

APPENDIX A

Tables

LIST OF TABLES

Table 1.	Lacamas Shores Water Quality Data, 1988 - 1993
Table 2.	Precipitation Record for Reporting Period, 1992-3
Table 3.	Inflowing Concentrations and Percent Reduction
Table 4.	Phosphorus Loading Rates for 1990, 1991, 1992 and 1993
Table 5.	Organochlorine Pesticides in Wastewater
Table 6.	Organophosphate Pesticides in Wastewater
Table 7.	Chlorinated Herbicides in Wastewater
Table 8.	Toxic Metals in Surface, Ground and Lake Water
Table 9.	Ground Water Depths in Shallow Wells
Table 10.	Transect 1 and Transect 2 Species Diversity
Table 11.	Transect 1 and Transect 2 Dominant Species
Table 12.	Water Quality Data for Monitoring Stations
Table 13.	Water Quality Data for Monitoring Stations
Table 14.	Water Quality Data for Monitoring Stations
Table 15.	Water Quality Data for Monitoring Stations

Table 1. Lacamas Shores Water Quality Data, 1988 - 1993.

DATE	STAT.	TEMP	pH	COND.	DEPTH	TP	PO4	NO3	TSS	O&G
21-Oct-88	b1	13.2	6.46	100		0.098	0.084	0.134	4.6	5.7
21-Oct-88	b2	13.3	6.34	90		0.106	0.091	0.135	10.6	1.1
21-Oct-88	c1	15.7	6.61	330		0.022	0.524	0.050	19.0	2.4
21-Oct-88	c2	13.8	7.92	230		0.088	0.032		44.7	4.2
21-Oct-88	c3	11.9	7.81	110		0.105	0.090	0.388	2.9	1.1
21-Oct-88	g1	13.9	6.61	300	0.43	0.159	0.173	0.040	160.3	4.4
21-Oct-88	g2	13.9	6.16	342	0.89					
21-Oct-88	g3	13.8	6.62	190	0.56					
21-Oct-88	g4	14.0	5.90	260	1.36					
21-Oct-88	g5	14.0	6.42	179	2.34					
21-Oct-88	g6	13.4	6.41	170	0.35	0.093	0.074	0.045	189.2	3.8
21-Oct-88	g7	13.2	6.10	260	0.19					
21-Oct-88	g8	13.8	6.78	380	3.00					
21-Oct-88	s2	11.4	6.76	120		0.040	0.021	0.082	9.1	2.8
27-Oct-88	g1	13.6	6.57	296	0.50					
27-Oct-88	g2	13.8	6.21	330	0.96					
27-Oct-88	g3	13.7	6.67	196	0.69					
27-Oct-88	g4	13.9	6.23	256	1.40					
27-Oct-88	g5	13.9	6.49	190	2.29					
27-Oct-88	g6	13.6	6.18	156	0.46					
27-Oct-88	g7	13.4	6.93	261	0.33					
27-Oct-88	g8	13.7	6.97	368	3.00					
27-Oct-88	g9				3.00					
21-Nov-88	g1	7.9	6.60	280	0.33					
21-Nov-88	g2	7.7	6.05	328	0.73					
21-Nov-88	g3	7.4	6.56	149	0.89					
21-Nov-88	g4	7.9	6.44	308	0.42					
21-Nov-88	g5	7.9	6.13	147	0.98					
21-Nov-88	g6	7.8	6.33	110	0.36					
21-Nov-88	g7	7.3	7.12	143	0.29					
21-Nov-88	g8	7.7	6.63	243	3.00					
21-Nov-88	g9	7.9	6.50	118	3.00					
16-Dec-88	g1	7.2	6.09	210	0.32					
16-Dec-88	g2	7.3	6.12	225	1.24					
16-Dec-88	g3	7.6	6.10	178	0.59					
16-Dec-88	g4	7.8	5.77	406	0.67					
16-Dec-88	g5	7.9	6.45	166	1.72					
16-Dec-88	g6	7.9	6.09	87	0.33					
16-Dec-88	g7	7.4	6.19	163	0.27					
16-Dec-88	g8	7.6	6.55	260	3.00					
16-Dec-88	g9	7.7	6.40	89	1.48					
21-Dec-88	b2	7.4	5.70	69		0.298	0.445	0.210	2.7	
21-Dec-88	c2	8.6	8.06	146		0.130	0.071	2.470	35.0	
21-Dec-88	c3	6.8	7.60	97		0.114	0.083	4.500	13.5	
21-Dec-88	g1		6.20	215	0.33	0.071	0.059	0.010	3.0	
21-Dec-88	g2		6.06	187	1.25	0.079	0.022	0.020	7.0	
21-Dec-88	g3		6.07	134		0.103	0.053	0.020	32.7	
21-Dec-88	g4		5.78	383	0.23	0.145	0.009	0.030	16.0	

Table 1. Lacamas Shores Water Quality Data, 1988 - 1993.

DATE	STAT.	TEMP	pH	COND.	DEPTH	TP	PO4	NO3	TSS	O&G
21-Dec-88	g5		6.31	100	0.73	0.128	0.059	0.240	24.0	
21-Dec-88	g6		6.02	115	0.35	0.215	0.026	0.020	10.8	
21-Dec-88	g7		6.07	176	0.23	0.158	0.064	0.020	32.0	
21-Dec-88	g8	7.0	6.88	210	3.00	0.215	0.333	0.080	210.0	
21-Dec-88	l1	6.0	6.50	68		0.319	0.213	0.010	45.0	
21-Dec-88	l2	8.0	6.60	58		0.100	0.288	0.100	20.8	
21-Dec-88	l3	6.0	6.13	66		0.086	0.042	1.100	8.0	
21-Dec-88	s1	6.0	6.60	48		0.358	0.236	0.420	109.0	
21-Dec-88	s2	6.0	6.49	61		0.124	0.068	0.100	22.7	
21-Dec-88	s2	6.0	6.30	67		0.243	0.120	0.010	42.0	
21-Dec-88	s3	7.0	6.50	118		0.199	0.088	0.140	52.9	
21-Dec-88	s4	7.0	6.20	67		0.103	0.058	0.060	10.4	
21-Dec-88	s6	7.0	6.30	80		0.115	0.053	0.060	57.0	
22-Mar-89	c1	10.3	6.96	80						
22-Mar-89	c2	10.8	7.14	142						
22-Mar-89	c3	8.5	6.69	66						
22-Mar-89	g1	9.0	6.26	211	0.50	0.160	0.006	0.020	66.2	0.5
22-Mar-89	g2	9.4	6.13	131	1.50	0.271	0.010	0.020	104.0	0.5
22-Mar-89	g3	8.9	6.46	141	1.30	0.218	0.019	0.020	352.0	0.5
22-Mar-89	g4	9.5	6.09	291	0.80	0.250	0.005	0.030	28.0	0.5
22-Mar-89	g5	9.5	6.60	88	2.10	0.160	0.027	0.060	64.0	0.5
22-Mar-89	g6	9.4	6.36	85	0.42	0.114	0.002	0.080	69.0	0.5
22-Mar-89	g7	9.3	6.31	130	0.33	0.278	0.002	0.020	748.0	0.5
22-Mar-89	g8	9.5	6.38	88	1.33	0.233	0.031	0.020	79.0	0.5
22-Mar-89	g9	9.5	6.27	95	1.13	0.230	0.026	0.020	36.0	0.5
22-Mar-89	l1	9.5	6.65	56						
22-Mar-89	l2	9.5	7.08	61						
22-Mar-89	l3	9.5	7.17	62						
22-Mar-89	s1	8.5	6.90	51						
22-Mar-89	s2	8.1	6.46	73						
22-Mar-89	s3	8.7	6.59	78						
22-Mar-89	s4	8.2	7.08	77						
14-Jun-89	c1	16.7	6.20	79		0.109	0.069	0.010	4.5	0.0
14-Jun-89	c2	15.8	7.00	180		0.117	0.042	6.360	25.0	1.2
14-Jun-89	c3	16.2	6.60	74		0.196	0.125	0.280	13.3	1.5
14-Jun-89	g1	11.1	6.10	200	1.33	0.106	0.057	0.020	46.0	0.0
14-Jun-89	g2	11.1	6.20	130	1.75					
14-Jun-89	g3	10.8	6.60	121	1.67	0.439	0.067	0.080	104.0	0.0
14-Jun-89	g4	11.2	6.80	288	1.98	0.323	0.079	0.100	33.0	5.5
14-Jun-89	g5	11.2	6.50	121	2.40	0.390	0.069	0.040	173.4	0.0
14-Jun-89	g6	11.3	6.90	97	3.25					
14-Jun-89	g7	10.9	6.30	119	0.40	0.213	0.039	0.100	67.0	2.2
14-Jun-89	g9	11.0		91	3.08					
14-Jun-89	g11	11.2		207	3.25					
14-Jun-89	l1	16.9	6.60	66		0.054	0.022	0.200	4.3	0.6
14-Jun-89	l2	16.9	6.30	67		0.064	0.024	0.230	4.3	1.5
14-Jun-89	l3	16.9	7.30	66		0.057	0.023	0.180	5.3	1.8
14-Jun-89	s1	12.8	6.10	53		0.289	0.056	0.010	57.3	1.5

Table 1. Lacamas Shores Water Quality Data, 1988 - 1993.

DATE	STAT.	TEMP	pH	COND.	DEPTH	TP	PO4	NO3	TSS	O&G
14-Jun-89	s2	12.9	6.90	65		0.054	0.019	0.270	5.3	4.0
14-Jun-89	s3	12.6	6.20	59		0.141	0.043	0.080	13.6	1.9
14-Jun-89	s4	12.7	6.50	74		0.218	0.102	0.010	40.5	1.9
02-Aug-89	b1		6.10	68		0.151		0.170	17.0	0.4
02-Aug-89	b2		5.60	100		0.072	0.039	0.170	9.0	1.4
02-Aug-89	g1	12.9	6.00	183	0.82	0.084		0.010	37.0	0.9
02-Aug-89	g2	13.0	6.20	122	1.57					
02-Aug-89	g3	13.7	6.56	115	0.79					
02-Aug-89	g4	13.6	6.95	278						
02-Aug-89	g5	13.6	6.39	116	2.29					
02-Aug-89	g6	13.6	6.44	89	3.35					
02-Aug-89	g7	13.5	6.77	115	0.23					
02-Aug-89	g9	13.7	6.42	87	3.20					
02-Aug-89	l1	23.3	9.30	77		0.054	0.003	0.050	5.0	1.2
02-Aug-89	l2	23.4	9.40	77		0.050	0.003	0.060	1.0	0.6
02-Aug-89	l3	23.4	9.20	76		0.272	0.033	0.090	7.0	0.3
02-Aug-89	s1	15.9	6.10	55		0.151		0.170	17.0	0.4
02-Aug-89	s2	15.8	6.30	105		0.078	0.032	0.030	15.0	0.7
02-Aug-89	s3	15.5	6.43	97		0.072	0.039	0.170	9.0	1.4
02-Aug-89	s4	15.6	6.50	76		0.115	0.051	0.010	49.0	1.1
02-Aug-89	s6		6.90	65						
10-Jan-90	b1	9.3	5.15	74		0.169	0.099	0.580	90.0	0.3
10-Jan-90	c1	7.7	5.45	37		0.118	0.045	0.400	4.7	1.4
10-Jan-90	c2	7.9	5.43	72		0.135	0.060	1.710	8.7	1.4
10-Jan-90	c3	8.1	5.44	53		0.108	0.086	2.430	4.7	0.9
10-Jan-90	g1	8.3		490	0.25	0.058	0.057	0.010	16.0	0.5
10-Jan-90	g2	7.7	5.19	71	0.94	0.155	0.013	0.090	75.6	
10-Jan-90	g3	8.4	5.06	112	0.79	0.132	0.064	0.010	72.0	
10-Jan-90	g6	8.4	5.16	96	0.50	0.534	0.143	0.010	50.0	
10-Jan-90	g7	8.4	5.34	74	0.29	0.233	0.157	0.010	76.0	
10-Jan-90	l3	8.5	5.14	40		0.119	0.064	0.960	10.0	
10-Jan-90	s2	8.6	4.87	64		0.150	0.039	0.330	17.5	
10-Jan-90	s3	9.4	5.16	66		0.232	0.045	0.260	8.0	
10-Jan-90	s4	8.9	5.55	63		0.098	0.038	0.590	16.5	
12-Mar-90	b1		8.66	43		0.067	0.021	0.465	6.0	0.6
12-Mar-90	c1		7.05	21		0.054	0.025	0.164	3.7	1.0
12-Mar-90	c2	8.0	6.86	63		0.063	0.028	2.330	5.3	0.7
12-Mar-90	c3	7.0	7.02	29		0.101	0.047	1.140	5.7	0.5
12-Mar-90	g1		7.90	100	0.46	0.263	0.013	0.037	57.3	0.2
12-Mar-90	g2		7.41	36	0.69	0.144	0.010	0.079	20.5	0.2
12-Mar-90	g3		7.05	53	1.13	0.128	0.050	0.120	90.0	0.1
12-Mar-90	g6		6.85	45	0.52	0.324	0.181	0.045	92.0	0.1
12-Mar-90	g7		6.54	50	0.23	0.478	0.120	0.084	26.0	0.1
12-Mar-90	l1		7.05	24		0.067	0.022	0.725	6.0	0.1
12-Mar-90	l3		6.95	25		0.093	0.021	0.703	6.0	0.6
12-Mar-90	s2					0.073	0.019	0.715	6.0	0.4
12-Mar-90	s3		7.31	36		0.065	0.041	0.239	7.7	1.0
12-Mar-90	s4		6.60	33		0.091	0.033	0.096	14.7	0.0

Table 1. Lacamas Shores Water Quality Data, 1988 - 1993.

DATE	STAT.	TEMP	pH	COND.	DEPTH	TP	PO4	NO3	TSS	O&G
25-Apr-90	g1		5.20	68						
25-Apr-90	g2		5.30	41	0.88					
25-Apr-90	g3		5.60	63	0.79					
25-Apr-90	g6		5.50	51	0.50					
25-Apr-90	g7		5.70	56	0.33					
25-Apr-90	s1		5.40	20						
27-Apr-90	b1		4.90	96		0.543	0.110	0.296	471.0	0.3
27-Apr-90	b2		6.06	50		0.135	0.027	0.265	39.0	1.0
27-Apr-90	c1		5.83	55		0.173	0.050	0.084	22.0	
27-Apr-90	c2		6.36	69		0.227	0.084	0.594	38.0	
27-Apr-90	c3		5.90	142		0.426	0.052	0.842	118.6	
27-Apr-90	g1		5.53	2		0.216	0.041	0.007	40.0	0.7
27-Apr-90	g2		5.45	138	0.83	0.175	0.031	0.052	25.0	1.9
27-Apr-90	g3		4.32	220	1.00	0.112	0.052	0.050	44.0	0.7
27-Apr-90	g6		5.90	126	0.75	0.265	0.198	0.044	78.8	0.2
27-Apr-90	g7		5.34	124	0.33	0.195	0.090	0.055	20.0	0.9
27-Apr-90	l1		5.00	115		0.080	0.023	0.484	4.3	0.6
27-Apr-90	l2		7.20	79		0.052	0.200	0.462	10.5	1.1
27-Apr-90	l3		3.32	79		0.057	0.009	0.486	11.3	0.2
27-Apr-90	s2		4.80	100		0.236	0.064	0.138	57.0	0.3
27-Apr-90	s3		6.00	43		0.344	0.025	0.182	58.0	2.1
27-Apr-90	s4		4.96	50		0.160	0.064	0.118	25.3	1.8
27-Apr-90	s6		2.45	86		0.203	0.033	0.148	38.0	3.8
29-May-90	g2		5.04	80	1.25					
29-May-90	g3		5.20	110	0.70					
29-May-90	g5		5.45	223	0.67					
14-Jun-90	c1	18.0	5.12	58		0.087	0.043	0.042	3.7	0.9
14-Jun-90	c2	19.0	5.47	121		0.257	0.110	3.540	31.2	2.4
14-Jun-90	c3	18.0	4.83	52		0.107	0.071	0.587	6.2	1.4
14-Jun-90	g2	14.0	4.63	79	1.00	0.129	0.017	0.042	10.3	3.2
14-Jun-90	g3	14.0	4.93	85	0.67	0.069	0.027	0.044	20.5	2.6
14-Jun-90	g7	13.0	NA	94	0.33	0.186	0.125	0.049	20.9	2.1
14-Jun-90	g11	18.0	5.17	167	0.79	1.370	0.188	L.008	1460.0	
14-Jun-90	l1	19.5	5.01	47		0.128	0.130	0.302	8.2	1.9
14-Jun-90	l2	21.0	4.97	45		0.127	0.017	0.193	71.0	1.6
14-Jun-90	l3	21.0	4.70	50		0.061	0.018	0.255	29.6	2.2
14-Jun-90	s1	13.0	4.69	80		0.109	0.113	0.211	11.8	1.2
14-Jun-90	s2	15.0	5.00	72		0.035	0.026	0.053	3.5	1.3
14-Jun-90	s3	17.0	5.37	59		0.050	0.034	0.057	8.5	0.9
14-Jun-90	s4	20.0	5.12	55		0.041	0.029	0.053	5.0	0.6
03-Oct-90	b1	14.0	6.15	66		1.200	0.107	0.463	225.0	2.1
03-Oct-90	b2	14.0	6.50	48		0.303	0.119	0.131	114.0	1.5
03-Oct-90	c1	15.0	6.62	118		0.286	0.161	0.477	12.0	0.6
03-Oct-90	c2	14.0	7.72	187		0.109	0.054	0.475	18.4	1.6
03-Oct-90	c3	13.0	7.45	94		0.191	0.141	0.853	16.8	0.6
03-Oct-90	g4	14.0	6.62	64	1.98					
03-Oct-90	g5	16.0	6.11	66	0.62					
03-Oct-90	g11	14.5	6.40	220	1.16					

Table 1. Lacamas Shores Water Quality Data, 1988 - 1993.

DATE	STAT.	TEMP	pH	COND.	DEPTH	TP	PO4	NO3	TSS	O&G
03-Oct-90	l1	17.5	8.42	80		0.047	0.011	0.205	18.0	2.7
03-Oct-90	l2	18.0	8.36	80		0.051	0.012	0.261	21.0	1.3
03-Oct-90	l3	17.0	7.75	80		0.031	0.009	0.220	18.0	5.3
03-Oct-90	s2	13.5	6.61	118		0.140	0.046	0.081	46.0	2.6
03-Oct-90	s3	13.0	6.84	66		0.594	0.176	0.057	261.0	4.5
03-Oct-90	s4	14.0	6.93	58		0.121	0.133	0.078	12.7	3.8
19-Oct-90	b1	12.0	6.28	80			0.039	1.240	92.0	
19-Oct-90	b2	11.0	6.13	49			0.027	0.024	2760.0	
19-Oct-90	c1	11.0	6.62	88			0.099	2.440	22.0	
19-Oct-90	c2	11.0	7.38	140			0.157	2.400	222.0	
19-Oct-90	c3	11.0	7.10	74			0.156	0.070	55.0	
19-Oct-90	g1	12.5	6.17	148	1.79	0.072	0.036	0.026	45.0	1.6
19-Oct-90	g2	12.5	6.07	76	1.05	0.059	0.017	0.563	23.0	0.9
19-Oct-90	g3	12.5	6.14	94	0.81	0.109	0.076	0.021	8.0	1.5
19-Oct-90	g4	12.5	6.79	69	1.74	1.880	0.046	0.580	4.8	2.4
19-Oct-90	g5	13.0	6.05	45	1.19	1.040	0.146	0.072	1355.0	2.3
19-Oct-90	g6	12.0	6.38	115	0.60	0.305	0.301	89.7	80.0	5.5
19-Oct-90	g7	12.0	6.23	99	0.41	0.160	0.127	0.085	28.0	4.1
19-Oct-90	g11	14.0	6.32	83	0.82	3.480	0.257	0.241	970.0	7.0
19-Oct-90	l1	14.0	6.81	62			0.015	0.182	20.0	
19-Oct-90	l2	13.0	7.56	58			0.011	0.213	15.0	
19-Oct-90	l3	11.0	6.90	59			0.010	0.021	18.0	
19-Oct-90	s2	11.0	6.37	71			0.055	0.126	66.0	
19-Oct-90	s3	12.0	6.67	60			0.423	0.008	362.0	
19-Oct-90	s4	12.0	7.09	59			0.042	0.417	0.5	
17-Dec-90	b1	9.0	6.30	42		0.060	0.070	0.913	68.0	
17-Dec-90	b2	10.5	6.17	50		0.706	0.155	0.407	190.0	
17-Dec-90	c1	6.3	6.39	25		0.156				
17-Dec-90	c2	7.0	7.40	67		0.147				
17-Dec-90	c3	7.5	6.85	35		0.176				
17-Dec-90	g1	8.5	6.31	87	0.26	0.078	0.030	0.084	34.0	
17-Dec-90	g2	8.0	5.83	51	0.61	0.092	0.016	0.036	28.0	
17-Dec-90	g3	9.0	6.26	76	0.22	0.047	0.054	0.131	14.0	
17-Dec-90	g4	9.5	6.14	57	0.58	0.048	0.039	0.213	79.0	
17-Dec-90	g5	7.0	6.13	41	0.75	0.557	0.022	0.213	300.0	
17-Dec-90	g6	7.0	6.52	65	0.47	0.348	0.286	0.024	45.0	
17-Dec-90	g7	8.0	6.54	72	0.14	0.097	0.044	0.069	32.0	
17-Dec-90	g11	9.0	6.12	292	0.14	0.182	0.045	0.057	663.0	
17-Dec-90	l1	7.0	7.14	46		0.038	0.026	0.241	9.0	
17-Dec-90	l2	7.5	7.05	41		0.159	0.050	0.762	14.0	
17-Dec-90	s2	7.0	6.88	44		0.028	0.050	0.134	30.0	
17-Dec-90	s3	7.5	6.88	37		0.084	0.074	0.559	28.0	
17-Dec-90	s4	7.5	7.17	40		0.067	0.049	0.571	20.0	
21-Feb-91	b1	10.0	6.49	174		0.212	0.051	1.660	12.9	
21-Feb-91	b2	9.5	6.28	182		0.341	0.094	0.730	137.1	
21-Feb-91	c1	8.5	7.26	116		0.141				
21-Feb-91	c2	9.0	7.44	222		0.162				
21-Feb-91	c3	8.0	6.89	94		0.104				

Table 1. Lacamas Shores Water Quality Data, 1988 - 1993.

DATE	STAT.	TEMP	pH	COND.	DEPTH	TP	PO4	NO3	TSS	O&G
21-Feb-91	g1	8.0	6.17	298	0.55	0.252	0.039	0.005	31.0	
21-Feb-91	g2	8.5	5.70	160	0.90	0.276	0.013	0.005	29.0	
21-Feb-91	g3	9.5	6.38	298	0.71	0.292	0.041	0.019	20.0	
21-Feb-91	g4	10.0	6.56	198	1.16	0.880	0.019	0.317	131.0	
21-Feb-91	g5	8.0	5.99	120	1.35	0.251	0.006	0.005	705.0	
21-Feb-91	g6	8.0	6.25	246	0.86	0.588	0.267	0.005	55.0	
21-Feb-91	g7	8.0	6.50	226	0.55	0.326	0.092	0.005	26.0	
21-Feb-91	g11	9.0	6.49	300	0.73	0.579	0.127	0.005	1892.0	
21-Feb-91	l1	8.5	7.01	163		0.231	0.015	0.465	31.0	
21-Feb-91	l2	8.0	6.81	162		0.182	0.013	0.933	7.7	
21-Feb-91	s2	8.5	6.94	162		0.129	0.127	0.514	8.0	
21-Feb-91	s3	8.5	6.57	166		0.137	0.019	1.150	6.4	
21-Feb-91	s4	8.0	6.96	162		0.129	0.013	1.010	4.8	
03-Apr-91	b1	9.5	5.92	61		0.129	0.024	0.081	13.5	
03-Apr-91	b2	9.0	6.29	91		0.347	0.066	0.376	17.0	
03-Apr-91	c1	10.5	7.05	45		0.103				
03-Apr-91	c2	11.0	7.06	126		0.076				
03-Apr-91	c3	10.5	7.28	53		0.156				
03-Apr-91	g1	8.0	6.10	138	0.60	0.043	0.044	0.036	16.1	
03-Apr-91	g2	9.0	5.92	78	1.02	0.039	0.017	0.038	36.0	
03-Apr-91	g3	9.25.0	6.25	124	0.68	0.059	0.044	0.002	10.5	
03-Apr-91	g4	10.0	6.71	60	2.00	0.145	0.046	0.017	87.0	
03-Apr-91	g5	9.0	6.13	56	1.33	1.520	0.029	0.190	226.7	
03-Apr-91	g6	9.0	6.35	86	0.37	0.275	0.236	0.052	36.9	
03-Apr-91	g7	9.0	6.24	114	0.52	0.127	0.085	0.017	21.3	
03-Apr-91	g11	9.5	6.41	149	0.71	0.068	0.067	0.024	86.0	
03-Apr-91	l1	9.0	6.81	73		0.079	0.020	0.042	6.8	
03-Apr-91	l2	9.3	6.61	60		0.158	0.020	0.042	81.3	
03-Apr-91	s2	9.0	6.28	75		0.041	0.040	0.002	12.5	
03-Apr-91	s3	9.5	5.88	58		0.148	0.014	0.042	44.7	
03-Apr-91	s4	9.5	6.34	60		0.124	0.014	0.027	54.5	
01-May-91	b1	11.5	6.04	91		0.187	0.050	0.501	0.5	
01-May-91	b2	11.0	6.27	93		0.051	0.046	0.244	0.7	
01-May-91	c1	13.0	7.55	58		0.065				
01-May-91	c2	14.0	7.71	153		0.087				
01-May-91	c3	13.5	7.70	63		0.111				
01-May-91	g1	11.0	6.29	195	0.69	0.072	0.006	0.003	14.0	
01-May-91	g2	11.0	5.88	111	1.23	0.064	0.008	0.065	18.0	
01-May-91	g3	10.0	6.30	188	0.82	0.078	0.033	0.052	4.0	
01-May-91	g4	14.0	7.08	73	1.49	0.742	0.028	0.003	84.0	
01-May-91	g5	12.5	6.11	73	2.20	0.638	0.016	0.025	136.0	
01-May-91	g6	13.0	6.32	142	0.32	0.328	0.200	0.003	19.0	
01-May-91	g7	11.5	6.46	119	0.52	0.156	0.092	0.031	25.0	
01-May-91	g11	13.0	6.25	108	0.72	0.204	0.046	0.003	50.0	
01-May-91	l1	11.0	6.87	101		0.068	0.123	0.015	4.7	
01-May-91	l2	10.5	6.60	80		0.092	0.003	0.012	46.7	
01-May-91	s2	11.5	6.61	100		0.054	0.006	0.003	5.0	
01-May-91	s3	11.5	6.23	181		0.054	0.003	0.009	6.0	

Table 1. Lacamas Shores Water Quality Data, 1988 - 1993.

DATE	STAT.	TEMP	pH	COND.	DEPTH	TP	PO4	NO3	TSS	O&G
01-May-91	s4	10.5	6.30	79		0.045	0.003	0.006	1.0	
09-Aug-91	b1	14.0	6.53	80		0.102	0.101	0.257	3.7	
09-Aug-91	b2	18.0	6.34	126		0.225	0.085	0.553	42.0	
09-Aug-91	c1					0.231	0.111	0.003	15.5	
09-Aug-91	c2					0.116	0.145	0.290	3.0	
09-Aug-91	c3									
09-Aug-91	g1									
09-Aug-91	g2	17.0	5.59	127	1.13	0.064	0.027	0.021		
09-Aug-91	g3	18.0	6.07	190	0.48	0.152	0.072	0.007		
09-Aug-91	g4									
09-Aug-91	g5									
09-Aug-91	g6	20.5	6.03	100	0.83	0.585	0.144	0.012		
09-Aug-91	g7	18.0	6.13	100	0.29	0.274	0.126	0.007		
09-Aug-91	g11	20.0	5.88	10	0.08	0.417	0.141	0.005		
09-Aug-91	l1	19.0	6.75	100		0.302	0.062	0.007	37.3	
09-Aug-91	l2	22.0	6.90	75		0.057	0.033	0.004	17.0	
09-Aug-91	s2	20.0	6.80	140		0.071	0.030	0.003	47.0	
09-Aug-91	s3	25.0	6.69	150		0.241	0.092	0.013	96.0	
09-Aug-91	s4	20.0	6.86	90		0.053	0.026	0.003	4.3	
25-Oct-91	b1	12.0	6.20	50		0.105	0.059	0.320	47.0	10.1
25-Oct-91	b2	11.5	6.47	35		0.141	0.071	0.057	67.3	10.3
25-Oct-91	c1	10.5	6.18	180		0.382	0.209	0.222	39.0	8.1
25-Oct-91	c2	10.5	6.89	205		0.097	0.047	5.110	10.0	9.0
25-Oct-91	c3	10.0	7.05	109		0.199	0.111	1.880	15.0	2.5
25-Oct-91	g1	11.0	6.28	271	0.00	0.279	0.019	0.077	915.0	2.3
25-Oct-91	g2	12.0	5.98	119	0.67	0.083	0.021	0.022	57.1	0.1
25-Oct-91	g3	12.0	6.15	198	0.42	0.115	0.030	0.003	48.9	5.7
25-Oct-91	g4	11.5	6.22	94	0.75	1.550	0.106	0.008	804.0	
25-Oct-91	g5	12.0	6.58	59	0.50	0.459	0.098	0.016	218.0	5.8
25-Oct-91	g6	11.0	6.34	91	0.08	0.624	0.074	0.003	849.0	0.7
25-Oct-91	g7	11.5	6.20	152	0.00	0.209	0.084	0.027	310.0	8.4
25-Oct-91	g11	12.0	6.22	72	0.10	0.331	0.064	0.030	65.0	6.6
25-Oct-91	l1	12.5	6.54	96		0.066	0.025	0.074	55.3	2.6
25-Oct-91	l2	13.0	6.70	94		0.080	0.009	0.066	7.3	1.4
25-Oct-91	s2	11.0	6.23	87		0.115	0.066	0.027	17.5	1.6
25-Oct-91	s3	12.0	6.62	45		0.202	0.061	0.027	28.0	1.2
25-Oct-91	s4	11.0	7.01	59		0.160	0.108	0.323	9.6	0.8
20-Dec-91	b1	11.5	5.96	75		0.130	0.058	0.753	3.8	
20-Dec-91	b2	11.0	6.02	76		0.092	0.049	0.704	3.3	
20-Dec-91	c1	5.0	5.92	46		0.094				
20-Dec-91	c2	7.5	5.87	118		0.113				
20-Dec-91	c3	6.5	5.77	64		0.138				
20-Dec-91	g1	7.0	5.83	227	0.25	0.137	0.014	0.029	88.8	
20-Dec-91	g2	8.5	5.62	92	0.71	0.094	0.023	0.003	20.6	
20-Dec-91	g3	9.0	5.82	163	0.46	0.180	0.009	0.003	37.0	
20-Dec-91	g4	8.0	5.76	88	0.00	0.990	0.045	0.018	564.0	
20-Dec-91	g5	6.5	6.01	79	0.21	0.576	0.159	0.073	302.0	
20-Dec-91	g6	7.5	5.77	79	0.08	0.560	0.009	0.010	111.4	

Table 1. Lacamas Shores Water Quality Data, 1988 - 1993.

DATE	STAT.	TEMP	pH	COND.	DEPTH	TP	PO4	NO3	TSS	O&G
20-Dec-91	g7	7.5	5.88	103	0.00	0.208	0.159	0.003	25.0	
20-Dec-91	g11	8.5	5.81	78	0.00	1.008	0.082	0.003	29.0	
20-Dec-91	l1	7.0	5.78	71		0.074	0.060	0.948	7.0	
20-Dec-91	l2	5.0	6.19	71		0.104	0.020	0.851	7.3	
20-Dec-91	s2	5.0	5.72	81		0.076	0.017	0.665	8.5	
20-Dec-91	s3	2.0	5.72	80		0.076	0.007	0.004	23.3	
20-Dec-91	s4	6.0	6.14	71		0.079	0.031	0.962	11.0	
20-Feb-92	b1	10.0	4.80	42		0.094	0.035	0.978	14.7	
20-Feb-92	b2	99.5	6.07	60		0.087	0.022	1.500	13.0	
20-Feb-92	c1	9.0	5.52	37		0.167				
20-Feb-92	c2	9.0	5.90	81		0.170				
20-Feb-92	c3	9.0	5.73	46		0.150				
20-Feb-92	g1	9.0	5.94	223	0.04	0.136	0.058	0.014	27.4	
20-Feb-92	g2	9.0	5.87	84	0.33	0.155	0.024	0.039	56.1	
20-Feb-92	g3	9.0	5.90	168	0.00	0.165	0.053	0.006	24.0	
20-Feb-92	g4	10.0	4.71	123	0.08	0.352	0.048	0.051	316.0	
20-Feb-92	g5	9.0	4.69	60	0.21	0.487	0.003	0.773	495.0	
20-Feb-92	g6	9.0	4.56	101	0.00	0.433	0.067	0.040	214.0	
20-Feb-92	g7	9.0	5.03	107	0.00	0.218	0.078	0.026	188.0	
20-Feb-92	g11	9.5	4.71	101	0.00	0.418	0.054	0.076	17.7	
20-Feb-92	l1	9.5	6.13	61		0.127	0.032	0.784	26.4	
20-Feb-92	l2	9.5	4.90	54		0.118	0.020	0.823	15.0	
20-Feb-92	s2	11.0	6.23	87		0.122	0.016	0.508	8.3	
20-Feb-92	s3	10.0	4.73	40		0.132	0.020	0.815	118.5	
20-Feb-92	s4	9.5	5.09	50		0.136	0.021	0.620	7.0	
30-Apr-92	b1	10.9	6.05	77		0.103	0.057	0.970	1.7	
30-Apr-92	b2	11.2	6.60	64		0.093	0.056	0.942	1.7	
30-Apr-92	c1	13.1	6.90	38		0.173	0.058	0.042	10.0	
30-Apr-92	c2	12.9	7.20	98		0.164	0.050	1.070	13.0	
30-Apr-92	c3	12.8	7.20	46		0.188	0.086	1.200	11.0	
30-Apr-92	g1	11.3	6.40	169	0.10	0.212	0.067	0.010	75.0	
30-Apr-92	g2	10.4	6.00	83	0.25	0.083	0.028	0.019	19.0	
30-Apr-92	g3	10.1	6.60	153	0.52	0.163	0.036	0.010	52.0	
30-Apr-92	g4	11.3	5.98	72	0.06	6.000	0.040	0.019	1290.0	
30-Apr-92	g5	11.7	5.83	59	0.35	0.671	0.023	0.070	720.0	
30-Apr-92	g6	11.4	5.86	105	0.17	0.415	0.120	0.010	354.3	
30-Apr-92	g7	10.0	5.98	122	0.21	0.153	0.066	0.010	13.3	
30-Apr-92	g11	12.2	5.82	84	0.00	1.050	0.084	0.012	272.0	
30-Apr-92	l1	15.5	6.14	61		0.068	0.012	0.486	11.0	
30-Apr-92	l2	14.9	6.42	57		0.079	0.010	0.520	11.0	
30-Apr-92	s2	13.6	6.90	62		0.112	0.024	0.131	6.5	
30-Apr-92	s3	14.7	6.20	54		0.093	0.029	0.259	4.5	
30-Apr-92	s4	12.4	5.98	65		0.105	0.040	0.207	6.5	
24-Sep-92	b1	11.8	6.00	93		0.129	0.064	0.360	2.7	0.4
24-Sep-92	b2	14.1	6.50	75		0.287	0.043	0.584	84.0	0.2
24-Sep-92	c1	14.0	6.20	145		0.378	0.089	0.018	24.5	1.3
24-Sep-92	c2	12.5	6.50	162		0.102	0.042	3.400	5.8	0.4
24-Sep-92	c3	12.9	6.70	102		0.260	0.138	0.357	7.8	0.5

Table 1. Lacamas Shores Water Quality Data, 1988 - 1993.

DATE	STAT.	TEMP	pH	COND.	DEPTH	TP	PO4	NO3	TSS	O&G
24-Sep-92	g1	13.5	6.00	254	0.33	0.144	0.016	0.003	65.0	0.4
24-Sep-92	g2	12.9	6.00	134	1.58	0.102	0.003	0.085	22.0	1.2
24-Sep-92	g3	13.2	6.00	158	0.63	0.159	0.039	0.001	14.3	0.8
24-Sep-92	g4	13.2	5.70	91	0.00	1.210	0.055	0.297	850.0	0.1
24-Sep-92	g5	13.8	5.60	51	0.44	0.351	0.040	0.215	81.5	0.8
24-Sep-92	g6	13.4	5.60	139	0.50	0.398	0.149	0.003	41.0	1.2
24-Sep-92	g7	12.8	5.20	128	0.06	0.265	0.065	0.219	26.2	0.6
24-Sep-92	g11	12.8	5.70	92	0.10	1.310	0.027	0.003	61.0	0.9
24-Sep-92	l1	16.7	6.70	88		0.046	0.003	0.243	3.2	0.5
24-Sep-92	l2	16.7	6.70	88		0.063	0.003	0.010	3.8	0.0
24-Sep-92	s2	13.1	5.70	100		0.124	0.021	0.003	13.3	0.6
24-Sep-92	s3	13.5	6.00	56		0.126	0.105	0.148	6.3	1.1
24-Sep-92	s4	13.0	5.40	83		0.099	0.048	0.225	5.8	1.4
30-Oct-92	b1	11.5	5.80	99		0.078	0.057	1.490	16.9	
30-Oct-92	b2	11.4	5.70	93		0.054	0.041	2.300	12.0	
30-Oct-92	c1	10.0	6.30	165		0.313	0.118	0.030	58.0	
30-Oct-92	c2	10.2	6.40	179		0.066	0.030	8.460	4.7	
30-Oct-92	c3	10.0	6.30	149		0.210	0.068	8.910	11.7	
30-Oct-92	g1	10.8	5.80	218	0.27	0.116	0.036	0.006	44.0	
30-Oct-92	g2	10.9	5.60	85	0.83	0.054	0.010	0.031	26.0	
30-Oct-92	g3	10.9	5.90	135	0.38	0.388	0.035	0.013	69.3	
30-Oct-92	g4	10.6	5.70	67	0.06	2.110	0.055	0.075	1436.0	
30-Oct-92	g5	11.1	5.50	57	0.21	0.235	0.026	0.080	49.5	
30-Oct-92	g6	10.3	5.80	115	0.40	0.212	0.130	0.017	76.0	
30-Oct-92	g7	11.0	5.90	113	0.38	0.274	0.030	0.017	48.0	
30-Oct-92	g11	10.9	5.70	75	0.21	0.148	0.042	0.011	214.0	
30-Oct-92	l1	11.4	5.80	82		0.042	0.014	0.109	4.3	
30-Oct-92	l2	11.1	5.90	74		0.030	0.010	0.307	8.5	
30-Oct-92	s2	10.2	5.50	89		0.095	0.034	0.329	8.9	
30-Oct-92	s3	10.0	5.70	66		0.080	0.044	0.051	5.5	
30-Oct-92	s4	10.5	5.80	70		0.089	0.084	0.801	6.3	
03-Mar-93	b1	7.4	5.95	95		0.093	0.086	0.398	4.0	
03-Mar-93	b2	7.4	6.21	79		0.056	0.050	0.547	0.8	
03-Mar-93	c1	4.1	5.71	49		0.060	0.034	0.139	2.5	
03-Mar-93	c2	4.2	6.22	142		0.096	0.059	2.710	5.0	
03-Mar-93	c3	4.7	5.95	62		0.066	0.035	1.170	5.3	
03-Mar-93	g1	3.2	5.80	151	0.23	0.122	0.041	0.009	70.0	
03-Mar-93	g2	3.0	5.64	74	0.75	0.045	0.010	0.034	20.5	
03-Mar-93	g3	3.7	5.80	153	0.67	0.109	0.025	0.013	36.0	
03-Mar-93	g4	2.8	6.07	71	0.08	0.320	0.067	0.037	182.0	
03-Mar-93	g5	2.5	5.97	57	0.42	0.251	0.050	0.041	248.0	
03-Mar-93	g6	2.7	6.03	76	0.17	0.335	0.169	0.005	64.0	
03-Mar-93	g7	3.5	6.16	97	0.23	0.195	0.071	0.032	54.7	
03-Mar-93	g11	2.4	6.14	51	0.08	0.813	0.090	0.050	704.0	
03-Mar-93	l1	3.9	6.15	64		0.076	0.031	0.745	14.0	
03-Mar-93	l2	3.3	6.53	60		0.066	0.038	0.758	14.4	
03-Mar-93	s2	6.4	6.01	136		0.060	0.029	0.291	4.8	
03-Mar-93	s3	4.0	6.22	45		0.086	0.047	0.036	4.3	

Table 1. Lacamas Shores Water Quality Data, 1988 - 1993.

DATE	STAT.	TEMP	pH	COND.	DEPTH	TP	PO4	NO3	TSS	O&G
03-Mar-93	s4	5.6	6.35	62		0.083	0.051	0.191	2.7	
22-Sep-93	b1	11.1	5.88	74		0.084	0.077	0.307	0.6	
22-Sep-93	b2	12.6	6.02	90		0.070	0.044	0.408	0.6	
22-Sep-93	c1	12.1	6.28	176		0.331	0.293	0.032	13.3	
22-Sep-93	c2	12.4	6.50	174		0.051	0.030	5.080	5.3	
22-Sep-93	c3	8.4	6.11	97		0.141	0.091	0.236	0.9	
22-Sep-93	g1				0.63					
22-Sep-93	g2				1.17					
22-Sep-93	g3				0.50					
22-Sep-93	g4				0.21					
22-Sep-93	g5				2.67					
22-Sep-93	g6				0.63					
22-Sep-93	g7				0.50					
22-Sep-93	g11				0.13					
22-Sep-93	l1	16.3	6.55	108		0.042	0.003	0.084	10.8	
22-Sep-93	l2	14.7	7.60	83		0.030	0.008	0.118	3.3	
22-Sep-93	s2	8.8	6.21	105		0.023	0.013	0.052	7.0	
22-Sep-93	s3	11.4	5.60	76		0.112	0.072	0.242	1.7	
22-Sep-93	s4	9.6	6.16	72		0.088	0.033	0.146	10.0	
17-Nov-93	b1	7.4	5.60	99		0.138	0.060	0.308	33.3	0.5
17-Nov-93	b2	7.8	6.20	50		0.070	0.030	0.280	4.7	0.3
17-Nov-93	c1	4.0	6.30	140		0.332	0.129	0.054	16.5	1.4
17-Nov-93	c2	5.0	6.50	195		0.074	0.033	6.360	4.0	0.6
17-Nov-93	c3	4.0	6.80	77		0.143	0.104	0.236	12.3	1.8
17-Nov-93	g1	5.8	6.00	222	0.29	0.284	0.012	0.024	88.0	1.5
17-Nov-93	g2	6.0	5.70	88	0.42	0.053	0.007	0.029	24.0	1.3
17-Nov-93	g3	4.8	6.10	110	0.38	0.183	0.040	0.018	29.0	0.2
17-Nov-93	g4				0.04					
17-Nov-93	g5				2.67					
17-Nov-93	g6	4.6	5.60	74	0.25	0.336	0.013	0.035	78.0	0.3
17-Nov-93	g7	6.9	6.00	121	0.42	0.182	0.052	0.078	47.0	0.5
17-Nov-93	g11				0.04					
17-Nov-93	l1	6.9	6.30	78		0.053	0.011	0.071	2.3	1.7
17-Nov-93	l2	6.3	6.10	64		0.136	0.051	0.261	35.3	0.8
17-Nov-93	s2	5.0	6.20	91		0.076	0.056	0.038	12.4	1.2
17-Nov-93	s3	6.5	5.60	68		0.183	0.098	0.406	38.7	0.7
17-Nov-93	s4	6.3	5.80	55		0.195	0.084	0.359	34.5	1.8

Table 2. Precipitation record for reporting period, 1992-3.

MONTH (1992/3)	TOTAL PREC. (in)	NORMAL* PREC. (in)	DIFF. (in)	DATE (1992/3)	PREC. (in)	DATE (1993)	PREC. (in)
October	4.51	4.08	0.43	10/25	0.00	9/17	0.00
November	7.12	7.76	-0.64	10/26	0.00	9/18	0.00
December	7.06	8.08	-1.02	10/27	0.00	9/19	0.00
January	3.94	7.39	-3.45	10/28	0.03	9/20	0.00
February	1.00	5.79	-4.79	10/29	0.31	9/21	0.00
March	5.21	5.54	-0.33	10/30	1.49	9/22	0.00
April	8.71	4.31	4.40	2/26	0.00	11/12	0.00
May	6.96	3.63	3.33	2/27	0.00	11/13	0.04
June	3.48	2.55	0.93	2/28	0.00	11/14	0.00
July	2.12	0.96	1.16	3/1	0.46	11/15	0.03
August	0.51	1.52	-1.01	3/2	0.00	11/16	0.00
September	0.01	2.51	-2.50	3/3	0.41	11/17	0.23
October	3.07	4.05	-0.98				
November	2.52	7.62	-5.10				

**NOTES: Normal precipitation based on 37 year average. Source: Reuben Bafus, Camas, Washington.*

Table 3. Inflowing concentrations and percent reduction of nutrients and total suspended solids, 1991, 1992, and 1993.

Parameter	Transect 1 (B1 to S4)		Transect 2 (B2 to S2)	
	inflow (mg/L)	percent difference	inflow (mg/L)	percent difference
1991				
TSS	24.3	-35%	75.7	-74%
TP	0.133	-27%	0.302	-76%
SP	0.059	-40%	0.086	-38%
NO3	0.622	-48%	0.395	-71%
1992				
TSS	5.7	32%	25.5	-64%
TP	0.114	-8%	0.140	-22%
SP	0.054	-35%	0.043	-54%
NO3	0.765	-34%	0.933	-65%
1993				
TSS	13.7	-2%	4.5	83%
TP	0.098	16%	0.063	2%
SP	0.070	-10%	0.041	-20%
NO3	0.626	-40%	0.884	-80%

Table 4. Phosphorus Loading Rates for 1990, 1991, 1992, and 1993.

STATION	DRAINAGE BASIN AREAS* (ha)	AVERAGE OUTFLOW [TP] (mg/l)	1990 (kg/ha/yr)**	AVERAGE OUTFLOW [TP] (mg/l)	1991 (kg/ha/yr)	AVERAGE OUTFLOW [TP] (mg/l)	1992 (kg/ha/yr)	AVERAGE OUTFLOW [TP] (mg/l)	1993 (kg/ha/yr)
Bubbler / Wetland 1 (S4)	4.1	0.102	0.702	0.096	0.724	0.105	0.690	0.114	0.902
Bubbler / Wetland 2 (S2)	8.8	0.127	0.872	0.072	0.543	0.109	0.716	0.064	0.504
Creek 1 (Dwyer Creek)	324	0.144	1.002	0.180	1.373	0.203	1.359	0.259	2.089
Creek 2 (Unnamed)	46.5	0.158	1.099	0.114	0.868	0.137	0.914	0.072	0.576
Creek 3 (Unnamed)	66.8	0.187	1.292	0.149	1.131	0.184	1.222	0.14	1.12

Notes: * Drainage areas from SRI 1991 second year report and from areas computed from construction drawings by Mackay and Sposito (M&S), 1991.

** Loading rates calculated using M&S's areas (bubblers only) and the corresponding water year's (WY) precipitation. WY values: 1990 = 44.94", 1991 = 48.36", 1992 = 43.44", 1993 = 50.53".

Table 5. Organochlorine Pesticides in Wastewater by EPA Method 8080, GC/ECD.

Lacamas Shores Wetland Monitoring - November 17, 1993

ANALYTE	DETECT. LIMIT	B1	B2	S2	S4
Aldrin	0.1	ND	ND	ND	ND
a-BHC	0.1	ND	ND	ND	ND
b-BHC	0.1	ND	ND	ND	ND
d-BHC	0.1	ND	ND	ND	ND
g-BHC (Lindane)	0.1	ND	ND	ND	ND
Chlordane	1.0	ND	ND	ND	ND
DDD	0.1	ND	ND	ND	ND
DDE	0.1	ND	ND	ND	ND
DDT	1.0	ND	ND	ND	ND
Dieldrin	0.1	ND	ND	ND	ND
Endosulfan I	0.05	ND	ND	ND	ND
Endosulfan II	0.2	ND	ND	ND	ND
Endosulfan sulfate	0.1	ND	ND	ND	ND
Endrin	0.2	ND	ND	ND	ND
Endrin aldehyde	0.1	ND	ND	ND	ND
Heptachlor	0.1	ND	ND	ND	ND
Heptachlor epoxide	0.1	ND	ND	ND	ND
Methoxychlor	1.0	ND	ND	ND	ND
Toxaphene	6.0	ND	ND	ND	ND

ND means none detected at or above the detection limit listed.

Results expressed as ug/L unless otherwise noted.

Table 6. Organophosphate Pesticides in Wastewater by EPA Method 8140, GC/FID.

Lacamas Shores Wetland Monitoring - November 17, 1993

ANALYTE	DETECT. LIMIT	B1	B2	S2	S4
Azinophos methyl	3.0	ND	ND	ND	ND
Bolstar	1.0	ND	ND	ND	ND
Chlorpyriphos	1.0	ND	ND	ND	ND
Coumaphos	5.0	ND	ND	ND	ND
DEF	1.0	ND	ND	ND	ND
Demeton-s	1.0	ND	ND	ND	ND
Diazinon	1.0	ND	ND	ND	ND
Dichlorvos	1.0	ND	ND	ND	ND
Disulfoton	1.0	ND	ND	ND	ND
EPN	1.0	ND	ND	ND	ND
Ethoprop	1.0	ND	ND	ND	ND
Fensulfothion	2.0	ND	ND	ND	ND
Fenthion	1.0	ND	ND	ND	ND
Malathion	1.0	ND	ND	ND	ND
Merphos	1.0	ND	ND	ND	ND
Mevinphos	1.0	ND	ND	ND	ND
Monocrotophos	2.0	ND	ND	ND	ND
Naled	4.0	ND	ND	ND	ND
Parathion ethyl	1.0	ND	ND	ND	ND
Parathion methyl	1.0	ND	ND	ND	ND
Phorate	1.0	ND	ND	ND	ND
Ronnel	1.0	ND	ND	ND	ND
Tetrachlorvinphos	1.0	ND	ND	ND	ND

ND means none detected at or above the detection limit listed.

Results expressed as ug/L unless otherwise noted.

Table 7. Chlorinated Herbicides in Wastewater by EPA Method 8150, GC/ECD.

Lacamas Shores Wetland Monitoring - November 17, 1993

ANALYTE	DETECT. LIMIT	B1	B2	S2	S4
2,4-D	20	ND	ND	ND	ND
2,4-DB	20	ND	ND	ND	ND
Dalapon	2.5	ND	ND	ND	ND
Dicamba	1.0	ND	ND	ND	ND
Dichlorprop	5.0	ND	ND	ND	ND
Dinoseb	2.0	ND	ND	ND	ND
Pentachlorophenol	0.6	ND	ND	ND	ND
Picloram	5.0	ND	ND	ND	ND
2,4,5-T	2.0	ND	ND	ND	ND
2,4,5-TP	1.3	ND	ND	ND	ND

ND means none detected at or above the detection limit listed.

Results expressed as ug/L unless otherwise noted.

Table 8. Toxic metals in surface, ground, and lake water for the first flush sampling.

Lacamas Shores Wetland Monitoring - November 17, 1993

ANALYTE	METHOD	DETECT. LIMIT	EPA LIMIT	B1	B2	C1	C2	C3	G1	G2	G3	G4
Chromium	*	0.05	0.05	ND	ND	ND	ND	ND	ND	ND	ND	ND
Copper	*	0.05	1.0	ND	ND	ND	ND	ND	ND	ND	ND	ND
Lead	*	0.1	0.05 **	ND	ND	ND	ND	ND	ND	ND	ND	ND
Zinc	*	0.05	5.0	0.05 (0.047)	ND	ND	ND	ND	ND	ND	ND	ND
Hardness	EPA 130.2			34	34	86	103	51	137	51	68	NS

ANALYTE	METHOD	DETECT. LIMIT	EPA LIMIT	G5	G6	G7	G11	L1	L2	S2	S3	S4
Chromium	*	0.05	0.05	ND	ND	ND	ND	ND	ND	ND	ND	ND
Copper	*	0.05	1.0	ND	ND	ND	ND	ND	ND	ND	ND	ND
Lead	*	0.1	0.05 **	ND	ND	ND	ND	ND	ND	ND	ND	ND
Zinc	*	0.05	5.0	ND	ND	ND	ND	ND	ND	ND	ND	0.05 (0.057)
Hardness	EPA 130.2			NS	34	68	NS	51	34	51	43	43

ND means none detected at or above the detection limit listed.

NS means no sample was taken.

Results are in mg/L unless otherwise noted. Values in parentheses are WA surface water quality criteria (WAC 173-201-047), and represent acute concentrations in freshwater. These are 1-hour average concentrations not to be exceeded more than once every three years. Calculations below:

Zinc: $\exp(0.8473 * \ln(\text{hardness})) + 0.8604$

* Federal Register, 40 CFR Part 136, Method 200.7, Friday, October 26, 1984, Part VIII.

** The current maximum contaminant level for lead is 0.05 mg/L. However, the EPA recommends corrective action whenever the lead levels in drinking water exceed 0.02 mg/L.

Table 9. Ground water depths (in feet) in shallow wells, 1989 through 1993. Water depths are relative to the ground surface.

	1989				1990			
	WINTER	SPRING	EARLY SUMMER	AVERAGE ANNUAL	WINTER	SPRING	EARLY SUMMER	AVERAGE ANNUAL
G1	0.33	0.50	1.33	0.72	0.25	0.46		0.36
G2	1.25	1.50	1.75	1.50	0.94	0.69	1.13	0.92
G3		1.30	1.67	1.49	0.79	1.13	0.69	0.91
G4	0.23	0.80	1.98	1.00				
G5	0.73	2.10	2.40	1.74			0.67	0.67
G6	0.35	0.42	3.25	1.34	0.50	0.52		0.51
G7	0.23	0.33	0.40	0.32	0.29	0.23	0.33	0.28
G8	3.00	1.33		2.17	dsc	dsc	dsc	
G9	1.48	1.13	3.08	1.90	dsc	dsc	dsc	
G10					dsc	dsc	dsc	
G11			3.25	3.25	1.69		0.79	1.24

	1991				1992			
	WINTER	SPRING	EARLY SUMMER	AVERAGE ANNUAL	WINTER	SPRING	LATE SUMMER	AVERAGE ANNUAL
G1	0.26	0.60		0.43	0.25	0.10	0.33	0.23
G2	0.61	1.02	1.13	0.92	0.71	0.25	1.58	0.85
G3	0.22	0.68	0.48	0.46	0.46	0.52	0.63	0.54
G4	0.58	2.00		1.29	0.00	0.06	0.00	0.02
G5	0.75	1.33		1.04	0.25	0.35	0.44	0.35
G6	0.47	0.37	0.83	0.56	0.08	0.17	0.50	0.25
G7	0.14	0.52	0.29	0.32	0.00	0.21	0.06	0.09
G11	0.14	0.71	0.08	0.31	0.00	0.00	0.10	0.03

	1993			
	WINTER	SPRING	EARLY FALL	AVERAGE ANNUAL
G1	0.27	0.23	0.63	0.38
G2	0.83	0.75	1.17	0.92
G3	0.38	0.67	0.50	0.51
G4	0.06	0.08	0.21	0.12
G5	0.21	0.42	2.67	1.10
G6	0.40	0.17	0.63	0.40
G7	0.38	0.23	0.50	0.37
G11	0.21	0.08	0.13	0.14

dsc = discontinued in 1990

Table 11. Transect 1 and Transect 2 permanent plots: Dominant species (>20% cover) for 1990 to 1993.

GENUS	SPECIES	COMMON NAME	R9IND*	TRANSECT 1				TRANSECT 2					
				1990	1991	1992	1993	1990	1991	1992	1993		
<i>Alnus</i>	<i>rubra</i>	Red alder	FAC		X	X				X	X		
<i>Carex</i>	<i>obnupta</i>	Slough sedge	OBL							X	X		
<i>Eleocharis</i>	<i>ovata</i>	Ovate spikerush	FACW-	X									
<i>Equisetum</i>	<i>arvense</i>	Field horsetail	FAC							X			X
<i>Glyceria</i>	<i>elata</i>	Tall manna grass	FACW+										X
<i>Holcus</i>	<i>lanatus</i>	Common velvet grass	FAC	X	X	X							
<i>Juncus</i>	<i>effusus</i>	Soft rush	FACW+	X	X	X	X						
<i>Lysichitum</i>	<i>americanum</i>	Yellow skunk-cabbage	OBL		X	X	X						
<i>Pteridium</i>	<i>aquilinum</i>	Bracken fern	UPL										
<i>Phalaris</i>	<i>arundinacea</i>	Reed canary grass	FACW								X		
<i>Rubus</i>	<i>discolor</i>	Himalayan blackberry	FACU-		X	X	X			X	X		X
<i>Rubus</i>	<i>ursinus</i>	California blackberry	NI			X							X
<i>Scirpus</i>	<i>microcarpus</i>	Small-fruit bulrush	OBL										
<i>Solanum</i>	<i>dulcamara</i>	Climbing nightshade	FAC							X	X		X
<i>Stachys</i>	<i>cooleyae</i>	Cooley's hedgenettle	FACW										
<i>Symphoricarpos</i>	<i>albus</i>	Snowberry	FACU							X			
<i>Typha</i>	<i>latifolia</i>	Broad-leaf cattail	OBL		X	X	X						X

*USFWS Region 9 Indicator (R9IND) Codes:

- OBL = Obligate Wetland
- FACW = Facultative Wetland
- FAC = Facultative
- FACU = Facultative Upland
- UPL = Upland
- NI = No Indicator

Table 12. Water quality data for monitoring stations above and below the wetlands, and the compliance criteria determined from 1988-1990 monitoring.

Lacamas Shores Wetland Monitoring - October 30, 1992

PARAMETER	UNITS	BUBBLER/WETLAND 1			BUBBLER/WETLAND 2		
		Station b1	Station s4	Compliance Level	Station b2	Station s2	Compliance Level
<u>primary</u>							
TP	mg/l	0.078	0.089	0.233	0.054	0.095	0.251
PO4	mg/l	0.057	0.084	0.131	0.041	0.034	0.090
NO3	mg/l	1.490	0.801	0.565	2.300	0.329	0.607
<u>secondary</u>							
pH	S.U.	5.8	5.8	4.7 - 7.9	5.7	5.5	4.4 - 7.8
COND.	umhos/cm	99	70	97	93	89	135
TSS	mg/l	16.9	6.3	51.6	12.0	8.9	72.0

Compliance levels are the mean of 1988-1990 monitoring data + 2 S.D.

Table 13. Water quality data for monitoring stations above and below the wetlands, and the compliance criteria determined from 1988-1990 monitoring.

Lacamas Shores Wetland Monitoring - March 3, 1993

PARAMETER	UNITS	BUBBLER/WETLAND 1			BUBBLER/WETLAND 2		
		Station b1	Station s4	Compliance Level	Station b2	Station s2	Compliance Level
<u>primary</u>							
TP	mg/l	0.093	0.083	0.233	0.056	0.060	0.251
PO4	mg/l	0.086	0.051	0.131	0.050	0.029	0.090
NO3	mg/l	0.398	0.191	0.565	0.547	0.291	0.607
<u>secondary</u>							
pH	S.U.	6.0	6.4	4.7 - 7.9	6.2	6.0	4.4 - 7.8
COND.	umhos/cm	95	62	97	79	136	135
TSS	mg/l	4.0	2.7	51.6	0.8	4.8	72.0

Compliance levels are the mean of 1988-1990 monitoring data + 2 S.D.

Table 14. Water quality data for monitoring stations above and below the wetlands, and the compliance criteria determined from 1988-1990 monitoring.

Lacamas Shores Wetland Monitoring - September 22, 1993

PARAMETER	UNITS	BUBBLER/WETLAND 1			BUBBLER/WETLAND 2		
		Station b1	Station s4	Compliance Level	Station b2	Station s2	Compliance Level
<u>primary</u>							
TP	mg/l	0.084	0.088	0.233	0.070	0.023	0.251
PO4	mg/l	0.077	0.033	0.131	0.044	0.013	0.090
NO3	mg/l	0.307	0.146	0.565	0.408	0.052	0.607
<u>secondary</u>							
pH	S.U.	5.9	6.2	4.7 - 7.9	6.0	6.2	4.4 - 7.8
COND.	umhos/cm	74	72	97	90	105	135
TSS	mg/l	0.6	10.0	51.6	0.6	7.0	72.0

Compliance levels are the mean of 1988-1990 monitoring data + 2 S.D.

Table 15. Water quality data for monitoring stations above and below the wetlands, and the compliance criteria determined from 1988-1990 monitoring.

Lacamas Shores Wetland Monitoring - November 17, 1993

PARAMETER	UNITS	BUBBLER/WETLAND 1			BUBBLER/WETLAND 2		
		Station b1	Station s4	Compliance Level	Station b2	Station s2	Compliance Level
<u>primary</u>							
TP	mg/l	0.138	0.195	0.233	0.070	0.076	0.251
PO4	mg/l	0.060	0.084	0.131	0.030	0.056	0.090
NO3	mg/l	0.308	0.359	0.565	0.280	0.038	0.607
<u>secondary</u>							
pH	S.U.	5.6	5.8	4.7 - 7.9	6.2	6.2	4.4 - 7.8
COND.	umhos/cm	99	55	97	50	91	135
TSS	mg/l	33.3	34.5	51.6	4.7	12.4	72.0
O&G	mg/l	0.5	1.8	1.5[4.2]	0.3	1.2	1.8[4.5]
Chromium	mg/l	ND	ND	0.718,0.870*	ND	ND	0.718,1.000
Copper	mg/l	ND	ND	0.006,0.008	ND	ND	0.006,0.009
Lead	mg/l	ND	ND	0.021,0.028	ND	ND	0.021,0.035
Zinc	mg/l	0.05	0.05	0.047,0.057	ND	ND	0.047,0.066
Organophosphate pesticides	ug/l	ND	ND	detection limit	ND	ND	detection limit
Chlorinated pesticides	ug/l	ND	ND	detection limit	ND	ND	detection limit
Chlorinated herbicides	ug/l	ND	ND	detection limit	ND	ND	detection limit

Compliance levels are the mean of 1988-1990 monitoring data + 2 S.D.

** These WA water quality criteria for the metals are for the 'b' and 's' sites, respectively. They represent 1-hour average concentrations not to be exceeded more than once every three years. They are calculated based on the hardness of the water sample.*

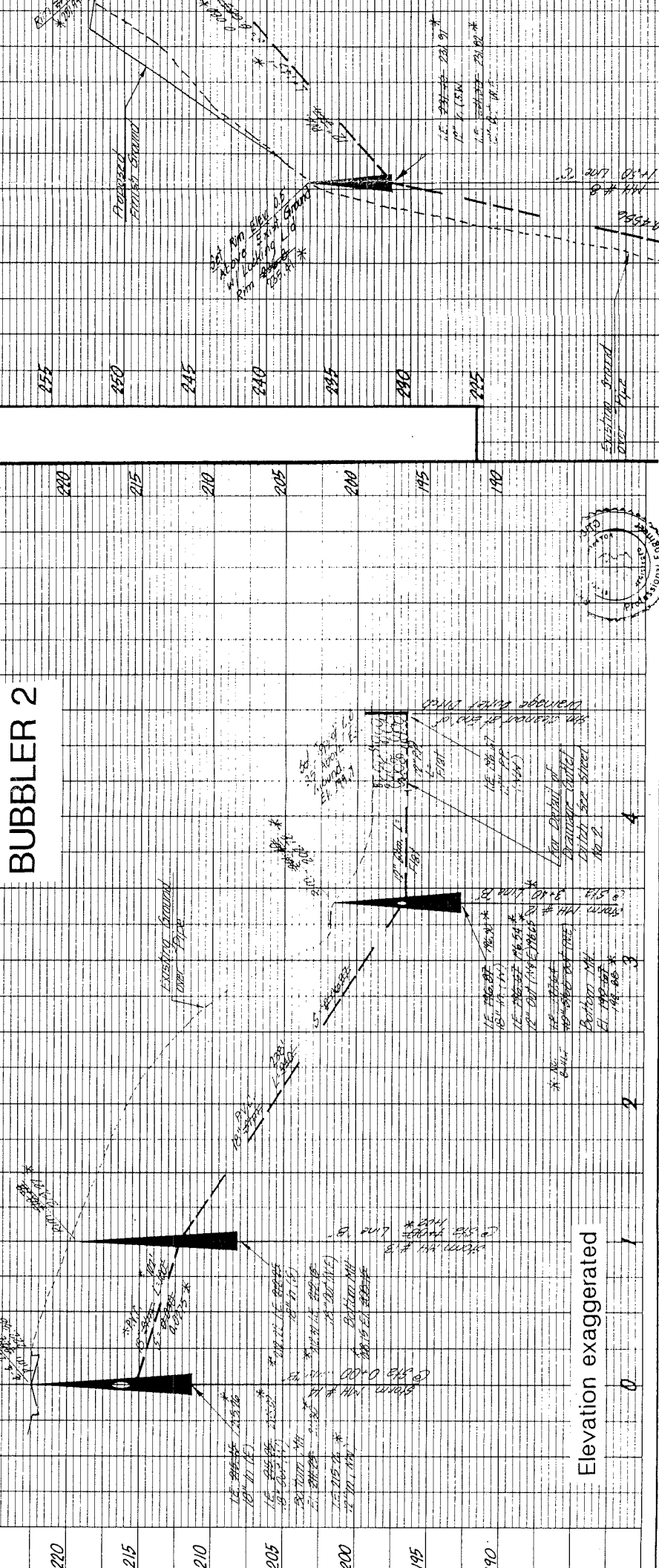
APPENDIX B

Figures

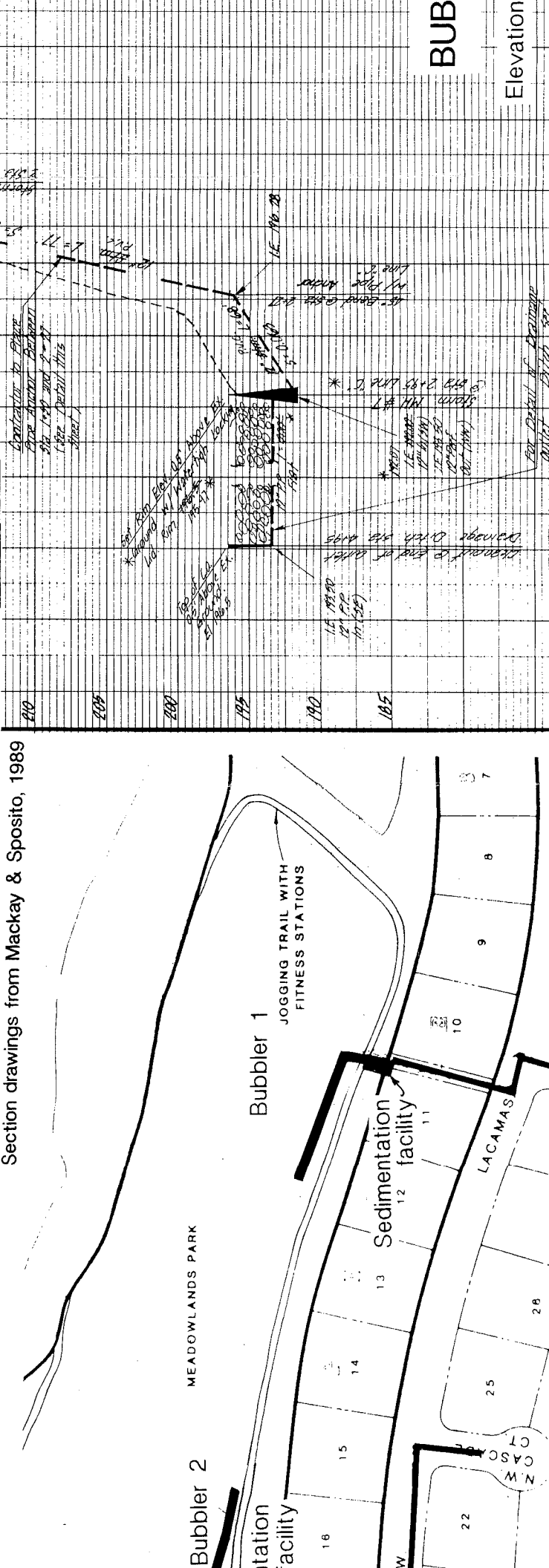
LIST OF FIGURES

- Figure 1. Lacamas Shores Site Plan
- Figure 2. Bubbler Design, Elevations and Locations
- Figure 3. Location of Bubblers and Sampling Sites
- Figure 4. Location of Creek Sites Sampled for Comparison
- Figure 5. Transect 1 Surface Water
- Figure 6. Transect 1 Surface Water
- Figure 7. Transect 1 Ground Water
- Figure 8. Transect 2 Surface Water
- Figure 9. Transect 2 Surface Water
- Figure 10. Transect 2 Ground Water
- Figure 11. Groundwater Wells pH
- Figure 12. Groundwater Wells Conductivity
- Figure 13. Groundwater Wells Total Suspended Solids
- Figure 14. Groundwater Wells Total Phosphorus
- Figure 15. Groundwater Wells Soluble Phosphorus
- Figure 16. Groundwater Wells Nitrate-Nitrogen
- Figure 17. Creeks, Streams and Lake pH
- Figure 18. Creeks, Streams and Lake Conductivity
- Figure 19. Creeks, Streams and Lake Total Suspended Solids
- Figure 20. Creeks, Streams and Lake Total Phosphorus
- Figure 21. Creeks, Streams and Lake Soluble Phosphorus
- Figure 22. Creeks, Streams and Lake Nitrate-Nitrogen
- Figure 23. Compliance for Total Suspended Solids
- Figure 24. Compliance for Total Phosphorus
- Figure 25. Soluble Phosphorus
- Figure 26. Compliance for Nitrate-Nitrogen
- Figure 27. Comparison of Phosphorus Loading Rates
- Figure 28. Comparison of Total Phosphorus Mass
- Figure 29. Transect 1 Comparison of Annual Means
- Figure 30. Transect 2 Comparison of Annual Means

BUBBLER 2



Section drawings from Mackay & Sposito, 1989

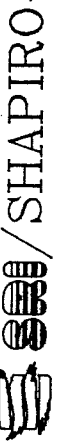
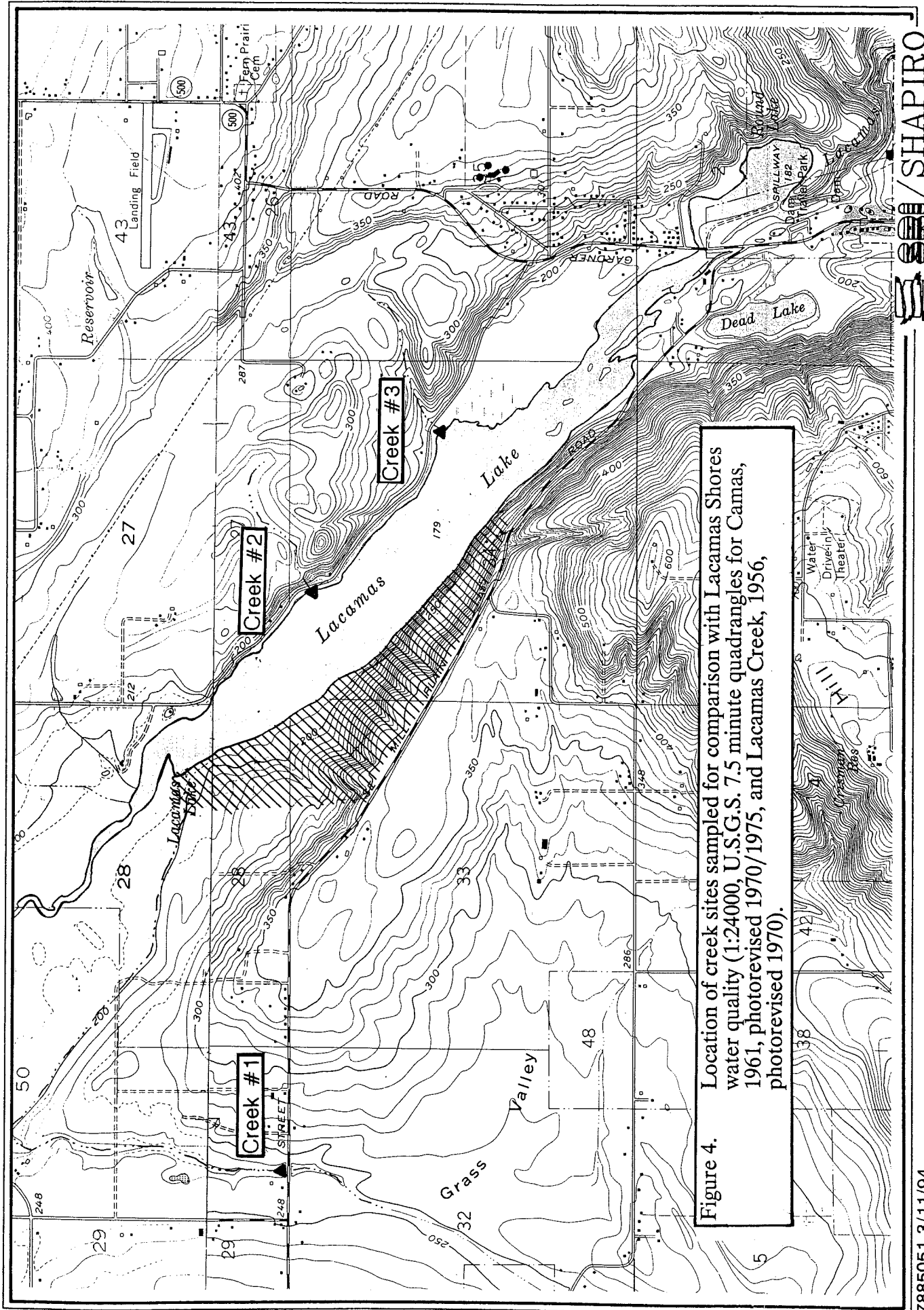


defined by Shapiro & Assoc.

LACAMAS LAKE



ment facility
 site
 e
 (drain)
 ect
 ndary



Stormwater Treatment by Wetlands Transect 1 Surface Water - 1993

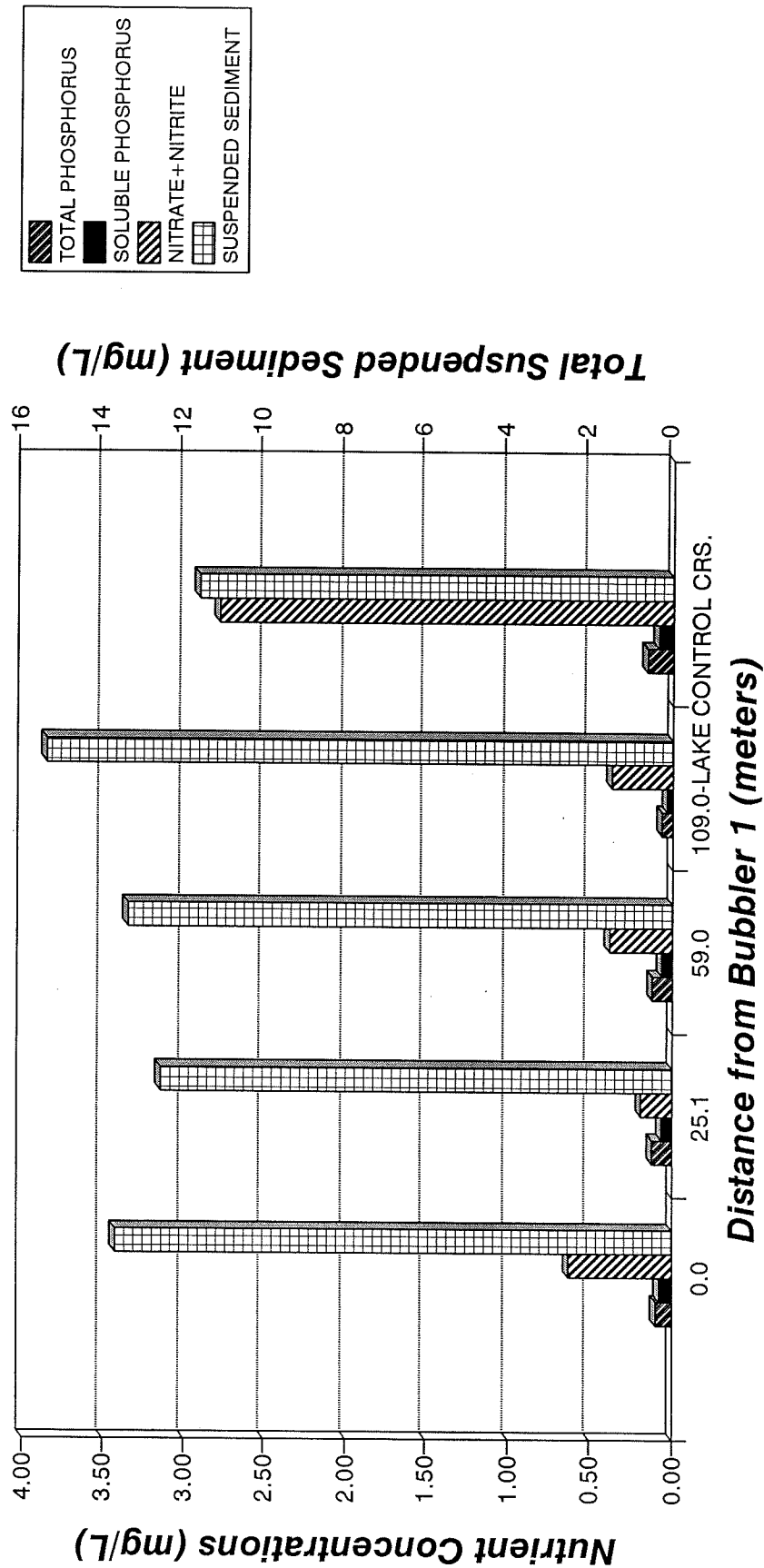
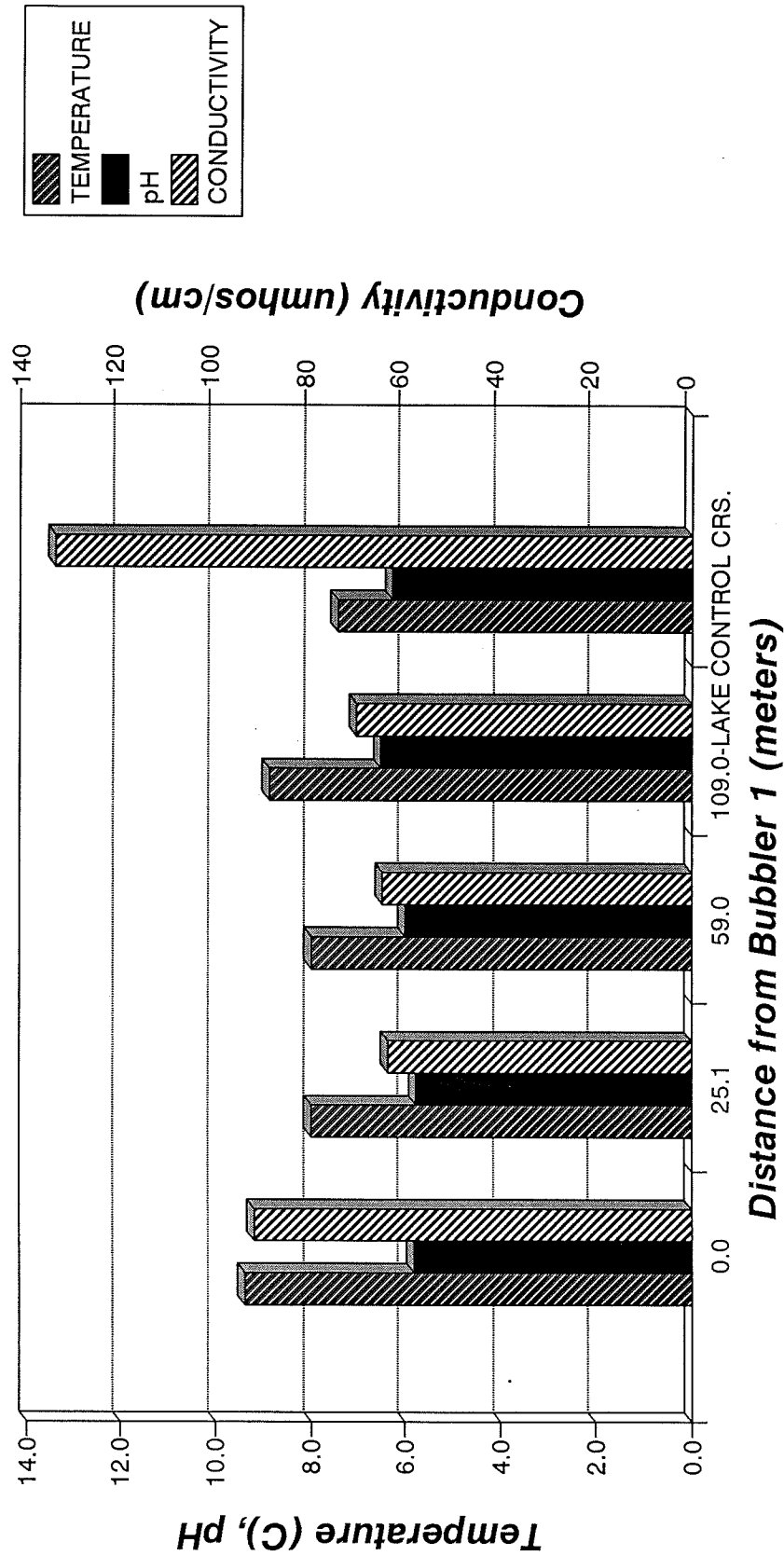


FIGURE 5

Each bar represents the average of the four monitoring dates.

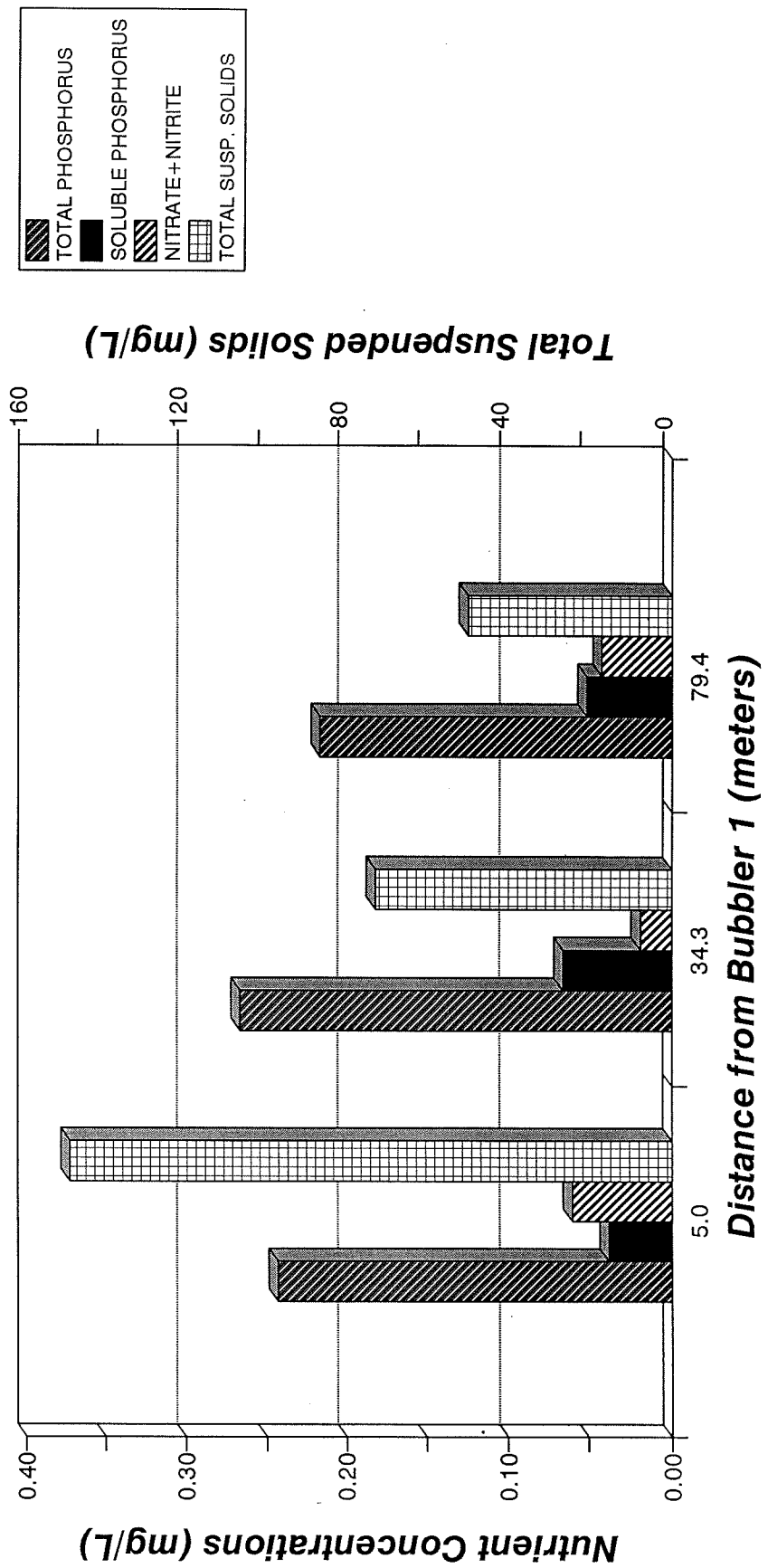
**Stormwater Treatment by Wetlands
Transect 1 Surface Water - 1993**



Each bar represents the average of the four monitoring dates.

FIGURE
6

**Stormwater Treatment by Wetlands
Transect 1 Ground Water - 1993**

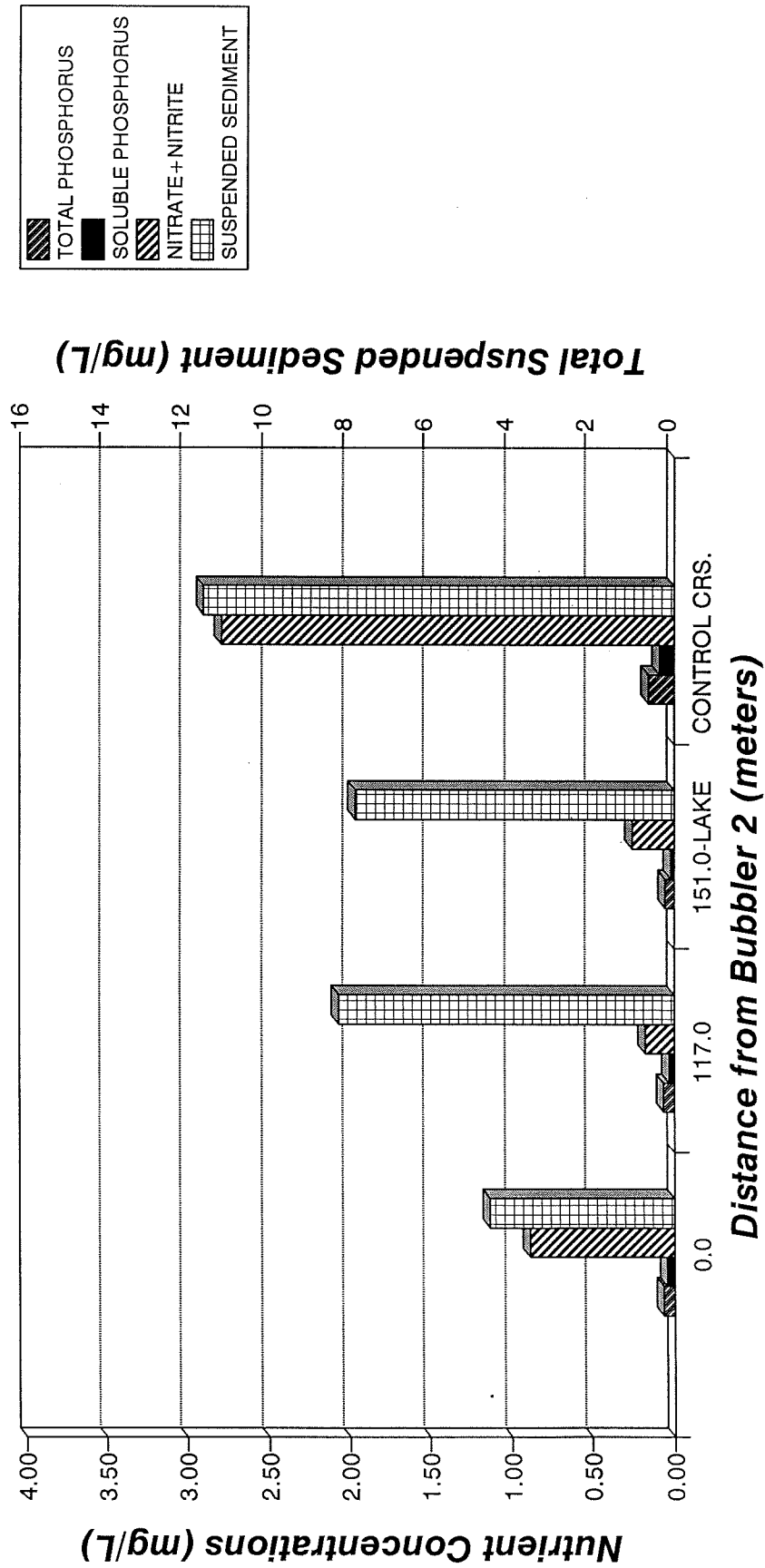


FIGURE

7

Each bar represents the average of the four monitoring dates.

**Stormwater Treatment by Wetlands
Transect 2 Surface Water - 1993**



FIGURE

8

Each bar represents the average of the four monitoring dates.

**Stormwater Treatment by Wetlands
Transect 2 Surface Water - 1993**

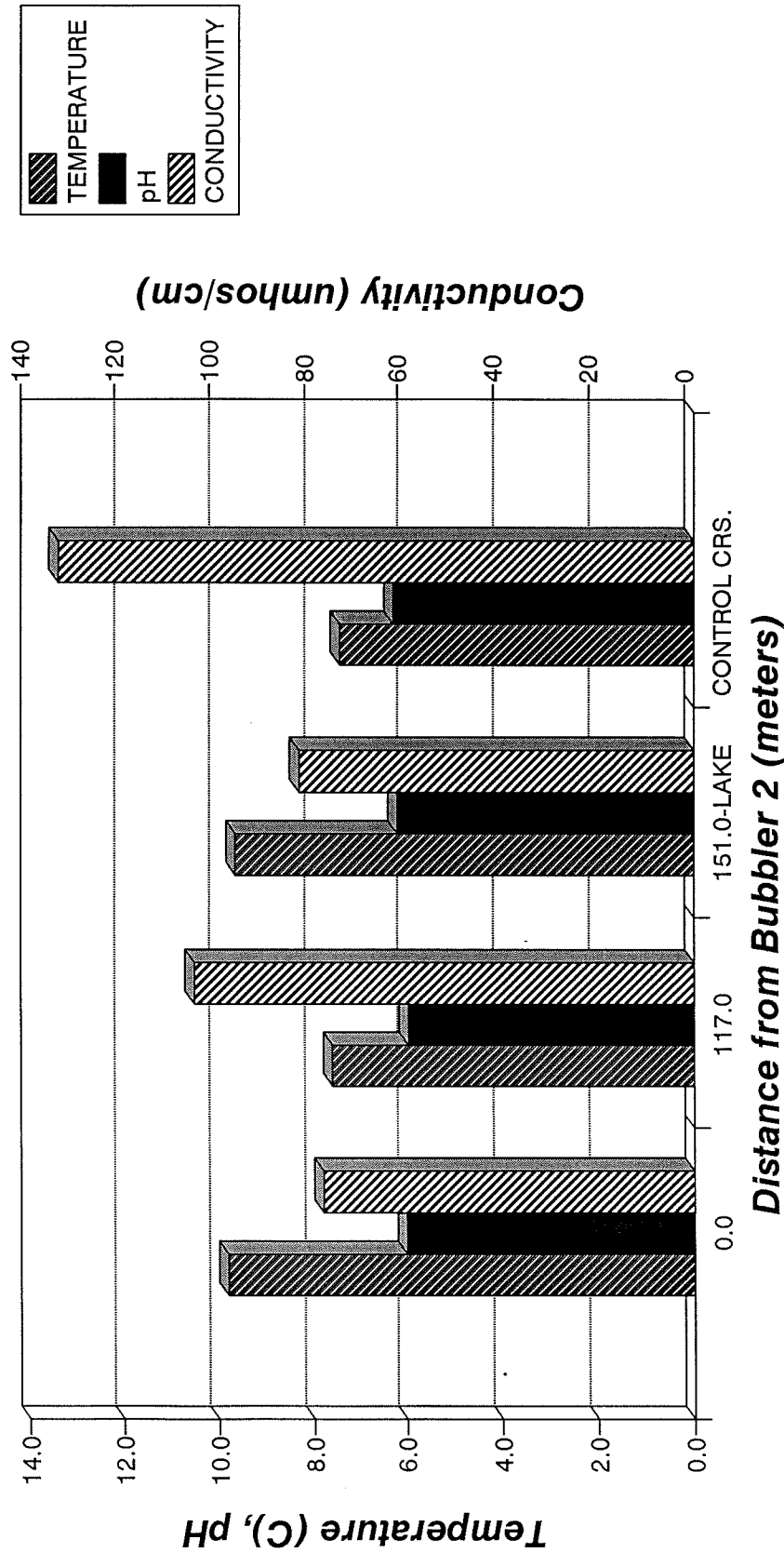
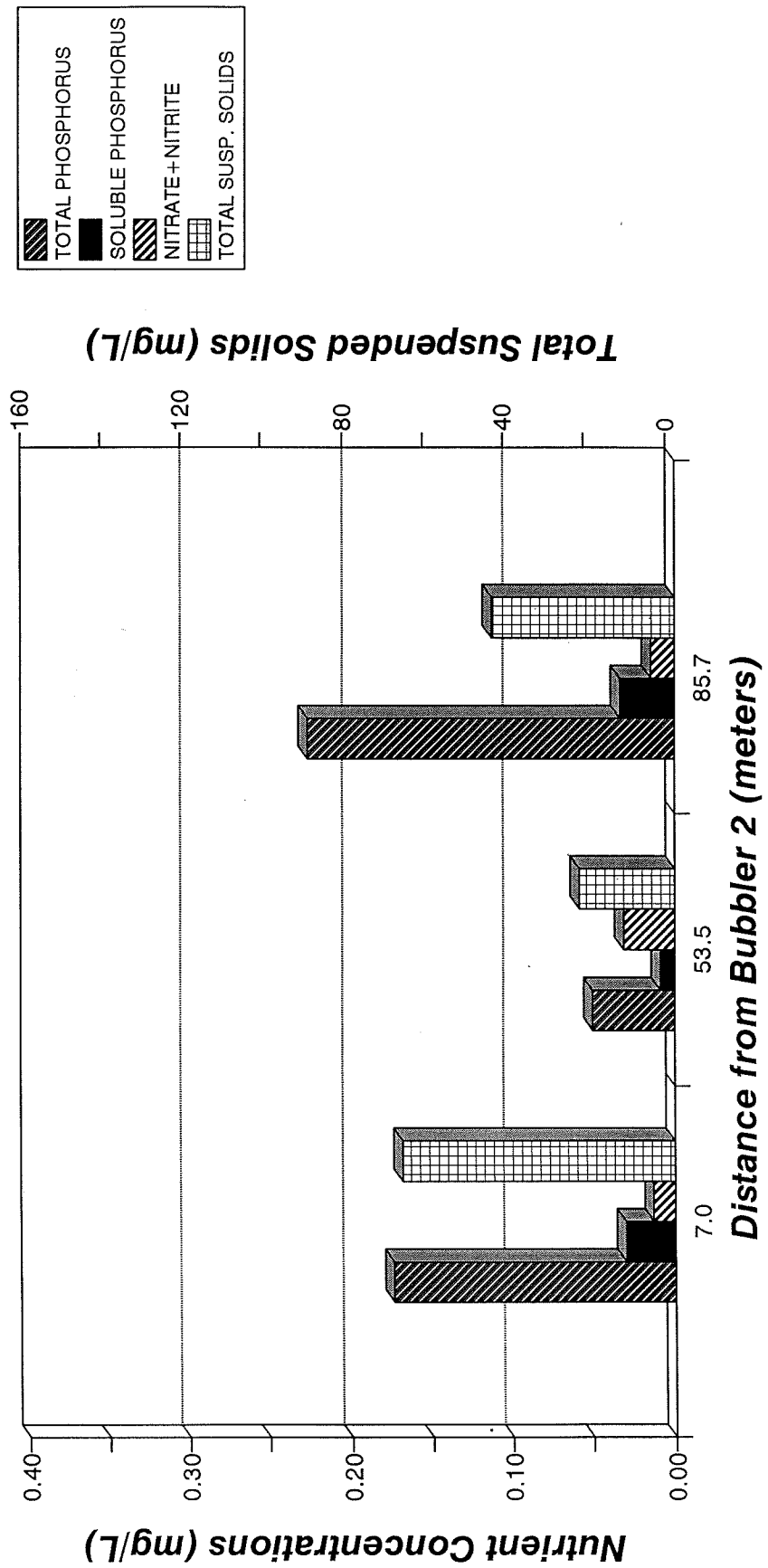


FIGURE
9

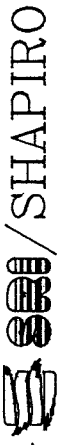
Each bar represents the average of the four monitoring dates.

**Stormwater Treatment by Wetlands
Transect 2 Ground Water - 1993**



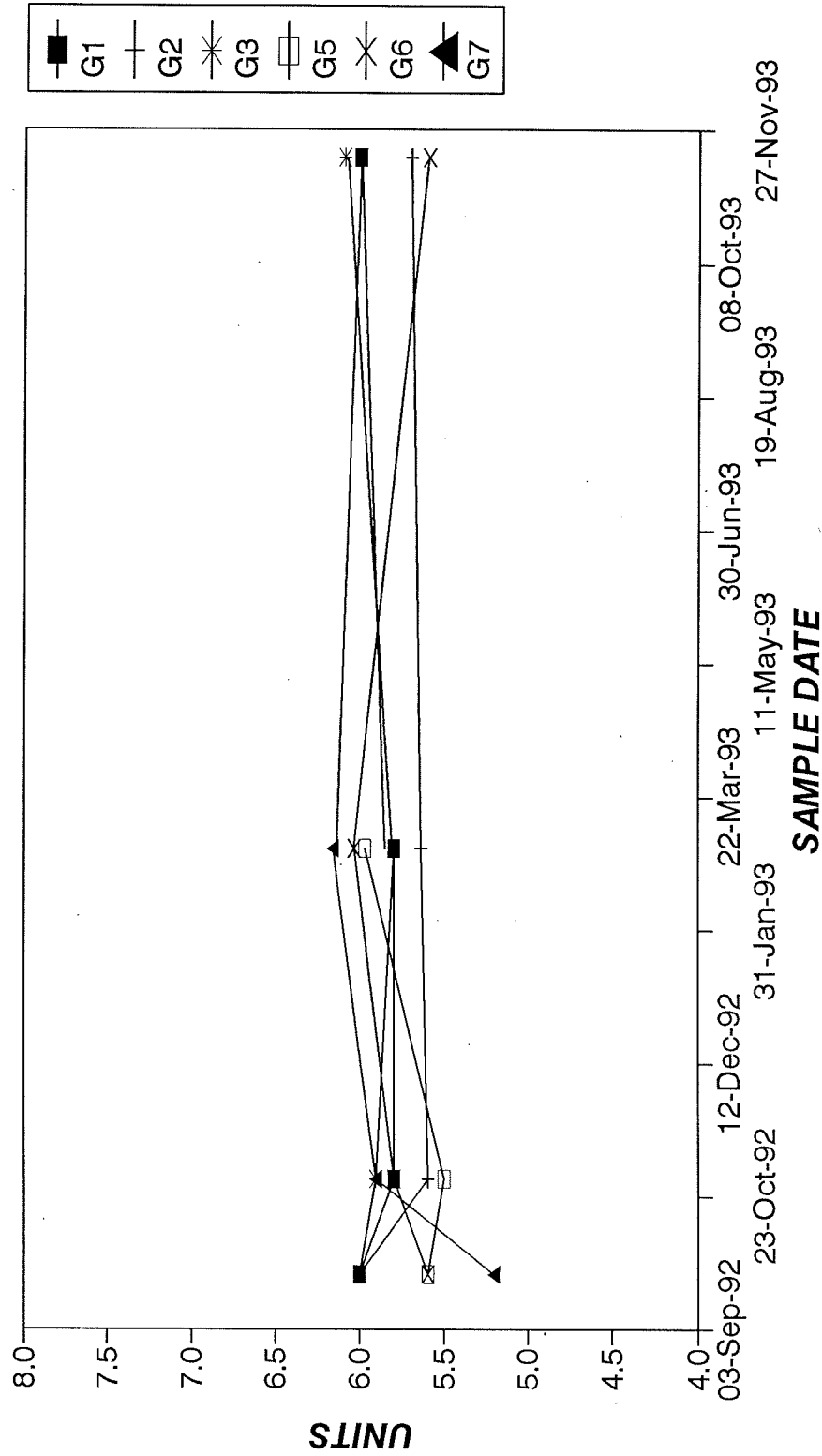
**FIGURE
10**

Each bar represents the average of the four monitoring dates.



SHAPIRO

1993 pH by Sample Date
Groundwater Wells 1-3,5-7



FIGURE

11

1993 Conductivity by Sample Date Groundwater Wells 1-3,5-7

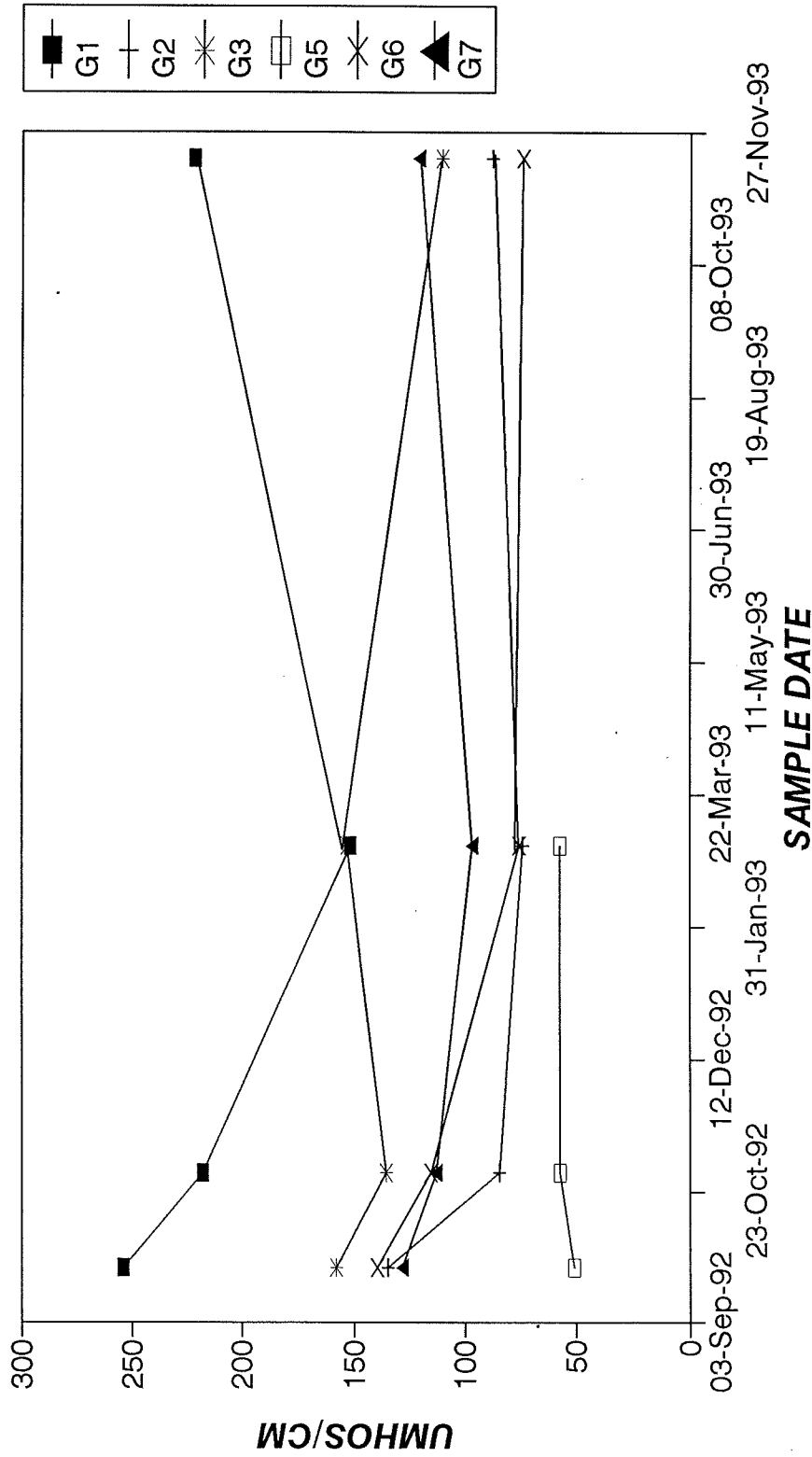


FIGURE
12

1993 Tot. Susp. Solids by Sample Date
Groundwater Wells 1-3, 5-7

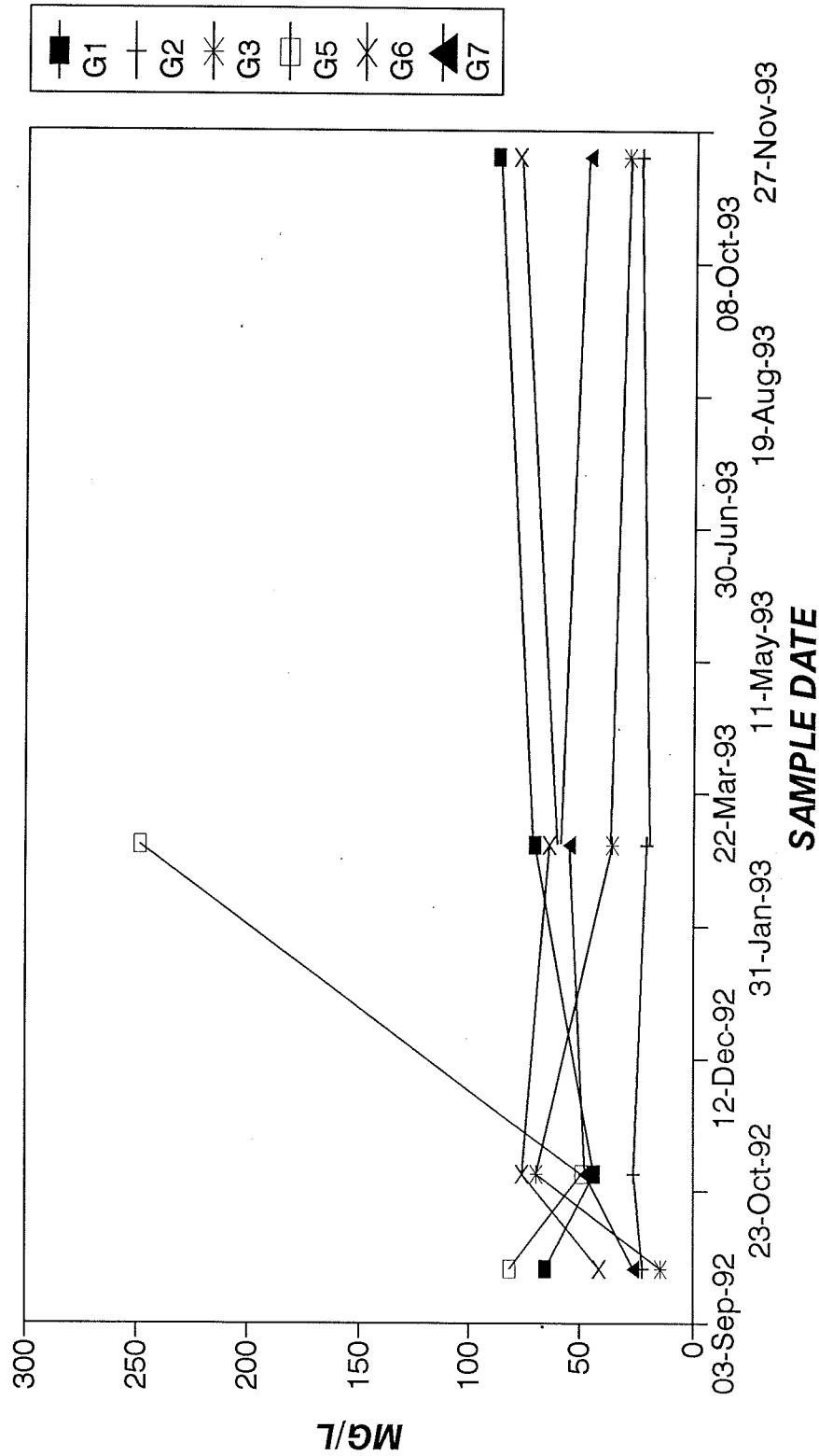
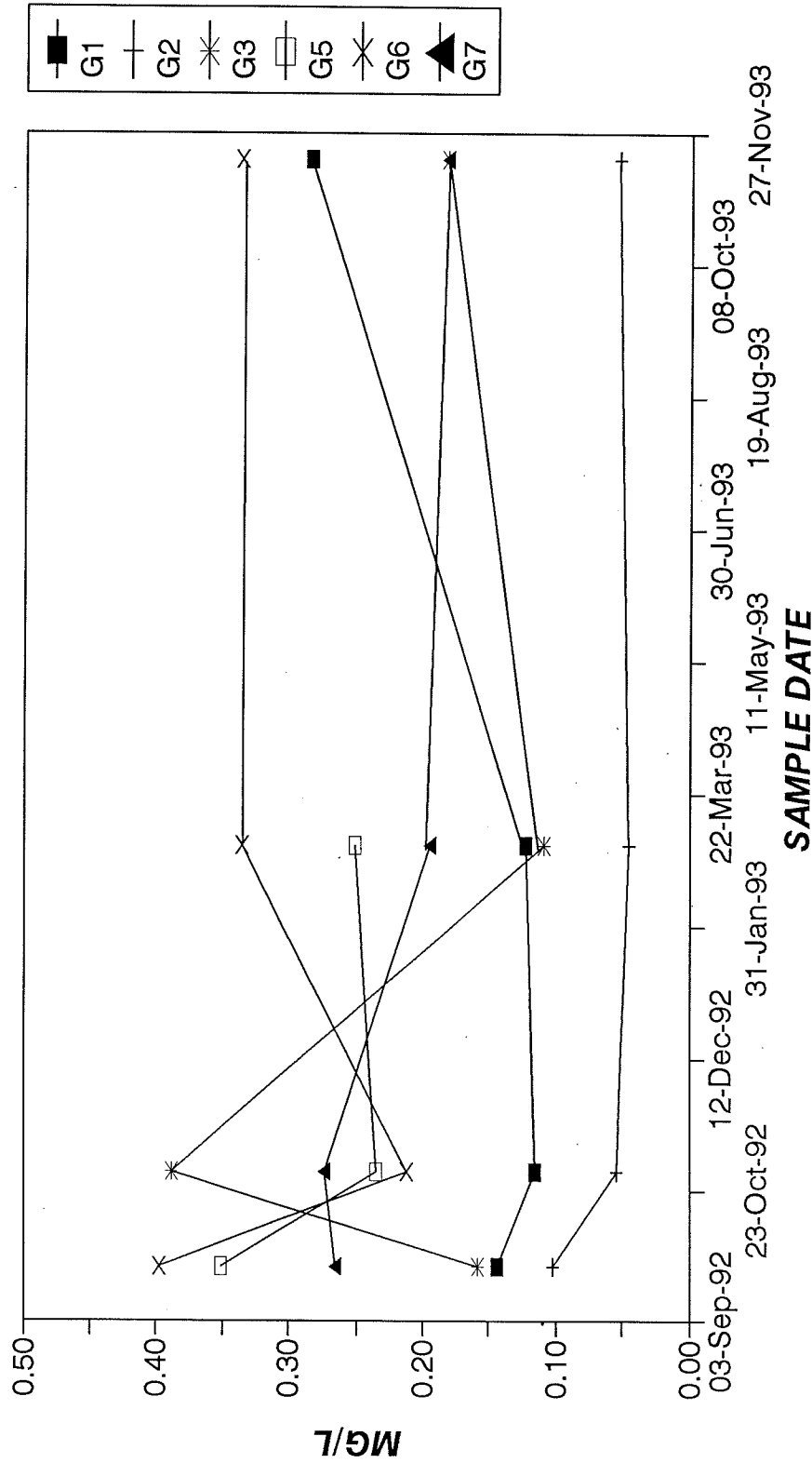


FIGURE
 13

1993 Total Phosphorus by Sample Date Groundwater Wells 1-3,5-7



FIGURE

14

1993 Soluble Phosphorus by Sample Date Groundwater Wells 1-3,5-7

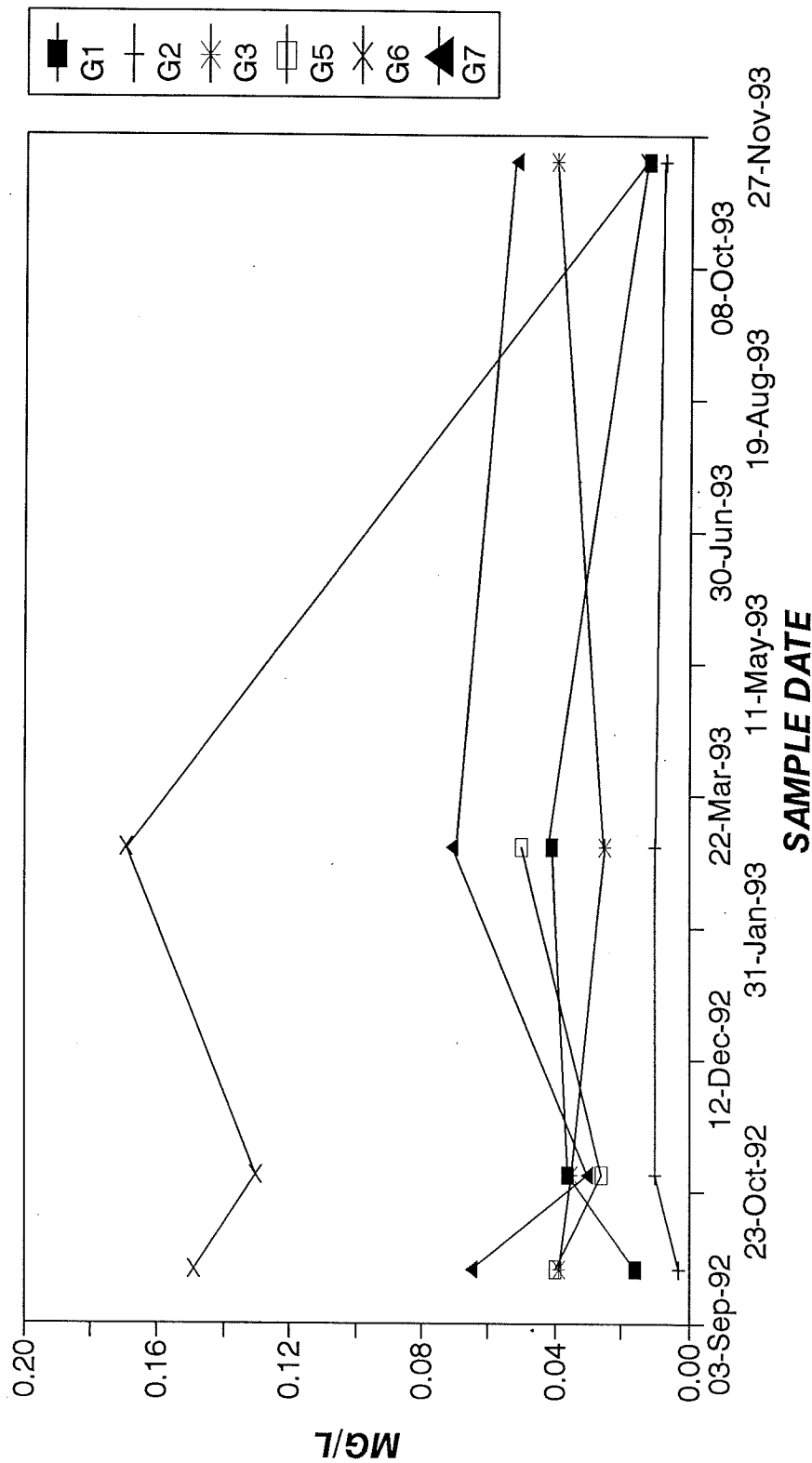


FIGURE
15

1993 Nitrate-Nitrogen by Sample Date Groundwater Wells 1-3,5-7

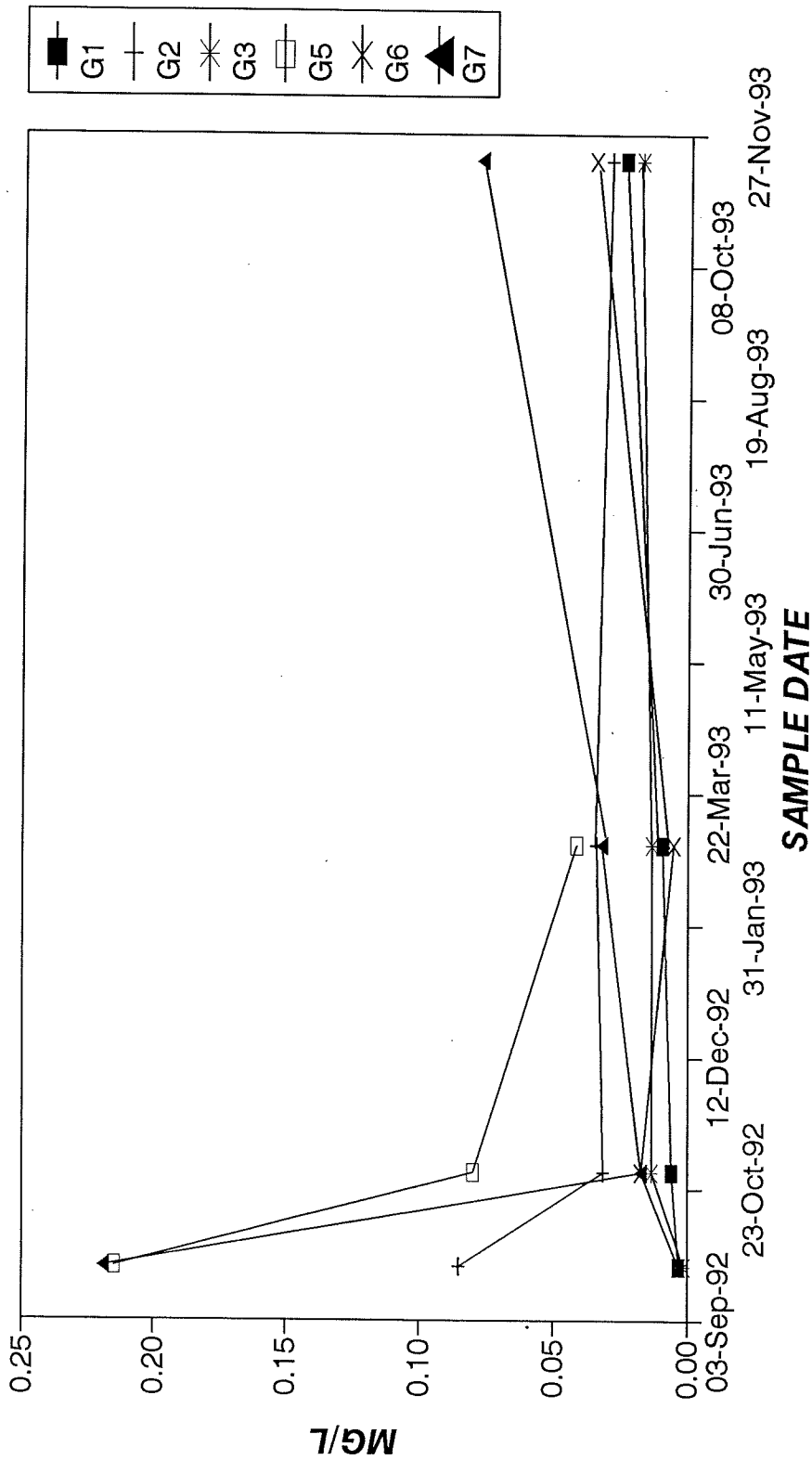


FIGURE
16

1993 pH by Sample Date Creeks, Streams, and Lake

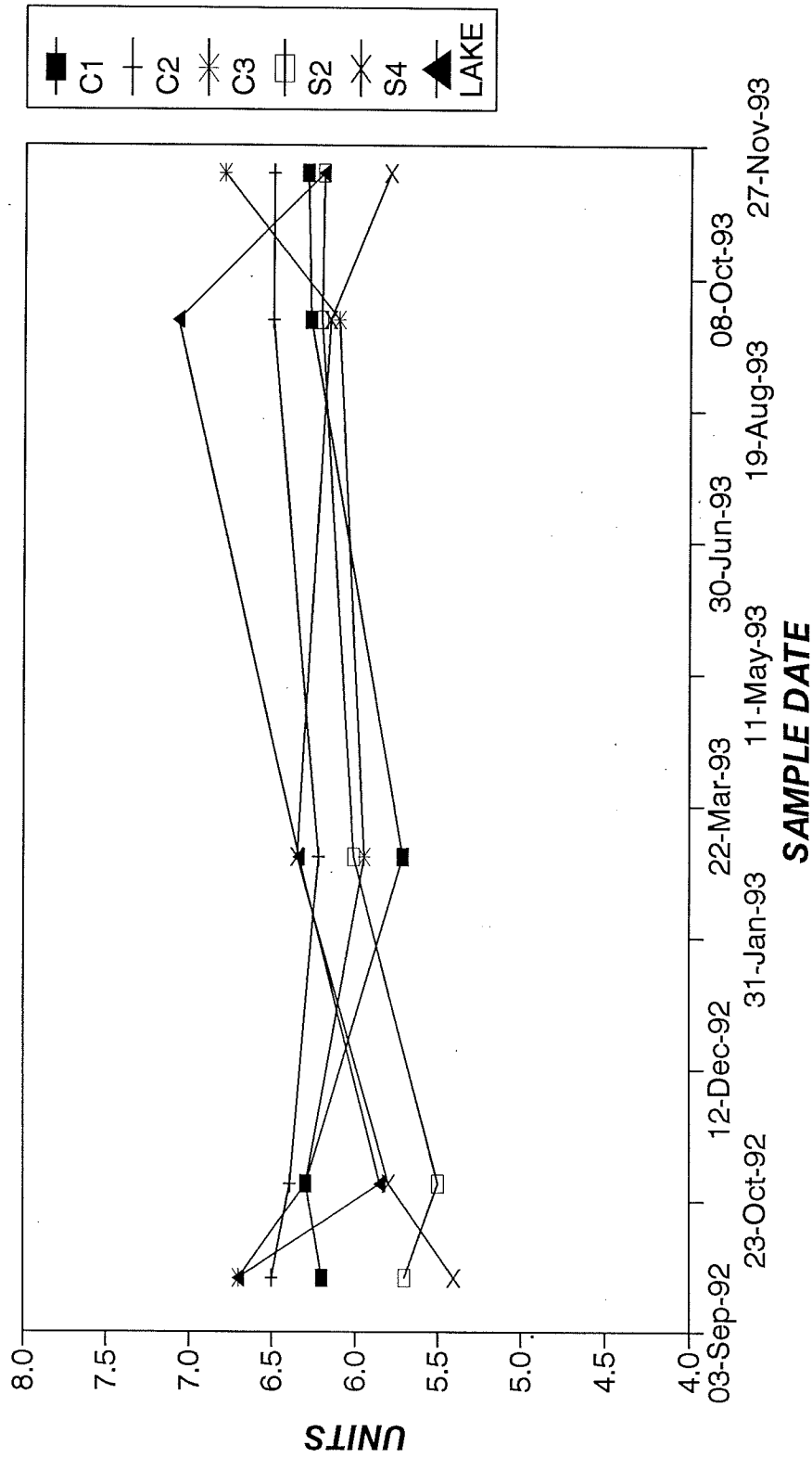


FIGURE
17

1993 Conductivity by Sample Date Creeks, Streams, and Lake

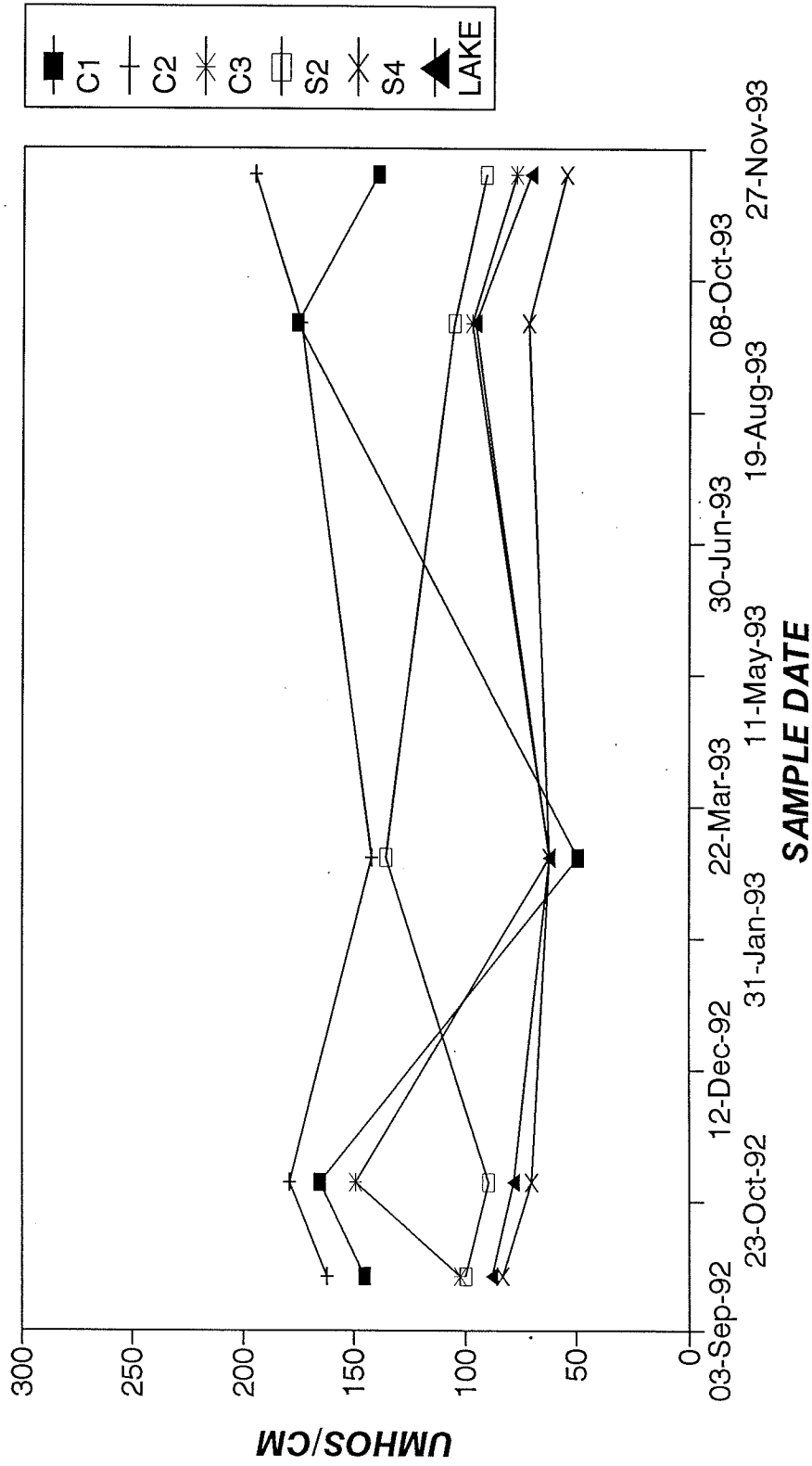


FIGURE
18

1993 Tot. Susp. Solids by Sample Date Creeks, Streams, and Lake

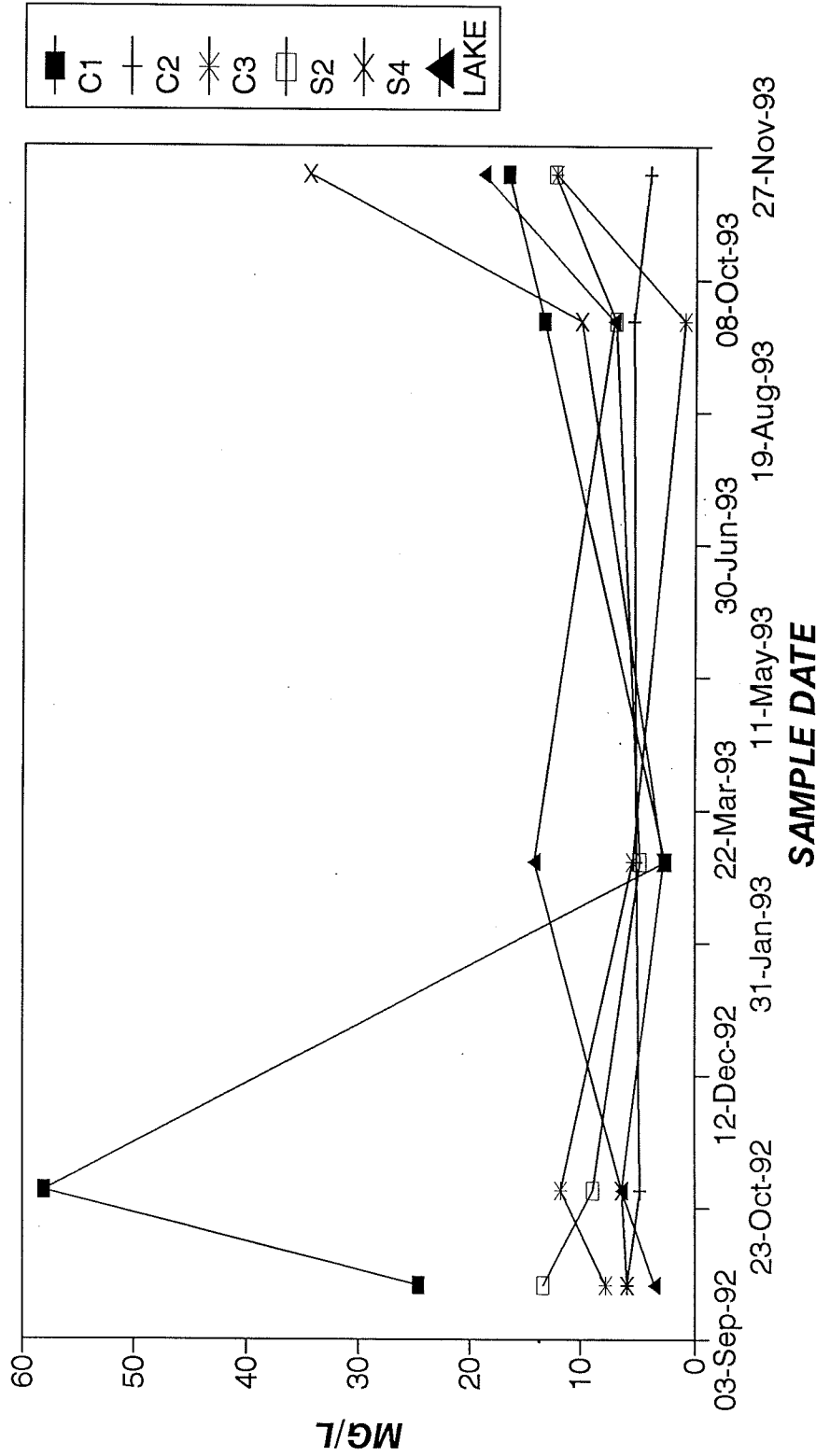


FIGURE
19

1993 Total Phosphorus by Sample Date Creeks, Streams, and Lake

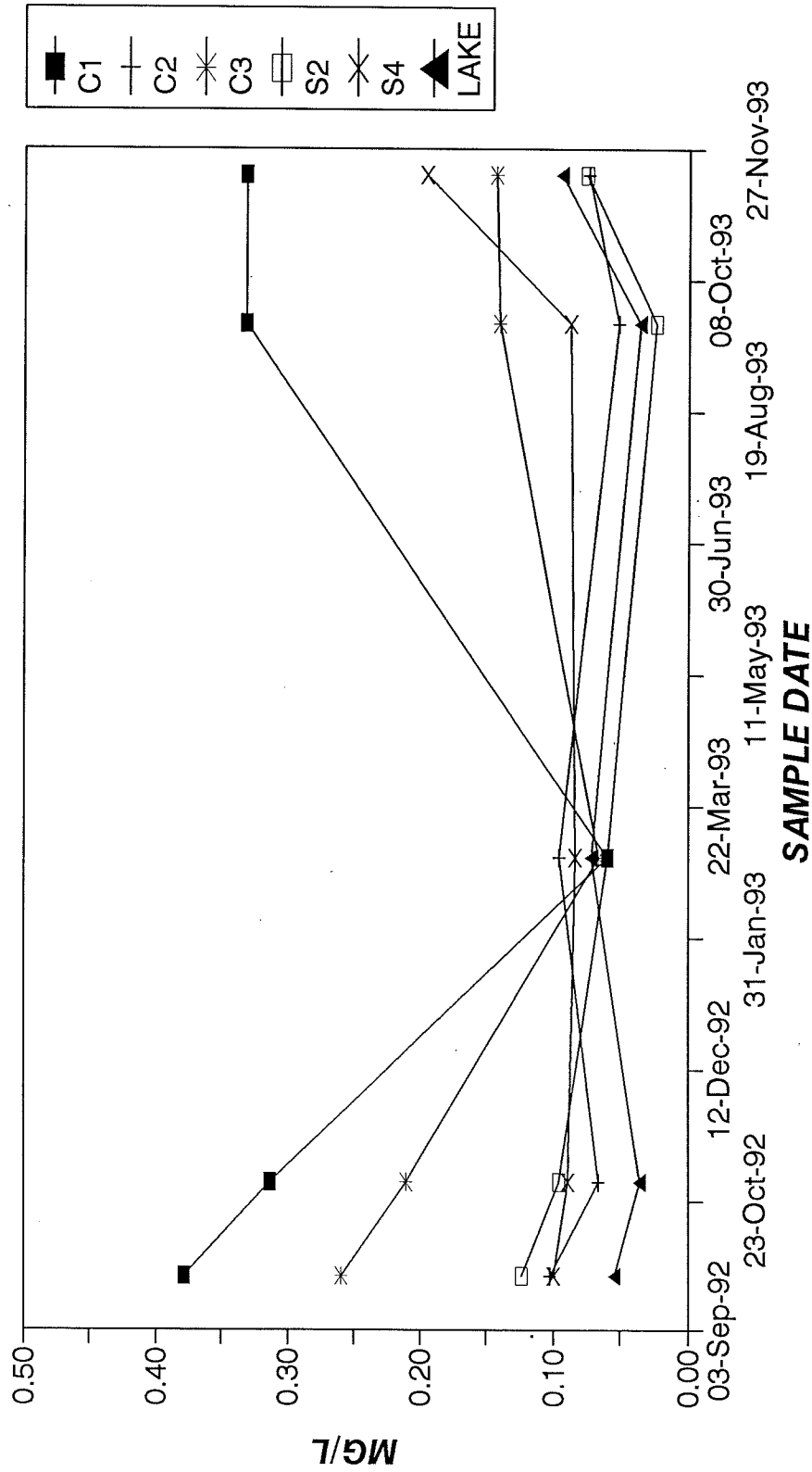
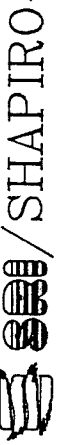


FIGURE
20



SHAPIRO

1993 Soluble Phosphorus by Sample Date Creeks, Streams, and Lake

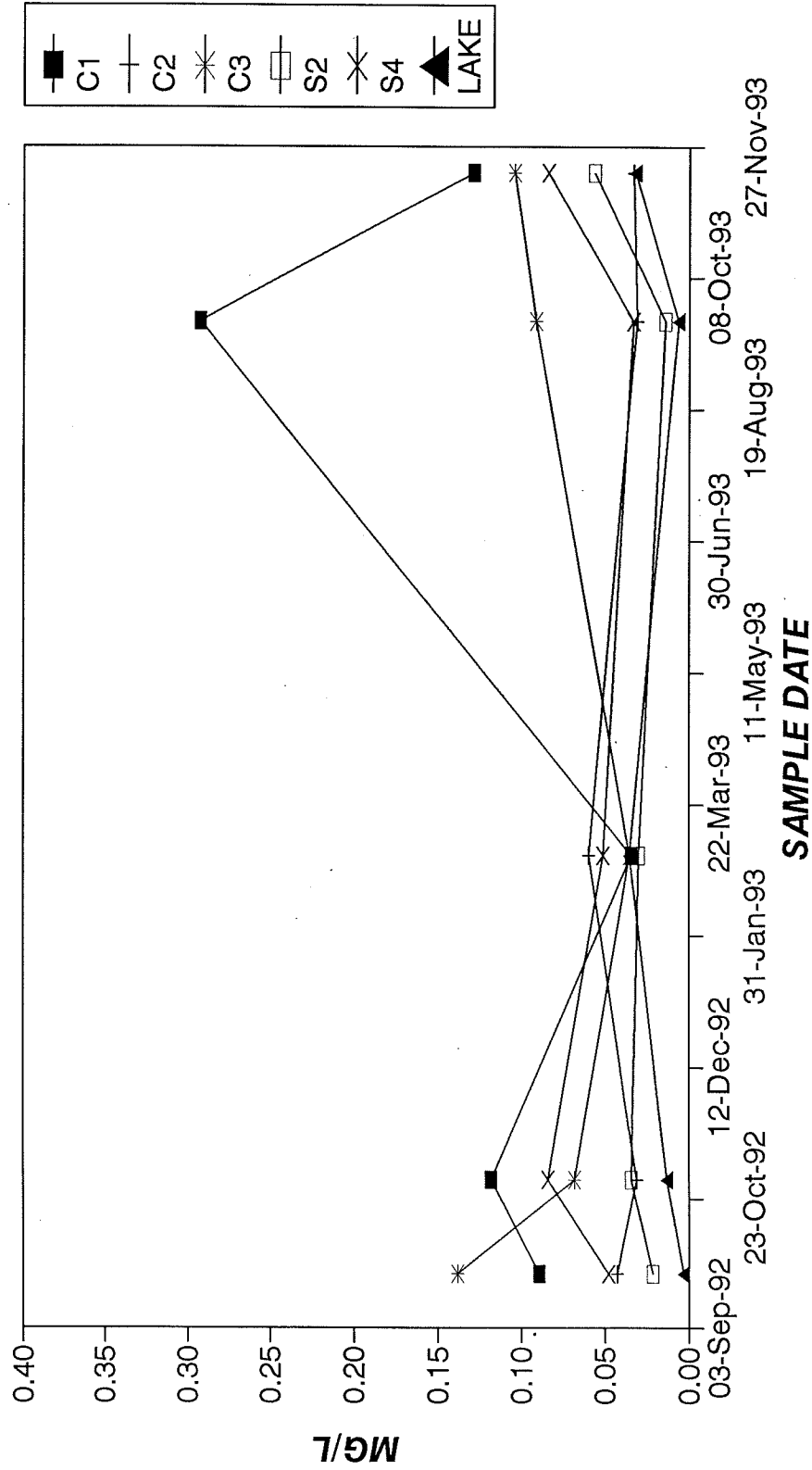
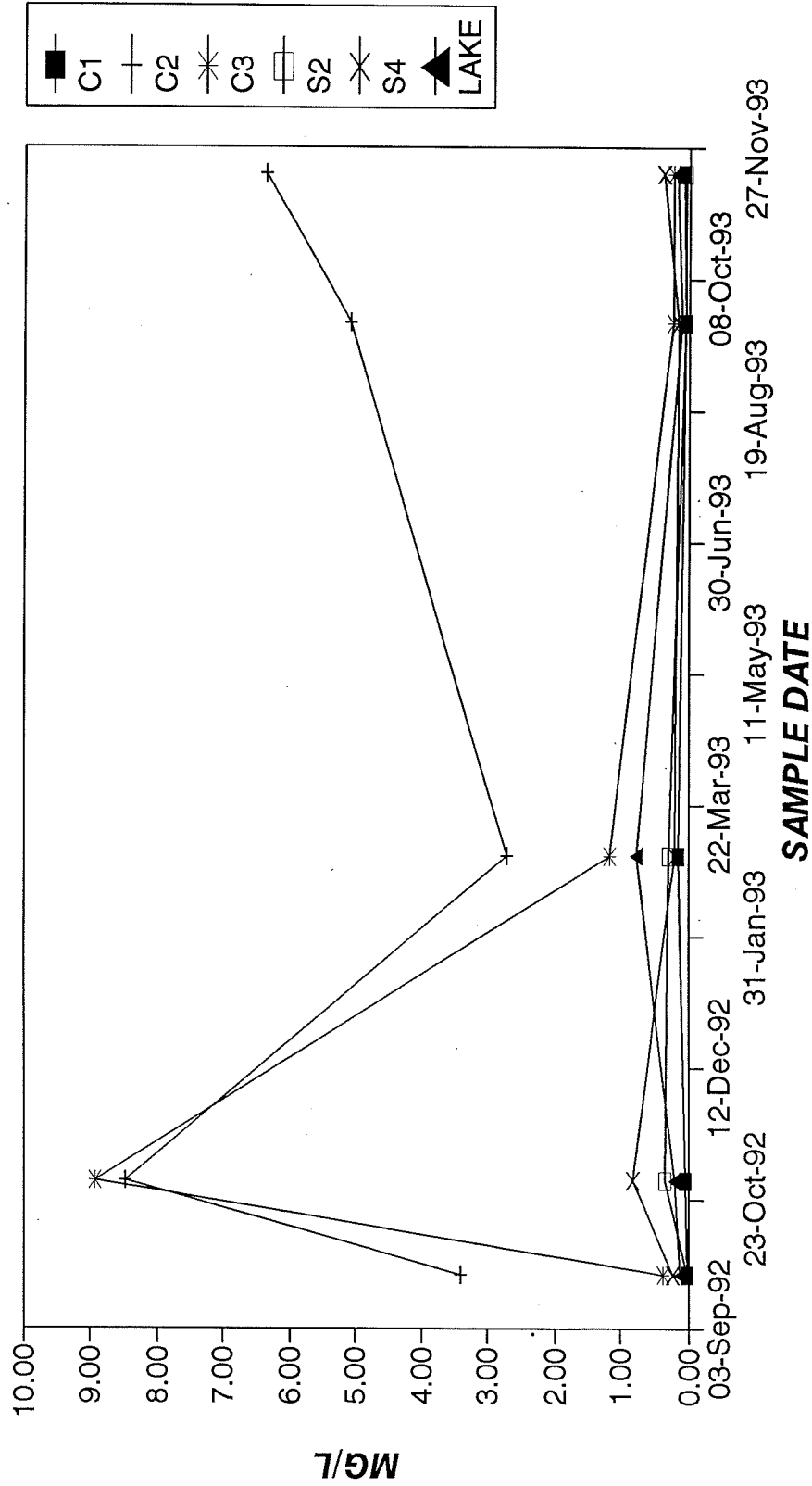


FIGURE
21

1993 Nitrate-Nitrogen by Sample Date Creeks, Streams, and Lake



FIGURE

22

1993 Compliance for Tot. Susp. Solid Stations B1, B2, S2, S4, and Lake

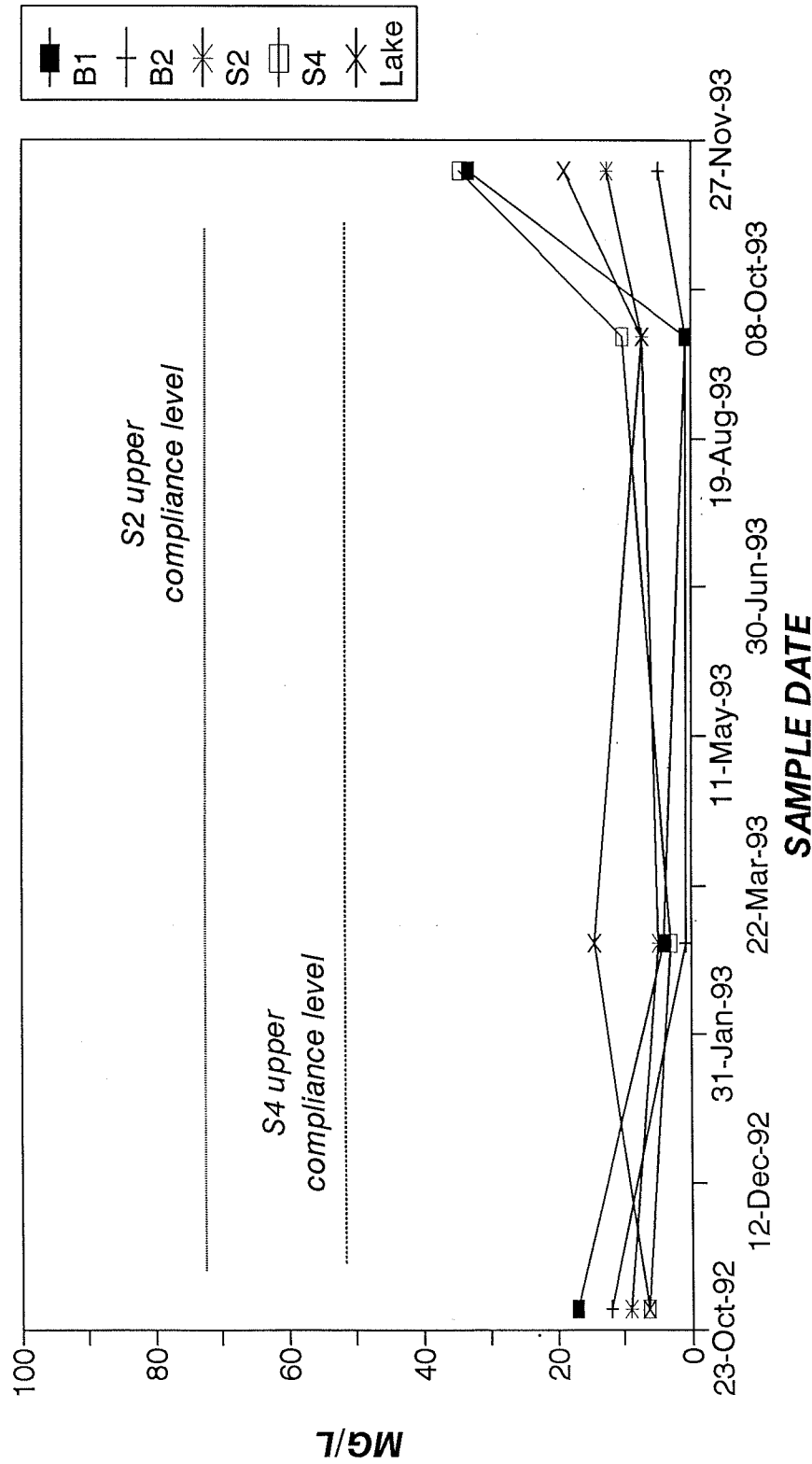


FIGURE
23

1993 Compliance for Total Phosphorus Stations B1, B2, S2, S4, and Lake

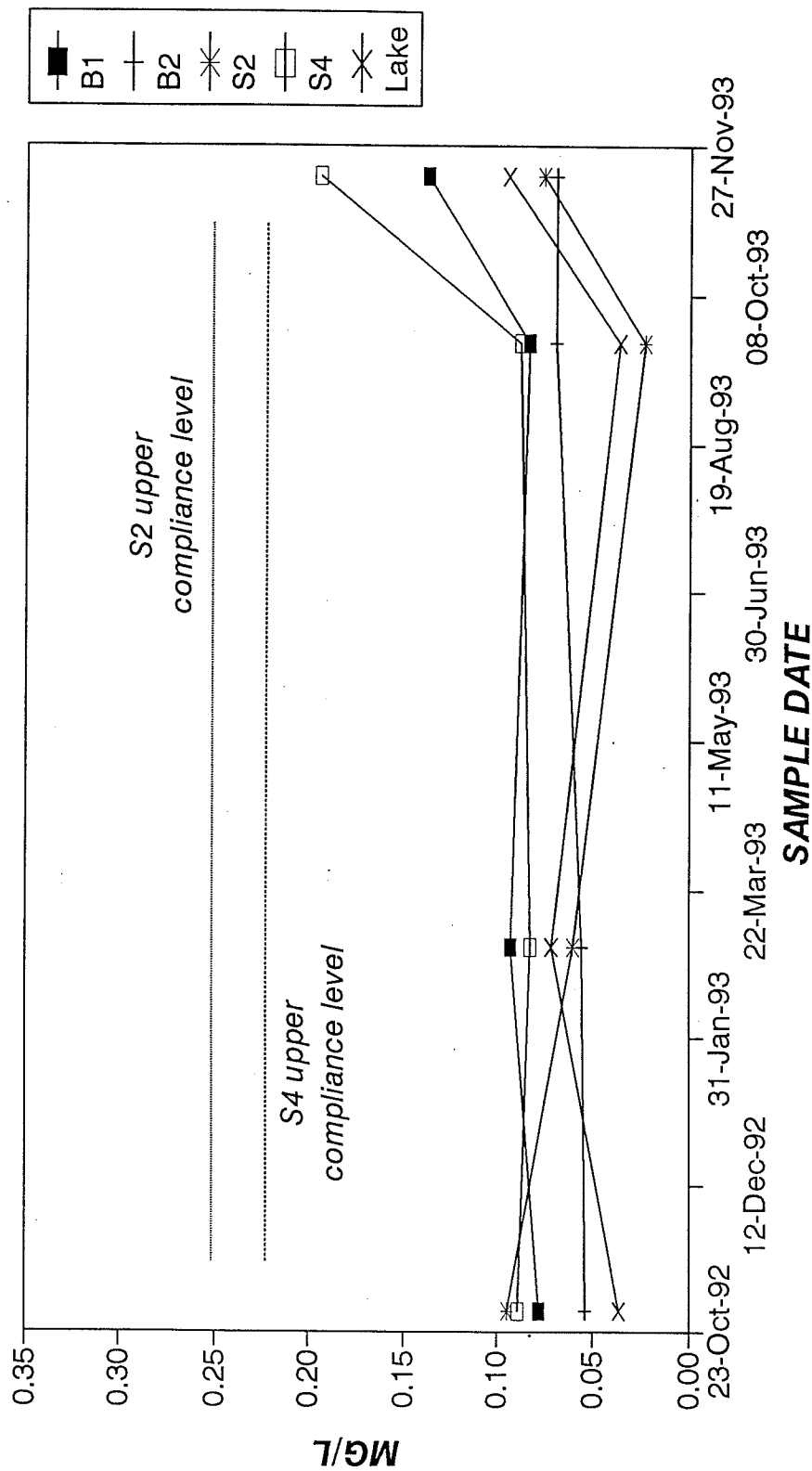


FIGURE
24

1993 Soluble Phosphorus by Sample Date Stations B1, B2, S2, S4, and Lake

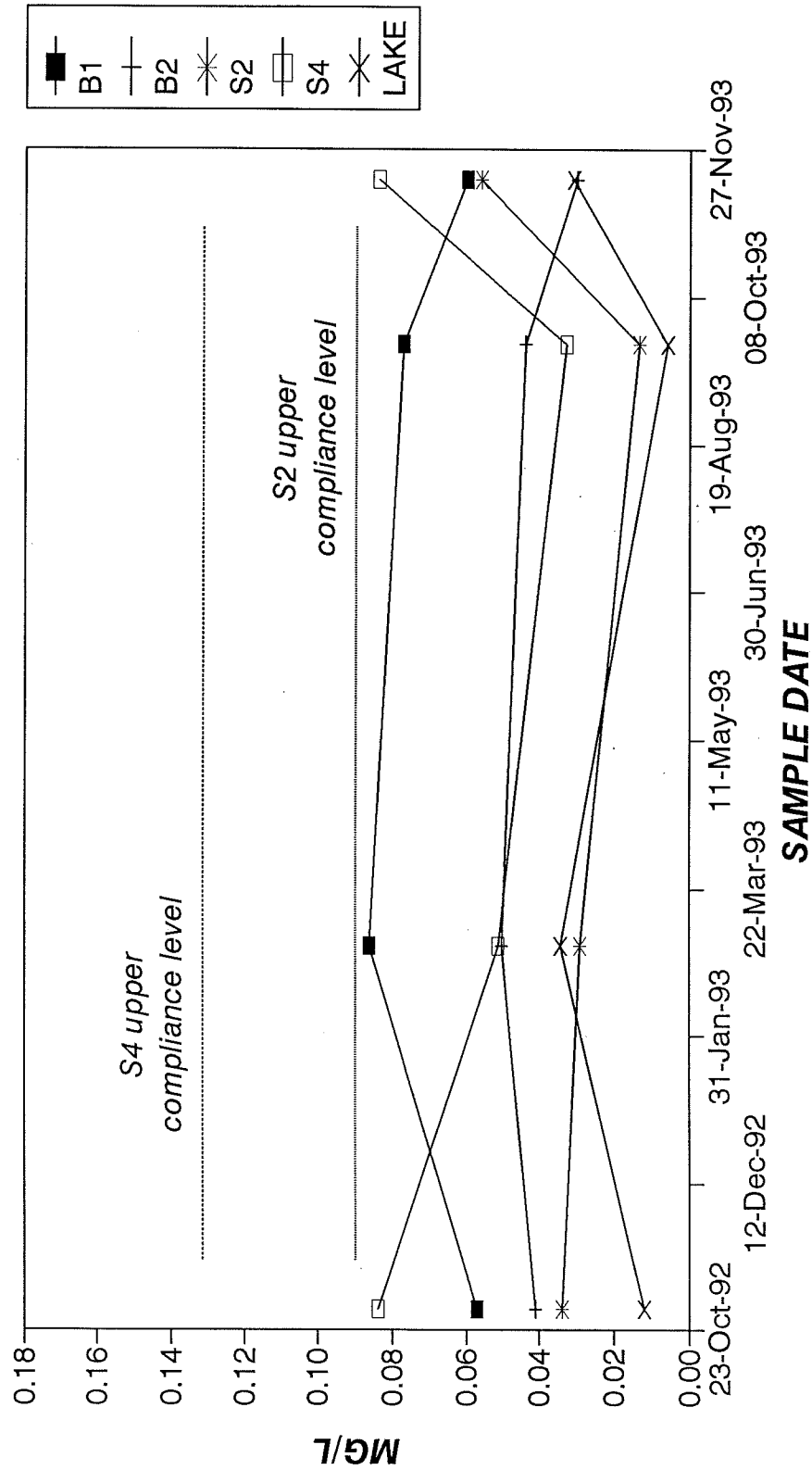


FIGURE
25

1993 Compliance for Nitrate-Nitrogen Stations B1, B2, S2, S4, and Lake

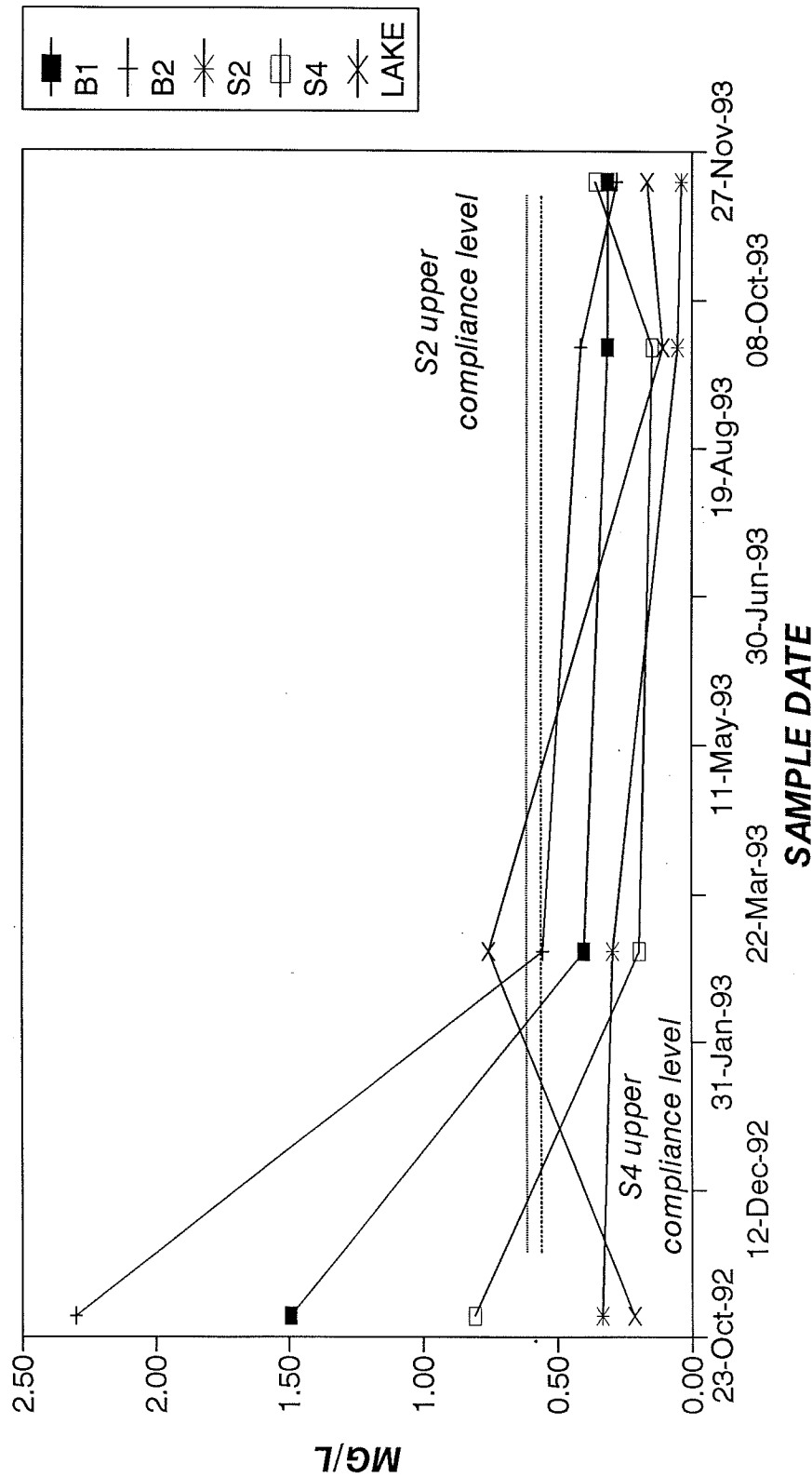


FIGURE
26

Comparison of Phosphorus Loading Rates Wetland Bubblers and Control Creeks

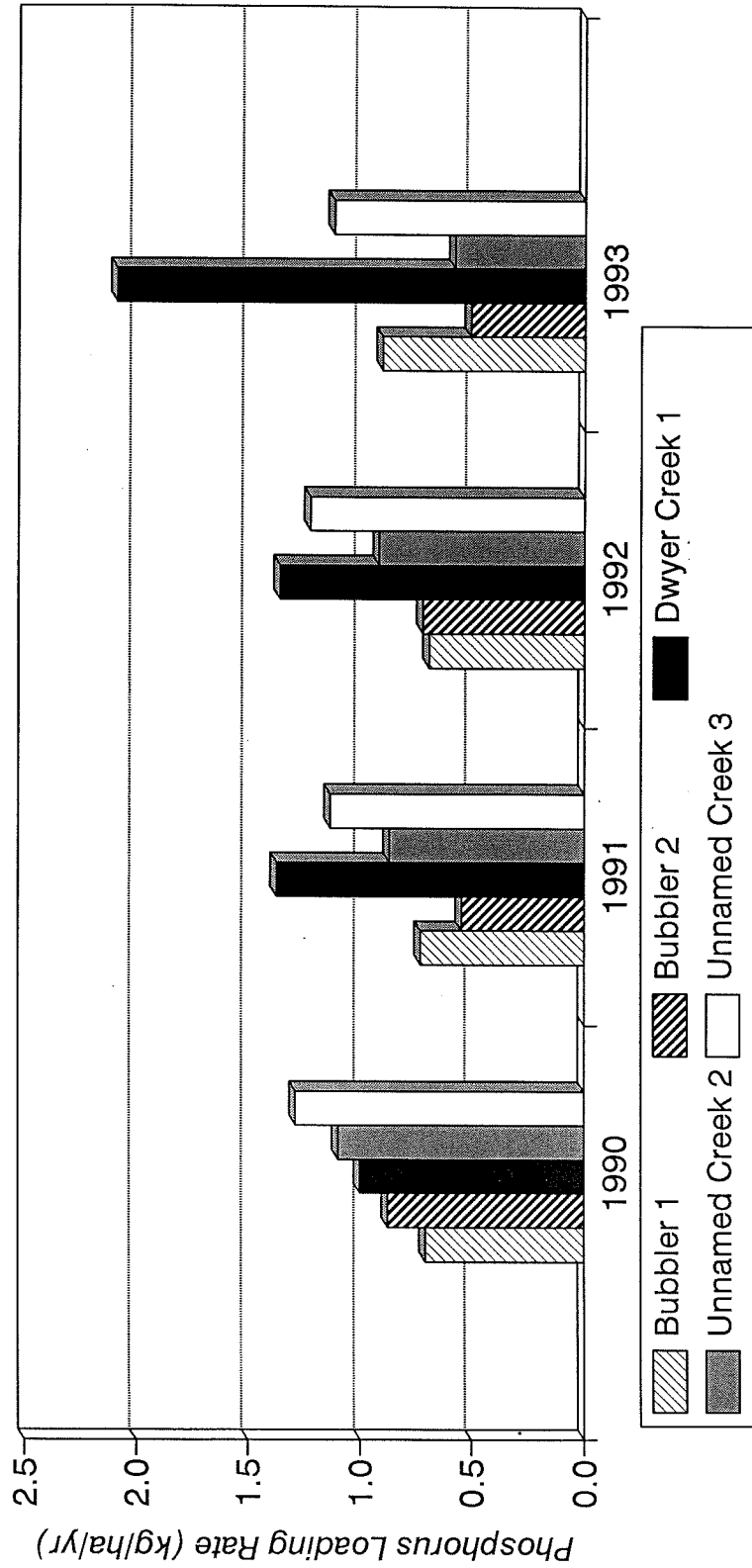
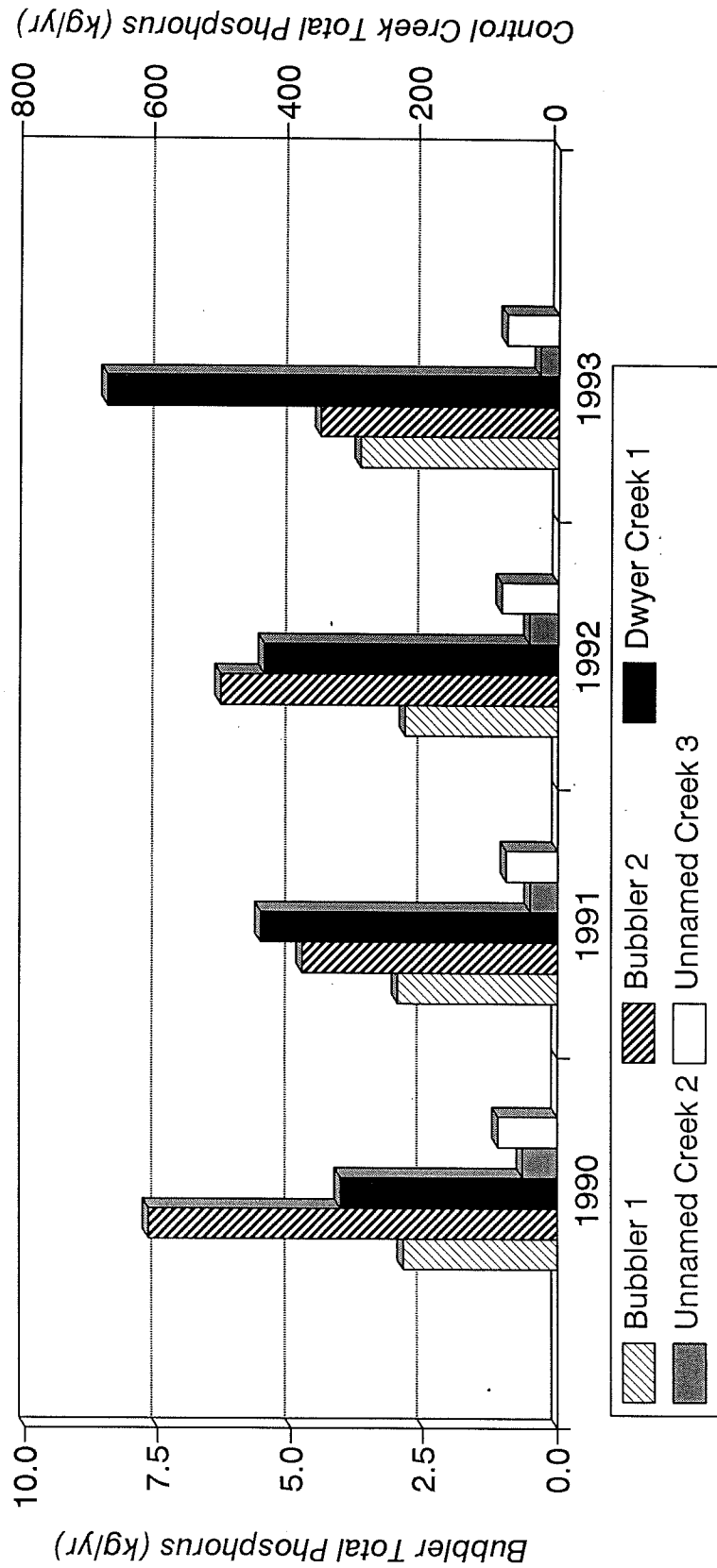


FIGURE
27

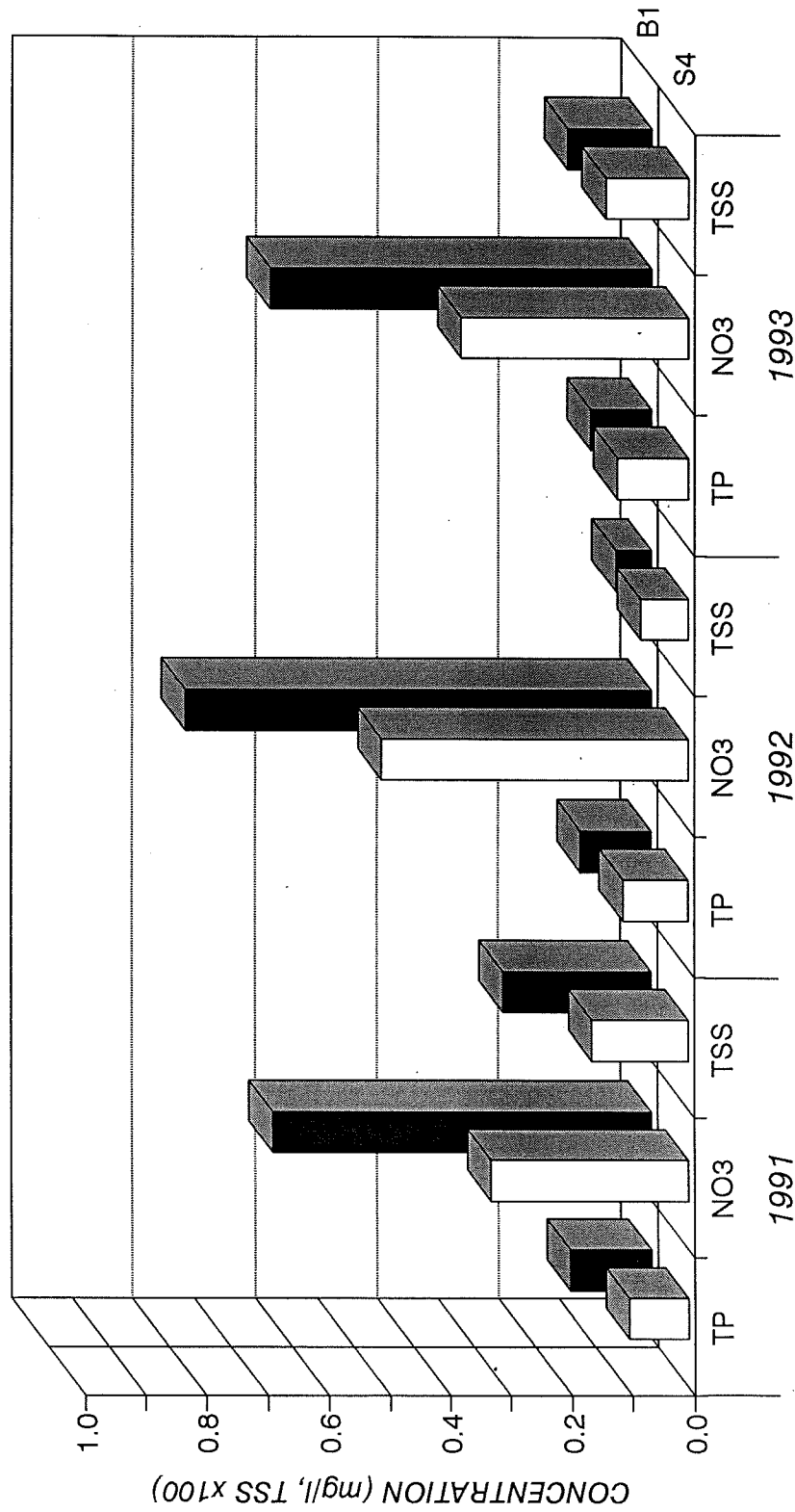
Comparison of Total Phosphorus Mass Wetland Bubblers and Control Creeks



FIGURE

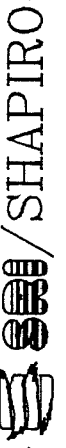
28

Comparison of Annual Means
Transect 1



FIGURE

29



Comparison of Annual Means
Transect 2

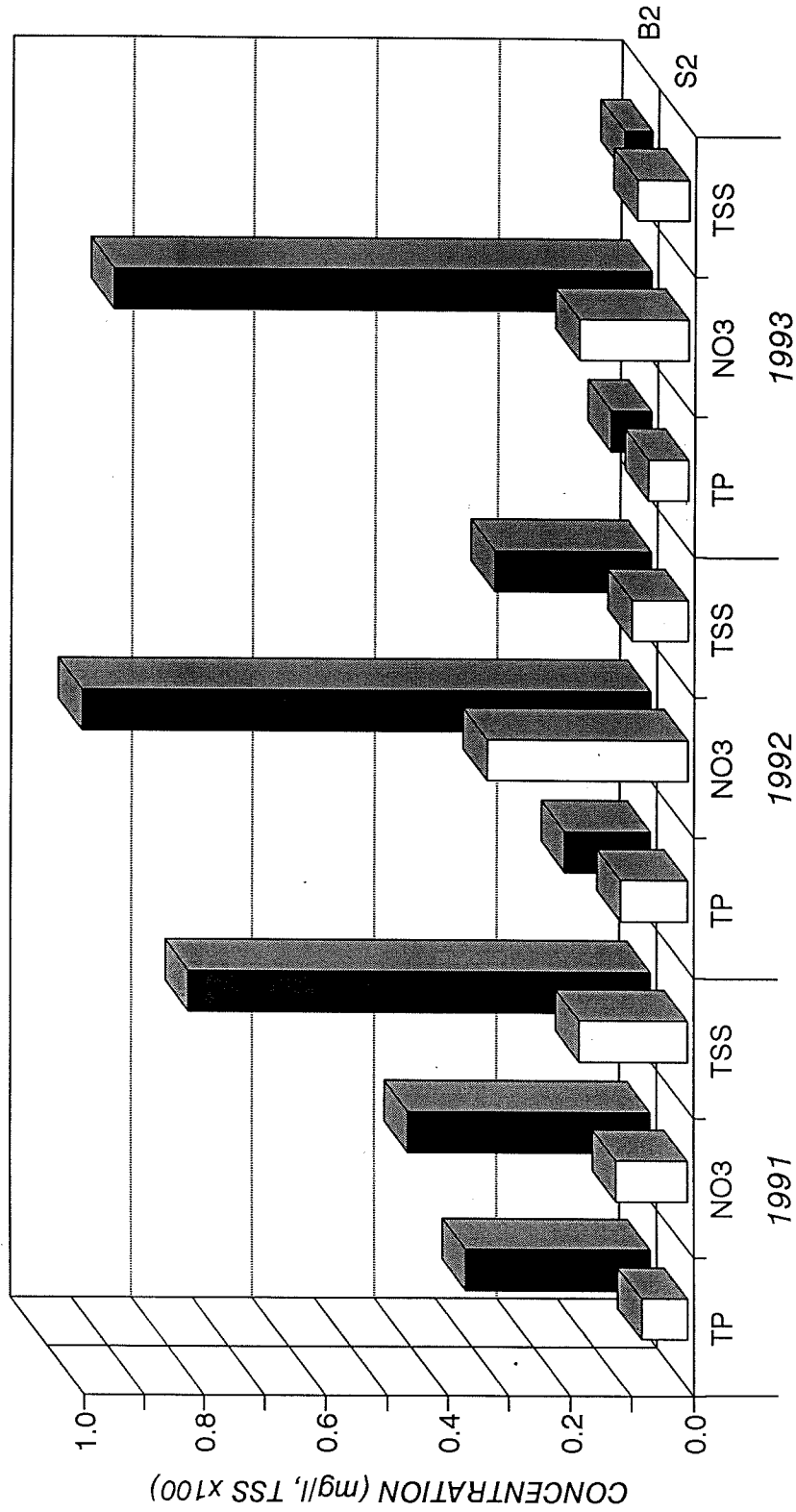


FIGURE
30



APPENDIX C

Washington Department of Ecology Letter



STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY

P.O. Box 47600 • Olympia, Washington 98504-7600 • (206) 407-6000 • TDD Only (Hearing Impaired) (206) 407-6006

March 2, 1994

TO: Mark Bautista
SRI Shapiro

FROM: Kim Van Zwalenburg *KWZ*
Shorelands and Coastal Zone
Management Program

SUBJECT: Fourth Year Report of Monitoring Program for Lacamas Shores

I am able to provide only the briefest of reviews on the monitoring data for the fourth year. I apologize for the long delay in submitting this to you.

Nitrate-Nitrogen Levels:

We continue to be concerned about the apparent increase in nitrate-nitrogen levels which has been showing up in the water flowing into the wetland. It appears that upstream source control measures should be implemented within the development to see if there is any reduction in input. Some one or combination of the following suggested source control measures, or any others that may help reduce the nitrate-nitrogen spike, should be considered. These source control measures can range from minimizing lawn fertilizers, restricting nitrogen content in fertilizers, restricting application rates and restricting fertilizer application to specific months. At a minimum, this approach will provide some information about whether the source is from the development or originates from offsite.

Species Diversity and Dominant Species:

The tables presented do not provide information regarding the changes in species diversity and dominance over time. Therefore, it is difficult to analyze the impacts over time on the wetland vegetation. A decrease in species diversity and/or an increase in the more invasive species could indicate negative impacts resulting from the changes in hydrology due to stormwater inputs. Variations in the climatic regime may also be a contributing factor but is not likely to be the only factor.

Mark Bautista
Page 2
March 2, 1994

The expansion of the reed canary grass should be watched closely and may require some intervention. While reed canary grass may provide biofiltration benefits, it is at the expense of the other currently existing functions and values, including habitat, of the wetland.

Removal Rates of Nutrients and Total Suspended Solids:

If the trend toward a reduction in the removal rates of nutrients and total suspended solids by the wetland continues, it may be an indication that additional pretreatment methods and/or source controls need to be implemented prior to the discharge of stormwater into the wetland.

KVZ:pz
O:\MANAGE\KIMVAN\BAUTIST.MEM

STORM SEWER SEDIMENTATION FACILITY

- TYPE I
- TYPE II

