13/2006 17:30	0.46	S	WET	0.46	NA	8.02	2.12	10.07	0.43	0.80	1.83	
52	1/15/2006 11:45	1.38	S	WET	1.38	NA	8.81	10.27	21.78	0.81	1.64	5.41	115
53	1/19/2006 14:40	1.84	S+DF	WET	1.84	NA	8.42	7.29	16.87	0.98	2.19	7.21	116
54	2/3/2006 14:45	2.54	R+S	WET	2.54	8.31	20.20	14.80	26.22	1.03	1.02	11.37	
55	2/6/2006 15:15	0.60	R+S	WET	0.60	1.52	5.33	3.67	6.01	0.10	0.10	3.26	

Samp. No.	Ward Valley Wet Collection Date-Time	Precip. (in)	Precip. Form	Collector Type	Precip Amt (in) used for Loading	H+ (g/ha)	NO3-N (g/ha)	(Load) NH4-N (g/ha)	TKN (g/ha)	SRP (g/ha)	DP (g/ha)	TP (g/ha)	Samp. No.
56	2/24/2006 13:15	0.73	S	WET	0.73	1.17	NA	NA	NA	NA	NA	NA	
57	3/1/2006 13:30	5.05	R+S	WET	5.05	5.35	24.68	14.06	31.81	1.17	4.43	21.79	
58	3/3/2006 15:55	0.92	S	WET	0.92	1.38	7.11	12.66	22.93	0.27	0.81	4.78	117
59	3/8/2006 12:30	1.00	S	WET	1.00	3.12	9.69	10.98	18.43	0.35	1.04	3.04	
60	3/13/2006 15:00	1.25	S	WET	0.15	NA	4.06+	2.73+	6.77+	0.09+	0.16+	0.55+	118
	3/15/2006 17:00	1.73	S	WET	T	NA	NA	NA	NA	NA	NA	NA	119
61	3/20/2006 12:10	0.39	R+S+DF	DRY	0.39	NA	10.28	10.51	19.27	0.29	0.40	3.22	120
62	3/24/2006 12:15	0.07		WET	0.07	NA	1.75	1.52	NA	0.09	0.14	NA	
63	3/27/2006 9:15	2.03	R+S	WET	2.03	3.25	12.81	15.19	32.33	1.18	1.78	0.64	
64	3/30/2006 11:45	0.83	R+S	WET	0.83	1.43	12.66	14.69	21.50	0.77	1.13	1.05	
65	4/6/2006 14:45	4.30	R+S	WET	4.30	6.73	29.21	22.25	42.55	2.53	9.53	3.05	
66	4/13/2006 15:00	1.28	R+S	WET	1.28	2.10	44.92	21.20	19.45	0.75	2.84	1.11	
67	4/17/2006 15:00	3.11	S	WET	3.11	3.96e	45.23e	115.57e	109.10e	1.83e	5.91e	3.92e	
68	4/25/2006 10:50	0.59	R	WET	0.59	2.38	41.32	43.26	41.06	0.59	1.40	2.00	
69	5/1/2006 16:15	0.29	R	WET	0.29	0.61	9.58	9.81	10.56	0.14	0.62	0.53	
70	5/26/2006 14:35	0.63	R	WET	0.63	NA	31.01	79.90	82.96	0.04	1.40	1.86	
71	6/2/2006 12:10	0.19	S	WET	0.19	0.96	2.30	1.41	5.52	NA	0.48	0.44	
72	6/16/2006 17:10	0.14	R	WET	0.14	NA	NA	22.55	32.86	0.04	0.37	NA	
73	6/30/2006 17:40	0.10	R	WET	0.10	NA	16.67	20.06	37.57	0.34	0.36	NA	
74	8/8/2006 16:00	0.04	R	WET	0.04	NA	5.00	2.72	6.80	0.02	0.39	0.44	143
75	9/18/2006 16:50	0.03	SG	WET	0.03	NA	2.18	2.03	3.83	0.09	NA	0.82	144
76	10/3/2006 11:25	0.01	R	WET	0.01	NA	0.47	1.07	4.69	0.04	0.43	0.61	151
77	10/9/2006 15:35	0.27	RS	WET	0.27	NA	14.61	12.60	32.10	0.11	0.46	1.37	
78	10/20/2006 17:45	0.10	R	WET	0.10	NA	3.75	2.39	NA	0.02	0.09	0.22	
79	11/6/2006 13:20	1.34	R	WET	1.34	0.85	8.53	2.53	18.39	0.31	1.57	1.35	
80	11/9/2006 11:00	0.35	R	WET	0.35	0.18	NA	NA	4.22	NA	NA	0.38	
81	11/15/2006 14:35	1.96	RS	WET	1.96	5.21	18.00	14.43	140.64	3.17	3.66	5.48	152
82	11/22/2006 11:00	0.05	R	WET	0.05	NA	3.27	1.62	NA	0.01	0.05	NA	
83	11/29/2006 12:50	1.27	S	WET	1.27	1.62	15.28	15.76	41.49	2.42	3.45	5.59	

Ward Valley Wet (Load)

Samp. No.	Collection Date-Time	Precip. (in)	Precip. Form	Collector Type	Precip Amt (in) used for Loading	H+ (g/ha)	NO3-N (g/ha)	NH4-N (g/ha)	TKN (g/ha)	SRP (g/ha)	DP (g/ha)	TP (g/ha)	Samp. No.
84	12/14/2006 16:35	0.70	RS	WET	0.70	1.38	4.08	NA	11.61	1.02	0.76	1.43	
85	12/20/2006 15:50	0.52	RS	WET	0.52	NA	4.30	NA	37.27	0.84	0.65	1.11	
86	12/28/2006 12:45	2.55	RS	WET	2.55	3.17	8.11	3.38	63.61	3.56	2.38	5.21	
87	1/5/2007 17:30	2.30	RS	WET	2.30	4.64	6.18	NA	17.75	7.40	2.15	5.43	
88	2/12/2007 17:30	4.54	RS	WET	4.54	7.28	21.86	7.00	56.14	2.63	NA	8.15	
89	2/23/2007 11:00	1.08		WET	1.08	NA	16.79	NA	37.77	0.94	NA	2.70	
90	2/27/2007 13:45	4.47+	S	WET	4.47+	NA	21.82	NA	46.04	NA	NA	10.81	170
91	3/2/2007 9:30	0.01	S	WET	0.01	NA	NA	NA	NA	NA	NA	NA	171
92	3/26/2007 9:40	0.03	S	WET	0.03	NA	1.90	NA	4.64	0.02	NA	0.41	172
93	3/29/2007 17:20	1.02	S	WET	1.02	1.53	8.32	NA	23.62	0.27	NA	2.63	
94	4/20/2007 10:10	1.00	S	WET	1.00	NA	16.28	NA	41.65	NA	2.21	2.78	
95	5/10/2007 14:00	2.25	S	WET	2.25	3.61	30.99	NA	54.25	0.13	NA	3.75	
96	6/1/2007 10:15	0.03	S	WET	0.03	NA	2.85	NA	7.57	NA	NA	0.06	198
97	6/12/2007 12:40	0.37	RS	WET	0.00	NA	NA	NA	NA	NA	NA	NA	185

Appendix Table 3.a. N and P concentrations in dry deposition at the Ward Valley Lake Level Station 7/1/04-6/30/07.

Samp. No.	Ward Valley Dry Start Date-Time	Collection Date-Time	Vol. Liters	Precip. Form	Collector Type	pH	H+ (µg/l)	Conc. NO3-N (µg/l)	NH4-N (µg/l)	TKN (µg/l)	SRP (µg/l)	DP (µg/l)	TP (µg/l)	Notes
1	6/24/2004 15:55	7/2/2004 11:10	2.745	DF	DRY	5.00	10.00	57.81	1.44	285.43	2.54	8.31	32.79	
2	7/2/2004 11:10	7/19/2004 10:25	0.798	DF	DRY	NA	NA	19.82	13.58	956.26	13.13	32.12	80.29	
3	7/19/2004 10:25	7/28/2004 10:45	2.219	DF	DRY	NA	NA	10.72	7.11	373.67	1.15	7.24	19.84	
4	7/28/2004 10:45	8/9/2004 17:00	1.455	DF	DRY	NA	NA	17.13	10.09	1524.91	0.17	9.87	13.27	
5	8/9/2004 17:00	8/16/2004 13:20	2.913	DF	DRY	NA	NA	14.49	2.52	326.21	0.14	4.46	9.48	
6	8/16/2004 13:20	9/1/2004 16:00	1.153	DF	DRY	NA	NA	32.60	12.35	112.93	11.24	30.13	88.67	
7	9/1/2004 16:00	9/9/2004 15:00	2.894	DF	DRY	NA	NA	9.41	7.01	201.99	0.17	6.59	5.93	
8	9/9/2004 15:00	9/17/2004 15:45	2.745	DF	DRY	NA	NA	5.78	7.45	269.45	3.23	10.99	19.60	
9	9/17/2004 15:45	9/24/2004 14:35	2.982	DF	DRY	4.85	14.13	12.86	21.00	218.64	4.25	10.99	13.38	
10	9/24/2004 14:35	10/5/2004 18:07	3.082	DF	DRY	NA	NA	16.01	NES	231.10	1.36	1.25	5.93	
11	10/5/2004 18:07	10/14/2004 15:35	3.250	DF	DRY	NA	NA	1.44	2.60	194.79	1.14	3.12	10.92	
12	10/14/2004 15:35	10/25/2004 11:30	3.767	DF	DRY	NA	NA	1.36	11.38	356.16	0.46	50.30	69.16	
13	10/25/2004 11:30	10/29/2004 16:15	3.675	DF	DRY	NA	NA	4.54	6.33	44.29	0.91	3.48	4.74	
14	10/29/2004 16:15	11/12/2004 11:20	3.827	DF	DRY	NA	NA	20.09	75.21	294.20	0.68	3.79	9.80	23
15	11/12/2004 11:20	11/22/2004 12:00	2.723	DF	DRY	NA	NA	10.88	9.76	356.50	0.57	4.43	11.72	
16	11/22/2004 12:00	11/29/2004 12:55	3.464	DF	DRY	NA	NA	6.71	9.76	35.30	5.25	5.38	8.24	24
17	11/29/2004 12:55	12/10/2004 11:15	4.790	DF+RS	DRY-BULK	5.38	4.17	16.32	11.87	124.52	1.60	6.02	11.09	25
18	12/10/2004 11:15	12/20/2004 11:15	2.920	DF	DRY	NA	NA	15.24	34.24	81.80	0.69	4.75	20.59	
19	12/20/2004 11:15	12/27/2004 12:30	2.893	DF	DRY	NA	NA	5.77	35.54	54.65	NA	4.75	13.62	
20	12/27/2004 12:30	1/3/2005 17:15	3.933	DF+S	DRY-BULK	NA	NA	13.85	23.37	62.46	0.44	4.75	8.08	50
21	1/3/2005 17:15	1/12/2005 15:15	5.093	DF+RS	DRY-BULK	5.25	5.62	NA	NA	NA	NA	NA	NA	51
22	1/12/2005 15:15	1/21/2005 11:45	3.230	DF	DRY	NA	NA	7.88	20.85	44.37	1.16	5.58	6.19	
23	1/21/2005 11:45	1/24/2005 16:30	3.646	DF	DRY	NA	NA	5.03	9.13	24.97	0.46	2.21	2.17	
24	1/24/2005 16:30	2/4/2005 17:00	2.903	DF	DRY	NA	NA	9.48	3.02	43.41	NA	12.40	17.80	
25	2/4/2005 17:00	2/15/2005 10:30	2.920	DF	DRY	NA	NA	NA	18.05	74.49	0.70	11.13	15.26	
26	2/15/2005 10:30	2/23/2005 13:20	4.250	DF+RS	DRY-BULK	NA	NA	NA	NA	NA	NA	NA	NA	50

Samp. No.	Ward Valley Dry Start Date-Time	Collection Date-Time	Vol. Liters	Precip. Form	Collector Type	pH	H+ (µg/l)	Conc. NO3-N (µg/l)	NH4-N (µg/l)	TKN (µg/l)	SRP (µg/l)	DP (µg/l)	TP (µg/l)	Notes
27	2/23/2005 13:20	3/7/2005 14:10	5.042	DF	DRY	NA	NA	5.10	9.69	41.80	1.15	5.35	11.80	
28	3/7/2005 14:10	3/9/2005 11:25	3.500	DF	DRY	NA	NA	1.71	5.37	34.57	1.15	3.78	4.72	53
29	3/9/2005 11:25	3/18/2005 14:10	2.328	DF	DRY	NA	NA	15.09	14.01	51.15	12.70	6.00	20.83	
30	3/18/2005 14:10	3/22/2005 12:15	5.946	DF+RS	DRY-BULK	NA	NA	NA	NA	NA	NA	NA	NA	52
31	3/22/2005 12:15	3/31/2005 17:15	0.510	DF+S	DRY	NA	NA	39.65	33.29	199.21	8.54	13.88	36.92	54
32	3/31/2005 17:15	4/14/2005 14:00	3.165	DF	DRY	NA	NA	27.66	18.05	116.62	2.54	5.05	14.86	55
33	4/14/2005 14:00	4/25/2005 16:10	1.744	DF	DRY	NA	NA	49.32	47.05	137.22	3.70	6.63	18.34	
34	4/25/2005 16:10	5/4/2005 15:15	2.424	DF	DRY	NA	NA	27.08	32.96	70.27	1.16	12.71	NA	56
35	5/4/2005 15:15	5/20/2005 16:00	2.116	DF	DRY	NA	NA	62.55	48.41	117.17	4.64	5.08	10.79	
36	5/20/2005 16:00	5/26/2005 11:00	2.902	DF	DRY	NA	NA	6.57	14.74	90.26	8.81	15.87	32.57	
37	5/26/2005 11:00	6/8/2005 14:00	1.952	DF	DRY	NA	NA	18.04	82.91	957.79	32.77	76.68	184.14	57
38	6/8/2005 14:00	6/20/2005 13:25	2.780	DF	DRY	NA	NA	19.40	130.81	519.75	11.54	16.28	27.23	
39	6/20/2005 13:25	7/1/2005 15:00	2.065	DF	DRY	NA	NA	16.68	17.12	462.01	8.08	14.40	14.16	74
40	7/1/2005 15:00	7/15/2005 14:30	1.534	DF	DRY	NA	NA	9.53	19.75	1314.54	19.11	59.31	NA	
41	7/15/2005 14:30	7/27/2005 13:45	1.852	DF	DRY	NA	NA	13.27	6.57	647.65	12.66	15.34	6.60	
42	7/27/2005 13:45	8/5/2005 17:15	2.332	DF	DRY	NA	NA	12.08	29.84	599.52	5.76	8.14	NA	
43	8/5/2005 17:15	8/17/2005 10:45	2.255	DF	DRY	NA	NA	10.38	9.67	364.78	4.84	8.14	16.26	
44	8/17/2005 10:45	8/26/2005 17:40	2.282	DF	DRY	NA	NA	12.76	41.90	381.26	2.76	9.08	14.07	
45	8/26/2005 17:40	9/6/2005 16:45	2.230	DF	DRY	NA	NA	66.88	4.84	355.70	9.31	18.78	37.46	
46	9/6/2005 16:45	9/15/2005 13:30	3.092	DF	DRY	NA	NA	12.25	21.07	475.76	1.14	5.01	NA	
47	9/15/2005 13:30	9/28/2005 18:15	2.880	DF	DRY	NA	NA	C	C	C	C	C	C	186
48	9/28/2005 18:15	10/6/2005 15:20	3.380	DF	DRY	NA	NA	9.53	13.39	188.79	2.95	5.32	12.91	
49	10/6/2005 15:20	10/20/2005 12:30	3.138	DF	DRY	NA	NA	C	C	C	C	C	C	101
50	10/20/2005 12:30	11/10/2005 11:10	3.623	DF	DRY	NA	NA	C	C	C	C	C	C	102
51	11/10/2005 11:10	11/18/2005 18:00	3.077	DF	DRY	NA	NA	7.16	3.52	111.55	0.23	3.15	12.46	
52	11/18/2005 18:00	12/6/2005 17:00	1.753	DF	DRY	NA	NA	18.00	27.06	154.91	17.75	27.72	41.73	
53	12/6/2005 17:00	12/15/2005 15:35	3.409	DF	DRY	NA	NA	9.73	12.46	25.45	0.23	4.41	14.89	
54	12/15/2005 15:35	12/23/2005 17:15	3.083	DF	DRY	NA	NA	11.20	3.00	20.92	0.23	5.35	6.60	
55	12/23/2005 17:15	1/4/2006 17:00	3.663	DF	DRY	NA	NA	9.92	8.62	14.57	1.60	C	5.03	100

Samp. No.	Ward Valley Dry Start Date-Time	Collection Date-Time	Vol. Liters	Precip. Form	Collector Type	pH	H+ (µg/l)	Conc. NO3-N (µg/l)	NH4-N (µg/l)	TKN (µg/l)	SRP (µg/l)	DP (µg/l)	TP (µg/l)	Notes
56	1/4/2006 17:00	1/19/2006 14:40	3.316	DF	DRY	NA	NA	12.56	7.49	58.21	2.09	5.63	27.06	121
57	1/19/2006 14:40	2/6/2006 15:15	4.092	DF	DRY	NA	NA	19.84	10.69	33.32	3.87	4.75	20.77	122
58	2/6/2006 15:15	2/17/2006 15:15	2.400	DF	DRY	NA	NA	31.22	26.67	70.50	3.24	2.22	43.74	123
59	2/17/2006 15:15	2/24/2006 13:15	3.515	DF	DRY	NA	NA	13.65	23.90	22.52	3.24	1.27	21.40	
	2/24/2006 13:15	3/1/2006 13:30	NA	DF	DRY	NA	NA	136.67	122.58	179.98	1.59	6.28	25.17	
60	3/1/2006 13:30	3/8/2006 12:30	3.045	DF	DRY	NA	NA	20.72	20.11	161.56	1.14	3.45	19.19	
61	3/8/2006 12:30	3/15/2006 17:00	6.881	DF+S	DRY-BULK	NA	NA	28.29	21.29	56.93	1.37	4.08	1.55	124
	3/15/2006 17:00	3/20/2006 12:10	0.630	DF+S	DRY-BULK			103.78	106.08	194.52	2.96	4.08	32.54	138
62	3/20/2006 12:10	3/27/2006 9:15	0.500	DF+R+S	DRY-BULK	5.19	6.46	50.33	41.29	138.20	2.51	4.40	40.90	129
63	3/27/2006 9:15	4/6/2006 14:45	3.082	DF	DRY	NA	NA	21.99	20.81	52.36	0.93	8.88	4.96	
64	4/6/2006 14:45	4/25/2006 10:50	1.736	DF	DRY	NA	NA	110.58	106.08	183.04	1.62	8.73	10.54	
65	4/25/2006 10:50	5/5/2006 15:30	1.980	DF	DRY	NA	NA	4.05	7.21	90.21	2.76	4.76	20.38	133
66	5/5/2006 15:30	5/15/2006 12:10	1.701	DF	DRY	NA	NA	3.40	2.80	161.51	1.84	6.04	32.48	
67	5/15/2006 12:10	5/26/2006 14:35	2.781	DF	DRY	NA	NA	24.86	46.87	636.16	10.96	34.97	111.83	
68	5/26/2006 14:35	6/12/2006 14:50	1.689	DF	DRY	NA	NA	18.00	29.20	1655.31	18.89	76.49	169.42	132
69	6/12/2006 14:50	6/23/2006 15:00	2.315	DF	DRY	NA	NA	6.62	17.58	560.61	10.49	36.22	62.81	134
	6/23/2006 15:00	6/23/2006 18:25	NA			NA	NA	NA	NA	NA	NA	NA	NA	
70	6/23/2006 18:25	6/30/2006 17:40	3.044	DF	DRY	NA	NA	5.09	8.27	597.51	0.46	13.11	46.11	135
71	6/30/2006 17:40	7/11/2006 16:45	1.618	DF	DRY	NA	NA	12.05	22.88	507.37	10.26	27.16	NA	
72	7/11/2006 16:45	7/28/2006 10:20	0.864	DF	DRY	NA	NA	23.60	59.55	1682.26	16.00	28.13	75.98	
73	7/28/2006 10:20	8/11/2006 14:15	1.510	DF	DRY	NA	NA	33.07	NA	648.84	6.65	NA	34.48	
74	8/11/2006 14:15	8/21/2006 16:55	2.465	DF	DRY	NA	NA	15.78	13.96	652.57	0.46	4.61	22.90	
75	8/21/2006 16:55	9/1/2006 12:10	2.275	DF	DRY	NA	NA	31.38	92.74	571.09	3.21	NA	12.82	
76	9/1/2006 12:10	9/13/2006 14:40	NA	DF	DRY	NA	NA	19.51	12.99	557.00	NA	3.38	11.76	187
77	9/13/2006 14:40	9/29/2006 17:20	2.617	DF	DRY	NA	NA	20.59	7.00	434.64	9.09	11.34	40.93	
78	9/29/2006 17:20	10/20/2006 17:45	2.888	DF	DRY	NA	NA	29.72	13.73	589.68	0.45	2.76	12.85	
79	10/20/2006 17:45	11/1/2006 11:25	3.337	DF	DRY	NA	NA	2.51	5.10	NA	2.27	3.68	18.05	153
80	11/1/2006 11:25	11/6/2006 13:20	3.855	DF	DRY	NA	NA	3.58	4.16	671.39	0.23	2.92	5.20	154
81	11/6/2006 13:20	11/17/2006 17:00	3.724	DF	DRY	NA	NA	1.69	2.29	53.50	9.30	15.25	25.99	154

Samp. No.	Ward Valley Dry Start Date-Time	Collection Date-Time	Vol. Liters	Precip. Form	Collector Type	pH	H+ (µg/l)	Conc. NO3-N (µg/l)	NH4-N (µg/l)	TKN (µg/l)	SRP (µg/l)	DP (µg/l)	TP (µg/l)	Notes
82	11/17/2006 17:00	12/1/2006 9:55	2.752	DF	DRY	NA	NA	8.12	12.81	26.71	2.04	4.88	18.57	
83	12/1/2006 9:55	12/8/2006 10:05	3.140	DF	DRY	NA	NA	4.94	12.43	29.96	7.09	17.43	15.50	
84	12/8/2006 10:05	12/23/2006 14:30	2.351	DF	DRY	NA	NA	31.57	12.22	127.13	4.37	3.06	21.71	155
85	12/23/2006 14:30	1/5/2007 17:30	3.330	DF	DRY	NA	NA	1.76	NA	88.50	29.91	24.50	45.89	
86	1/5/2007 17:30	1/20/2007 13:00	2.482	DF	DRY	NA	NA	12.07	NA	28.25	NA	NA	30.64	
87	1/20/2007 13:00	1/24/2007 13:40	3.620	DF	DRY	NA	NA	3.17	0.77	NA	6.63	8.22	15.48	173
88	1/24/2007 13:40	2/1/2007 14:30	3.055	DF	DRY	NA	NA	10.41	NA	77.53	2.40	7.27	7.84	
89	2/1/2007 14:30	2/12/2007 17:30	3.511	DF	DRY	NA	NA	13.76	NA	44.62	2.74	7.59	13.52	
90	2/12/2007 17:30	2/23/2007 15:30	2.450	DF	DRY	NA	NA	18.87	NA	217.31	2.51	NA	14.39	
91	2/23/2007 15:30	3/2/2007 9:30	3.994	DF	DRY	NA	NA	3.90	NA	37.18	NA	NA	5.55	188
92	3/2/2007 9:30	3/15/2007 14:00	1.870	DF	DRY	NA	NA	NA	NA	161.49	NA	NA	30.66	
93	3/15/2007 14:00	3/29/2007 17:20	2.780	DF	DRY	NA	NA	30.16	NA	58.86	1.59	NA	20.96	
94	3/29/2007 17:20	4/6/2007 10:35	2.700	DF	DRY	NA	NA	6.88	NA	97.33	0.35	NA	11.40	
95	4/6/2007 10:35	4/20/2007 10:10	2.544	DF	DRY	NA	NA	24.15	NA	96.24	NA	8.53	15.33	
96	4/20/2007 10:10	5/4/2007 10:00	1.680	DF	DRY	NA	NA	35.94	NA	348.33	NA	NA	28.78	
97	5/4/2007 10:00	5/18/2007 14:20	NA	DF	DRY	NA	NA	NA	NA	NA	NA	NA	NA	
98	5/18/2007 14:20	6/1/2007 10:15	1.366	DF	DRY	NA	NA	31.58	NA	520.25	30.26	NA	96.34	189
99	6/1/2007 10:15	6/18/2007 18:20	1.879	DF	DRY	NA	NA	NA	NA	NA	NA	NA	NA	
100	6/18/2007 18:20	6/25/2007 15:45	2.553	DF	DRY	NA	NA	6	4.24	1075.12	1.59	6	47	
101	6/25/2007 15:45	6/26/2007 15:40	3.770	DF	DRY	NA	NA	9	5.08	104.55	0.45	3	5	
102	6/26/2007 15:40	6/27/2007 13:17	4.005	DF	DRY	NA	NA	16	8.89	559.39	0.68	2	3	
103	6/27/2007 13:17	6/28/2007 13:59	4.156	DF	DRY	NA	NA	9	3.81	132.36	0.45	2	4	

Appendix Table 3.b. N and P loads in dry deposition at the Ward Valley Lake Level Station 7/1/04-6/30/07.

Samp. No.	Ward Valley Dry Start Date-Time	Collection Date-Time	Vol. Liters	Precip. Form	Collector Type	H+ (g/ha)	NO3-N (g/ha)	NH4-N (g/ha)	(Load) TKN (g/ha)	SRP (g/ha)	DP (g/ha)	TP (g/ha)	Notes
1	6/24/2004 15:55	7/2/2004 11:10	2.745	DF	DRY	5.42	31.32	0.78	154.63	1.38	4.50	17.76	
2	7/2/2004 11:10	7/19/2004 10:25	0.798	DF	DRY	NA	3.12	2.14	150.60	2.07	5.06	12.64	
3	7/19/2004 10:25	7/28/2004 10:45	2.219	DF	DRY	NA	4.69	3.11	163.64	0.50	3.17	8.69	
4	7/28/2004 10:45	8/9/2004 17:00	1.455	DF	DRY	NA	4.92	2.90	437.88	0.05	2.83	3.81	
5	8/9/2004 17:00	8/16/2004 13:20	2.913	DF	DRY	NA	8.33	1.45	187.54	0.08	2.56	5.45	
6	8/16/2004 13:20	9/1/2004 16:00	1.153	DF	DRY	NA	7.42	2.81	25.70	2.56	6.86	20.18	
7	9/1/2004 16:00	9/9/2004 15:00	2.894	DF	DRY	NA	5.37	4.00	115.37	0.10	3.76	3.39	
8	9/9/2004 15:00	9/17/2004 15:45	2.745	DF	DRY	NA	3.13	4.04	145.97	1.75	5.95	10.62	
9	9/17/2004 15:45	9/24/2004 14:35	2.982	DF	DRY	8.31	7.57	12.36	128.67	2.50	6.47	7.87	
10	9/24/2004 14:35	10/5/2004 18:07	3.082	DF	DRY	NA	9.74	NES	140.57	0.83	0.76	3.61	
11	10/5/2004 18:07	10/14/2004 15:35	3.250	DF	DRY	NA	0.92	1.67	124.94	0.73	2.00	7.00	
12	10/14/2004 15:35	10/25/2004 11:30	3.767	DF	DRY	NA	1.01	8.46	264.78	0.34	37.39	51.42	
13	10/25/2004 11:30	10/29/2004 16:15	3.675	DF	DRY	NA	3.29	4.59	32.12	0.66	2.52	3.44	
14	10/29/2004 16:15	11/12/2004 11:20	3.827	DF	DRY	NA	15.17	56.80	222.20	0.51	2.86	7.40	23
15	11/12/2004 11:20	11/22/2004 12:00	2.723	DF	DRY	NA	5.85	5.25	191.58	0.31	2.38	6.30	
16	11/22/2004 12:00	11/29/2004 12:55	3.464	DF	DRY	NA	4.59	6.67	24.13	3.59	3.68	5.63	24
17	11/29/2004 12:55	12/10/2004 11:15	4.790	DF+RS	D-BULK	3.94	15.43	11.22	117.71	1.51	5.69	10.48	25
18	12/10/2004 11:15	12/20/2004 11:15	2.920	DF	DRY	NA	8.78	19.73	47.14	0.40	2.74	11.87	
19	12/20/2004 11:15	12/27/2004 12:30	2.893	DF	DRY	NA	3.29	20.29	31.20	NA	2.71	7.78	
20	12/27/2004 12:30	1/3/2005 17:15	3.933	DF+S	D-BULK	NA	10.75	18.14	48.48	0.34	3.69	6.27	50
21	1/3/2005 17:15	1/12/2005 15:15	5.093	DF+RS	D-BULK	5.65	NA	NA	NA	NA	NA	NA	51
22	1/12/2005 15:15	1/21/2005 11:45	3.230	DF	DRY	NA	5.02	13.29	28.28	0.74	3.56	3.95	
23	1/21/2005 11:45	1/24/2005 16:30	3.646	DF	DRY	NA	3.62	6.57	17.97	0.33	1.59	1.56	
24	1/24/2005 16:30	2/4/2005 17:00	2.903	DF	DRY	NA	5.43	1.73	24.87	NA	7.10	10.20	
25	2/4/2005 17:00	2/15/2005 10:30	2.920	DF	DRY	NA	NA	10.40	42.93	0.40	6.41	8.79	
26	2/15/2005 10:30	2/23/2005 13:20	4.250	DF+RS	D-BULK	NA	NA	NA	NA	NA	NA	NA	50

Samp. No.	Ward Valley Dry Start Date-Time	Collection Date-Time	Vol. Liters	Precip. Form	Collector Type	H+ (g/ha)	NO3-N (g/ha)	NH4-N (g/ha)	TKN (g/ha)	SRP (g/ha)	DP (g/ha)	TP (g/ha)	Notes
27	2/23/2005 13:20	3/7/2005 14:10	5.042	DF	DRY	NA	5.07	9.64	41.59	1.14	5.32	11.74	
28	3/7/2005 14:10	3/9/2005 11:25	3.500	DF	DRY	NA	1.18	3.71	23.88	0.79	2.61	3.26	53
29	3/9/2005 11:25	3/18/2005 14:10	2.328	DF	DRY	NA	6.93	6.44	23.50	5.83	2.76	9.57	
30	3/18/2005 14:10	3/22/2005 12:15	5.946	DF+RS	D-BULK	NA	NA	NA	NA	NA	NA	NA	52
31	3/22/2005 12:15	3/31/2005 17:15	0.510	DF+S	DRY	NA	3.99	3.35	20.05	0.86	1.40	3.72	54
32	3/31/2005 17:15	4/14/2005 14:00	3.165	DF	DRY	NA	17.28	11.27	72.84	1.59	3.15	9.28	55
33	4/14/2005 14:00	4/25/2005 16:10	1.744	DF	DRY	NA	16.98	16.19	47.23	1.27	2.28	6.31	
34	4/25/2005 16:10	5/4/2005 15:15	2.424	DF	DRY	NA	12.95	15.77	33.62	0.55	6.08	NA	56
35	5/4/2005 15:15	5/20/2005 16:00	2.116	DF	DRY	NA	26.12	20.22	48.93	1.94	2.12	4.51	
36	5/20/2005 16:00	5/26/2005 11:00	2.902	DF	DRY	NA	3.76	8.44	51.69	5.05	9.09	18.65	
37	5/26/2005 11:00	6/8/2005 14:00	1.952	DF	DRY	NA	6.95	31.94	368.98	12.62	29.54	70.94	57
38	6/8/2005 14:00	6/20/2005 13:25	2.780	DF	DRY	NA	10.64	71.77	285.16	6.33	8.93	14.94	
39	6/20/2005 13:25	7/1/2005 15:00	2.065	DF	DRY	NA	6.80	6.98	188.28	3.29	5.87	5.77	74
40	7/1/2005 15:00	7/15/2005 14:30	1.534	DF	DRY	NA	2.89	5.98	397.96	5.79	17.96	NA	
41	7/15/2005 14:30	7/27/2005 13:45	1.852	DF	DRY	NA	4.85	2.40	236.71	4.63	5.61	2.41	
42	7/27/2005 13:45	8/5/2005 17:15	2.332	DF	DRY	NA	5.56	13.73	275.92	2.65	3.75	NA	
43	8/5/2005 17:15	8/17/2005 10:45	2.255	DF	DRY	NA	4.62	4.30	162.34	2.15	3.62	7.24	
44	8/17/2005 10:45	8/26/2005 17:40	2.282	DF	DRY	NA	5.75	18.87	171.70	1.24	4.09	6.34	
45	8/26/2005 17:40	9/6/2005 16:45	2.230	DF	DRY	NA	29.43	2.13	156.54	4.10	8.27	16.49	
46	9/6/2005 16:45	9/15/2005 13:30	3.092	DF	DRY	NA	7.48	12.86	290.32	0.70	3.06	NA	
47	9/15/2005 13:30	9/28/2005 18:15	2.880	DF	DRY	NA	C	C	C	C	C	C	186
48	9/28/2005 18:15	10/6/2005 15:20	3.380	DF	DRY	NA	6.36	8.93	125.93	1.97	3.55	8.61	
49	10/6/2005 15:20	10/20/2005 12:30	3.138	DF	DRY	NA	C	C	C	C	C	C	101
50	10/20/2005 12:30	11/10/2005 11:10	3.623	DF	DRY	NA	C	C	C	C	C	C	102
51	11/10/2005 11:10	11/18/2005 18:00	3.077	DF	DRY	NA	4.35	2.14	67.74	0.14	1.91	7.57	
52	11/18/2005 18:00	12/6/2005 17:00	1.753	DF	DRY	NA	6.23	9.36	53.59	6.14	9.59	14.44	
53	12/6/2005 17:00	12/15/2005 15:35	3.409	DF	DRY	NA	6.55	8.38	17.12	0.15	2.97	10.02	
54	12/15/2005 15:35	12/23/2005 17:15	3.083	DF	DRY	NA	6.81	1.83	12.73	0.14	3.26	4.02	
55	12/23/2005 17:15	1/4/2006 17:00	3.663	DF	DRY	NA	7.17	6.23	10.53	1.16	C	3.64	100

Samp. No.	Ward Valley Dry Start Date-Time	Collection Date-Time	Vol. Liters	Precip. Form	Collector Type	H+ (g/ha)	NO3-N (g/ha)	NH4-N (g/ha)	TKN (g/ha)	SRP (g/ha)	DP (g/ha)	TP (g/ha)	Notes
56	1/4/2006 17:00	1/19/2006 14:40	3.316	DF	DRY	NA	8.22	4.90	38.09	1.37	3.68	17.71	121
57	1/19/2006 14:40	2/6/2006 15:15	4.092	DF	DRY	NA	16.02	8.63	26.91	3.13	3.84	16.77	122
58	2/6/2006 15:15	2/17/2006 15:15	2.400	DF	DRY	NA	14.79	12.63	33.39	1.53	1.05	20.72	123
59	2/17/2006 15:15	2/24/2006 13:15	3.515	DF	DRY	NA	9.47	16.58	15.62	2.25	0.88	14.85	
	2/24/2006 13:15	3/1/2006 13:30	NA	DF	DRY	NA	NA	NA	NA	NA	NA	NA	
60	3/1/2006 13:30	3/8/2006 12:30	3.045	DF	DRY	NA	12.45	12.08	97.09	0.69	2.07	11.53	
61	3/8/2006 12:30	3/15/2006 17:00	6.881	DF+S	D-BULK	NA	38.42	28.91	77.31	1.86	5.54	2.10	124
	3/15/2006 17:00	3/20/2006 12:10	0.630	DF+S	D-BULK		10.32	10.55	19.34	0.29	0.41	3.24	138
62	3/20/2006 12:10	3/27/2006 9:15	0.500	DF+R+S	D-BULK	NA	3.97	3.26	10.91	0.20	0.35	3.23	129
63	3/27/2006 9:15	4/6/2006 14:45	3.082	DF	DRY	NA	13.38	12.66	31.85	0.57	5.40	3.02	
64	4/6/2006 14:45	4/25/2006 10:50	1.736	DF	DRY	NA	37.89	36.34	62.71	0.56	2.99	3.61	
65	4/25/2006 10:50	5/5/2006 15:30	1.980	DF	DRY	NA	1.58	2.82	35.25	1.08	1.86	7.96	133
66	5/5/2006 15:30	5/15/2006 12:10	1.701	DF	DRY	NA	1.14	0.94	54.22	0.62	2.03	10.90	
67	5/15/2006 12:10	5/26/2006 14:35	2.781	DF	DRY	NA	13.64	25.72	349.15	6.02	19.19	61.38	
68	5/26/2006 14:35	6/12/2006 14:50	1.689	DF	DRY	NA	6.00	9.73	551.76	6.30	25.50	56.47	132
69	6/12/2006 14:50	6/23/2006 15:00	2.315	DF	DRY	NA	3.02	8.03	256.13	4.79	16.55	28.70	134
	6/23/2006 15:00	6/23/2006 18:25	NA	DF	DRY	NA	NA	NA	NA	NA	NA	NA	
70	6/23/2006 18:25	6/30/2006 17:40	3.044	DF	DRY	NA	3.06	4.97	358.95	0.28	7.88	27.70	135
71	6/30/2006 17:40	7/11/2006 16:45	1.618	DF	DRY	NA	3.85	7.31	162.01	3.28	8.67	NA	
72	7/11/2006 16:45	7/28/2006 10:20	0.864	DF	DRY	NA	4.02	10.15	286.85	2.73	4.80	12.96	
73	7/28/2006 10:20	8/11/2006 14:15	1.510	DF	DRY	NA	9.85	NA	193.36	1.98	NA	10.28	
74	8/11/2006 14:15	8/21/2006 16:55	2.465	DF	DRY	NA	7.68	6.79	317.46	0.22	2.24	11.14	
75	8/21/2006 16:55	9/1/2006 12:10	2.275	DF	DRY	NA	14.09	41.64	256.41	1.44	NA	5.76	
76	9/1/2006 12:10	9/13/2006 14:40	NA	DF	DRY	NA	NA	NA	NA	NA	NA	NA	187
77	9/13/2006 14:40	9/29/2006 17:20	2.617	DF	DRY	NA	10.63	3.62	224.48	4.69	5.86	21.14	
78	9/29/2006 17:20	10/20/2006 17:45	2.888	DF	DRY	NA	16.94	7.83	336.09	0.26	1.57	7.32	
79	10/20/2006 17:45	11/1/2006 11:25	3.337	DF	DRY	NA	1.65	3.36	NA	1.49	2.42	11.89	153
80	11/1/2006 11:25	11/6/2006 13:20	3.855	DF	DRY	NA	2.72	3.16	510.79	0.17	2.22	3.96	154
81	11/6/2006 13:20	11/17/2006 17:00	3.724	DF	DRY	NA	1.24	1.68	39.32	6.83	11.21	19.10	154

Samp. No.	Ward Valley Dry Start Date-Time	Collection Date-Time	Vol. Liters	Precip. Form	Collector Type	H+ (g/ha)	NO3-N (g/ha)	NH4-N (g/ha)	TKN (g/ha)	SRP (g/ha)	DP (g/ha)	TP (g/ha)	Notes
82	11/17/2006 17:00	12/1/2006 9:55	2.752	DF	DRY	NA	4.41	6.96	14.51	1.11	2.65	10.09	
83	12/1/2006 9:55	12/8/2006 10:05	3.140	DF	DRY	NA	3.06	7.70	18.57	4.39	10.80	9.61	
84	12/8/2006 10:05	12/23/2006 14:30	2.351	DF	DRY	NA	14.65	5.67	58.99	2.03	1.42	10.07	155
85	12/23/2006 14:30	1/5/2007 17:30	3.330	DF	DRY	NA	1.16	NA	58.16	19.66	16.10	30.16	
86	1/5/2007 17:30	1/20/2007 13:00	2.482	DF	DRY	NA	5.91	NA	13.84	NA	NA	15.01	
87	1/20/2007 13:00	1/24/2007 13:40	3.620	DF	DRY	NA	2.26	0.55	NA	4.74	5.87	11.06	173
88	1/24/2007 13:40	2/1/2007 14:30	3.055	DF	DRY	NA	6.28	NA	46.74	1.45	4.38	4.73	
89	2/1/2007 14:30	2/12/2007 17:30	3.511	DF	DRY	NA	9.53	NA	30.92	1.90	5.26	9.37	
90	2/12/2007 17:30	2/23/2007 15:30	2.450	DF	DRY	NA	9.12	NA	105.07	1.21	NA	6.96	
91	2/23/2007 15:30	3/2/2007 9:30	3.994	DF	DRY	NA	3.07	NA	29.31	0.18	NA	4.37	188
92	3/2/2007 9:30	3/15/2007 14:00	1.870	DF	DRY	NA	NA	NA	59.60	NA	NA	11.32	
93	3/15/2007 14:00	3/29/2007 17:20	2.780	DF	DRY	NA	16.55	NA	32.29	0.87	11.47	11.50	
94	3/29/2007 17:20	4/6/2007 10:35	2.700	DF	DRY	NA	3.67	NA	51.86	0.19	NA	6.07	
95	4/6/2007 10:35	4/20/2007 10:10	2.544	DF	DRY	NA	12.12	NA	48.32	NA	4.28	7.70	
96	4/20/2007 10:10	5/4/2007 10:00	1.680	DF	DRY	NA	11.92	NA	115.49	NA	NA	9.54	
97	5/4/2007 10:00	5/18/2007 14:20	NA	DF	DRY	NA	NA	NA	NA	NA	NA	NA	
98	5/18/2007 14:20	6/1/2007 10:15	1.366	DF	DRY	NA	8.51	NA	140.25	8.16	NA	25.97	189
99	6/1/2007 10:15	6/18/2007 18:20	1.879	DF	DRY	NA	NA	NA	NA	NA	NA	NA	
100	6/18/2007 18:20	6/25/07 1545	2.553	DF	DRY	NA	3.02	2.14	541.69	0.80	3.02	23.68	
101	6/25/07 1545	6/26/07 1540	3.770	DF	DRY	NA	5.21▪	0.80▪	70.35▪	0.33▪	0.74▪	2.23▪	200
102	6/26/07 1540	6/27/2007 13:17	4.005	DF	DRY	NA	11.07▪	3.87▪	434.24▪	0.54▪	0.00▪	0.79▪	200
103	6/27/2007 13:17	6/28/2007 13:59	4.156	DF	DRY	NA	5.74▪	0▪	100.36▪	0.37▪	0.00▪	1.64▪	200

Appendix Table 3.c. N and P loading per day in dry deposition at the Ward Valley Lake Level Station 7/1/04-6/30/07.

Samp. No.	Ward Valley Dry Start Date-Time	Collection Date-Time	Vol. Liters	Precip. Form	Collector Type	NO3-N (g/ha/d)	NH4-N (g/ha/d)	TKN (g/ha/d)	SRP (g/ha/d)	DP (g/ha/d)	TP (g/ha/d)	Notes
1	6/24/2004 15:55	7/2/2004 11:10	2.745	DF	DRY	4.01	0.10	19.82	0.18	0.58	2.28	
2	7/2/2004 11:10	7/19/2004 10:25	0.798	DF	DRY	0.18	0.13	8.88	0.12	0.30	0.75	
3	7/19/2004 10:25	7/28/2004 10:45	2.219	DF	DRY	0.52	0.35	18.15	0.06	0.35	0.96	
4	7/28/2004 10:45	8/9/2004 17:00	1.455	DF	DRY	0.40	0.24	35.72	0.00	0.23	0.31	
5	8/9/2004 17:00	8/16/2004 13:20	2.913	DF	DRY	1.22	0.21	27.39	0.01	0.37	0.80	
6	8/16/2004 13:20	9/1/2004 16:00	1.153	DF	DRY	0.46	0.17	1.60	0.16	0.43	1.25	
7	9/1/2004 16:00	9/9/2004 15:00	2.894	DF	DRY	0.68	0.50	14.50	0.01	0.47	0.43	
8	9/9/2004 15:00	9/17/2004 15:45	2.745	DF	DRY	0.39	0.50	18.18	0.22	0.74	1.32	
9	9/17/2004 15:45	9/24/2004 14:35	2.982	DF	DRY	1.09	1.78	18.51	0.36	0.93	1.13	
10	9/24/2004 14:35	10/5/2004 18:07	3.082	DF	DRY	0.87	NA	12.61	0.07	0.07	0.32	
11	10/5/2004 18:07	10/14/2004 15:35	3.250	DF	DRY	0.10	0.19	14.05	0.08	0.22	0.79	
12	10/14/2004 15:35	10/25/2004 11:30	3.767	DF	DRY	0.09	0.78	24.45	0.03	3.45	4.75	
13	10/25/2004 11:30	10/29/2004 16:15	3.675	DF	DRY	0.78	1.09	7.65	0.16	0.60	0.82	
14	10/29/2004 16:15	11/12/2004 11:20	3.827	DF	DRY	1.10	4.12	16.11	0.04	0.21	0.54	23
15	11/12/2004 11:20	11/22/2004 12:00	2.723	DF	DRY	0.58	0.52	19.11	0.03	0.24	0.63	
16	11/22/2004 12:00	11/29/2004 12:55	3.464	DF	DRY	0.65	0.95	3.43	0.51	0.52	0.80	24
17	11/29/2004 12:55	12/10/2004 11:15	4.790	DF+RS	D-BULK	1.41	1.03	10.77	0.14	0.52	0.96	25
18	12/10/2004 11:15	12/20/2004 11:15	2.920	DF	DRY	0.88	1.97	4.71	0.04	0.27	1.19	
19	12/20/2004 11:15	12/27/2004 12:30	2.893	DF	DRY	0.47	2.88	4.42	NA	0.38	1.10	
20	12/27/2004 12:30	1/3/2005 17:15	3.933	DF+S	D-BULK	1.49	2.52	6.74	0.05	0.51	0.87	50
21	1/3/2005 17:15	1/12/2005 15:15	5.093	DF+RS	D-BULK	NA	NA	NA	NA	NA	NA	51
22	1/12/2005 15:15	1/21/2005 11:45	3.230	DF	DRY	0.57	1.50	3.19	0.08	0.40	0.45	
23	1/21/2005 11:45	1/24/2005 16:30	3.646	DF	DRY	1.13	2.05	5.62	0.10	0.50	0.49	
24	1/24/2005 16:30	2/4/2005 17:00	2.903	DF	DRY	0.49	0.16	2.26	NA	0.64	0.93	
25	2/4/2005 17:00	2/15/2005 10:30	2.920	DF	DRY	NA	0.97	4.00	0.04	0.60	0.82	
26	2/15/2005 10:30	2/23/2005 13:20	4.250	DF+RS	D-BULK	NA	NA	NA	NA	NA	NA	50

Samp. No.	Ward Valley Dry Start Date-Time	Collection Date-Time	Vol. Liters	Precip. Form	Collector Type	NO3-N (g/ha/d)	NH4-N (g/ha/d)	TKN (g/ha/d)	SRP (g/ha/d)	DP (g/ha/d)	TP (g/ha/d)	Notes
27	2/23/2005 13:20	3/7/2005 14:10	5.042	DF	DRY	0.42	0.80	3.46	0.10	0.44	0.98	
28	3/7/2005 14:10	3/9/2005 11:25	3.500	DF	DRY	0.63	1.97	12.67	0.42	1.38	1.73	53
29	3/9/2005 11:25	3/18/2005 14:10	2.328	DF	DRY	0.76	0.71	2.58	0.64	0.30	1.05	
30	3/18/2005 14:10	3/22/2005 12:15	5.946	DF+RS	D-BULK	NA	NA	NA	NA	NA	NA	52
31	3/22/2005 12:15	3/31/2005 17:15	0.510	DF+S	DRY	0.43	0.36	2.18	0.09	0.15	0.40	54
32	3/31/2005 17:15	4/14/2005 14:00	3.165	DF	DRY	1.25	0.81	5.25	0.11	0.23	0.67	55
33	4/14/2005 14:00	4/25/2005 16:10	1.744	DF	DRY	1.53	1.46	4.26	0.11	0.21	0.57	
34	4/25/2005 16:10	5/4/2005 15:15	2.424	DF	DRY	1.45	1.76	3.75	0.06	0.68	NA	56
35	5/4/2005 15:15	5/20/2005 16:00	2.116	DF	DRY	1.63	1.26	3.05	0.12	0.13	0.28	
36	5/20/2005 16:00	5/26/2005 11:00	2.902	DF	DRY	0.65	1.46	8.93	0.87	1.57	3.22	
37	5/26/2005 11:00	6/8/2005 14:00	1.952	DF	DRY	0.53	2.43	28.11	0.96	2.25	5.40	57
38	6/8/2005 14:00	6/20/2005 13:25	2.780	DF	DRY	0.89	5.99	23.81	0.53	0.75	1.25	
39	6/20/2005 13:25	7/1/2005 15:00	2.065	DF	DRY	0.61	0.63	17.01	0.30	0.53	0.52	74
40	7/1/2005 15:00	7/15/2005 14:30	1.534	DF	DRY	0.21	0.43	28.47	0.41	1.28	NA	
41	7/15/2005 14:30	7/27/2005 13:45	1.852	DF	DRY	0.41	0.20	19.78	0.39	0.47	0.20	
42	7/27/2005 13:45	8/5/2005 17:15	2.332	DF	DRY	0.61	1.50	30.17	0.29	0.41	NA	
43	8/5/2005 17:15	8/17/2005 10:45	2.255	DF	DRY	0.39	0.37	13.84	0.18	0.31	0.62	
44	8/17/2005 10:45	8/26/2005 17:40	2.282	DF	DRY	0.62	2.03	18.49	0.13	0.44	0.68	
45	8/26/2005 17:40	9/6/2005 16:45	2.230	DF	DRY	2.69	0.19	14.28	0.37	0.75	1.50	
46	9/6/2005 16:45	9/15/2005 13:30	3.092	DF	DRY	0.84	1.45	32.75	0.08	0.34	NA	
47	9/15/2005 13:30	9/28/2005 18:15	2.880	DF	DRY	C	C	C	C	C	C	186
48	9/28/2005 18:15	10/6/2005 15:20	3.380	DF	DRY	0.81	1.13	15.98	0.25	0.45	1.09	
49	10/6/2005 15:20	10/20/2005 12:30	3.138	DF	DRY	C	C	C	C	C	C	101
50	10/20/2005 12:30	11/10/2005 11:10	3.623	DF	DRY	C	C	C	C	C	C	102
51	11/10/2005 11:10	11/18/2005 18:00	3.077	DF	DRY	0.52	0.26	8.18	0.02	0.23	0.91	
52	11/18/2005 18:00	12/6/2005 17:00	1.753	DF	DRY	0.35	0.52	2.98	0.34	0.53	0.80	
53	12/6/2005 17:00	12/15/2005 15:35	3.409	DF	DRY	0.73	0.94	1.92	0.02	0.33	1.12	
54	12/15/2005 15:35	12/23/2005 17:15	3.083	DF	DRY	0.84	0.23	1.58	0.02	0.40	0.50	
55	12/23/2005 17:15	1/4/2006 17:00	3.663	DF	DRY	0.60	0.52	0.88	0.10	C	0.30	100

Samp. No.	Ward Valley Dry Start Date-Time	Collection Date-Time	Vol. Liters	Precip. Form	Collector Type	NO3-N (g/ha/d)	NH4-N (g/ha/d)	TKN (g/ha/d)	SRP (g/ha/d)	DP (g/ha/d)	TP (g/ha/d)	Notes
56	1/4/2006 17:00	1/19/2006 14:40	3.316	DF	DRY	0.55	0.33	2.56	0.09	0.25	1.19	121
57	1/19/2006 14:40	2/6/2006 15:15	4.092	DF	DRY	0.89	0.48	1.49	0.17	0.21	0.93	122
58	2/6/2006 15:15	2/17/2006 15:15	2.400	DF	DRY	1.34	1.15	3.04	0.14	0.10	1.88	123
59	2/17/2006 15:15	2/24/2006 13:15	3.515	DF	DRY	1.37	2.40	2.26	0.32	0.13	2.15	
	2/24/2006 13:15	3/1/2006 13:30	NA	DF	DRY	NA	NA	NA	NA	NA	NA	
60	3/1/2006 13:30	3/8/2006 12:30	3.045	DF	DRY	1.79	1.74	13.95	0.10	0.30	1.66	
61	3/8/2006 12:30	3/15/2006 17:00	6.881	DF+S	D-BULK	5.35	4.02	10.76	0.26	0.77	0.29	124
	3/15/2006 17:00	3/20/2006 12:10	0.630	DF+S	D-BULK	2.15	2.20	4.03	0.06	0.08	0.67	138
62	3/20/2006 12:10	3/27/2006 9:15	0.500	DF+R+S	D-BULK	0.58	0.47	1.59	0.03	0.05	0.47	129
63	3/27/2006 9:15	4/6/2006 14:45	3.082	DF	DRY	1.31	1.24	3.11	0.06	0.53	0.29	
64	4/6/2006 14:45	4/25/2006 10:50	1.736	DF	DRY	2.01	1.93	3.33	0.03	0.16	0.19	
65	4/25/2006 10:50	5/5/2006 15:30	1.980	DF	DRY	0.16	0.28	3.46	0.11	0.18	0.78	133
66	5/5/2006 15:30	5/15/2006 12:10	1.701	DF	DRY	0.12	0.10	5.50	0.06	0.21	1.11	
67	5/15/2006 12:10	5/26/2006 14:35	2.781	DF	DRY	1.23	2.32	31.45	0.54	1.73	5.53	
68	5/26/2006 14:35	6/12/2006 14:50	1.689	DF	DRY	0.35	0.57	32.44	0.37	1.50	3.32	132
69	6/12/2006 14:50	6/23/2006 15:00	2.315	DF	DRY	0.27	0.73	23.27	0.44	1.50	2.61	134
	6/23/2006 15:00	6/23/2006 18:25	NA	DF	DRY	NA	NA	NA	NA	NA	NA	
70	6/23/2006 18:25	6/30/2006 17:40	3.044	DF	DRY	0.44	0.71	51.51	0.04	1.13	3.97	135
71	6/30/2006 17:40	7/11/2006 16:45	1.618	DF	DRY	0.35	0.67	14.78	0.30	0.79	NA	
72	7/11/2006 16:45	7/28/2006 10:20	0.864	DF	DRY	0.24	0.61	17.14	0.16	0.29	0.77	
73	7/28/2006 10:20	8/11/2006 14:15	1.510	DF	DRY	0.70	NA	13.65	0.14	NA	0.73	
74	8/11/2006 14:15	8/21/2006 16:55	2.465	DF	DRY	0.76	0.67	31.40	0.02	0.22	1.10	
75	8/21/2006 16:55	9/1/2006 12:10	2.275	DF	DRY	1.30	3.85	23.74	0.13	NA	0.53	
76	9/1/2006 12:10	9/13/2006 14:40	NA	DF	DRY	NA	NA	NA	NA	NA	NA	187
77	9/13/2006 14:40	9/29/2006 17:20	2.617	DF	DRY	0.66	0.22	13.93	0.29	0.36	1.31	
78	9/29/2006 17:20	10/20/2006 17:45	2.888	DF	DRY	0.81	0.37	15.99	0.01	0.07	0.35	
79	10/20/2006 17:45	11/1/2006 11:25	3.337	DF	DRY	0.14	0.29	NA	0.13	0.21	1.01	153
80	11/1/2006 11:25	11/6/2006 13:20	3.855	DF	DRY	0.54	0.62	100.55	0.03	0.44	0.78	154
81	11/6/2006 13:20	11/17/2006 17:00	3.724	DF	DRY	0.11	0.15	3.53	0.61	1.00	1.71	154

Samp. No.	Ward Valley Dry Start Date-Time	Collection Date-Time	Vol. Liters	Precip. Form	Collector Type	NO3-N (g/ha/d)	NH4-N (g/ha/d)	TKN (g/ha/d)	SRP (g/ha/d)	DP (g/ha/d)	TP (g/ha/d)	Notes
82	11/17/2006 17:00	12/1/2006 9:55	2.752	DF	DRY	0.32	0.51	1.06	0.08	0.19	0.74	
83	12/1/2006 9:55	12/8/2006 10:05	3.140	DF	DRY	0.44	1.10	2.65	0.63	1.54	1.37	
84	12/8/2006 10:05	12/23/2006 14:30	2.351	DF	DRY	0.96	0.37	3.88	0.13	0.09	0.66	155
85	12/23/2006 14:30	1/5/2007 17:30	3.330	DF	DRY	0.09	NA	4.43	1.50	1.23	2.30	
86	1/5/2007 17:30	1/20/2007 13:00	2.482	DF	DRY	0.40	NA	0.93	NA	NA	1.01	
87	1/20/2007 13:00	1/24/2007 13:40	3.620	DF	DRY	0.56	0.14	NA	1.18	1.46	2.75	173
88	1/24/2007 13:40	2/1/2007 14:30	3.055	DF	DRY	0.78	NA	5.82	0.18	0.55	0.59	
89	2/1/2007 14:30	2/12/2007 17:30	3.511	DF	DRY	0.86	NA	2.78	0.17	0.47	0.84	
90	2/12/2007 17:30	2/23/2007 15:30	2.450	DF	DRY	0.84	NA	9.62	0.11	NA	0.64	
91	2/23/2007 15:30	3/2/2007 9:30	3.994	DF	DRY	0.46	NA	4.34	0.03	NA	0.65	188
92	3/2/2007 9:30	3/15/2007 14:00	1.870	DF	DRY	NA	NA	4.52	NA	NA	0.86	
93	3/15/2007 14:00	3/29/2007 17:20	2.780	DF	DRY	1.17	NA	2.28	0.06	0.81	0.81	
94	3/29/2007 17:20	4/6/2007 10:35	2.700	DF	DRY	0.47	NA	6.72	0.02	NA	0.79	
95	4/6/2007 10:35	4/20/2007 10:10	2.544	DF	DRY	0.87	NA	3.46	NA	0.31	0.55	
96	4/20/2007 10:10	5/4/2007 10:00	1.680	DF	DRY	0.85	NA	8.25	NA	NA	0.68	
97	5/4/2007 10:00	5/18/2007 14:20	NA	DF	DRY	NA	NA	NA	NA	NA	NA	
98	5/18/2007 14:20	6/1/2007 10:15	1.366	DF	DRY	0.62	NA	10.14	0.59	NA	1.88	189
99	6/1/2007 10:15	6/18/2007 18:20	1.879	DF	DRY	NA	NA	NA	NA	NA	NA	
100	6/18/2007 18:20	6/25/07 1545	2.553	DF	DRY	0.44	0.31	78.59	0.12	0.44	3.44	
101	6/25/07 1545	6/26/07 1540	3.770	DF	DRY	5.23▪	0.81▪	70.59▪	0.34▪	0.75▪	2.24▪	200
102	6/26/07 1540	6/27/2007 13:17	4.005	DF	DRY	12.29▪	4.29▪	482.11▪	0.60▪	0.00▪	0.88▪	200
103	6/27/2007 13:17	6/28/2007 13:59	4.156	DF	DRY	5.58▪	0.00▪	97.52▪	0.36▪	0.00▪	1.59▪	200

Appendix Table 4.a. Precipitation amounts, pH, N and P concentrations in bulk deposition collected in Snow Tube collector at the Mid-lake Buoy (TB-1) Station 7/1/04-6/30/07.

No.	Mid-lake Start Date-Time	Snow Tube Collection Date-Time	Precip. (in.)	Precip. Form	Collector Type	pH	H+ (µg/l)	(Conc.) NO3-N (µg/l)	NH4-N (µg/l)	TKN (µg/l)	SRP (µg/l)	DP (µg/l)	TP (µg/l)	Notes
1	6/24/2004 13:00	7/2/2004 14:14	0.00	DF	ST	NA	NA	43.80	24.46	174.48	15.73	19.86	32.18	2
	7/2/2004 14:14	7/17/2004 11:25	0.00	DF	ST	NA	NA	NA	NA	NA	NA	NA	NA	2
	7/17/2004 11:25	7/27/2004 11:10	0.00	DF	ST	NA	NA	NA	NA	NA	NA	NA	NA	2
2	7/27/2004 11:10	8/9/2004 9:55	T	R+DF	ST	NA	NA	87.73	21.72	141.24	0.34	7.64	15.48	2
3	8/9/2004 9:55	8/16/2004 11:00	0.00	DF	ST	NA	NA	50.10	11.28	81.25	0.97	5.09	9.16	2
	8/16/2004 11:00	8/31/2004 8:40	0.00	DF	ST	NA	NA	NA	NA	NA	NA	NA	NA	
4	8/31/2004 8:40	9/9/2004 12:40	0.00	DF	ST	NA	NA	25.45	13.18	216.23	3.93	7.22	14.00	2
5	9/9/2004 12:40	9/17/2004 9:05	0.00	DF	ST	NA	NA	9.51	7.42	81.30	0.14	5.34	0.94	2
6	9/17/2004 9:05	9/24/2004 9:45	0.02	RS+DF	ST	NA	NA	395.50	63.71	224.85	8.62	14.91	28.62	5
	9/24/2004 9:45	10/5/2004 12:35	0.00	DF	ST	NA	NA	NA	NA	NA	NA	NA	NA	
	10/5/2004 12:35	10/14/2004 10:20	0.00	DF	ST	NA	NA	NA	NA	NA	NA	NA	NA	2
7	10/14/2004 10:20	10/22/2004 11:10	1.95+	DF+RS	ST	4.97	10.72	410.70	213.62	321.42	23.19	28.13	56.57	28
8	10/22/2004 11:10	10/29/2004 11:40	0.84	DF+S	ST	4.90	12.59	264.78	140.57	243.03	14.55	17.07	32.24	
9	10/29/2004 11:40	11/15/2004 13:50	0.37	DF+RS	ST	4.42	38.02	807.00	532.02	835.70	19.10	24.02	40.77	
10	11/15/2004 13:50	11/29/2004 15:45	0.61	DF+S	ST	4.90	12.59	333.70	128.15	244.83	6.39	10.45	29.78	
11	11/29/2004 15:45	12/10/2004 14:00	0.88	DF+RS	ST	4.99	10.23	199.49	58.81	207.90	8.22	9.50	26.92	
12	12/10/2004 14:00	12/24/2004 8:30	0.00	DF	ST	NA	NA	28.12	29.91	NA	2.30	5.07	NA	2
13	12/24/2004 8:30	1/6/2005 11:40	0.54+	DF+S	ST	NA	NA	114.30	65.90	779.52	2.98	5.38	22.81	28
14	1/6/2005 11:40	1/13/2005 13:50	0.43+	DF+RS	ST	5.13	7.41	NA	NA	NA	NA	NA	NA	28
15	1/13/2005 13:50	1/24/2005 15:50	0.01	DF+R	ST	NA	NA	235.00	70.57	128.21	2.31	2.84	3.40	41
16	1/24/2005 15:50	2/4/2005 16:30	0.01+	DF+RS	ST	5.20	6.31	27.47	4.29	45.66	0.23	2.22	10.81	42
17	2/4/2005 16:30	2/24/2005 14:25	0.53+	DF+RS	ST	4.51	30.90	419.90	358.42	411.56	5.75	11.15	18.67	28
18	2/24/2005 14:25	3/9/2005 10:40	0.34	DF+S	ST	4.60	25.12	270.00	294.48	430.41	5.08	9.13	13.85	
19	3/9/2005 10:40	3/16/2005 10:23	T	DF+T	ST	NA	NA	272.70	9.26	36.80	3.69	10.10	10.73	43
20	3/16/2005 10:23	3/24/2005 10:05	0.03+	DF+RS	ST	NA	NA	7.13	6.45	43.37	1.62	4.74	10.73	44

No.	Mid-lake Start Date-Time	Snow Tube Collection Date-Time	Precip. (in.)	Precip. Form	Collector Type	pH	H+ (µg/l)	(Conc.) NO3-N (µg/l)	NH4-N (µg/l)	TKN (µg/l)	SRP (µg/l)	DP (µg/l)	TP (µg/l)	Notes
21	3/24/2005 10:05	3/31/2005 9:35	0.39+	DF+RS	ST	NA	NA	193.42	127.24	217.86	5.08	10.10	17.67	28
22	3/31/2005 9:35	4/14/2005 13:20	0.03	DF+S	ST	NA	NA	28.63	45.96	160.16	9.25	15.79	23.71	
23	4/14/2005 13:20	4/22/2005 15:00	0.02	DF+RS	ST	NA	NA	31.33	38.34	73.30	2.54	4.10	9.48	46
24	4/22/2005 15:00	5/25/2005 16:20	0.69	DF+RSG	ST	NA	NA	409.25	432.57	818.17	39.89	48.24	74.26	
25	5/25/2005 16:20	6/8/2005 8:35	0.07	DF+RS	ST	NA	NA	148.06	100.96	311.33	15.12	21.28	NA	48
26	6/8/2005 8:35	6/20/2005 11:34	0.16	DF+RS	ST	NA	NA	443.33	613.02	816.60	16.85	30.67	31.79	
27	6/20/2005 11:34	6/29/2005 10:50	0.00	DF	ST	NA	NA	22.97	48.33	92.17	5.31	6.57	NA	49
28	6/29/2005 10:50	7/13/2005 12:49	0.00	DF	ST	NA	NA	20.42	47.23	304.00	17.27	20.03	60.91	
	7/13/2005 12:49	7/27/2005 8:55	0.00	DF	ST	NA	NA	C	C	C	C	C	C	92
29	7/27/2005 8:55	8/6/2005 10:50	0.01	R+DF	ST	NA	NA	NA	NA	NA	NA	NA	NA	75
30	8/6/2005 10:50	8/18/2005 7:28	NA	R+DF	ST	NA	NA	80.84	114.12	437.95	44.21	48.83	NA	90
31	8/18/2005 7:28	8/26/2005 13:46	0.00	DF	ST	NA	NA	28.93	80.13	120.04	6.22	6.89	11.57	91
	8/26/2005 13:46	9/6/2005 12:35	0.00	DF	ST	NA	NA	NA	NA	NA	NA	NA	NA	93
32	9/6/2005 12:35	9/15/2005 15:32	0.00	DF	ST	NA	NA	25.53	71.35	280.85	2.73	6.89	NA	72
33	9/15/2005 15:32	9/27/2005 12:05	0.11	R+S+DF	ST	NA	NA	C	C	C	C	C	C	76
34	9/27/2005 12:05	10/6/2005 13:00	0.00	DF	ST	NA	NA	16.17	62.58	62.59	1.82	5.01	10.39	103
35	10/6/2005 13:00	10/20/2005 13:15	0.15	R+S+DF	ST	5.30	5.01	C	C	C	C	C	C	104
	10/20/2005 13:15	11/10/2005 12:55	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	105
	11/10/2005 12:55	11/18/2005 10:05	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	106
	11/18/2005 10:05	12/6/2005 13:02	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	107
	12/6/2005 13:02	12/23/2005 12:30	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	105
	12/23/2005 12:30	1/4/2006 12:47	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	105
36	1/4/2006 12:47	1/24/2006 12:35	0.37	S+DF	ST	5.20	6.31	526.32	100.40	336.31	3.19	10.63	44.37	
37	1/24/2006 12:35	2/6/2006 13:25	0.59+	R+S+DF	ST	NA	NA	147.82	68.43	131.89	1.37	0.95	26.12	125
38	2/6/2006 13:25	2/23/2006 9:50	0.12	S+DF	ST	NA	NA	68.63	75.46	92.67	2.55	0.32	5.27	126
39	2/23/2006 9:50	3/8/2006 12:15	1.66	R+S+DF	ST	4.90	12.59	128.95	77.48	180.83	3.42	5.65	19.51	
40	3/8/2006 12:15	4/6/2006 10:45	0.06+	R+S+DF	ST	NA	NA	8.04	9.38	27.78	1.39	6.86	3.72	127
41	4/6/2006 10:45	4/21/2006 10:15	0.18	R+S+DF	ST	NA	NA	581.99	783.90	NA	11.13	18.70	NA	
42	4/21/2006 10:15	5/5/2006 12:55	0.53	R+DF	ST	4.29	51.29	NA	557.32	586.96	18.97	28.91	47.02	

No.	Mid-lake Start Date-Time	Snow Tube Collection Date-Time	Precip. (in.)	Precip. Form	Collector Type	pH	H+ (µg/l)	(Conc.) NO3-N (µg/l)	NH4-N (µg/l)	TKN (µg/l)	SRP (µg/l)	DP (µg/l)	TP (µg/l)	Notes
43	5/5/2006 12:55	6/14/2006 9:45	0.20	R+DF	ST	NA	NA	493.91	589.89	843.46	15.62	33.72	59.74	136
44	6/14/2006 9:45	6/23/2006 12:25	0.00	DF	ST	NA	NA	7.30	23.51	283.27	15.16	33.41	55.15	137
	6/23/2006 12:25	6/29/2006 10:05	0.00	DF	ST	NA	NA	NA	NA	NA	NA	NA	NA	
45	6/29/2006 10:05	7/10/2006 9:30	0.01	R+DF	ST	NA	NA	122.24	324.69	673.05	44.77	60.57	98.35	145
46	7/10/2006 9:30	8/2/2006 14:45	0.04	R+DF	ST	NA	NA	188.75	884.63	2553.83	NA	203.79	342.96	146
47	8/2/2006 14:45	8/15/2006 9:40	0.00	DF	ST	NA	NA	36.47	41.40	216.08	11.58	17.21	39.00	147
48	8/15/2006 9:40	9/1/2006 8:00	0.00	DF	ST	NA	NA	29.69	44.67	363.00	9.17	23.05	45.50	147
49	9/1/2006 8:00	9/13/2006 10:05	0.00	DF	ST	NA	NA	20.36	16.27	258.49	11.92	NA	43.33	147
50	9/13/2006 10:05	9/29/2006 9:00	0.00	DF	ST	NA	NA	54.42	32.68	126.66	4.77	11.96	34.05	147
51	9/29/2006 9:00	10/13/2006 10:35	0.18	R+DF	ST	NA	NA	726.82	401.36	849.51	60.20	79.09	175.38	156
	10/13/2006 10:35	10/27/2006 12:05	0.02	R+DF	ST	NA	NA	C	C	C	C	C	C	157
52	10/27/2006 12:05	11/6/2006 11:12	0.41	R+DF	ST	4.60	25.12	449.24	NA	1118.81	32.25	48.20	56.61	158
53	11/6/2006 11:12	11/17/2006 10:16	0.53	RS+DF	ST	4.48	33.11	431.47	222.07	1090.59	23.14	35.08	38.84	159
54	11/17/2006 10:16	12/7/2006 14:43	0.10	S+DF	ST	4.91	12.30	170.19	69.68	188.05	4.80	10.41	22.28	160
55	12/7/2006 14:43	12/19/2006 11:38	0.16	RS+DF	ST	NA	NA	261.90	122.27	368.04	9.66	14.40	31.32	161
56	12/19/2006 11:38	1/9/2007 9:45	0.06+	RS+DF	ST	NA	NA	17.64	0.32	78.52	8.97	4.74	19.22	174
57	1/9/2007 9:45	1/23/2007 11:44	0.01	DF	ST	NA	NA	34.39	NA	8.22	7.32	6.95	15.48	175
58	1/23/2007 11:44	2/1/2007 12:45	0.00	DF	ST	NA	NA	7.23	6.98	13.73	2.06	5.37	5.86	147
59	2/1/2007 12:45	2/12/2007 11:04	1.6e	RS+DF	ST	NA	NA	365.08	129.51	60.87	2.97	15.33	49.16	176
60	2/12/2007 11:04	3/2/2007 9:18	0.19	S+DF	ST	NA	NA	601.41	NA	933.56	3.52	NA	51.46	
61	3/2/2007 9:18	3/15/2007 10:00	0.01	DF	ST	NA	NA	24.69	NA	51.27	NA	NA	8.94	177
62	3/15/2007 10:00	4/6/2007 14:20	0.01	S+DF	ST	NA	NA	188.71	NA	189.46	2.28	NA	26.81	190
63	4/6/2007 14:20	5/10/2007 14:41	0.12+	R+S+DF	ST	NA	NA	197.25	NA	NA	23.46	NA	NA	191
64	5/10/2007 14:41	5/31/2007 10:30	0.01	DF	ST	NA	NA	6.69	NA	NA	16.65	NA	NA	192

Appendix Table 4.b. Precipitation amounts, pH, N and P loads in bulk deposition collected in Snow Tube collector at the Mid-lake Buoy (TB-1) Station 7/1/04-6/30/07.

Samp. No.	Mid-lake Start Date-Time	Snow Tube Collection Date-Time	Precip. (in.)	Precip. Form	Collector Type	(Load) H+ (g/ha)	NO3-N (g/ha)	NH4-N (g/ha)	TKN (g/ha)	SRP (g/ha)	DP (g/ha)	TP (g/ha)	Notes
1	6/24/2004 13:00	7/2/2004 14:14	0.00	DF	ST	NA	6.75	3.77	26.89	2.42	3.06	4.96	2
	7/2/2004 14:14	7/17/2004 11:25	0.00	DF	ST	NA	NA	NA	NA	NA	NA	NA	2
	7/17/2004 11:25	7/27/2004 11:10	0.00	DF	ST	NA	NA	NA	NA	NA	NA	NA	2
2	7/27/2004 11:10	8/9/2004 9:55	T	R+DF	ST	NA	13.52	3.35	21.77	0.05	1.18	2.39	2
3	8/9/2004 9:55	8/16/2004 11:00	0.00	DF	ST	NA	7.72	1.74	12.52	0.15	0.78	1.41	2
	8/16/2004 11:00	8/31/2004 8:40	0.00	DF	ST	NA	NA	NA	NA	NA	NA	NA	
4	8/31/2004 8:40	9/9/2004 12:40	0.00	DF	ST	NA	3.92	2.03	33.33	0.61	1.11	2.16	2
5	9/9/2004 12:40	9/17/2004 9:05	0.00	DF	ST	NA	1.47	1.14	12.53	0.02	0.82	0.14	2
6	9/17/2004 9:05	9/24/2004 9:45	0.02	RS+DF	ST	NA	60.96	9.82	34.66	1.33	2.30	4.41	5
	9/24/2004 9:45	10/5/2004 12:35	0.00	DF	ST	NA	NA	NA	NA	NA	NA	NA	
	10/5/2004 12:35	10/14/2004 10:20	0.00	DF	ST	NA	NA	NA	NA	NA	NA	NA	2
7	10/14/2004 10:20	10/22/2004 11:10	1.95+	DF+RS	ST	5.31	203.42	105.81	159.20	11.49	13.93	28.02	28
8	10/22/2004 11:10	10/29/2004 11:40	0.84	DF+S	ST	2.69	56.49	29.99	51.85	3.10	3.64	6.88	
9	10/29/2004 11:40	11/15/2004 13:50	0.37	DF+RS	ST	3.57	75.84	50.00	78.54	1.80	2.26	3.83	
10	11/15/2004 13:50	11/29/2004 15:45	0.61	DF+S	ST	1.95	51.70	19.86	37.93	0.99	1.62	4.61	
11	11/29/2004 15:45	12/10/2004 14:00	0.88	DF+RS	ST	2.29	44.59	13.15	46.47	1.84	2.12	6.02	
12	12/10/2004 14:00	12/24/2004 8:30	0.00	DF	ST	NA	4.33	4.61	NA	0.35	0.78	NA	2
13	12/24/2004 8:30	1/6/2005 11:40	0.54+	DF+S	ST	NA	15.68	9.04	106.92	0.41	0.74	3.13	28
14	1/6/2005 11:40	1/13/2005 13:50	0.43+	DF+RS	ST	0.81	NA	NA	NA	NA	NA	NA	28
15	1/13/2005 13:50	1/24/2005 15:50	0.01	DF+R	ST	NA	36.44	10.94	19.88	0.36	0.44	0.53	41
16	1/24/2005 15:50	2/4/2005 16:30	0.01+	DF+RS	ST	0.97	4.23	0.66	7.04	0.04	0.34	1.67	42
17	2/4/2005 16:30	2/24/2005 14:25	0.53+	DF+RS	ST	4.16	56.53	48.25	55.40	0.77	1.50	2.51	28
18	2/24/2005 14:25	3/9/2005 10:40	0.34	DF+S	ST	2.17	23.32	25.43	37.17	0.44	0.79	1.20	
19	3/9/2005 10:40	3/16/2005 10:23	T	DF+T	ST	NA	42.03	1.43	5.67	0.57	1.56	1.65	43
20	3/16/2005 10:23	3/24/2005 10:05	0.03+	DF+RS	ST	NA	1.11	1.00	6.75	0.25	0.74	1.67	44

Samp. No.	Mid-lake Start Date-Time	Snow Tube Collection Date-Time	Precip. (in.)	Precip. Form	Collector Type	H+ (g/ha)	(Load) NO3-N (g/ha)	NH4-N (g/ha)	TKN (g/ha)	SRP (g/ha)	DP (g/ha)	TP (g/ha)	Notes
21	3/24/2005 10:05	3/31/2005 9:35	0.39+	DF+RS	ST	NA	19.16	12.60	21.58	0.50	1.00	1.75	28
22	3/31/2005 9:35	4/14/2005 13:20	0.03	DF+S	ST	NA	4.41	7.08	24.68	1.43	2.43	3.65	
23	4/14/2005 13:20	4/22/2005 15:00	0.02	DF+RS	ST	NA	4.83	5.91	11.30	0.39	0.63	1.46	46
24	4/22/2005 15:00	5/25/2005 16:20	0.69	DF+RSG	ST	NA	71.73	75.81	143.39	6.99	8.45	13.01	
25	5/25/2005 16:20	6/8/2005 8:35	0.07	DF+RS	ST	NA	22.82	15.56	47.98	2.33	3.28	NA	48
26	6/8/2005 8:35	6/20/2005 11:34	0.16	DF+RS	ST	NA	18.02	24.91	33.19	0.68	1.25	1.29	
27	6/20/2005 11:34	6/29/2005 10:50	0.00	DF	ST	NA	3.54	7.45	14.21	0.82	1.01	NA	49
28	6/29/2005 10:50	7/13/2005 12:49	0.00	DF	ST	NA	3.15	7.28	46.85	2.66	3.09	9.39	
	7/13/2005 12:49	7/27/2005 8:55	0.00	DF	ST	C	C	C	C	C	C	C	92
29	7/27/2005 8:55	8/6/2005 10:50	0.01	R+DF	ST	NA	NA	NA	NA	NA	NA	NA	75
30	8/6/2005 10:50	8/18/2005 7:28	NA	R+DF	ST	NA	12.46	17.59	67.50	6.81	7.53	NA	90
31	8/18/2005 7:28	8/26/2005 13:46	0.00	DF	ST	NA	4.46	12.35	18.50	0.96	1.06	1.78	91
	8/26/2005 13:46	9/6/2005 12:35	0.00	DF	ST	NA	NA	NA	NA	NA	NA	NA	93
32	9/6/2005 12:35	9/15/2005 15:32	0.00	DF	ST	NA	3.93	11.00	43.29	0.42	1.06	NA	72
33	9/15/2005 15:32	9/27/2005 12:05	0.11	R+S+DF	ST	C	C	C	C	C	C	C	76
34	9/27/2005 12:05	10/6/2005 13:00	0.00	DF	ST	NA	2.49	9.65	9.65	0.28	0.77	1.60	103
35	10/6/2005 13:00	10/20/2005 13:15	0.15	R+S+DF	ST	C	C	C	C	C	C	C	104
	10/20/2005 13:15	11/10/2005 12:55	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	105
	11/10/2005 12:55	11/18/2005 10:05	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	106
	11/18/2005 10:05	12/6/2005 13:02	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	107
	12/6/2005 13:02	12/23/2005 12:30	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	105
	12/23/2005 12:30	1/4/2006 12:47	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	105
36	1/4/2006 12:47	1/24/2006 12:35	0.37	S+DF	ST	0.59	49.46	9.44	31.61	0.30	1.00	4.17	
37	1/24/2006 12:35	2/6/2006 13:25	0.59+	R+S+DF	ST	NA	22.15	10.25	19.77	0.21	0.14	3.91	125
38	2/6/2006 13:25	2/23/2006 9:50	0.12	S+DF	ST	NA	10.58	11.63	14.28	0.39	0.05	0.81	126
39	2/23/2006 9:50	3/8/2006 12:15	1.66	R+S+DF	ST	5.31	54.37	32.67	76.25	1.44	2.38	8.23	
40	3/8/2006 12:15	4/6/2006 10:45	0.06+	R+S+DF	ST	NA	1.24	1.45	4.28	0.21	1.06	0.57	127
41	4/6/2006 10:45	4/21/2006 10:15	0.18	R+S+DF	ST	NA	26.61	35.84	NA	0.51	0.85	NA	
42	4/21/2006 10:15	5/5/2006 12:55	0.53	R+DF	ST	6.90	NA	75.03	79.02	2.55	3.89	6.33	

Samp. No.	Mid-lake Start Date-Time	Snow Tube Collection Date-Time	Precip. (in.)	Precip. Form	Collector Type	H+ (g/ha)	(Load) NO3-N (g/ha)	NH4-N (g/ha)	TKN (g/ha)	SRP (g/ha)	DP (g/ha)	TP (g/ha)	Notes
43	5/5/2006 12:55	6/14/2006 9:45	0.20	R+DF	ST	NA	76.74	91.65	131.05	2.43	5.24	9.28	136
44	6/14/2006 9:45	6/23/2006 12:25	0.00	DF	ST	NA	1.13	3.62	43.66	2.34	5.15	8.50	137
	6/23/2006 12:25	6/29/2006 10:05	0.00	DF	ST	NA	NA	NA	NA	NA	NA	NA	
45	6/29/2006 10:05	7/10/2006 9:30	0.01	R+DF	ST	NA	17.22	45.74	94.81	6.31	8.53	13.85	145
46	7/10/2006 9:30	8/2/2006 14:45	0.04	R+DF	ST	NA	14.55	68.17	196.81	NA	15.70	26.43	146
47	8/2/2006 14:45	8/15/2006 9:40	0.00	DF	ST	NA	5.62	6.38	33.30	1.78	2.65	6.01	147
48	8/15/2006 9:40	9/1/2006 8:00	0.00	DF	ST	NA	4.58	6.88	55.95	1.41	3.55	7.01	147
49	9/1/2006 8:00	9/13/2006 10:05	0.00	DF	ST	NA	3.14	2.51	39.84	1.84	NA	6.68	147
50	9/13/2006 10:05	9/29/2006 9:00	0.00	DF	ST	NA	8.39	5.04	19.52	0.74	1.84	5.25	147
51	9/29/2006 9:00	10/13/2006 10:35	0.18	R+DF	ST	NA	112.02	61.86	130.93	9.28	12.19	27.03	156
	10/13/2006 10:35	10/27/2006 12:05	0.02	R+DF	ST	NA	C	C	C	C	C	C	157
52	10/27/2006 12:05	11/6/2006 11:12	0.41	R+DF	ST	2.62	46.78	NA	116.51	3.36	5.02	5.90	158
53	11/6/2006 11:12	11/17/2006 10:16	0.53	RS+DF	ST	4.46	58.08	29.90	146.82	3.12	4.72	5.23	159
54	11/17/2006 10:16	12/7/2006 14:43	0.10	S+DF	ST	0.31	26.23	10.74	28.98	0.12	1.60	3.43	160
55	12/7/2006 14:43	12/19/2006 11:38	0.16	RS+DF	ST	NA	40.37	18.85	56.72	1.49	2.22	4.83	161
56	12/19/2006 11:38	1/9/2007 9:45	0.06	RS+DF	ST	NA	2.72	0.05	12.10	1.38	0.73	2.96	174
57	1/9/2007 9:45	1/23/2007 11:44	0.01	DF	ST	NA	2.65	NA	0.63	0.56	0.54	1.19	175
58	1/23/2007 11:44	2/1/2007 12:45	0.00	DF	ST	NA	1.11	1.08	2.12	0.16	0.83	0.90	147
59	2/1/2007 12:45	2/12/2007 11:04	0.90+	RS+DF	ST	NA	83.46	29.61	13.91	0.23	1.18	3.79	176
60	2/12/2007 11:04	3/2/2007 9:18	0.19	S+DF	ST	NA	29.02	NA	45.05	0.17	NA	2.48	
61	3/2/2007 9:18	3/15/2007 10:00	0.01	DF	ST	NA	3.81	NA	7.90	NA	NA	1.38	177
62	3/15/2007 10:00	4/6/2007 14:20	0.01	S+DF	ST	NA	29.09	NA	29.20	0.35	NA	4.13	190
63	4/6/2007 14:20	5/10/2007 14:41	0.12+	R+S+DF	ST	NA	30.40	NA	NA	3.62	NA	NA	191
64	5/10/2007 14:41	5/31/2007 10:30	0.01	DF	ST	NA	1.03	NA	NA	2.57	NA	NA	192

Appendix Table 4.c. Precipitation amounts, pH, N and P loading per day in bulk deposition collected in Snow Tube collector at the Mid-lake Buoy (TB-1) Station 7/1/04-6/30/07.

Samp. No.	Mid-lake Start Date-Time	Snow Tube Collection Date-Time	Precip. (in.)	Precip. Form	Collector Type	NO3-N (g/ha/d)	NH4-N (g/ha/d)	TKN (g/ha/d)	SRP (g/ha/d)	DP (g/ha/d)	TP (g/ha/d)	Notes
1	6/24/2004 13:00	7/2/2004 14:14	0.00	DF	ST	0.84	0.47	3.34	0.30	0.38	0.62	2
	7/2/2004 14:14	7/17/2004 11:25	0.00	DF	ST	NA	NA	NA	NA	NA	NA	2
	7/17/2004 11:25	7/27/2004 11:10	0.00	DF	ST	NA	NA	NA	NA	NA	NA	2
2	7/27/2004 11:10	8/9/2004 9:55	T	R+DF	ST	1.04	0.26	1.68	0.00	0.09	0.18	2
3	8/9/2004 9:55	8/16/2004 11:00	0.00	DF	ST	1.10	0.25	1.78	0.02	0.11	0.20	2
	8/16/2004 11:00	8/31/2004 8:40	0.00	DF	ST	NA	NA	NA	NA	NA	NA	
4	8/31/2004 8:40	9/9/2004 12:40	0.00	DF	ST	0.43	0.22	3.64	0.07	0.12	0.24	2
5	9/9/2004 12:40	9/17/2004 9:05	0.00	DF	ST	0.19	0.15	1.60	0.00	0.10	0.02	2
6	9/17/2004 9:05	9/24/2004 9:45	0.02	RS+DF	ST	8.67	1.40	4.93	0.19	0.33	0.63	5
	9/24/2004 9:45	10/5/2004 12:35	0.00	DF	ST	NA	NA	NA	NA	NA	NA	
	10/5/2004 12:35	10/14/2004 10:20	0.00	DF	ST	NA	NA	NA	NA	NA	NA	2
7	10/14/2004 10:20	10/22/2004 11:10	1.95+	DF+RS	ST	25.32	13.17	19.81	1.43	1.73	3.49	28
8	10/22/2004 11:10	10/29/2004 11:40	0.84	DF+S	ST	8.05	4.27	7.39	0.44	0.52	0.98	
9	10/29/2004 11:40	11/15/2004 13:50	0.37	DF+RS	ST	4.44	2.93	4.60	0.11	0.13	0.22	
10	11/15/2004 13:50	11/29/2004 15:45	0.61	DF+S	ST	3.67	1.41	2.69	0.07	0.11	0.33	
11	11/29/2004 15:45	12/10/2004 14:00	0.88	DF+RS	ST	4.08	1.20	4.25	0.17	0.19	0.55	
12	12/10/2004 14:00	12/24/2004 8:30	0.00	DF	ST	0.31	0.33	NA	0.03	0.06	NA	2
13	12/24/2004 8:30	1/6/2005 11:40	0.54+	DF+S	ST	1.19	0.69	8.14	0.03	0.06	0.24	28
14	1/6/2005 11:40	1/13/2005 13:50	0.43+	DF+RS	ST	NA	NA	NA	NA	NA	NA	28
15	1/13/2005 13:50	1/24/2005 15:50	0.01	DF+R	ST	3.29	0.99	1.79	0.03	0.04	0.05	41
16	1/24/2005 15:50	2/4/2005 16:30	0.01+	DF+RS	ST	0.38	0.06	0.64	0.00	0.03	0.15	42
17	2/4/2005 16:30	2/24/2005 14:25	0.53+	DF+RS	ST	2.84	2.42	2.78	0.04	0.08	0.13	28
18	2/24/2005 14:25	3/9/2005 10:40	0.34	DF+S	ST	1.82	1.98	2.89	0.03	0.06	0.09	
19	3/9/2005 10:40	3/16/2005 10:23	T	DF+T	ST	6.01	0.20	0.81	0.08	0.22	0.24	43

Samp. No.	Mid-lake Start Date-Time	Snow Tube Collection Date-Time	Precip. (in.)	Precip. Form	Collector Type	NO3-N (g/ha/d)	NH4-N (g/ha/d)	TKN (g/ha/d)	SRP (g/ha/d)	DP (g/ha/d)	TP (g/ha/d)	Notes
20	3/16/2005 10:23	3/24/2005 10:05	0.03+	DF+RS	ST	0.14	0.13	0.85	0.03	0.09	0.21	44
21	3/24/2005 10:05	3/31/2005 9:35	0.39+	DF+RS	ST	2.75	1.81	3.09	0.07	0.14	0.25	28
22	3/31/2005 9:35	4/14/2005 13:20	0.03	DF+S	ST	0.31	0.50	1.74	0.10	0.17	0.26	
23	4/14/2005 13:20	4/22/2005 15:00	0.02	DF+RS	ST	0.60	0.73	1.40	0.05	0.08	0.18	46
24	4/22/2005 15:00	5/25/2005 16:20	0.69	DF+RSG	ST	2.17	2.29	4.34	0.21	0.26	0.39	
25	5/25/2005 16:20	6/8/2005 8:35	0.07	DF+RS	ST	1.67	1.14	3.51	0.17	0.24	NA	48
26	6/8/2005 8:35	6/20/2005 11:34	0.16	DF+RS	ST	1.49	2.05	2.74	0.06	0.10	0.11	
27	6/20/2005 11:34	6/29/2005 10:50	0.00	DF	ST	0.39	0.83	1.58	0.09	0.11	NA	49
28	6/29/2005 10:50	7/13/2005 12:49	0.00	DF	ST	0.22	0.52	3.33	0.19	0.22	0.67	
	7/13/2005 12:49	7/27/2005 8:55	0.00	DF	ST	C	C	C	C	C	C	92
29	7/27/2005 8:55	8/6/2005 10:50	0.01	R+DF	ST	NA	NA	NA	NA	NA	NA	75
30	8/6/2005 10:50	8/18/2005 7:28	NA	R+DF	ST	1.05	1.48	5.69	0.57	0.63	NA	90
31	8/18/2005 7:28	8/26/2005 13:46	0.00	DF	ST	0.54	1.49	2.24	0.12	0.13	0.22	91
	8/26/2005 13:46	9/6/2005 12:35	0.00	DF	ST	NA	NA	NA	NA	NA	NA	93
32	9/6/2005 12:35	9/15/2005 15:32	0.00	DF	ST	0.43	1.21	4.74	0.05	0.12	NA	72
33	9/15/2005 15:32	9/27/2005 12:05	0.11	R+S+DF	ST	NA	NA	NA	NA	NA	NA	76
34	9/27/2005 12:05	10/6/2005 13:00	0.00	DF	ST	0.28	1.07	1.07	0.03	0.09	0.18	103
35	10/6/2005 13:00	10/20/2005 13:15	0.15	R+S+DF	ST	NA	NA	NA	NA	NA	NA	104
	10/20/2005 13:15	11/10/2005 12:55	NA	NA	NA	NA	NA	NA	NA	NA	NA	105
	11/10/2005 12:55	11/18/2005 10:05	NA	NA	NA	NA	NA	NA	NA	NA	NA	106
	11/18/2005 10:05	12/6/2005 13:02	NA	NA	NA	NA	NA	NA	NA	NA	NA	107
	12/6/2005 13:02	12/23/2005 12:30	NA	NA	NA	NA	NA	NA	NA	NA	NA	105
	12/23/2005 12:30	1/4/2006 12:47	NA	NA	NA	NA	NA	NA	NA	NA	NA	105
36	1/4/2006 12:47	1/24/2006 12:35	0.37	S+DF	ST	2.47	0.47	1.58	0.01	0.05	0.21	
37	1/24/2006 12:35	2/6/2006 13:25	0.59+	R+S+DF	ST	1.70	0.79	1.52	0.02	0.01	0.30	125
38	2/6/2006 13:25	2/23/2006 9:50	0.12	S+DF	ST	0.63	0.69	0.85	0.02	0.00	0.05	126
39	2/23/2006 9:50	3/8/2006 12:15	1.66	R+S+DF	ST	4.15	2.49	5.82	0.11	0.18	0.63	
40	3/8/2006 12:15	4/6/2006 10:45	0.06+	R+S+DF	ST	0.04	0.05	0.15	0.01	0.04	0.02	127
41	4/6/2006 10:45	4/21/2006 10:15	0.18	R+S+DF	ST	1.78	2.39	NA	0.03	0.06	NA	

Samp. No.	Mid-lake Start Date-Time	Snow Tube Collection Date-Time	Precip. (in.)	Precip. Form	Collector Type	NO3-N (g/ha/d)	NH4-N (g/ha/d)	TKN (g/ha/d)	SRP (g/ha/d)	DP (g/ha/d)	TP (g/ha/d)	Notes
42	4/21/2006 10:15	5/5/2006 12:55	0.53	R+DF	ST	NA	5.32	5.60	0.18	0.28	0.45	
43	5/5/2006 12:55	6/14/2006 9:45	0.20	R+DF	ST	1.92	2.30	3.29	0.06	0.13	0.23	136
44	6/14/2006 9:45	6/23/2006 12:25	0.00	DF	ST	0.12	0.40	4.79	0.26	0.57	0.93	137
	6/23/2006 12:25	6/29/2006 10:05	0.00	DF	ST	NA	NA	NA	NA	NA	NA	
45	6/29/2006 10:05	7/10/2006 9:30	0.01	R+DF	ST	1.57	4.17	8.64	0.57	0.78	1.26	145
46	7/10/2006 9:30	8/2/2006 14:45	0.04	R+DF	ST	0.63	2.94	8.48	NA	0.68	1.14	146
47	8/2/2006 14:45	8/15/2006 9:40	0.00	DF	ST	0.44	0.50	2.60	0.14	0.21	0.47	147
48	8/15/2006 9:40	9/1/2006 8:00	0.00	DF	ST	0.27	0.41	3.30	0.08	0.21	0.41	147
49	9/1/2006 8:00	9/13/2006 10:05	0.00	DF	ST	0.26	0.21	3.30	0.15	NA	0.55	147
50	9/13/2006 10:05	9/29/2006 9:00	0.00	DF	ST	0.53	0.32	1.22	0.05	0.12	0.33	147
51	9/29/2006 9:00	10/13/2006 10:35	0.18	R+DF	ST	7.96	4.40	9.31	0.66	0.87	1.92	156
	10/13/2006 10:35	10/27/2006 12:05	0.02	R+DF	ST	NA	NA	NA	NA	NA	NA	157
52	10/27/2006 12:05	11/6/2006 11:12	0.41	R+DF	ST	4.70	NA	11.69	0.34	0.50	0.59	158
53	11/6/2006 11:12	11/17/2006 10:16	0.53	RS+DF	ST	5.30	2.73	13.39	0.28	0.43	0.48	159
54	11/17/2006 10:16	12/7/2006 14:43	0.10	S+DF	ST	1.30	0.53	1.44	0.01	0.08	0.17	160
55	12/7/2006 14:43	12/19/2006 11:38	0.16	RS+DF	ST	3.40	1.59	4.78	0.13	0.19	0.41	161
56	12/19/2006 11:38	1/9/2007 9:45	0.06	RS+DF	ST	0.13	0.00	0.58	0.07	0.03	0.14	174
57	1/9/2007 9:45	1/23/2007 11:44	0.01	DF	ST	0.19	NA	0.04	0.04	0.04	0.08	175
58	1/23/2007 11:44	2/1/2007 12:45	0.00	DF	ST	0.12	0.12	0.23	0.02	0.09	0.10	147
59	2/1/2007 12:45	2/12/2007 11:04	0.90+	RS+DF	ST	NA	2.71	1.27	0.02	0.11	0.35	176
60	2/12/2007 11:04	3/2/2007 9:18	0.19	S+DF	ST	1.62	NA	2.51	0.01	NA	0.14	
61	3/2/2007 9:18	3/15/2007 10:00	0.01	DF	ST	0.29	NA	0.61	NA	NA	0.11	177
62	3/15/2007 10:00	4/6/2007 14:20	0.01	S+DF	ST	1.31	NA	1.32	0.02	NA	0.19	190
63	4/6/2007 14:20	5/10/2007 14:41	0.12+	R+S+DF	ST	0.89	NA	NA	0.11	NA	NA	191
64	5/10/2007 14:41	5/31/2007 10:30	0.01	DF	ST	0.05	NA	NA	0.12	NA	NA	192

Appendix Table 5.a. N, P, and H concentrations in dry-bulk deposition (buoy bucket collector) at the Mid-lake Buoy (TB-1) Station 7/1/04-6/30/07.

Samp. No.	Mid-lake Station Start Date-Time	Dry-Bulk Collection Date-Time	Vol. Liters	Precip. Form	Collector Type	pH	H+ (µg/l)	(Conc.) NO3-N (µg/l)	NH4-N (µg/l)	TKN (µg/l)	SRP (µg/l)	DP (µg/l)	TP (µg/l)	Notes
1	6/24/2004 13:00	7/2/2004 14:14	1.070	DF	DRY-BULK	4.60	25.12	231.25	186.17	311.67	10.64	13.24	39.72	
2	7/2/2004 14:14	7/17/2004 11:25	0.000	DF	DRY-BULK	NA	NA	357.21	357.88	568.28	4.84	15.43	45.65	6
3	7/17/2004 11:25	7/27/2004 11:10	0.168	DF	DRY-BULK	NA	NA	374.17	368.40	984.72	4.15	14.48	43.77	7
4	7/27/2004 11:10	8/9/2004 9:55	0.000	DF+T	DRY-BULK	NA	NA	368.60	311.01	545.45	0.30	8.60	18.00	6
5	8/9/2004 9:55	8/16/2004 11:00	1.330	DF	DRY-BULK	4.70	19.95	145.70	123.20	297.26	0.29	3.82	7.26	
6	8/16/2004 11:00	8/31/2004 8:40	0.000	DF	DRY-BULK	NA	NA	273.15	216.98	332.45	1.30	5.97	11.35	6
7	8/31/2004 8:40	9/9/2004 12:40	0.100	DF	DRY-BULK	NA	NA	360.60	387.70	651.99	3.58	8.79	60.36	9
8	9/9/2004 12:40	9/17/2004 9:05	0.150	DF	DRY-BULK	NA	NA	209.30	225.25	351.91	2.34	6.91	10.89	10
9	9/17/2004 9:05	9/24/2004 9:45	0.725	DF+RS	DRY-BULK	4.50	31.62	244.50	224.23	299.03	4.73	9.42	13.38	
10	9/24/2004 9:45	10/5/2004 12:35	1.420	DF	DRY-BULK	4.59	25.70	148.60	131.03	293.46	3.52	5.30	8.11	
11	10/5/2004 12:35	10/14/2004 10:20	0.140	DF	DRY-BULK	4.51	30.90	473.20	510.91	811.16	4.09	12.16	31.82	11
12	10/14/2004 10:20	10/22/2004 11:10	2.243	DF+RS	DRY-BULK	5.30	5.01	71.94	C	240.52	12.28	12.33	34.77	
13	10/22/2004 11:10	10/29/2004 11:40	1.992	DF+RS	DRY-BULK	4.92	12.02	53.93	24.32	112.39	13.64	13.59	22.76	
14	10/29/2004 11:40	11/15/2004 13:50	0.230	DF+RS	DRY-BULK	4.11	77.62	1740.00	1561.77	1656.58	16.82	20.23	96.40	58
15	11/15/2004 13:50	11/29/2004 15:45	1.113	DF+S	DRY-BULK	4.80	15.85	136.38	74.88	91.73	1.37	6.18	14.89	
16	11/29/2004 15:45	12/10/2004 14:00	1.160	DF+RS	DRY-BULK	5.00	10.00	90.32	34.92	183.51	3.42	6.97	17.74	
17	12/10/2004 14:00	12/24/2004 8:30	0.737	DF	DRY-BULK	4.82	15.14	196.50	117.79	377.92	1.52	5.70	18.69	
18	12/24/2004 8:30	1/6/2005 11:40	0.670	DF+S	DRY-BULK	4.78	16.60	166.85	117.05	410.77	1.16	5.70	20.91	
19	1/6/2005 11:40	1/13/2005 13:50	1.754	DF+S	DRY-BULK	5.10	7.94	NA	NA	NA	NA	NA	NA	
20	1/13/2005 13:50	1/24/2005 15:50	1.876	DF+S	DRY-BULK	4.82	15.14	104.70	14.77	344.98	0.23	4.10	1.55	
21	1/24/2005 15:50	2/4/2005 16:30	0.796	DF+RS	DRY-BULK	4.80	15.85	C	C	C	C	C	C	193
22	2/4/2005 16:30	2/24/2005 14:25	1.352	DF+RS	DRY-BULK	4.80	15.85	258.20	187.20	232.35	2.07	6.51	8.54	
23	2/24/2005 14:25	3/9/2005 10:40	0.830	DF+S	DRY-BULK	4.78	16.60	264.52	193.40	503.62	2.54	6.61	10.70	
24	3/9/2005 10:40	3/16/2005 10:23	0.920	DF+T	DRY-BULK	5.37	4.27	236.00	101.45	153.59	6.00	10.41	14.52	59
25	3/16/2005 10:23	3/24/2005 10:05	1.903	DF+RS	DRY-BULK	4.98	10.47	73.08	49.86	118.35	0.92	6.00	6.63	60

Samp. No.	Mid-lake Station Start Date-Time	Dry-Bulk Collection Date-Time	Vol. Liters	Precip. Form	Collector Type	pH	H+ (µg/l)	(Conc.) NO3-N (µg/l)	NH4-N (µg/l)	TKN (µg/l)	SRP (µg/l)	DP (µg/l)	TP (µg/l)	Notes
26	3/24/2005 10:05	3/31/2005 9:35	1.353	DF+RS	DRY-BULK	4.98	10.47	48.74	26.37	62.02	0.46	4.73	5.68	61
27	3/31/2005 9:35	4/14/2005 13:20	1.000	DF+RS	DRY-BULK	5.30	5.01	176.02	156.76	311.16	10.64	16.10	23.40	62
28	4/14/2005 13:20	4/22/2005 15:00	0.840	DF+RS	DRY-BULK	4.90	12.59	120.12	89.45	189.75	4.16	6.00	24.66	
29	4/22/2005 15:00	5/25/2005 16:20	0.500	DF+RSG	DRY-BULK	4.73	18.62	481.62	607.59	1077.31	55.19	77.75	94.26	63
30	5/25/2005 16:20	6/8/2005 8:35	0.500	DF+RS	DRY-BULK	5.00	10.00	268.04	245.70	704.52	14.31	19.88	67.04	64
31	6/8/2005 8:35	6/20/2005 11:34	0.539	DF+RS	DRY-BULK	4.40	39.81	382.06	520.92	532.60	59.08	109.23	NA	65
32	6/20/2005 11:34	6/29/2005 10:50	1.009	DF	DRY-BULK	4.80	15.85	136.15	222.67	419.23	2.77	7.20	NA	
33	6/29/2005 10:50	7/13/2005 12:49	0.500	DF	DRY-BULK	NA	NA	276.55	246.79	884.84	13.59	22.85	NA	77
34	7/13/2005 12:49	7/27/2005 8:55	0.500	DF	DRY-BULK	NA	NA	C	C	C	C	C	C	78
35	7/27/2005 8:55	8/6/2005 10:50	0.500	DF	DRY-BULK	5.18	6.61	C	C	C	C	C	C	79
36	8/6/2005 10:50	8/18/2005 7:28	0.500	R+DF	DRY-BULK	4.52	30.20	619.47	322.45	743.90	6.68	8.76	NA	80
37	8/18/2005 7:28	8/26/2005 13:46	0.435	DF	DRY-BULK	4.51	30.90	497.79	779.69	NA	37.99	46.64	50.02	81
38	8/26/2005 13:46	9/6/2005 12:35	0.500	DF	DRY-BULK	NA	NA	19.57	420.04	750.77	2.95	8.45	NA	82
39	9/6/2005 12:35	9/15/2005 15:32	0.699	DF	DRY-BULK	4.49	32.36	321.65	613.02	847.03	8.18	17.21	NA	88
40	9/15/2005 15:32	9/27/2005 12:05	0.500	DF	DRY-BULK	NA	NA	554.80	602.06	922.65	8.18	11.58	NA	83
41	9/27/2005 12:05	10/6/2005 13:00	0.678	DF	DRY-BULK	4.37	42.66	298.67	363.23	562.07	6.36	9.08	18.57	
42	10/6/2005 13:00	10/20/2005 13:15	0.290	R+S+DF	DRY-BULK	5.09	8.13	943.67	1549.94	1938.12	5.49	24.41	92.74	108
43	10/20/2005 13:15	11/10/2005 12:55	0.190	R+S+DF	DRY-BULK	4.51	30.90	851.97	950.69	1177.40	7.33	11.53	34.27	109
44	11/10/2005 12:55	11/18/2005 10:05	1.835	DF	DRY-BULK	5.00	10.00	57.85	32.23	74.75	0.92	3.46	4.36	108
45	11/18/2005 10:05	12/6/2005 13:02	2.325	R+S+DF	DRY-BULK	4.98	10.47	47.20	14.54	159.51	1.14	6.61	20.79	110
46	12/6/2005 13:02	12/23/2005 12:30	3.121	R+S+DF	DRY-BULK	NA	NA	51.42	13.12	37.71	2.29	5.04	3.46	110
47	12/23/2005 12:30	1/4/2006 13:25	2.514	R+S+DF	DRY-BULK	5.11	7.76	26.45	10.42	16.08	0.69	3.78	5.66	110
48	1/4/2006 13:25	1/24/2006 12:35	0.500	S+DF	DRY-BULK	<5.6	>2.51	374.18	128.74	329.34	1.14	5.63	36.19	128
49	1/24/2006 12:35	2/6/2006 13:25	1.136	R+S+DF	DRY-BULK	5.06	8.71	79.92	107.64	133.94	1.14	0.32	64.51	
50	2/6/2006 13:25	2/23/2006 9:50	1.065	S+DF	DRY-BULK	4.90	12.59	155.65	123.83	140.42	4.63	3.17	22.82	
51	2/23/2006 9:50	3/8/2006 12:15	1.796	R+S+DF	DRY-BULK	4.91	12.30	67.76	41.93	131.55	2.28	4.08	11.33	
52	3/8/2006 12:15	4/6/2006 10:45	1.105	R+S+DF	DRY-BULK	4.79	16.22	153.73	150.48	177.32	5.10	11.22	12.71	
53	4/6/2006 10:45	4/21/2006 10:15	0.524	R+S+DF	DRY-BULK	4.61	24.55	187.69	304.04	427.09	6.72	14.34	12.71	
54	4/21/2006 10:15	5/5/2006 12:55	1.102	R+DF	DRY-BULK	NA	NA	380.98	295.02	507.91	23.45	29.86	57.60	

Samp. No.	Mid-lake Station Start Date-Time	Dry-Bulk Collection Date-Time	Vol. Liters	Precip. Form	Collector Type	pH	H+ (µg/l)	(Conc.) NO3-N (µg/l)	NH4-N (µg/l)	TKN (µg/l)	SRP (µg/l)	DP (µg/l)	TP (µg/l)	Notes
55	5/5/2006 12:55	6/14/2006 9:45	0.500	R+DF	DRY-BULK	NA	NA	344.02	387.21	1152.85	35.91	65.56	117.65	
56	6/14/2006 9:45	6/23/2006 12:25	0.500	DF	DRY-BULK	NA	NA	63.33	64.04	603.74	7.93	26.85	75.98	138
57	6/23/2006 12:25	6/29/2006 10:05	1.879	DF	DRY-BULK	NA	NA	110.53	121.08	224.08	0.46	11.86	18.08	
58	6/29/2006 10:05	7/10/2006 9:30	0.500	R+DF	DRY-BULK	NA	NA	146.69	321.46	731.20	73.60	186.08	304.91	148
59	7/10/2006 9:30	8/2/2006 14:45	0.500	R+DF	DRY-BULK	NA	NA	364.72	189.96	1671.72	63.39	125.19	209.38	148
60	8/2/2006 14:45	8/15/2006 9:40	0.500	DF	DRY-BULK	NA	NA	424.09	290.35	753.93	0.92	9.88	16.79	148
61	8/15/2006 9:40	9/1/2006 8:00	0.500	DF	DRY-BULK	NA	NA	247.67	187.78	730.46	14.44	NA	79.69	148
62	9/1/2006 8:00	9/13/2006 10:05	0.350	DF	DRY-BULK	NA	NA	654.79	851.86	1350.49	3.44	7.38	56.33	149
63	9/13/2006 10:05	9/29/2006 9:00	0.500	DF	DRY-BULK	NA	NA	421.32	313.70	638.16	NA	18.30	49.23	148
64	9/29/2006 9:00	10/13/2006 10:35	0.264	R+H+DF	DRY-BULK	NA	NA	1650.55	1828.74	NA	22.04	23.91	202.46	
65	10/13/2006 10:35	10/27/2006 12:05	0.645	R+DF	DRY-BULK	4.81	15.49	300.85	NA	420.06	0.68	3.66	39.47	
66	10/27/2006 12:05	11/6/2006 11:12	2.003	R+DF	DRY-BULK	4.91	12.30	69.37	48.42	NA	0.23	1.83	5.51	162
67	11/6/2006 11:12	11/17/2006 10:16	0.547	R+S+DF	DRY-BULK	4.41	38.90	197.97	87.89	211.96	0.91	3.66	6.73	
68	11/17/2006 10:16	12/7/2006 14:43	3.140	S+DF	DRY-BULK	5.10	7.94	88.01	42.97	185.76	7.09	15.56	17.98	194
69	12/7/2006 14:43	12/19/2006 11:38	0.491	R+S+DF	DRY-BULK	NA	NA	136.33	187.58	313.41	4.83	NA	21.71	
70	12/19/2006 11:38	1/9/2007 9:45	0.500	R+S+DF	DRY-BULK	4.70	19.95	346.40	96.69	251.94	12.89	8.22	29.15	178
71	1/9/2007 9:45	1/23/2007 11:44	0.490	DF	DRY-BULK	5.20	6.31	127.16	53.67	11.63	2.97	NA	11.67	
72	1/23/2007 11:44	2/1/2007 12:45	2.050	DF	DRY-BULK	4.78	16.60	84.30	52.54	100.69	2.28	5.69	7.53	
73	2/1/2007 12:45	2/12/2007 11:04	2.487	R+S+DF	DRY-BULK	5.01	9.77	35.72	29.90	60.87	2.28	5.37	5.22	
74	2/12/2007 11:04	3/2/2007 9:18	0.500	S+DF	DRY-BULK	NA	NA	300.89	NA	346.61	NA	NA	15.10	179
75	3/2/2007 9:18	3/15/2007 10:00	1.503	DF	DRY-BULK	4.79	16.22	92.77	NA	134.77	0.68	NA	8.94	
76	3/15/2007 10:00	4/6/2007 14:20	0.505	S+DF	DRY-BULK	NA	NA	455.98	NA	580.35	7.29	NA	41.29	195
77	4/6/2007 14:20	5/10/2007 14:41	0.500	S+DF	DRY-BULK	NA	NA	NA	NA	430.46	3.99	NA	45.04	147
78	5/10/2007 14:41	5/31/2007 10:30	0.500	DF	DRY-BULK	NA	NA	260.03	NA	NA	6.57	NA	NA	196
79	5/31/2007 10:30	6/25/2007 16:02	0.500	R+S+DF	DRY-BULK	NA	NA	341	127.93	502.02	13.85	28	39	
80	6/25/2007 16:02	6/26/2007 13:38	2.875	DF	DRY-BULK	NA	NA	8	8.68	33.09	0.23	2	2	
81	6/26/2007 13:38	6/27/2007 8:15	3.282	DF	DRY-BULK	NA	NA	10	12.27	45.93	0.23	<1	2	
82	6/27/2007 8:15	6/28/2007 7:35	3.046	DF	DRY-BULK	NA	NA	12	9.73	45.50	0.23	1	1	

Appendix Table 5.b. N, P, and H loads in dry-bulk deposition (buoy bucket collector) at the Mid-lake Buoy (TB-1) Station 7/1/04-6/30/07.

Samp. No.	Mid-lake Station Start Date-Time	Dry-Bulk Collection Date-Time	Vol. Liters	Precip. Form	Collector Type	H+ (g/ha)	(Load) NO3-N (g/ha)	NH4-N (g/ha)	TKN (g/ha)	SRP (g/ha)	DP (g/ha)	TP (g/ha)	Notes
1	6/24/2004 13:00	7/2/2004 14:14	1.070	DF	DRY-BULK	5.30	48.83	39.31	65.81	2.25	2.80	8.39	
2	7/2/2004 14:14	7/17/2004 11:25	0.000	DF	DRY-BULK	NA	35.25	35.31	56.08	0.48	1.52	4.50	6
3	7/17/2004 11:25	7/27/2004 11:10	0.168	DF	DRY-BULK	NA	36.92	36.35	97.17	0.41	1.43	4.32	7
4	7/27/2004 11:10	8/9/2004 9:55	0.000	DF+T	DRY-BULK	NA	38.26	32.28	56.62	0.03	0.89	1.87	6
5	8/9/2004 9:55	8/16/2004 11:00	1.330	DF	DRY-BULK	5.24	38.24	32.34	78.02	0.08	1.00	1.91	
6	8/16/2004 11:00	8/31/2004 8:40	0.000	DF	DRY-BULK	NA	56.71	45.05	69.02	0.27	1.24	2.36	6
7	8/31/2004 8:40	9/9/2004 12:40	0.100	DF	DRY-BULK	NA	35.58	38.26	64.34	0.35	0.87	5.96	9
8	9/9/2004 12:40	9/17/2004 9:05	0.150	DF	DRY-BULK	NA	41.31	44.45	69.45	0.46	1.36	2.15	10
9	9/17/2004 9:05	9/24/2004 9:45	0.725	DF+RS	DRY-BULK	4.52	34.98	32.08	42.79	0.68	1.35	1.91	
10	9/24/2004 9:45	10/5/2004 12:35	1.420	DF	DRY-BULK	7.58	43.81	38.63	86.51	1.04	1.56	2.39	
11	10/5/2004 12:35	10/14/2004 10:20	0.140	DF	DRY-BULK	3.11	47.63	51.42	81.64	0.41	1.22	3.20	11
12	10/14/2004 10:20	10/22/2004 11:10	2.243	DF+RS	DRY-BULK	2.22	31.85	C	106.47	5.44	5.46	15.39	
13	10/22/2004 11:10	10/29/2004 11:40	1.992	DF+RS	DRY-BULK	4.73	21.20	9.56	44.18	5.36	5.34	8.95	
14	10/29/2004 11:40	11/15/2004 13:50	0.230	DF+RS	DRY-BULK	3.52	78.98	70.89	75.19	0.76	0.92	4.38	58
15	11/15/2004 13:50	11/29/2004 15:45	1.113	DF+S	DRY-BULK	3.48	29.96	16.45	20.15	0.30	1.36	3.27	
16	11/29/2004 15:45	12/10/2004 14:00	1.160	DF+RS	DRY-BULK	2.29	20.68	7.99	42.01	0.78	1.60	4.06	
17	12/10/2004 14:00	12/24/2004 8:30	0.737	DF	DRY-BULK	2.20	28.58	17.13	54.97	0.22	0.83	2.72	
18	12/24/2004 8:30	1/6/2005 11:40	0.670	DF+S	DRY-BULK	2.19	22.06	15.48	54.31	0.15	0.75	2.76	
19	1/6/2005 11:40	1/13/2005 13:50	1.754	DF+S	DRY-BULK	2.89	NA	NA	NA	NA	NA	NA	
20	1/13/2005 13:50	1/24/2005 15:50	1.876	DF+S	DRY-BULK	5.89	40.78	5.75	134.36	0.09	1.60	0.60	
21	1/24/2005 15:50	2/4/2005 16:30	0.796	DF+RS	DRY-BULK	C	C	C	C	C	C	C	193
22	2/4/2005 16:30	2/24/2005 14:25	1.352	DF+RS	DRY-BULK	4.45	72.47	52.54	65.22	0.58	1.83	2.40	
23	2/24/2005 14:25	3/9/2005 10:40	0.830	DF+S	DRY-BULK	2.72	43.33	31.68	82.49	0.42	1.08	1.75	
24	3/9/2005 10:40	3/16/2005 10:23	0.920	DF+T	DRY-BULK	0.81	45.07	19.38	29.33	1.15	1.99	2.77	59
25	3/16/2005 10:23	3/24/2005 10:05	1.903	DF+RS	DRY-BULK	3.93	27.45	18.73	44.45	0.35	2.25	2.49	60
26	3/24/2005 10:05	3/31/2005 9:35	1.353	DF+RS	DRY-BULK	2.94	13.69	7.41	17.42	0.13	1.33	1.60	61

Samp. No.	Mid-lake Station Start Date-Time	Dry-Bulk Collection Date-Time	Vol. Liters	Precip. Form	Collector Type	H+ (g/ha)	(Load) NO3-N (g/ha)	NH4-N (g/ha)	TKN (g/ha)	SRP (g/ha)	DP (g/ha)	TP (g/ha)	Notes
27	3/31/2005 9:35	4/14/2005 13:20	1.000	DF+RS	DRY-BULK	0.99	34.74	30.94	61.41	2.10	3.18	4.62	62
28	4/14/2005 13:20	4/22/2005 15:00	0.840	DF+RS	DRY-BULK	2.09	19.91	14.83	31.46	0.69	0.99	4.09	
29	4/22/2005 15:00	5/25/2005 16:20	0.500	DF+RSG	DRY-BULK	1.93	49.99	63.07	111.83	5.73	8.07	9.78	63
30	5/25/2005 16:20	6/8/2005 8:35	0.500	DF+RS	DRY-BULK	0.99	26.45	24.24	69.52	1.41	1.96	6.62	64
31	6/8/2005 8:35	6/20/2005 11:34	0.539	DF+RS	DRY-BULK	4.23	40.64	55.41	56.65	6.28	11.62	NA	65
32	6/20/2005 11:34	6/29/2005 10:50	1.009	DF	DRY-BULK	3.32	28.52	46.64	87.82	0.58	1.51	NA	
33	6/29/2005 10:50	7/13/2005 12:49	0.500	DF	DRY-BULK	NA	27.29	24.35	87.31	1.34	2.25	NA	77
34	7/13/2005 12:49	7/27/2005 8:55	0.500	DF	DRY-BULK	NA	C	C	C	C	C	C	78
35	7/27/2005 8:55	8/6/2005 10:50	0.500	DF	DRY-BULK	0.65	C	C	C	C	C	C	79
36	8/6/2005 10:50	8/18/2005 7:28	0.500	R+DF	DRY-BULK	3.13	64.30	33.47	77.22	0.69	0.91	NA	80
37	8/18/2005 7:28	8/26/2005 13:46	0.435	DF	DRY-BULK	2.65	42.73	66.94	NA	3.26	4.00	4.29	81
38	8/26/2005 13:46	9/6/2005 12:35	0.500	DF	DRY-BULK	NA	2.03	43.60	77.93	0.31	0.88	NA	82
39	9/6/2005 12:35	9/15/2005 15:32	0.699	DF	DRY-BULK	4.46	44.37	84.57	116.85	1.13	2.37	NA	88
40	9/15/2005 15:32	9/27/2005 12:05	0.500	DF	DRY-BULK	NA	57.59	62.49	95.77	0.85	1.20	NA	83
41	9/27/2005 12:05	10/6/2005 13:00	0.678	DF	DRY-BULK	6.00	42.04	51.13	79.11	0.90	1.28	2.61	
42	10/6/2005 13:00	10/20/2005 13:15	0.290	R+S+DF	DRY-BULK	0.47	54.01	88.71	110.92	0.31	1.40	5.31	108
43	10/20/2005 13:15	11/10/2005 12:55	0.190	R+S+DF	DRY-BULK	1.16	31.95	35.65	44.15	0.27	0.43	1.29	109
44	11/10/2005 12:55	11/18/2005 10:05	1.835	DF	DRY-BULK	3.62	20.95	11.67	27.07	0.33	1.25	1.58	108
45	11/18/2005 10:05	12/6/2005 13:02	2.325	R+S+DF	DRY-BULK	4.80	21.66	6.67	73.19	0.52	3.03	9.54	110
46	12/6/2005 13:02	12/23/2005 12:30	3.121	R+S+DF	DRY-BULK	NA	31.67	8.08	23.23	1.41	3.10	2.13	110
47	12/23/2005 12:30	1/4/2006 13:25	2.514	R+S+DF	DRY-BULK	3.85	13.12	5.17	7.98	0.34	1.88	2.81	110
48	1/4/2006 13:25	1/24/2006 12:35	0.500	S+DF	DRY-BULK	>0.02	36.92	12.70	32.50	0.11	0.56	3.57	128
49	1/24/2006 12:35	2/6/2006 13:25	1.136	R+S+DF	DRY-BULK	2.05	18.85	25.39	31.59	0.27	0.08	15.21	
50	2/6/2006 13:25	2/23/2006 9:50	1.065	S+DF	DRY-BULK	2.65	32.71	26.03	29.51	0.97	0.67	4.80	
51	2/23/2006 9:50	3/8/2006 12:15	1.796	R+S+DF	DRY-BULK	4.36	24.02	14.86	46.63	0.81	1.45	4.02	
52	3/8/2006 12:15	4/6/2006 10:45	1.105	R+S+DF	DRY-BULK	3.54	33.52	32.82	38.67	1.11	2.45	2.77	
53	4/6/2006 10:45	4/21/2006 10:15	0.524	R+S+DF	DRY-BULK	2.67	20.42	33.07	46.46	0.73	1.56	1.38	
54	4/21/2006 10:15	5/5/2006 12:55	1.102	R+DF	DRY-BULK	NA	82.86	64.16	110.46	5.10	6.49	12.53	
55	5/5/2006 12:55	6/14/2006 9:45	0.500	R+DF	DRY-BULK	NA	35.71	40.19	119.67	3.73	6.81	12.21	

Samp. No.	Mid-lake Station Start Date-Time	Dry-Bulk Collection Date-Time	Vol. Liters	Precip. Form	Collector Type	H+ (g/ha)	(Load) NO3-N (g/ha)	NH4-N (g/ha)	TKN (g/ha)	SRP (g/ha)	DP (g/ha)	TP (g/ha)	Notes
56	6/14/2006 9:45	6/23/2006 12:25	0.500	DF	DRY-BULK	NA	6.25	6.32	59.57	0.78	2.65	7.50	138
57	6/23/2006 12:25	6/29/2006 10:05	1.879	DF	DRY-BULK	NA	40.99	44.90	83.09	0.17	4.40	6.70	
58	6/29/2006 10:05	7/10/2006 9:30	0.500	R+DF	DRY-BULK	NA	14.47	31.72	72.15	7.26	18.36	30.09	148
59	7/10/2006 9:30	8/2/2006 14:45	0.500	R+DF	DRY-BULK	NA	35.99	18.74	164.96	6.26	12.35	20.66	148
60	8/2/2006 14:45	8/15/2006 9:40	0.500	DF	DRY-BULK	NA	41.85	28.65	74.40	0.09	0.97	1.66	148
61	8/15/2006 9:40	9/1/2006 8:00	0.500	DF	DRY-BULK	NA	24.44	18.53	72.08	1.42	NA	7.86	148
62	9/1/2006 8:00	9/13/2006 10:05	0.350	DF	DRY-BULK	NA	45.23	58.84	93.28	0.24	0.51	3.89	149
63	9/13/2006 10:05	9/29/2006 9:00	0.500	DF	DRY-BULK	NA	43.73	32.56	66.24	NA	1.90	5.11	148
64	9/29/2006 9:00	10/13/2006 10:35	0.264	R+H+DF	DRY-BULK	NA	86.00	95.28	NA	1.15	1.25	10.55	
65	10/13/2006 10:35	10/27/2006 12:05	0.645	R+DF	DRY-BULK	1.97	38.30	NA	53.47	0.09	0.47	5.02	
66	10/27/2006 12:05	11/6/2006 11:12	2.003	R+DF	DRY-BULK	4.86	27.42	19.14	NA	0.09	0.72	2.18	162
67	11/6/2006 11:12	11/17/2006 10:16	0.547	R+S+DF	DRY-BULK	4.20	21.37	9.49	22.88	0.10	0.40	0.73	
68	11/17/2006 10:16	12/7/2006 14:43	3.140	S+DF	DRY-BULK	4.92	54.54	26.63	115.11	4.39	9.64	11.14	194
69	12/7/2006 14:43	12/19/2006 11:38	0.491	R+S+DF	DRY-BULK	NA	13.90	19.12	31.95	0.49	NA	2.21	
70	12/19/2006 11:38	1/9/2007 9:45	0.500	R+S+DF	DRY-BULK	1.97	34.18	9.54	24.86	1.27	0.81	2.88	178
71	1/9/2007 9:45	1/23/2007 11:44	0.490	DF	DRY-BULK	0.64	12.94	5.46	1.19	0.30	NA	1.19	
72	1/23/2007 11:44	2/1/2007 12:45	2.050	DF	DRY-BULK	6.72	34.11	21.26	40.74	0.92	2.30	3.05	
73	2/1/2007 12:45	2/12/2007 11:04	2.487	R+S+DF	DRY-BULK	4.80	17.53	14.68	29.88	1.12	2.64	2.56	
74	2/12/2007 11:04	3/2/2007 9:18	0.500	S+DF	DRY-BULK	NA	29.69	NA	34.20	NA	NA	1.49	179
75	3/2/2007 9:18	3/15/2007 10:00	1.503	DF	DRY-BULK	5.06	28.95	NA	42.05	0.21	NA	2.79	
76	3/15/2007 10:00	4/6/2007 14:20	0.505	S+DF	DRY-BULK	NA	45.44	NA	57.84	0.73	NA	4.12	195
77	4/6/2007 14:20	5/10/2007 14:41	0.500	S+DF	DRY-BULK	NA	NA	NA	42.48	0.39	NA	4.44	147
78	5/10/2007 14:41	5/31/2007 10:30	0.500	DF	DRY-BULK	NA	25.66	NA	NA	0.65	NA	NA	196
79	5/31/2007 10:30	6/25/2007 16:02	0.500	R+S+DF	DRY-BULK	NA	35.40	13.28	52.11	1.44	2.91	4.05	
80	6/25/2007 16:02	6/26/2007 13:38	2.875	DF	DRY-BULK	NA	3.40▪	2.66▪	13.10▪	0.13▪	0▪	0▪	200
81	6/26/2007 13:38	6/27/2007 8:15	3.282	DF	DRY-BULK	NA	5.45▪	5.63▪	24.48▪	0.16▪	0▪	0▪	200
82	6/27/2007 8:15	6/28/2007 7:35	3.046	DF	DRY-BULK	NA	6.01▪	3.44▪	21.34▪	0.14▪	0▪	0▪	200

Appendix Table 5.c. N, P, and H loading per day in dry-bulk deposition (buoy bucket collector) at the Mid-lake Buoy (TB-1) Station 7/1/04-6/30/07.

Samp. No.	Mid-lake Station Start Date-Time	Dry-Bulk Collection Date-Time	Vol. Liters	Precip. Form	Collector Type	H+ (g/ha/d)	NO3-N (g/ha/d)	NH4-N (g/ha/d)	TKN (g/ha/d)	SRP (g/ha/d)	DP (g/ha/d)	TP (g/ha/d)	Notes
1	6/24/2004 13:00	7/2/2004 14:14	1.070	DF	DRY-BULK	0.66	6.07	4.88	8.17	0.28	0.35	1.04	
2	7/2/2004 14:14	7/17/2004 11:25	0.000	DF	DRY-BULK	NA	2.37	2.37	3.77	0.03	0.10	0.30	6
3	7/17/2004 11:25	7/27/2004 11:10	0.168	DF	DRY-BULK	NA	3.70	3.64	9.73	0.04	0.14	0.43	7
4	7/27/2004 11:10	8/9/2004 9:55	0.000	DF+T	DRY-BULK	NA	2.96	2.49	4.37	0.00	0.07	0.14	6
5	8/9/2004 9:55	8/16/2004 11:00	1.330	DF	DRY-BULK	0.74	5.43	4.59	11.07	0.01	0.14	0.27	
6	8/16/2004 11:00	8/31/2004 8:40	0.000	DF	DRY-BULK	NA	3.81	3.02	4.63	0.02	0.08	0.16	6
7	8/31/2004 8:40	9/9/2004 12:40	0.100	DF	DRY-BULK	NA	3.88	4.17	7.02	0.04	0.09	0.65	9
8	9/9/2004 12:40	9/17/2004 9:05	0.150	DF	DRY-BULK	NA	5.26	5.66	8.85	0.06	0.17	0.27	10
9	9/17/2004 9:05	9/24/2004 9:45	0.725	DF+RS	DRY-BULK	0.64	4.98	4.57	6.09	0.10	0.19	0.27	
10	9/24/2004 9:45	10/5/2004 12:35	1.420	DF	DRY-BULK	0.68	3.94	3.47	7.78	0.09	0.14	0.22	
11	10/5/2004 12:35	10/14/2004 10:20	0.140	DF	DRY-BULK	0.35	5.35	5.77	9.17	0.05	0.14	0.36	11
12	10/14/2004 10:20	10/22/2004 11:10	2.243	DF+RS	DRY-BULK	0.28	3.96	C	13.25	0.68	0.68	1.92	
13	10/22/2004 11:10	10/29/2004 11:40	1.992	DF+RS	DRY-BULK	0.67	3.02	1.36	6.29	0.76	0.76	1.27	
14	10/29/2004 11:40	11/15/2004 13:50	0.230	DF+RS	DRY-BULK	0.21	4.62	4.15	4.40	0.04	0.05	0.26	58
15	11/15/2004 13:50	11/29/2004 15:45	1.113	DF+S	DRY-BULK	0.25	2.13	1.17	1.43	0.02	0.10	0.23	
16	11/29/2004 15:45	12/10/2004 14:00	1.160	DF+RS	DRY-BULK	0.21	1.89	0.73	3.84	0.07	0.15	0.37	
17	12/10/2004 14:00	12/24/2004 8:30	0.737	DF	DRY-BULK	0.16	2.08	1.24	3.99	0.02	0.06	0.20	
18	12/24/2004 8:30	1/6/2005 11:40	0.670	DF+S	DRY-BULK	0.17	1.68	1.18	4.14	0.01	0.06	0.21	
19	1/6/2005 11:40	1/13/2005 13:50	1.754	DF+S	DRY-BULK	0.41	NA	NA	NA	NA	NA	NA	
20	1/13/2005 13:50	1/24/2005 15:50	1.876	DF+S	DRY-BULK	0.53	3.68	0.52	12.12	0.01	0.14	0.05	
21	1/24/2005 15:50	2/4/2005 16:30	0.796	DF+RS	DRY-BULK	C	C	C	C	C	C	C	193
22	2/4/2005 16:30	2/24/2005 14:25	1.352	DF+RS	DRY-BULK	0.22	3.64	2.64	3.28	0.03	0.09	0.12	
23	2/24/2005 14:25	3/9/2005 10:40	0.830	DF+S	DRY-BULK	0.21	3.37	2.47	6.42	0.03	0.08	0.14	

Samp. No.	Mid-lake Station Start Date-Time	Dry-Bulk Collection Date-Time	Vol. Liters	Precip. Form	Collector Type	H+ (g/ha/d)	NO3-N (g/ha/d)	NH4-N (g/ha/d)	TKN (g/ha/d)	SRP (g/ha/d)	DP (g/ha/d)	TP (g/ha/d)	Notes
24	3/9/2005 10:40	3/16/2005 10:23	0.920	DF+T	DRY-BULK	0.12	6.45	2.77	4.20	0.16	0.28	0.40	59
25	3/16/2005 10:23	3/24/2005 10:05	1.903	DF+RS	DRY-BULK	0.49	3.44	2.34	5.56	0.04	0.28	0.31	60
26	3/24/2005 10:05	3/31/2005 9:35	1.353	DF+RS	DRY-BULK	0.42	1.96	1.06	2.50	0.02	0.19	0.23	61
27	3/31/2005 9:35	4/14/2005 13:20	1.000	DF+RS	DRY-BULK	0.07	2.45	2.19	4.34	0.15	0.22	0.33	62
28	4/14/2005 13:20	4/22/2005 15:00	0.840	DF+RS	DRY-BULK	0.26	2.47	1.84	3.90	0.09	0.12	0.51	
29	4/22/2005 15:00	5/25/2005 16:20	0.500	DF+RSG	DRY-BULK	0.06	1.51	1.91	3.38	0.17	0.24	0.30	63
30	5/25/2005 16:20	6/8/2005 8:35	0.500	DF+RS	DRY-BULK	0.07	1.93	1.77	5.08	0.10	0.14	0.48	64
31	6/8/2005 8:35	6/20/2005 11:34	0.539	DF+RS	DRY-BULK	0.35	3.35	4.57	4.67	0.52	0.96	NA	65
32	6/20/2005 11:34	6/29/2005 10:50	1.009	DF	DRY-BULK	0.37	3.18	5.20	9.79	0.06	0.17	NA	
33	6/29/2005 10:50	7/13/2005 12:49	0.500	DF	DRY-BULK	NA	1.94	1.73	6.20	0.10	0.16	NA	77
34	7/13/2005 12:49	7/27/2005 8:55	0.500	DF	DRY-BULK	C	C	C	C	C	C	C	78
35	7/27/2005 8:55	8/6/2005 10:50	0.500	DF	DRY-BULK	0.06	C	C	C	C	C	C	79
36	8/6/2005 10:50	8/18/2005 7:28	0.500	R+DF	DRY-BULK	0.26	5.42	2.82	6.51	0.06	0.08	NA	80
37	8/18/2005 7:28	8/26/2005 13:46	0.435	DF	DRY-BULK	0.32	5.17	8.10	NA	0.39	0.48	0.52	81
38	8/26/2005 13:46	9/6/2005 12:35	0.500	DF	DRY-BULK	NA	0.19	3.98	7.12	0.03	0.08	NA	82
39	9/6/2005 12:35	9/15/2005 15:32	0.699	DF	DRY-BULK	0.49	4.86	9.27	12.81	0.12	0.26	NA	88
40	9/15/2005 15:32	9/27/2005 12:05	0.500	DF	DRY-BULK	NA	4.86	5.27	8.08	0.07	0.10	NA	83
41	9/27/2005 12:05	10/6/2005 13:00	0.678	DF	DRY-BULK	0.66	4.65	5.66	8.75	0.10	0.14	0.29	
42	10/6/2005 13:00	10/20/2005 13:15	0.290	R+S+DF	DRY-BULK	0.03	3.85	6.33	7.92	0.02	0.10	0.38	108
43	10/20/2005 13:15	11/10/2005 12:55	0.190	R+S+DF	DRY-BULK	0.06	1.52	1.70	2.10	0.01	0.02	0.06	109
44	11/10/2005 12:55	11/18/2005 10:05	1.835	DF	DRY-BULK	0.46	2.66	1.48	3.43	0.04	0.16	0.20	108
45	11/18/2005 10:05	12/6/2005 13:02	2.325	R+S+DF	DRY-BULK	0.27	1.20	0.37	4.04	0.03	0.17	0.53	110
46	12/6/2005 13:02	12/23/2005 12:30	3.121	R+S+DF	DRY-BULK	NA	1.87	0.48	1.37	0.08	0.18	0.13	110
47	12/23/2005 12:30	1/4/2006 13:25	2.514	R+S+DF	DRY-BULK	0.32	1.09	0.43	0.66	0.03	0.16	0.23	110
48	1/4/2006 13:25	1/24/2006 12:35	0.500	S+DF	DRY-BULK	0.00	1.85	0.64	1.63	0.01	0.03	0.18	128
49	1/24/2006 12:35	2/6/2006 13:25	1.136	R+S+DF	DRY-BULK	0.16	1.45	1.95	2.42	0.02	0.01	1.17	

Samp. No.	Mid-lake Station Start Date-Time	Dry-Bulk Collection Date-Time	Vol. Liters	Precip. Form	Collector Type	H+ (g/ha/d)	NO3-N (g/ha/d)	NH4-N (g/ha/d)	TKN (g/ha/d)	SRP (g/ha/d)	DP (g/ha/d)	TP (g/ha/d)	Notes
50	2/6/2006 13:25	2/23/2006 9:50	1.065	S+DF	DRY-BULK	0.16	1.94	1.54	1.75	0.06	0.04	0.28	
51	2/23/2006 9:50	3/8/2006 12:15	1.796	R+S+DF	DRY-BULK	0.33	1.83	1.13	3.56	0.06	0.11	0.31	
52	3/8/2006 12:15	4/6/2006 10:45	1.105	R+S+DF	DRY-BULK	0.12	1.16	1.13	1.34	0.04	0.08	0.10	
53	4/6/2006 10:45	4/21/2006 10:15	0.524	R+S+DF	DRY-BULK	0.18	1.36	2.21	3.10	0.05	0.10	0.09	
54	4/21/2006 10:15	5/5/2006 12:55	1.102	R+DF	DRY-BULK	NA	5.87	4.55	7.83	0.36	0.46	0.89	
55	5/5/2006 12:55	6/14/2006 9:45	0.500	R+DF	DRY-BULK	NA	0.90	1.01	3.00	0.09	0.17	0.31	
56	6/14/2006 9:45	6/23/2006 12:25	0.500	DF	DRY-BULK	NA	0.69	0.69	6.54	0.09	0.29	0.82	138
57	6/23/2006 12:25	6/29/2006 10:05	1.879	DF	DRY-BULK	NA	6.94	7.61	14.08	0.03	0.75	1.14	
58	6/29/2006 10:05	7/10/2006 9:30	0.500	R+DF	DRY-BULK	NA	1.32	2.89	6.57	0.66	1.67	2.74	148
59	7/10/2006 9:30	8/2/2006 14:45	0.500	R+DF	DRY-BULK	NA	1.55	0.81	7.10	0.27	0.53	0.89	148
60	8/2/2006 14:45	8/15/2006 9:40	0.500	DF	DRY-BULK	NA	3.27	2.24	5.82	0.01	0.08	0.13	148
61	8/15/2006 9:40	9/1/2006 8:00	0.500	DF	DRY-BULK	NA	1.44	1.09	4.26	0.08	NA	0.46	148
62	9/1/2006 8:00	9/13/2006 10:05	0.350	DF	DRY-BULK	NA	3.74	4.87	7.72	0.02	0.04	0.32	149
63	9/13/2006 10:05	9/29/2006 9:00	0.500	DF	DRY-BULK	NA	2.74	2.04	4.15	NA	0.12	0.32	148
64	9/29/2006 9:00	10/13/2006 10:35	0.264	R+H+DF	DRY-BULK	NA	6.11	6.77	NA	0.08	0.09	0.75	
65	10/13/2006 10:35	10/27/2006 12:05	0.645	R+DF	DRY-BULK	0.14	2.72	NA	3.80	0.01	0.03	0.36	
66	10/27/2006 12:05	11/6/2006 11:12	2.003	R+DF	DRY-BULK	0.49	2.75	1.92	NA	0.01	0.07	0.22	162
67	11/6/2006 11:12	11/17/2006 10:16	0.547	R+S+DF	DRY-BULK	0.38	1.95	0.87	2.09	0.01	0.04	0.07	
68	11/17/2006 10:16	12/7/2006 14:43	3.140	S+DF	DRY-BULK	0.24	2.70	1.32	5.70	0.22	0.48	0.55	194
69	12/7/2006 14:43	12/19/2006 11:38	0.491	R+S+DF	DRY-BULK	NA	1.17	1.61	2.69	0.04	NA	0.19	
70	12/19/2006 11:38	1/9/2007 9:45	0.500	R+S+DF	DRY-BULK	0.09	1.63	0.46	1.19	0.06	0.04	0.14	178
71	1/9/2007 9:45	1/23/2007 11:44	0.490	DF	DRY-BULK	0.05	0.92	0.39	0.08	0.02	NA	0.08	
72	1/23/2007 11:44	2/1/2007 12:45	2.050	DF	DRY-BULK	0.74	3.77	2.35	4.51	0.10	0.25	0.34	
73	2/1/2007 12:45	2/12/2007 11:04	2.487	R+S+DF	DRY-BULK	0.44	1.60	1.34	2.73	0.10	0.24	0.23	
74	2/12/2007 11:04	3/2/2007 9:18	0.500	S+DF	DRY-BULK	NA	1.66	NA	1.91	NA	NA	0.08	179
75	3/2/2007 9:18	3/15/2007 10:00	1.503	DF	DRY-BULK	0.39	2.22	NA	3.23	0.02	NA	0.21	

Samp. No.	Mid-lake Station Start Date-Time	Dry-Bulk Collection Date-Time	Vol. Liters	Precip. Form	Collector Type	H+ (g/ha/d)	NO3-N (g/ha/d)	NH4-N (g/ha/d)	TKN (g/ha/d)	SRP (g/ha/d)	DP (g/ha/d)	TP (g/ha/d)	Notes
76	3/15/2007 10:00	4/6/2007 14:20	0.505	S+DF	DRY-BULK	NA	2.05	NA	2.61	0.03	NA	0.19	195
77	4/6/2007 14:20	5/10/2007 14:41	0.500	S+DF	DRY-BULK	NA	NA	NA	1.25	0.01	NA	0.13	147
78	5/10/2007 14:41	5/31/2007 10:30	0.500	DF	DRY-BULK	NA	1.23	NA	NA	0.03	NA	NA	196
79	5/31/2007 10:30	6/25/2007 16:02	0.500	R+S+DF	DRY-BULK	NA	1.40	0.53	2.07	0.06	0.12	0.16	
80	6/25/2007 16:02	6/26/2007 13:38	2.875	DF	DRY-BULK	NA	3.78▪	2.95▪	14.56▪	0.14▪	0▪	0▪	200
81	6/26/2007 13:38	6/27/2007 8:15	3.282	DF	DRY-BULK	NA	7.03▪	7.26▪	31.56▪	0.20▪	0▪	0▪	200
82	6/27/2007 8:15	6/28/2007 7:35	3.046	DF	DRY-BULK	NA	6.18▪	3.54▪	21.95▪	0.14▪	0▪	0▪	200

Appendix Table 6.a. N, P, and H concentrations in dry-bulk deposition (buoy bucket collector) at the Northwest Buoy (TB-4) Station 7/1/04-6/30/07.

Samp. No.	Buoy TB-4 Start Date-Time	Dry-Bulk Collection Date-Time	Vol. Liters	Precip. Form	Collector Type	pH	H+ (µg/l)	(Conc.) NO3-N (µg/l)	NH4-N (µg/l)	TKN (µg/l)	SRP (µg/l)	DP (µg/l)	TP (µg/l)	Notes
1	6/24/2004 12:28	7/2/2004 13:53	0.810	DF	DRY-BULK	4.60	25.12	183.95	166.62	245.48	7.17	7.39	23.40	
2	7/2/2004 13:53	7/17/2004 10:50	0.000	DF	DRY-BULK	NA	NA	352.74	553.24	745.15	5.07	12.91	41.25	6
3	7/17/2004 10:50	7/27/2004 9:10	0.017	DF	DRY-BULK	NA	NA	397.39	865.06	1101.18	2.07	9.76	25.82	12
4	7/27/2004 9:10	8/9/2004 9:22	0.000	DF	DRY-BULK	NA	NA	261.20	134.67	389.50	48.20	61.13	105.50	6
5	8/9/2004 9:22	8/16/2004 10:40	1.317	DF	DRY-BULK	4.55	28.18	142.70	130.50	256.37	0.29	4.78	9.00	
6	8/16/2004 10:40	8/31/2004 8:22	0.000	DF	DRY-BULK	NA	NA	214.30	190.43	328.64	1.50	7.53	16.49	8
7	8/31/2004 8:22	9/9/2004 12:05	0.000	DF	DRY-BULK	NA	NA	332.60	221.12	618.25	5.04	7.22	21.78	6
8	9/9/2004 12:05	9/17/2004 8:36	0.000	DF	DRY-BULK	NA	NA	158.60	169.73	270.95	1.77	6.59	9.02	8
9	9/17/2004 8:36	9/24/2004 9:20	0.836	DF+RS	DRY-BULK	4.52	30.20	173.00	168.25	350.75	3.75	8.47	21.16	
10	9/24/2004 9:20	10/5/2004 11:57	0.935	DF	DRY-BULK	4.50	31.62	176.90	140.79	310.37	4.55	8.73	25.27	
11	10/5/2004 11:57	10/14/2004 9:55	0.375	DF	DRY-BULK	4.35	44.67	490.40	451.83	795.21	5.46	13.10	44.60	
12	10/14/2004 9:55	10/22/2004 10:40	2.730	DF+RS	DRY-BULK	5.20	6.31	50.45	194.26	252.07	1.36	6.01	11.69	
13	10/22/2004 10:40	10/29/2004 11:15	1.930	DF+RS	DRY-BULK	4.95	11.22	65.98	28.70	52.57	1.14	3.16	5.37	
14	10/29/2004 11:15	11/15/2004 16:10	0.349	DF+RS	DRY-BULK	4.20	63.10	1322.58	721.93	991.88	8.53	9.80	26.23	
15	11/15/2004 16:10	11/29/2004 16:08	1.333	DF+S	DRY-BULK	4.89	12.88	155.06	69.38	163.61	1.37	5.07	10.77	
16	11/29/2004 16:08	12/10/2004 13:40	1.394	DF+RS	DRY-BULK	5.18	6.61	74.36	27.52	85.07	4.79	6.02	14.25	
17	12/10/2004 13:40	12/24/2004 9:00	0.799	DF	DRY-BULK	4.70	19.95	179.80	106.97	299.75	0.87	5.07	8.55	
18	12/24/2004 9:00	1/6/2005 11:20	0.825	DF+S	DRY-BULK	4.82	15.14	108.70	106.55	199.15	2.37	5.07	10.45	
19	1/6/2005 11:20	1/13/2005 14:30	2.034	DF+S	DRY-BULK	5.10	7.94	NA	NA	NA	NA	NA	NA	
20	1/13/2005 14:30	1/24/2005 16:20	1.959	DF+S	DRY-BULK	4.90	12.59	NA	NA	NA	NA	NA	NA	
21	1/24/2005 16:20	2/4/2005 16:55	1.257	DF+RS	DRY-BULK	4.68	20.89	266.18	61.66	144.16	1.00	10.81	13.03	
22	2/4/2005 16:55	2/24/2005 14:50	1.682	DF+RS	DRY-BULK	4.70	19.95	281.70	194.44	298.63	2.07	11.13	18.99	
23	2/24/2005 14:50	3/9/2005 11:20	1.009	DF+S	DRY-BULK	4.89	12.88	140.81	157.00	290.78	2.54	5.35	8.18	
24	3/9/2005 11:20	3/16/2005 10:45	0.843	DF	DRY-BULK	5.28	5.25	103.25	89.17	224.43	5.08	9.15	17.67	
25	3/16/2005 10:45	3/24/2005 10:40	3.098	DF+RS	DRY-BULK	4.98	10.47	49.80	36.90	71.70	0.92	4.42	5.36	
26	3/24/2005 10:40	3/31/2005 10:05	1.491	DF+RS	DRY-BULK	4.90	12.59	41.59	31.02	71.35	0.23	5.05	5.68	

Samp. No.	Buoy TB-4 Start Date-Time	Dry-Bulk Collection Date-Time	Vol. Liters	Precip. Form	Collector Type	pH	H+ (µg/l)	(Conc.) NO3-N (µg/l)	NH4-N (µg/l)	TKN (µg/l)	SRP (µg/l)	DP (µg/l)	TP (µg/l)	Notes
27	3/31/2005 10:05	4/14/2005 13:55	1.001	DF+RS	DRY-BULK	5.37	4.27	155.90	166.08	260.37	2.31	3.79	13.28	66
28	4/14/2005 13:55	4/22/2005 15:20	0.935	DF+RS	DRY-BULK	4.90	12.59	102.13	70.40	88.98	2.54	5.37	8.85	
29	4/22/2005 15:20	5/25/2005 16:44	0.511	DF+RSG	DRY-BULK	4.50	31.62	700.38	947.12	1280.90	82.33	93.30	128.53	67
30	5/25/2005 16:44	6/8/2005 9:00	0.500	DF+RS	DRY-BULK	4.50	31.62	218.69	261.05	462.41	10.15	17.53	32.11	68
31	6/8/2005 9:00	6/20/2005 11:52	0.411	DF+RS	DRY-BULK	4.40	39.81	431.42	604.25	742.75	21.00	26.29	38.40	69
32	6/20/2005 11:52	6/29/2005 10:30	0.587	DF	DRY-BULK	4.60	25.12	248.47	461.71	679.04	3.23	7.51	43.44	
33	6/29/2005 10:30	7/13/2005 12:26	0.500	DF	DRY-BULK	NA	NA	171.89	134.95	565.14	7.37	14.08	NA	82
34	7/13/2005 12:26	7/27/2005 8:55	0.500	DF	DRY-BULK	NA	NA	368.45	193.06	833.28	10.13	15.34	NA	82
35	7/27/2005 8:55	8/6/2005 10:32	0.500	DF	DRY-BULK	NA	NA	453.54	619.60	1013.75	6.45	10.64	NA	84
36	8/6/2005 10:32	8/18/2005 7:13	0.500	DF	DRY-BULK	NA	NA	C	C	C	C	C	C	85
37	8/18/2005 7:13	8/26/2005 13:25	0.500	DF	DRY-BULK	4.80	15.85	427.59	617.41	834.36	5.07	8.61	12.19	86
38	8/26/2005 13:25	9/6/2005 12:03	0.500	DF	DRY-BULK	NA	NA	NA	369.60	651.08	4.32	10.95	NA	87
39	9/6/2005 12:03	9/15/2005 15:10	0.763	DF	DRY-BULK	4.60	25.12	244.21	520.92	740.46	10.22	14.40	NA	88
40	9/15/2005 15:10	9/27/2005 11:40	0.500	DF	DRY-BULK	NA	NA	513.96	586.71	1015.47	4.54	8.45	NA	89
41	9/27/2005 11:40	10/6/2005 12:24	0.565	DF	DRY-BULK	4.34	45.71	350.58	460.61	641.62	5.91	8.45	28.01	
42	10/6/2005 12:24	10/20/2005 13:50	0.098	R+S+DF	DRY-BULK	4.89	12.88	559.90	909.75	1072.77	3.66	12.21	37.84	112
43	10/20/2005 13:50	11/10/2005 13:30	0.385	R+S+DF	DRY-BULK	4.41	38.90	111.07	1547.66	1511.64	8.01	6.85	21.81	
44	11/10/2005 13:30	11/18/2005 9:50	1.815	DF	DRY-BULK	5.10	7.94	54.91	33.06	81.22	0.46	9.23	3.43	
45	11/18/2005 9:50	12/6/2005 13:45	2.276	R+S+DF	DRY-BULK	5.09	8.13	37.28	15.17	32.72	0.23	8.31	12.10	110
46	12/6/2005 13:45	12/23/2005 12:05	2.892	R+S+DF	DRY-BULK	NA	NA	52.16	11.09	42.56	1.83	6.30	4.40	110
47	12/23/2005 12:05	1/4/2006 12:47	3.735	R+S+DF	DRY-BULK	5.15	7.08	9.00	10.42	7.41	1.14	3.46	3.46	110
48	1/4/2006 12:47	1/24/2006 11:45	0.225	S+DF	DRY-BULK	<5.6	>2.51	364.31	146.63	313.58	0.91	5.79	28.01	
49	1/24/2006 11:45	2/6/2006 12:51	1.570	R+S+DF	DRY-BULK	4.92	12.02	56.07	55.65	68.11	0.91	0.80	11.33	
50	2/6/2006 12:51	2/23/2006 9:35	0.996	S+DF	DRY-BULK	4.90	12.59	182.24	118.51	144.17	4.63	1.90	26.12	
51	2/23/2006 9:35	3/8/2006 12:58	1.509	R+S+DF	DRY-BULK	5.02	9.55	52.63	38.92	88.23	2.28	3.45	11.96	
52	3/8/2006 12:58	4/6/2006 12:54	1.969	R+S+DF	DRY-BULK	4.88	13.18	96.31	107.40	141.87	2.78	9.66	7.29	
53	4/6/2006 12:54	4/21/2006 9:35	0.714	R+S+DF	DRY-BULK	4.70	19.95	230.90	343.60	420.08	6.26	12.78	24.48	
54	4/21/2006 9:35	5/5/2006 16:40	0.830	R+DF	DRY-BULK	4.41	38.90	561.12	494.22	755.80	22.99	29.54	55.76	197
55	5/5/2006 16:40	6/14/2006 9:25	1.955	R+DF	DRY-BULK	NA	NA	115.79	105.80	341.97	8.98	23.73	39.83	

Samp. No.	Buoy TB-4 Start Date-Time	Dry-Bulk Collection Date-Time	Vol. Liters	Precip. Form	Collector Type	pH	H+ (µg/l)	(Conc.) NO3-N (µg/l)	NH4-N (µg/l)	TKN (µg/l)	SRP (µg/l)	DP (µg/l)	TP (µg/l)	Notes
56	6/14/2006 9:25	6/23/2006 12:25	0.500	DF	DRY-BULK	NA	NA	93.38	126.58	392.08	7.23	24.35	37.99	137
57	6/23/2006 12:25	6/29/2006 10:05	1.872	DF	DRY-BULK	NA	NA	103.06	140.12	189.95	0.23	12.18	10.42	
58	6/29/2006 9:45	7/10/2006 8:50	0.500	R+DF	DRY-BULK	NA	NA	283.57	417.23	630.89	3.01	15.92	29.11	148
59	7/10/2006 8:50	8/2/2006 14:25	0.500	R+DF	DRY-BULK	NA	NA	247.67	175.76	555.73	4.81	15.38	34.17	148
60	8/2/2006 14:25	8/15/2006 10:15	0.500	DF	DRY-BULK	NA	NA	432.57	403.97	669.33	0.92	6.15	10.09	148
61	8/15/2006 10:15	9/1/2006 7:40	0.500	DF	DRY-BULK	NA	NA	236.64	170.30	451.92	6.19	11.06	39.69	148
62	9/1/2006 7:40	9/13/2006 9:45	0.358	DF	DRY-BULK	NA	NA	566.58	902.11	1380.15	2.98	3.69	30.33	187
63	9/13/2006 9:45	9/29/2006 8:40	0.500	DF	DRY-BULK	NA	NA	295.02	272.94	979.28	7.04	11.96	61.54	148
64	9/29/2006 8:40	10/13/2006 10:18	0.505	R+H+DF	DRY-BULK	NA	NA	930.90	1058.69	1617.03	2.73	3.99	81.23	163
65	10/13/2006 10:18	10/27/2006 12:25	0.803	R+DF	DRY-BULK	4.59	25.70	223.06	149.94	426.86	0.45	3.68	5.51	
66	10/27/2006 12:25	11/6/2006 10:50	2.592	R+DF	DRY-BULK	4.99	10.23	51.38	27.63	307.81	0.91	3.07	8.87	164
67	11/6/2006 10:50	11/17/2006 10:36	1.450	R+S+DF	DRY-BULK	4.60	25.12	97.80	33.51	70.47	0.23	2.14	2.75	
68	11/17/2006 10:36	12/7/2006 14:15	0.500	S+DF	DRY-BULK	4.58	26.30	441.80	308.84	386.86	5.75	5.36	42.71	165
69	12/7/2006 14:15	12/19/2006 11:20	1.221	R+S+DF	DRY-BULK	NA	NA	61.02	66.72	73.41	4.60	5.51	18.60	
70	12/19/2006 11:20	1/16/2007 10:13	0.500	R+S+DF	DRY-BULK	NA	NA	353.83	25.68	NA	10.35	6.32	NA	180
71	1/16/2007 10:13	1/23/2007 10:28	2.100	DF	DRY-BULK	5.10	7.94	38.80	11.79	53.96	1.60	4.74	9.29	
72	1/23/2007 10:28	2/1/2007 13:05	2.126	DF	DRY-BULK	4.80	15.85	96.12	NA	105.77	2.97	4.74	8.60	
73	2/1/2007 13:05	2/12/2007 10:40	2.647	R+S+DF	DRY-BULK	5.20	6.31	26.28	23.73	24.30	2.51	6.01	3.99	
74	2/12/2007 10:40	3/2/2007 9:42	0.674	S+DF	DRY-BULK	4.88	13.18	247.80	NA	484.95	0.47	NA	12.02	
75	3/2/2007 9:42	3/15/2007 9:45	1.822	DF	DRY-BULK	4.90	12.59	86.42	NA	200.81	0.68	NA	8.94	
76	3/15/2007 9:45	4/6/2007 15:00	0.500	S+DF	DRY-BULK	NA	NA	415.34	NA	570.83	1.14	NA	29.58	147
77	4/6/2007 15:00	5/10/2007 15:21	0.500	S+DF	DRY-BULK	NA	NA	NA	NA	NA	NA	NA	NA	147
78	5/10/2007 15:21	5/31/2007 9:25	0.500	DF	DRY-BULK	NA	NA	346.95	NA	NA	3.52	NA	NA	196
79	5/31/2007 9:25	6/25/2007 15:01	0.500	R+S+DF	DRY-BULK	NA	NA	327	127.93	401.08	1.59	4	27	
80	6/25/2007 15:01	6/26/2007 12:07	2.830	DF	DRY-BULK	NA	NA	8	12.90	45.50	0.11	2	3	
81	6/26/2007 12:07	6/27/2007 7:24	3.010	DF	DRY-BULK	NA	NA	14	17.55	60.48	0.23	1	3	
82	6/27/2007 7:24	6/28/2007 6:46	2.805	DF	DRY-BULK	NA	NA	12	16.50	53.63	0.23	1	3	

Appendix Table 6.b. N, P, and H loading in dry-bulk deposition (buoy bucket collector) at the Northwest Buoy (TB-4) Station 7/1/04-6/30/07.

Samp. No.	Buoy TB-4 Start Date-Time	Dry-Bulk Collection Date-Time	Vol. Liters	Precip. Form	Collector Type	H+ (g/ha)	(Load) NO3-N (g/ha)	NH4-N (g/ha)	TKN (g/ha)	SRP (g/ha)	DP (g/ha)	TP (g/ha)	Notes
1	6/24/2004 12:28	7/2/2004 13:53	0.810	DF	DRY-BULK	4.02	29.41	26.64	39.24	1.15	1.18	3.74	
2	7/2/2004 13:53	7/17/2004 10:50	0.000	DF	DRY-BULK	NA	36.61	57.43	77.35	0.53	1.34	4.28	6
3	7/17/2004 10:50	7/27/2004 9:10	0.017	DF	DRY-BULK	NA	39.37	85.70	109.10	0.21	0.97	2.56	12
4	7/27/2004 9:10	8/9/2004 9:22	0.000	DF	DRY-BULK	NA	25.77	13.29	38.43	4.76	6.03	10.41	6
5	8/9/2004 9:22	8/16/2004 10:40	1.317	DF	DRY-BULK	7.71	39.02	35.68	70.09	0.08	1.31	2.46	
6	8/16/2004 10:40	8/31/2004 8:22	0.000	DF	DRY-BULK	NA	44.49	39.53	68.23	0.31	1.56	3.42	8
7	8/31/2004 8:22	9/9/2004 12:05	0.000	DF	DRY-BULK	NA	32.82	21.82	61.01	0.50	0.71	2.15	6
8	9/9/2004 12:05	9/17/2004 8:36	0.000	DF	DRY-BULK	NA	32.93	35.24	56.25	0.37	1.37	1.87	8
9	9/17/2004 8:36	9/24/2004 9:20	0.836	DF+RS	DRY-BULK	4.98	28.54	27.76	57.87	0.62	1.40	3.49	
10	9/24/2004 9:20	10/5/2004 11:57	0.935	DF	DRY-BULK	5.84	32.64	25.98	57.27	0.84	1.61	4.66	
11	10/5/2004 11:57	10/14/2004 9:55	0.375	DF	DRY-BULK	3.31	36.29	33.44	58.85	0.40	0.97	3.30	
12	10/14/2004 9:55	10/22/2004 10:40	2.730	DF+RS	DRY-BULK	3.40	27.18	104.66	135.81	0.73	3.24	6.30	
13	10/22/2004 10:40	10/29/2004 11:15	1.930	DF+RS	DRY-BULK	4.50	26.44	11.50	21.06	0.46	1.27	2.15	
14	10/29/2004 11:15	11/15/2004 16:10	0.349	DF+RS	DRY-BULK	4.35	91.09	49.72	68.32	0.59	0.67	1.81	
15	11/15/2004 16:10	11/29/2004 16:08	1.333	DF+S	DRY-BULK	3.57	42.91	19.20	45.28	0.38	1.40	2.98	
16	11/29/2004 16:08	12/10/2004 13:40	1.394	DF+RS	DRY-BULK	1.82	20.46	7.57	23.40	1.32	1.66	3.92	
17	12/10/2004 13:40	12/24/2004 9:00	0.799	DF	DRY-BULK	3.31	29.82	17.74	49.72	0.14	0.84	1.42	
18	12/24/2004 9:00	1/6/2005 11:20	0.825	DF+S	DRY-BULK	2.59	18.62	18.25	34.11	0.41	0.87	1.79	
19	1/6/2005 11:20	1/13/2005 14:30	2.034	DF+S	DRY-BULK	3.19	NA	NA	NA	NA	NA	NA	
20	1/13/2005 14:30	1/24/2005 16:20	1.959	DF+S	DRY-BULK	4.87	NA	NA	NA	NA	NA	NA	
21	1/24/2005 16:20	2/4/2005 16:55	1.257	DF+RS	DRY-BULK	5.18	66.03	15.30	35.76	0.25	2.68	3.23	
22	2/4/2005 16:55	2/24/2005 14:50	1.682	DF+RS	DRY-BULK	6.62	93.51	64.54	99.13	0.69	3.69	6.30	
23	2/24/2005 14:50	3/9/2005 11:20	1.009	DF+S	DRY-BULK	2.70	29.50	32.89	60.91	0.53	1.12	1.71	
24	3/9/2005 11:20	3/16/2005 10:45	0.843	DF	DRY-BULK	0.87	17.18	14.84	37.34	0.85	1.52	2.94	
25	3/16/2005 10:45	3/24/2005 10:40	3.098	DF+RS	DRY-BULK	6.40	30.45	22.56	43.84	0.56	2.70	3.28	
26	3/24/2005 10:40	3/31/2005 10:05	1.491	DF+RS	DRY-BULK	3.90	12.87	9.60	22.09	0.07	1.56	1.76	

Samp. No.	Buoy TB-4 Start Date-Time	Dry-Bulk Collection Date-Time	Vol. Liters	Precip. Form	Collector Type	H+ (g/ha)	(Load) NO3-N (g/ha)	NH4-N (g/ha)	TKN (g/ha)	SRP (g/ha)	DP (g/ha)	TP (g/ha)	Notes
27	3/31/2005 10:05	4/14/2005 13:55	1.001	DF+RS	DRY-BULK	0.84	30.78	32.79	51.41	0.46	0.75	2.62	66
28	4/14/2005 13:55	4/22/2005 15:20	0.935	DF+RS	DRY-BULK	2.44	19.82	13.67	17.27	0.49	1.04	1.72	
29	4/22/2005 15:20	5/25/2005 16:44	0.511	DF+RSG	DRY-BULK	3.19	70.63	95.51	129.18	8.30	9.41	12.96	67
30	5/25/2005 16:44	6/8/2005 9:00	0.500	DF+RS	DRY-BULK	3.28	22.70	27.10	48.00	1.05	1.82	3.33	68
31	6/8/2005 9:00	6/20/2005 11:52	0.411	DF+RS	DRY-BULK	3.40	36.81	51.56	63.37	1.79	2.24	3.28	69
32	6/20/2005 11:52	6/29/2005 10:30	0.587	DF	DRY-BULK	2.91	28.78	53.49	78.66	0.37	0.87	5.03	
33	6/29/2005 10:30	7/13/2005 12:26	0.500	DF	DRY-BULK	NA	16.96	13.32	55.77	0.73	1.39	NA	82
34	7/13/2005 12:26	7/27/2005 8:55	0.500	DF	DRY-BULK	NA	36.36	19.05	82.23	1.00	1.51	NA	82
35	7/27/2005 8:55	8/6/2005 10:32	0.500	DF	DRY-BULK	NA	44.75	61.14	100.03	0.64	1.05	NA	84
36	8/6/2005 10:32	8/18/2005 7:13	0.500	DF	DRY-BULK	C	C	C	C	C	C	C	85
37	8/18/2005 7:13	8/26/2005 13:25	0.500	DF	DRY-BULK	1.56	42.19	60.92	82.33	0.50	0.85	1.20	86
38	8/26/2005 13:25	9/6/2005 12:03	0.500	DF	DRY-BULK	NA	NA	36.47	64.25	0.43	1.08	NA	87
39	9/6/2005 12:03	9/15/2005 15:10	0.763	DF	DRY-BULK	3.98	38.68	82.51	117.29	1.62	2.28	NA	88
40	9/15/2005 15:10	9/27/2005 11:40	0.500	DF	DRY-BULK	NA	50.72	57.89	100.20	0.45	0.83	NA	89
41	9/27/2005 11:40	10/6/2005 12:24	0.565	DF	DRY-BULK	5.10	39.09	51.36	71.54	0.66	0.94	3.12	
42	10/6/2005 12:24	10/20/2005 13:50	0.098	R+S+DF	DRY-BULK	0.25	10.83	17.60	20.75	0.07	0.24	0.73	112
43	10/20/2005 13:50	11/10/2005 13:30	0.385	R+S+DF	DRY-BULK	3.11	8.88	123.70	120.82	0.64	0.55	1.74	
44	11/10/2005 13:30	11/18/2005 9:50	1.815	DF	DRY-BULK	2.85	19.67	11.84	29.09	0.16	3.31	1.23	
45	11/18/2005 9:50	12/6/2005 13:45	2.276	R+S+DF	DRY-BULK	3.65	16.75	6.81	14.70	0.10	3.73	5.44	110
46	12/6/2005 13:45	12/23/2005 12:05	2.892	R+S+DF	DRY-BULK	NA	29.77	6.33	24.29	1.04	3.60	2.51	110
47	12/23/2005 12:05	1/4/2006 12:47	3.735	R+S+DF	DRY-BULK	5.49	6.98	8.08	5.75	0.88	2.68	2.68	110
48	1/4/2006 12:47	1/24/2006 11:45	0.225	S+DF	DRY-BULK	>0.02	16.18	6.51	13.92	0.04	0.26	1.24	
49	1/24/2006 11:45	2/6/2006 12:51	1.570	R+S+DF	DRY-BULK	3.92	18.28	18.14	22.20	0.30	0.26	3.69	
50	2/6/2006 12:51	2/23/2006 9:35	0.996	S+DF	DRY-BULK	2.47	35.82	23.29	28.34	0.91	0.37	5.13	
51	2/23/2006 9:35	3/8/2006 12:58	1.509	R+S+DF	DRY-BULK	2.99	16.49	12.19	27.64	0.71	1.08	3.75	
52	3/8/2006 12:58	4/6/2006 12:54	1.969	R+S+DF	DRY-BULK	5.12	37.42	41.73	55.13	1.08	3.75	2.83	
53	4/6/2006 12:54	4/21/2006 9:35	0.714	R+S+DF	DRY-BULK	2.81	32.54	48.42	59.19	0.88	1.80	3.45	
54	4/21/2006 9:35	5/5/2006 16:40	0.830	R+DF	DRY-BULK	6.37	91.91	80.95	123.80	3.77	4.84	9.13	197
55	5/5/2006 16:40	6/14/2006 9:25	1.955	R+DF	DRY-BULK	NA	44.67	40.82	131.94	3.46	9.16	15.37	

Samp. No.	Buoy TB-4 Start Date-Time	Dry-Bulk Collection Date-Time	Vol. Liters	Precip. Form	Collector Type	H+ (g/ha)	(Load) NO3-N (g/ha)	NH4-N (g/ha)	TKN (g/ha)	SRP (g/ha)	DP (g/ha)	TP (g/ha)	Notes
56	6/14/2006 9:25	6/23/2006 12:25	0.500	DF	DRY-BULK	NA	9.21	12.49	38.69	0.71	2.40	3.75	137
57	6/23/2006 12:25	6/29/2006 10:05	1.872	DF	DRY-BULK	NA	40.05	54.46	73.82	0.09	4.73	4.05	
58	6/29/2006 9:45	7/10/2006 8:50	0.500	R+DF	DRY-BULK	NA	27.98	41.17	62.25	0.30	1.57	2.87	148
59	7/10/2006 8:50	8/2/2006 14:25	0.500	R+DF	DRY-BULK	NA	24.44	17.34	54.84	0.47	1.52	3.37	148
60	8/2/2006 14:25	8/15/2006 10:15	0.500	DF	DRY-BULK	NA	44.90	41.93	69.48	0.10	0.64	1.05	148
61	8/15/2006 10:15	9/1/2006 7:40	0.500	DF	DRY-BULK	NA	23.35	16.80	44.59	0.61	1.09	3.92	148
62	9/1/2006 7:40	9/13/2006 9:45	0.358	DF	DRY-BULK	NA	42.11	67.05	102.58	0.22	0.27	2.25	187
63	9/13/2006 9:45	9/29/2006 8:40	0.500	DF	DRY-BULK	NA	29.11	26.93	96.63	0.69	1.18	6.07	148
64	9/29/2006 8:40	10/13/2006 10:18	0.505	R+H+DF	DRY-BULK	NA	92.78	105.51	161.16	0.27	0.40	8.10	163
65	10/13/2006 10:18	10/27/2006 12:25	0.803	R+DF	DRY-BULK	4.28	37.19	25.00	71.16	0.08	0.61	0.92	
66	10/27/2006 12:25	11/6/2006 10:50	2.592	R+DF	DRY-BULK	5.23	26.28	14.13	157.46	0.47	1.57	4.54	164
67	11/6/2006 10:50	11/17/2006 10:36	1.450	R+S+DF	DRY-BULK	7.56	29.44	10.09	21.21	0.07	0.64	0.83	
68	11/17/2006 10:36	12/7/2006 14:15	0.500	S+DF	DRY-BULK	2.60	43.60	30.48	38.17	0.57	0.53	4.21	165
69	12/7/2006 14:15	12/19/2006 11:20	1.221	R+S+DF	DRY-BULK	NA	14.70	16.08	17.69	1.11	1.33	4.48	
70	12/19/2006 11:20	1/16/2007 10:13	0.500	R+S+DF	DRY-BULK	NA	34.91	2.53	NA	1.02	0.62	NA	180
71	1/16/2007 10:13	1/23/2007 10:28	2.100	DF	DRY-BULK	3.29	16.08	4.89	22.36	0.66	1.96	3.85	
72	1/23/2007 10:28	2/1/2007 13:05	2.126	DF	DRY-BULK	6.65	40.33	NA	44.38	1.25	1.99	3.61	
73	2/1/2007 13:05	2/12/2007 10:40	2.647	R+S+DF	DRY-BULK	3.47	14.44	13.04	13.35	1.38	3.30	2.19	
74	2/12/2007 10:40	3/2/2007 9:42	0.674	S+DF	DRY-BULK	1.75	32.96	NA	64.51	0.06	NA	1.60	
75	3/2/2007 9:42	3/15/2007 9:45	1.822	DF	DRY-BULK	4.53	31.07	NA	72.21	0.24	NA	3.21	
76	3/15/2007 9:45	4/6/2007 15:00	0.500	S+DF	DRY-BULK	NA	40.98	NA	56.33	0.11	NA	2.92	147
77	4/6/2007 15:00	5/10/2007 15:21	0.500	S+DF	DRY-BULK	NA	NA	NA	NA	NA	NA	NA	147
78	5/10/2007 15:21	5/31/2007 9:25	0.500	DF	DRY-BULK	NA	34.24	NA	NA	0.35	NA	NA	196
79	5/31/2007 9:25	6/25/2007 15:01	0.500	R+S+DF	DRY-BULK	NA	32.27	12.62	39.58	0.16	0.39	2.66	
80	6/25/2007 15:01	6/26/2007 12:07	2.830	DF	DRY-BULK	NA	3.35▪	4.97▪	19.83▪	0.06▪	0▪	0.56▪	
81	6/26/2007 12:07	6/27/2007 7:24	3.010	DF	DRY-BULK	NA	7.13▪	8.05▪	29.99▪	0.14▪	0▪	0.59▪	
82	6/27/2007 7:24	6/28/2007 6:46	2.805	DF	DRY-BULK	NA	5.54▪	6.92▪	24.15▪	0.13▪	0▪	0.55▪	

Appendix Table 6.c. N, P, and H loading per day in dry-bulk deposition (buoy bucket collector) at the Northwest Buoy (TB-4) Station 7/1/04-6/30/07.

Samp. No.	Buoy TB-4 Start Date-Time	Dry-Bulk Collection Date-Time	Vol. Liters	Precip. Form	Collector Type	H+ (g/ha/d)	NO3-N (g/ha/d)	NH4-N (g/ha/d)	TKN (g/ha/d)	SRP (g/ha/d)	DP (g/ha/d)	TP (g/ha/d)	Notes
1	6/24/2004 12:28	7/2/2004 13:53	0.810	DF	DRY-BULK	0.50	3.65	3.31	4.87	0.14	0.15	0.46	
2	7/2/2004 13:53	7/17/2004 10:50	0.000	DF	DRY-BULK	NA	2.46	3.86	5.20	0.04	0.09	0.29	6
3	7/17/2004 10:50	7/27/2004 9:10	0.017	DF	DRY-BULK	NA	3.96	8.63	10.99	0.02	0.10	0.26	12
4	7/27/2004 9:10	8/9/2004 9:22	0.000	DF	DRY-BULK	NA	1.98	1.02	2.95	0.37	0.46	0.80	6
5	8/9/2004 9:22	8/16/2004 10:40	1.317	DF	DRY-BULK	1.09	5.53	5.06	9.94	0.01	0.19	0.35	
6	8/16/2004 10:40	8/31/2004 8:22	0.000	DF	DRY-BULK	NA	2.99	2.65	4.58	0.02	0.10	0.23	8
7	8/31/2004 8:22	9/9/2004 12:05	0.000	DF	DRY-BULK	NA	3.58	2.38	6.66	0.05	0.08	0.23	6
8	9/9/2004 12:05	9/17/2004 8:36	0.000	DF	DRY-BULK	NA	4.19	4.49	7.16	0.05	0.17	0.24	8
9	9/17/2004 8:36	9/24/2004 9:20	0.836	DF+RS	DRY-BULK	0.71	4.06	3.95	8.23	0.09	0.20	0.50	
10	9/24/2004 9:20	10/5/2004 11:57	0.935	DF	DRY-BULK	0.53	2.94	2.34	5.16	0.08	0.15	0.42	
11	10/5/2004 11:57	10/14/2004 9:55	0.375	DF	DRY-BULK	0.37	4.07	3.75	6.60	0.05	0.11	0.37	
12	10/14/2004 9:55	10/22/2004 10:40	2.730	DF+RS	DRY-BULK	0.42	3.38	13.03	16.91	0.09	0.40	0.78	
13	10/22/2004 10:40	10/29/2004 11:15	1.930	DF+RS	DRY-BULK	0.64	3.76	1.64	3.00	0.07	0.18	0.31	
14	10/29/2004 11:15	11/15/2004 16:10	0.349	DF+RS	DRY-BULK	0.25	5.29	2.89	3.97	0.03	0.04	0.11	
15	11/15/2004 16:10	11/29/2004 16:08	1.333	DF+S	DRY-BULK	0.25	3.07	1.37	3.23	0.03	0.10	0.21	
16	11/29/2004 16:08	12/10/2004 13:40	1.394	DF+RS	DRY-BULK	0.17	1.88	0.69	2.15	0.12	0.15	0.36	
17	12/10/2004 13:40	12/24/2004 9:00	0.799	DF	DRY-BULK	0.24	2.16	1.29	3.60	0.01	0.06	0.10	
18	12/24/2004 9:00	1/6/2005 11:20	0.825	DF+S	DRY-BULK	0.20	1.42	1.39	2.60	0.03	0.07	0.14	
19	1/6/2005 11:20	1/13/2005 14:30	2.034	DF+S	DRY-BULK	0.45	NA	NA	NA	NA	NA	NA	
20	1/13/2005 14:30	1/24/2005 16:20	1.959	DF+S	DRY-BULK	0.44	NA	NA	NA	NA	NA	NA	
21	1/24/2005 16:20	2/4/2005 16:55	1.257	DF+RS	DRY-BULK	0.47	5.99	1.39	3.24	0.02	0.24	0.29	
22	2/4/2005 16:55	2/24/2005 14:50	1.682	DF+RS	DRY-BULK	0.33	4.70	3.24	4.98	0.03	0.19	0.32	
23	2/24/2005 14:50	3/9/2005 11:20	1.009	DF+S	DRY-BULK	0.21	2.29	2.56	4.74	0.04	0.09	0.13	
24	3/9/2005 11:20	3/16/2005 10:45	0.843	DF	DRY-BULK	0.13	2.46	2.13	5.35	0.12	0.22	0.42	
25	3/16/2005 10:45	3/24/2005 10:40	3.098	DF+RS	DRY-BULK	0.80	3.81	2.82	5.48	0.07	0.34	0.41	

Samp. No.	Buoy TB-4 Start Date-Time	Dry-Bulk Collection Date-Time	Vol. Liters	Precip. Form	Collector Type	H+ (g/ha/d)	NO3-N (g/ha/d)	NH4-N (g/ha/d)	TKN (g/ha/d)	SRP (g/ha/d)	DP (g/ha/d)	TP (g/ha/d)	Notes
26	3/24/2005 10:40	3/31/2005 10:05	1.491	DF+RS	DRY-BULK	0.56	1.85	1.38	3.17	0.01	0.22	0.25	
27	3/31/2005 10:05	4/14/2005 13:55	1.001	DF+RS	DRY-BULK	0.06	2.17	2.32	3.63	0.03	0.05	0.19	66
28	4/14/2005 13:55	4/22/2005 15:20	0.935	DF+RS	DRY-BULK	0.30	2.46	1.70	2.14	0.06	0.13	0.21	
29	4/22/2005 15:20	5/25/2005 16:44	0.511	DF+RSG	DRY-BULK	0.10	2.14	2.89	3.91	0.25	0.28	0.39	67
30	5/25/2005 16:44	6/8/2005 9:00	0.500	DF+RS	DRY-BULK	0.24	1.66	1.98	3.51	0.08	0.13	0.24	68
31	6/8/2005 9:00	6/20/2005 11:52	0.411	DF+RS	DRY-BULK	0.28	3.04	4.25	5.23	0.15	0.19	0.27	69
32	6/20/2005 11:52	6/29/2005 10:30	0.587	DF	DRY-BULK	0.33	3.22	5.98	8.80	0.04	0.10	0.56	
33	6/29/2005 10:30	7/13/2005 12:26	0.500	DF	DRY-BULK	NA	1.20	0.95	3.96	0.05	0.10	NA	82
34	7/13/2005 12:26	7/27/2005 8:55	0.500	DF	DRY-BULK	NA	2.62	1.38	5.94	0.07	0.11	NA	82
35	7/27/2005 8:55	8/6/2005 10:32	0.500	DF	DRY-BULK	NA	4.45	6.07	9.94	0.06	0.10	NA	84
36	8/6/2005 10:32	8/18/2005 7:13	0.500	DF	DRY-BULK	C	C	C	C	C	C	C	85
37	8/18/2005 7:13	8/26/2005 13:25	0.500	DF	DRY-BULK	0.19	5.11	7.38	9.97	0.06	0.10	0.15	86
38	8/26/2005 13:25	9/6/2005 12:03	0.500	DF	DRY-BULK	NA	NA	3.33	5.87	0.04	0.10	NA	87
39	9/6/2005 12:03	9/15/2005 15:10	0.763	DF	DRY-BULK	0.44	4.24	9.04	12.85	0.18	0.25	NA	88
40	9/15/2005 15:10	9/27/2005 11:40	0.500	DF	DRY-BULK	NA	4.28	4.88	8.45	0.04	0.07	NA	89
41	9/27/2005 11:40	10/6/2005 12:24	0.565	DF	DRY-BULK	0.56	4.33	5.69	7.92	0.07	0.10	0.35	
42	10/6/2005 12:24	10/20/2005 13:50	0.098	R+S+DF	DRY-BULK	0.02	0.77	1.25	1.48	0.01	0.02	0.05	112
43	10/20/2005 13:50	11/10/2005 13:30	0.385	R+S+DF	DRY-BULK	0.15	0.42	5.89	5.76	0.03	0.03	0.08	
44	11/10/2005 13:30	11/18/2005 9:50	1.815	DF	DRY-BULK	0.36	2.51	1.51	3.71	0.02	0.42	0.16	
45	11/18/2005 9:50	12/6/2005 13:45	2.276	R+S+DF	DRY-BULK	0.20	0.92	0.38	0.81	0.01	0.21	0.30	110
46	12/6/2005 13:45	12/23/2005 12:05	2.892	R+S+DF	DRY-BULK	NA	1.76	0.37	1.43	0.06	0.21	0.15	110
47	12/23/2005 12:05	1/4/2006 12:47	3.735	R+S+DF	DRY-BULK	0.46	0.58	0.67	0.48	0.07	0.22	0.22	110
48	1/4/2006 12:47	1/24/2006 11:45	0.225	S+DF	DRY-BULK	0.00	0.81	0.33	0.70	0.00	0.01	0.06	
49	1/24/2006 11:45	2/6/2006 12:51	1.570	R+S+DF	DRY-BULK	0.30	1.40	1.39	1.70	0.02	0.02	0.28	
50	2/6/2006 12:51	2/23/2006 9:35	0.996	S+DF	DRY-BULK	0.15	2.12	1.38	1.68	0.05	0.02	0.30	
51	2/23/2006 9:35	3/8/2006 12:58	1.509	R+S+DF	DRY-BULK	0.23	1.25	0.93	2.10	0.05	0.08	0.29	
52	3/8/2006 12:58	4/6/2006 12:54	1.969	R+S+DF	DRY-BULK	0.18	1.29	1.44	1.90	0.04	0.13	0.10	
53	4/6/2006 12:54	4/21/2006 9:35	0.714	R+S+DF	DRY-BULK	0.19	2.19	3.26	3.98	0.06	0.12	0.23	
54	4/21/2006 9:35	5/5/2006 16:40	0.830	R+DF	DRY-BULK	0.45	6.43	5.66	8.66	0.26	0.34	0.64	197

Samp. No.	Buoy TB-4 Start Date-Time	Dry-Bulk Collection Date-Time	Vol. Liters	Precip. Form	Collector Type	H+ (g/ha/d)	NO3-N (g/ha/d)	NH4-N (g/ha/d)	TKN (g/ha/d)	SRP (g/ha/d)	DP (g/ha/d)	TP (g/ha/d)	Notes
55	5/5/2006 16:40	6/14/2006 9:25	1.955	R+DF	DRY-BULK	NA	1.13	1.03	3.32	0.09	0.23	0.39	
56	6/14/2006 9:25	6/23/2006 12:25	0.500	DF	DRY-BULK	NA	1.01	1.37	4.25	0.08	0.26	0.41	137
57	6/23/2006 12:25	6/29/2006 9:45	1.872	DF	DRY-BULK	NA	6.79	9.23	12.51	0.02	0.80	0.69	
58	6/29/2006 9:45	7/10/2006 8:50	0.500	R+DF	DRY-BULK	NA	2.55	3.76	5.68	0.03	0.14	0.26	148
59	7/10/2006 8:50	8/2/2006 14:25	0.500	R+DF	DRY-BULK	NA	1.05	0.75	2.36	0.02	0.07	0.15	148
60	8/2/2006 14:25	8/15/2006 10:15	0.500	DF	DRY-BULK	NA	3.50	3.27	5.42	0.01	0.05	0.08	148
61	8/15/2006 10:15	9/1/2006 7:40	0.500	DF	DRY-BULK	NA	1.38	0.99	2.64	0.04	0.06	0.23	148
62	9/1/2006 7:40	9/13/2006 9:45	0.358	DF	DRY-BULK	NA	3.48	5.55	8.49	0.02	0.02	0.19	187
63	9/13/2006 9:45	9/29/2006 8:40	0.500	DF	DRY-BULK	NA	1.82	1.69	6.06	0.04	0.07	0.38	148
64	9/29/2006 8:40	10/13/2006 10:18	0.505	R+H+DF	DRY-BULK	NA	6.59	7.50	11.46	0.02	0.03	0.58	163
65	10/13/2006 10:18	10/27/2006 12:25	0.803	R+DF	DRY-BULK	0.30	2.64	1.77	5.05	0.01	0.04	0.07	
66	10/27/2006 12:25	11/6/2006 10:50	2.592	R+DF	DRY-BULK	0.53	2.65	1.42	15.85	0.05	0.16	0.46	164
67	11/6/2006 10:50	11/17/2006 10:36	1.450	R+S+DF	DRY-BULK	0.69	2.68	0.92	1.93	0.01	0.06	0.08	
68	11/17/2006 10:36	12/7/2006 14:15	0.500	S+DF	DRY-BULK	0.13	2.16	1.51	1.89	0.03	0.03	0.21	165
69	12/7/2006 14:15	12/19/2006 11:20	1.221	R+S+DF	DRY-BULK	NA	1.24	1.35	1.49	0.09	0.11	0.38	
70	12/19/2006 11:20	1/16/2007 10:13	0.500	R+S+DF	DRY-BULK	NA	1.25	0.09	NA	0.04	0.02	NA	180
71	1/16/2007 10:13	1/23/2007 10:28	2.100	DF	DRY-BULK	0.47	2.29	0.70	3.19	0.09	0.28	0.55	
72	1/23/2007 10:28	2/1/2007 13:05	2.126	DF	DRY-BULK	0.73	4.43	NA	4.87	0.14	0.22	0.40	
73	2/1/2007 13:05	2/12/2007 10:40	2.647	R+S+DF	DRY-BULK	0.32	1.32	1.20	1.23	0.13	0.30	0.20	
74	2/12/2007 10:40	3/2/2007 9:42	0.674	S+DF	DRY-BULK	0.10	1.84	NA	3.59	0.00	NA	0.09	
75	3/2/2007 9:42	3/15/2007 9:45	1.822	DF	DRY-BULK	0.35	2.39	NA	5.55	0.02	NA	0.25	
76	3/15/2007 9:45	4/6/2007 15:00	0.500	S+DF	DRY-BULK	NA	1.84	NA	2.54	0.01	NA	0.13	147
77	4/6/2007 15:00	5/10/2007 15:21	0.500	S+DF	DRY-BULK	NA	NA	NA	NA	NA	NA	NA	147
78	5/10/2007 15:21	5/31/2007 9:25	0.500	DF	DRY-BULK	NA	1.65	NA	NA	0.02	NA	NA	196
79	5/31/2007 9:25	6/25/2007 15:01	0.500	R+S+DF	DRY-BULK	NA	1.28	0.50	1.57	0.01	0.02	0.11	
80	6/25/2007 15:01	6/26/2007 12:07	2.830	DF	DRY-BULK	NA	3.81▪	5.65▪	22.55▪	0.07▪	0▪	0.64▪	200
81	6/26/2007 12:07	6/27/2007 7:24	3.010	DF	DRY-BULK	NA	8.87▪	10.02▪	37.32▪	0.17▪	0▪	0.74▪	200
82	6/27/2007 7:24	6/28/2007 6:46	2.805	DF	DRY-BULK	NA	5.69▪	7.11▪	24.81▪	0.13▪	0▪	0.57▪	200

Table Legend:

Precipitation Form: (S=snow; R=rain; DF= dry fall (Dry deposition); H=hail; G=graupel; NA=information on type not available; T=trace of precip.)

Collector Type: (ST= 8 in. dia. Snow tube; TBG= 8 in. dia. Electrically heated tipping bucket rain and snow gauge; Wet= Aerochem Metrics Wet Bucket; Dry= Dry-Bulk bucket with 4 liter deionized water added, placed in dry-side of Aerochem Metrics sampler; Dry-Bulk= Aerochem Metrics bucket with reduced side height, filled with 4 liters of deionized H2O)

pH: (NES= not enough sample); C= sample contaminated; NA= not measured.

Nutrient Concentrations: (C= sample contamination; NA= Not available or not enough sample for analysis; note units are micrograms/liter; TBA= data not yet available).

"e"- load estimated from total precipitation and concentration of portion of total precipitation;

"+" - not all precipitation caught, loading underestimated;

"▪" - special Angora fire samples, see note 200.

Table Notes:

(1) ST had much pollen, bugs, algae, added 500ml deionized H2O to process; (2) ST dry, added 500ml deionized H2O to process; (3) added 462ml of deionized water to 38 ml sample to process; (5) added 481ml deionized water to 19ml sample to process; (6) bucket dry, added 500ml deionized water to process; (7) added 332 ml deionized water to 168 ml sample to process; (8) bucket dry, added 1000 ml deionized water to process; (9) added 400ml deionized water to 100ml sample to process; (10) added 850ml deionized water to 150ml sample to process (11) added 370ml deionized water to 140ml of sample to process; (12) added 485ml deionized water to 17ml of sample to process; (13) ST bridged with snow, TBG bottles overflowed, used datalogger amount recorded of 6.70 inches as estimate of total for this storm; (16) wet bucket had snow 2 inches above bucket rim, Aerochem Metrics lid frozen over dry-side collector, sample caught some dry deposition; (17) snow 3 inches above bucket rim, Aerochem lid stuck over dry bucket; (18) much of precipitation caught in dry bucket this period, loading is for 0.46 inches of wet precipitation caught only, remainder included with dry-bulk; (23) Dry bucket caught 5 aspen leaves, added 2 liters of deionized water during period; (24) Aerochem Metrics lid frozen over dry-side, missed some of dry deposition this period; (25) Dry bucket caught much of precipitation this storm; (28) small leak in ST; (29) 19 ml of precipitation, added 481ml deionized water for processing; (30) 5 feet of new snow when sampled, had compacted, ST and TBG bottles full, missed some of storm, logger recorded 8.40 inches, but likely under-represents snowfall, collected snow core to depth of old snow pack for chemistry, water content was 12.12 inches, appears to over-represent snowfall, SNOTEL precipitation estimate during period at Ward #3 was 10.4 inches, used this as estimate for this storm; (31) approximately 4 feet of new snow when sampled, had compacted, ST and TBG bottles full, missed some of storm, logger recorded 7.86 inches, but likely under-represents snowfall, collected snow core to snowboard placed out prior to storm, water content was 9.90 inches, use this for amount, SNOTEL precipitation amount was 9.8 inches for this period at Ward #3, used TBG water for chemistry; (32) used TBG amount of 0.70 inches; (33) 4ml of precipitation, added 496ml of deionized water to bring to 500ml for processing; (34) TBG overflowed and ST may have as well, missed some of storm, logger recorded 7.69 inches, appears to have over-recorded, used 6.4 inches precipitation, based on SNOTEL amount of 6.1 inches for 3/22-3/30 and accounting for precipitation on 3/21 after last collection at 1800; (35) approximately 4 ½ feet of snow this period, covered wet/dry sampler, collected snow in bucket + snow over bucket for chemistry, but only about ½ the snow which fell was collected, used the snow collected as representative of snow chemistry and logger amount 6.53 inches as actual precipitation, some snow fell in the dry bucket, appears to be a small amount; (36) approximately 2 feet of snow this period, over-topped sampler, collected bucket and snow over bucket, and ran chemistry for both, used TBG total of 3.76-0.47=3.29 inches for period, took avg. conc. for buckets applied to 3.29 inches for load; (37) the dry bucket caught a significant portion of this storm estimate 0.72 inches fell in dry bucket; (38) the dry bucket caught precipitation this period, estimated 0.42 inches; (39) wet bucket caught some dry deposition this period, wire to station crept down with snow back pulling plug out of socket and cutting power; (40) Aerochem Metrics malfunction, dry bucket caught portion of precipitation this period, wet caught 1.04 inches and dry caught 1.77 inches; (41) 5ml of sample, added 498 ml deionized water to process; (42) ST had pin-hole leak, 9ml of sample, added 491ml of deionized water to process; (43) trace of precipitation, added 500ml of deionized water to process; (44) sample probably leaked, 27 ml of precipitation, added 478 ml to process; (45) Important note for Lower Ward Wet loading data: the loading precipitation amount is only that precipitation amount caught in the wet bucket, this differs from the total precipitation (which is shown with the concentration data in the upper portion of the table); (46) ST caught 16 ml precip added 484ml of deionized water to process; (48) ST caught 57ml of precip added 443ml deionized

water to process; (49) ST dry, added 500ml deionized water to process; (50) dry bucket caught a portion of precipitation this period; (51) dry bucket caught much of storm this period; (52) dry bucket caught much of precipitation this period, bucket nearly full, spilled portion when removed due to bucket being nearly full; (53) no heater this period, bucket froze during portion of collection period, some sample spilled in transport due to ice in bucket, use data with caution; (54) bucket placed out dry this period to check function of Aerochem Metrics sampler, 33ml of precipitation caught in dry, added 477ml of deionized water to process; (55) added 1 additional liter of deionized water to dry bucket during period; (56) changed Aerochem Metrics sensor and motor to improve function on 5/3/05; (57) dead ladybug in sample; (58) sample filter very dirty; (59) small piece black debris and 1 small bug in sample; (60) small black flake and debris in sample; (61) metal flake in sample; (62) added 1 liter deionized water to process part of dead fly in sample; (63) bucket dry, added 500ml deionized water to process, many small black bugs and small piece of green organic mater in sample; (64) bucket had 57ml of water in it, added 443ml deionized water to process; (65) strong winds during period, some pollen in sample; (66) bucket dry, added 1 liter deionized water to process; (67) 4-5 small black bugs, a couple of larger bugs in sample; (68) 80 ml of sample + 420ml of deionized water; (69) windy during period, sample filter dirty, pollen and silt?; (70) ST dry added 500 ml deionized H2O to process; (71) ST had 100ml of precipitation, added 400ml deionized H2O to process, many bugs in sample; (72) ST dry, added 500ml DIW to process, used non-precombusted filter to filter; (73) 7 ml of sample, added 493ml DIW to process; (74) much pollen in sample; (75) ST had 12ml precip added 488ml DIW to process; (76) ST had 90ml precip added 410ml DIW to process; (77) bucket dry, added 500ml DIW to process, much pollen; (78) bucket dry, added 500ml DIW to process, dead bee and many small bugs in bucket; (79) bucket had 1 bug and suds, maybe not enough DIW rinses last time washed; (80) 10ml precip in bucket, added 490ml DIW to process; (81) many plastic flakes; (82) bucket dry, added 500ml DIW to process; (83) 129ml sample in bucket, added 371ml DIW to process; (84) 70ml sample in bucket added 430ml DIW to process; (85) many bugs, pollen, some suds in sample, filter very dirty; (86) 145 ml sample, added 355ml DIW to process; (87) bucket dry, added 500ml DIW to process; (88) deionized water used suspect these samples, cartridges bad; (89) 145ml sample added 365ml DIW; (90) Trace amount of precip + 500ml DIW; (91) added 500ml DIW to process; (92) bird dung and many small bugs in ST, discarded; (93) ST dry, not processed; (94) 120 V AC power no longer supplied to station, Alpine Meadows is replacing chairlift, power no longer supplied to old blockhouse; (95) sample not collected for 1 week after storm; (96) ST had approximately 19 inches of frozen water with some snow in it at top; (97) 3 aspen leaves in wet bucket; (98) precipitation rain from system which had tropical moisture associated with it; (99) added 391ml DIW to 109 ml sample for processing; (100) power outage along west shore and Tahoe City 1/31/05-1/2/06, Aerochem Metrics lid stuck over dry bucket, wet bucket caught some dry deposition, dry bucket missed some dry deposition; (101) 10+ aspen leaves in dry bucket, hazy, smokey from controlled burns in basin; (102) many aspen leaves in dry bucket; (103) ST dry, added 500ml DIW to process; (104) ST water cloudy, filter brown with silt, also one small bug in sample, 120ml of sample, added 380ml of DIW to process; (105) no sample ST had leak; (106) ST cap plastic torn, ST cap returned to lab for repair, no sample; (107) no ST in place, ST cap in lab for repairs; (108) many plastic flakes in sample; (109) 190ml of sample + added 310ml DIW to process; (110) gusty winds this period, may have impacted bucket if caused some sample to spill; (strong winds and significant rain this period may have impacted sample); (112) 98 ml of sample + 402ml DIW added to process; (113) pH high, suspect; (114) small leak in bottom of tube; (115) Aerochem Metrics lid loose and plastic underneath ripped, poor seal over buckets, snow 4 inches above rim compacted; (116) Aerochem Metrics lid frozen over dry bucket, snow accumulated 10 inches above wet bucket rim; (117) snow 4-5 inches above bucket rim, compacted; (118) dry bucket caught majority of precipitation this storm, amount from TBG=1.25 inches, amount in wet bucket=0.15 inches; (119) nearly all snow caught by dry bucket again, left wet bucket out, changed dry bucket, replaced with a dry bucket without deionized water; (120) Aerochem Metrics sampler dry bucket caught all precipitation, replaced precipitation sensor with sensor from CARB Aerochem Metrics sampler; (121) Aerochem Metrics lid frozen over dry bucket during portion of the period; (122) added 1 liter of deionized water to dry 2/3/06; (123) ice on surface of sampler during portion of the period; (124) dry bucket caught nearly all snow this storm; (125) leak in corner of ST portion of sample lost; (126) 102ml of precipitation, added 398ml of deionized water to process; (127) ST had leak, 50 ml of sample left in ST, added 450ml of deionized water to process; (128) 140ml of sample, added 360ml of deionized water; (129) Dry bucket had 10ml of precipitation, added 490ml of deionized water to process, this was old-style dry bucket with no deionized water at start; (130) snow tube appears to have bridged, did not catch all precipitation; (131) sample sat out at site for approximately 12 days at station before collection; (132) much pollen; (133) heater plug briefly contacted sample water when moving; (134) trimmed aspen trees adjacent to station; (135) placed new bucket out after trimming trees; (136) added 341ml deionized water to 163ml sample to process; (137) ST dry, added 500ml deionized water to process; (138) bucket dry, added 500ml deionized water to process; (139) Dry bucket caught most of precipitation, load included with wet; (140) Likely contamination, many bugs, pollen, bird dung upper bag, cut away; 3ml sample, added 497ml DI to process;(141) Large dead bug in ST, added 500ml DI to process; (142) ST had large bugs, probable contamination, sample discarded; (143) 30ml sample, added 470ml DI to process; (144) 56ml sample, added 444ml DI to process; (145) 7ml sample + 450ml DIW, many dead bugs146- 30ml sample + 220ml DIW to process; (147) added 500ml DI to process; (148) Bucket dry, added 500ml to process; (149) Dry filter brown150-Smokey pd.; (150); (151) 10ml of precip. Added 490ml of deionized water; (152) very strong winds this storm; (153) several aspen leaves in bucket; (154) aspen leaf in bucket; (155) part of bucket rim fell into sample, possible contamination; (156) ST had 145ml sample, added 355ml deionized water; (157) 15ml of sample, ST contaminated, bird dung on inside of bag, not processed; (158) ST filter very dirty, ST had puncture about 2.5 in.

up side, sample probably ok; (159) ST filter very dirty; (160) 85ml of sample, added 315ml of deionized water to process; (161) 135ml of sample, added 365ml of deionized water to process; (162) piece of tape in dry bucket, possible contamination; (163) 205ml sample + 300 ml deionized H2O; (164) filtered through uncombusted GF/C filter; (165) 261 ml sample + 239 ml deionized water; (165) small amount of rain, no collector in place; (166) WVB samples this period on only analyzed for precipitation amount, leak in ST corner, caught most precip.; (167) much ice in ST from storms earlier in month, lost small amount of sample in collection, Ward #3 SNOTEL recorded 7.4; (168) pin-hole leak and ST bridging during storm, 4.37 inches caught, not all precip collected, Ward #3 SNOTEL recorded 8.9, use this; (169) no ST in place, use Ward #3 SNOTEL 0.4; (170) 4-5 feet of snow from 2 storms, use TBG as estimate of precip although overflowed; (171) 14ml precip + 486 ml deionized water for processing; (172) 55ml precip + 445 ml deionized water for processing; (173) dry bucket partially frozen; 46ml sample + 454 ml deionized water for processing; (175) 10 ml sample + 240 ml deionized water for processing; (176) ST bag had leak, not all precip collected; (177) 5ml sample + 495ml deionized water; (178) 150 ml sample + 350ml deionized water; (179) dry bucket had 10ml sample + 490 ml deionized water; (180) bucket dry, added 500ml deionized water to process; (181) no ST in place this storm; (182) pin-hole leak in WT ; (183) no power to TBG; (184) pin-hole leak in ST ;(185) Dry bkt caught all precip.; (186) 1 dead fly and large aspen leaf in sample ; (187) much smoke during part of period from Ralston fire near Foresthill ;(188) plastic bag contacted sample water; (189) many small black bugs in dry bucket ; (190) 10ml of sample + 490ml deionized water ; (191) pin-hole leak in ST, 98 ml sample + 402ml deionized water; (192) 5ml sample + 495ml deionized water; (193) probable sample contamination; (194) 375ml sample + 3140 ml deionized water; (195) 55ml sample +450ml deionized water ; (196) 0 ml sample + 500ml deionized water; (197) several small bugs in bucket and small pieces of black debris; (198) 53ml sample + 447ml DIW ; (199) sample concentrations unusually high, probable contamination; (200) ▪ these were special samples collected during the Angora fire, collection duration was about 1 day, during these time periods, quality of initial deionized water is critical for calculating loads, in calculating loads for these samples the following starting deionized water concentrations were subtracted from the measured concentration to estimate loading due to atmospheric deposition: NO3 (2 μg/l), NH4 (4 μg/l), TKN (10 μg/l), SRP (0 μg/l), DP (2 μg/l), TP (2 μg/l).

Appendix 7. Lake Tahoe Bioassay Procedure

UC Davis Tahoe Environmental Research Center (TERC) Bioassay Procedure

1. Sample Collection

1.1. A 20 liter carboy (with a spigot for easy water dispensing) and a funnel with 80µm mesh-size netting zooplankton netting over the small end is thoroughly cleaned prior to sample collection using a phosphorus-free soap (i.e. Liquinox) and a brush, deionized H_2O, 0.1N HCl and finally 10x deionized water rinses.
1.2. Lake water containing natural phytoplankton assemblages is collected at the TERC Index station using a 3 liter Van Dorn bottle. Equal volumes of discreet depth samples collected from depths of 2, 5, 8, 11, 14, 17, 20m are passed through 80µm mesh-size netting (to remove larger zooplankton) and composited in the 20 liter carboy. Care should be taken to avoid contaminating the sample at any point during the process.
1.3. The sample is transported back to the lab as soon as possible after collection to initiate the bioassay. The carboy containing the lake water should be kept out of direct sunlight and kept near lake temperature while transporting back to the lab. Once back at the lab, the sample is held in an incubator or cold room at approximately the average ambient lake temperature for the depths sampled until the bioassay is initiated the same day.

2. Glassware Preparation
Incubation flasks to be used in the bioassay should be carefully cleaned. Typically 18 500ml Erlenmeyer flasks are used as the incubation flasks. These are scrubbed with Liquinox soap and tap H_2O, pre-rinsed with deionized water, rinsed 2X with 0.1N HCl, then 10X rinsed with deionized water. A small amount of deionized water is left in the flasks, they are then capped with aluminum foil and autoclaved for 15 minutes. All other glassware used in the bioassay is cleaned with Liquinox soap and tap H_2O, pre-rinsed with deionized water, 1X 0.1N HCl, and 10X with deionized water.

3. Nutrient Stock Preparation
Nutrient stock solutions for use in bioassay treatments are typically either prepared fresh or stored refrigerated (for up to a couple of months). A 10 mg N/liter Nitrogen stock solution is prepared by adding 0.0143 grams of NH_4NO_3 to 500ml deionized H_2O. A 5mg P/liter Phosphorus stock solution is prepared by adding either 0.0115 grams Na_2HPO_4 to 500ml deionized water or 0.0097 grams NaH_2PO_4 to 500ml deionized water.

4. Bioassay Experiment Set-up
4.1. Allow the bioassay flasks to cool after autoclaving, swirl the deionized water in flasks and discard. Then pre-rinse each flask 5 X with lake sample and discard (mix the lake sample carboy frequently during the rinsing process).
4.2. Empty residual water from the flasks. Number the flasks 1-18. To flasks #1-3 no treatment is added, these will be the controls. Dispense nutrient stock solution to the remaining flasks using an adjustable pipette according to the experimental design below. Each treatment is made in triplicate. After adding nutrient stock solution to all flasks,

450ml of lake composite water containing natural algal assemblages is then added to each flask. To do this, mix lake water in the 20 liter carboy before initially starting, then use a cleaned 500 ml graduated cylinder and measure out 450ml of mixed sample to each flask. Mix water in the carboy after every second flask.

Treatment Design for standard bioassay:

Flask #	Nutrient(s) Added + 450ml Lake Sample	Final Treatment Conc.
1-3	None + 450ml lake	Control
4-6	0.9 ml N-Stock + 450 ml lake	N20 (20ppb N)
7-9	0.18 ml P-Stock + 450ml lake	P2 (2ppb P)
10-12	0.9 ml P-Stock + 450ml lake	P10 (10ppb P)
13-15	0.9 ml N-Stock + 0.18ml P-Stock + 450ml lake	N20+P2
16-18	0.9 ml N-Stock + 0.9 ml P-Stock + 450ml lake	N20+P10

4.3. After adding 450 ml of lake water to all flasks, place the flasks in the incubator. The flasks are distributed in the incubator to assure different positions in the incubator for the various flasks within a treatment. Flasks are shifted daily to different positions in the incubator. Alternatively, the positions of flasks daily can be randomized.

4.4. The flasks are incubated in a Percival incubator. Incubator temperature is set to approximately the average ambient lake temperature for the water column down to 20m. Daylight cycle is adjusted to the daily lighting hours for the time of the year. Lighting in the incubator is by 3 cool white fluorescent lights directly over flasks.

4.5. The initial *in vivo* fluorescence of the sample should be measured. Warm the Turner Designs 10AU fluorometer up for at least 20 min. (The fluorometer should be configured to measure *in vivo* chlorophyll *a*). Measure the fluorescence of mixed lake composite water 3 times and record the results in the lab book.

4.6. Replicate 100ml aliquots of sample are filtered through a 2.5cm dia. GF/C filter and the filters frozen for possible later chlorophyll *a* analysis.

4.7. The flasks are swirled once or twice daily during the experiment.

4.8. *In vivo* fluorescence of all samples is measured on Days 4 and 6 of the bioassay. Warm up the fluorometer for at least 20 minutes. Measure the fluorescence of each sample. Typically, we will measure the fluorescence of at least two subsamples from each flask to provide replicate subsamples (on Day 6 we usually measure fluorescence of 3 replicate sub-samples, from each flask). Results are entered into a Laboratory notebook for bioassay experiments.

4.9. In a portion of the bioassays, 100ml of sample from the final day of the experiment will be filtered through a GF/C filter and the filter saved frozen for potential future chlorophyll *a* analysis.

5.0. Bioassay Data Analysis

Each set of Day 4 and Day 6 *in vivo* fluorescence measurements is statistically analyzed using Analysis of Variance (ANOVA). An F test is first done to test whether there are significant differences among treatment means. A significant F test at the $P \leq 0.05$ level for the ANOVA indicates there are significant differences among treatment means. When the overall ANOVA F test is significant, all treatment means are compared with the control treatment mean fluorescence using Fisher's Protected Least Significant Difference (PLSD) test. A treatment mean is considered to be significantly different from the control mean when the PLSD value exceeds the PLSD value for the P=0.05 level. When the mean *in vivo* fluorescence is statically significantly higher than the control fluorescence, the treatment is considered to be significantly stimulatory to growth. When the treatment is statistically significantly less than the control, the treatment is considered to be significantly inhibitory to growth. Day 6 results are typically reported as the "final results" for a bioassay since treatment differences usually become apparent by Day 6. Longer incubation times are not used due to the potential for algal community characteristics to change.

6.0. Quality Assurance

The bioassay program is designed to provide an indication of the nutrient limitation of phytoplankton in the upper euphotic zone in the lake. The Index station along the west shore of Lake Tahoe has been shown to be fairly representative of average algal production levels around the lake.

6.1. Field collection of samples.

A critical quality assurance concern in collection of samples is avoidance of sources of contamination and factors which can compromise samples. The carboy and funnel with zooplankton should be carefully cleaned in the lab as described in Section 1 above with phosphorus-free soap, 0.1N HCl and deionized water. When sampling on the research boat, standard, clean limnological sampling techniques should be employed to prevent contamination of sample from handling of equipment, contacting the sample water or material blowing into the sample carboy. After collection, the sample should be protected from direct sun and kept cool, ideally placed in a refrigerator on board if available. The sample should be transported back to the lab and bioassay initiated as soon as possible after collection.

6.2. Bioassay experiment set up.

Similarly, avoidance of sources of contamination in bioassay set-up is of critical concern. Experimental flasks and all glassware should be cleaned with Liquinox soap, 0.1N HCl and deionized water rinsed as in Section 2 above. Rinsing of bioassay flasks 5X with lake sample provides additional protection against contamination and should provide initial coating of cleaned glass surfaces with ions from the lake water. Nutrient stock solutions should be prepared with very high quality deionized water and high quality lab N and P reagents. Careful laboratory techniques are employed to minimize potential contamination.

Sample treatments are replicated in triplicate. This level of replication is necessary to take into account natural variability in phytoplankton and particulate matter distributed to each flask. Shake the lake composite sample frequently when dispensing sub-samples to resuspend phytoplankton and particulates.

6.3. Acceptance of data.

Typically there is some variation in *in vivo* fluorescence values for replicate flasks for a treatment as well as variation among repeated fluorescence measures from a single treatment flask. However, usually the fluorescence values for all the replicates for a treatment are relatively close. When there are no obvious "outliers" among treatment replicates, all the data for a bioassay is typically accepted and included in the ANOVA.

Occasionally, the *in vivo* fluorescence from a single treatment replicate (flask) will be substantially different than the other replicate values for a treatment and repeated measures of fluorescence from the sample confirm such a difference. Such factors as contamination of the sample or glassware either with nutrients or toxic chemicals, presence of zooplankton (grazing and excreting) or unequal distribution of phytoplankton in initial set-up of bioassay may contribute to outliers among treatment replicates. The data must be reviewed to determine whether to censor the data and not include it in the ANOVA. Usually, if one of the factors above appears likely to have led to the observed results, the data from the replicate is censored and not included in the ANOVA.

In the case where there is much variability among treatment replicates or multiple "outliers" this may or may not indicate a problem with the bioassay. Naturally high variation has been observed in past bioassays with phytoplankton assemblages composed of large colonies of cells or in samples in which the phytoplankton population was possibly senescing. However, high variation may also indicate contamination or experimental problems. When high variability in bioassay results is observed, typically all the data is included in an ANOVA. If contamination or experimental problems are suspected, the experiment should be re-run again with new water collected from the lake within a short time span after completion of the first bioassay.