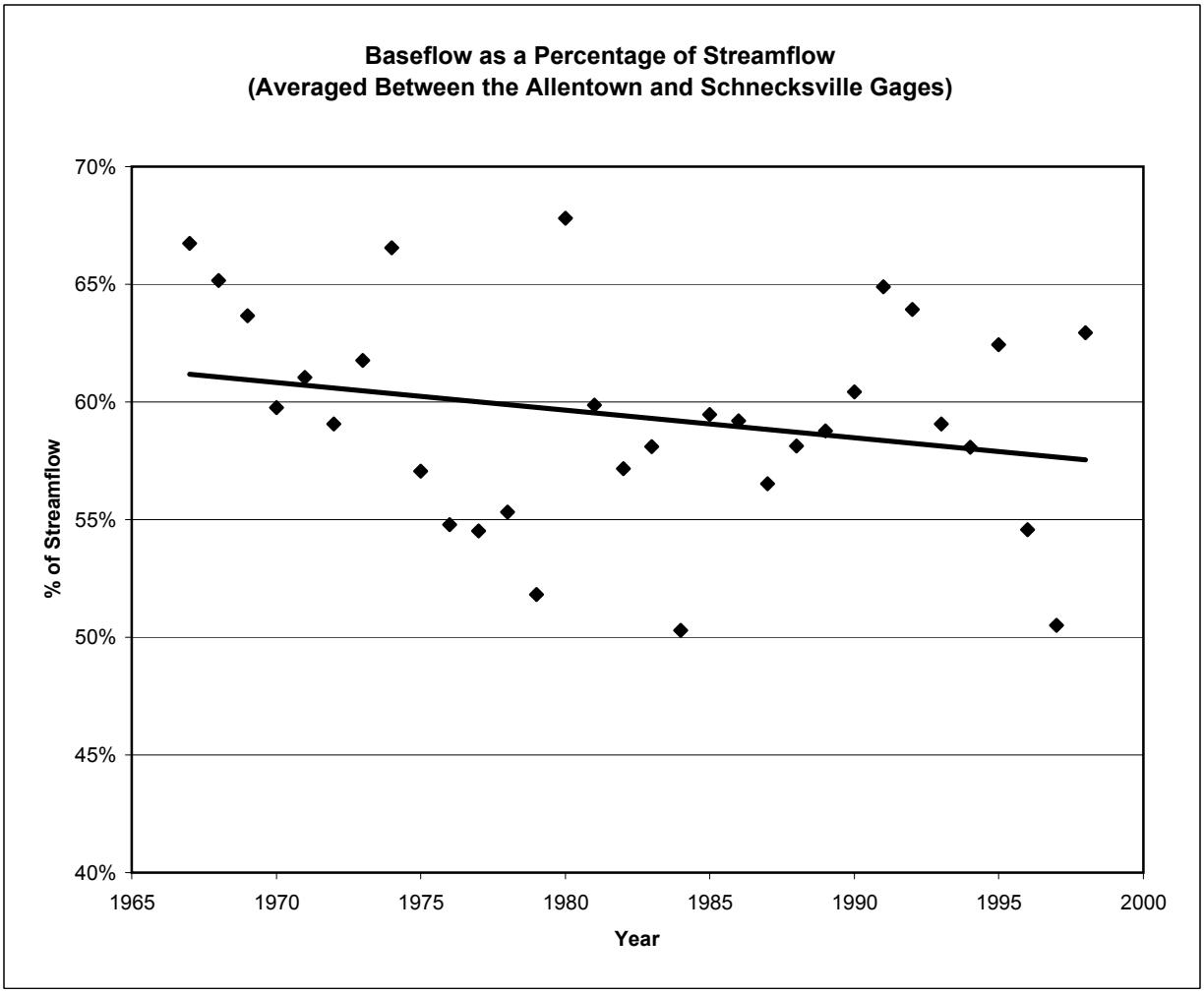
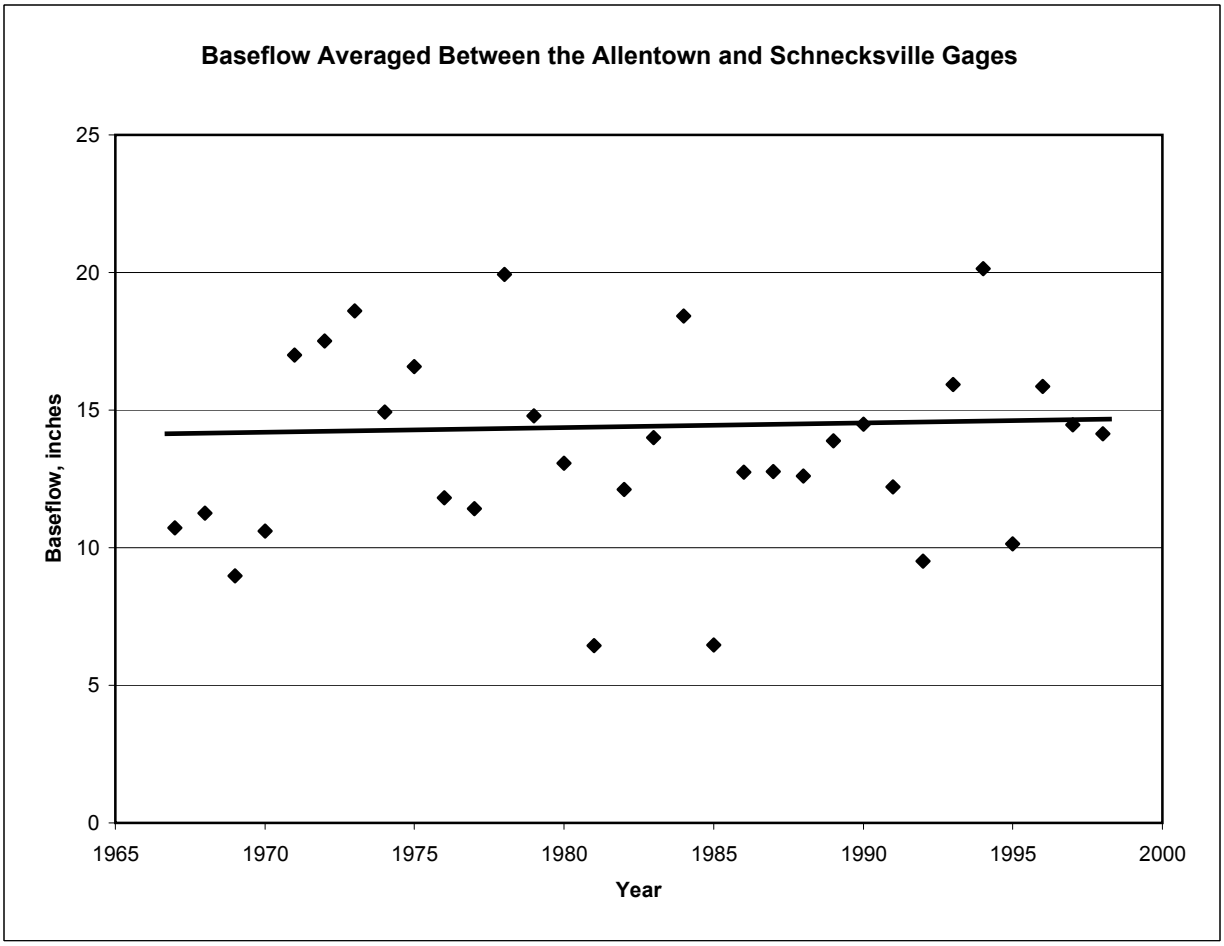
APPENDIX A

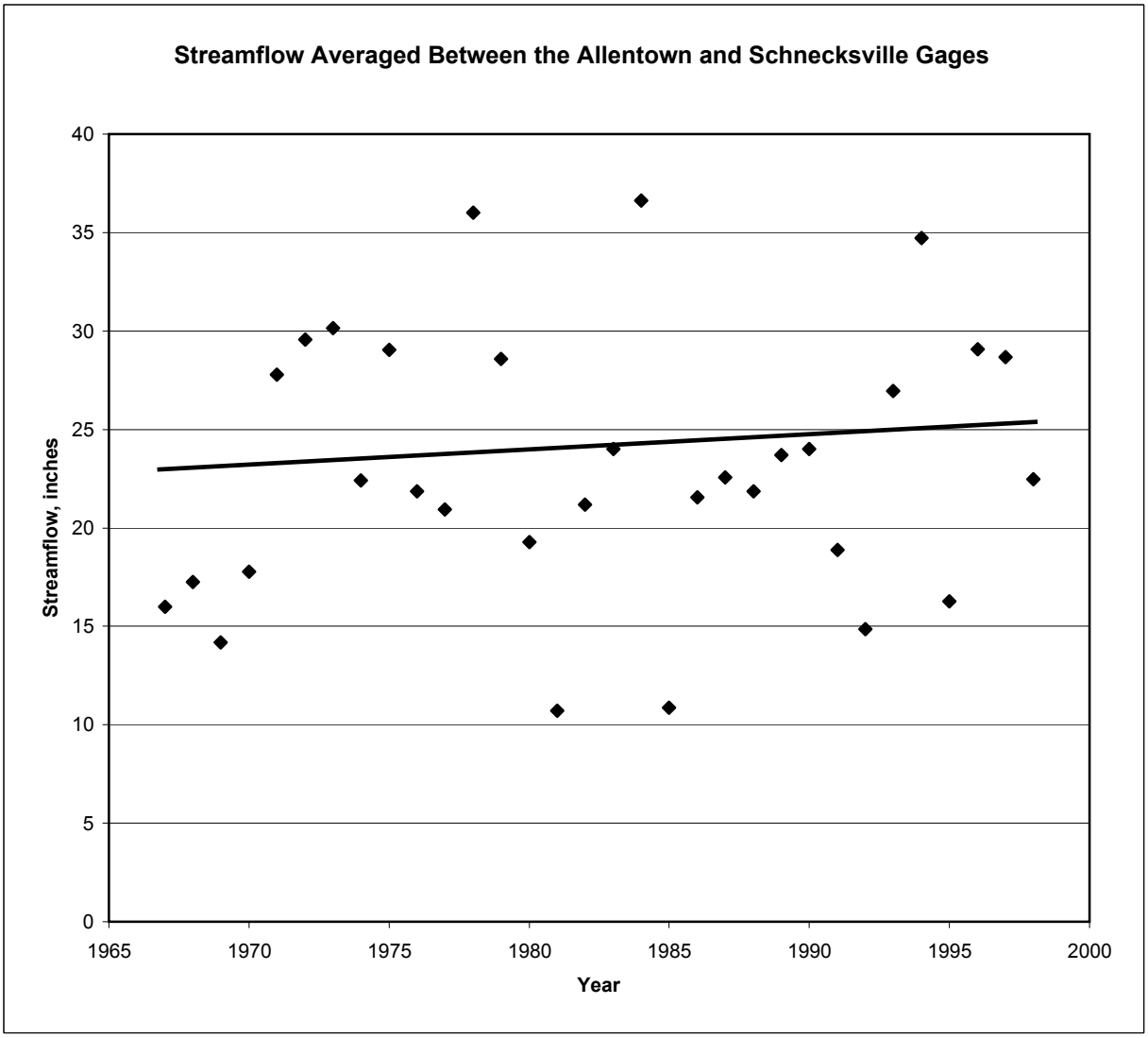
JORDAN CREEK PRECIPITATION, STREAM FLOW, BASE FLOW AND RUNOFF CHARACTERISTICS

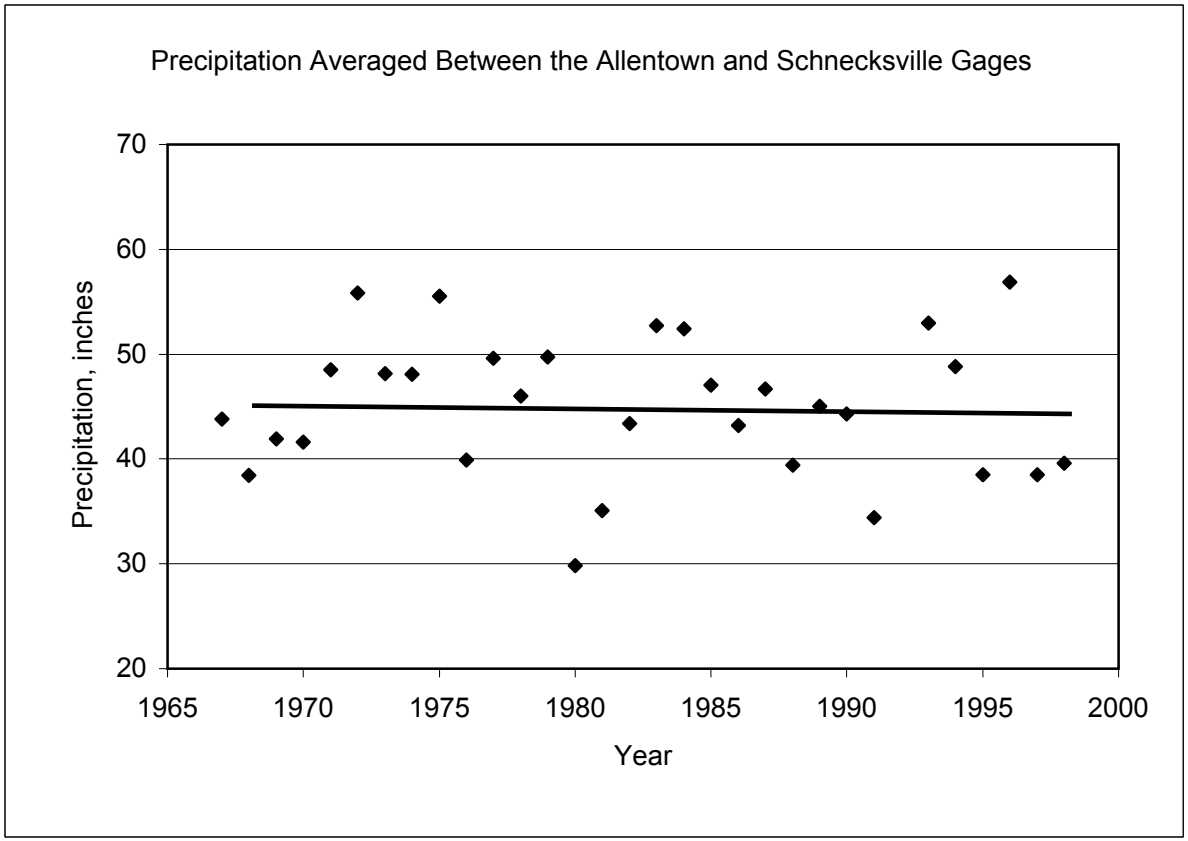
Table A1. Jordan Creek Precipitation, Streamflow and Baseflow Characteristics

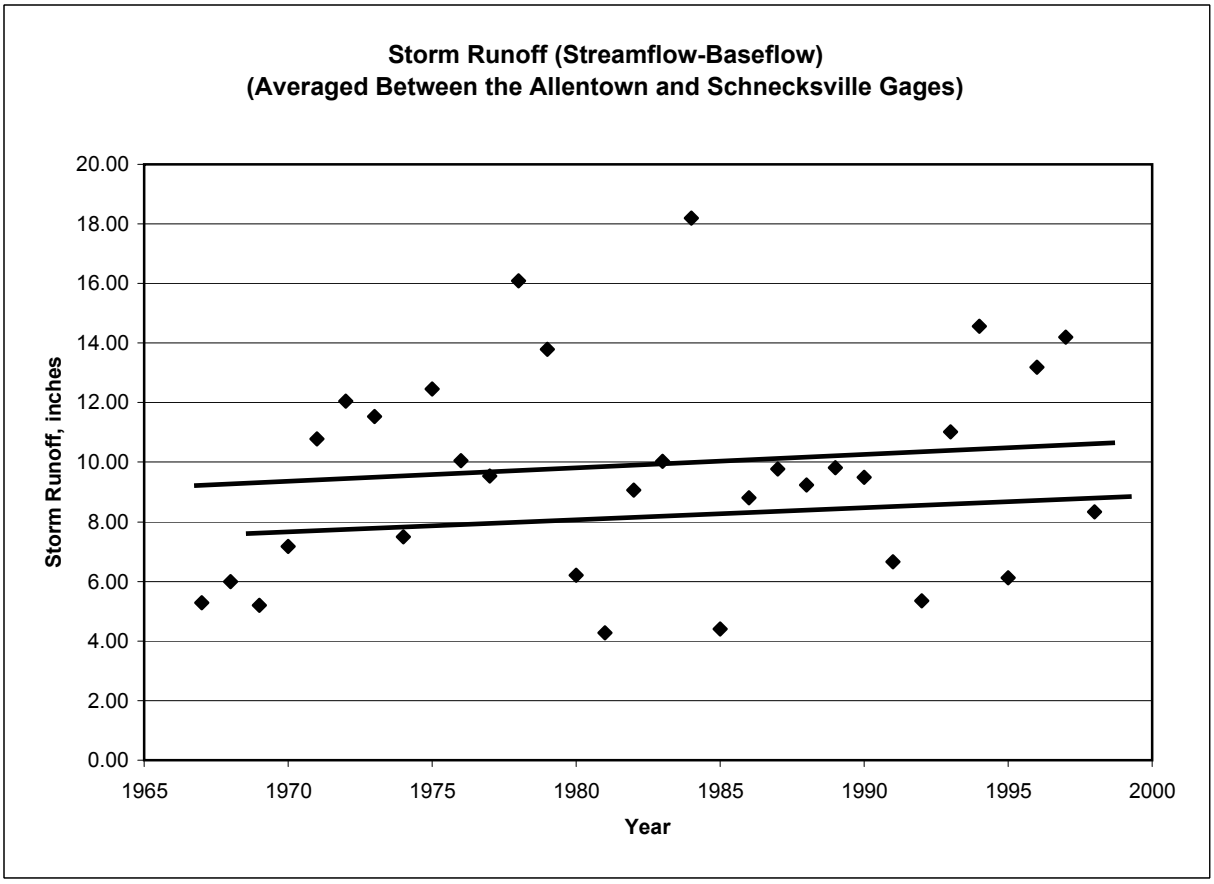
YEAR	PRECIPITATION			STREAMFLOW			BASEFLOW			% BASEFLOW			STORM
	Schnecksville	Allentown	Average	Schnecksville	Allentown	Average	Schnecksville	Allentown	Average	Schnecksville	Allentown	Average	RUNOFF
1967	43.79	43.79	43.79	16.91	15.10	16.01	11.58	9.88	10.73	68.05%	65.44%	66.75%	5.28
1968	38.43	38.43	38.43	18.11	16.37	17.24	12.06	10.44	11.25	66.59%	63.73%	65.16%	5.99
1969	41.89	41.89	41.89	15.69	12.66	14.18	9.48	8.47	8.975	60.43%	66.89%	63.66%	5.20
1970	41.59	41.59	41.59	18.21	17.36	17.79	10.03	11.19	10.61	55.08%	64.46%	59.77%	7.18
1971	48.50	48.50	48.50	29.43	26.12	27.78	18.61	15.37	16.99	63.24%	58.83%	61.04%	10.79
1972	55.85	55.85	55.85	30.64	28.49	29.57	19.48	15.54	17.51	63.59%	54.54%	59.07%	12.06
1973	48.17	48.17	48.17	31.80	28.49	30.15	19.55	17.67	18.61	61.48%	62.03%	61.76%	11.54
1974	48.19	48.00	48.10	22.97	21.88	22.43	15.55	14.31	14.93	67.71%	65.40%	66.56%	7.50
1975	55.54	55.54	55.54	29.55	28.51	29.03	17.23	15.92	16.575	58.29%	55.83%	57.06%	12.46
1976	39.90	39.90	39.90	21.86	21.88	21.87	11.79	11.84	11.815	53.95%	55.63%	54.79%	10.06
1977	49.60	49.60	49.60	20.60	21.28	20.94	11.56	11.26	11.41	56.13%	52.91%	54.52%	9.53
1978	45.99	45.99	45.99	38.00	34.03	36.02	21.08	18.78	19.93	55.47%	55.19%	55.33%	16.09
1979	49.71	49.71	49.71	30.51	26.66	28.59	15.6	14	14.8	51.12%	52.50%	51.81%	13.79
1980	29.82	29.82	29.82	20.57	18.00	19.29	14.04	12.12	13.08	68.28%	67.32%	67.80%	6.21
1981	35.08	35.08	35.08	11.61	9.83	10.72	7.41	5.49	6.45	63.84%	55.89%	59.87%	4.27
1982	43.40	43.40	43.40	22.25	20.11	21.18	12.71	11.51	12.11	57.12%	57.21%	57.17%	9.07
1983	52.70	52.70	52.70	25.15	22.89	24.02	15.38	12.61	13.995	61.14%	55.07%	58.11%	10.03
1984	52.41	52.41	52.41	36.77	36.46	36.62	18.09	18.74	18.415	49.20%	51.41%	50.31%	18.20
1985	47.03	47.03	47.03	11.25	10.51	10.88	6.86	6.09	6.475	60.96%	57.97%	59.47%	4.41
1986	43.20	43.20	43.20	22.96	20.14	21.55	13.21	12.26	12.735	57.53%	60.89%	59.21%	8.82
1987	46.70	46.70	46.70	23.89	21.22	22.56	13.65	11.9	12.775	56.95%	56.08%	56.52%	9.78
1988	39.42	39.42	39.42	24.72	18.97	21.85	13.61	11.62	12.615	55.05%	61.22%	58.14%	9.23
1989	45.01	45.01	45.01	25.43	21.98	23.71	14.28	13.49	13.885	56.16%	61.37%	58.77%	9.82
1990	44.27	44.27	44.27	25.55	22.44	24.00	15.42	13.57	14.495	60.37%	60.48%	60.43%	9.50
1991	34.38	34.38	34.38	20.35	17.38	18.87	12.9	11.53	12.215	63.42%	66.35%	64.89%	6.65
1992	N/A	N/A	N/A	15.70	14.00	14.85	10.29	8.73	9.51	65.52%	62.35%	63.94%	5.34
1993	52.96	52.98	52.97	27.26	26.66	26.96	16.81	15.05	15.93	61.68%	56.43%	59.06%	11.03
1994	48.82	48.82	48.82	33.54	35.89	34.72	19.83	20.47	20.15	59.13%	57.03%	58.08%	14.57
1995	38.46	38.49	38.48	16.83	15.71	16.27	10.18	10.11	10.145	60.51%	64.34%	62.43%	6.13
1996	56.87	56.87	56.87	29.42	28.72	29.07	16.44	15.3	15.87	55.89%	53.25%	54.57%	13.20
1997	38.49	38.49	38.49	29.91	27.42	28.67	14.89	14.04	14.465	49.78%	51.22%	50.50%	14.20
1998	39.62	39.62	39.62	24.17	20.80	22.49	15.14	13.15	14.145	62.62%	63.25%	62.94%	8.34


Baseflow as a Percentage of Streamflow
(Averaged Between the Allentown and Schnecksville Gages)
70%
65%
60%
55%
50%
45%
40%
% of Streamflow
1965
1970
1975
1980
1985
1990
1995
2000
Year


Baseflow Averaged Between the Allentown and Schnecksville Gages
Baseflow, inches
25
20
15
10
5
0
1965
1970
1975
1980
1985
1990
1995
2000
Year


Streamflow Averaged Between the Allentown and Schnecksville Gages
Streamflow, inches
Year
0
5
10
15
20
25
30
35
40
1965
1970
1975
1980
1985
1990
1995
2000


Precipitation Averaged Between the Allentown and Schnecksville Gages
Precipitation, inches
70
60
50
40
30
20
1965
1970
1975
1980
1985
1990
1995
2000
Year


Storm Runoff (Streamflow-Baseflow)
(Averaged Between the Allentown and Schnecksville Gages)
Storm Runoff, inches
20.00
18.00
16.00
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
1965
1970
1975
1980
1985
1990
1995
2000
Year

APPENDIX B

WATER QUALITY MONITORING DATA AND ANALYSIS

Table B1. 1999 Water Quality Parameter Averages

Site #	Air Temp. (°C)	Water Temp. (°C)	pH	Dissolved Oxygen (mg/L)	Specific Conductance (μmhos)	(NH4 +) Ammonia (mg/L)	(PO4) Phospate (mg/L)	(NO3) Nitrate (mg/L)	Dissolved Solids (mg/L)	Total Hardness (mg/L)	Calcium Hardness (mg/L)	Alkalinity (mg/L)
1	27.10	22.80	8.10	11.10	774.30	0.11	0.11	9.20	495.50	263.00	142.80	168.60
2	27.30	23.00	8.30	11.50	792.30	0.02	0.19	7.00	506.50	248.00	164.80	162.00
4	26.00	24.70	8.10	8.80	1281.30	0.07	0.72	7.20	821.30	326.00	173.60	223.20
5	27.00	23.70	8.40	8.70	252.10	0.01	0.13	9.50	161.00	95.00	71.00	47.50
7	26.00	21.30	7.80	8.60	318.70	0.04	0.03	5.50	204.00	119.00	81.80	69.80
8	27.00	24.30	7.30	6.70	232.30	0.05	0.03	3.80	148.80	80.00	55.20	57.60
10	27.00	23.20	8.60	9.60	218.30	0.03	0.01	5.30	139.50	83.00	51.30	49.50
11	26.00	23.00	8.20	10.10	235.00	0.05	0.11	16.30	150.60	86.00	52.00	40.30
11.5	28.00	26.20	8.70	10.10	207.40	0.03	0.02	4.60	132.80	81.00	44.40	50.60
12	28.50	24.90	8.10	9.30	232.60	0.14	0.02	6.30	148.80	88.00	48.80	52.70
13	31.00	24.90	8.70	9.90	196.00	0.02	0.01	3.70	125.60	78.00	42.80	49.60
14	25.00	24.10	8.80	10.00	193.00	0.02	0.04	5.20	123.40	73.00	53.60	52.80
15	25.50	22.80	8.00	8.80	203.60	0.13	0.05	4.40	130.60	83.00	53.20	58.30
17	28.10	20.20	7.20	8.30	89.90	0.02	0.02	6.80	57.60	30.00	17.60	22.00

Table B2. Weekly Water Quality Data, Summer 1998 and Summer 1999

site #	date	water temperature	dissolved oxygen	specific conductance	pH	dissolved solids	alkalinity	total hardness	calcium hardness	nitrate	ammonia nitrogen	phosphate	discharge	turbidity
		°c	mg/L O_2	µmhos		mg/L TDS	mg/L $CaCo_3$	mg/L $CaCo_3$	mg/L Ca	mg/L NO_3	mg/L NH_4	mg/L PO_4	ft^3/s	NTU
1	6/3/1999	21.9	8.4	522	7.92	334	127	170	114				53.44	
1	6/29/1999	24.4	8.7	863	7.85	552	186.5	265	150				18.07	6
1	7/14/1999	20.7	12.52	872	8.19	558	197.5	300	134				11.58	10
1	7/28/1999	24.4	14.99	840	8.42	538	171	325	166				14.99	3
1	7/2/1998	21.0	9.8	410	8.22	206	91	155	42	13.2	1	0.11		3
1	7/7/1998	21.2	11.7	435	8.6	218	121	175	50	12.32	0.048	0.09	44.28	27
1	7/14/1998	22.2	10.5	200	8.62	250	145	210		9.68	0.028	0.18	36.38	3
1	7/21/1998	23.5	11.8	607	8.35	304	159	250	196	8.36	0	0.23	28.61	0
1	7/28/1998	22.5	14.2	638	8.44	319	159	290	150	8.58	0.04	0.2	22.48	0
1	8/6/1998	22.5		765	8.2	382	171	290	196	10.34	0.028	0.23	27.9	0
1	8/13/1998	21.0	10.6	850		424	178	260	205	8.14	0.004	0.36	27.26	3
1	8/18/1998	21.9	9.4	660		329	182	250	175	7.92	0.035	0.3	27.96	10
1	1999 average	22.9	11.15	774.3	8.1	495.5	168.6	263	143	24.64	0.65	0.45	26.29	6
1	1998 average	22.0	11.14	570.6	8.41	304	150.8	235	145	9.82	0.148	0.21	30.7	6
1	98-99 average	22.3	11.15	638.5	8.28	367.8	157.6	246	144	11.46	0.204	0.24	28.86	6
2	6/3/1999	22.8	9.74	571	8.27	365	119	170	150				43.08	
2	6/17/1999						164	235	166				13.61	
2	6/29/1999	25.3	10.99	835	8.22	534	161	260	185				8.37	6
2	7/28/1999	23.8	15.72	847	8.48	542	171	300	166				9.12	6
2	7/2/1998	21.1	9.5	433	8.08	216	107	135	61	12.76	2	0.23		10
2	7/7/1998	21.2	9.6	397	8.44	199	106	150	69	13.2	0.48	0.2	26.16	24
2	7/14/1998	22.4	12.1	434	8.85	218	119	180		8.8	0.028	0.27	20.1	10
2	7/21/1998	22.2	11.3	578	8.61	289	119	220	175	6.38	0.035	0.27	15.86	0
2	7/28/1998	22.0	13.6	621	8.46	310	117	215	134	7.4	0.06	0.25	10.58	3
2	8/6/1998	22.2	10.8	778	8	388	139	250	185	8.36	0.035	0.2	11.45	0
2	8/13/1998	20.9		830		415	139	250	175	6.82	0.035	0.25	10.99	10
2	8/18/1998	21.0	10	760		380	178	250	205	6.6	0.015	0.18	10.28	15

site #	date	water temperature	dissolved oxygen	specific conductance	pH	dissolved solids	alkalinity	total hardness	calcium hardness	nitrate	ammonia nitrogen	phosphate	discharge	turbidity
		°c	mg/L O_2	µmhos		mg/L TDS	mg/L $CaCo_3$	mg/L $CaCo_3$	mg/L Ca	mg/L NO_3	mg/L NH_4	mg/L PO_4	ft^3/s	NTU
2	1999 average	23.0	12.94	792.3	8.31	506.5	162	248	165	5.15	0.008	0.3	16.61	7

Table B2. Weekly 1998 and 1999 water quality data

2	1998 average	21.6	10.99	603.9	8.41	301.9	128	206	143	8.79	0.336	0.23	15.06	9
2	98-99 average	22.1	11.69	666.7	8.37	370.1	141.1	222	152	8.39	0.3	0.24	15.71	9
4	6/3/1999	23.8	8.36	497	8.05	319	97	150	91				44.27	
4	6/17/1999						191	270	205				6.9	
4	6/29/1999	26.8	8.19	1576	8.15	1010	299	410	134				4.38	10
4	7/14/1999	22.6	8.68	1459	8.06	936	271	400	196				6.57	10
4	7/2/1998	21.2	8	431	7.73	216	82	125	17	9.68	4	0.2		6
4	7/7/1998	23.3	11	427	8.48	215	87	135	19	10.78	0.28	0.5	18.34	19
4	7/14/1998	24.7	10.6	515	8.45	257	142	180		7.48	0.02	0.36	12.76	19
4	7/21/1998	25.2	6.9	934	8.05	466	164	270	242	5.5	0	0.27	5.23	0
4	7/28/1998	24.1	8	1313	7.87	657	195	300	218	5.28	0.085	0.2	2.54	10
4	8/6/1998	24.9	9.9	1230	7.95	613	221	310	218	9.24	0.02	0.15	0.88	0
4	8/13/1998	23.5	8.4	1205		603	168	250	185	9.68	0.04	0.5	2.76	12
4	8/18/1998	23.4	8.5	1226		613	288	300	255	5.37	0.055	0.27	19.64	19
4	1999 average	24.7	8.77	1281.3	8.14	821.3	223.2	326	174				15.53	8
4	1998 average	23.8	8.91	910.1	8.09	455	168.4	234	165	7.88	0.563	0.31	8.88	11
4	98-99 average	24.1	8.87	1033.8	8.11	577.1	189.5	269	169	7.88	0.563	0.31	11.3	10
5	6/3/1999	23.7	9.6	252	8.41	161	41	87	69				39.66	
5	6/17/1999						54	102	73				4.06	
5	7/2/1998	20.7	8.1	207	7.47	104.4	37	82	16	13.64	5	0.13		6
5	7/7/1998	23.6	9.4	228	8.38	115.1	49	85	8	10.56	0.028	0.61	17.96	10
5	7/14/1998	24.9	9.5	246	8.75	123.7	47	90		9.24	0.028	0.42	7.49	21
5	7/21/1998	24.8	8.6	256	8.55	129.2	58	100	96	6.38	0	0.48	0	0
5	7/28/1998	21.3	7.5	349	7.62	175	84	140	126	5.5	0.076	0.33		0
5	8/6/1998	18.1	9	472	7.62	234	142	220	166	20.24	0.008	0.2		0
5	8/13/1998	22.7	6.8	262		130	50	90	86	5.15	0.07	0.33	0	3

site #	date	water temperature	dissolved oxygen	specific conductance	pH	dissolved solids	alkalinity	total hardness	calcium hardness	nitrate	ammonia nitrogen	phosphate	discharge	turbidity
		^{o}c	mg/L O_2	µmhos		mg/L TDS	mg/L $CaCo_3$	mg/L $CaCo_3$	mg/L Ca	mg/L NO_3	mg/L NH_4	mg/L PO_4	ft^3/s	NTU
5	8/18/1998	24.1	9.6	271		135	74	85	73	5.94	0.015	0.27	18.11	27
5	1999 average	23.7	9.6	252	8.41	161	47.5	95	71				21.86	
5	1998 average	22.5	8.56	286.4	8.07	143.3	67.6	112	82	9.58	0.653	0.35	8.71	8
5	98-99 average	22.7	8.68	282.6	8.11	145.3	63.6	108	79	9.58	0.653	0.35	12.47	8

Table B2. Weekly 1998 and 1999 water quality data

7	6/3/1999	20.4	8.63	265	7.85	170	53	105	69				8.85	
7	6/17/1999						67	120	86				3.32	
7	6/29/1999	24.2	8.04	341	7.72	218	67	122	86				1	6
7	7/14/1999	19.5	7.75	350	7.68	224	92	130	86				0.15	6
7	7/1/1998	21.7	10	269		135.2	71	110	8	9.46	0	0.09		3
7	7/7/1998	20.5	9	275	7.79	139	57	110	8	6.38	0.02	0.27	2.09	3
7	7/14/1998	21.3	8.8	278	7.84	139	87	110		5.72	0.008	0.27	1.52	12
7	7/21/1998	23.3	7.3	288	7.19	145.5	65	120	119	4.18	0	0.33	1.22	0
7	7/28/1998	21.6	8.9	292	7.35	145	74	119	96	3.3	0.085	0.23	0.53	3
7	8/4/1998	21.8	8	287	7.68	144.6	95	125	91	2.46	0	0.27	0.18	0
7	8/13/1998	21.4	8.8	304		152.6	73	125	114	1.98	0.003	0.27	0.35	3
7	8/18/1998	21.9	9	312		157.1	115	120	107	3.26	0	0.2	2.24	19
7	1999 average	21.3	8.14	318.7	7.75	204	69.8	119	82				3.33	6
7	1998 average	21.7	8.73	288.1	7.57	144.8	79.6	117	78	4.59	0.015	0.24	1.16	5
7	98-99 average	21.6	8.53	298.3	7.65	164.5	75.8	118	79	4.59	0.015	0.24	2.06	6
8	6/3/1999	22.1	7.18	195	7.36	125	36	81	50				46.94	
8	6/17/1999						60	83	55				13.4	
8	6/29/1999	26.3	5.57	237	7.19	152	54	86	50				9.41	15
8	7/14/1999	22.0	6.49	250	7.31	160	72	95	52				3.81	10
8	7/28/1999	26.9	6.88	247	7.51	158	66	97	69				2.5	0
8	7/1/1998	22.6	9.95	184		92	42.5	72	7	15.18	0	0.09		6
8	7/7/1998	22.1	7.3	194.6	7.46	97.4	45	80	7	9.24	0.028	0.3	18.44	21
8	7/14/1998	22.9	6.9	196.8	7.19	98.6	44	80		4.07	0.02	0.36	19.46	19

site #	date	water temperature	dissolved oxygen	specific conductance	pH	dissolved solids	alkalinity	total hardness	calcium hardness	nitrate	ammonia nitrogen	phosphate	discharge	turbidity
		°c	mg/L O_2	µmhos		mg/L TDS	mg/L $CaCo_3$	mg/L $CaCo_3$	mg/L Ca	mg/L NO_3	mg/L NH_4	mg/L PO_4	ft^3/s	NTU
8	7/21/1998	24.5	5.4	199	7.15	100.1	62	80	73	5.28	0.015	0.3	11.4	0
8	7/28/1998	23.6	5.6	199.9	7.33	100.6	58	80	55	3.3	0.076	0.3	7.38	6
8	8/4/1998	23.6	7	195.8	7.78	97.9	62	89	65	14.3	0.028	0.25	6.16	0
8	8/13/1998	22.9	5.2	204		102.5	43	81	59	3.48	0.04	0.3	9.27	12
8	8/18/1998	22.2	7.2	199		100.5	72	78	61	4.75	0.015	0.25	34.97	19
8	1999 average	24.3	6.53	232.3	7.34	148.8	57.6	88	55				15.21	8
8	1998 average	23.1	6.82	196.6	7.38	98.7	53.6	80	47	7.45	0.028	0.27	15.3	10
8	98-99 average	23.5	6.72	208.5	7.36	115.4	55.1	83	50	7.45	0.028	0.27	15.26	10

Table B2. Weekly 1998 and 1999 water quality data

10	6/17/1999						42.5	82	55				12.81	
10	7/14/1999	21.3	11.91	231	8.92	147	62	90	59	13.86			3.19	19
10	7/27/1999	23.2	10.38	223	8.9	143	54	90	50					3
10	7/1/1998	23.0	10	178.1		89	72	75	28		0	0.09		15
10	7/6/1998	24.5	10	185.9	9.08	94.9	18	75	8	14.3	0.055	0.15	20.16	6
10	7/13/1998	26.6	7.6	189.2	9.17	94.7	42.5	80		11.22	0.035	0.27	21.69	12
10	7/21/1998	22.7	8.1	195	8.25	97.5	39	70	61	6.82	0	0.25	13.6	0
10	7/28/1998	21.4	9.2	196.2	8.25	98	63	85	52	6.38	0.07	0.2	8.63	0
10	8/4/1998	26.5	10	199	8.81	100.1	59	95	65	5.06	0.008	0.18	9.36	0
10	8/13/1998	21.9	10.42	200	8.21	100.9	44	85	69	4.4	0.04	0.18	11.76	19
10	8/18/1998	21.6	9.3	188.8		94.4	70	72	44	4.4	0.008	0.27	22.57	21
10	1999 average	23.2	10.23	218.3	8.61	139.5	49.5	83	51	11.79	0.455	0.3	14.23	11
10	1998 average	23.5	9.33	191.5	8.63	96.2	50.9	80	47	7.51	0.027	0.2	15.4	9
10	98-99 average	23.4	9.63	200.4	8.62	110.6	50.4	81	49	8.54	0.113	0.22	14.97	10
11	6/1/1999	21.3	8.96	209	8.02	134	34	79	44				7.93	
11	6/15/1999	21.3	8.81	234	7.86	150	43	82	59				3.58	
11	6/28/1999	25.1	9.27	242	8.29	155	39.5	85	52				1.78	10
11	7/13/1999	21.2	10.39	251	8.54	161	43	92	50				2.94	10
11	7/27/1999	26.0	10.51	239	8.46	153	42	90	55				1.6	3

site #	date	water temperature	dissolved oxygen	specific conductance	pH	dissolved solids	alkalinity	total hardness	calcium hardness	nitrate	ammonia nitrogen	phosphate	discharge	turbidity
		^{o}c	mg/L O_2	µmhos		mg/L TDS	mg/L $CaCo_3$	mg/L $CaCo_3$	mg/L Ca	mg/L NO_3	mg/L NH_4	mg/L PO_4	ft^3/s	NTU
11	7/1/1998	20.1	9.7	192.4		96.2	43	82	36	11.44	0	0.2		21
11	7/6/1998	20.5	9.2	201	8.34	100	13	80	11	15.4	0.02	0.27	5.32	12
11	7/13/1998	21.6	8.9	206	8.41	103.7	43	75		15.4	0	0.39	4.13	6
11	7/21/1998	20.7	7.8	210	7.33	105.8	42	85	78	17.38	0.035	0.45	2.91	0
11	7/27/1998	22.1	9.3	217	7.55	108	34	85	69	16.28	0.055	0.36		0
11	8/4/1998	20.9	9.6	223	8.32	112.4	80	92	61	16.28	0.008	0.3	1.33	0
11	8/12/1998	22.6	10	226	7.84	113.9	67	95	73	10.78	0	0.39	1.54	0
11	8/17/1998	22.1		199		100.2	58	75	52	12.32	0.035	0.25	7.13	19
11	1999 average	23.0	9.59	235	8.23	150.6	40.3	86	52				3.57	8
11	1998 average	21.3	9.21	209.3	7.97	105	47.5	84	54	14.41	0.019	0.33	3.73	7
11	98-99 average	22.0	9.37	219.2	8.09	122.6	44.7	84	53	14.41	0.019	0.33	3.65	7

Table B2. Weekly 1998 and 1999 water quality data

11.5	6/1/1999	24.8	9.18	195	8.41	125	41	76	32				12.57	
11.5	6/15/1999	25.1	10	206	8.64	132	53	78	47				9.98	
11.5	6/28/1999	28.7	9.49	209	8.77	133	50	78	44				4.8	10
11.5	7/13/1999	23.9	10.66	218	8.71	140	55	87	47				2.07	12
11.5	7/27/1999	28.7	14.12	209	9.15	134	54	85	52				0.34	6
11.5	6/25/1998	25.3	9.4	169	8.8		15.5	70	4	11.66	0	0.02		0
11.5	7/6/1998	23.6	9.2	178.1	8.81	89	14.5	70	9	10.78	0.035	0.11	16.78	15
11.5	7/13/1998	24.0	9	183.9	8.99	92	34	70		9.68	0.008	0.25	14.96	10
11.5	7/20/1998	25.5	9.8	181.7	8.78	90.8	46	70	59	8.58	0.35	0.3	11.83	0
11.5	7/27/1998	24.6	10.6	181.4	9.1	90.7	45	75	50	3.39	0.028	0.2		3
11.5	8/4/1998	22.5	10.2	186.9	8.51	93.5	56	79	55	4.75	0.008	0.2	5.96	0
11.5	8/12/1998	24.7	10.6	199	7.94	100	77	79	69	3.7	0.003	0.25	7.22	0
11.5	8/17/1998	23.0	9.2	178.7		89.4	67	72	47	2.95	0	0.13	13.72	19
11.5	1999 average	26.2	10.69	207.4	8.74	132.8	50.6	81	44				5.95	9
11.5	1998 average	24.2	9.75	182.3	8.7	92.2	44.4	73	42	6.94	0.054	0.18	11.75	6
11.5	98-99 average	25.0	10.11	192	8.72	109.1	46.8	76	43	6.94	0.054	0.18	9.11	7

site #	date	water temperature	dissolved oxygen	specific conductance	pH	dissolved solids	alkalinity	total hardness	calcium hardness	nitrate	ammonia nitrogen	phosphate	discharge	turbidity
		^{o}c	mg/L O_2	µmhos		mg/L TDS	mg/L $CaCo_3$	mg/L $CaCo_3$	mg/L Ca	mg/L NO_3	mg/L NH_4	mg/L PO_4	ft^3/s	NTU
12	6/1/1999	24.4	8.02	213	7.77	136	42.5	81	47				5.56	
12	6/15/1999	24.5	8.87	228	8.06	146	52	84	42				3.06	
12	6/28/1999	27.9	9.37	236	8.45	151	52	83	44				1.7	15
12	7/13/1999	24.0	11	239	8.66	153	59	90	50				0.97	12
12	7/28/1999	23.8	9.5	247	7.68	158	58	100	61					3
12	6/25/1998	24.9	9.8	187	8.24		20	72	8	12.1	0	0		0
12	7/6/1998	22.2	9.4	196.5	8.38	98.8	20	80	18	11.22	0.035	0.15	4.66	19
12	7/13/1998	22.7	9.5	203	7.26	102.4	35	75		10.56	0.015	0.27	4.02	15
12	7/20/1998	24.4	9.1	203	8.37	101	35	80	52	8.58	0	0.3	2.5	3
12	7/27/1998	22.6	8.5	208	8.34	103	45	85	69	6.28	0	0.27		19
12	8/4/1998	20.7	9.8	200	7.85	100.7	73	90	65	5.37	0	0.11	1.8	0
12	8/12/1998	22.6	9.7	222	7.69	112.1	73	87	82	4.58	0.028	0.27	2.04	0
12	8/17/1998	22.6	8.4	200		100.8	72.5	80	55	3.7	0.015	0.11	5.6	21
12	1999 average	24.9	9.35	232.6	8.12	148.8	52.7	88	49				2.82	10
12	1998 average	22.8	9.28	202.4	8.02	102.7	46.7	81	50	7.8	0.012	0.19	3.44	10
12	98-99 average	23.6	9.3	214	8.06	121.9	49	84	49	7.8	0.012	0.19	3.19	10

Table B2. Weekly 1998 and 1999 water quality data

13	6/1/1999	25.6	9.34	180	8.66	115	36	67	32				8.84	
13	6/15/1999	25.4	10.19	193	8.8	124	48	76	39				6.32	
13	6/28/1999	28.8	11.78	190	9	122	50	68	36				2.92	10
13	7/13/1999	23.7	11.17	204	8.9	131	59	82	52				1.2	10
13	7/28/1999	20.9	8.4	213	7.91	136	55	95	55				1.17	6
13	6/25/1998	24.5	10	163	8.43		15.5	65	7	9.24	0	0.02		10
13	7/6/1998	21.4	10.6	169	9.09	84.5	22	70	19	13.2	0.048	0.07	10.95	15
13	7/13/1998	21.9	9.7	172.9	9.15	86.4	32	70		11.22	0.003	0.25	9.74	21
13	7/20/1998	24.4	9.5	168.5	8.99	84.4	30	70	50	8.58	0.003	0.42	6.04	6
13	7/27/1998	22.6	10	1723	8.91	86.1	51	75	47	5.15	0.048	0.18		10
13	8/3/1998	21.4	9.4	185.5	7.88	86.7	39	74	55	4.4	0.015	0.13	4.12	0
13	8/12/1998	22.9	10	190.2	7.98	95.1	66	80	52	4.4	0.003	0.25	6.9	0
13	8/17/1998	23.2	9.2	172.5		86.2	72	70	42	3.26	0.008	0.18	8.42	12

site #	date	water temperature	dissolved oxygen	specific conductance	pH	dissolved solids	alkalinity	total hardness	calcium hardness	nitrate	ammonia nitrogen	phosphate	discharge	turbidity
		^{o}c	mg/L O_2	µmhos		mg/L TDS	mg/L $CaCo_3$	mg/L $CaCo_3$	mg/L Ca	mg/L NO_3	mg/L NH_4	mg/L PO_4	ft^3/s	NTU
13	1999 average	24.9	10.18	196	8.65	125.6	49.6	78	43				4.09	9
13	1998 average	22.8	9.8	368.1	8.63	87.1	40.9	72	39	7.43	0.016	0.19	7.7	9
13	98-99 average	23.6	9.94	301.9	8.64	103.1	44.3	74	41	7.43	0.016	0.19	6.06	9
14	6/1/1999	23.7	9.81	181	8.64	116	47	65	39				4.71	
14	6/15/1999	23.0	9.84	193	8.51	123	57	70	55				6.03	
14	6/28/1999	26.6	11.45	191	9.09	122	49	69	50				1.9	12
14	7/13/1999	21.2	10.97	203	8.69	130	56	82	65				1.08	6
14	7/27/1999	25.8	14.53	197	8.86	126	55	80	59				0.61	6
14	6/25/1998	22.6	9.4	1.7	8.34		16.5	70	11	13.86	0	0.09		3
14	7/6/1998	20.6	10.2	169.3	8.24	84.7	27	70	28	13.64	0.028	0.07	11.88	12
14	7/13/1998	20.4	9.2	171.9	8.5	85.9	34	70		9.24	0	0.27	10.04	12
14	7/20/1998	23.1	9.8	166.8	7.96	83.2	32	65	55	5.5	0.008	0.27	7.66	6
14	7/27/1998	21.1	7.9	169.5	7.8	84.6	44	78	50	8.36	0.003	0.3		12
14	8/3/1998	18.1	8.4	177	7.62	88.5	50	76	50	3.6	0	0.25	3.8	0
14	8/12/1998	21.5	9.8	195.2	7.87	97.6	66	80	61	5.37	0.02	0.36	5.22	0
14	8/17/1998	21.7	8.4	175.3		87.6	70	70	50	4.93	0	0.3	8.22	12
14	1999 average	24.1	11.32	193	8.76	123.4	52.8	73	54				2.87	8
14	1998 average	21.1	9.14	153.3	8.05	87.4	42.4	72	44	8.06	0.007	0.24	7.8	7

Table B2. Weekly 1998 and 1999 water quality data

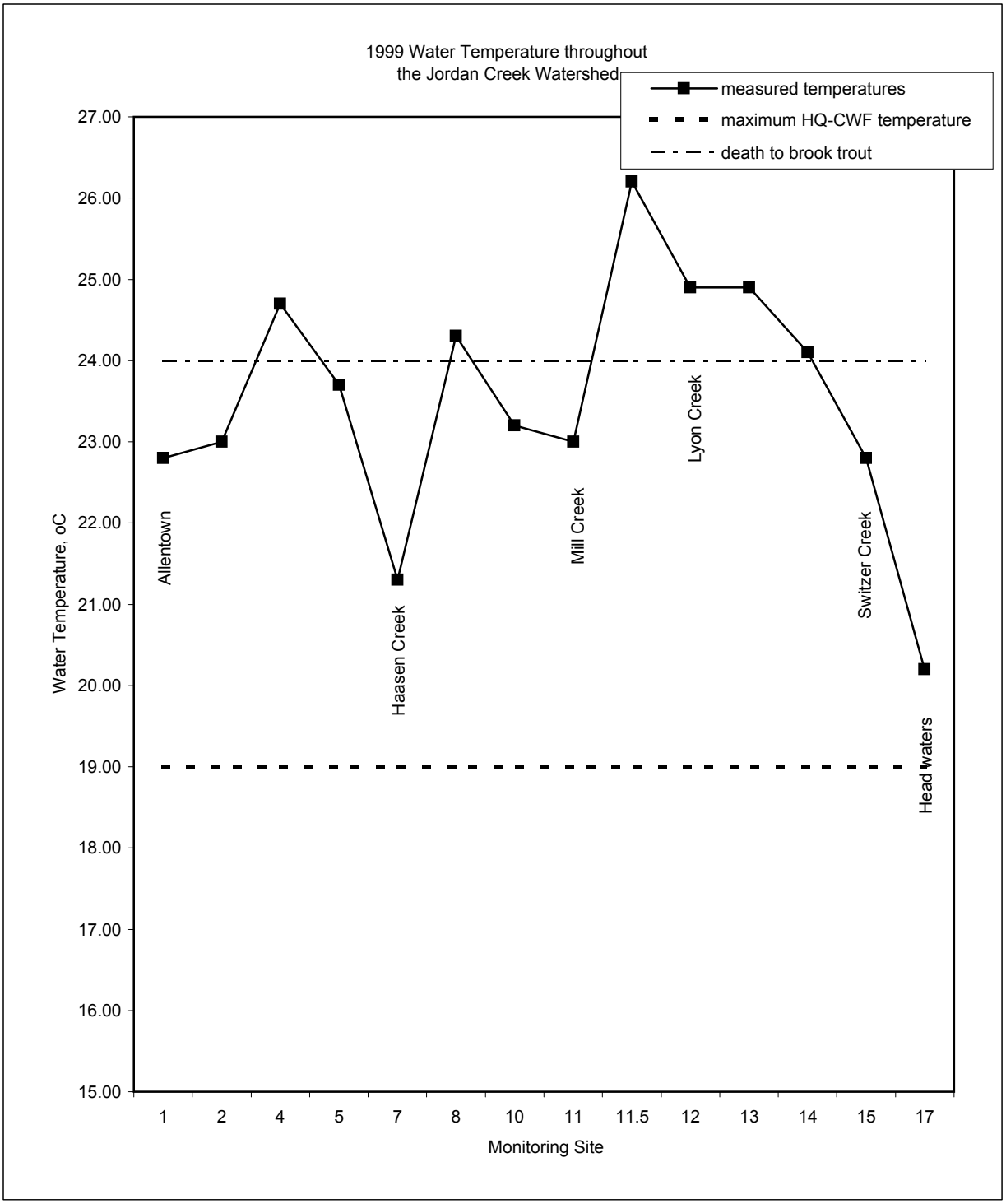
14	98-99 average	22.3	9.98	168.6	8.34	102.4	46.4	73	48	8.06	0.007	0.24	5.56	7
15	6/1/1999	22.6	8.61	194	7.88	125	47	80	52				3.11	
15	6/15/1999	21.6	8.87	205	7.89	131	57	81	50				1.86	
15	6/28/1999	25.0	8.16	209	7.75	134	63	82	55				0.9	21
15	7/13/1999	19.4	8.98	208	7.82	133	77	90	50				----	10
15	7/27/1999	25.3	11.96	202	8.55	130	47.5	83	59					3
15	6/25/1998	22.5	8.8	184	7.68		13	72	13	14.3	0.028	0.02		0
15	7/6/1998	19.5	9.2	188.1	7.6	94.1	31	75	34	13.64	0.048	0	3.81	10
15	7/13/1998	19.9	8.9	191	7.95	95.7	39.5	80		10.34	0.003	0.33	3.33	19
15	7/20/1998	23.7	8.1	187	7.59	93.1	52	85	69	8.14	0.02	0.33	2.61	0

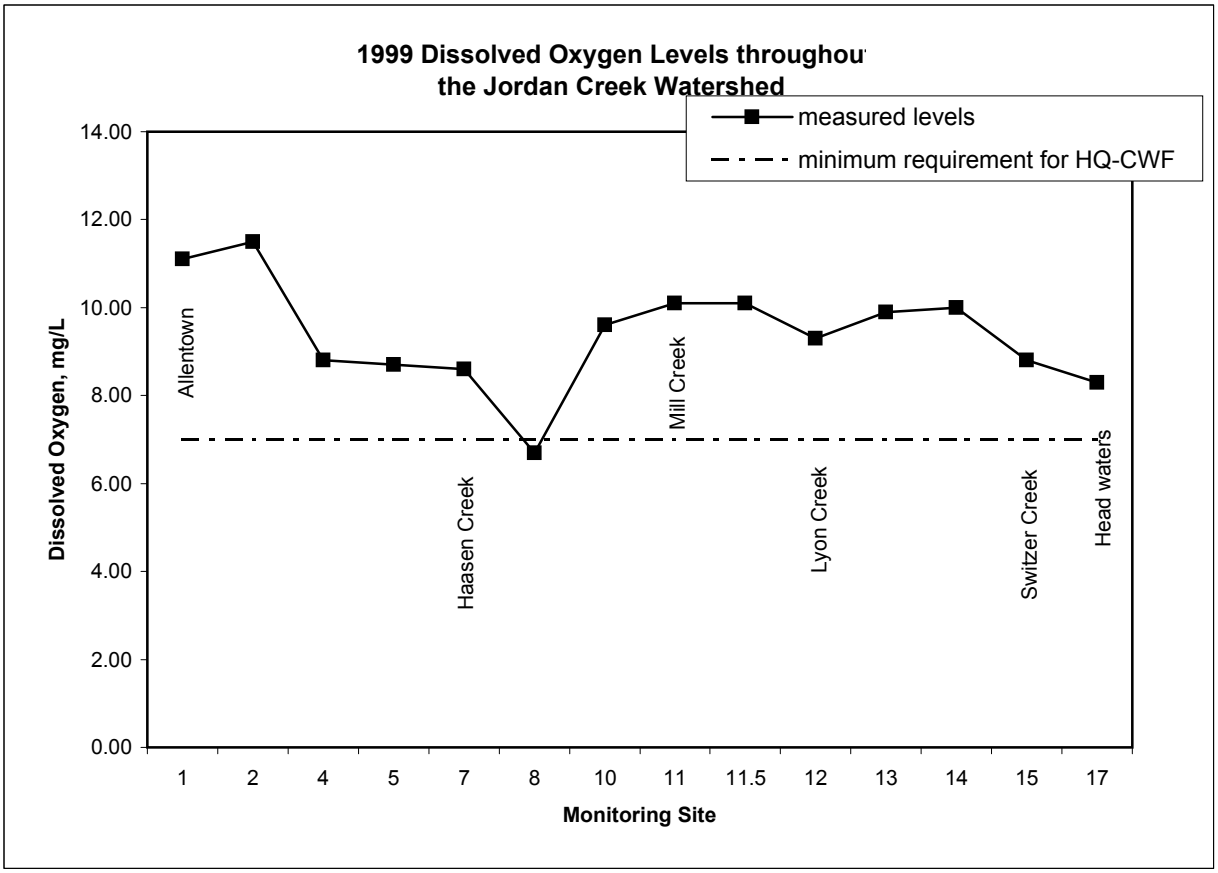
site #	date	water temperature °c	dissolved oxygen mg/L O_2	specific conductance µmhos	pH	dissolved solids mg/L TDS	alkalinity mg/L $CaCo_3$	total hardness mg/L $CaCo_3$	calcium hardness mg/L Ca	nitrate mg/L NO_3	ammonia nitrogen mg/L NH_4	phosphate mg/L PO_4	discharge ft^3/s	turbidity NTU
15	7/27/1998	21.1	7.95	185.5	7.43	92.1	47	75	55	4.93	0.04	0.2		15
15	8/3/1998	18.0	7.8	185.3	7.73	92.9	51	78	55	5.37	0.008	0.23	0.81	3
15	8/12/1998	21.7	9.1	210	7.06	104	80	82	78	4.58	0.07	0.23	0.84	0
15	8/17/1998	22.2	8.2	180.2		90.8	69	75	52	3.7	0.035	0.23	3.73	27
15	1999 average	22.8	9.32	203.6	7.98	130.6	58.3	83	53				1.96	11
15	1998 average	21.1	8.51	188.9	7.58	94.7	47.8	78	51	8.12	0.032	0.2	2.52	9
15	98-99 average	21.7	8.82	194.5	7.74	109.6	51.8	80	52	8.12	0.032	0.2	2.33	10
17	6/1/1999	17.2	8.24	86.5	7.25	55.4	23	30	19				1.45	
17	6/15/1999	23.0	8.47	99.4	7.17	63.6	28	35	19				1.48	
17	6/28/1999	21.5	7.37	90.2	7.05	57.9	20	30	17				0.65	0
17	7/13/1999	17.4	8.05	89.4	7.07	57.2	23	30	14				0.55	3
17	7/27/1999	21.9	8.95	84	7.28	54	16	26	19					6
17	6/25/1998	18.9	8.7	109	6.1		11	50	13	18.48	0.003	0.02		0
17	7/6/1998	16.8	9.1	97.1	7.79	48.5	2	40	16	14.3	0.008	0.05	2.73	6
17	7/13/1998	17.4	8.8	94.6	7.94	47.5	2	35		14.3	0.008	0.05	1.58	6
17	7/20/1998	13.8	7.8	90.5	7.3	45.3	13	35	18	9.68	0.003	0.27	2.16	0
17	7/27/1998	17.6	8.2	89.4	7.65	44.7	19	40	14	7.48	0.055	0.18		15
17	8/3/1998	17.2	7.8	85	7.46	42.7	20.5	30	16	5.94	0.04	0.2	1.86	0
17	8/12/1998	19.5	8.2	98	7.57	49	44	30	22	18.92	0.035	0.33	1.66	0
17	8/17/1998	19.9	8.2	87.6		43.7	39	25	16	5.72	0.003	0.13	1.22	21
17	1999 average	20.2	8.22	89.9	7.16	57.6	22	30	18				1.03	3

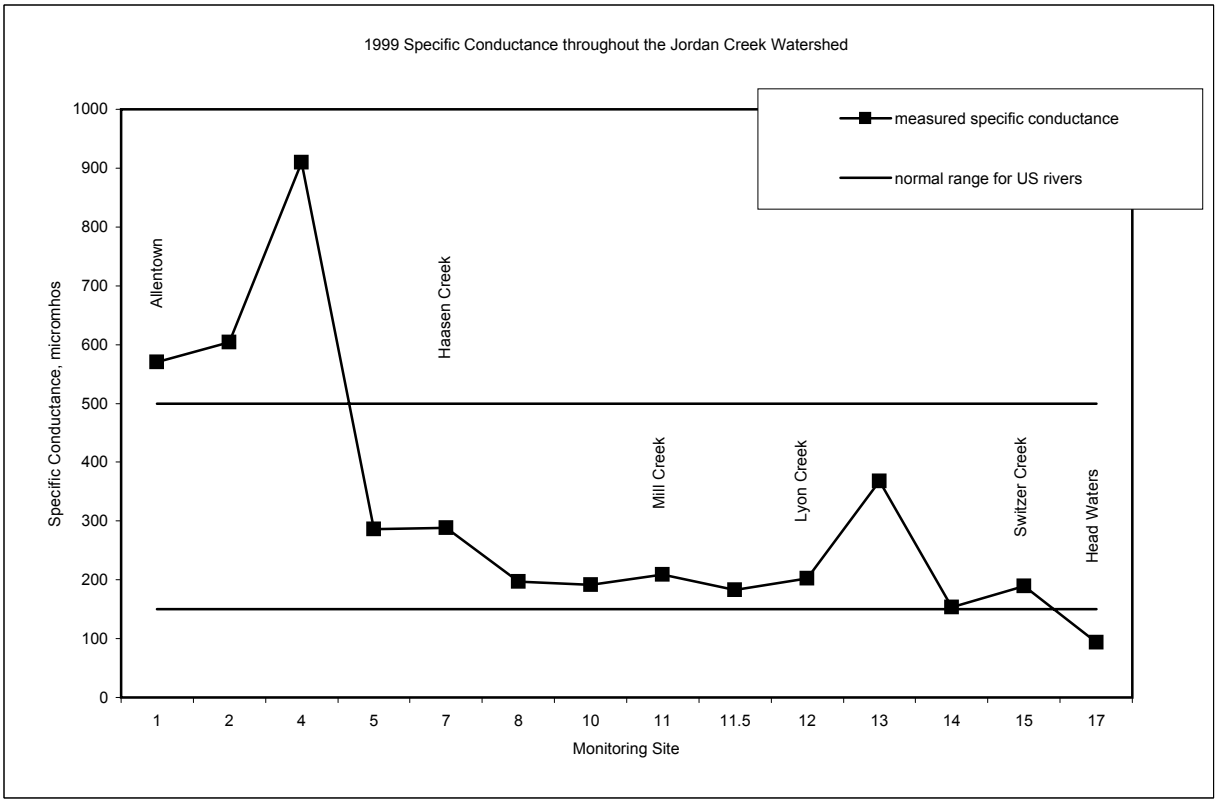
Table B2. Weekly 1998 and 1999 water quality data

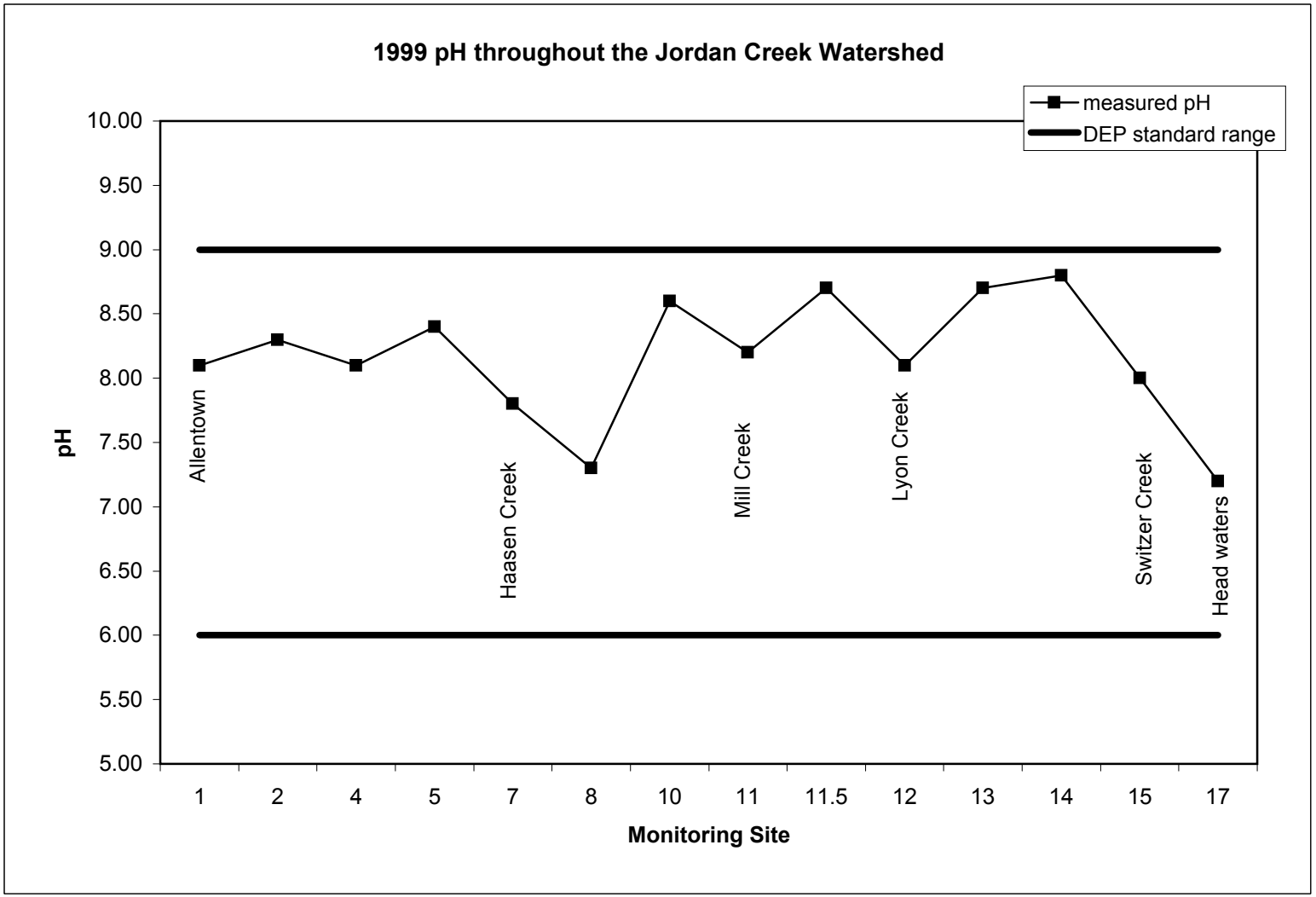
17	1998 average	17.6	8.35	93.9	7.4	45.9	18.8	36	16	11.85	0.019	0.15	1.87	6
17	98-99 average	18.6	8.3	92.4	7.3	50.8	20	34	17	11.85	0.019	0.15	1.53	5

Table B2. Weekly 1998 and 1999 water quality data


1999 Water Temperature throughout
the Jordan Creek Watershed
measured temperatures
maximum HQ-CWF temperature
death to brook trout
Water Temperature, oC
27.00
26.00
25.00
24.00
23.00
22.00
21.00
20.00
19.00
18.00
17.00
16.00
15.00
Allentown
Haasen Creek
Mill Creek
Lyon Creek
Switzer Creek
Head Waters
1
2
4
5
7
8
10
11
11.5
12
13
14
15
17
Monitoring Site


1999 Dissolved Oxygen Levels throughou
the Jordan Creek Watershed
measured levels
minimum requirement for HQ-CWF
Dissolved Oxygen, mg/L
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
Allentown
Haasen Creek
Mill Creek
Lyon Creek
Switzer Creek
Head waters
1
2
4
5
7
8
10
11
11.5
12
13
14
15
17
Monitoring Site


1999 Specific Conductance throughout the Jordan Creek Watershed
measured specific conductance
normal range for US rivers
Specific Conductance, micromhos
1000
900
800
700
600
500
400
300
200
100
0
Allentown
Haasen Creek
Mill Creek
Lyon Creek
Switzer Creek
Head Waters
1
2
4
5
7
8
10
11
11.5
12
13
14
15
17
Monitoring Site


1999 pH throughout the Jordan Creek Watershed
measured pH
DEP standard range
10.00
9.50
9.00
8.50
8.00
7.50
7.00
6.50
6.00
5.50
5.00
pH
Allentown
Haasen Creek
Mill Creek
Lyon Creek
Switzer Creek
Head waters
1
2
4
5
7
8
10
11
11.5
12
13
14
15
17
Monitoring Site

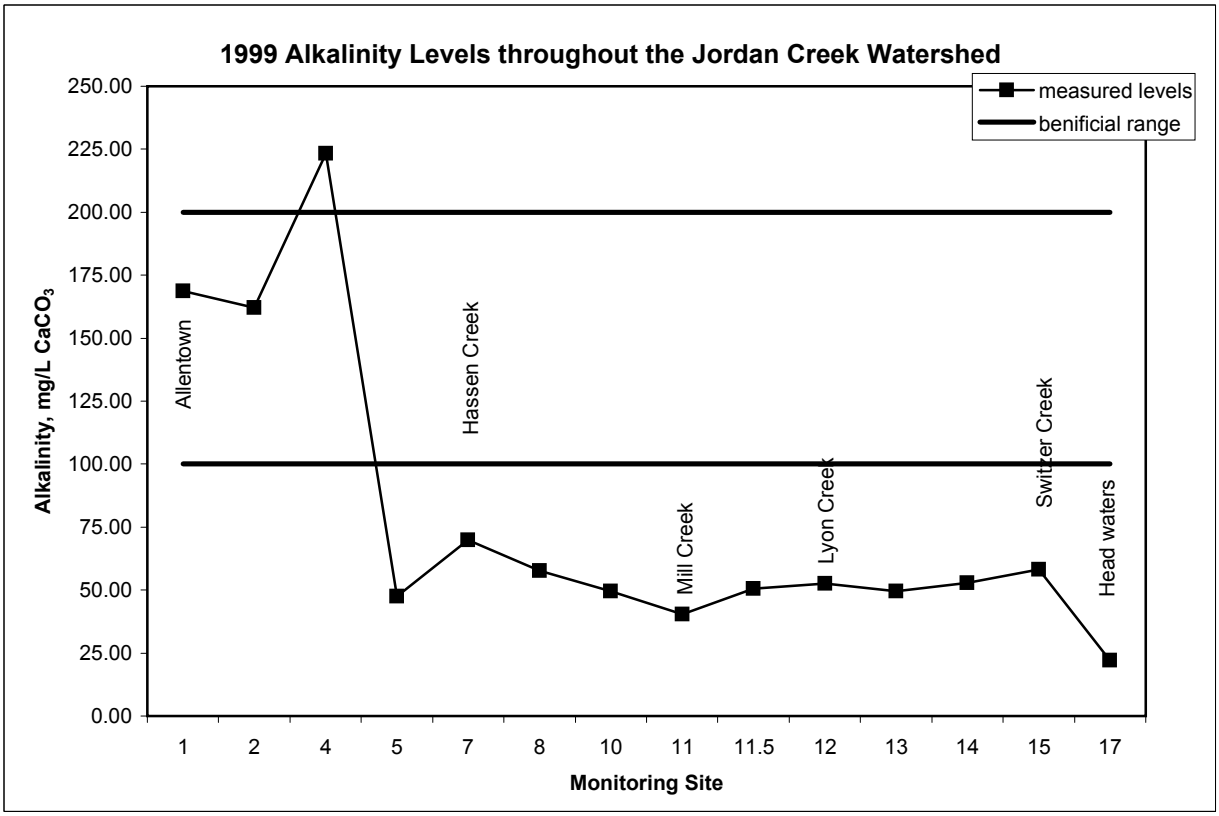
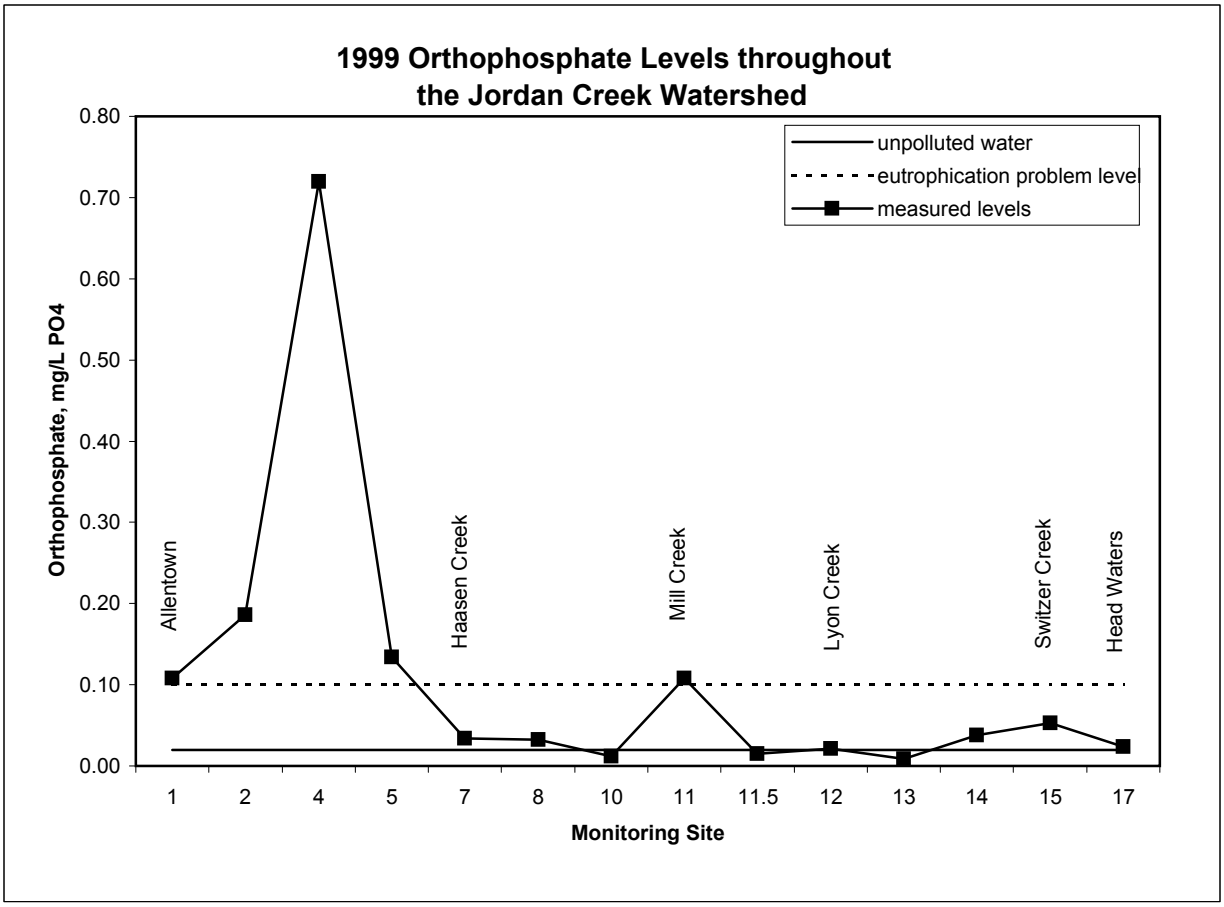
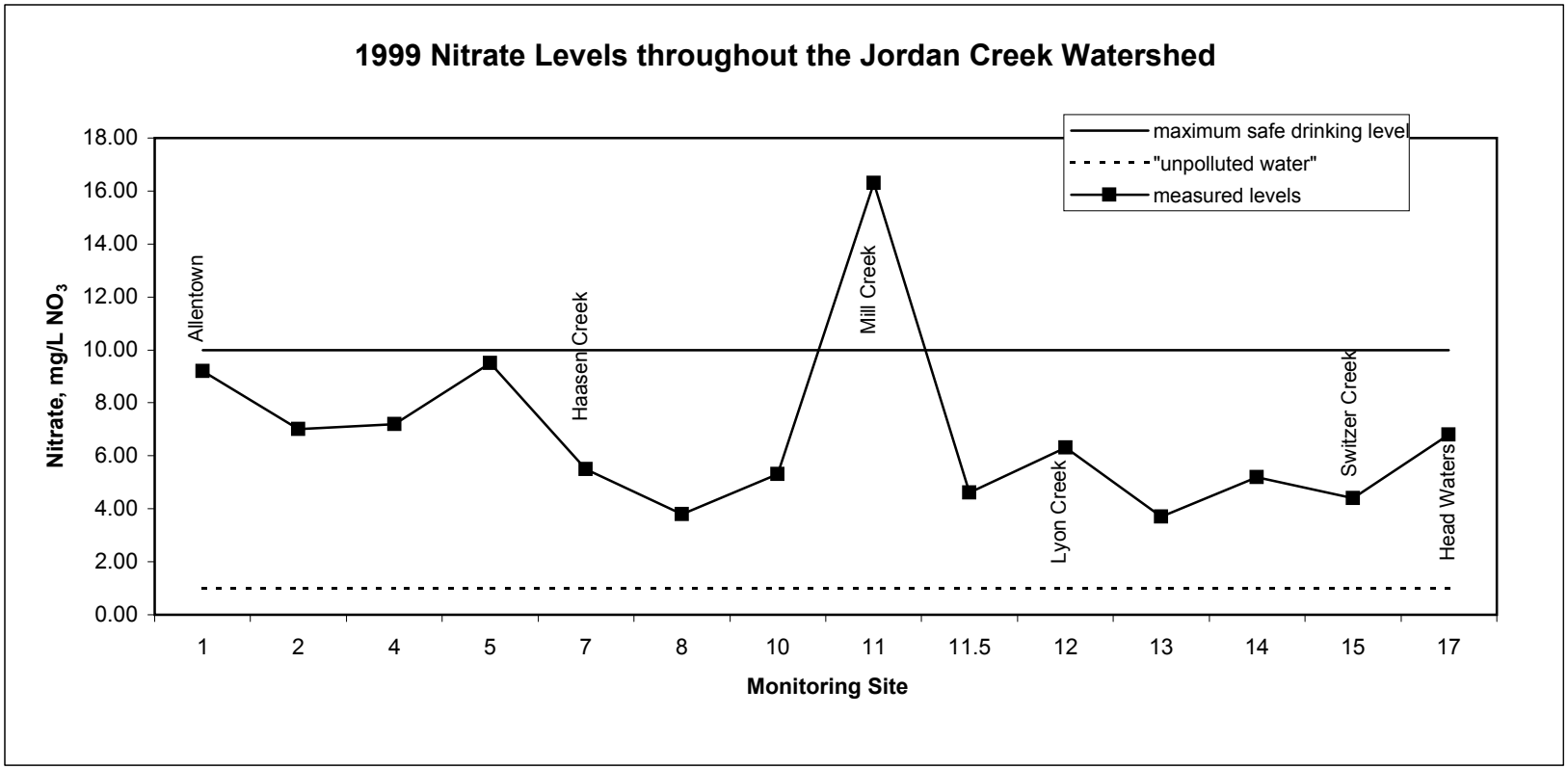


Figure B5. Alkalinity


1999 Orthophosphate Levels throughout the Jordan Creek Watershed
Orthophosphate, mg/L PO4
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
unpolluted water
eutrophication problem level
measured levels
Allentown
Haasen Creek
Mill Creek
Lyon Creek
Switzer Creek
Head Waters
1
2
4
5
7
8
10
11
11.5
12
13
14
15
17
Monitoring Site


1999 Nitrate Levels throughout the Jordan Creek Watershed
maximum safe drinking level
"unpolluted water"
measured levels
Nitrate, mg/L NO3
18.00
16.00
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
Allentown
Haasen Creek
Mill Creek
Lyon Creek
Switzer Creek
Head Waters
1
2
4
5
7
8
10
11
11.5
12
13
14
15
17
Monitoring Site

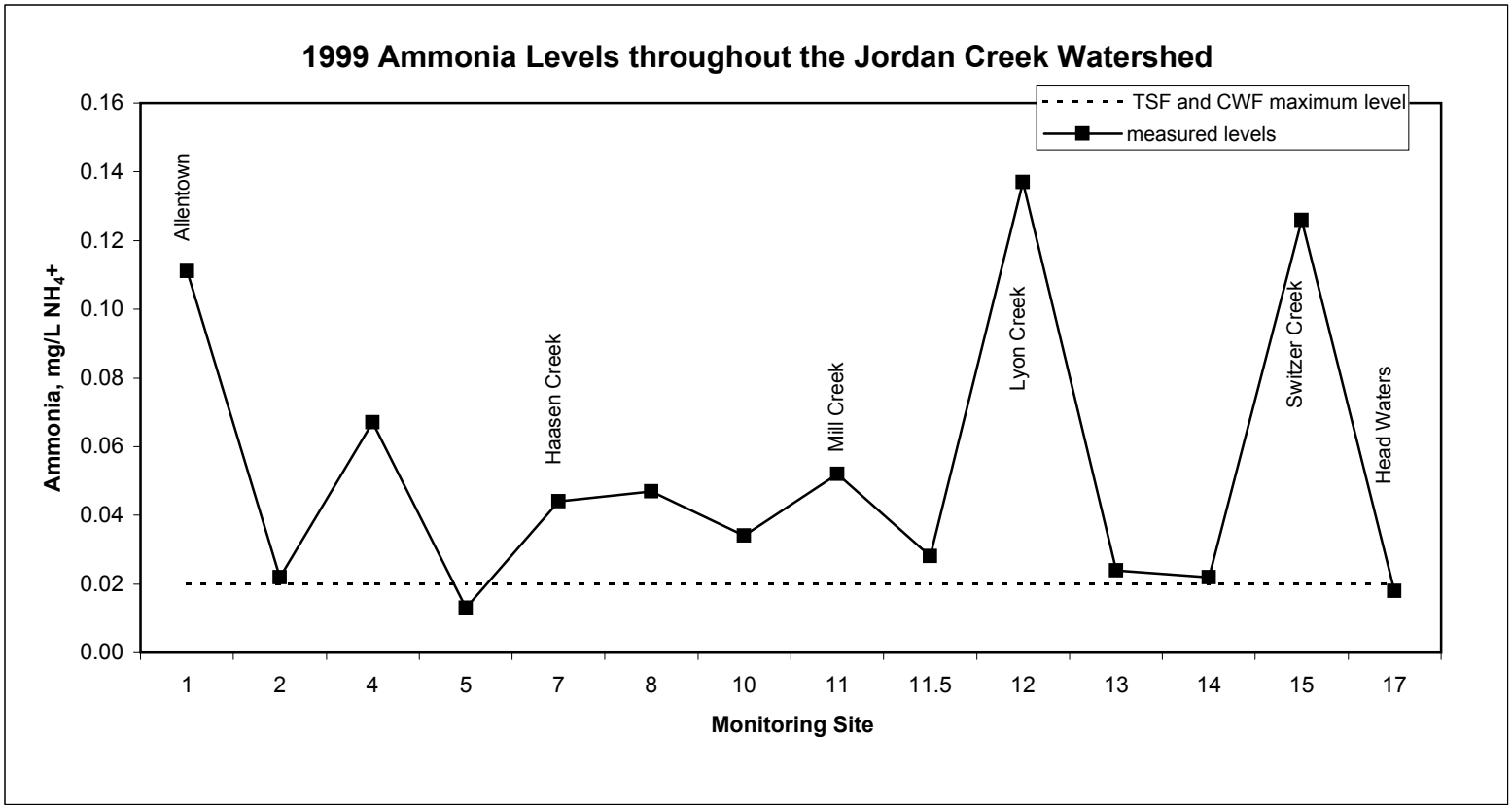

1999 Ammonia Levels throughout the Jordan Creek Watershed
TSF and CWF maximum level
measured levels
Ammonia, mg/L NH4+
0.16
0.14
0.12
0.10
0.08
0.06
0.04
0.02
0.00
Allentown
Haasen Creek
Mill Creek
Lyon Creek
Switzer Creek
Head Waters
1
2
4
5
7
8
10
11
11.5
12
13
14
15
17
Monitoring Site

Table B3. Explanation of Water Quality Parameters

pH

Background: pH is based on a scale from 1 to 14. On this scale, 0 is the most acidic value, and 14 is the most alkaline value. Seven would be neutral. A change of one pH unit represents a 10-fold change in acidity or alkalinity. Type of bedrock and other natural conditions may affect pH readings. For instance, streams underlain by limestone may reach a pH as high as 9. In addition, abundance of algae may cause pH to become more acidic after sundown, and then increase after dawn due to changes in carbon dioxide concentrations. However, abnormal pH values may be indicative of pollution.

Sources of Abnormal Readings: Sources of abnormal readings include abandoned mine drainage, industrial effluent, acid rain, sewage lagoons, and livestock containment areas. Sources of alkaline conditions include concrete plants, water treatment plants, and raw sewage.

Standards: pH levels between 6.5 and 8.2 are optimal for most aquatic organisms. The Department of Environmental Protection Water Quality Standard for pH is between 6 and 9.

SPECIFIC CONDUCTANCE/TOTAL DISSOLVED SOLIDS

Background: The specific conductance of a stream measures the quantity of ions in the water, or the ability of the water to conduct an electrical current. Conductivity is typically measured in microhoms. Geologic formations have significant impact on the specific conductance of a stream. Streams flowing through carbonate bedrocks often yield high conductivity. Specific conductance values typically have a direct relationship to total dissolved solids (TDS), which is the concentration of dissolved materials, such as salts, found in the water.

Sources of Abnormal Readings: A specific conductance or TDS value falling outside the normal range for a site may be caused by almost any pollutant. Point source discharges as well as storm water runoff may be contributors to excessive readings. Basically these testing parameters serve as a check to make sure pollutants are not being overlooked that are not part of the regular sampling routine.

ALKALINITY

Background: Alkalinity measures the ability of a stream to resist changes in pH. This property is often referred to as the buffering capacity of a stream. Buffering capacity is important because it allows a stream to assimilate acidic pollution or contamination. Like specific conductance, alkalinity is greatly determined by the type of underlying bedrock and also the soil type through which the water flows.

Source of Abnormal Readings: Alkalinity values in excess of what bedrock types indicate as normal may be a result of sewage, livestock wastes, and/or the production of concrete. Very low readings may be due to heavy rains or other acidic contamination. Abrupt changes in alkalinity may signify pollution.

Standards: Alkalinity levels between 100 and 200 mg/L provide ideal buffering within a stream. Endurable pH levels may be maintained at this level of alkalinity, and aquatic life may be protected from acidic shock. This occurs when there is a sudden increase or decrease in pH that aquatic life can not rapidly adapt to for survival.

TOTAL HARDNESS

Background: Total hardness tests usually measure the calcium and magnesium carbonate concentration in a water sample. These are the major components of hardness, which is the amount of dissolved minerals in water. Minerals are dissolved from bedrock and soil as water passes through them. The calcium component of hardness is very important to aquatic life as it is used for the cell walls of plants and the shells and bones of aquatic organisms. However, high levels of hardness can cause precipitation and deposition of calcium carbonate on the stream bottom, which disrupts normal stream activity. Water with high hardness may also cause indoor plumbing problems. Hard water also aids buffering capacity as heavy metals and other toxic compounds may be more detrimental in soft water than in hard water.

Sources of Abnormal Readings: High hardness values are often associated with limestone formations.

Standards: Optimal values of hardness for aquatic life range from 100 to 200 mg/L. At levels above 250 mg/L, calcium carbonate will begin to precipitate. Hardness values should be slightly higher than alkalinity values. If there is a major difference between the two values, chloride and sulfate ions may be present.

CALCIUM

Background: Calcium is the most abundant of the alkaline-earth metals and is a major constituent of many common rock minerals. It is an essential element for plant and animal life and is a major component of the solutes in most natural water.

Sources of Abnormal Readings: Calcium is generally a predominant cation in river waters. Measured pH in river water is generally not well correlated with calcium concentration.

Standards: The average concentration of calcium in river water is between 13.4 to 15 mg/L.

TEMPERATURE

Background: Temperature is a key determinant of what species can survive in a particular environment. Although temperature preferences vary widely among species, they do have one commonality. All species are negatively impacted by rapid fluctuations in temperature.

Sources of Abnormal Readings: Discharges of coolant and waste waters from industrial or utility plants, runoff from heated surfaces such as pavement and roofs, and lack of stream cover to provide shading are among the top sources of thermal pollution.

Standards: Life and the reproductive necessities for trout are the target standards for water temperature. Growth is impaired in an adult brook trout at temperatures above 66°F or about 19°C. Death of brook trout will occur at temperatures above 75°F or about 24°C. DEP Water Quality Standards dictate a temperature no greater than 66°F for a high quality, cold water fishery (HQ-CWF). There should also be no fluctuation greater than 2°F in a one-hour period.

DISOLVED OXYGEN

Background: Dissolved oxygen is absorbed from the atmosphere and its concentration is related to the temperature and density of the water. Cold water can hold more oxygen than warm water. Therefore low values can sometimes be attributed to shallow, poorly shaded water, which can cause warming and decrease the amount of oxygen the water can hold. The decomposition of organic material can also lower levels of dissolved oxygen. Plant life also influences dissolved oxygen content. Plant life may cause a diurnal fluctuation in DO levels. During the day, while plants are undergoing photosynthesis, they emit oxygen to the stream. However, the DO level will drop at night while the plants are not producing oxygen but fish and other aquatic life are still consuming it. The result is a drop in DO at night, reaching a minimum just before dawn, then rising to a peak by late afternoon. Thus, plant life may have a dramatic impact on DO levels.

Sources of Abnormal Readings: In areas of dense algae growth, DO levels are likely to drop significantly at night or increase excessively during the day. Low readings may also be indicative of pollutants, such as inadequately treated sewage, introduced to the water supply that consume the available oxygen so that it is not available to aquatic life. Bacteria are capable of consuming large quantities of oxygen during the decomposition of organic material. High DO levels may occur where turbulent conditions increase the natural aeration of the stream.

Standards: Trout require a dissolved oxygen (DO) level of at least 7 mg/L for unimpaired production, which is the minimum Water Quality Standard set by the DEP for a high quality, cold-water fishery (HQCWF) such as the Jordan Creek.

NITROGEN

Background: Nitrogen exists in several forms in the aquatic environment. Nitrate is the most completely oxidized state of nitrogen commonly found in water, and is the most readily available state utilized for plant growth. Since nitrate plays a key role in stimulating plant growth, it is heavily used as a nutrient component of fertilizer. High nitrate levels in streams cause excessive plant and algae growth and promote a deteriorating process called eutrophication.

Sources of Abnormal Readings: Fertilizer runoff resulting from improper application, human and animal wastes from failing septic systems and sewage treatment plants and livestock confinement areas, and decomposing organic matter are all causes for elevated nitrate readings.

Standards: Unpolluted waters will normally have a nitrate level less than 1 mg/L. The DEP Water Quality Standard for nitrate is 10 mg/L. At higher concentrations water is unsafe to drink due to the possible presence of altered forms of nitrite, which may cause serious illness to both man and wildlife.

ORTHO-PHOSPHATE

Background: Ortho-phosphate is just one form of phosphorus found in natural waters. This is the tested form of phosphate because it is the form of phosphate used in fertilizer and applied to agricultural fields and residential lawns. Other forms of phosphorus found in natural waters that have not been tested include polyphosphates, and organically bound phosphates. Phosphates naturally found in water are derived from decomposing organic material and leaching of phosphorus rich bedrock. Like nitrates, phosphates negatively impact water by causing accelerated rates of eutrophication.

Sources of Abnormal Readings: Fertilizer runoff; human and animal waste from failing septic systems, sewage treatment plants, and livestock confinement areas; mass quantities of decomposing organic matter; industrial effluent; and detergent wastewater are all possible sources of elevated phosphate levels.

Standards: Phosphate levels below 0.03 mg/l are generally considered to be unpolluted. Levels between 0.03 and 0.1 mg/l are sufficient to stimulate plant growth. The critical level for avoiding accelerated eutrophication is 0.1 mg/L. Levels above 0.1 mg/l are considered problem areas. There has not been a standard set for safe drinking water because humans can tolerate extremely high levels before it even takes affect on the digestive system.

APPENDIX C

JORDAN CREEK
MACRO-INVERTEBRATE AND FISH
DATA AND ANALYSIS

Table C1. 1999 Jordan Creek Macro-Invertebrate Sampling Data

(Source: Lehigh University and Wildlands Conservancy)

				Sampling Site					
Class	**Family**	**EPA PTR***	**Feeding Group****	**1**	**2**	**3**	**4**	**5**	**6**
Coleoptera	Psephenidae	4	SC	2	6	1	1	9	1
	Gyrinidae	N/A	PR	0	1	0	0	0	0
	Elmidae	4	SC	18	24	36	41	121	58
Ephemeroptera	Ephemerellidae	1	CG	4	0	6	3	32	2
	Heptagenidae	4	CG	8	13	13	1	6	2
	Baetidae	4	CG	2	9	14	7	6	0
	Leptophlebidae	2	CG	0	1	0	0	0	0
	Caenidae	7	CG / CF	1	15	71	19	15	12
	Tricorythidae	4	CG	0	2	0	1	0	0
Plecoptera	Perlidae	1	PR	1	8	3	0	0	0
	Perlodidae	2	PR / SC / CG	7	2	1	0	0	1
Trichoptera	Hydropyschidae	4	CF	9	33	5	9	6	85
	Hydroptilidae	4	SC / CG	3	3	9	0	6	13
	Philopotamidae	3	CF	0	9	3	20	9	2
	Limnephilidae	4	SH / CG / SC	1	0	1	0	1	0
	Glossosomatidae	0	SC	0	1	0	0	0	0
	Uenoidae	N/A	SC / CG	0	1	0	0	0	0
	Helicopsychidae	3	SC	0	0	0	2	3	1
Diptera	Chironomidae	6	CG / 10% PR	84	163	86	22	67	224
	Ceratopogonidae	6	PR / CG	2	0	2	3	1	0
	Tipuliidae	3	CG	7	9	3	0	2	2
Odonata	Gomphidae	1	PR	0	0	0	0	2	0
	Coenagriondae	9	PR	0	0	1	0	0	0
Hemiptera	Veliidae	N/A	PR	3	11	9	0	1	0
	Gerridae	N/A	PR	0	0	0	0	0	0
Megaloptera	Corydalidae	0	PR	1	1	0	0	0	0
	Sialidae	4	PR	0	0	1	0	0	0
Mollusca	Bivalvia	N/A	CF	0	1	1	2	1	0
Gastropoda	Gastropoda	N/A	N/A	0	0	0	6	7	0
Annelida	Oligachaeta	6 to 10	N/A	8	7	0	4	0	1
	Hirudinea	10	N/A	0	0	5	0	17	11
			TOTALS	**161**	**320**	**271**	**141**	**312**	**415**

*EPA Pollution Tolerance Rating
(0-3.75 excellent) (3.76-4.25 very good) (4.26-5 good) (5.01-5.75 fair) (5.76-6.5 fairly poor) (6.51-7.25 poor) (>7.26 very poor)

** Macro-invertebrate Functional Feeding Group
CG=Collector Gatherers SH=Shredders
SC=Scrapers CF=Collector Filterers PR=Predators

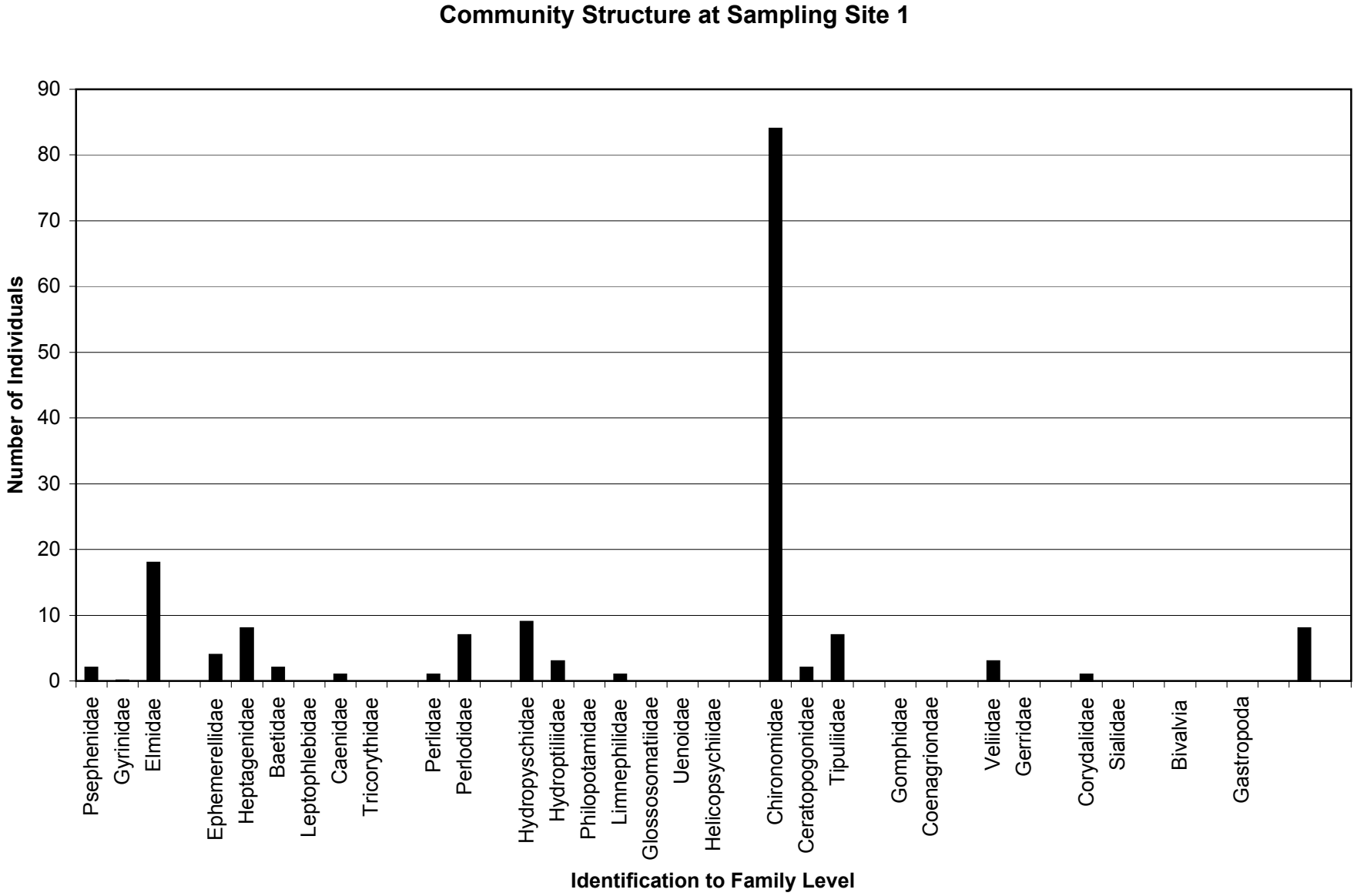

Community Structure at Sampling Site 1
Number of Individuals
0
10
20
30
40
50
60
70
80
90
Psephenidae
Gyrinidae
Elmidae
Ephemerellidae
Heptagenidae
Baetidae
Leptophlebidae
Caenidae
Tricorythidae
Perlidae
Perlodidae
Hydropsychidae
Hydroptiliidae
Philopotamidae
Limnephilidae
Glossosomatiidae
Uenoidae
Helicopsychiidae
Chironomidae
Ceratopogonidae
Tipuliidae
Gomphidae
Coenagriondae
Veliidae
Gerridae
Corydalidae
Sialidae
Bivalvia
Gastropoda
Identification to Family Level

Figure C1a.

Percent Composition of Macro-Invertebrate Community at Sampling Site1

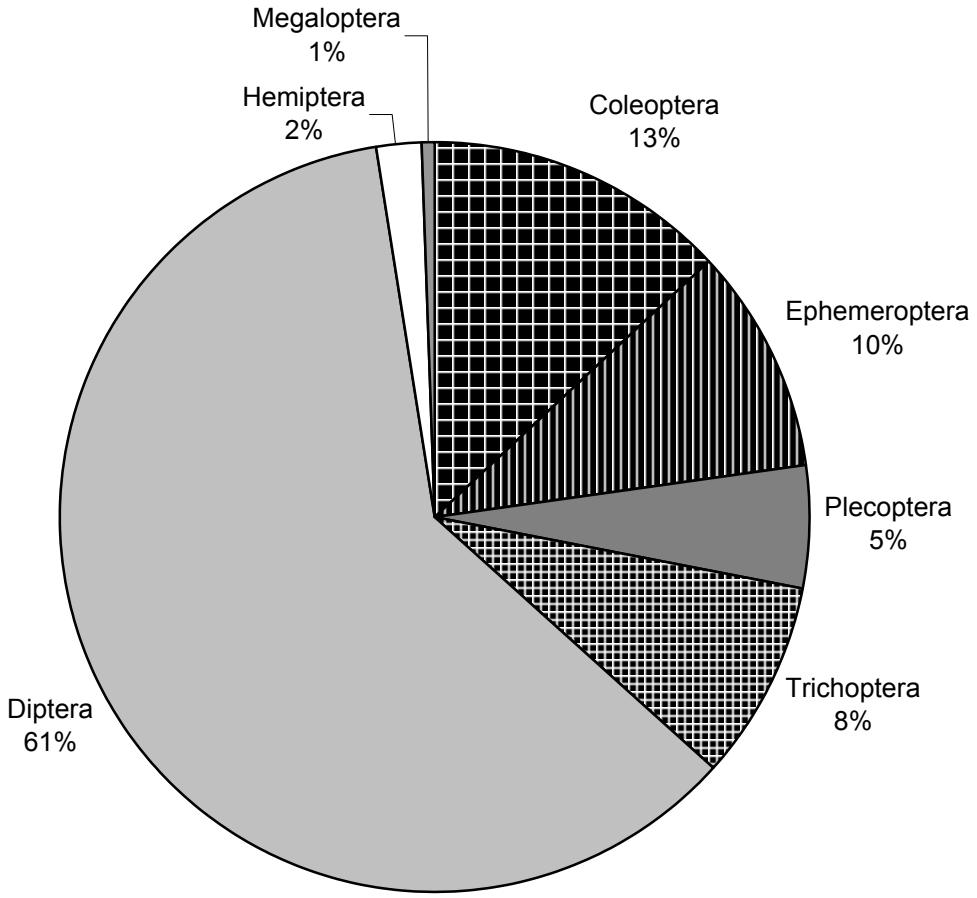


Figure C1b

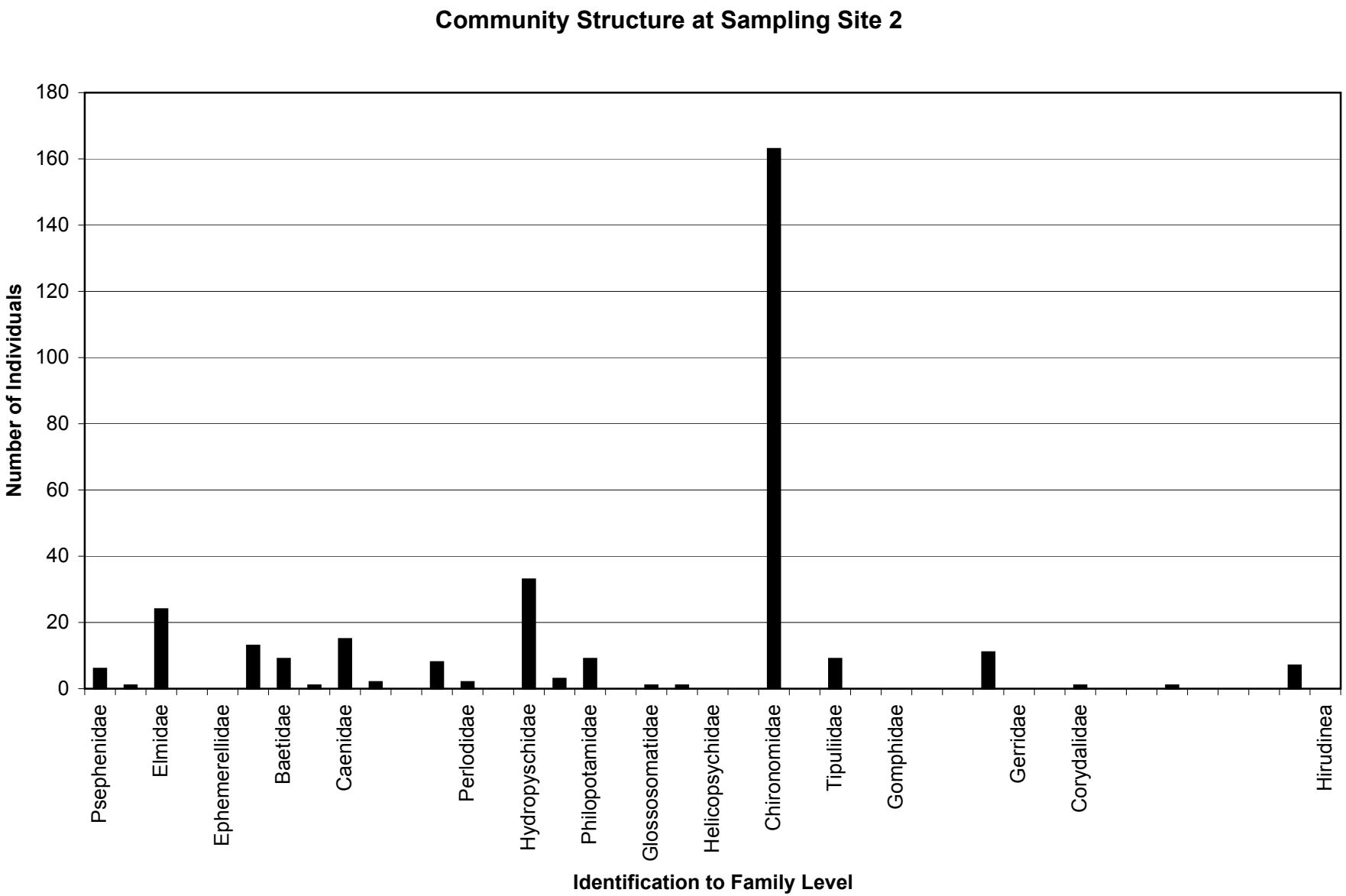

Community Structure at Sampling Site 2
Number of Individuals
180
160
140
120
100
80
60
40
20
0
Psephenidae
Elmidae
Ephemerellidae
Baetidae
Caenidae
Perlodidae
Hydropyschidae
Philopotamidae
Glossosomatidae
Helicopsychidae
Chironomidae
Tipulidae
Gomphidae
Gerridae
Corydalidae
Hirudinea
Identification to Family Level

Figure C2a.

Percent Composition of Macro-Invertebrate Community at Sampling Site 2

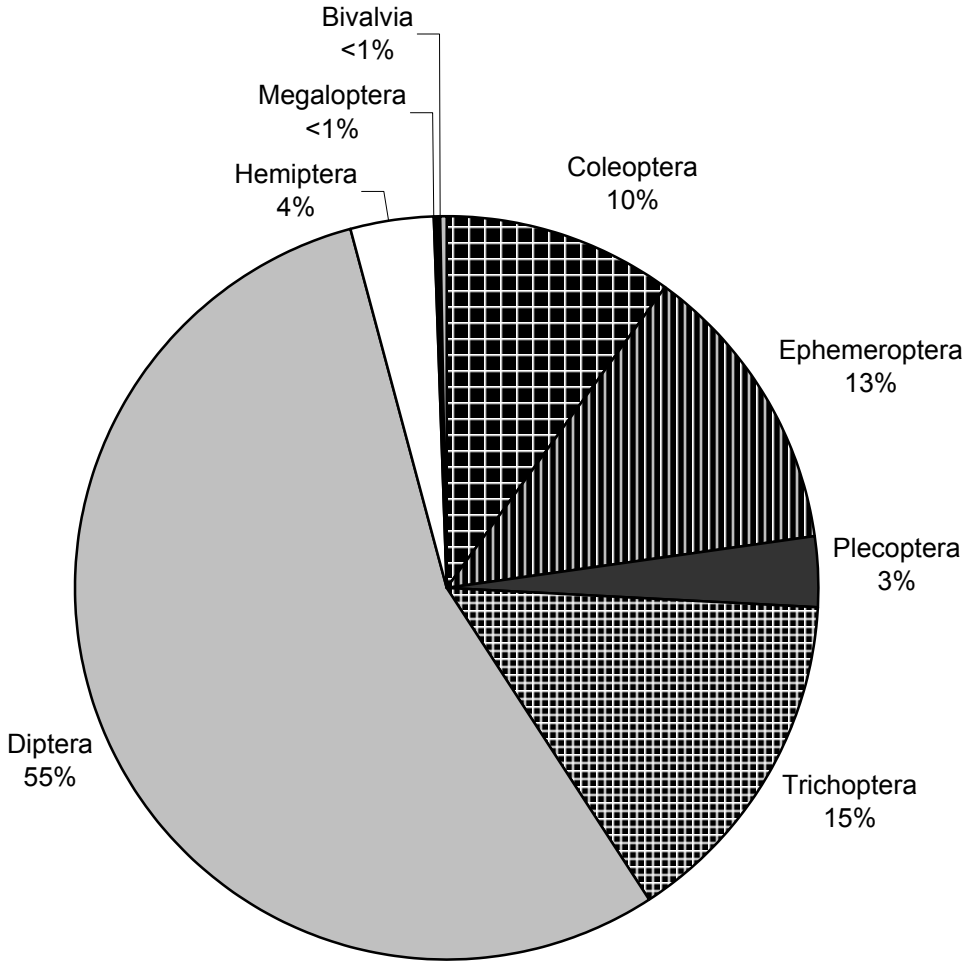


Figure C2b

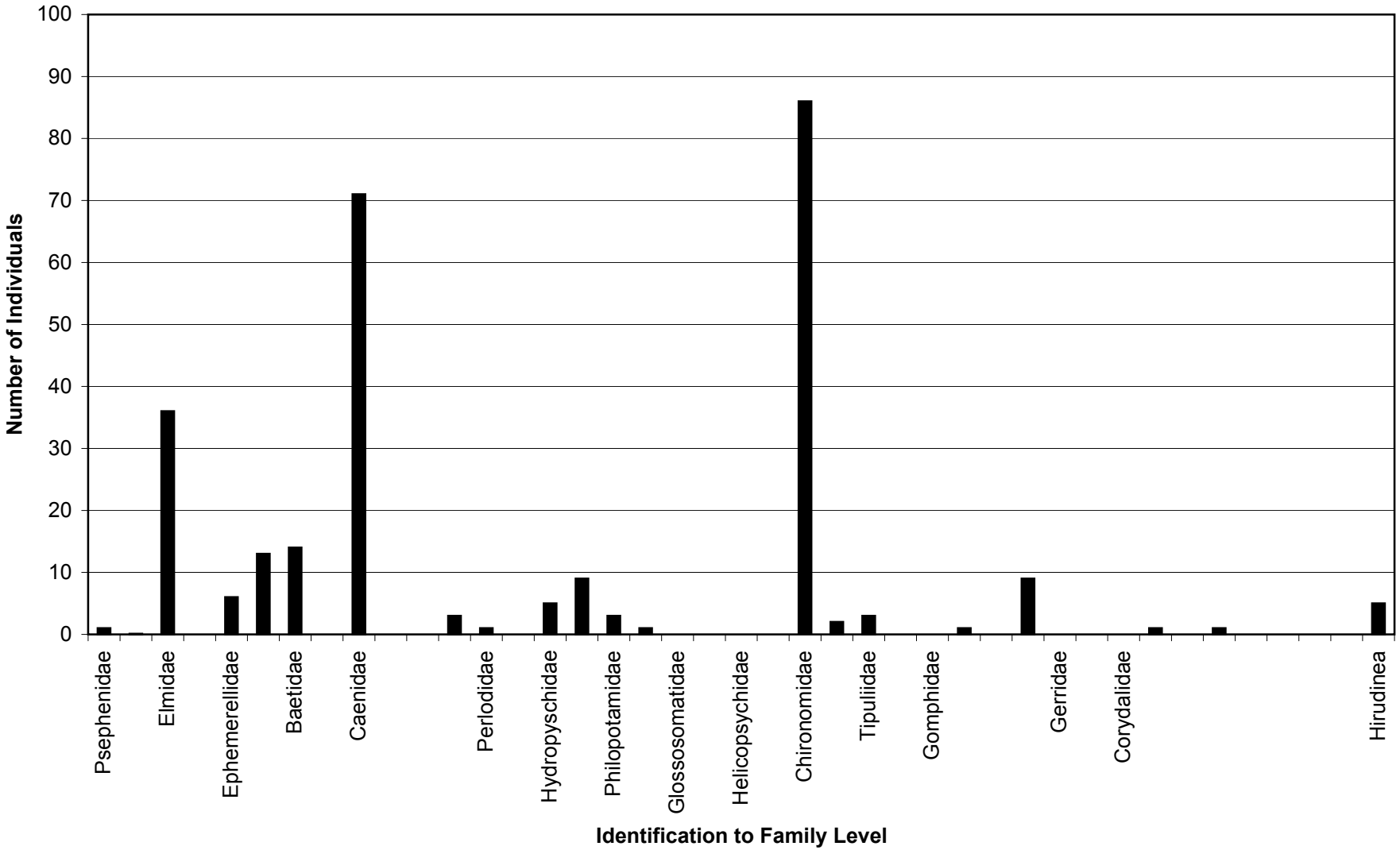

Community Structure at Sampling Site 3
Number of Individuals
100
90
80
70
60
50
40
30
20
10
0
Psephenidae
Elmidae
Ephemerellidae
Baetidae
Caenidae
Perlodidae
Hydropyschidae
Philopotamidae
Glossosomatidae
Helicopsychidae
Chironomidae
Tipulidae
Gomphidae
Gerridae
Corydalidae
Hirudinea
Identification to Family Level

Figure C3a.

Percent Composition of Macro-Invertebrate Community at Sampling Site 3

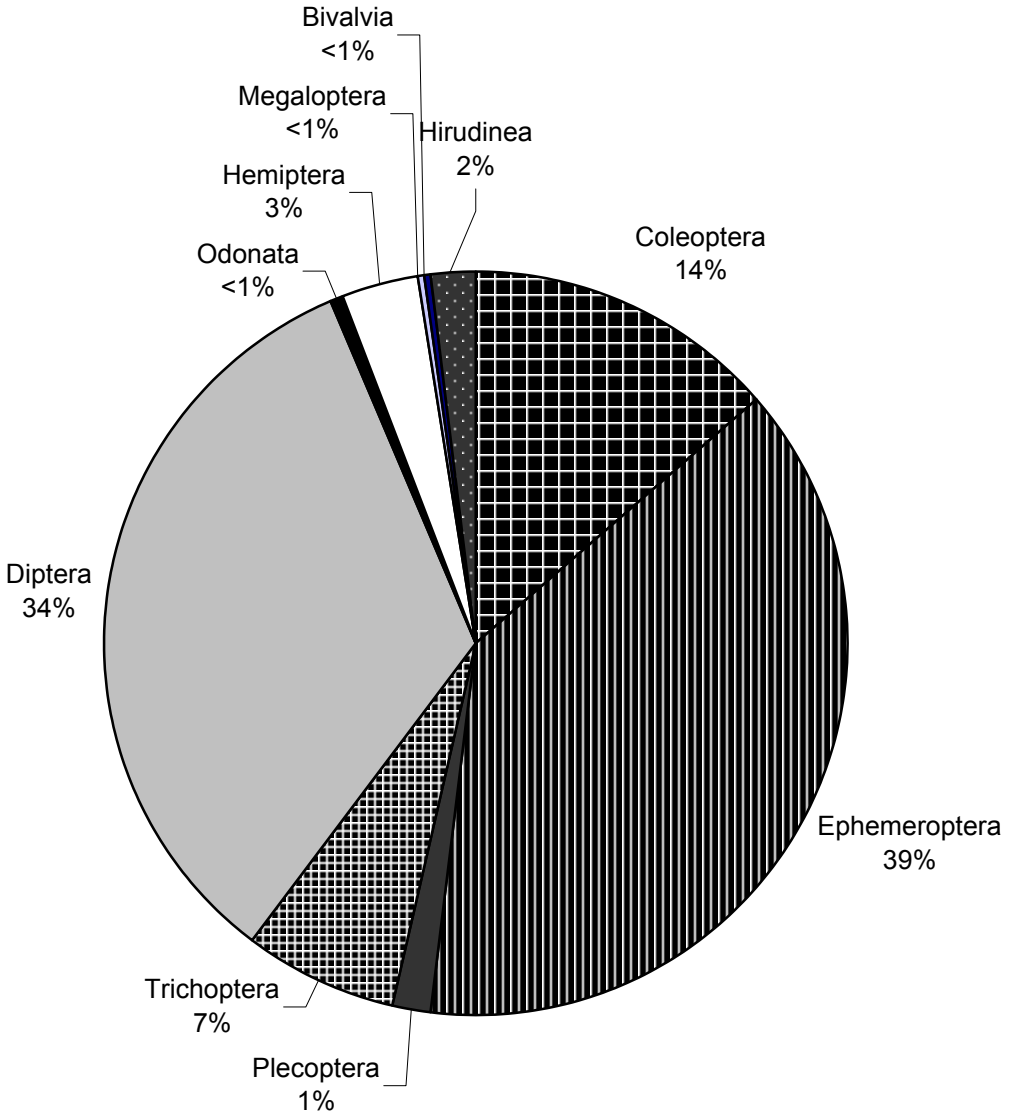


Figure C3b

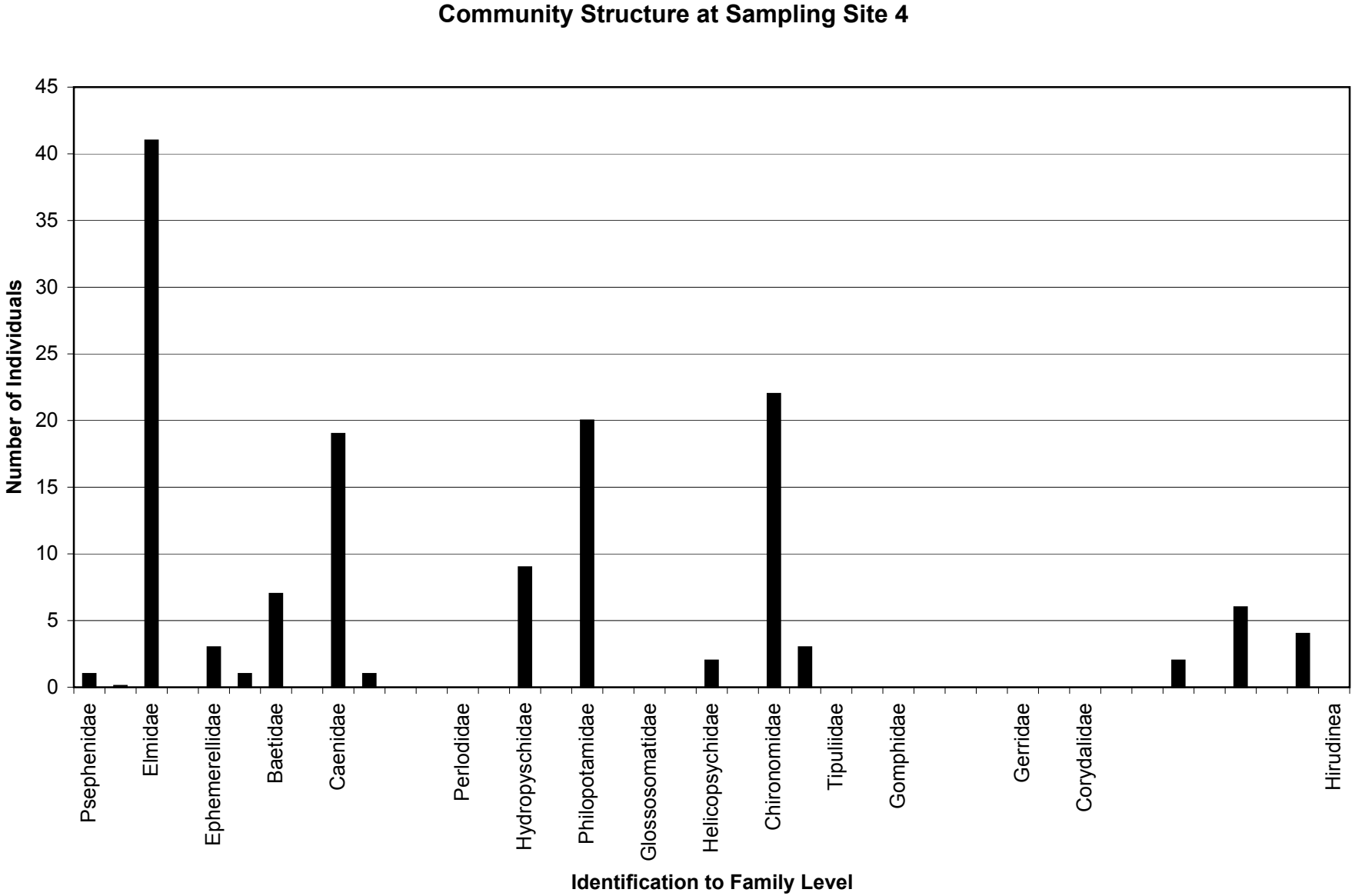

Community Structure at Sampling Site 4
Number of Individuals
0
5
10
15
20
25
30
35
40
45
Psephenidae
Elmidae
Ephemerellidae
Baetidae
Caenidae
Perlodidae
Hydropyschidae
Philopotamidae
Glossosomatidae
Helicopsychidae
Chironomidae
Tipulidae
Gomphidae
Gerridae
Corydalidae
Hirudinea
Identification to Family Level

Figure C4a .

Percent Composition of Macro-Invertebrate Community at Sampling Site 4

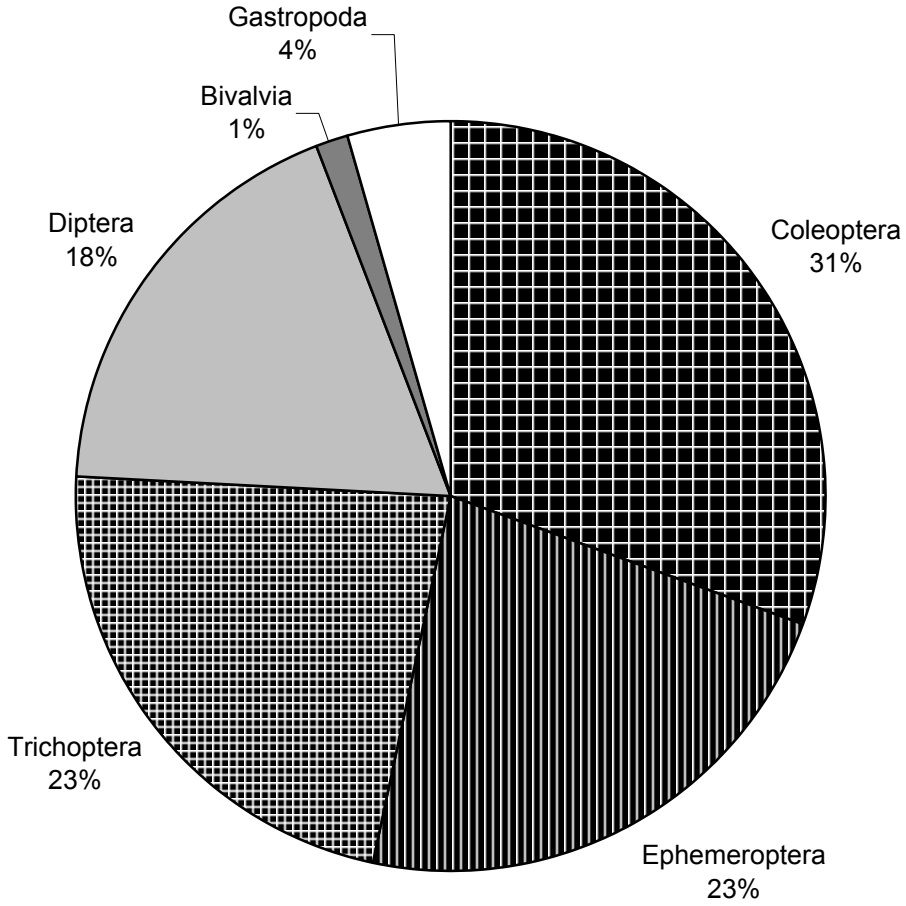


Figure C4b

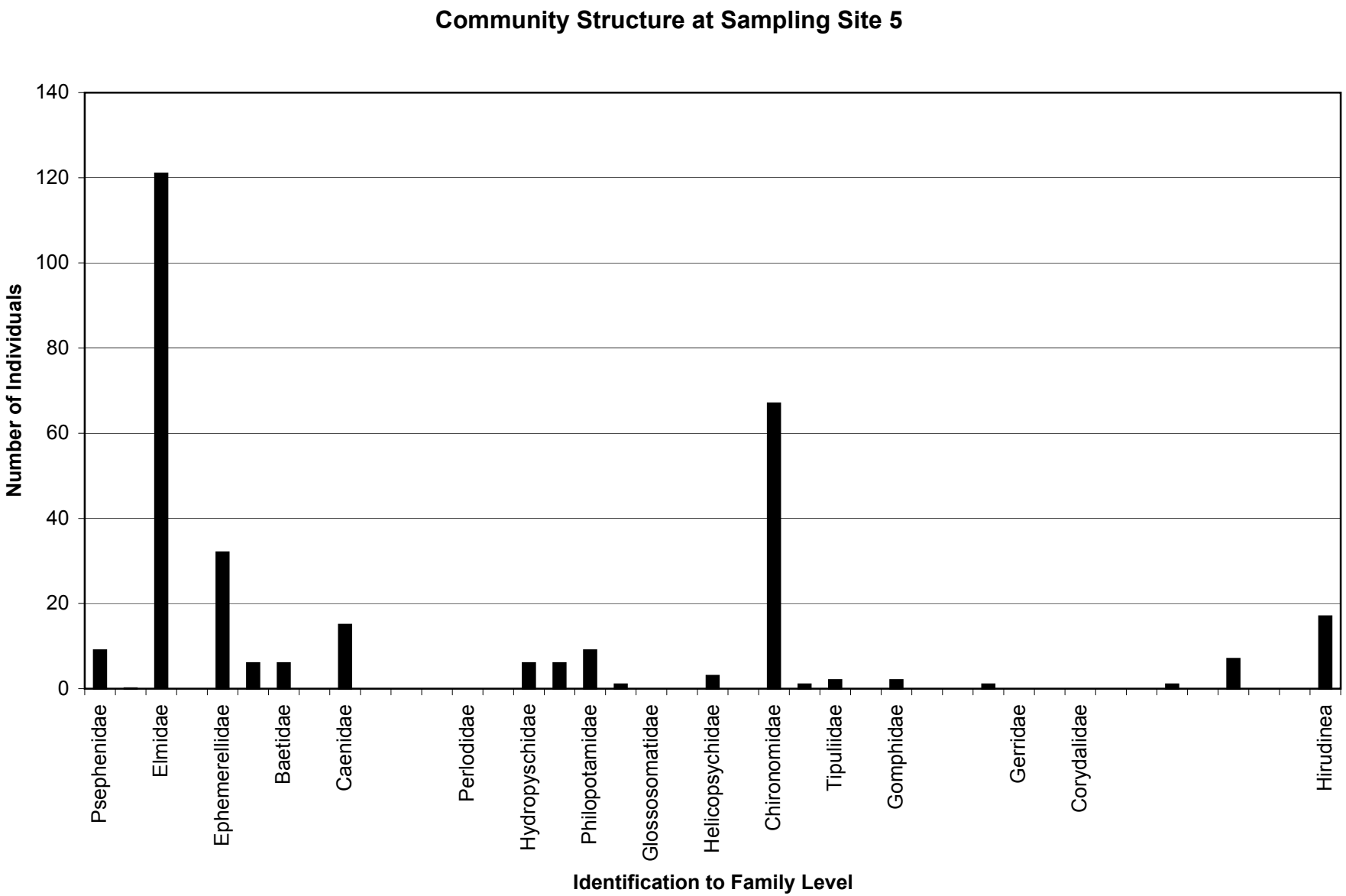

Community Structure at Sampling Site 5
Number of Individuals
140
120
100
80
60
40
20
0
Psephenidae
Elmidae
Ephemerellidae
Baetidae
Caenidae
Perlodidae
Hydropsychidae
Philopotamidae
Glossosomatidae
Helicopsychidae
Chironomidae
Tipulidae
Gomphidae
Gerridae
Corydalidae
Hirudinea
Identification to Family Level

Figure C5a.

Percent Composition of Macro-Invertebrate Community at Sampling Site 5

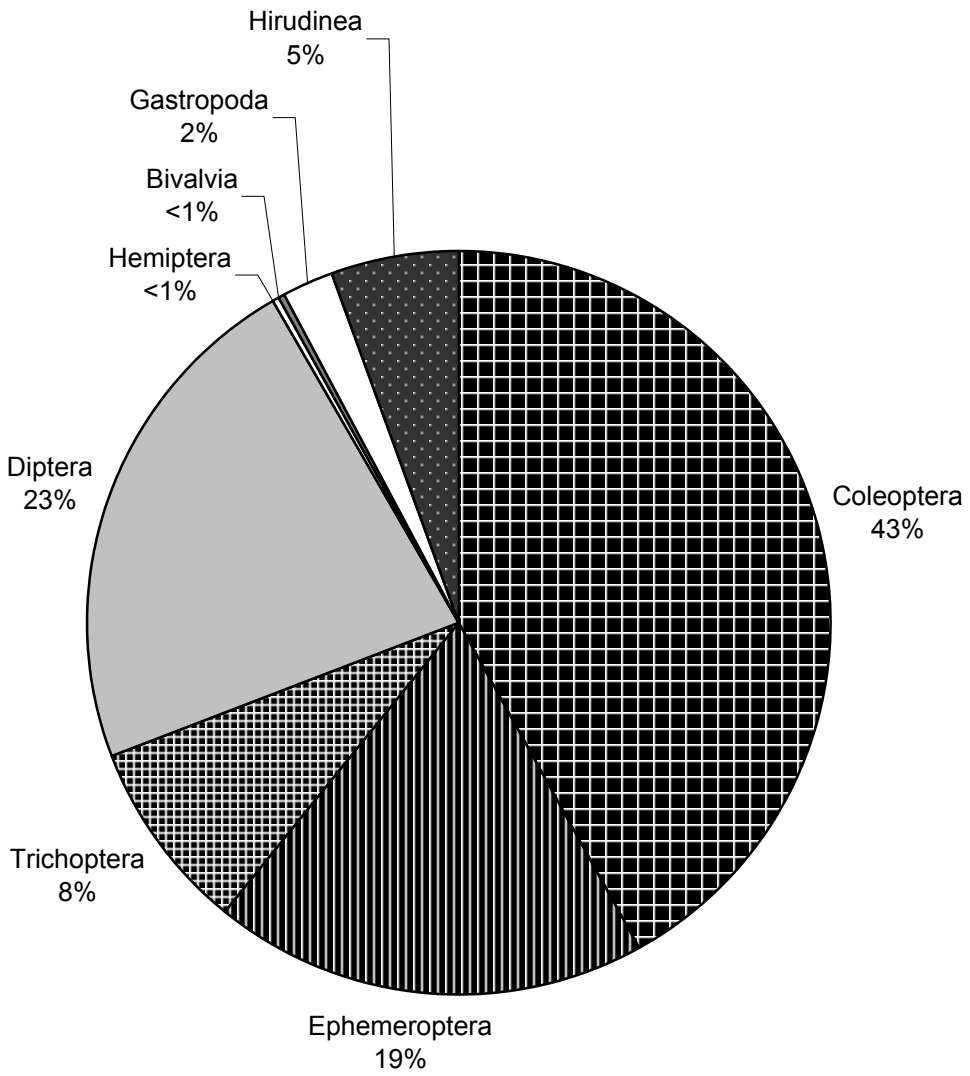


Figure C5b

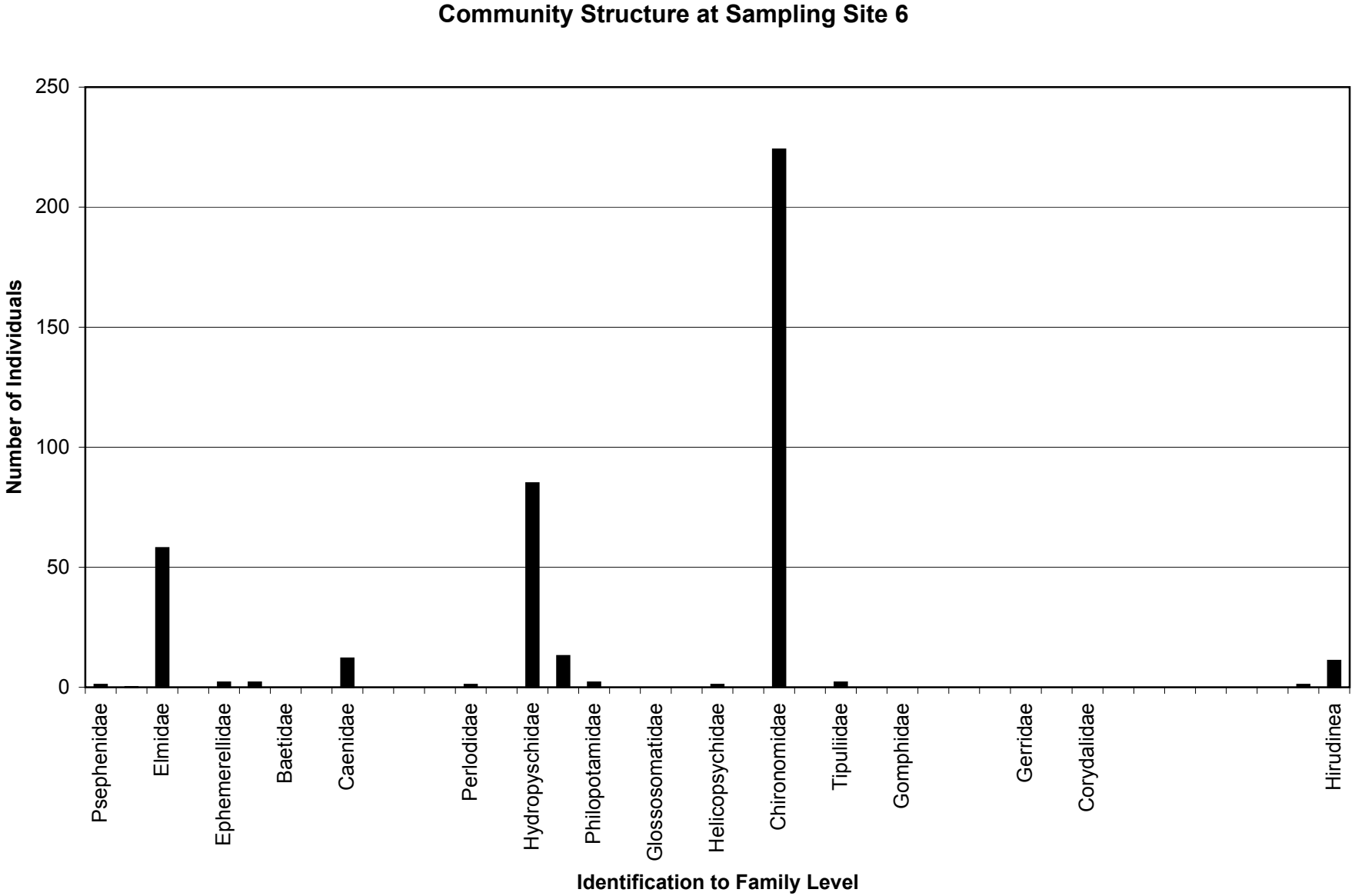

Community Structure at Sampling Site 6
Number of Individuals
250
200
150
100
50
0
Psephenidae
Elmidae
Ephemerellidae
Baetidae
Caenidae
Perlodidae
Hydropyschidae
Philopotamidae
Glossosomatidae
Helicopsychidae
Chironomidae
Tipulidae
Gomphidae
Gerridae
Corydalidae
Hirudinea
Identification to Family Level

Figure C6a.

Percent Composition of Macro-Invertebrate Community at Sampling Site 6

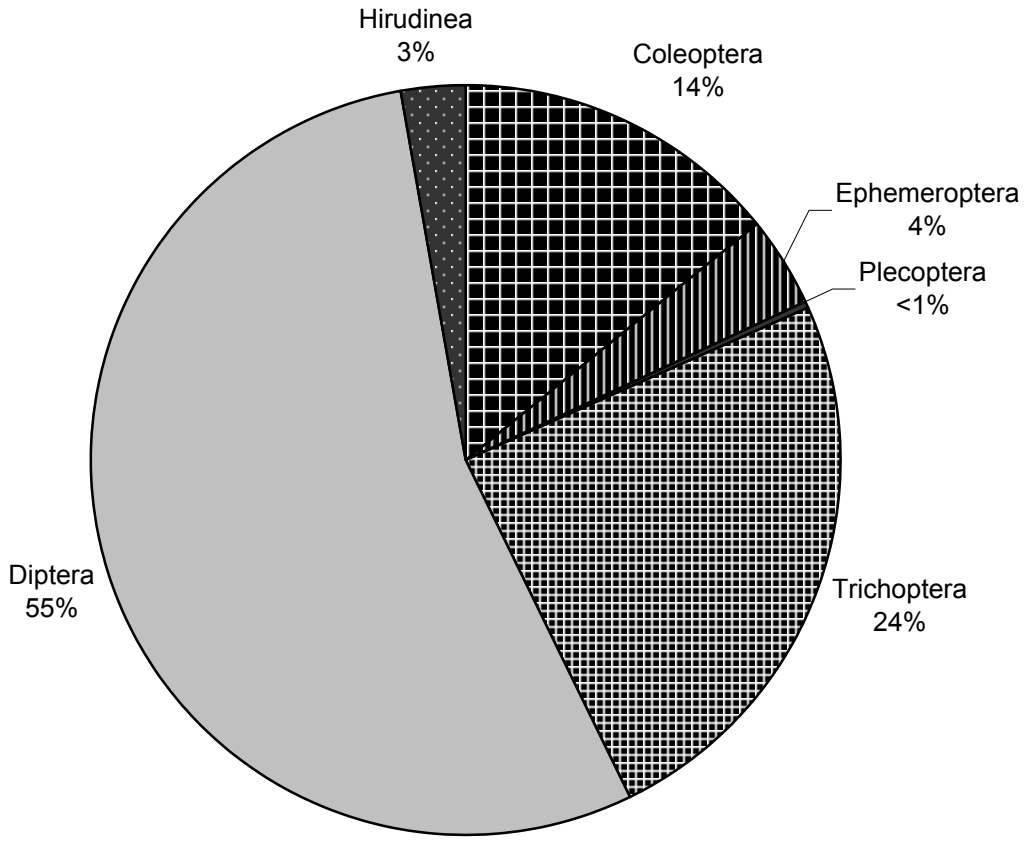


Figure C6b

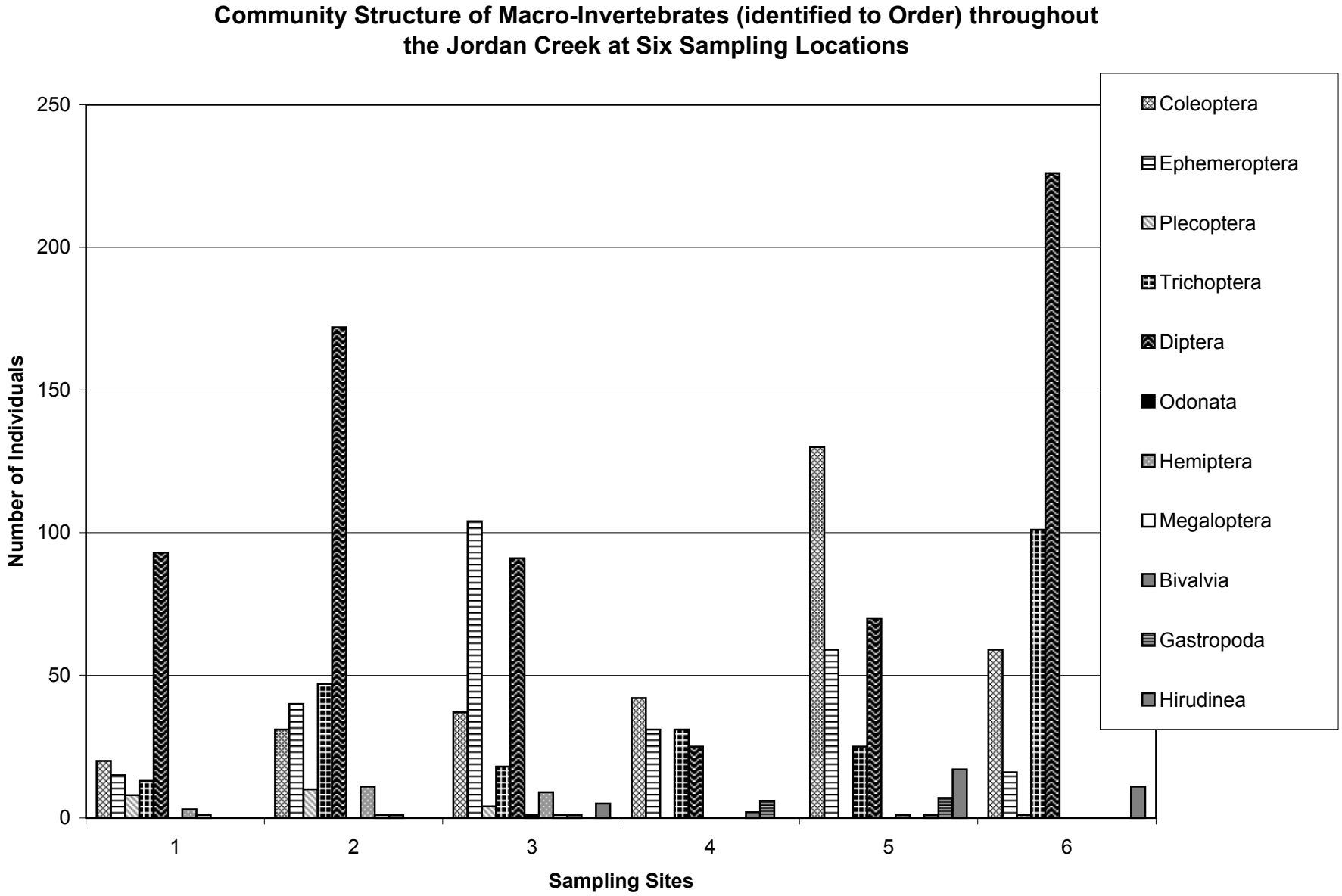

Community Structure of Macro-Invertebrates (identified to Order) throughout the Jordan Creek at Six Sampling Locations
Number of Individuals
250
200
150
100
50
0
1
2
3
4
5
6
Sampling Sites
Coleoptera
Ephemeroptera
Plecoptera
Trichoptera
Diptera
Odonata
Hemiptera
Megaloptera
Bivalvia
Gastropoda
Hirudinea

Figure C7

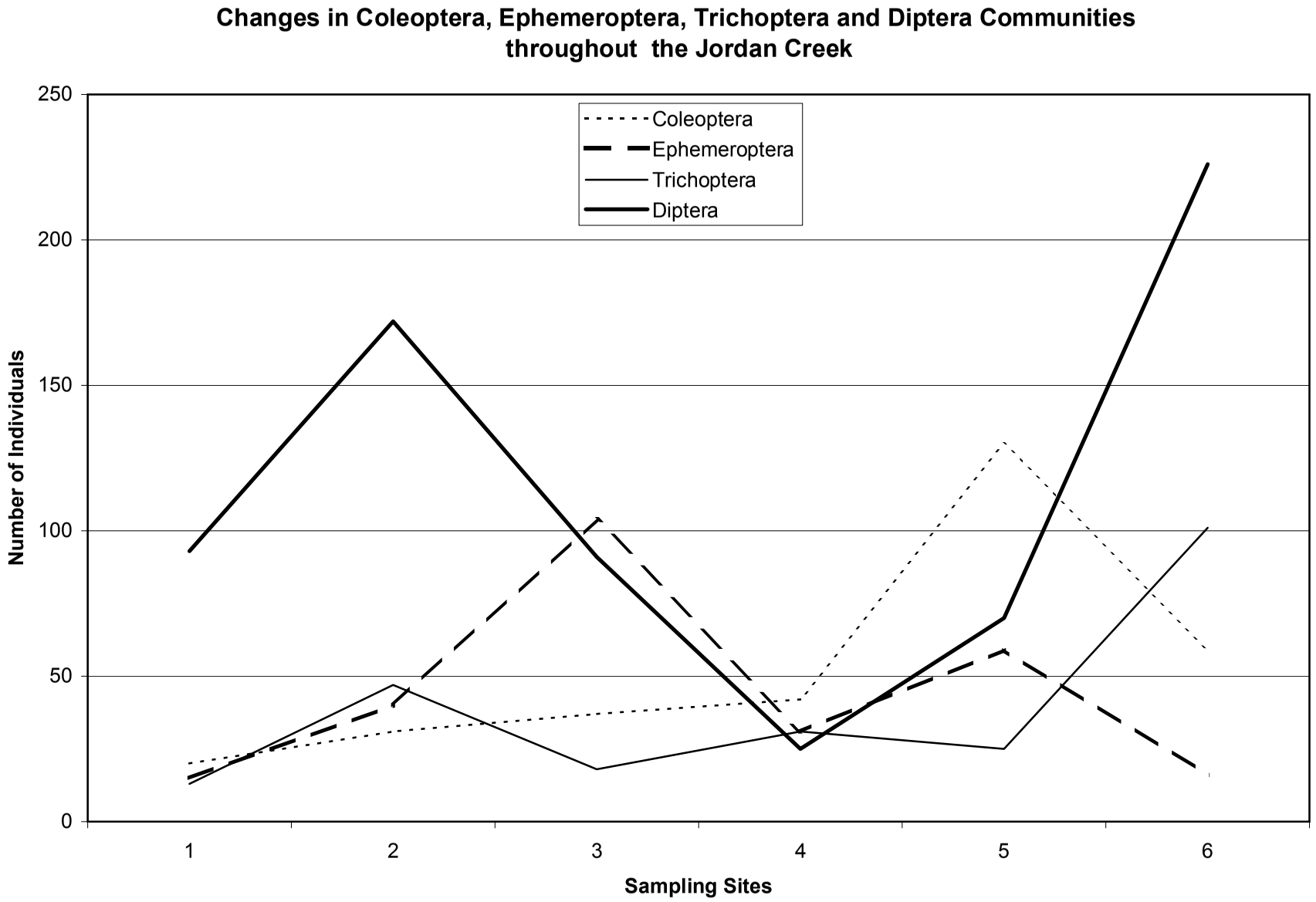

Changes in Coleoptera, Ephemeroptera, Trichoptera and Diptera Communities throughout the Jordan Creek
Coleoptera
Ephemeroptera
Trichoptera
Diptera
Number of Individuals
250
200
150
100
50
0
1
2
3
4
5
6
Sampling Sites

Figure C8

Table C2. Educational Fish Survey 1988, Jordan Creek

Date: 6-29-88 **Station**

Species	Scientific Name		1	2	3	4	Tolerance Rating
American Eel	*Anguilla rostrata*		2	0	0	0	Tolerant
Banded Killifish	*Fundulus diaphanus*		17	11	5	0	Tolerant
Blacknose Dace	*Rhinichthys atratulus*		1	4	0	0	Tolerant
Bluntnose Minnow	*Pimephales notatus*		0	0	2	0	Tolerant
Brown Bullhead	*Ictalurus nebulosus*		0	1	2	84	Tolerant
Brown Trout	*Salmo trutta*		1	0	0	0	Intolerant
Carp	*Cyprinus carpio*		0	0	0	2	Tolerant
Comely Shiner	*Notropis ameonus*		13	1	0	1	Tolerant
Common Goldfish	*Carassius auratus*		1	0	2	0	Tolerant
Common shiner	*Notropis cornutus*		7	5	1	0	Intermediate
Cutlips Minnow	*Exoglossum maxillingua*		1	1	0	0	Intolerant
Fallfish	*Semotulus corporalis*		10	1	0	0	Intermediate
Golden Shiner	*Notemigonas crysoleucas*		1	0	1	0	Tolerant
Largemouth Bass	*Micropterus salmoides*		0	0	0	2	Intermediate
Marginated Madtom	*Noturus insignis*		2	0	0	0	Intermediate
Pumpkinseed	*Lepomis gibbosus*		23	1	8	3	Intermediate
Redbreast Sunfish	*Lepomis auritus*		2	0	4	0	Intermediate
Rockbass	*Ambloplites repositories*		17	4	0	0	Intermediate
Satinfin Shiner	*Notropis analostanus*		6	2	0	0	Tolerant
Smallmouth Bass	*Micropterus dolomieui*		1	0	0	0	Intermediate
Spottail Shiner	*Notropis hudsonius*		9	0	0	0	Intermediate
Tessalated Darter	*Etheostoma olmstedi*		2	0	0	0	Intermediate
White Sucker	*Catostomas commersoni*		16	23	0	0	Tolerant
	Total Species		**19**	**11**	**8**	**5**	

Table C3. Educational Fish Survey 1988, Jordan Creek

Date: 10-19-88 **Station**

Species	Scientific Name		1	2	Tolerance Rating
Banded Killifish	*Fundulus diaphanus*		2	1	Tolerant
Blacknose Dace	*Rhinichthys atratulus*		7	3	Tolerant
Comely Shiner	*Notropis ameonus*		0	12	Tolerant
Common Shiner	*Notropis cornutus*		2	1	Intermediate
Cutlips Minnow	*Exoglossum maxillingua*		2	2	Intolerant
Fallfish	*Semotulus corporalis*		7	21	Intermediate
Golden Shiner	*Notemigonas crysoleucas*		2	0	Tolerant
Longnose Dace	*Rhinicthys cataractae*		3	1	Intermediate
Marginated Madtom	*Noturus insignis*		1	0	Intermediate
Pumpkinseed	*Lepomis gibbosus*		4	1	Intermediate
Redbreast Sunfish	*Lepomis auritus*		2	3	Intermediate
Rockbass	*Ambloplites repositories*		4	6	Intermediate
Satinfin Shiner	*Notropis analostanus*		5	0	Tolerant
Smallmouth Bass	*Micropterus dolomieui*		1	0	Intermediate
Spottail Shiner	*Notropis hudsonius*		61	13	Intermediate
Tessalated Darter	*Etheostoma olmstedi*		1	0	Intermediate
White Sucker	*Catostomas commersoni*		4	12	Tolerant
	Total Species		**16**	**12**	

Table C4. International Minerals and Chemical Corporation Fish Survey

Date: 6-12-90

Species	Scientific Name		Station 2	Tolerance Rating
American Eel	*Anguilla rostrata*	X	R	Tolerant
Common Carp	*Cyprinus carpio*	X	R	Tolerant
Common Shiner	*Notropis cornutus*	X	A	Intermediate
Fallfish	*Semotilus corporalis*	X	P	Intermediate
Green Sunfish	*Lepomis cyanellus*	X	P	Tolerant
Pumpkinseed Sunfish	*Lepomis gibbosus*	X	C	Intermediate
Rock Bass	*Ambloplites rupestris*	X	R	Intermediate
White Sucker	*Catostomus commersoni*	X	R	Tolerant
	Total Species	**8**		

R - Rare (1-2 Individuals)
P - Present (3-24 Individuals)
C - Common (25-99 Individuals)
A - Abundant (>100 Individuals)

Table C5. Catchable Trout Program Survey 1990, Jordan Creek

Date: 7-23-90

Species	Scientific Name	Site 2	Site 3	Tolerance Rating
American Eel	Anguilla rostrata	X	X	Tolerant
Blacknose Dace	Rhinicthys atratulus	X	X	Tolerant
Brown Bullhead	Ameirus nebulosus		X	Tolerant
Brown Trout	Salmo trutta	X		Intolerant
Common Shiner	Luxulus cornutus	X	X	Intermediate
Creek Chub	Semotilus atromaculatus	X	X	Tolerant
Cutlips Minnow	Exoglossum maxillingua		X	Intolerant
Fallfish	Semotilus corporalis	X		Intermediate
Green Sunfish	Lepomis cyanellus		X	Tolerant
Largemouth Bass	Micropterus salmoides	X	X	Intermediate
Longnose Dace	Rhinichthys cataractae	X	X	Intermediate
Margined Madtom	Notorus insignis	X	X	Intermediate
Pumpkinseed Sunfish	Lepomis gibbosus		X	Intermediate
Redbreast Sunfish	Lepomis auritus		X	Intermediate
Rock Bass	Ambloplites rupestris	X	X	Intermediate
Satinfin Shiner	Cyprinella analostana		X	Tolerant
Smallmouth Bass	Micropterus dolomieu		X	Intermediate
Tessellated Darter	Etheostoma olmstedi	X	X	Intermediate
White Sucker	Catastomus commersoni	X	X	Tolerant
	Total Species	**12**	**17**	

Table C6. Pittman-Moore,Inc. 1991, Jordan Creek Fish Survey

Date: 7-2-91 **Site**

Species	Scientific Name		1	2	3	Tolerance Rating
American Eel	*Anguilla rostrata*		X		X	Tolerant
Banded Killifish	*Fundulus diaphanous*			X	X	Tolerant
Blacknose Dace	*Rhinichthys artratulus*		X		X	Tolerant
Brook Trout	*Salvelinus fontinalis*				X	Intolerant
Brown Bullhead	*Ictalurus nebulosus*		X	X	X	Tolerant
Brown Trout	*Salmo trutta*				X	Intolerant
Carp	*Cyprinus carpio*		X	X		Tolerant
Common Shiner	*Notropis ameonus*		X		X	Intermediate
Creek Chub	*Semotilus atromaculatus*			X		Tolerant
Cutlips Minnow	*Exoglossum maxillingua*		X	X	X	Intolerant
Golden Shiner	*Notemigonas crysoleucas*			X		Tolerant
Goldfish	*Carassius aurafus*			X		Tolerant
Green Sunfish	*Lepomis cyanellus*		X	X	X	Tolerant
Largemouth Bass	*Mirropterus salmoides*		X			Intermediate
Longnose Dace	*Rhinichthys cataractae*				X	Intermediate
Margined Madtom	*Noturus insignis*				X	Intermediate
Pumpkinseed	*Lepomis macrochirus*		X	X		Intermediate
Rainbow Trout	*Salmo gairdneri*				X	Intolerant
Redbreast Sunfish	*Lepomis macrochirus*			X	X	Intermediate
Rock Bass	*Ambloplites rupellus*		X		X	Intermediate
Smallmouth Bass	*Micropterus dolomieui*		X		X	Intermediate
Spotfin Shiner	*Notropis spilopferus*		X	X	X	Tolerant
Spottail Shiner	*Notropis hudsonius*		X		X	Intermediate
Tesselated Darter	*Etheostoma olmstedi*				X	Intermediate
White Sucker	*Catostomus commersoni*		X	X	X	Tolerant
	Total Species		**14**	**12**	**19**	

1999 Water Quality Parameter Averages

Site #	Air Temp ° C	Water Temp °C	pH	Dissolved Oxygen mg/L	Specific Conductar mmhos	NH4 + Ammonia mg/L	PO4 Phosphate mg/L	NO3 Nitrate mg/L	Dissolved Solids mg/L	Total Hardness mg/L	Calcium Hardness mg/L	Alkalinity mg/L					
1	27.100	22.800	8.100	11.100	774.300	0.111	0.108	9.200	495.500	263	142.8	168.6	0.02	0.02	0.1	10	1
2	27.300	23.000	8.300	11.500	792.300	0.022	0.186	7.000	506.500	248	164.8	162	0.02	0.02	0.1	10	1
4	26.000	24.700	8.100	8.800	1281.300	0.067	0.720	7.200	821.300	326	173.6	223.2	0.02	0.02	0.1	10	1
5	27.000	23.700	8.400	8.700	252.100	0.013	0.134	9.500	161.000	95	71	47.5	0.02	0.02	0.1	10	1
7	26.000	21.300	7.800	8.600	318.700	0.044	0.034	5.500	204.000	119	81.8	69.8	0.02	0.02	0.1	10	1
8	27.000	24.300	7.300	6.700	232.300	0.047	0.032	3.800	148.800	80	55.2	57.6	0.02	0.02	0.1	10	1
10	27.000	23.200	8.600	9.600	218.300	0.034	0.012	5.300	139.500	83	51.3	49.5	0.02	0.02	0.1	10	1
11	26.000	23.000	8.200	10.100	235.000	0.052	0.108	16.300	150.600	86	52	40.3	0.02	0.02	0.1	10	1
11.5	28.000	26.200	8.700	10.100	207.400	0.028	0.015	4.600	132.800	81	44.4	50.6	0.02	0.02	0.1	10	1
12	28.500	24.900	8.100	9.300	232.600	0.137	0.021	6.300	148.800	88	48.8	52.7	0.02	0.02	0.1	10	1
13	31	24.9	8.7	9.9	196	0.024	0.009	3.7	125.6	78	42.8	49.6	0.02	0.02	0.1	10	1
14	25	24.1	8.8	10	193	0.022	0.038	5.2	123.4	73	53.6	52.8	0.02	0.02	0.1	10	1
15	25.5	22.8	8	8.8	203.6	0.126	0.053	4.4	130.6	83	53.2	58.3	0.02	0.02	0.1	10	1
17	28.1	20.2	7.2	8.3	89.9	0.018	0.024	6.8	57.6	30	17.6	22	0.02	0.02	0.1	10	1

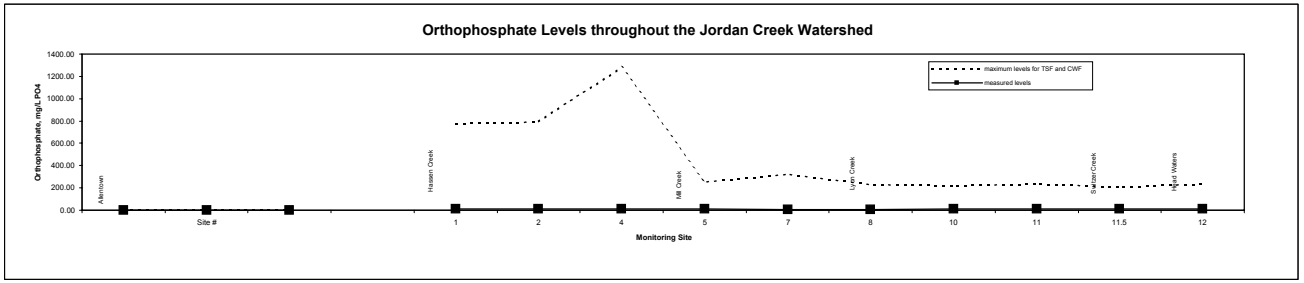


Table 5 . Definitions of Water Quality Parameters

DEFINITION	SOURCES	PURPOSE OF TEST	NORMAL LEVELS
Nitrate			
One of the forms of nitrogen found in aquatic ecosystems; others include ammonia (NH_3) and nitrite (NO_2)	Fertilizer runoff, failing septic systems, animal wastes, decomposing organic matter	High nitrate levels combined with phosphates cause excessive plant and algae growth, a deteriorating process called eutrophication; causes changes in the types of plants and animals in a stream; may lead to low dissolved oxygen; may cause temperature increase	Unpolluted waters normally have less than 1 mg/L, DEP water quality standard in 10 mg/L
Dissolved Oxygen			
A stream with running water will contain more dissolved oxygen than still water; cold water holds more oxygen than warm water	Wastewater from sewage treatment plants, stormwater runoff and failing septic systems	If more oxygen is consumed than produced, some organisms may die due to low levels; spikes in dissolved oxygen may indicate sources of pollution	Trout require at least 7 mg/L dissolved oxygen for unimpaired production; dissolved oxygen levels of at least 4-5 mg/L are needed to support a wide variety of aquatic life
Specific Conductance			
The ability of water to conduct an electrical current; determined by the presence of inorganic dissolved solids	Carbonate bedrocks often yeild high conductivity; discharges to a stream can impact conductivity	Measurements outside normal range for a stream may indicate the presence of a contaminant	U.S. rivers range from 150 to 500 micromhos/cm; conductivity beyond this range may not be suitable for certain fish and macro-invertebrates
Phosphates			
Organic phosphates are associated with living material and can be used by animals; phosphate is an essential nutrient for plant and animal growth.	Wastewater from sewage treatment plants, fertilizer runoff, faulty septic systems, livestock confinement and manure storage facilities	Slight increases may cause numerous undesirable effects: accelerated plant growth, algae blooms, low dissolved oxygen and death of certain aquatic organisms	Phosphate levels below 0.03 mg/L are generally considered to be unpolluted; levels between 0.03 and 0.1 mg/L are sufficient to stimulate plant growth; the critical level for avoiding severe impact is 0.1 mg/L

DEFINITION	SOURCES	PURPOSE OF TEST	NORMAL LEVELS
Temperature			
Temperature is a key determinant of what species can survive in a particular environment	Discharges of coolant and waste waters from industrial or utility plants; runoff from heated surfaces; lack od stream cover to provide shade	Temperature preferences vary widely among species and all species are negatively impacted by rapid fluctuations in temperature	Growth is imaired in Brook Trout at temperatures above 19^{o} C; death will occur above 24^{o} C; desired temperatures depend on the desired use of the water body
pH			
pH indicates acidity or alkalinity; 7 is a neutral measurement; freshwater ranges from 2-12	Dissolved minerals from rocks and soil; acid mine drainage, acid rain, livestock containment areas contribute to acidity; water treatment and sewage plants contribute to alkalinity	Variations in pH affect chemical and biological processes in water; low pH increases availability of metals and other toxics for intake of aquatic life; it is critical to survival, growth and reproduction of fish and macroinvertebrates to mainatin a constant pH	Range from 6.5 to 8.2 is optimal for most organisms; the DEP standard is between 06 and 9
Alkalinity			
Alkalinity is a measure of a stream's ability to neutrlize acids	Alkalinity is greatly determined by the type of underlying bedrock and soil; high values may be caused by sewage and livestock waste	Alkalinity is the best measure of a stream's sensitivity to acid inputs; abrupt changes in alkalinity may signify pollution; without neutralizing capacity, any acid added to a stream would cause an immediate change in pH	Alkalinity levels between 100 and 200 mg/L provide ideal buffering within a stream; endurable pH levels may be maintained at this level of alkalinity, and aquatic life may be protected from acidic shock; this occurs when there is a sudden decrease in pH that aquatic life can not rapidly adapt to survival

APPENDIX F

CONSERVATION FUNDING PROGRAMS

APPENDIX D

CORRELATIONS BETWEEN LAND USE IN THE JORDAN CREEK AND GEOLOGY AND WATER QUALITY

APPENDIX E

PREVIOUS WATER QUALITY DATA

APPENDIX G

BEST MANAGEMENT PRACTICES