APPENDIX A

Comparison of Water Quality Results from Different Sampling Protocols for King County's Ambient and Green-Duwamish Watershed Water Quality Assessment Monitoring Programs, 2001 through 2003

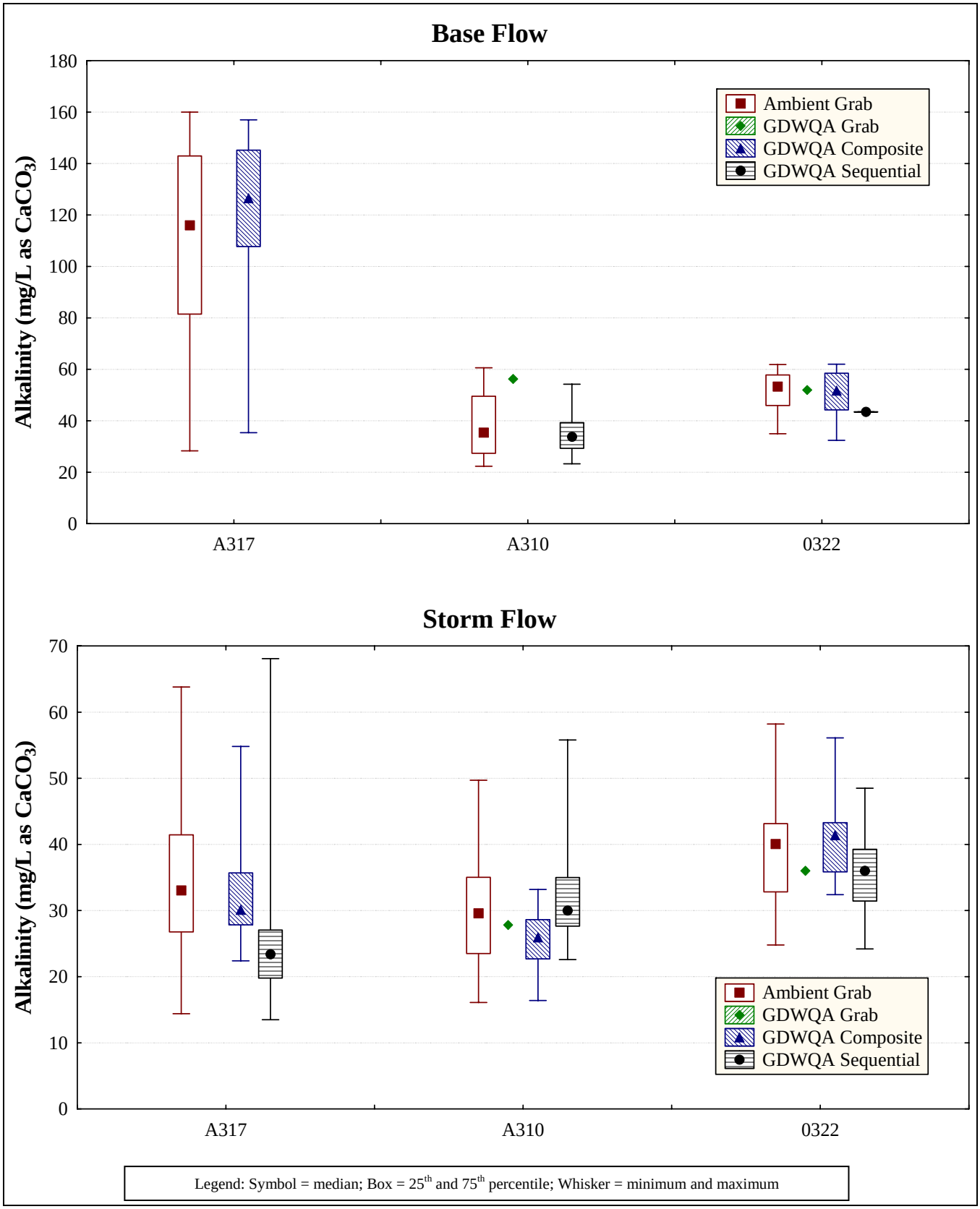

Figure A-1. Comparison of alkalinity concentrations measured at sites in the Green-Duwamish watershed using different sampling protocols for King County's ambient and GDWQA monitoring programs, 2001 – 2003.

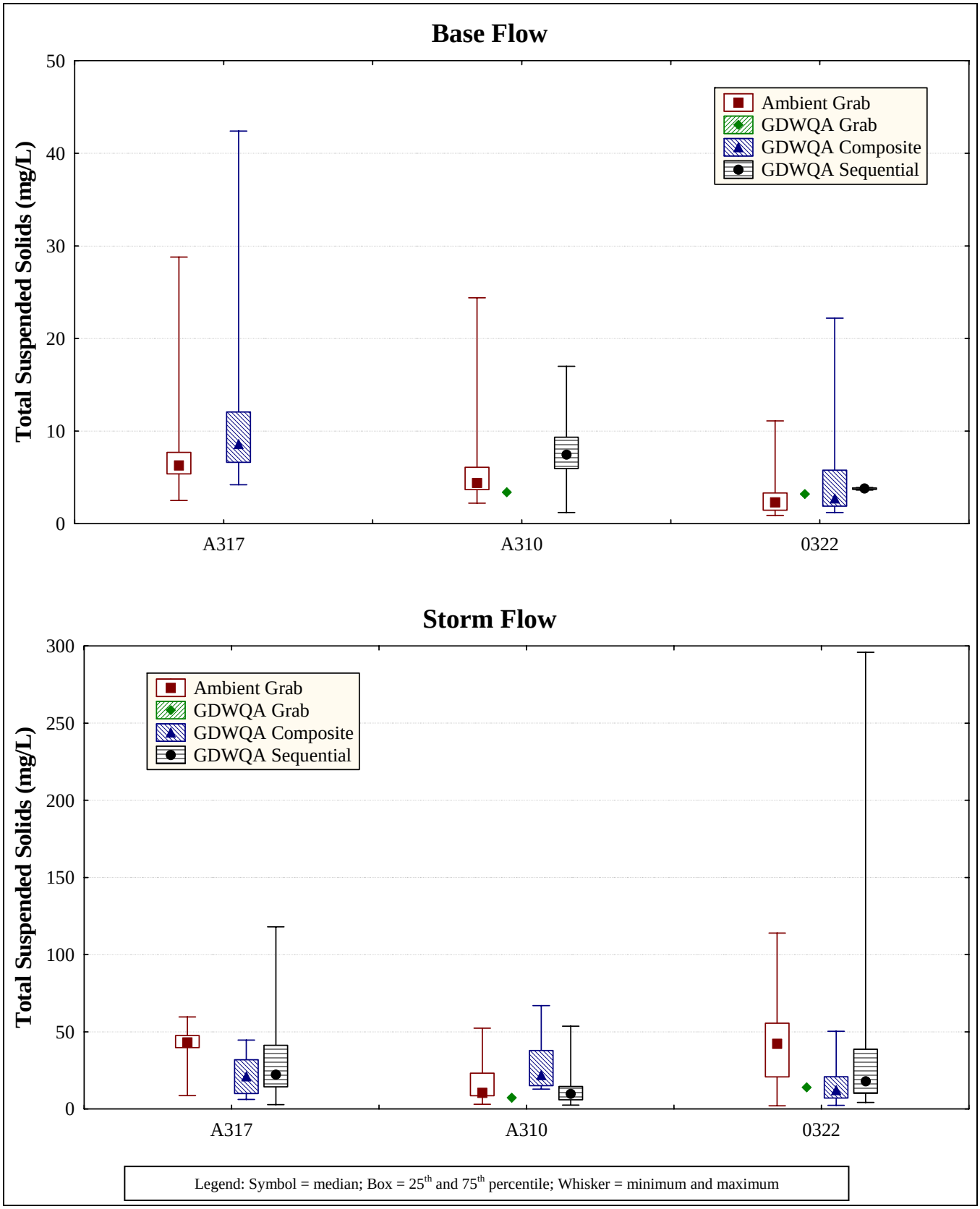

Figure A-2. Comparison of total suspended solids concentrations measured at sites in the Green-Duwamish watershed using different sampling protocols for King County's ambient and GDWQA monitoring programs, 2001 – 2003.

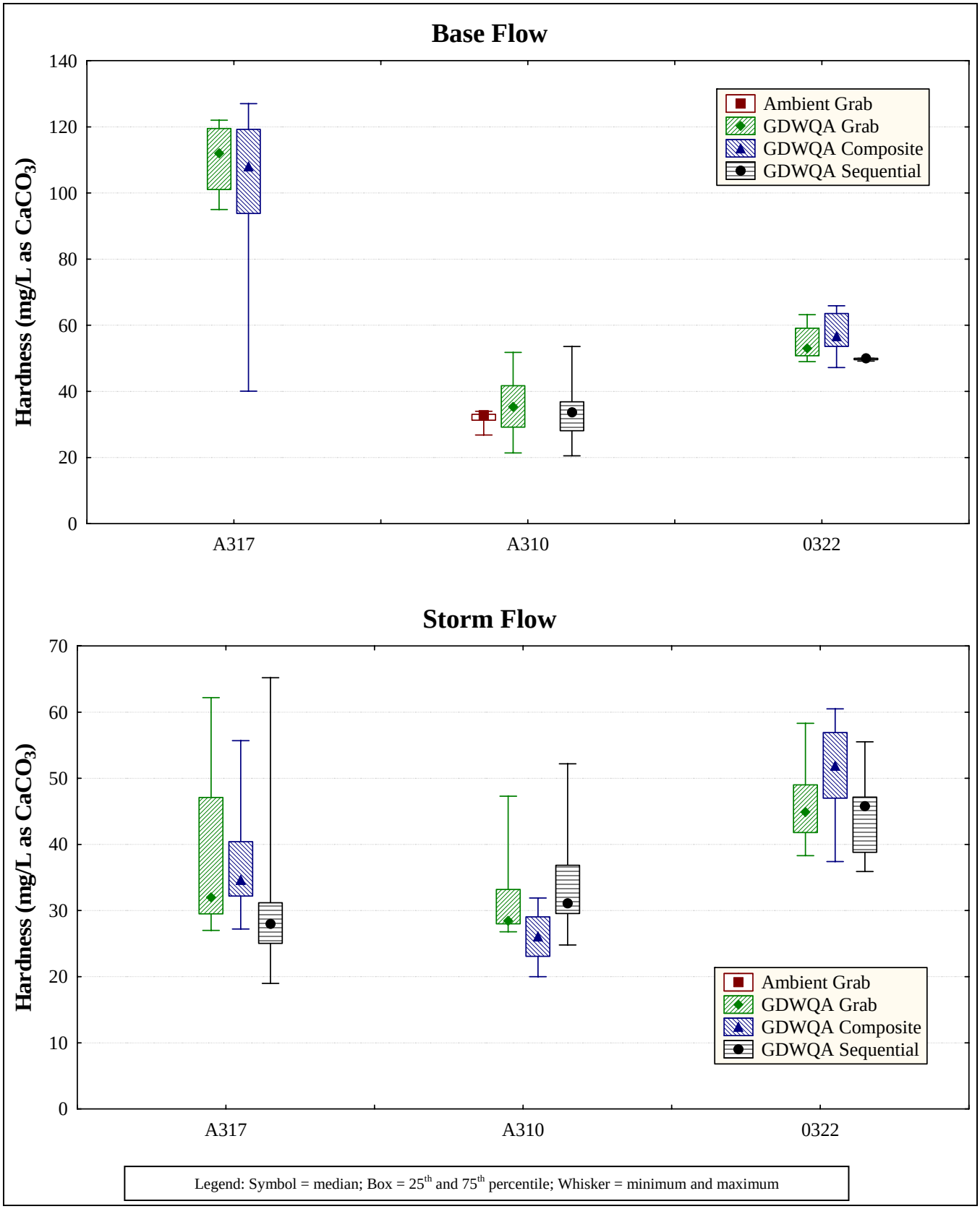

Figure A-3. Comparison of hardness concentrations measured at sites in the Green-Duwamish watershed using different sampling protocols for King County's ambient and GDWQA monitoring programs, 2001 – 2003.

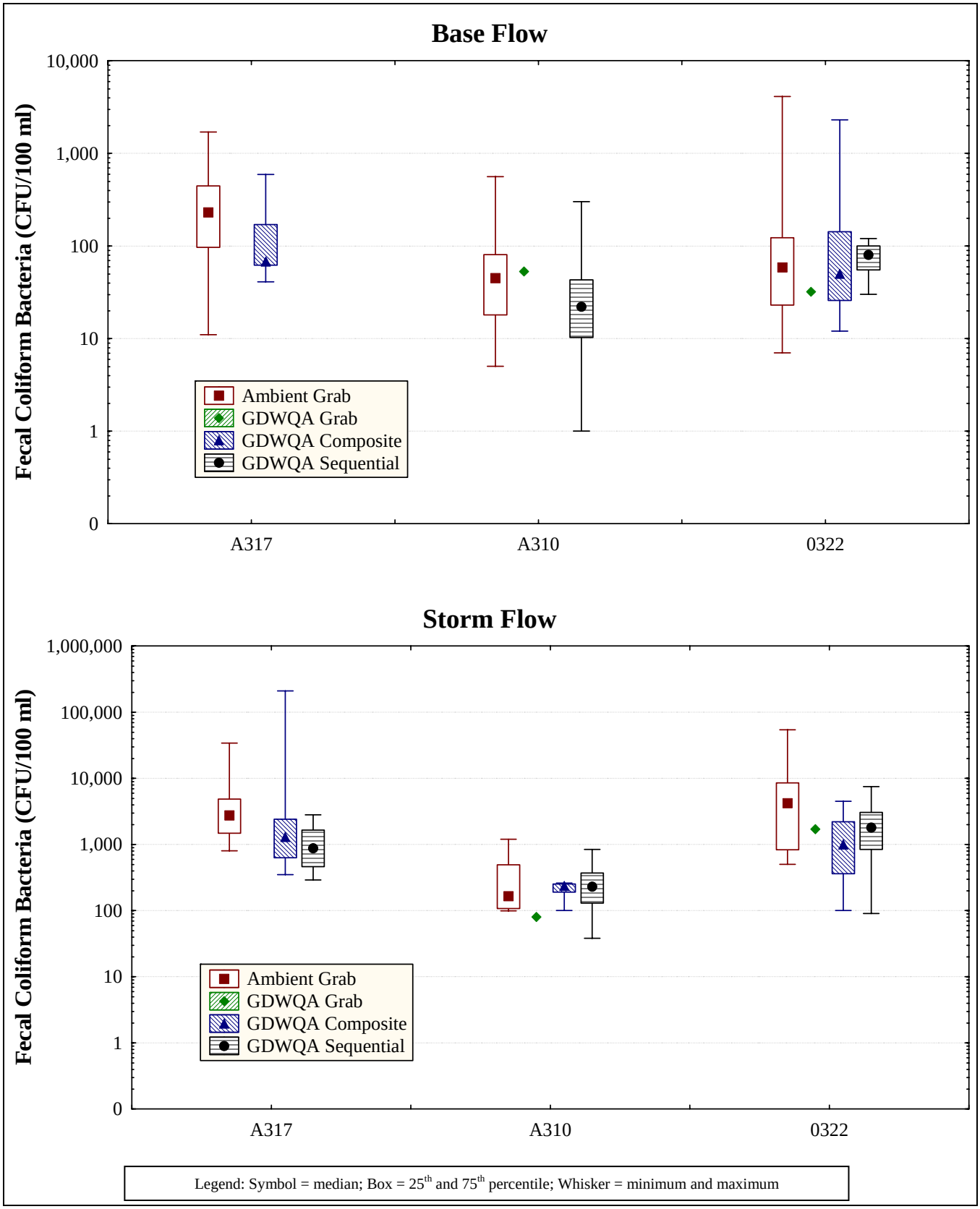

Figure A-4. Comparison of fecal coliform bacteria concentrations measured at sites in the Green-Duwamish watershed using different sampling protocols for King County's ambient and GDWQA monitoring programs, 2001 – 2003.

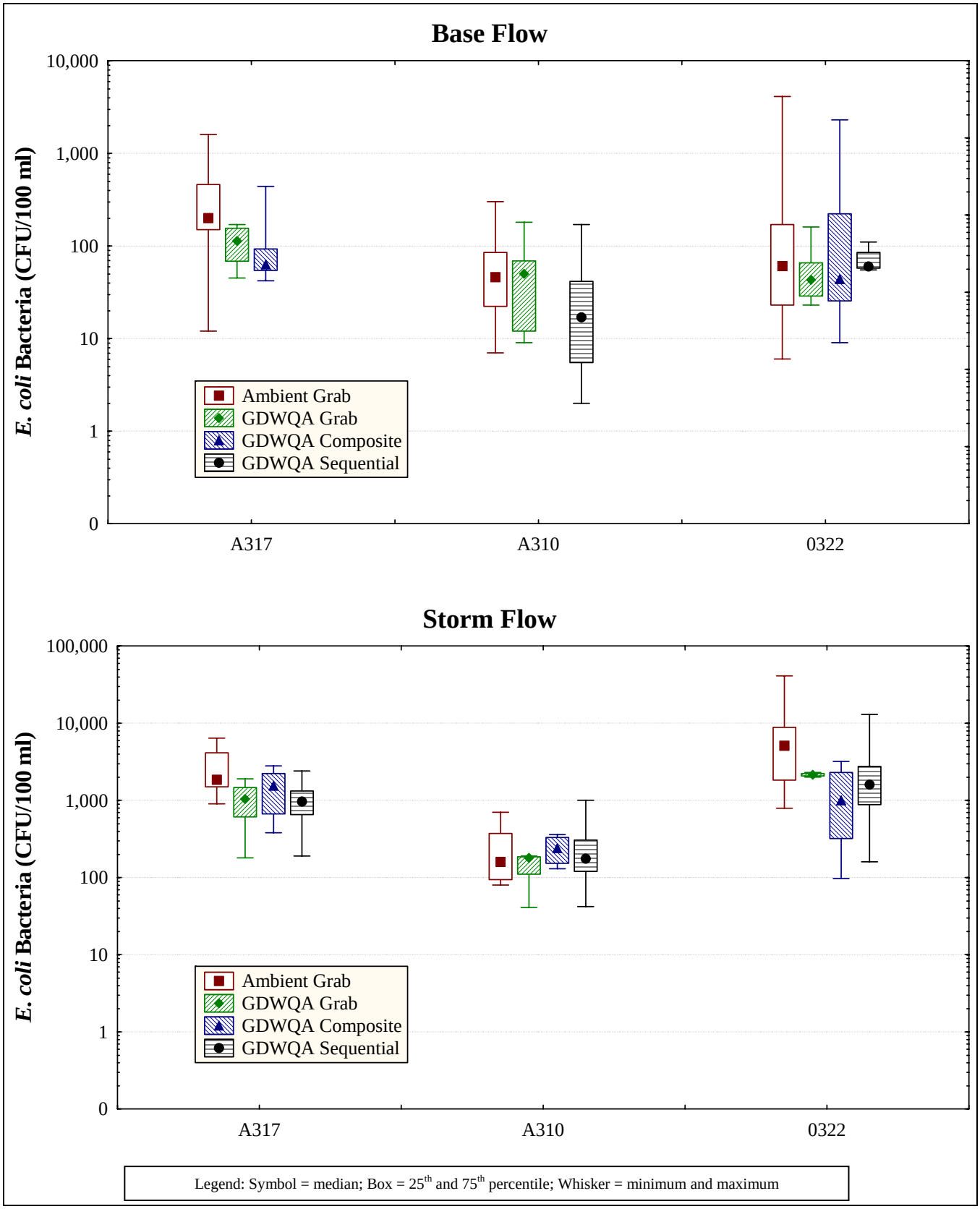

Figure A-5. Comparison of *E. coli* bacteria concentrations measured at sites in the Green-Duwamish watershed using different sampling protocols for King County's ambient and GDWQA monitoring programs, 2001 – 2003.

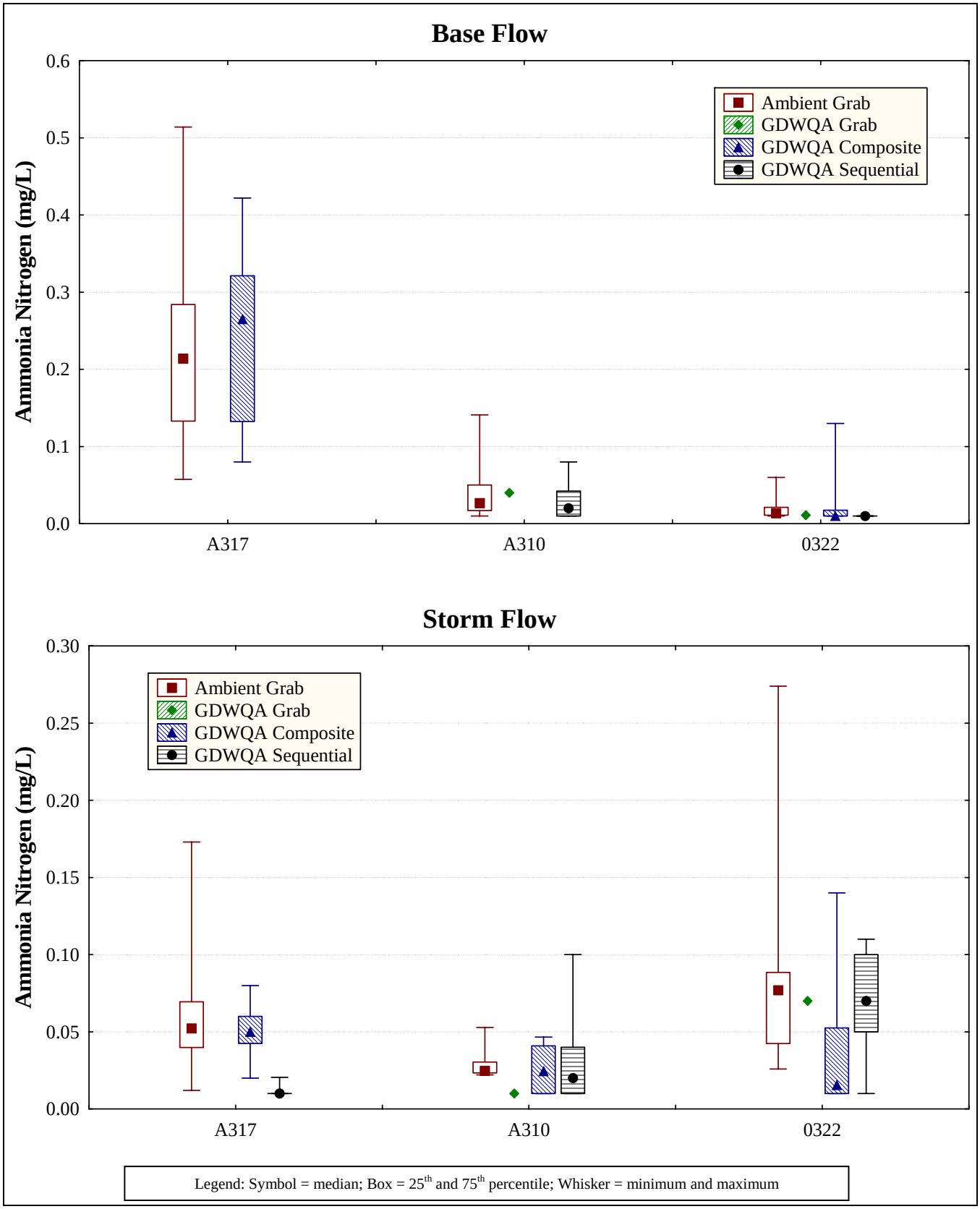

Figure A-6. Comparison of ammonia nitrogen concentrations measured at sites in the Green-Duwamish watershed using different sampling protocols for King County's ambient and GDWQA monitoring programs, 2001 – 2003.

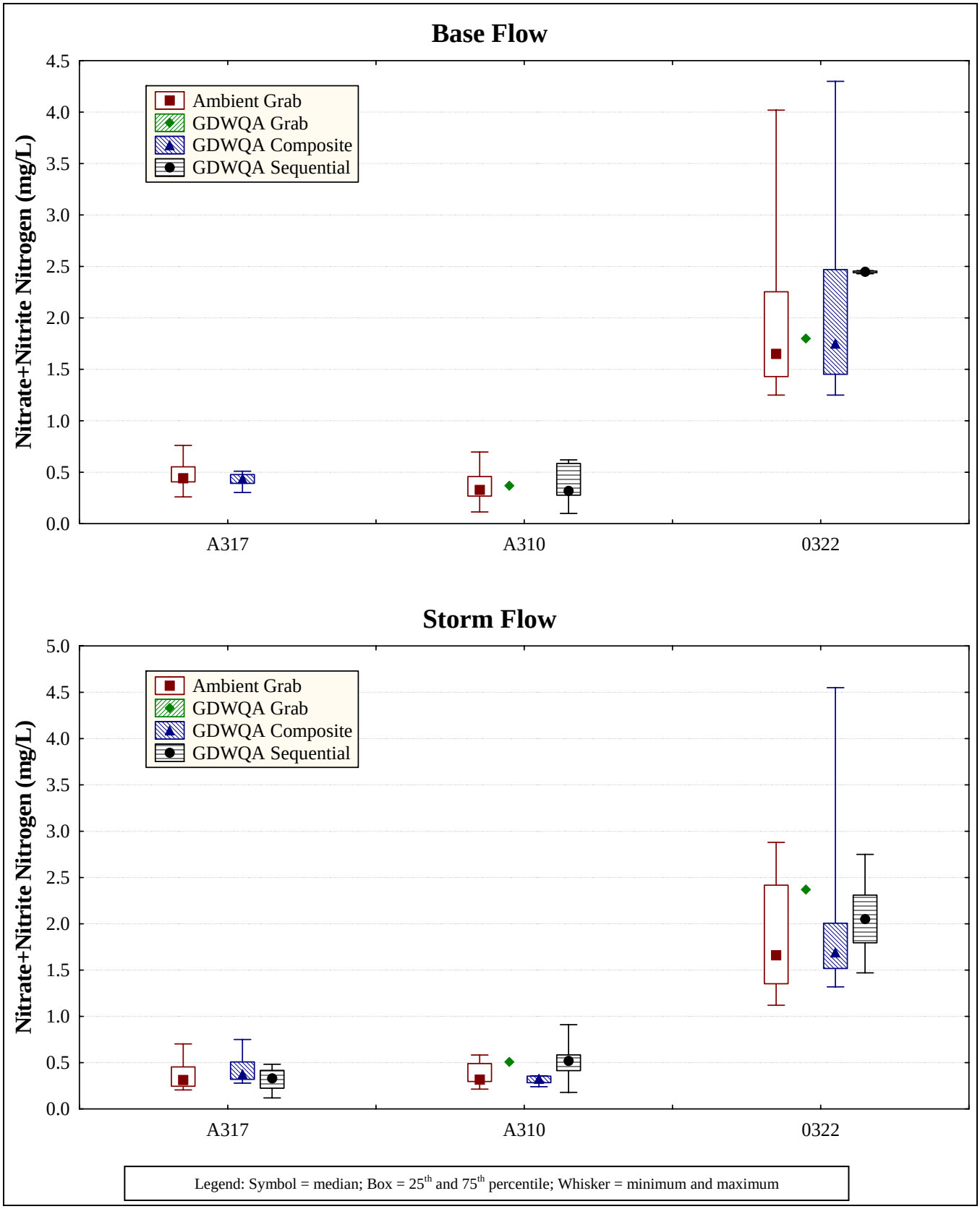

Figure A-7. Comparison of nitrate+nitrite nitrogen concentrations measured at sites in the Green-Duwamish watershed using different sampling protocols for King County's ambient and GDWQA monitoring programs, 2001 – 2003.

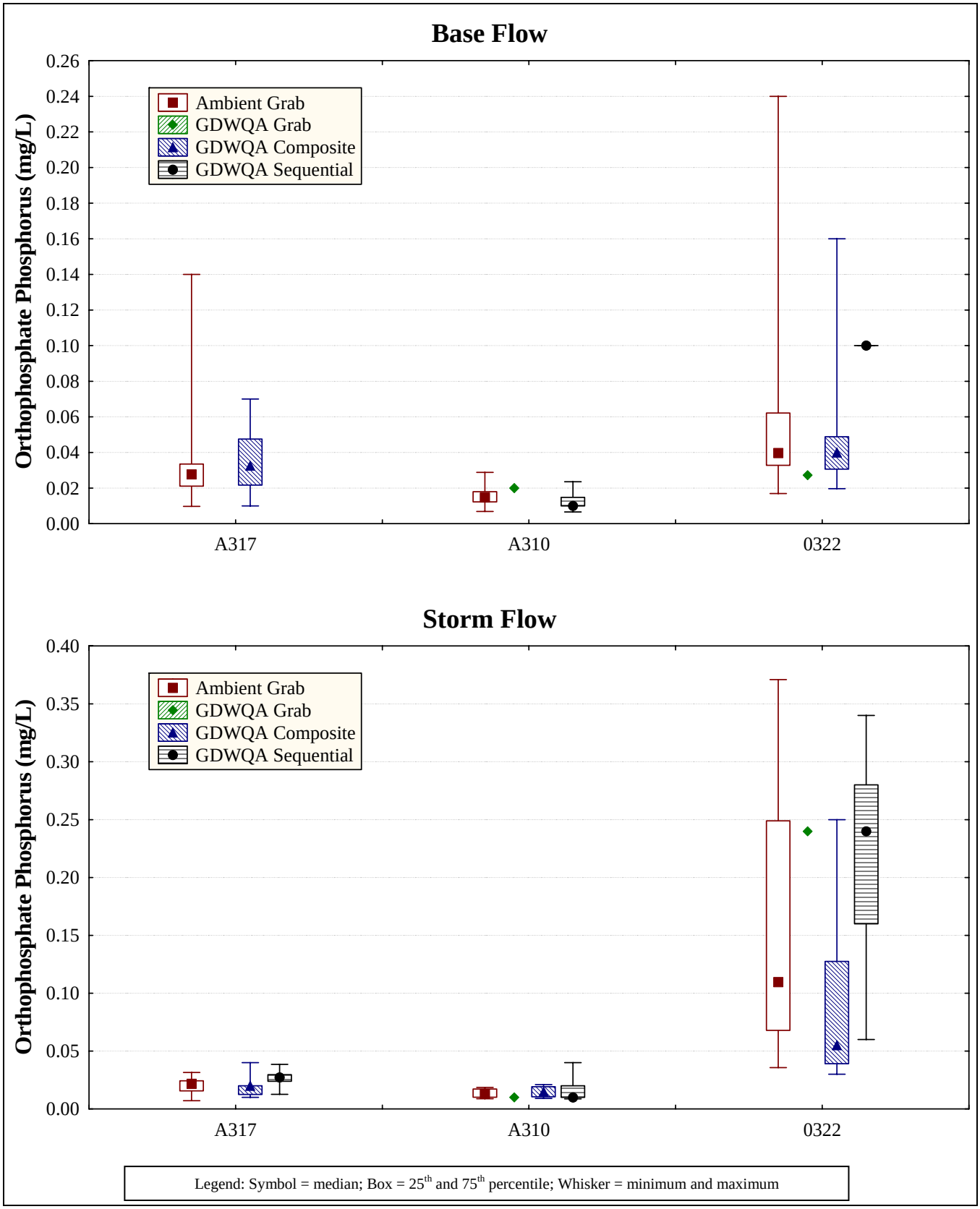

Figure A-8. Comparison of orthophosphate phosphorus concentrations measured at sites in the Green-Duwamish watershed using different sampling protocols for King County's ambient and GDWQA monitoring programs, 2001 – 2003.

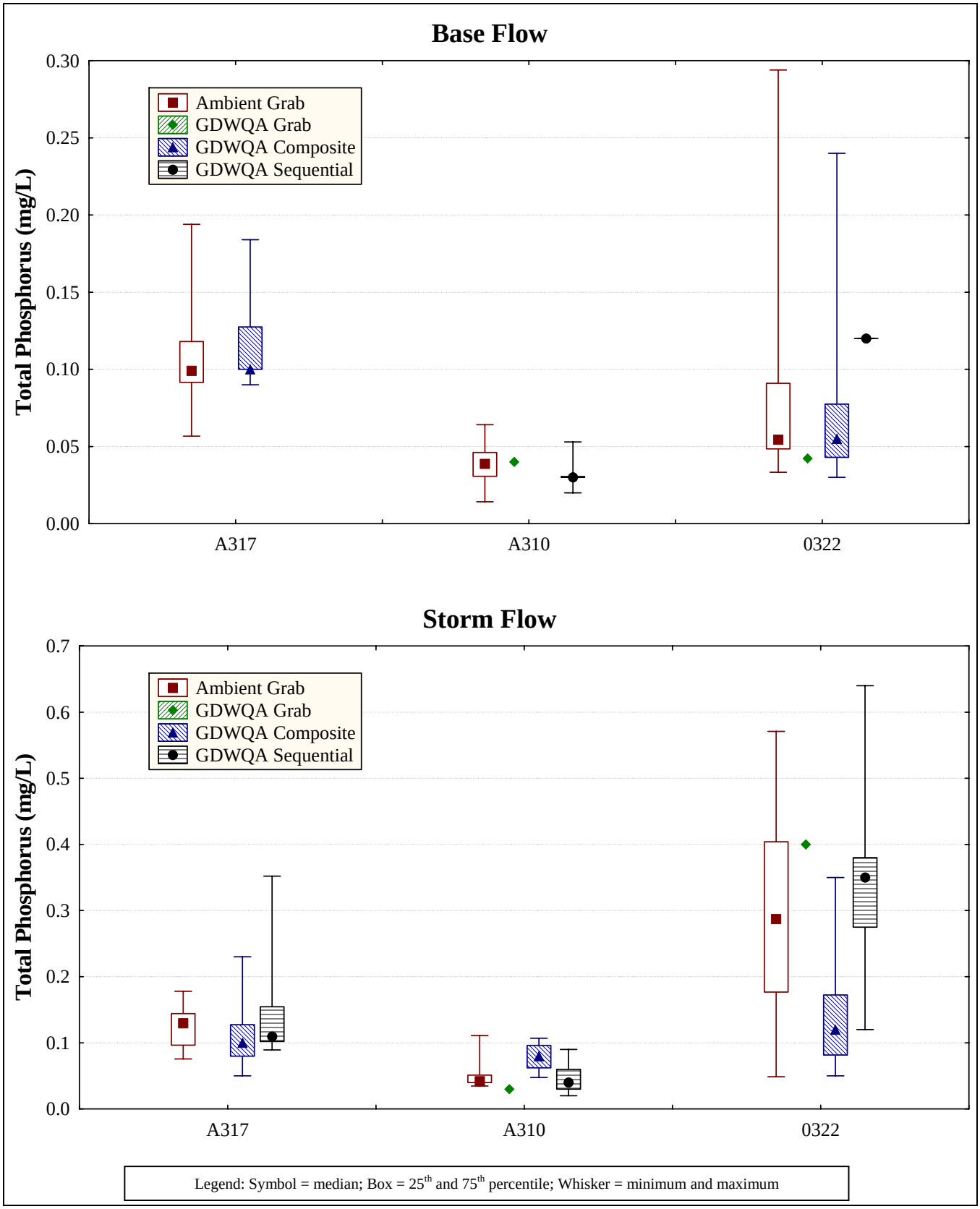

Figure A-9. Comparison of total phosphorus concentrations measured at sites in the Green-Duwamish watershed using different sampling protocols for King County's ambient and GDWQA monitoring programs, 2001 – 2003.

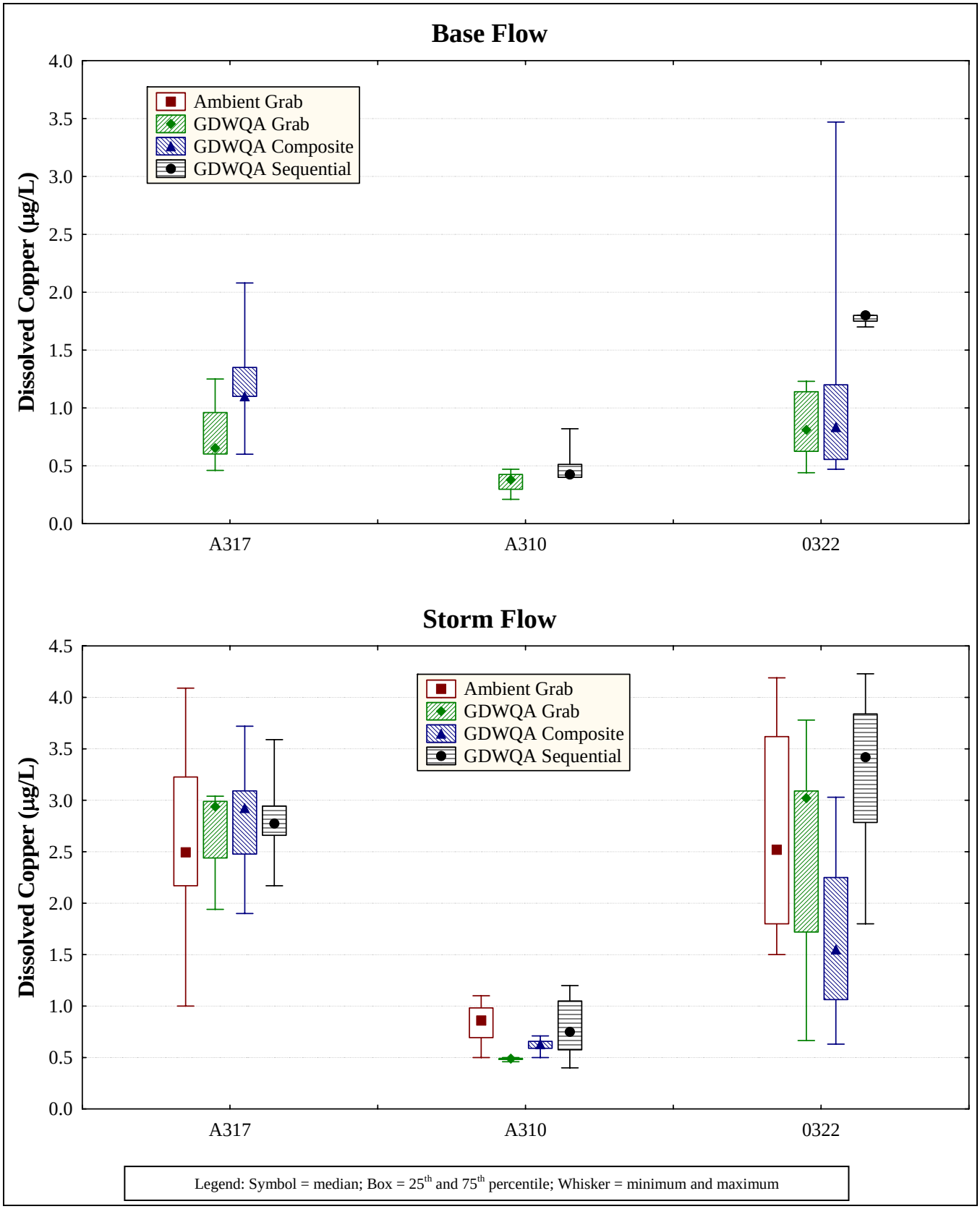

Figure A-10. Comparison of dissolved copper concentrations measured at sites in the Green-Duwamish watershed using different sampling protocols for King County's ambient and GDWQA monitoring programs, 2001 – 2003.

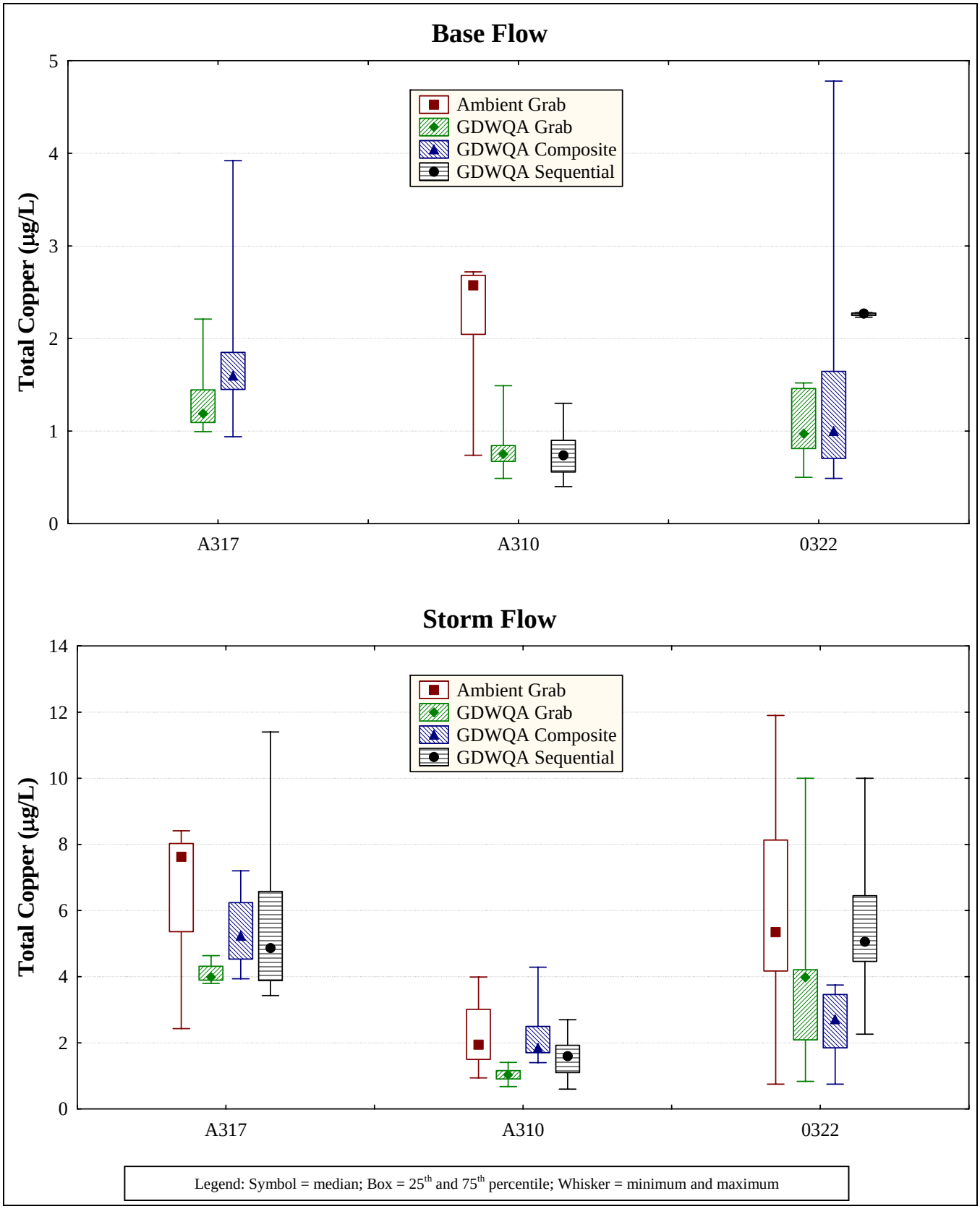

Figure A-11. Comparison of total copper concentrations measured at sites in the Green-Duwamish watershed using different sampling protocols for King County's ambient and GDWQA monitoring programs, 2001 – 2003.

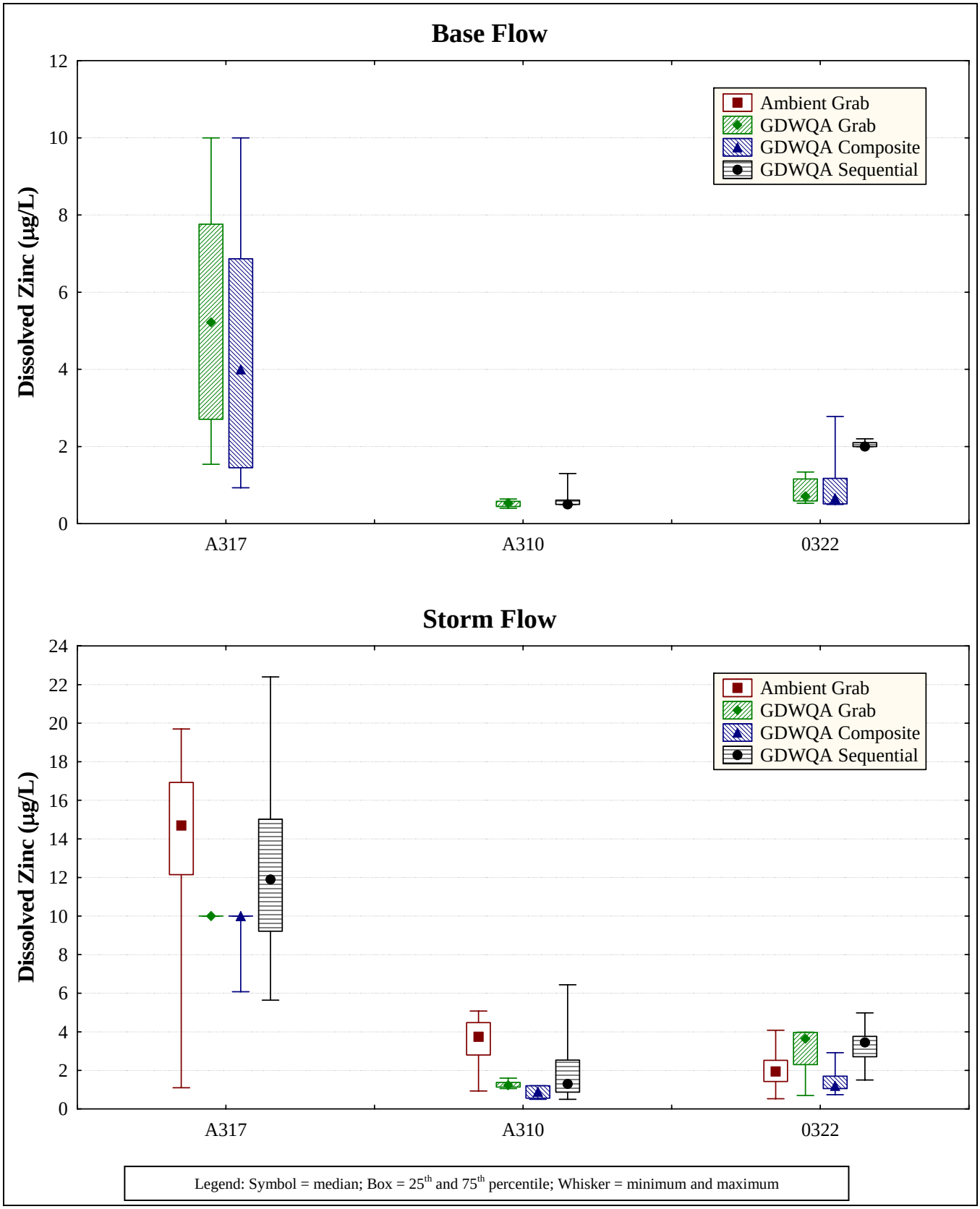

Figure A-12. Comparison of dissolved zinc concentrations measured at sites in the Green-Duwamish watershed using different sampling protocols for King County's ambient and GDWQA monitoring programs, 2001 – 2003.

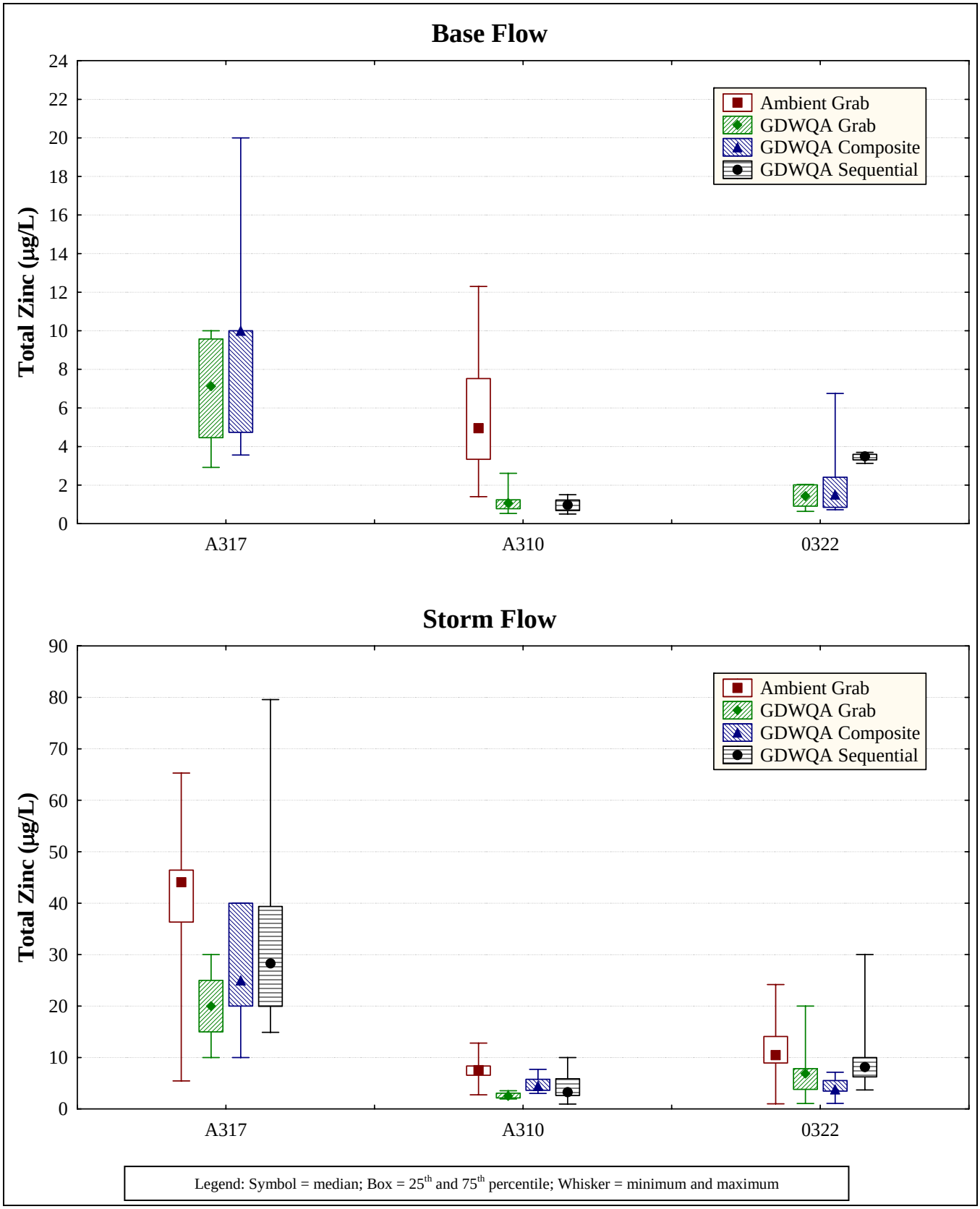

Figure A-13. Comparison of total zinc concentrations measured at sites in the Green-Duwamish watershed using different sampling protocols for King County's ambient and GDWQA monitoring programs, 2001 – 2003.

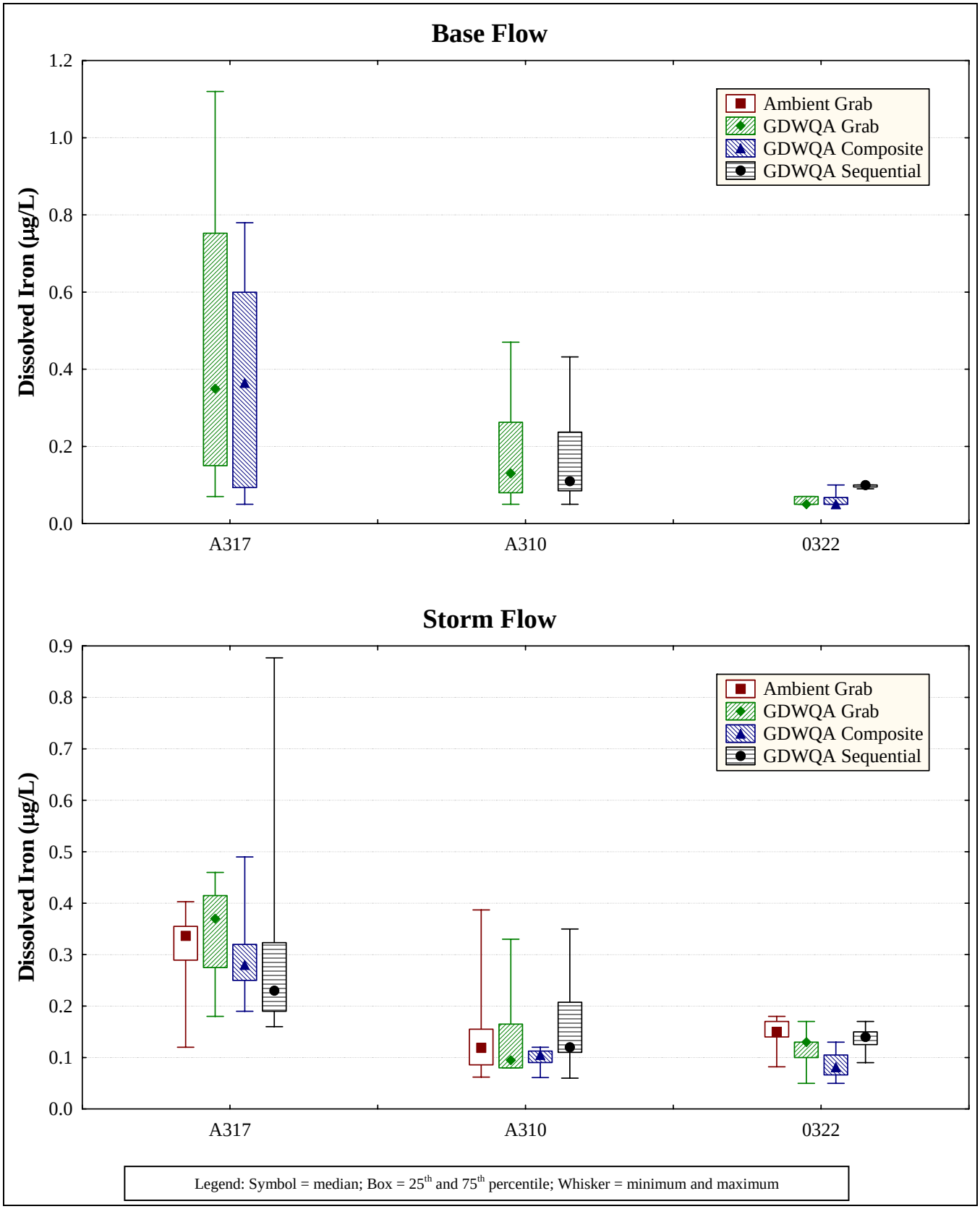

Figure A-14. Comparison of dissolved iron concentrations measured at sites in the Green-Duwamish watershed using different sampling protocols for King County's ambient and GDWQA monitoring programs, 2001 – 2003.

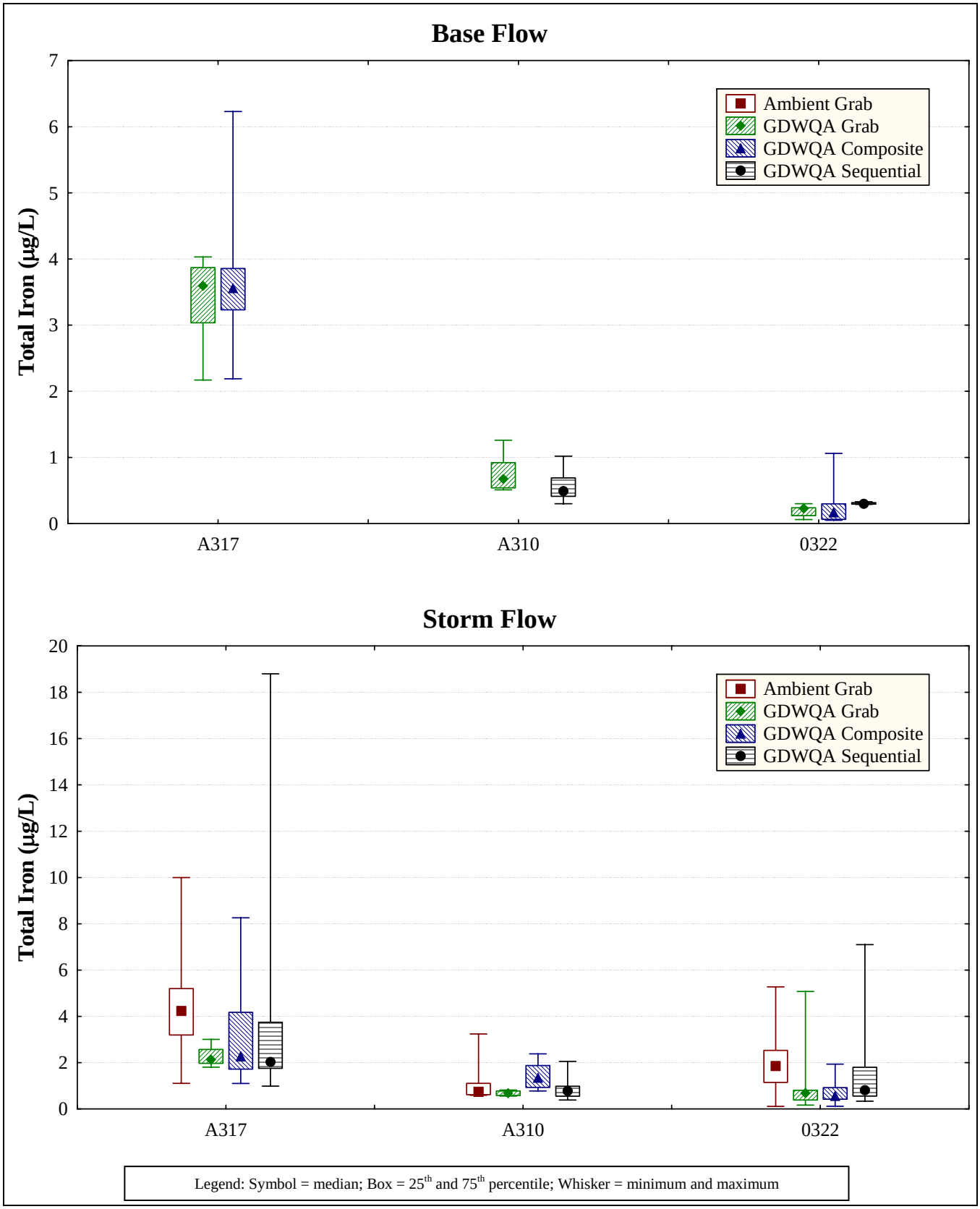

Figure A-15. Comparison of total iron concentrations measured at sites in the Green-Duwamish watershed using different sampling protocols for King County's ambient and GDWQA monitoring programs, 2001 – 2003.

APPENDIX B

Comparison of Water Quality Data Collected during Storm Flow and Base Flow Conditions in the Green-Duwamish Watershed, 2001 through 2003

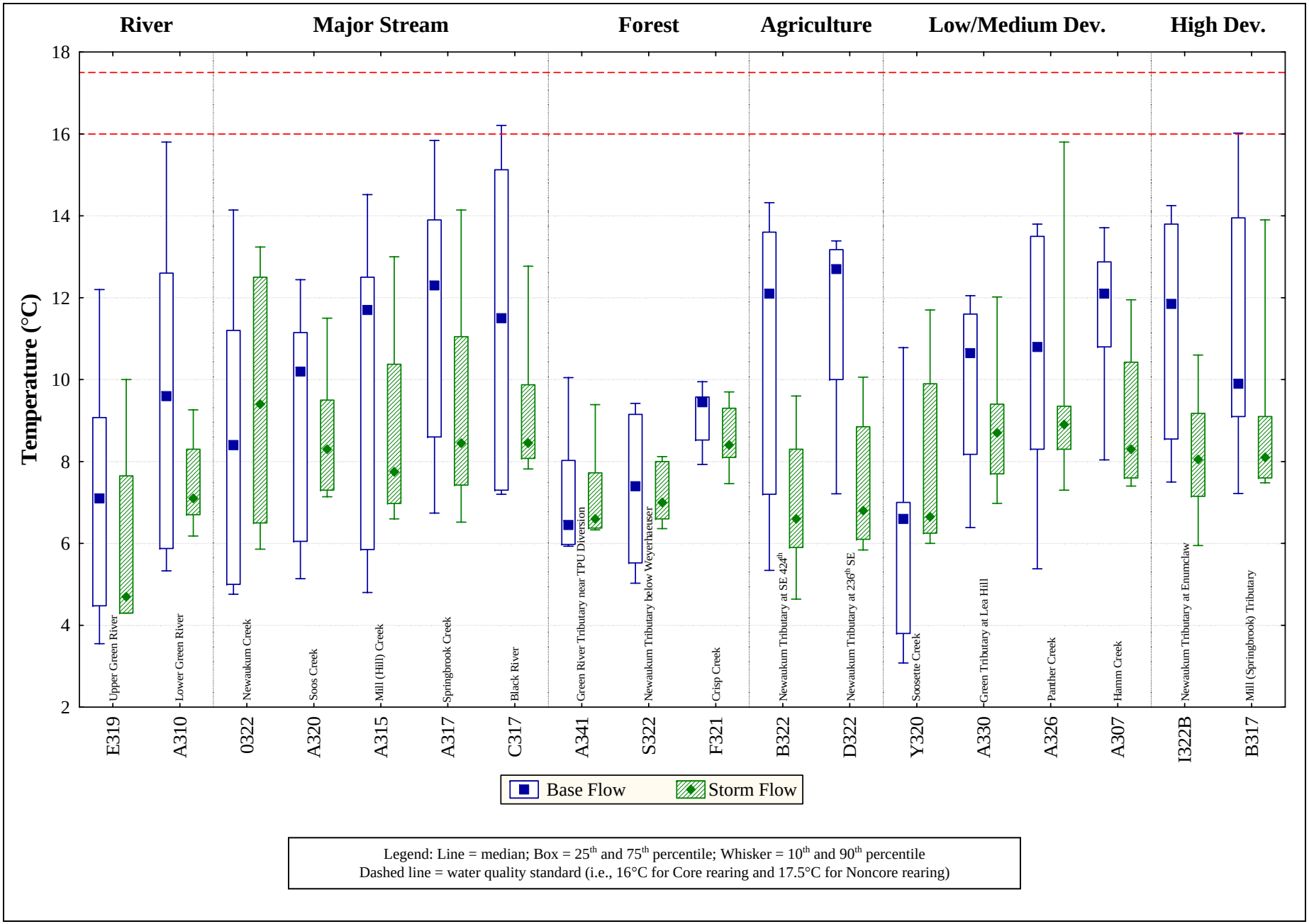

Figure B-1. Base and storm flow temperature levels measured at sites in the Green-Duwamish watershed, 2001 – 2003.

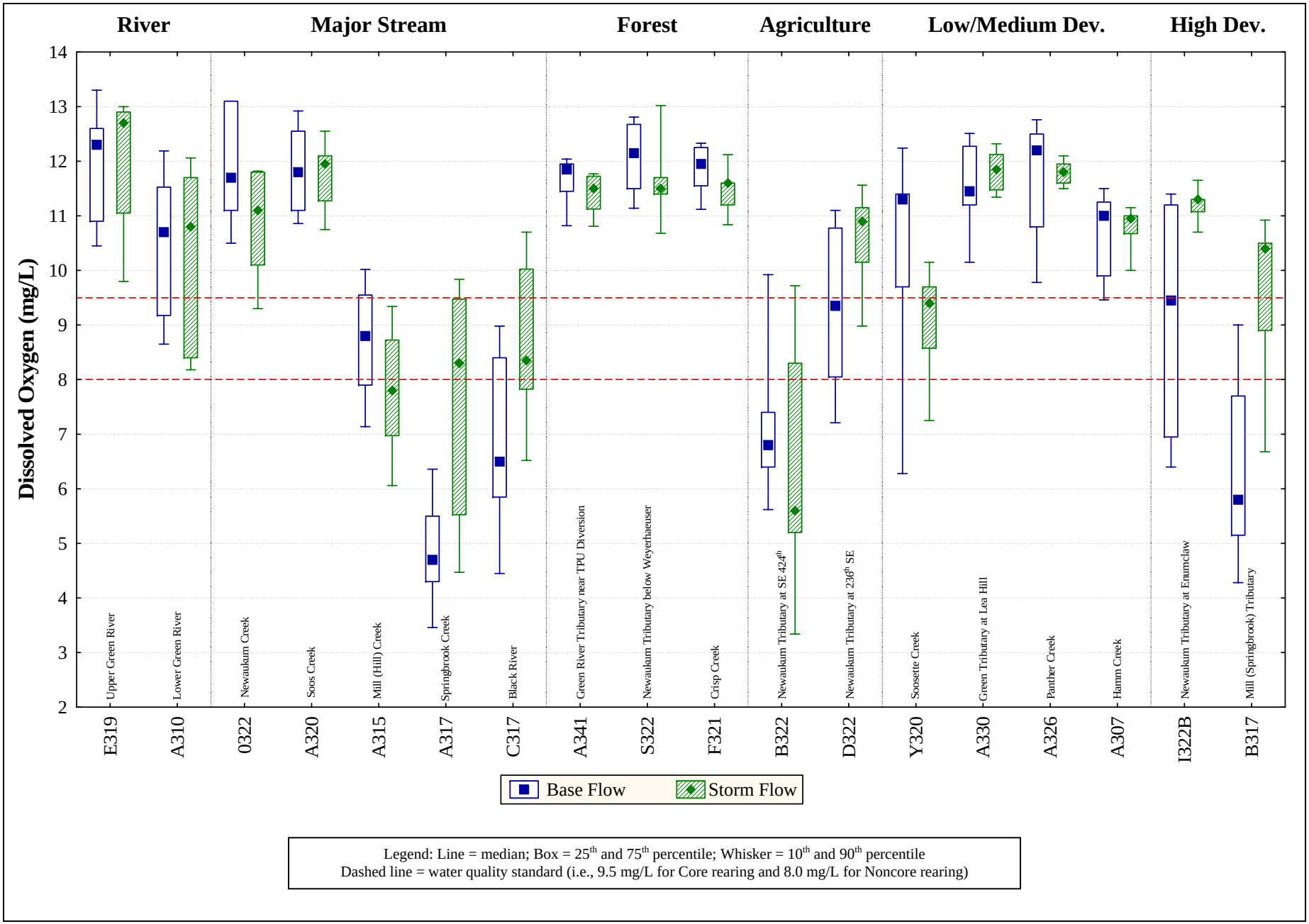

Figure B-2. Base and storm flow dissolved oxygen concentrations measured at sites in the Green-Duwamish watershed, 2001 – 2003.

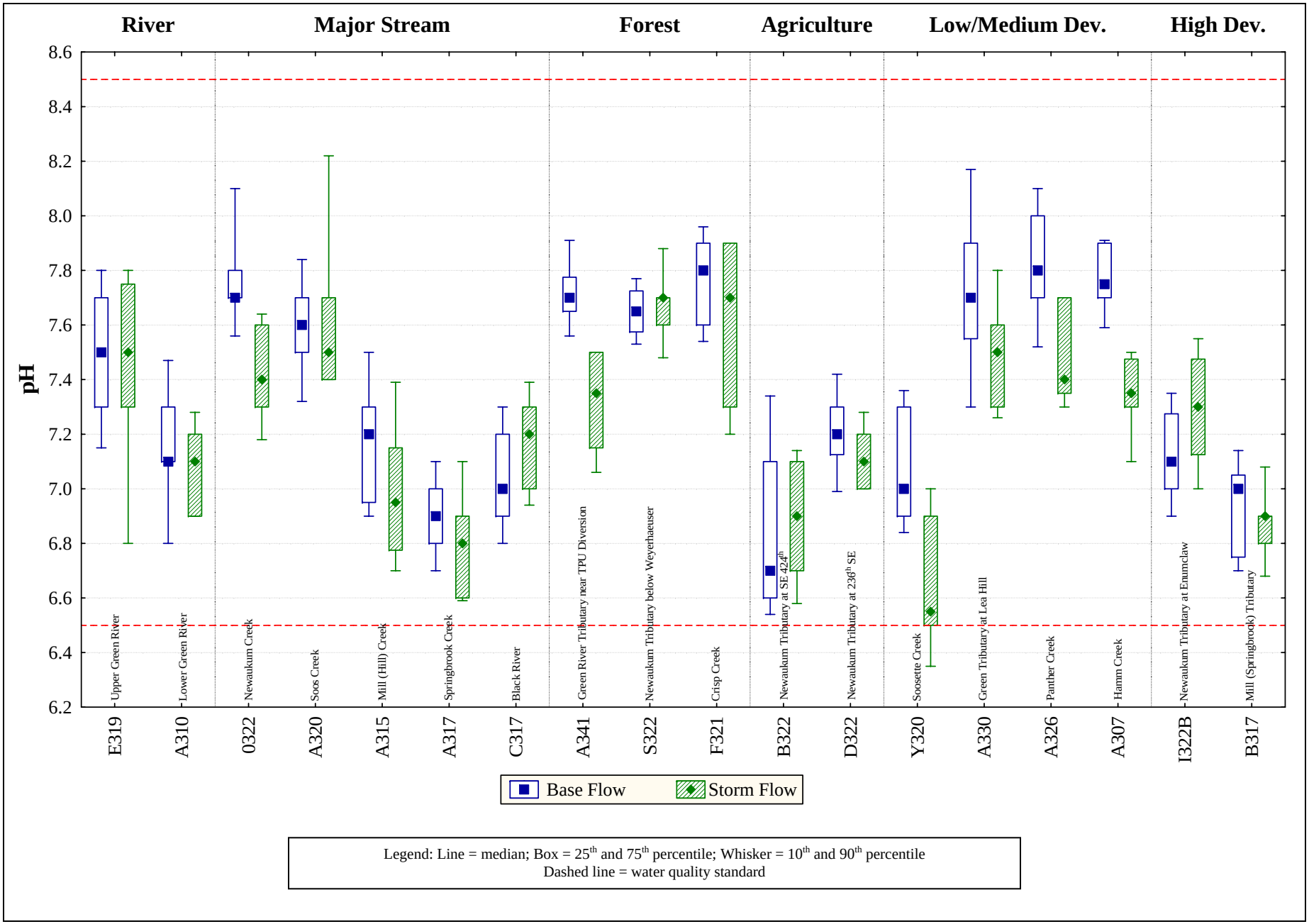

Figure B-3. Base and storm flow pH levels measured at sites in the Green-Duwamish watershed, 2001 – 2003.

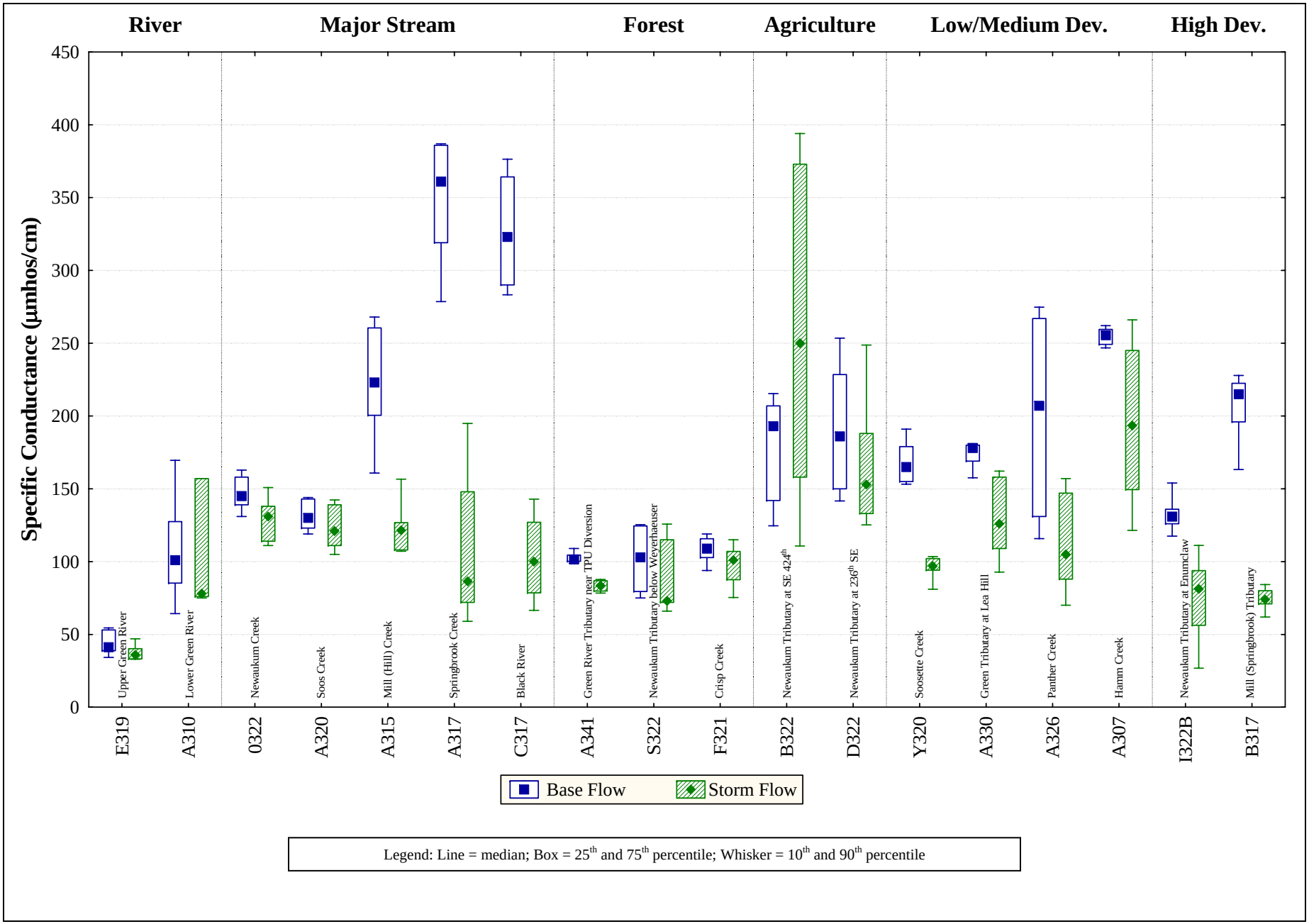

Figure B-4. Base and storm flow specific conductance levels measured at sites in the Green-Duwamish watershed, 2001 – 2003.

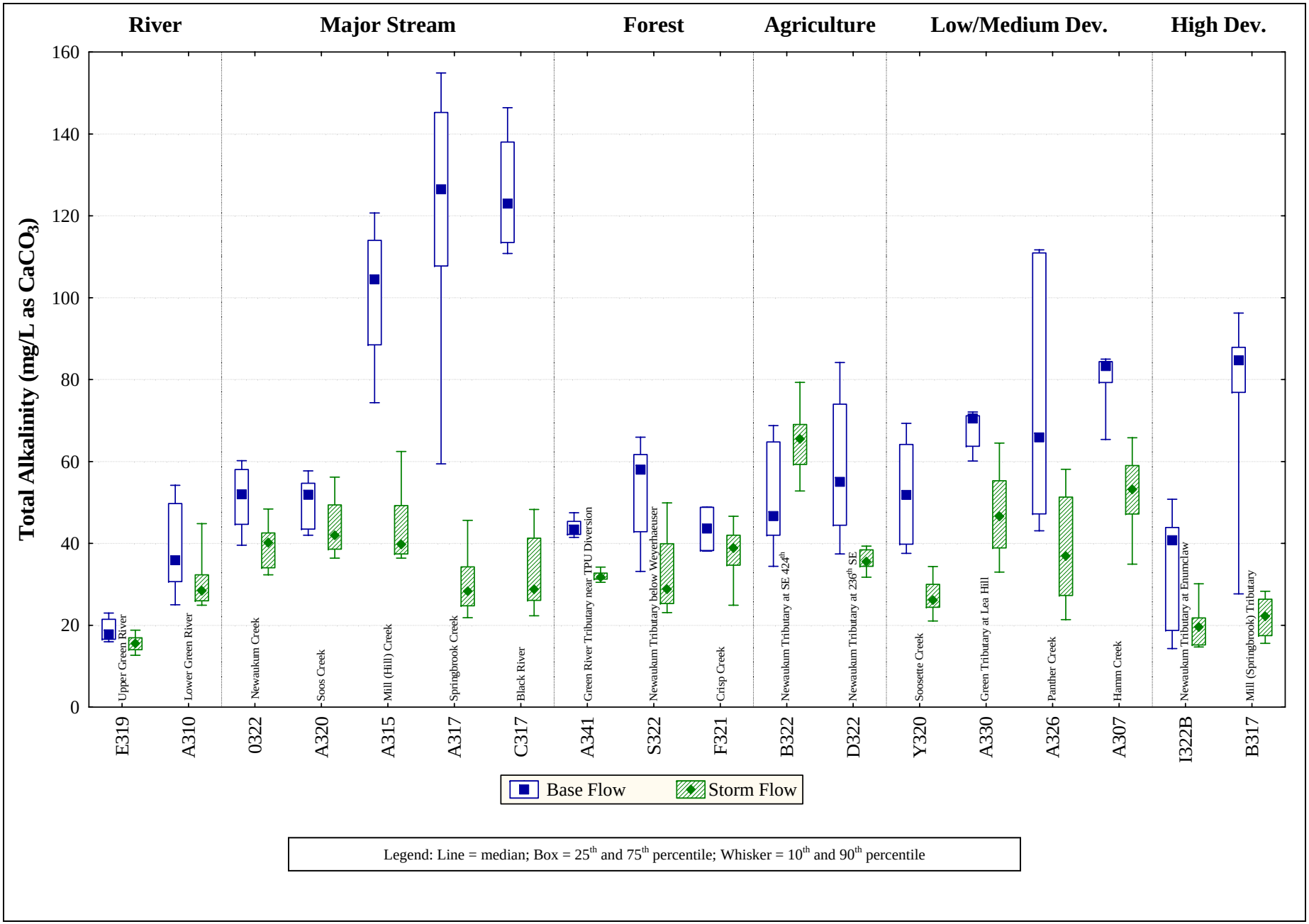

Figure B-5. Base and storm flow alkalinity concentrations measured at sites in the Green-Duwamish watershed, 2001 – 2003.

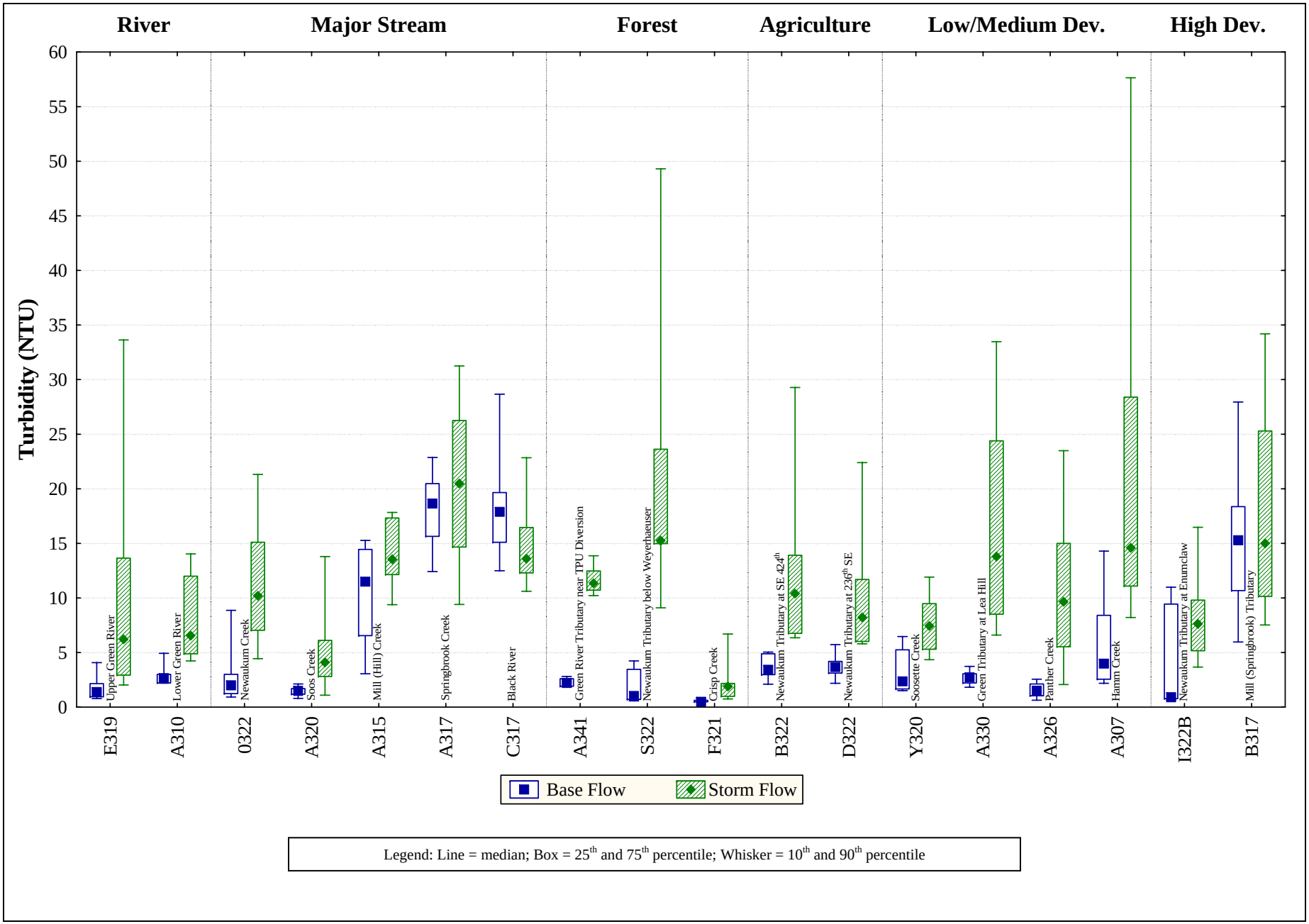

Figure B-6. Base and storm flow turbidity levels measured at sites in the Green-Duwamish watershed, 2001 – 2003.

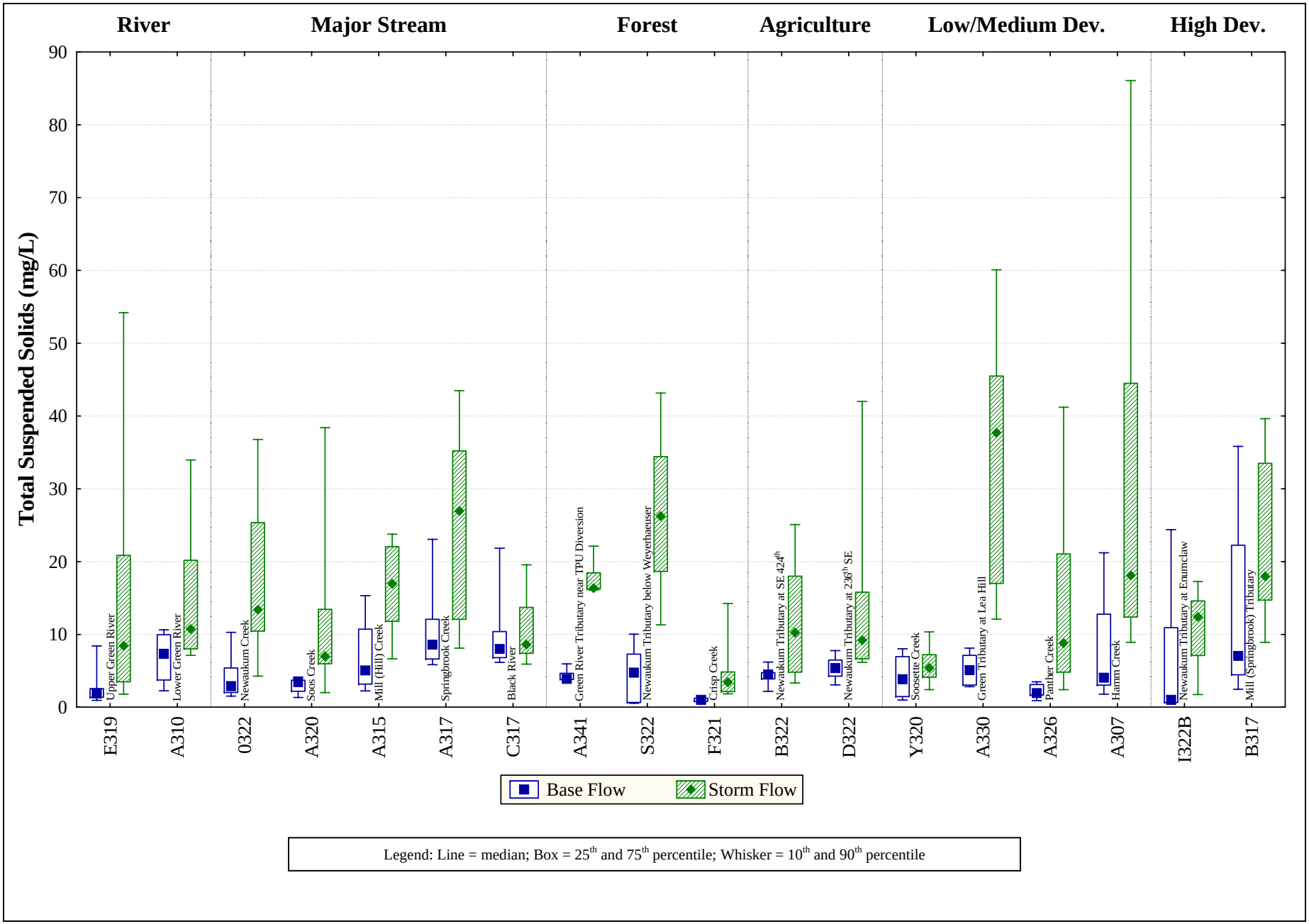

Figure B-7. Base and storm flow total suspended solids concentrations measured at sites in the Green-Duwamish watershed, 2001 – 2003.

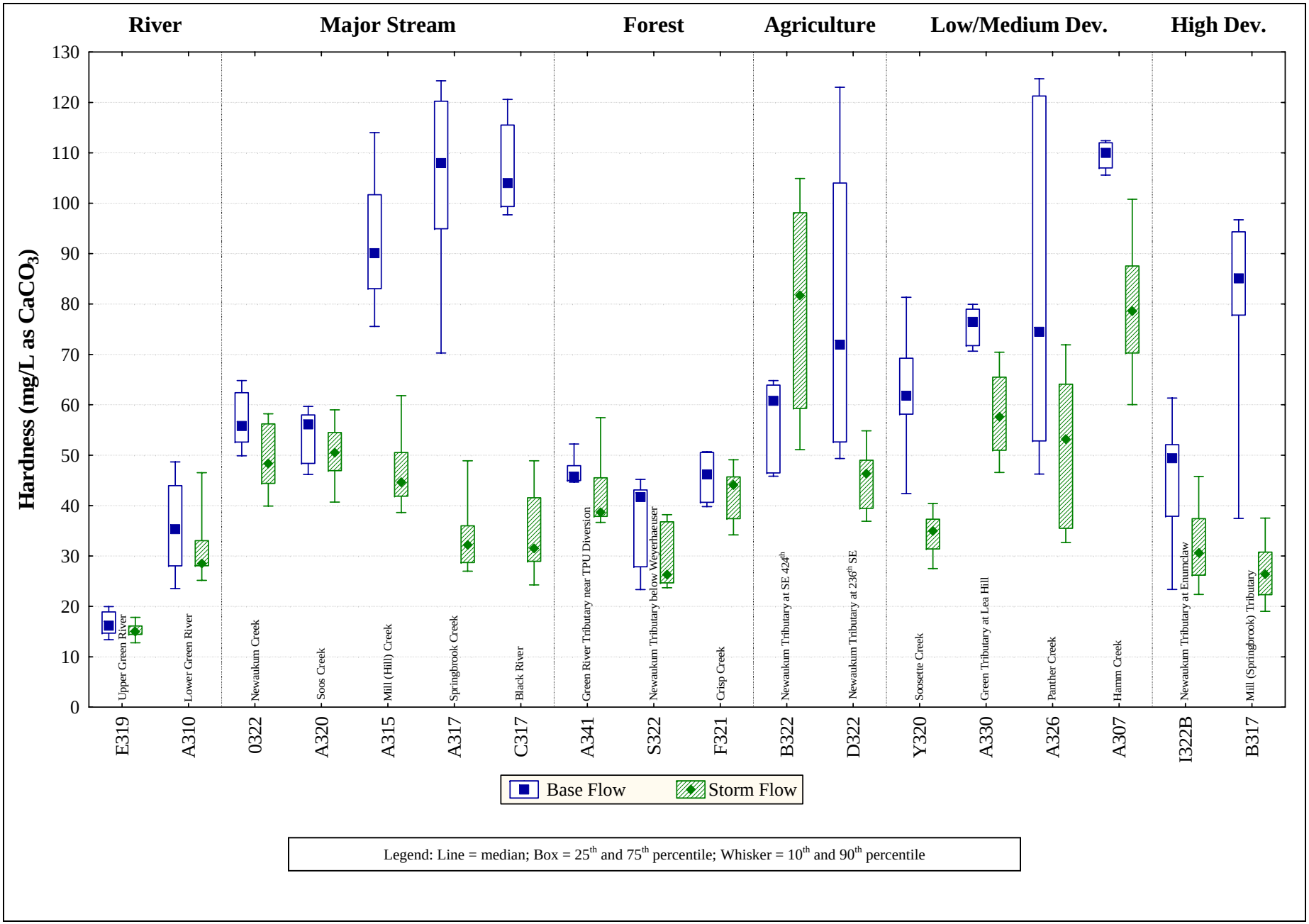

Figure B-9. Base and storm flow hardness concentrations measured at sites in the Green-Duwamish watershed, 2001 – 2003.

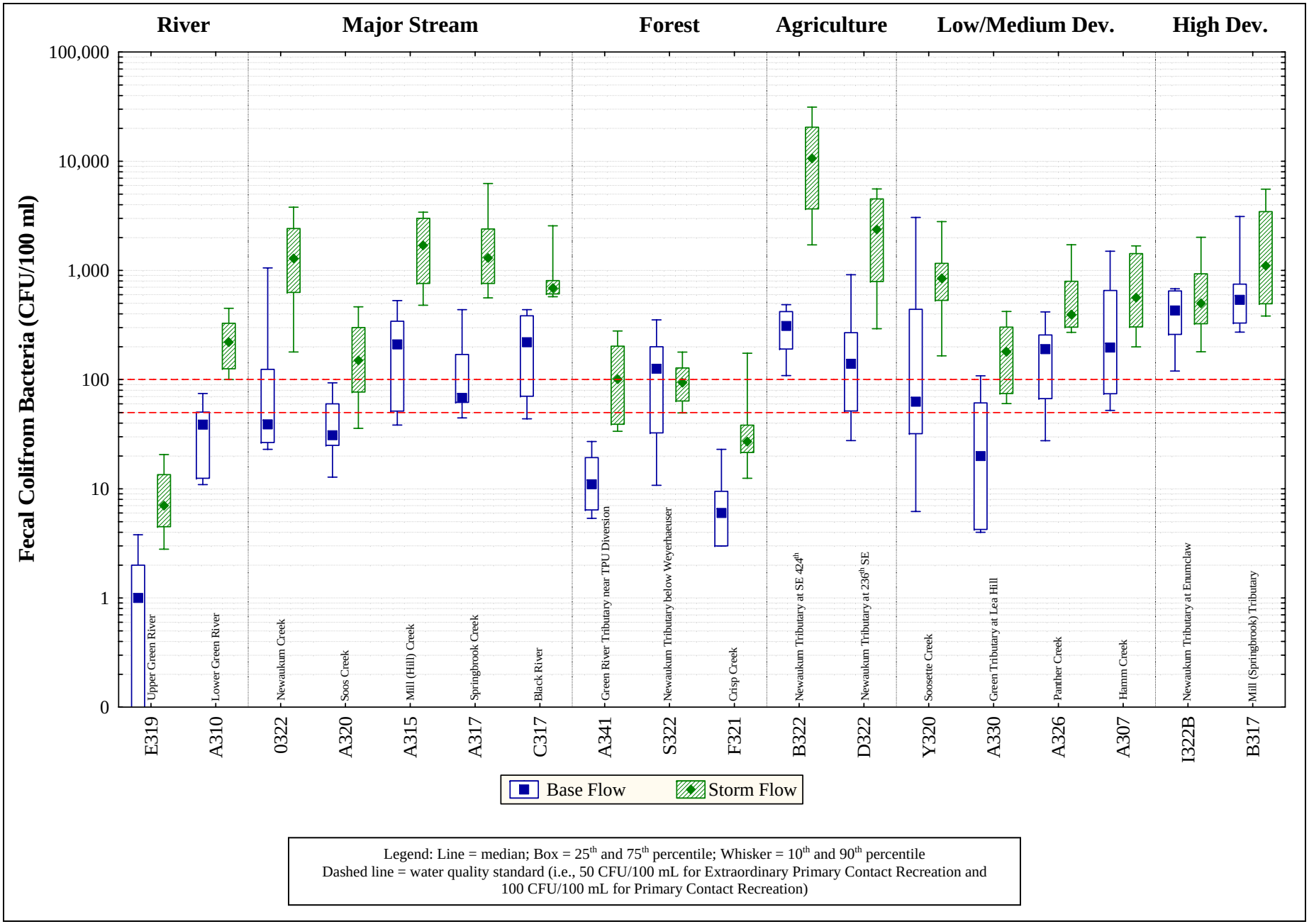

Figure B-9. Base and storm flow fecal coliform bacteria concentrations measured at sites in the Green-Duwamish watershed, 2001 – 2003.

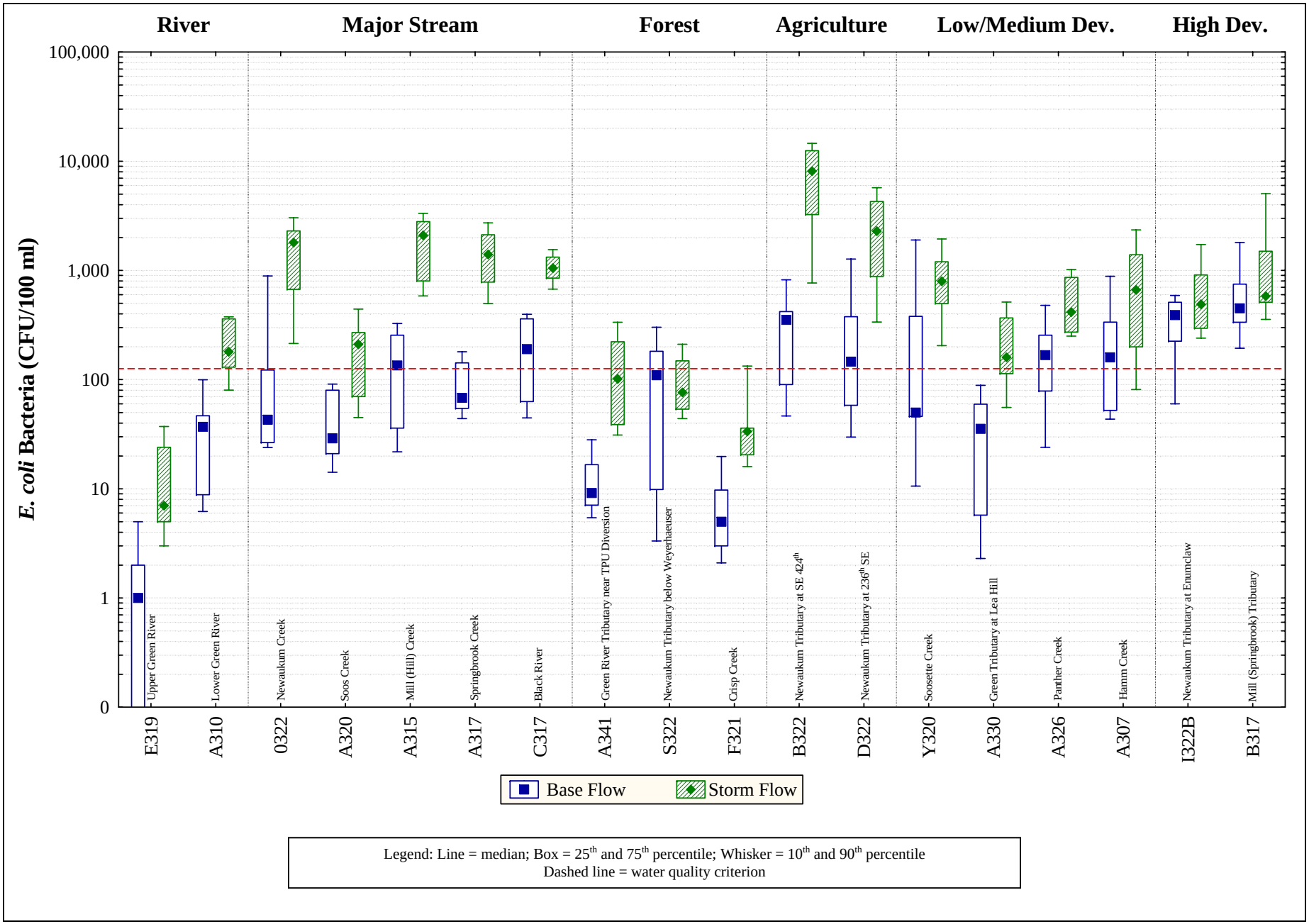

Figure B-10. Base and storm flow *E. coli* bacteria concentrations measured at sites in the Green-Duwamish watershed, 2001 – 2003.

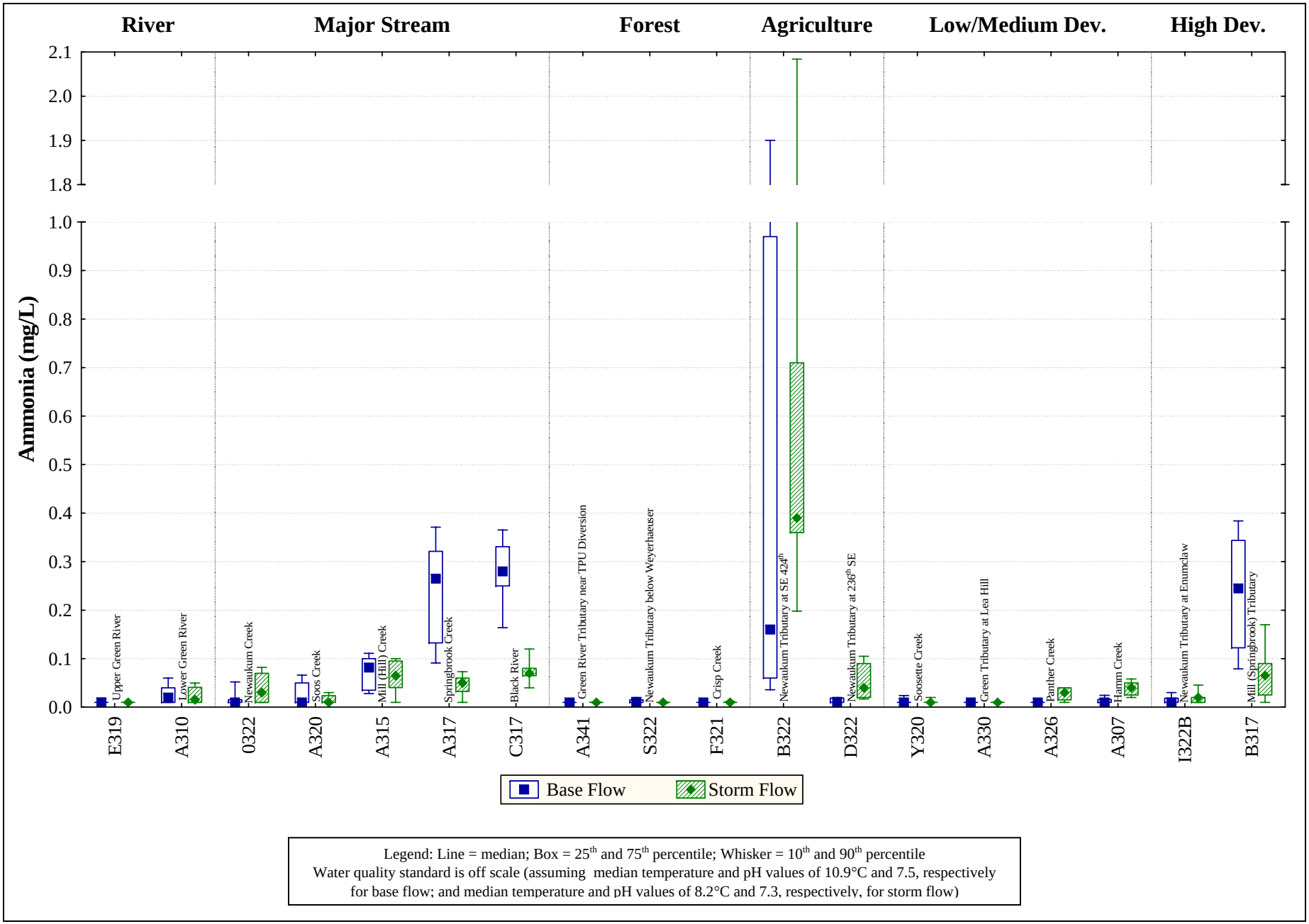

Figure B-11. Base and storm flow ammonia nitrogen concentrations measured at sites in the Green-Duwamish watershed, 2001 – 2003.

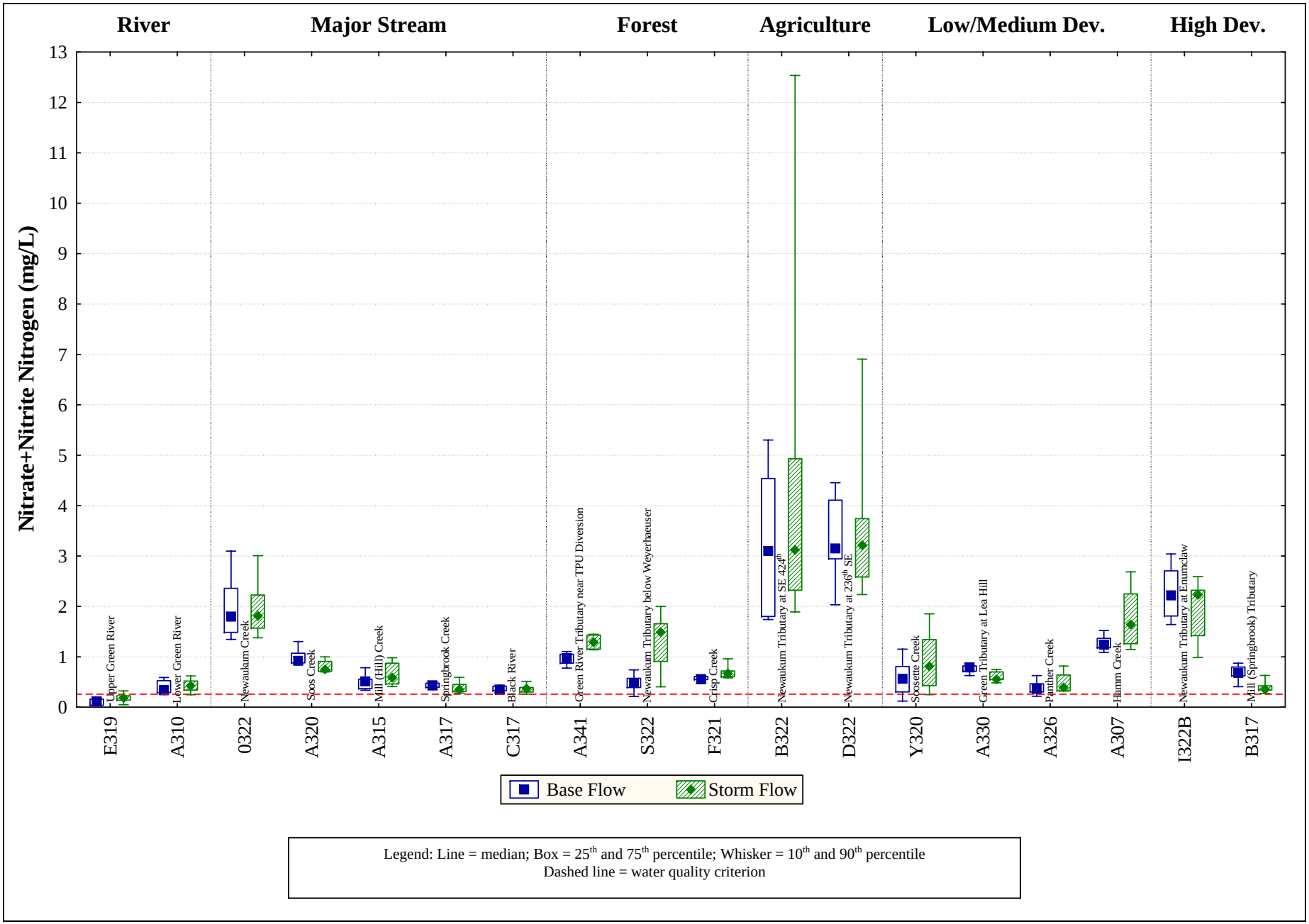

Figure B-12. Base and storm flow nitrate+nitrite nitrogen concentrations measured at sites in the Green-Duwamish watershed, 2001 – 2003.

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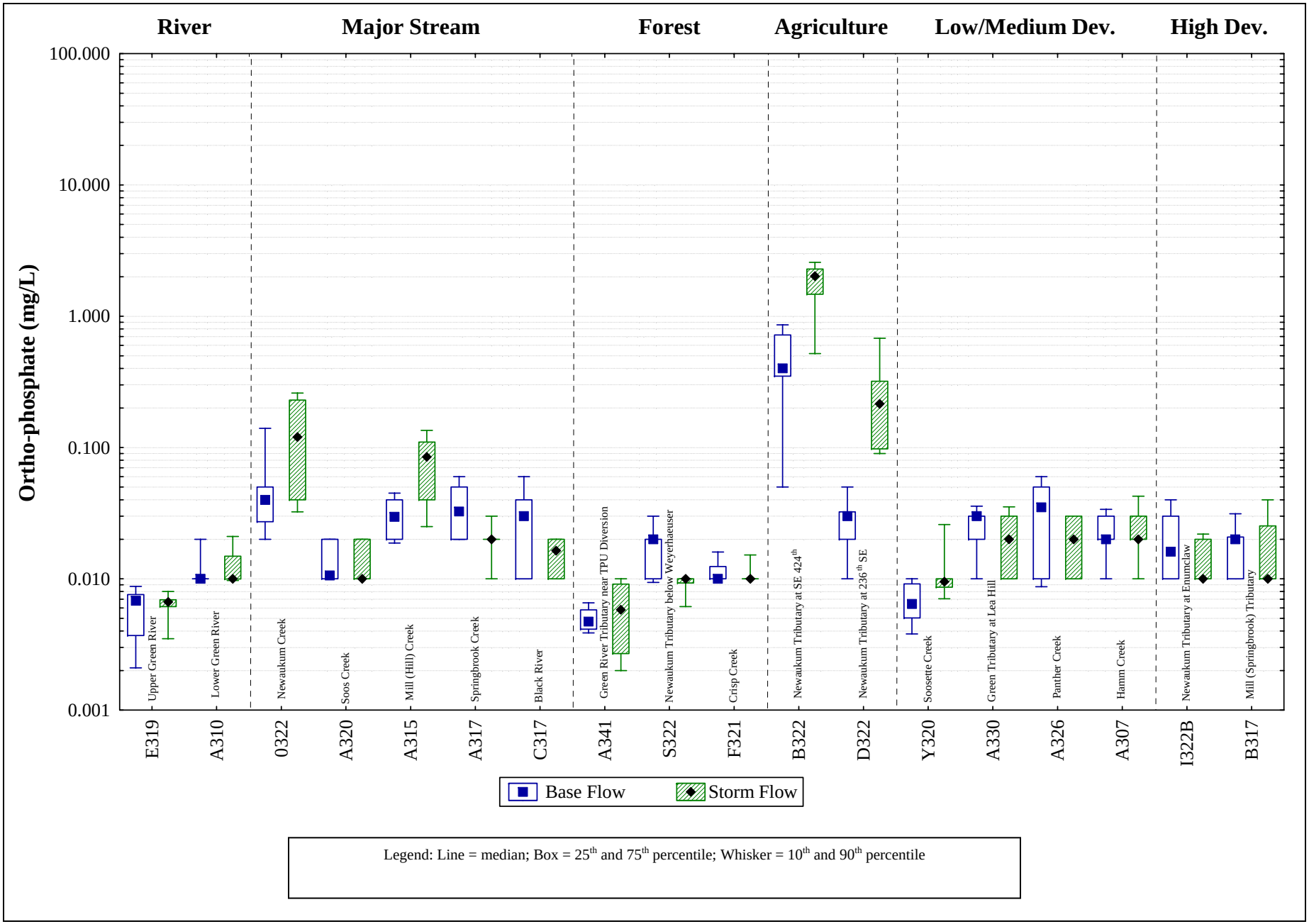

Figure B-13. Base and storm flow ortho-phosphate concentrations measured at sites in the Green-Duwamish watershed, 2001 – 2003.

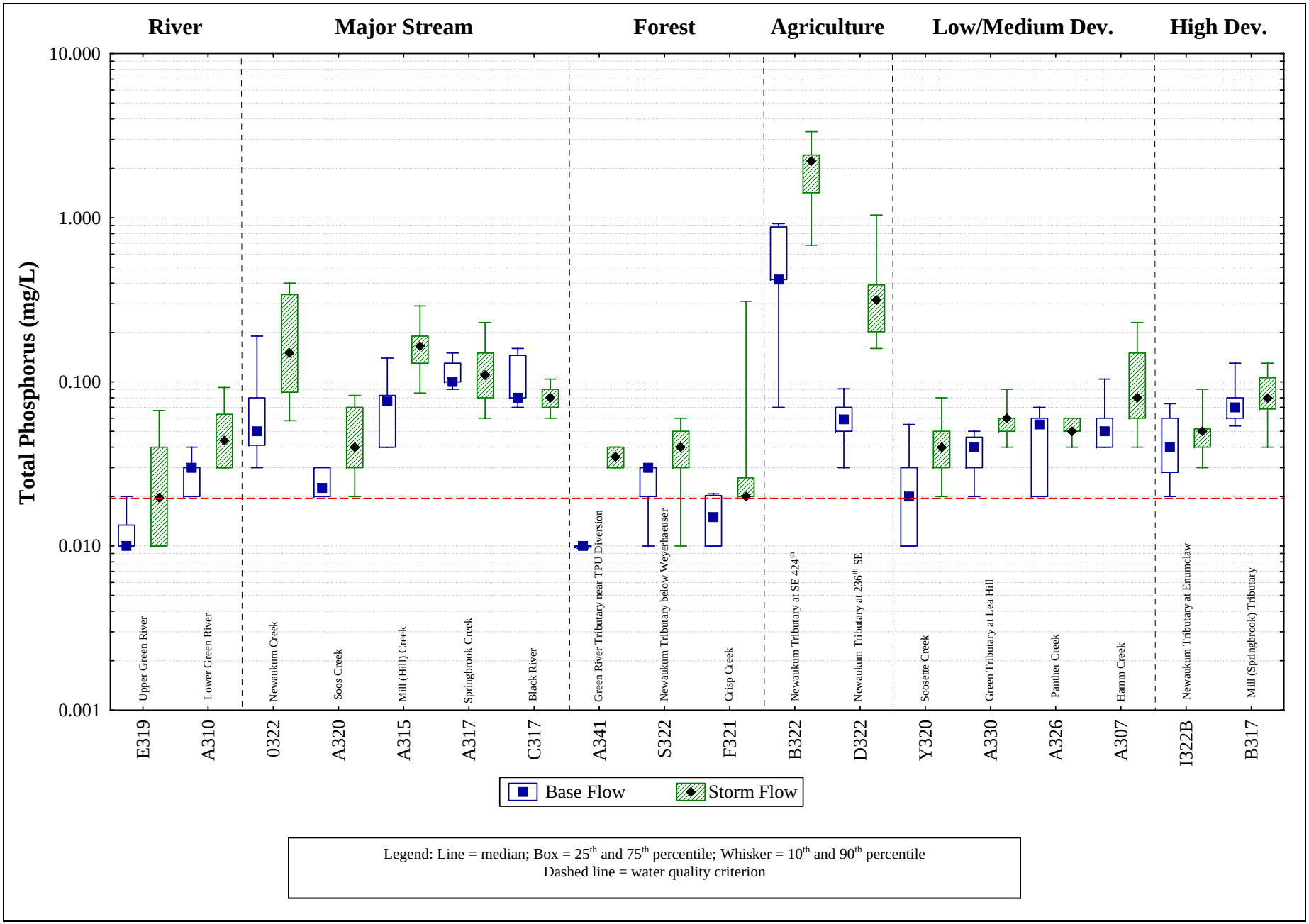

Figure B-14. Base and storm flow total phosphorus concentrations measured at sites in the Green-Duwamish watershed, 2001 – 2003.

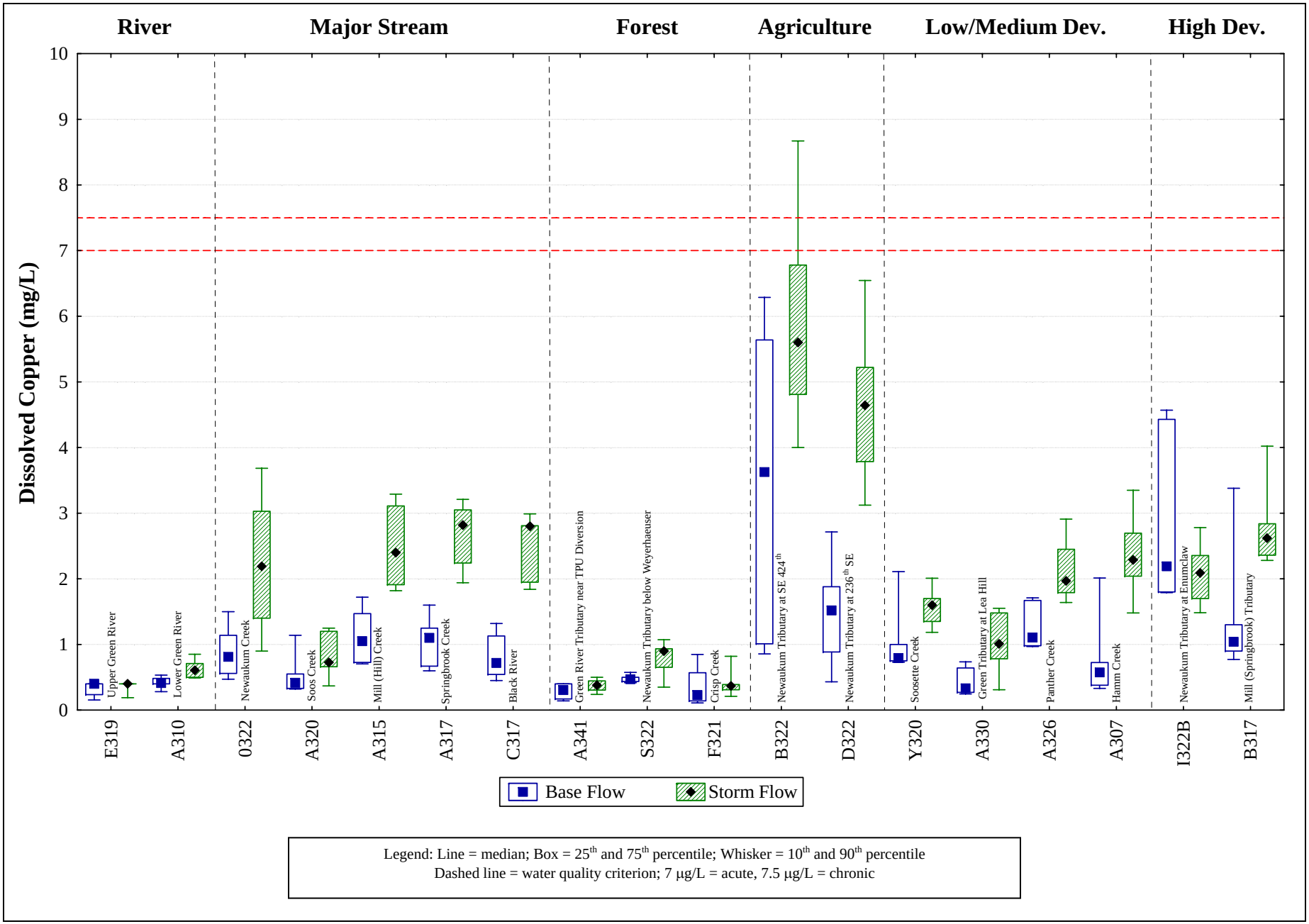

Figure B-15. Base and storm flow dissolved copper concentrations measured at sites in the Green-Duwamish watershed, 2001 – 2003.

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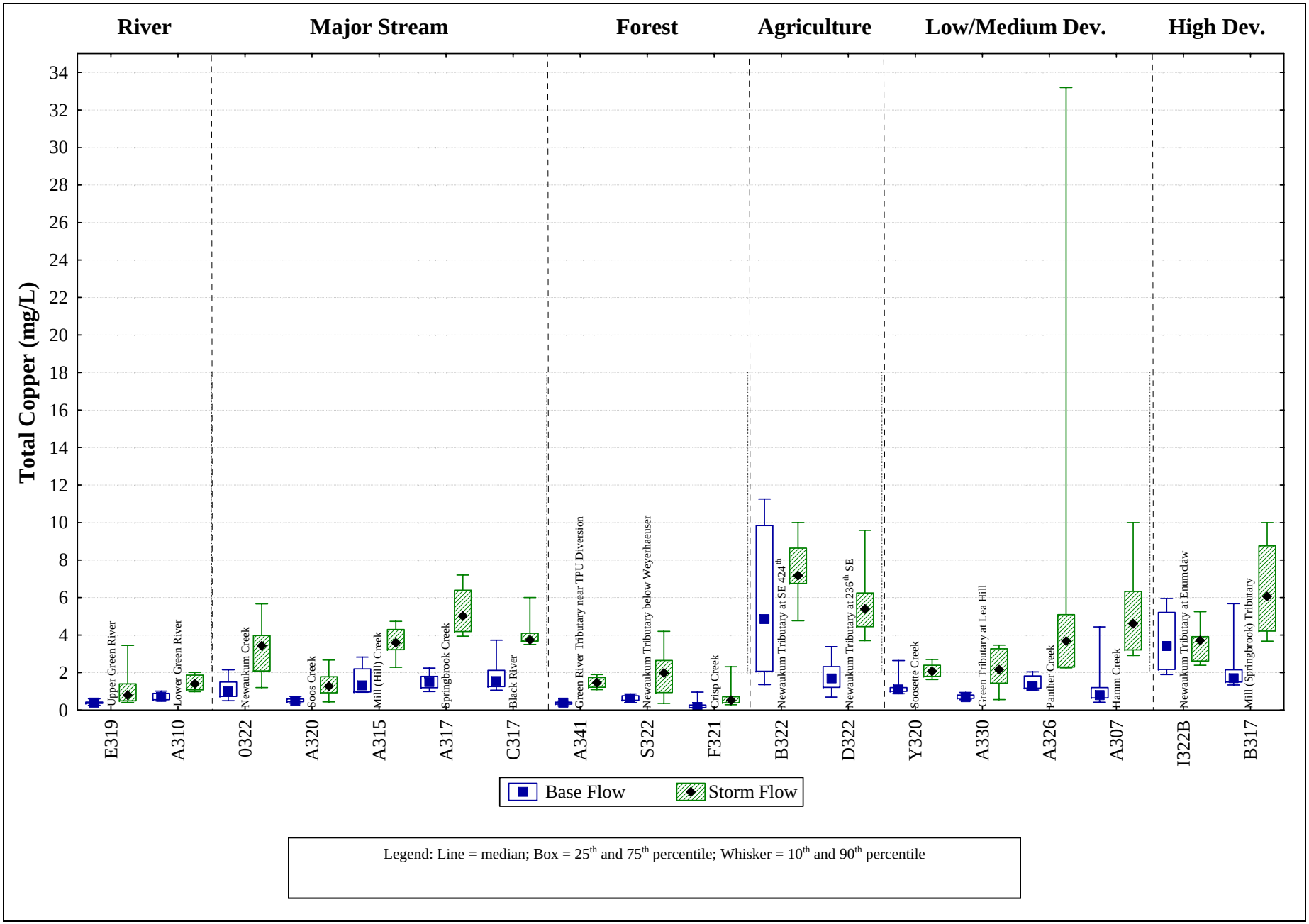

Figure B-16. Base and storm flow total copper concentrations measured at sites in the Green-Duwamish watershed, 2001 – 2003.

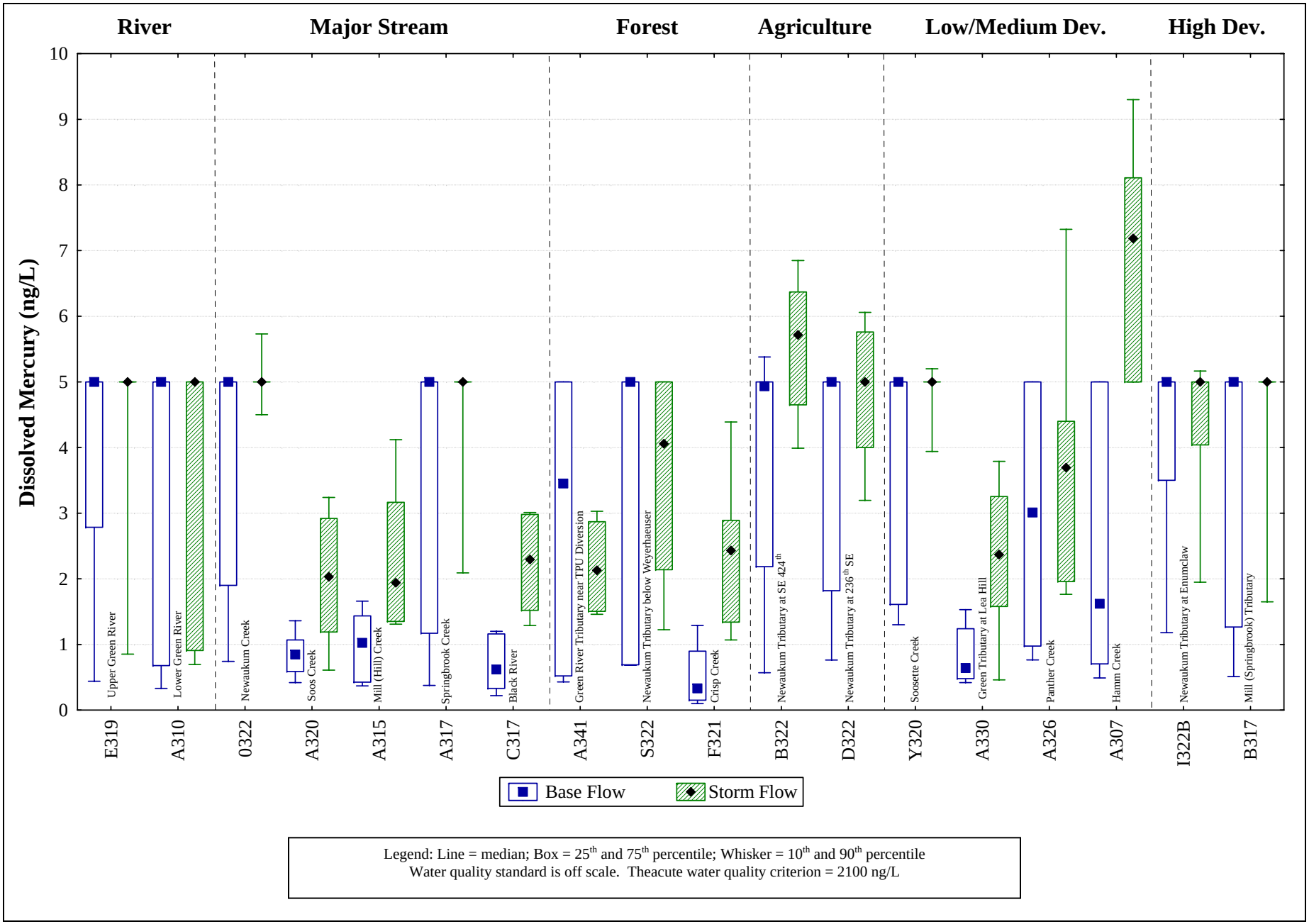

Figure B-17. Base and storm flow dissolved mercury concentrations measured at sites in the Green-Duwamish watershed, 2001 – 2003.

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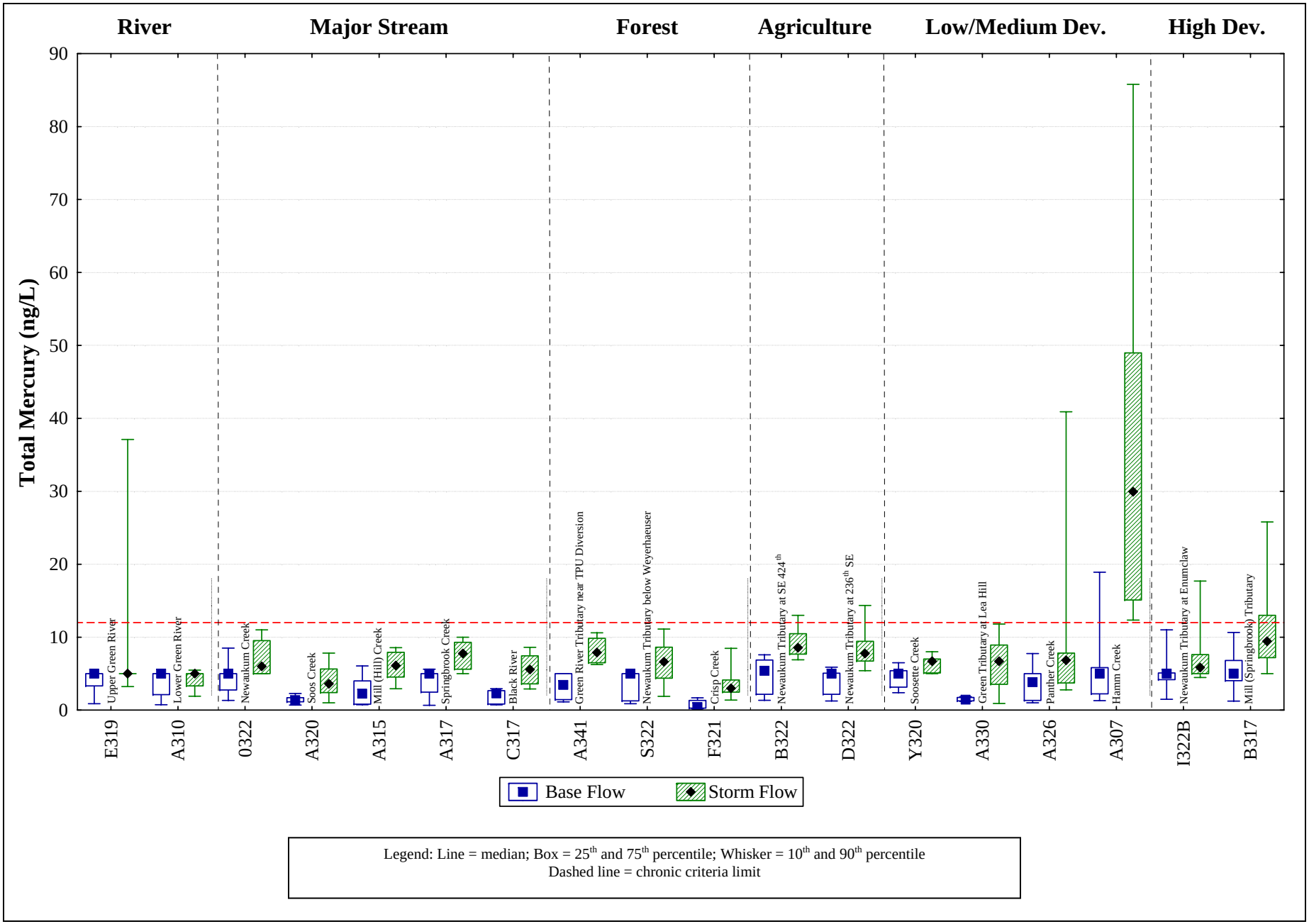

Figure B-18. Base and storm flow total mercury concentrations measured at sites in the Green-Duwamish watershed, 2001 – 2003.

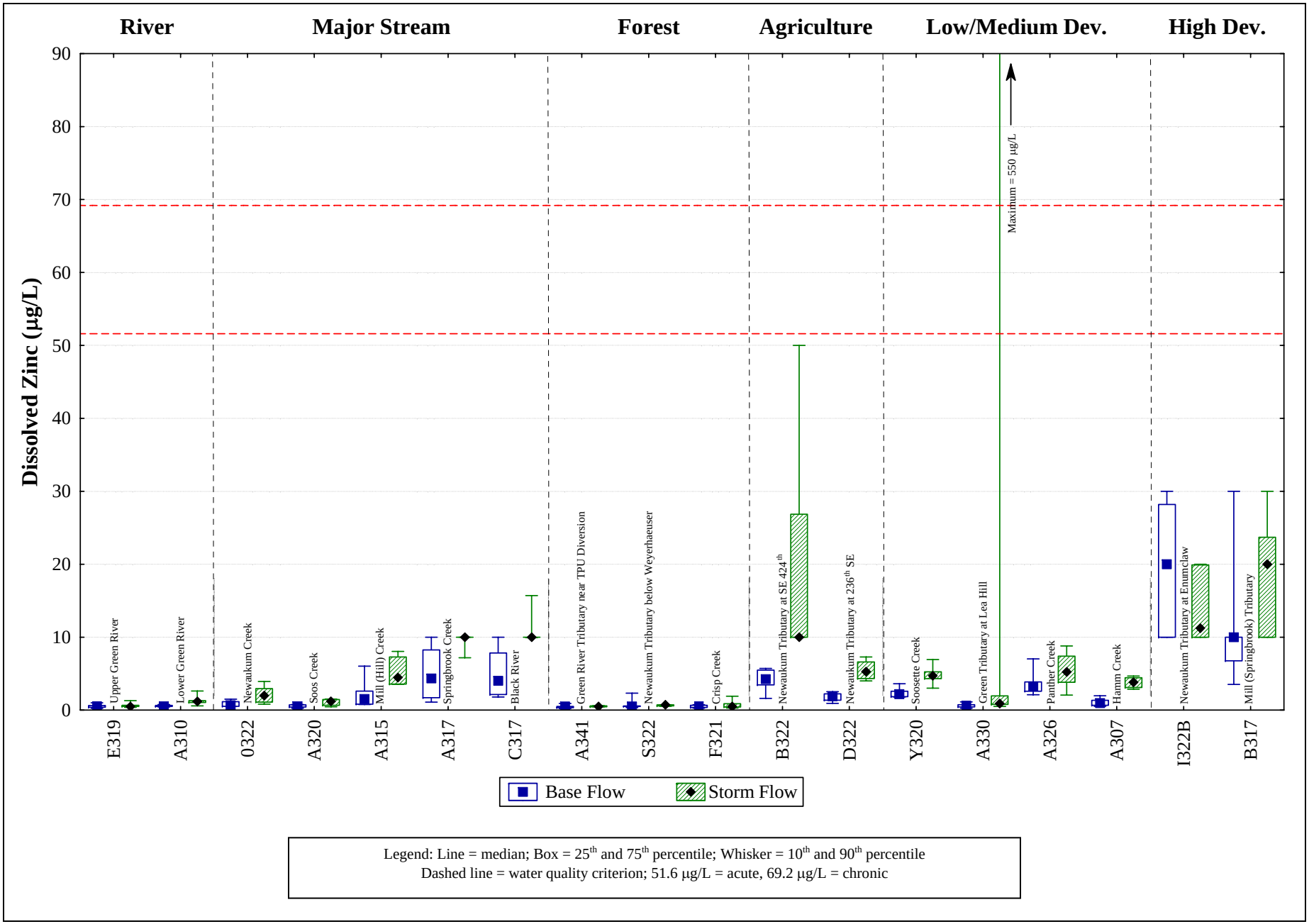

Figure B-19. Base and storm flow dissolved zinc concentrations measured at sites in the Green-Duwamish watershed, 2001 – 2003.

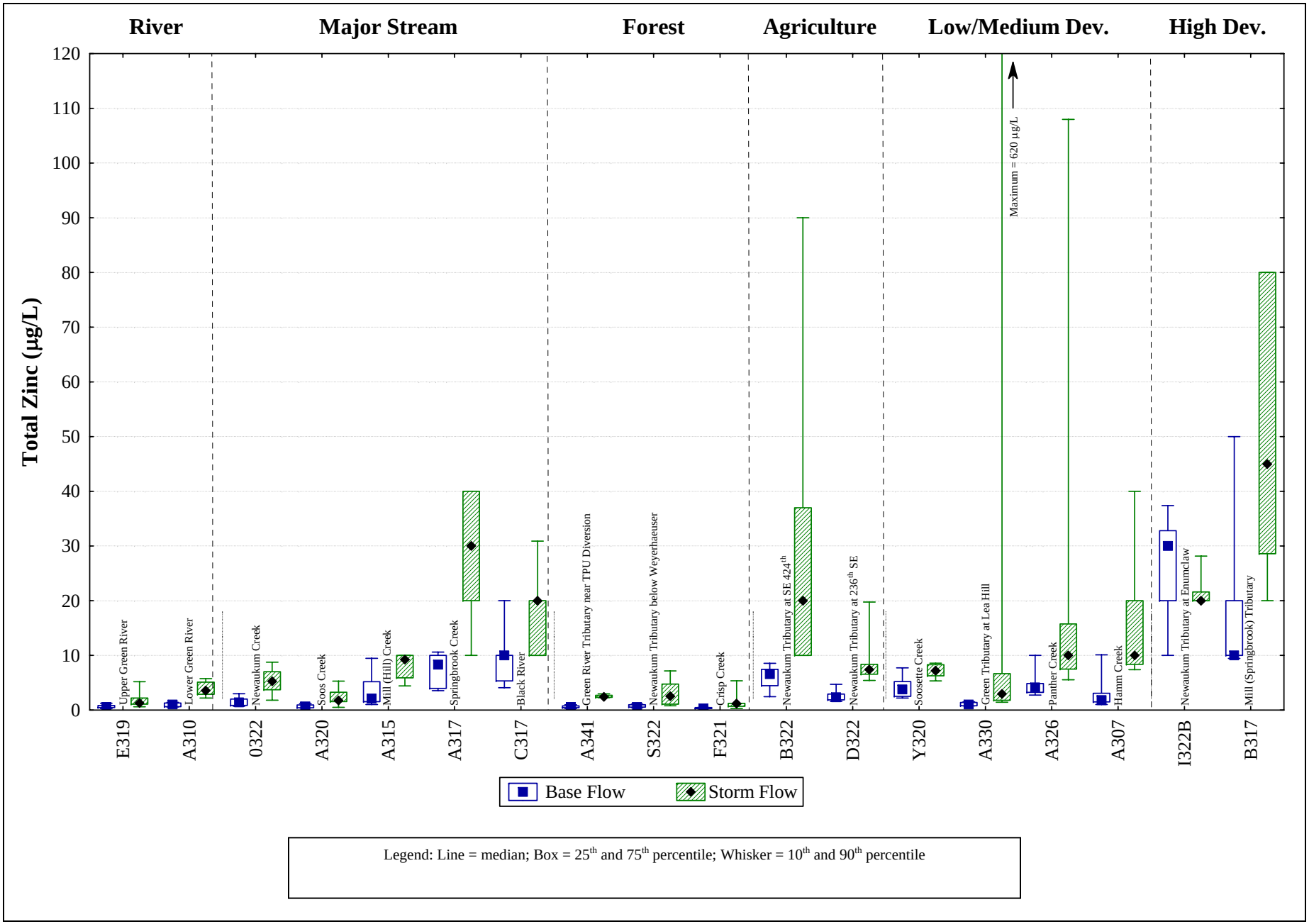

Figure B-20. Base and storm flow total zinc concentrations measured at sites in the Green-Duwamish watershed, 2001 – 2003.

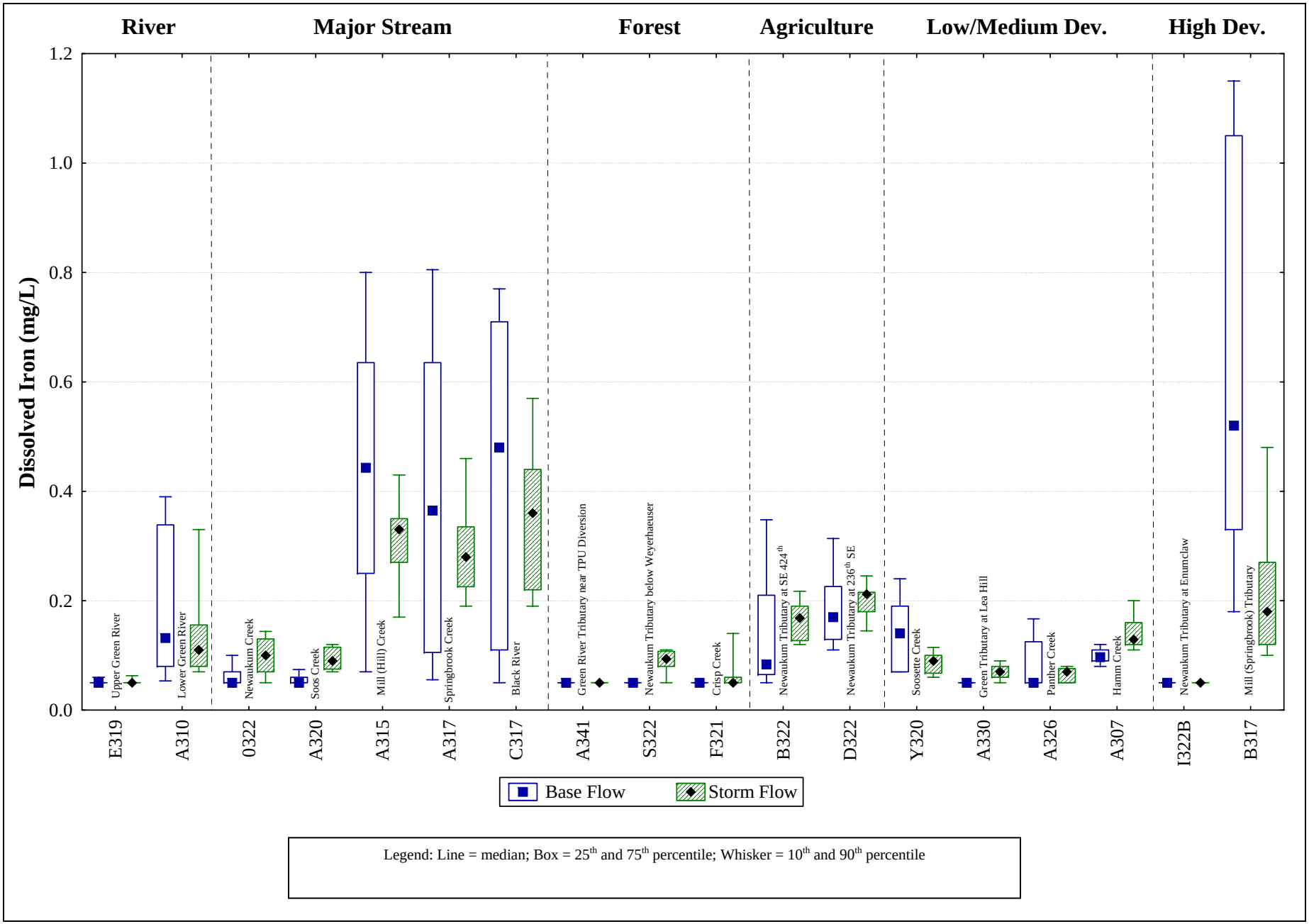

Figure B-21. Base and storm flow dissolved iron concentrations measured at sites in the Green-Duwamish watershed, 2001 – 2003.

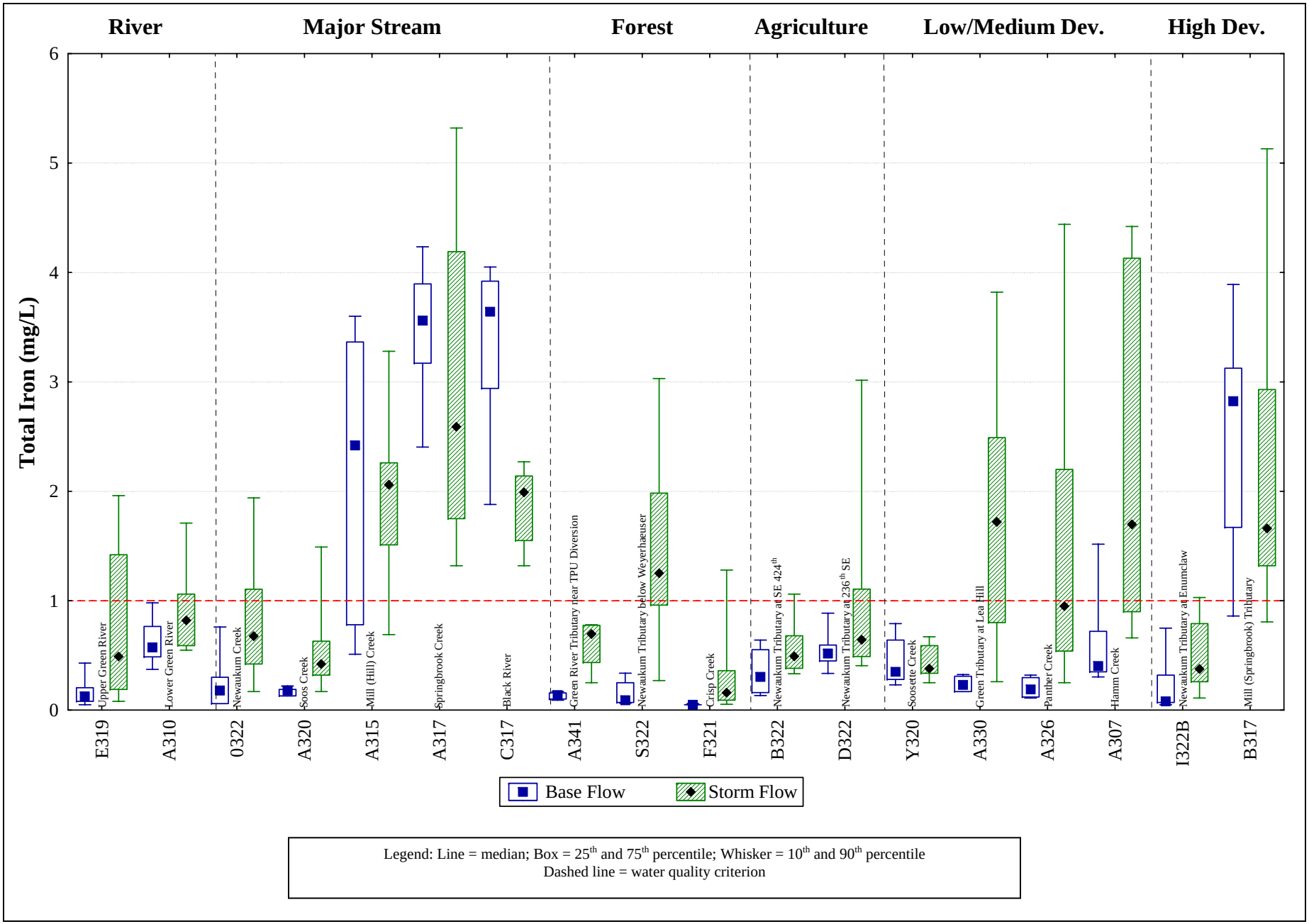

Figure B-22. Base and storm flow total iron concentrations measured at sites in the Green-Duwamish watershed, 2001 – 2003.

Table B-1. Comparison of median storm and base flow dissolved oxygen concentrations for sites in the Green-Duwamish watershed, 2001 - 2003.

	Base n	Storm n	Base Median (mg/L)	Storm Median (mg/L)	Storm/Base Ratio[a]	p-value[b]
River						
E319 - Upper Green River	16	11	12.3	12.7	1.0	0.5437
A310 - Lower Green	14	9	10.7	10.8	1.0	0.9263
Major Stream						
0322 - Newaukum Creek	17	9	11.7	11.3	1.0	0.0846
A320 - Soos Creek	19	12	11.8	12.0	1.0	0.6174
A315 - Mill (Hill) Creek	15	12	8.6	7.8	0.9	0.1138
A317 - Springbrook Creek	13	10	4.7	8.2	1.7	**0.0080**
C317 - Black River	14	8	6.5	8.4	1.3	0.1266
Forest						
A341 - Green River Tributary near TPU Diversion	4	4	11.9	11.5	1.0	0.3429
S322 - Newaukum Tributary below Weyerhaeuser	4	5	12.2	11.5	0.9	0.5556
F321 - Crisp Creek	10	9	12.0	11.6	1.0	0.2110
Agriculture						
B322 - Newaukum Tributary at SE 424th	5	9	6.8	5.6	0.8	0.6993
D322 - Newaukum Tributary at 236th SE	10	7	9.4	10.9	1.2	0.1613
Low/Medium Development						
Y320 - Soosette Creek	5	6	11.3	9.4	0.8	0.2468
A330 - Green Tributary at Lea Hill	14	8	11.5	11.9	1.0	0.5252
A326 - Panther Creek	13	11	12.2	11.8	1.0	0.6085
A307 - Hamm Creek	10	6	11.0	10.9	1.0	0.6354
High Development						
I322B - Newaukum Creek at Enumclaw	6	6	8.0	11.3	1.4	0.1797
B317 - Mill (Springbrook) Tributary	7	5	5.8	9.7	1.7	0.0732

[a] Ratio of media storm flow concentration to median base flow concentration.

[b] Values in bold indicate a significant difference ($\alpha = 0.05$) exists between the median storm and base flow concentrations based on the results from a Mann Whitney U-test.

mg/L: milligram/liter

Table B-2 Comparison of median storm and base flow pH levels for sites in the Green-Duwamish watershed, 2001 - 2003.

	Base n	Storm n	Base Median	Storm Median	Storm/Base Ratio[a]	p-value[b]
River						
E319 - Upper Green River	16	11	7.5	7.5	1.0	0.8273
A310 - Lower Green	14	9	7.1	7.1	1.0	0.6883
Major Stream						
0322 - Newaukum Creek	17	9	7.7	7.5	1.0	**0.0012**
A320 - Soos Creek	17	13	7.6	7.5	1.0	0.6206
A315 - Mill (Hill) Creek	15	12	7.2	7.0	1.0	0.0926
A317 - Springbrook Creek	13	10	6.9	6.7	1.0	0.1475
C317 - Black River	14	8	7.0	7.2	1.0	0.2667
Forest						
A341 - Green River Tributary near TPU Diversion	4	4	7.7	7.4	1.0	0.0571
S322 - Newaukum Tributary below Weyerhaeuser	4	5	7.7	7.7	1.0	0.9048
F321 - Crisp Creek	9	9	7.8	7.7	1.0	0.6048
Agriculture						
B322 - Newaukum Tributary at SE 424th	5	9	6.7	6.9	1.0	0.7972
D322 - Newaukum Tributary at 236th SE	10	7	7.2	7.1	1.0	0.3148
Low/Medium Development						
Y320 - Soosette Creek	5	6	7.0	6.6	0.9	0.0823
A330 - Green Tributary at Lea Hill	14	9	7.7	7.5	1.0	0.0956
A326 - Panther Creek	13	11	7.8	7.4	0.9	**0.0088**
A307 - Hamm Creek	10	6	7.8	7.4	0.9	**0.0005**
High Development						
I322B - Newaukum Creek at Enumclaw	6	6	7.0	7.3	1.0	0.3095
B317 - Mill (Springbrook) Tributary	7	5	7.0	6.9	1.0	0.7551

[a] Ratio of media storm flow concentration to median base flow concentration.

[b] Values in bold indicate a significant difference ($\alpha = 0.05$) exists between the median storm and base flow concentrations based on the results from a Mann Whitney U-test.

Table B-3 Comparison of median storm and base flow specific conductance levels for sites in the Green-Duwamish watershed, 2001 - 2003.

	Base n	Storm n	Base Median (µmhos/cm)	Storm Median (µmhos/cm)	Storm/Base Ratio[a]	p-value[b]
River						
E319 - Upper Green River	16	11	41.2	36.0	0.9	**0.0390**
A310 - Lower Green	14	9	101	78.0	0.8	0.5571
Major Stream						
0322 - Newaukum Creek	17	9	145	134	0.9	**0.0183**
A320 - Soos Creek	19	13	130	121	0.9	0.0995
A315 - Mill (Hill) Creek	15	12	248	122	0.5	**< 0.0001**
A317 - Springbrook Creek	13	10	360	86.0	0.2	**< 0.0001**
C317 - Black River	14	8	323	100	0.3	**< 0.0001**
Forest						
A341 - Green River Tributary near TPU Diversion	4	4	102	83.5	0.8	**0.0286**
S322 - Newaukum Tributary below Weyerhaeuser	4	5	103	73.0	0.7	0.5556
F321 - Crisp Creek	10	9	109	101	0.9	0.0947
Agriculture						
B322 - Newaukum Tributary at SE 424th	5	9	193	250	1.3	0.2977
D322 - Newaukum Tributary at 236th SE	10	7	186	153	0.8	0.3638
Low/Medium Development						
Y320 - Soosette Creek	5	6	165	96.9	0.6	**0.0043**
A330 - Green Tributary at Lea Hill	13	9	178	126	0.7	**0.0026**
A326 - Panther Creek	13	11	207	105	0.5	**0.0088**
A307 - Hamm Creek	10	6	253	194	0.8	0.2198
High Development						
I322B - Newaukum Creek at Enumclaw	6	6	133	92.3	0.7	**0.0087**
B317 - Mill (Springbrook) Tributary	7	5	217	77.0	0.4	**0.0025**

[a] Ratio of media storm flow concentration to median base flow concentration.

[b] Values in bold indicate a significant difference ($\alpha = 0.05$) exists between the median storm and base flow concentrations based on the results from a Mann Whitney U-test.

µmhos/cm: micromhos/centimeter

Table B-4 Comparison of median storm and base flow alkalinity concentrations for sites in the Green-Duwamish watershed, 2001 - 2003.

	Base n	Storm n	Base Median (mg/L as $CaCO_3$)	Storm Median (mg/L as $CaCO_3$)	Storm/Base Ratio[a]	p-value[b]
River						
E319 - Upper Green River	19	14	18.2	15.3	0.8	**0.0028**
A310 - Lower Green	11	12	35.9	28.5	0.8	0.1037
Major Stream						
0322 - Newaukum Creek	15	19	52.0	39.0	0.8	**0.0006**
A320 - Soos Creek	13	11	51.9	42.0	0.8	0.0629
A315 - Mill (Hill) Creek	10	10	105	39.8	0.4	**<0.0001**
A317 - Springbrook Creek	14	18	130	28.6	0.2	**<0.0001**
C317 - Black River	7	7	123	28.8	0.2	**0.0006**
Forest						
A341 - Green River Tributary near TPU Diversion	4	4	43.4	31.8	0.7	**0.0286**
S322 - Newaukum Tributary below Weyerhaeuser	7	7	58.0	28.9	0.5	0.0530
F321 - Crisp Creek	12	9	43.7	38.9	0.9	0.1479
Agriculture						
B322 - Newaukum Tributary at SE 424th	5	9	46.7	65.5	1.4	0.1469
D322 - Newaukum Tributary at 236th SE	14	6	53.2	37.5	0.7	**0.0015**
Low/Medium Development						
Y320 - Soosette Creek	10	18	56.1	25.8	0.5	**0.0001**
A330 - Green Tributary at Lea Hill	14	9	70.5	46.6	0.7	**0.0012**
A326 - Panther Creek	14	11	66.0	36.9	0.6	**0.0028**
A307 - Hamm Creek	11	13	83.3	53.7	0.6	**<0.0001**
High Development						
I322B - Newaukum Creek at Enumclaw	11	13	41.7	18.4	0.4	0.0629
B317 - Mill (Springbrook) Tributary	14	16	86.4	22.6	0.3	**<0.0001**

[a] Ratio of media storm flow concentration to median base flow concentration.

[b] Values in bold indicate a significant difference ($\alpha = 0.05$) exists between the median storm and base flow concentrations based on the results from a Mann Whitney U-test.

mg/L: milligram/liter

Table B-5 Comparison of median storm and base flow turbidity levels for sites in the Green-Duwamish watershed, 2001 - 2003.

	Base n	Storm n	Base Median (NTU)	Storm Median (NTU)	Storm/Base Ratio[a]	p-value[b]
River						
E319 - Upper Green River	19	15	1.4	6.5	4.6	**0.0003**
A310 - Lower Green	11	12	2.7	6.6	2.5	**0.0002**
Major Stream						
0322 - Newaukum Creek	15	19	2.0	11	5.6	**0.0001**
A320 - Soos Creek	13	11	1.5	4.1	2.7	**0.0031**
A315 - Mill (Hill) Creek	10	10	12	14	1.2	0.1903
A317 - Springbrook Creek	14	18	19	23	1.3	0.6129
C317 - Black River	7	7	18	14	0.8	0.2086
Forest						
A341 - Green River Tributary near TPU Diversion	4	4	2.2	11	5.1	**0.0286**
S322 - Newaukum Tributary below Weyerhaeuser	7	7	1.0	18	17.4	**0.0175**
F321 - Crisp Creek	12	9	0.5	1.9	3.8	**0.0002**
Agriculture						
B322 - Newaukum Tributary at SE 424th	5	9	3.4	10	3.0	**0.0020**
D322 - Newaukum Tributary at 236th SE	14	6	3.7	6.4	1.7	**0.0023**
Low/Medium Development						
Y320 - Soosette Creek	10	18	2.2	6.7	3.0	**0.0011**
A330 - Green Tributary at Lea Hill	14	9	2.7	14	5.0	**< 0.0001**
A326 - Panther Creek	14	11	1.7	9.7	5.8	**0.0005**
A307 - Hamm Creek	11	13	3.5	19	5.5	**0.0025**
High Development						
I322B - Newaukum Creek at Enumclaw	11	13	0.9	9.5	10.5	0.0933
B317 - Mill (Springbrook) Tributary	14	16	15	15	1.0	0.7277

[a] Ratio of media storm flow concentration to median base flow concentration.

[b] Values in bold indicate a significant difference ($\alpha = 0.05$) exists between the median storm and base flow concentrations based on the results from a Mann Whitney U-test.

NTU: nephelometric turbidity unit

Table B-6 Comparison of median storm and base flow total suspended solids concentrations for sites in the Green-Duwamish watershed, 2001 - 2003.

	Base n	Storm n	Base Median (mg/L)	Storm Median (mg/L)	Storm/Base Ratio[a]	p-value[b]
River						
E319 - Upper Green River	19	14	1.8	10.0	5.5	**0.0042**
A310 - Lower Green	11	12	7.3	10.8	1.5	0.0512
Major Stream						
0322 - Newaukum Creek	15	19	2.9	14.0	4.8	**0.0001**
A320 - Soos Creek	13	11	3.4	7.0	2.0	**0.0025**
A315 - Mill (Hill) Creek	10	10	5.1	17.0	3.4	**0.0068**
A317 - Springbrook Creek	14	18	8.4	27.0	3.2	**0.0036**
C317 - Black River	7	7	8.0	8.6	1.1	0.7104
Forest						
A341 - Green River Tributary near TPU Diversion	4	4	3.9	16.4	4.2	**0.0286**
S322 - Newaukum Tributary below Weyerhaeuser	7	7	4.9	29.5	6.0	**0.0262**
F321 - Crisp Creek	12	9	1.0	3.5	3.4	**< 0.0001**
Agriculture						
B322 - Newaukum Tributary at SE 424th	5	9	4.5	10.3	2.3	0.0829
D322 - Newaukum Tributary at 236th SE	14	6	5.4	7.8	1.5	**0.0256**
Low/Medium Development						
Y320 - Soosette Creek	10	17	3.0	5.6	1.9	0.2638
A330 - Green Tributary at Lea Hill	14	9	5.1	37.7	7.4	**0.0001**
A326 - Panther Creek	14	11	1.9	8.8	4.5	**0.0075**
A307 - Hamm Creek	11	13	4.0	29.4	7.4	**0.0039**
High Development						
I322B - Newaukum Creek at Enumclaw	11	13	0.8	14.9	19.6	0.1191
B317 - Mill (Springbrook) Tributary	14	15	7.0	18.0	2.6	**0.0367**

[a] Ratio of media storm flow concentration to median base flow concentration.

[b] Values in bold indicate a significant difference ($\alpha = 0.05$) exists between the median storm and base flow concentrations based on the results from a Mann Whitney U-test.

mg/L: milligram/liter

Table B-7 Comparison of median storm and base flow hardness concentrations for sites in the Green-Duwamish watershed, 2001 - 2003.

	Base n	Storm n	Base Median (mg/L as $CaCO_3$)	Storm Median (mg/L as $CaCO_3$)	Storm/Base Ratio[a]	p-value[b]
River						
E319 - Upper Green River	24	19	16.3	15.0	0.9	0.0941
A310 - Lower Green	16	15	35.3	28.5	0.8	0.2814
Major Stream						
0322 - Newaukum Creek	19	24	58.0	48.4	0.8	**0.0006**
A320 - Soos Creek	12	11	56.2	50.5	0.9	0.2604
A315 - Mill (Hill) Creek	8	10	90.1	44.7	0.5	**< 0.0001**
A317 - Springbrook Creek	20	21	108	33.0	0.3	**< 0.0001**
C317 - Black River	7	7	104	31.5	0.3	**0.0006**
Forest						
A341 - Green River Tributary near TPU Diversion	8	4	45.8	38.7	0.8	0.2141
S322 - Newaukum Tributary below Weyerhaeuser	11	11	41.7	26.4	0.6	0.1164
F321 - Crisp Creek	11	9	46.2	44.1	1.0	0.2610
Agriculture						
B322 - Newaukum Tributary at SE 424th	8	13	60.8	81.7	1.3	0.0638
D322 - Newaukum Tributary at 236th SE	20	10	72.0	47.8	0.7	**0.0002**
Low/Medium Development						
Y320 - Soosette Creek	15	21	62.2	34.9	0.6	**< 0.0001**
A330 - Green Tributary at Lea Hill	14	9	76.5	57.6	0.8	**0.0003**
A326 - Panther Creek	18	13	74.5	53.2	0.7	**0.0095**
A307 - Hamm Creek	17	15	110	78.6	0.7	**< 0.0001**
High Development						
I322B - Newaukum Creek at Enumclaw	17	17	50.1	27.8	0.6	**0.0076**
B317 - Mill (Springbrook) Tributary	20	18	90.8	26.9	0.3	**< 0.0001**

[a] Ratio of media storm flow concentration to median base flow concentration.

[b] Values in bold indicate a significant difference ($\alpha = 0.05$) exists between the median storm and base flow concentrations based on the results from a Mann Whitney U-test.

mg/L: milligram/liter

Table B-8 Comparison of median storm and base flow fecal coliform bacteria concentrations for sites in the Green-Duwamish watershed, 2001 - 2003.

	Base n	Storm n	Base Median (CFU/100 ml)	Storm Median (CFU/100 ml)	Storm/Base Ratio[a]	p-value[b]
River						
E319 - Upper Green River	17	15	1	8	8.0	**0.0001**
A310 - Lower Green	10	11	39	220	5.7	**< 0.0001**
Major Stream						
0322 - Newaukum Creek	15	18	39	1600	41.0	**< 0.0001**
A320 - Soos Creek	13	9	31	150	4.8	**0.0033**
A315 - Mill (Hill) Creek	10	9	210	1700	8.1	**0.0003**
A317 - Springbrook Creek	13	17	68	1306	19.2	**< 0.0001**
C317 - Black River	7	6	220	690	3.1	**0.0012**
Forest						
A341 - Green River Tributary near TPU Diversion	4	4	11	101	9.2	0.0571
S322 - Newaukum Tributary below Weyerhaeuser	6	6	126	97	0.8	1.0000
F321 - Crisp Creek	12	8	6	27	4.5	**0.0011**
Agriculture						
B322 - Newaukum Tributary at SE 424th	4	8	310	10636	34.3	**0.0040**
D322 - Newaukum Tributary at 236th SE	14	6	94	2429	25.9	**0.0200**
Low/Medium Development						
Y320 - Soosette Creek	9	16	56	900	16.1	**0.0369**
A330 - Green Tributary at Lea Hill	14	8	20	180	9.0	**0.0016**
A326 - Panther Creek	13	10	190	395	2.1	**0.0025**
A307 - Hamm Creek	11	13	125	1057	8.4	0.0548
High Development						
I322B - Newaukum Creek at Enumclaw	11	11	260	495	1.9	0.5190
B317 - Mill (Springbrook) Tributary	13	15	540	800	1.5	0.0799

[a] Ratio of media storm flow concentration to median base flow concentration.

[b] Values in bold indicate a significant difference ($\alpha = 0.05$) exists between the median storm and base flow concentrations based on the results from a Mann Whitney U-test.

CFU/100 ml: colony forming units/100 milliliters

Table B-9 Comparison of median storm and base flow *E. coli* bacteria concentrations for sites in the Green-Duwamish watershed, 2001 - 2003.

	Base n	Storm n	Base Median (CFU/100 ml)	Storm Median (CFU/100 ml)	Storm/Base Ratio[a]	p-value[b]
River						
E319 - Upper Green River	21	17	1	8	8.0	**0.0001**
A310 - Lower Green	15	13	37	180	4.9	**< 0.0001**
Major Stream						
0322 - Newaukum Creek	20	19	43	2000	46.5	**< 0.0001**
A320 - Soos Creek	13	9	29	210	7.2	**0.0089**
A315 - Mill (Hill) Creek	10	9	135	2100	15.6	**< 0.0001**
A317 - Springbrook Creek	16	18	68	1400	20.6	**< 0.0001**
C317 - Black River	7	6	190	1050	5.5	**0.0012**
Forest						
A341 - Green River Tributary near TPU Diversion	4	4	9	102	11.1	0.0571
S322 - Newaukum Tributary below Weyerhaeuser	7	6	110	79	0.7	0.8357
F321 - Crisp Creek	12	8	5	34	6.7	**0.0022**
Agriculture						
B322 - Newaukum Tributary at SE 424th	5	8	353	8128	23.0	**0.0062**
D322 - Newaukum Tributary at 236th SE	14	6	104	2350	22.7	**0.0154**
Low/Medium Development						
Y320 - Soosette Creek	9	16	50	800	16.2	**0.0428**
A330 - Green Tributary at Lea Hill	14	8	36	160	4.5	**0.0016**
A326 - Panther Creek	14	10	168	415	2.5	**0.0107**
A307 - Hamm Creek	12	14	66	800	12.1	0.0849
High Development						
I322B - Newaukum Creek at Enumclaw	11	11	315	442	1.4	0.3653
B317 - Mill (Springbrook) Tributary	12	15	450	580	1.3	0.1138

[a] Ratio of media storm flow concentration to median base flow concentration.

[b] Values in bold indicate a significant difference ($\alpha = 0.05$) exists between the median storm and base flow concentrations based on the results from a Mann Whitney U-test.

CFU/100 ml: colony forming units/100 milliliters

Table B-10 Comparison of median storm and base flow ammonia concentrations for sites in the Green-Duwamish watershed, 2001 - 2003.

	Base n	Storm n	Base Median (mg/L)	Storm Median (mg/L)	Storm/Base Ratio[a]	p-value[b]
River						
E319 - Upper Green River	19	15	0.010	0.010	1.0	0.9864
A310 - Lower Green	11	12	0.020	0.019	0.9	0.7399
Major Stream						
0322 - Newaukum Creek	15	19	0.010	0.055	5.5	**0.0018**
A320 - Soos Creek	13	11	0.010	0.010	1.0	0.9095
A315 - Mill (Hill) Creek	10	10	0.082	0.065	0.8	0.6305
A317 - Springbrook Creek	14	18	0.290	0.050	0.2	**<0.0001**
C317 - Black River	7	7	0.280	0.070	0.3	**0.0175**
Forest						
A341 - Green River Tributary near TPU Diversion	4	4	0.010	0.010	1.0	
S322 - Newaukum Tributary below Weyerhaeuser	7	7	0.010	0.010	1.0	0.3829
F321 - Crisp Creek	12	9	0.010	0.010	1.0	0.7021
Agriculture						
B322 - Newaukum Tributary at SE 424th	5	9	0.168	0.396	2.4	0.5185
D322 - Newaukum Tributary at 236th SE	14	6	0.014	0.028	2.0	0.2083
Low/Medium Development						
Y320 - Soosette Creek	10	17	0.010	0.010	1.0	0.9397
A330 - Green Tributary at Lea Hill	14	9	0.010	0.010	1.0	0.7813
A326 - Panther Creek	14	11	0.010	0.030	3.0	**0.0287**
A307 - Hamm Creek	11	13	0.013	0.034	2.6	**0.0012**
High Development						
I322B - Newaukum Creek at Enumclaw	11	13	0.010	0.019	1.9	**0.0131**
B317 - Mill (Springbrook) Tributary	14	16	0.310	0.070	0.2	**0.0053**

[a] Ratio of media storm flow concentration to median base flow concentration.

[b] Values in bold indicate a significant difference ($\alpha = 0.05$) exists between the median storm and base flow concentrations based on the results from a Mann Whitney U-test.

mg/L: milligram/liter

Table B-11 Comparison of median storm and base flow nitrate+nitrite nitrogen concentrations for sites in the Green-Duwamish watershed, 2001 - 2003.

	Base n	Storm n	Base Median (mg/L)	Storm Median (mg/L)	Storm/Base Ratio[a]	p-value[b]
River						
E319 - Upper Green River	18	16	0.100	0.181	1.8	**0.0297**
A310 - Lower Green	38	71	0.340	0.431	1.3	0.5658
Major Stream						
0322 - Newaukum Creek	18	54	1.700	1.886	1.1	0.3908
A320 - Soos Creek	10	8	0.921	0.748	0.8	**0.0129**
A315 - Mill (Hill) Creek	9	9	0.515	0.588	1.1	0.2475
A317 - Springbrook Creek	13	39	0.453	0.360	0.8	0.1167
C317 - Black River	7	7	0.340	0.370	1.1	0.9015
Forest						
A341 - Green River Tributary near TPU Diversion	16	4	0.975	1.290	1.3	0.0571
S322 - Newaukum Tributary below Weyerhaeuser	26	69	0.480	1.461	3.0	**0.0379**
F321 - Crisp Creek	10	7	0.560	0.670	1.2	**0.0043**
Agriculture						
B322 - Newaukum Tributary at SE 424th	14	49	3.100	3.120	1.0	0.6064
D322 - Newaukum Tributary at 236th SE	54	52	3.152	3.204	1.0	0.5208
Low/Medium Development						
Y320 - Soosette Creek	10	45	0.407	0.818	2.0	0.0951
A330 - Green Tributary at Lea Hill	11	9	0.790	0.552	0.7	**0.0069**
A326 - Panther Creek	25	24	0.350	0.408	1.2	0.2671
A307 - Hamm Creek	36	67	1.254	1.680	1.3	**0.0306**
High Development						
I322B - Newaukum Creek at Enumclaw	9	57	2.245	1.790	0.8	0.1056
B317 - Mill (Springbrook) Tributary	11	19	0.730	0.350	0.5	**<0.0001**

[a] Ratio of media storm flow concentration to median base flow concentration.

[b] Values in bold indicate a significant difference ($\alpha = 0.05$) exists between the median storm and base flow concentrations based on the results from a Mann Whitney U-test.

mg/L: milligram/liter

Table B-12 Comparison of median storm and base flow orthophosphate phosphorus concentrations for sites in the Green-Duwamish watershed, 2001 - 2003.

	Base n	Storm n	Base Median (mg/L)	Storm Median (mg/L)	Storm/Base Ratio[a]	p-value[b]
River						
E319 - Upper Green River	18	16	0.007	0.007	0.9	0.2968
A310 - Lower Green	38	71	0.010	0.014	1.4	0.6947
Major Stream						
0322 - Newaukum Creek	18	54	0.040	0.140	3.5	**0.0004**
A320 - Soos Creek	10	8	0.011	0.010	0.9	0.8201
A315 - Mill (Hill) Creek	9	9	0.030	0.085	2.9	**0.0052**
A317 - Springbrook Creek	13	39	0.035	0.020	0.6	**0.0010**
C317 - Black River	7	7	0.030	0.016	0.5	0.2593
Forest						
A341 - Green River Tributary near TPU Diversion	16	4	0.005	0.006	1.2	1.0000
S322 - Newaukum Tributary below Weyerhaeuser	26	69	0.020	0.010	0.5	**0.0379**
F321 - Crisp Creek	10	7	0.010	0.010	1.0	0.8078
Agriculture						
B322 - Newaukum Tributary at SE 424th	14	49	0.403	2.020	5.0	**0.0040**
D322 - Newaukum Tributary at 236th SE	54	52	0.030	0.124	4.1	**0.0015**
Low/Medium Development						
Y320 - Soosette Creek	10	45	0.006	0.009	1.7	**0.0231**
A330 - Green Tributary at Lea Hill	11	9	0.030	0.020	0.7	0.1245
A326 - Panther Creek	25	24	0.035	0.020	0.6	0.2441
A307 - Hamm Creek	36	67	0.024	0.025	1.1	0.4031
High Development						
I322B - Newaukum Creek at Enumclaw	9	57	0.014	0.015	1.1	0.8340
B317 - Mill (Springbrook) Tributary	11	19	0.020	0.010	0.5	0.2158

[a] Ratio of media storm flow concentration to median base flow concentration.

[b] Values in bold indicate a significant difference ($\alpha = 0.05$) exists between the median storm and base flow concentrations based on the results from a Mann Whitney U-test.

mg/L: milligram/liter

Table B-13 Comparison of median storm and base flow total phosphorus concentrations for sites in the Green-Duwamish watershed, 2001 - 2003.

	Base n	Storm n	Base Median (mg/L)	Storm Median (mg/L)	Storm/Base Ratio[a]	p-value[b]
River						
E319 - Upper Green River	18	16	0.010	0.019	1.9	0.0697
A310 - Lower Green	38	71	0.030	0.048	1.6	**0.0036**
Major Stream						
0322 - Newaukum Creek	18	54	0.050	0.190	3.8	**<0.0001**
A320 - Soos Creek	10	8	0.023	0.040	1.8	**0.0059**
A315 - Mill (Hill) Creek	9	9	0.076	0.165	2.2	**0.0021**
A317 - Springbrook Creek	13	39	0.100	0.110	1.1	0.8798
C317 - Black River	7	7	0.080	0.080	1.0	0.3829
Forest						
A341 - Green River Tributary near TPU Diversion	16	4	0.010	0.035	3.5	**0.0286**
S322 - Newaukum Tributary below Weyerhaeuser	26	69	0.030	0.037	1.2	0.0973
F321 - Crisp Creek	10	7	0.015	0.020	1.3	**0.0227**
Agriculture						
B322 - Newaukum Tributary at SE 424th	14	49	0.428	2.220	5.2	**0.0040**
D322 - Newaukum Tributary at 236th SE	54	52	0.064	0.234	3.7	**0.0073**
Low/Medium Development						
Y320 - Soosette Creek	10	45	0.020	0.040	2.0	**0.0171**
A330 - Green Tributary at Lea Hill	11	9	0.040	0.060	1.5	**0.0003**
A326 - Panther Creek	25	24	0.055	0.050	0.9	0.5719
A307 - Hamm Creek	36	67	0.044	0.095	2.1	**<0.0001**
High Development						
I322B - Newaukum Creek at Enumclaw	9	57	0.030	0.052	1.7	**0.0382**
B317 - Mill (Springbrook) Tributary	11	19	0.070	0.079	1.1	0.2324

[a] Ratio of media storm flow concentration to median base flow concentration.

[b] Values in bold indicate a significant difference ($\alpha = 0.05$) exists between the median storm and base flow concentrations based on the results from a Mann Whitney U-test.

mg/L: milligram/liter

Table B-14 Comparison of median storm and base flow dissolved copper concentrations for sites in the Green-Duwamish watershed, 2001 - 2003.

	Base n	Storm n	Base Median (µg/L)	Storm Median (µg/L)	Storm/Base Ratio[a]	p-value[b]
River						
E319 - Upper Green River	20	18	0.40	0.40	1.0	0.7837
A310 - Lower Green	39	52	0.41	0.61	1.5	**0.0001**
Major Stream						
0322 - Newaukum Creek	21	55	0.88	2.10	2.4	**0.0006**
A320 - Soos Creek	8	7	0.37	0.73	2.0	**0.0101**
A315 - Mill (Hill) Creek	7	7	1.05	2.59	2.5	**0.0003**
A317 - Springbrook Creek	17	39	1.10	2.82	2.6	**<0.0001**
C317 - Black River	6	5	0.72	2.80	3.9	**0.0043**
Forest						
A341 - Green River Tributary near TPU Diversion	20	4	0.31	0.38	1.2	0.5697
S322 - Newaukum Tributary below Weyerhaeuser	28	48	0.47	0.90	1.9	**0.0164**
F321 - Crisp Creek	8	5	0.20	0.34	1.7	0.2198
Agriculture						
B322 - Newaukum Tributary at SE 424th	12	29	3.63	5.60	1.5	0.0879
D322 - Newaukum Tributary at 236th SE	62	60	1.34	4.26	3.2	**<0.0001**
Low/Medium Development						
Y320 - Soosette Creek	12	46	0.79	1.60	2.0	**0.0033**
A330 - Green Tributary at Lea Hill	10	7	0.33	1.01	3.1	**0.0017**
A326 - Panther Creek	26	11	1.08	1.97	1.8	**0.0001**
A307 - Hamm Creek	42	57	0.54	2.40	4.5	**<0.0001**
High Development						
I322B - Newaukum Creek at Enumclaw	12	59	2.28	2.13	0.9	0.2564
B317 - Mill (Springbrook) Tributary	15	17	1.00	2.59	2.6	**0.0003**

[a] Ratio of media storm flow concentration to median base flow concentration.

[b] Values in bold indicate a significant difference ($\alpha = 0.05$) exists between the median storm and base flow concentrations based on the results from a Mann Whitney U-test.

µg/L: microgram/liter

Table B-15 Comparison of median storm and base flow total copper concentrations for sites in the Green-Duwamish watershed, 2001 - 2003.

	Base n	Storm n	Base Median (µg/L)	Storm Median (µg/L)	Storm/Base Ratio[a]	p-value[b]
River						
E319 - Upper Green River	20	18	0.40	0.87	2.2	**<0.0001**
A310 - Lower Green	39	53	0.70	1.41	2.0	**<0.0001**
Major Stream						
0322 - Newaukum Creek	21	55	1.00	3.41	3.4	**0.0001**
A320 - Soos Creek	8	7	0.48	1.28	2.7	**0.0101**
A315 - Mill (Hill) Creek	7	7	1.32	3.83	2.9	**0.0006**
A317 - Springbrook Creek	17	39	1.50	5.02	3.3	**<0.0001**
C317 - Black River	6	5	1.55	3.75	2.4	**0.0173**
Forest						
A341 - Green River Tributary near TPU Diversion	20	4	0.40	1.46	3.7	**0.0040**
S322 - Newaukum Tributary below Weyerhaeuser	28	49	0.63	1.98	3.2	**0.0164**
F321 - Crisp Creek	8	5	0.20	0.52	2.7	**0.0075**
Agriculture						
B322 - Newaukum Tributary at SE 424th	12	29	4.86	7.17	1.5	0.2721
D322 - Newaukum Tributary at 236th SE	62	60	1.64	4.74	2.9	**<0.0001**
Low/Medium Development						
Y320 - Soosette Creek	12	46	1.10	2.07	1.9	**0.0014**
A330 - Green Tributary at Lea Hill	10	7	0.67	2.16	3.2	**0.0063**
A326 - Panther Creek	26	11	1.24	3.54	2.9	**<0.0001**
A307 - Hamm Creek	42	58	0.79	4.60	5.8	**<0.0001**
High Development						
I322B - Newaukum Creek at Enumclaw	12	59	3.21	3.72	1.2	0.5801
B317 - Mill (Springbrook) Tributary	15	17	1.60	4.97	3.1	**0.0002**

[a] Ratio of media storm flow concentration to median base flow concentration.

[b] Values in bold indicate a significant difference ($\alpha = 0.05$) exists between the median storm and base flow concentrations based on the results from a Mann Whitney U-test.

µg/L: microgram/liter

Table B-16 Comparison of median storm and base flow dissolved mercury concentrations for sites in the Green-Duwamish watershed, 2001 - 2003.

	Base n	Storm n	Base Median (ng/L)	Storm Median (ng/L)	Storm/Base Ratio[a]	p-value[b]
River						
E319 - Upper Green River	23	20	5.0	5.0	1.0	0.7267
A310 - Lower Green	43	74	5.0	5.0	1.0	0.4232
Major Stream						
0322 - Newaukum Creek	22	59	5.0	5.0	1.0	0.1212
A320 - Soos Creek	9	7	0.7	2.0	2.7	**0.0118**
A315 - Mill (Hill) Creek	8	8	1.0	2.5	2.4	**0.0055**
A317 - Springbrook Creek	19	42	5.0	5.0	1.0	0.3851
C317 - Black River	7	6	0.6	2.3	3.7	**0.0012**
Forest						
A341 - Green River Tributary near TPU Diversion	20	4	3.5	2.1	0.6	0.8081
S322 - Newaukum Tributary below Weyerhaeuser	30	72	5.0	4.1	0.8	0.9177
F321 - Crisp Creek	9	6	0.8	2.2	2.7	**0.0008**
Agriculture						
B322 - Newaukum Tributary at SE 424th	17	52	4.9	5.7	1.2	**0.0201**
D322 - Newaukum Tributary at 236th SE	62	60	2.9	5.0	1.7	**0.0067**
Low/Medium Development						
Y320 - Soosette Creek	15	49	5.0	5.0	1.0	0.1413
A330 - Green Tributary at Lea Hill	11	8	0.7	2.4	3.3	**0.0050**
A326 - Panther Creek	29	21	2.8	3.3	1.2	0.4150
A307 - Hamm Creek	42	69	1.5	7.4	5.0	**<0.0001**
High Development						
I322B - Newaukum Creek at Enumclaw	13	63	5.0	5.0	1.0	0.3267
B317 - Mill (Springbrook) Tributary	16	21	5.0	5.0	1.0	0.2537

[a] Ratio of media storm flow concentration to median base flow concentration.

[b] Values in bold indicate a significant difference ($\alpha = 0.05$) exists between the median storm and base flow concentrations based on the results from a Mann Whitney U-test.

ng/L: nanogram/liter

Table B-17 Comparison of median storm and base flow total mercury concentrations for sites in the Green-Duwamish watershed, 2001 - 2003.

	Base n	Storm n	Base Median (ng/L)	Storm Median (ng/L)	Storm/Base Ratio[a]	p-value[b]
River						
E319 - Upper Green River	23	20	5.0	5.0	1.0	0.1784
A310 - Lower Green	43	74	5.0	5.0	1.0	0.5196
Major Stream						
0322 - Newaukum Creek	22	59	5.0	7.3	1.5	**0.0006**
A320 - Soos Creek	9	7	1.3	3.6	2.8	**0.0118**
A315 - Mill (Hill) Creek	8	8	2.3	7.4	3.3	**0.0079**
A317 - Springbrook Creek	19	42	5.0	7.5	1.5	**0.0000**
C317 - Black River	7	6	2.3	5.6	2.4	**0.0023**
Forest						
A341 - Green River Tributary near TPU Diversion	20	4	3.5	7.9	2.3	**0.0040**
S322 - Newaukum Tributary below Weyerhaeuser	30	72	5.0	6.6	1.3	**0.0197**
F321 - Crisp Creek	9	6	1.2	2.9	2.5	**0.0018**
Agriculture						
B322 - Newaukum Tributary at SE 424th	17	52	5.4	8.6	1.6	**0.0002**
D322 - Newaukum Tributary at 236th SE	62	60	4.3	7.3	1.7	**<0.0001**
Low/Medium Development						
Y320 - Soosette Creek	15	49	5.0	6.4	1.3	**0.0056**
A330 - Green Tributary at Lea Hill	11	8	1.4	6.7	4.6	**0.0029**
A326 - Panther Creek	29	21	3.7	5.7	1.5	0.0531
A307 - Hamm Creek	42	69	4.3	29.9	7.0	**<0.0001**
High Development						
I322B - Newaukum Creek at Enumclaw	13	63	5.0	6.1	1.2	**0.0016**
B317 - Mill (Springbrook) Tributary	16	21	5.0	9.4	1.9	**0.0007**

[a] Ratio of media storm flow concentration to median base flow concentration.

[b] Values in bold indicate a significant difference ($\alpha = 0.05$) exists between the median storm and base flow concentrations based on the results from a Mann Whitney U-test.

ng/L: nanogram/liter

Table B-18 Comparison of median storm and base flow dissolved zinc concentrations for sites in the Green-Duwamish watershed, 2001 - 2003.

	Base n	Storm n	Base Median (µg/L)	Storm Median (µg/L)	Storm/Base Ratio[a]	p-value[b]
River						
E319 - Upper Green River	20	18	0.52	0.50	1.0	0.5927
A310 - Lower Green	39	52	0.55	1.19	2.2	**<0.0001**
Major Stream						
0322 - Newaukum Creek	21	55	0.70	2.15	3.1	**0.0001**
A320 - Soos Creek	8	7	0.55	1.21	2.2	**0.0172**
A315 - Mill (Hill) Creek	7	7	1.54	5.47	3.5	**0.0037**
A317 - Springbrook Creek	17	39	4.35	10.00	2.3	**<0.0001**
C317 - Black River	6	5	4.03	10.00	2.5	**0.0173**
Forest						
A341 - Green River Tributary near TPU Diversion	20	4	0.50	0.51	1.0	0.5697
S322 - Newaukum Tributary below Weyerhaeuser	28	48	0.50	0.71	1.4	0.1142
F321 - Crisp Creek	8	5	0.55	0.47	0.8	0.9578
Agriculture						
B322 - Newaukum Tributary at SE 424th	12	29	4.26	10.00	2.3	**0.0004**
D322 - Newaukum Tributary at 236th SE	62	60	1.75	4.87	2.8	**<0.0001**
Low/Medium Development						
Y320 - Soosette Creek	12	46	2.20	4.73	2.2	**0.0001**
A330 - Green Tributary at Lea Hill	10	7	0.61	0.91	1.5	**0.0236**
A326 - Panther Creek	26	11	3.25	5.23	1.6	**0.0231**
A307 - Hamm Creek	42	57	0.94	3.76	4.0	**<0.0001**
High Development						
I322B - Newaukum Creek at Enumclaw	12	59	20.00	12.32	0.6	**0.0494**
B317 - Mill (Springbrook) Tributary	15	17	7.72	20.00	2.6	**0.0018**

[a] Ratio of media storm flow concentration to median base flow concentration.

[b] Values in bold indicate a significant difference ($\alpha = 0.05$) exists between the median storm and base flow concentrations based on the results from a Mann Whitney U-test.

µg/L: microgram/liter

Table B-19 Comparison of median storm and base flow total zinc concentrations for sites in the Green-Duwamish watershed, 2001 - 2003.

	Base n	Storm n	Base Median (µg/L)	Storm Median (µg/L)	Storm/Base Ratio[a]	p-value[b]
River						
E319 - Upper Green River	20	18	0.59	1.67	2.9	**<0.0001**
A310 - Lower Green	39	53	1.01	3.56	3.5	**<0.0001**
Major Stream						
0322 - Newaukum Creek	21	55	1.52	6.42	4.2	**<0.0001**
A320 - Soos Creek	8	7	0.67	1.75	2.6	**0.0101**
A315 - Mill (Hill) Creek	7	7	2.11	9.62	4.6	**0.0059**
A317 - Springbrook Creek	17	39	8.30	30.00	3.6	**<0.0001**
C317 - Black River	6	5	10.00	20.00	2.0	0.1255
Forest						
A341 - Green River Tributary near TPU Diversion	20	4	0.60	2.42	4.0	**0.0040**
S322 - Newaukum Tributary below Weyerhaeuser	28	49	0.57	2.54	4.5	**0.0012**
F321 - Crisp Creek	8	5	0.38	0.95	2.5	0.0559
Agriculture						
B322 - Newaukum Tributary at SE 424th	12	29	6.61	20.00	3.0	**0.0004**
D322 - Newaukum Tributary at 236th SE	62	60	2.37	6.64	2.8	**<0.0001**
Low/Medium Development						
Y320 - Soosette Creek	12	46	3.79	7.22	1.9	**0.0012**
A330 - Green Tributary at Lea Hill	10	7	0.94	2.97	3.2	**0.0001**
A326 - Panther Creek	26	11	4.01	10.00	2.5	**0.0002**
A307 - Hamm Creek	42	58	1.80	10.10	5.6	**<0.0001**
High Development						
I322B - Newaukum Creek at Enumclaw	12	59	23.50	20.35	0.9	1.0000
B317 - Mill (Springbrook) Tributary	15	17	10.00	40.00	4.0	**0.0018**

[a] Ratio of media storm flow concentration to median base flow concentration.

[b] Values in bold indicate a significant difference ($\alpha = 0.05$) exists between the median storm and base flow concentrations based on the results from a Mann Whitney U-test.

µg/L: microgram/liter

Table B-20 Comparison of median storm and base flow dissolved iron concentrations for sites in the Green-Duwamish watershed, 2001 - 2003.

	Base n	Storm n	Base Median (mg/L)	Storm Median (mg/L)	Storm/Base Ratio[a]	p-value[b]
River						
E319 - Upper Green River	22	20	0.05	0.05	1.0	0.6993
A310 - Lower Green	43	69	0.13	0.11	0.8	0.5986
Major Stream						
0322 - Newaukum Creek	22	58	0.05	0.10	2.0	**0.0001**
A320 - Soos Creek	9	8	0.05	0.08	1.6	**<0.0001**
A315 - Mill (Hill) Creek	8	9	0.44	0.32	0.7	0.2031
A317 - Springbrook Creek	19	41	0.48	0.28	0.6	0.7888
C317 - Black River	7	7	0.48	0.36	0.8	0.8048
Forest						
A341 - Green River Tributary near TPU Diversion	20	4	0.05	0.05	1.0	
S322 - Newaukum Tributary below Weyerhaeuser	30	70	0.05	0.09	1.9	**0.0024**
F321 - Crisp Creek	9	7	0.05	0.05	1.0	0.2299
Agriculture						
B322 - Newaukum Tributary at SE 424th	17	49	0.08	0.17	2.0	**0.0446**
D322 - Newaukum Tributary at 236th SE	62	60	0.15	0.21	1.4	0.0865
Low/Medium Development						
Y320 - Soosette Creek	15	48	0.15	0.09	0.6	**0.0009**
A330 - Green Tributary at Lea Hill	11	9	0.05	0.07	1.4	**0.0012**
A326 - Panther Creek	29	22	0.05	0.07	1.4	0.8283
A307 - Hamm Creek	42	68	0.09	0.13	1.4	**<0.0001**
High Development						
I322B - Newaukum Creek at Enumclaw	13	62	0.05	0.05	1.0	0.8393
B317 - Mill (Springbrook) Tributary	16	21	0.52	0.20	0.4	**0.0033**

[a] Ratio of media storm flow concentration to median base flow concentration.

[b] Values in bold indicate a significant difference ($\alpha = 0.05$) exists between the median storm and base flow concentrations based on the results from a Mann Whitney U-test.

mg/L: milligram/liter

Table B-21 Comparison of median storm and base flow total iron concentrations for sites in the Green-Duwamish watershed, 2001 - 2003.

	Base n	Storm n	Base Median (mg/L)	Storm Median (mg/L)	Storm/Base Ratio[a]	p-value[b]
River						
E319 - Upper Green River	23	20	0.12	0.51	4.3	**0.0003**
A310 - Lower Green	43	74	0.57	0.82	1.4	**0.0152**
Major Stream						
0322 - Newaukum Creek	22	59	0.18	0.75	4.2	**<0.0001**
A320 - Soos Creek	9	8	0.18	0.41	2.3	**0.0004**
A315 - Mill (Hill) Creek	8	9	2.42	1.95	0.8	0.5148
A317 - Springbrook Creek	19	42	3.52	2.78	0.8	**0.0972**
C317 - Black River	7	7	3.64	1.99	0.5	**0.0070**
Forest						
A341 - Green River Tributary near TPU Diversion	20	4	0.14	0.70	5.1	**0.0040**
S322 - Newaukum Tributary below Weyerhaeuser	30	73	0.09	1.25	13.9	**0.0008**
F321 - Crisp Creek	9	7	0.05	0.15	3.0	**0.0004**
Agriculture						
B322 - Newaukum Tributary at SE 424th	17	53	0.30	0.49	1.6	**0.0756**
D322 - Newaukum Tributary at 236th SE	62	60	0.51	0.64	1.3	0.1236
Low/Medium Development						
Y320 - Soosette Creek	15	49	0.35	0.39	1.1	0.7126
A330 - Green Tributary at Lea Hill	11	9	0.25	1.72	7.0	**0.0001**
A326 - Panther Creek	29	25	0.19	0.72	3.8	**0.0002**
A307 - Hamm Creek	42	69	0.40	1.70	4.3	**<0.0001**
High Development						
I322B - Newaukum Creek at Enumclaw	13	63	0.07	0.40	5.8	**<0.0001**
B317 - Mill (Springbrook) Tributary	16	22	2.70	2.21	0.8	0.6296

[a] Ratio of media storm flow concentration to median base flow concentration.

[b] Values in bold indicate a significant difference ($\alpha = 0.05$) exists between the median storm and base flow concentrations based on the results from a Mann Whitney U-test.

mg/L: milligram/liter

APPENDIX C

Alkalinity and Total Suspended Solids Hysteresis Loops from Selected Sites within the Green-Duwamish Watershed, 2001 through 2003

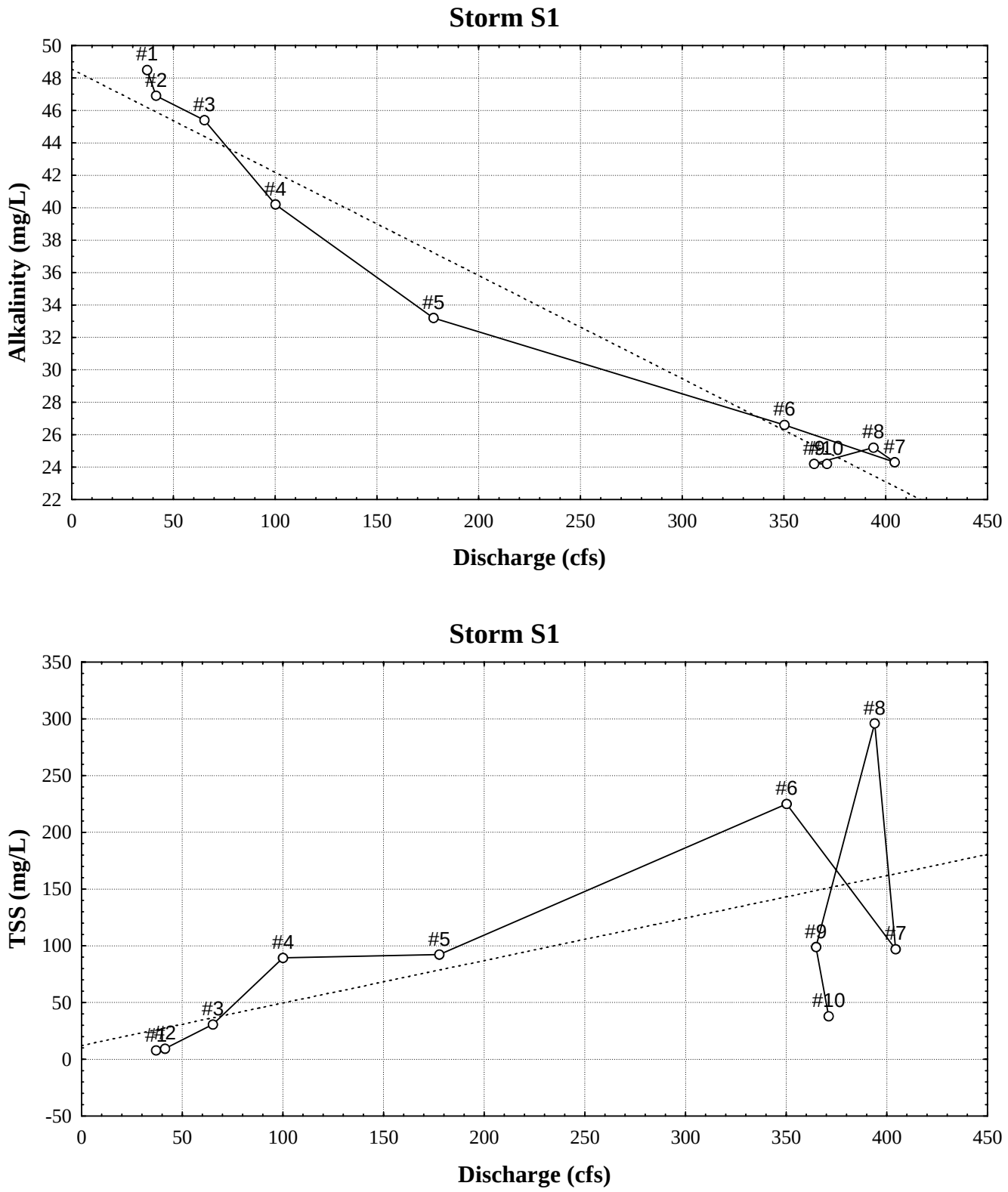

Figure C-1. Alkalinity and TSS hysteresis for autosampler sequential samples collected from Newaukum Creek (0322) during storm event S1. Dashed line indicates best fit linear regression; numbers indicate temporal sequence of sampling.

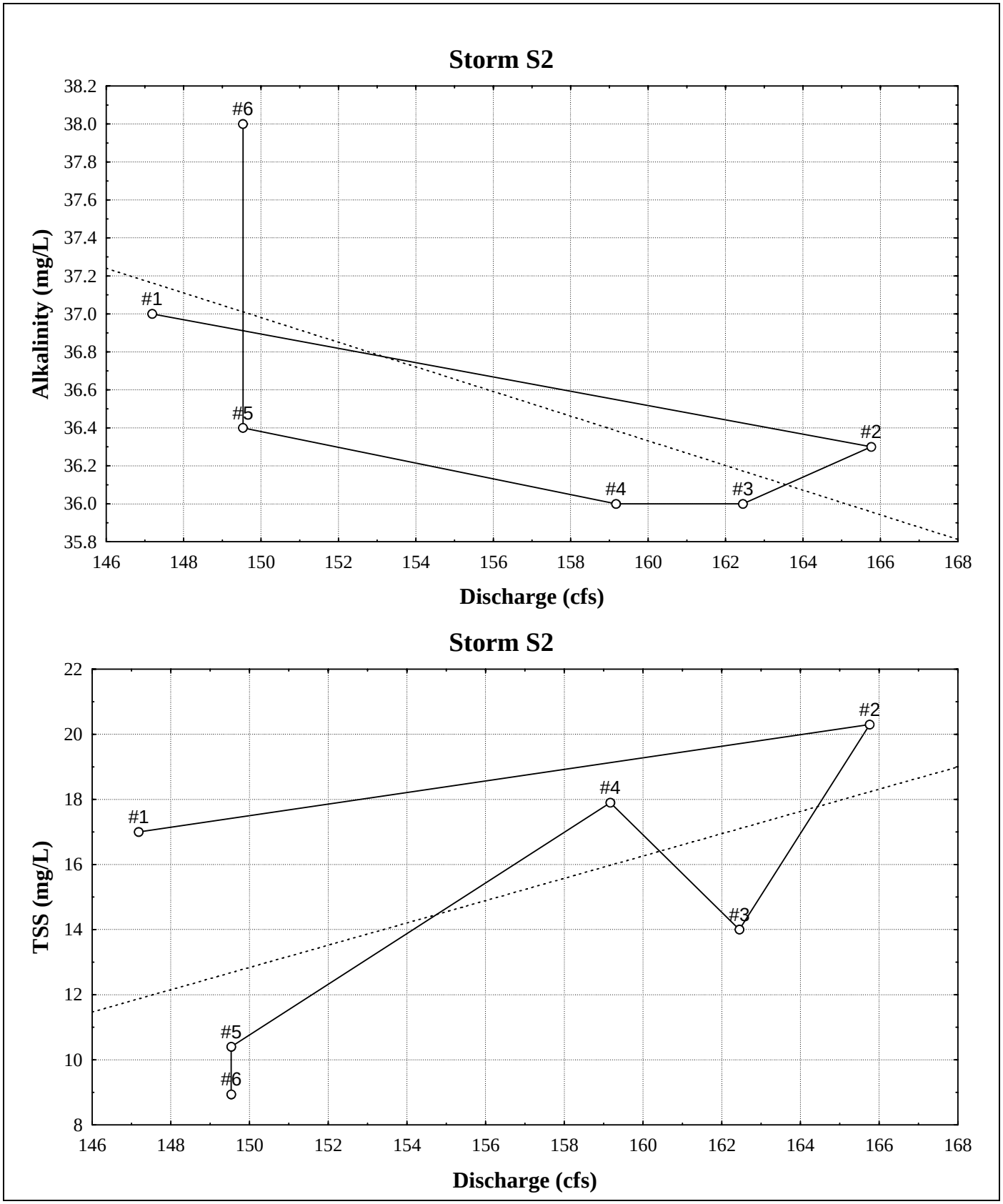

Figure C-2. Alkalinity and TSS hysteresis for autosampler sequential samples collected from Newaukum Creek (0322) during storm event S2. Dashed line indicates best fit linear regression; numbers indicate temporal sequence of sampling.

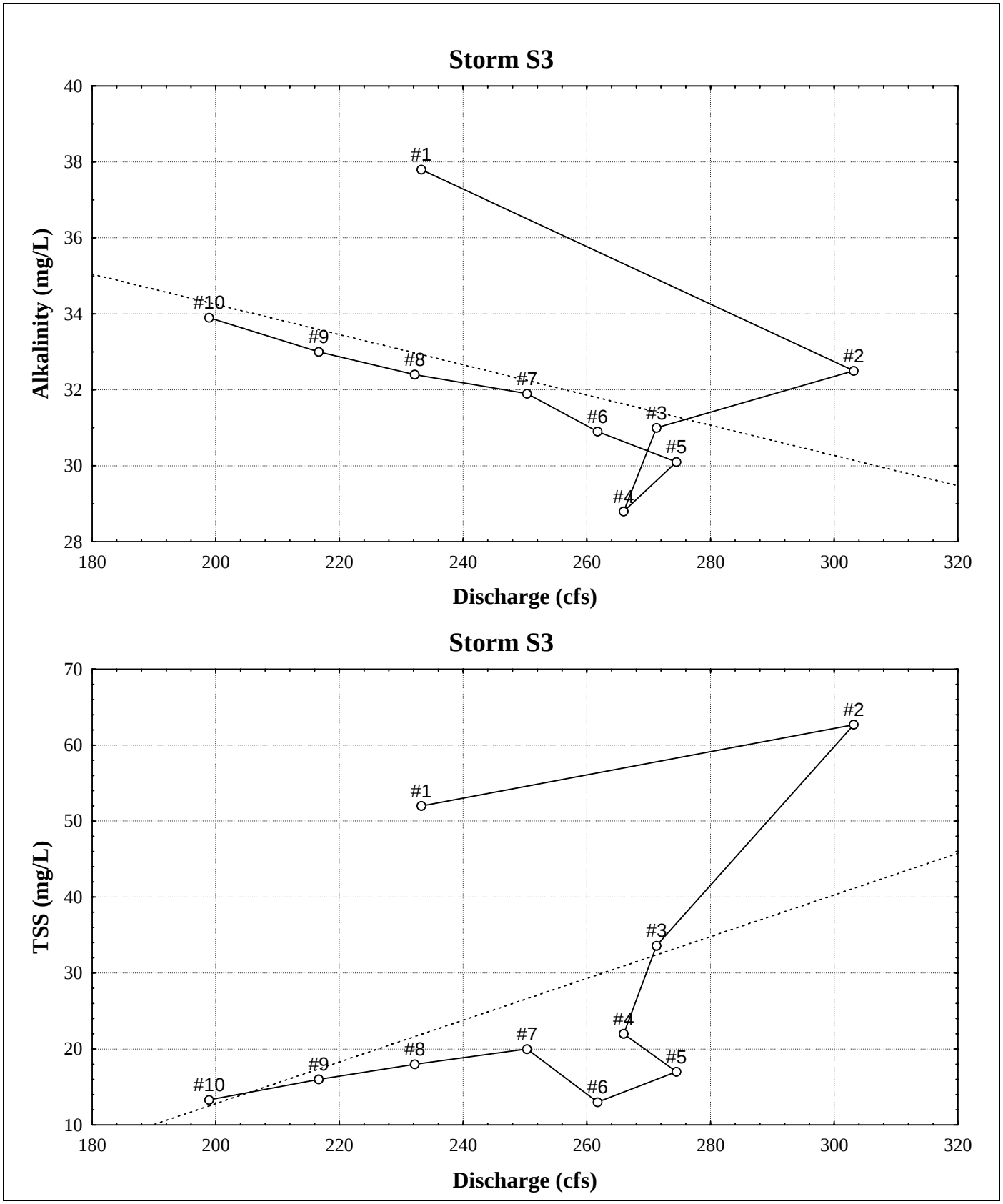

Figure C-3. Alkalinity and TSS hysteresis for autosampler sequential samples collected from Newaukum Creek (0322) during storm event S3. Dashed line indicates best fit linear regression; numbers indicate temporal sequence of sampling.

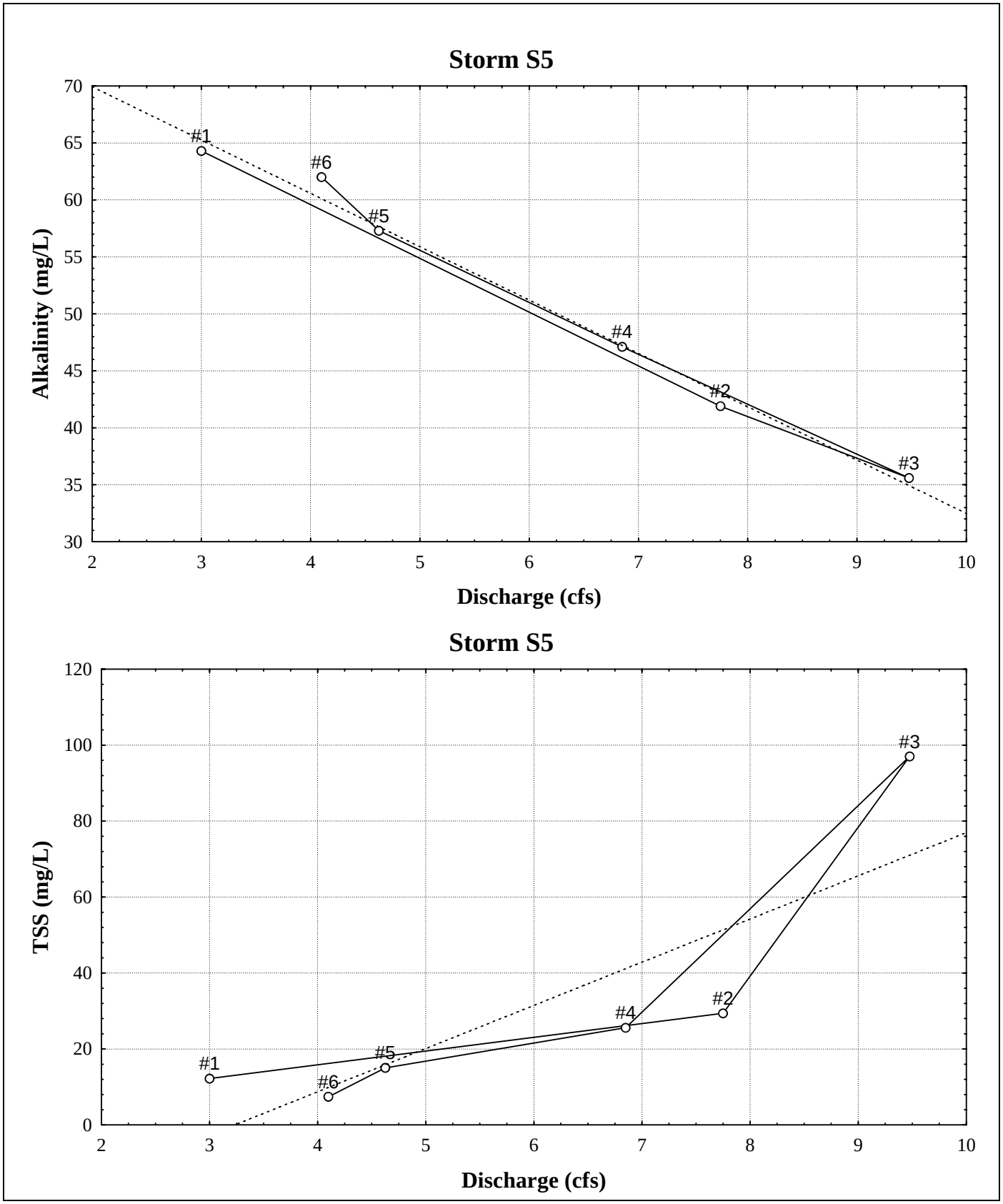

Figure C-4. Alkalinity and TSS hysteresis for autosampler sequential samples collected from Hamm Creek (A307) during storm event S5. Dashed line indicates best fit linear regression; numbers indicate temporal sequence of sampling.

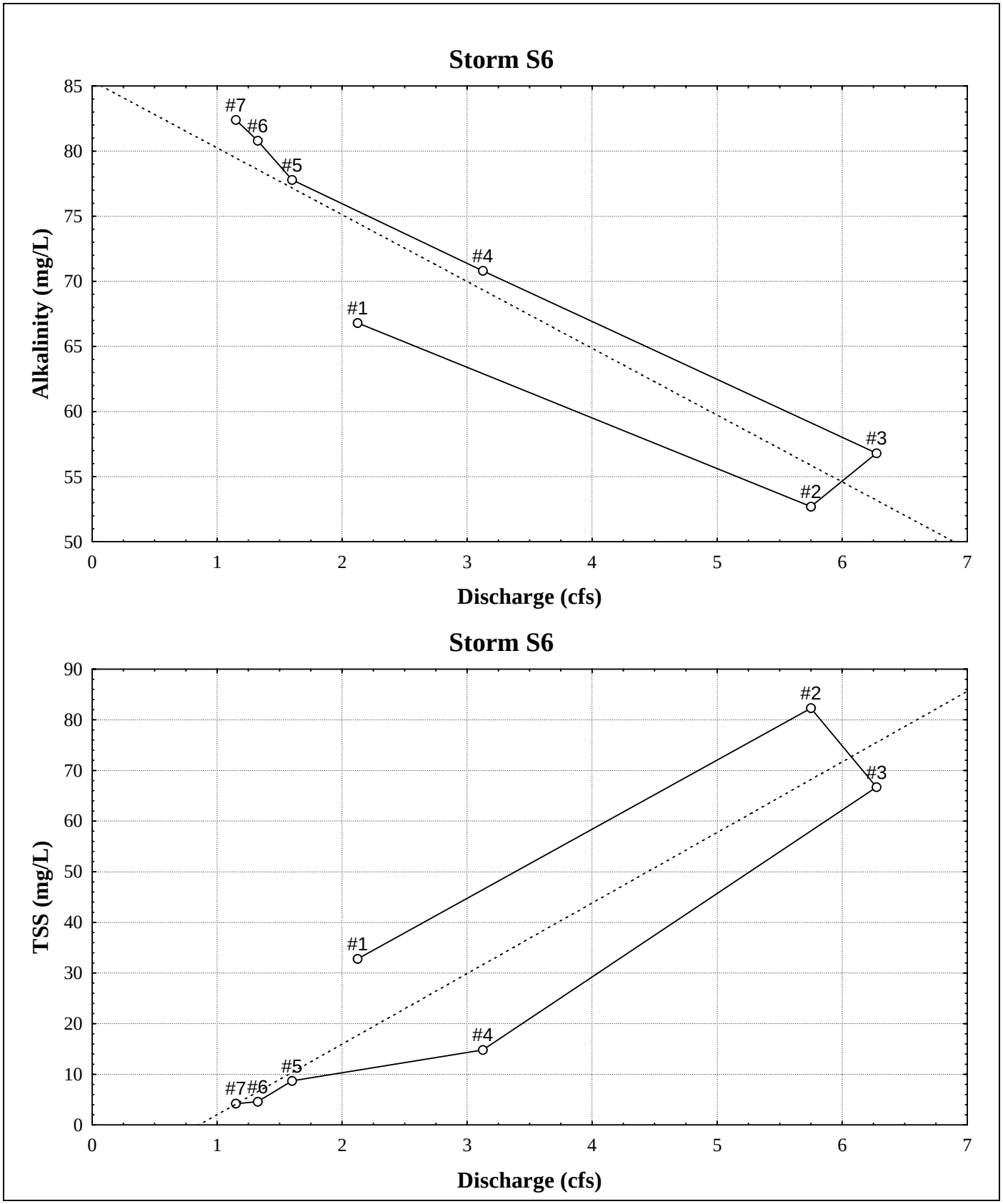

Figure C-5. Alkalinity and TSS hysteresis for autosampler sequential samples collected from Hamm Creek (A307) during storm event S6. Dashed line indicates best fit linear regression; numbers indicate temporal sequence of sampling.

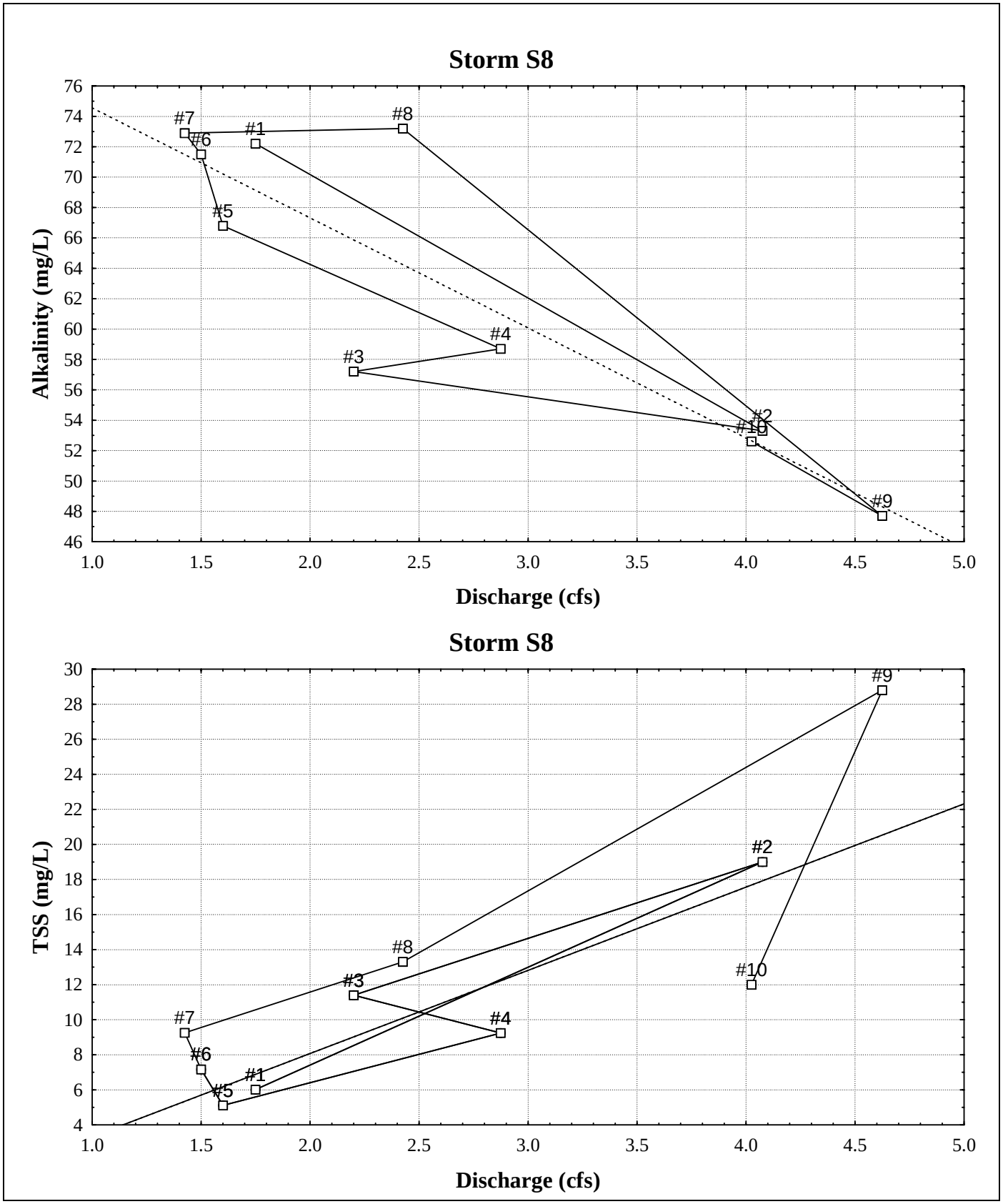

Figure C-6. Alkalinity and TSS hysteresis for autosampler sequential samples collected from Hamm Creek (A307) during storm event S8. Dashed line indicates best fit linear regression; numbers indicate temporal sequence of sampling.

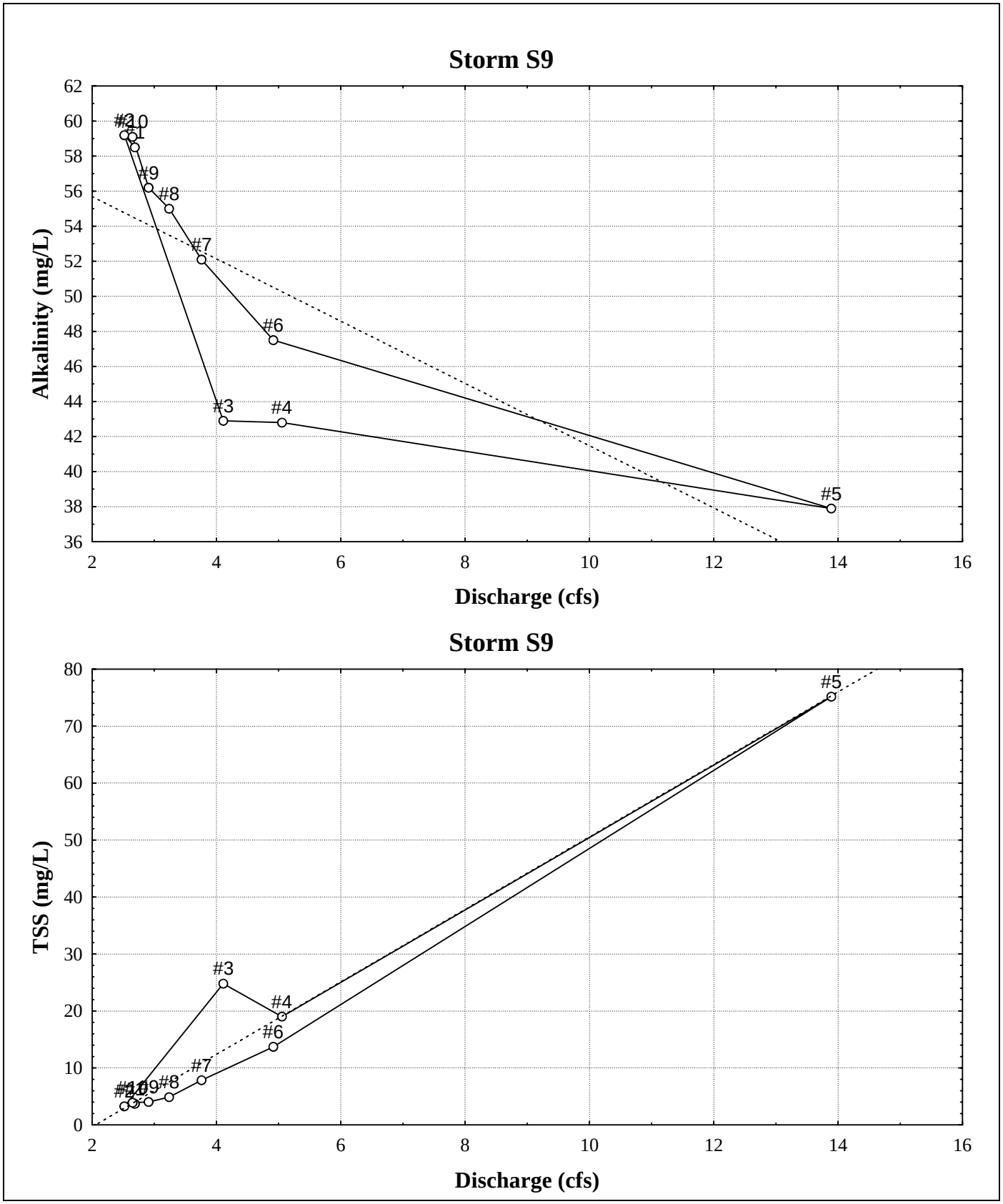

Figure C-7. Alkalinity and TSS hysteresis for autosampler sequential samples collected from Hamm Creek (A307) during storm event S9. Dashed line indicates best fit linear regression; numbers indicate temporal sequence of sampling.

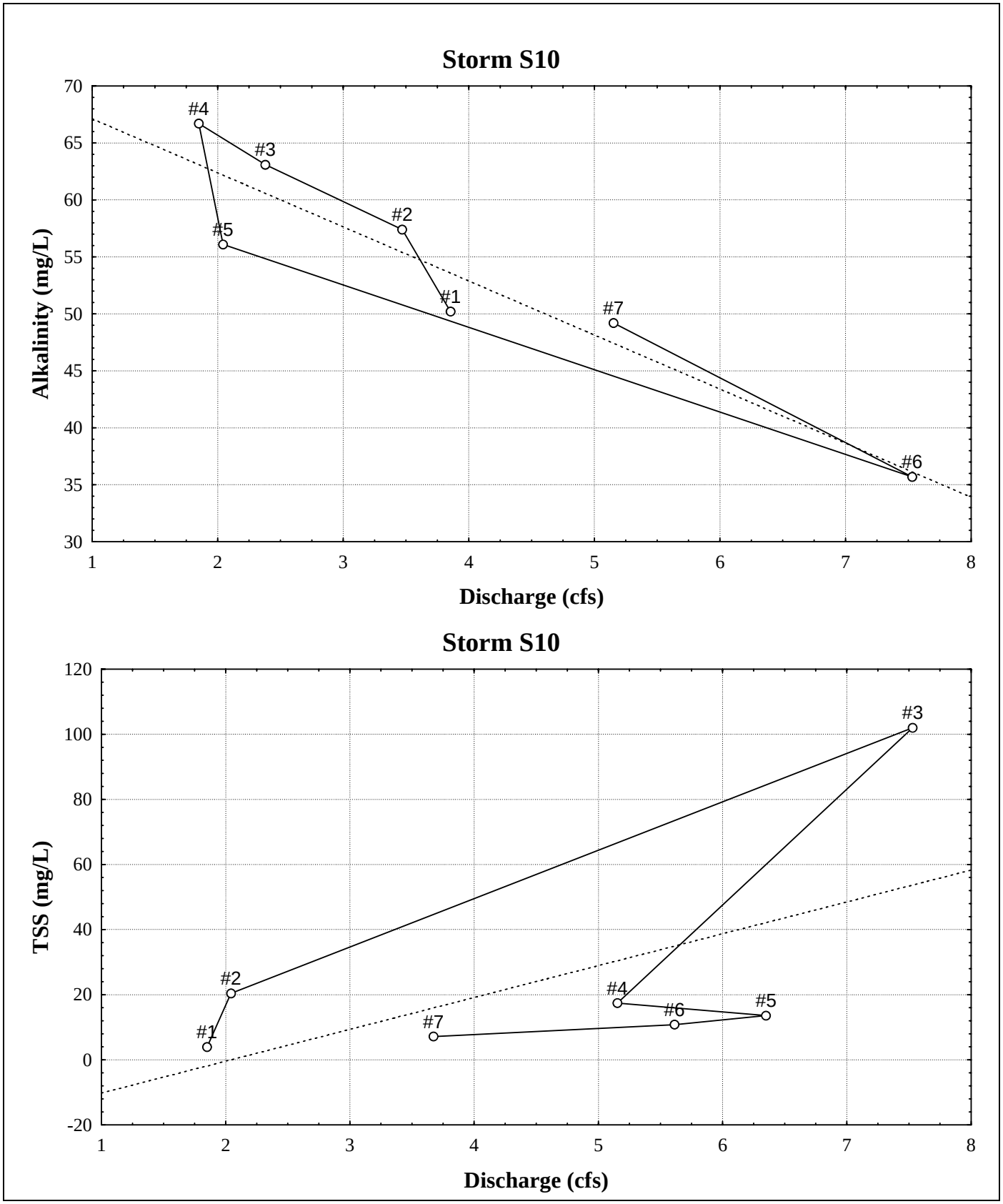

Figure C-8. Alkalinity and TSS hysteresis for autosampler sequential samples collected from Hamm Creek (A307) during storm event S10. Dashed line indicates best fit linear regression; numbers indicate temporal sequence of sampling.

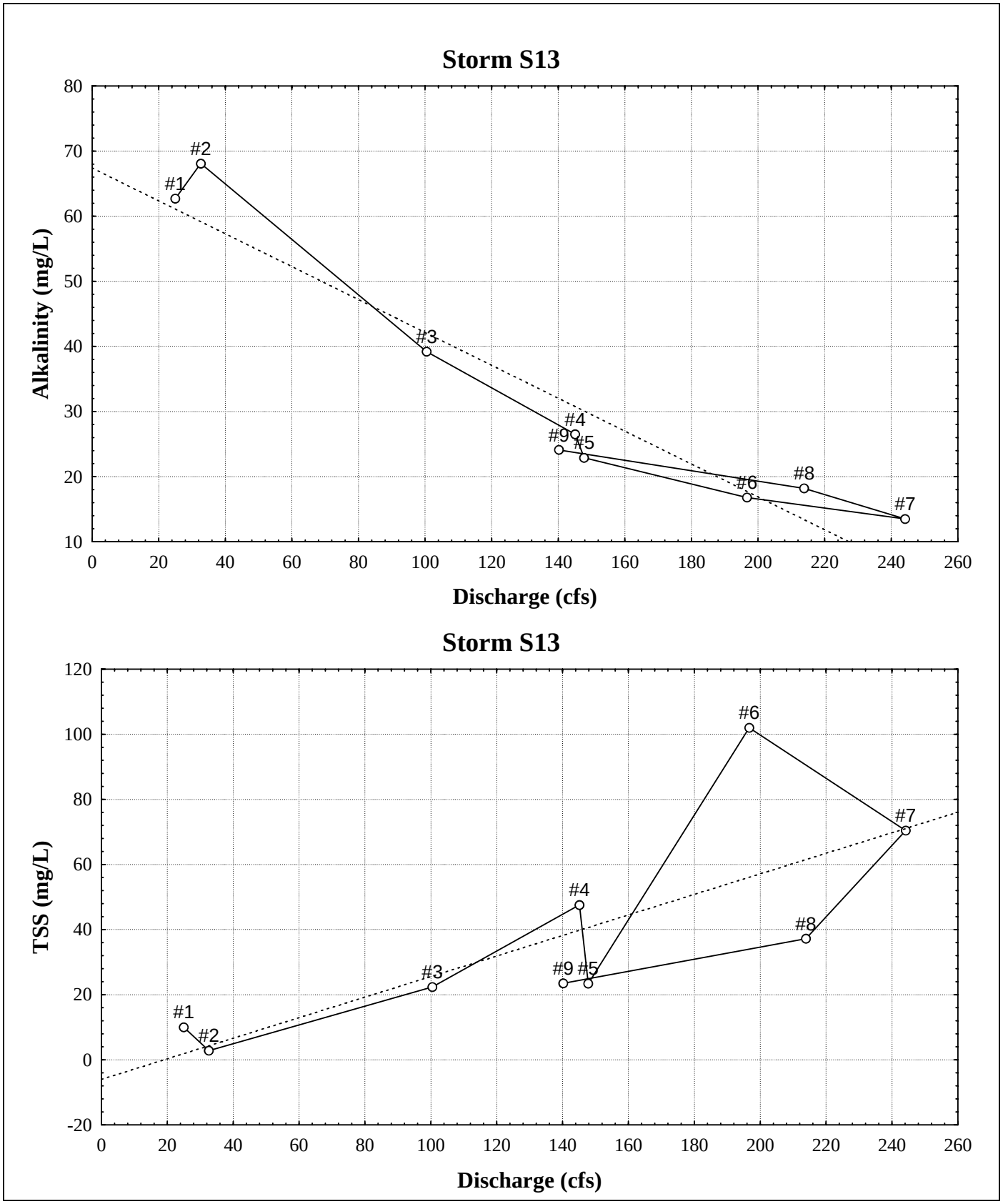

Figure C-9. Alkalinity and TSS hysteresis for autosampler sequential samples collected from Springbrook Creek (A317) during storm event S13. Dashed line indicates best fit linear regression; numbers indicate temporal sequence of sampling.

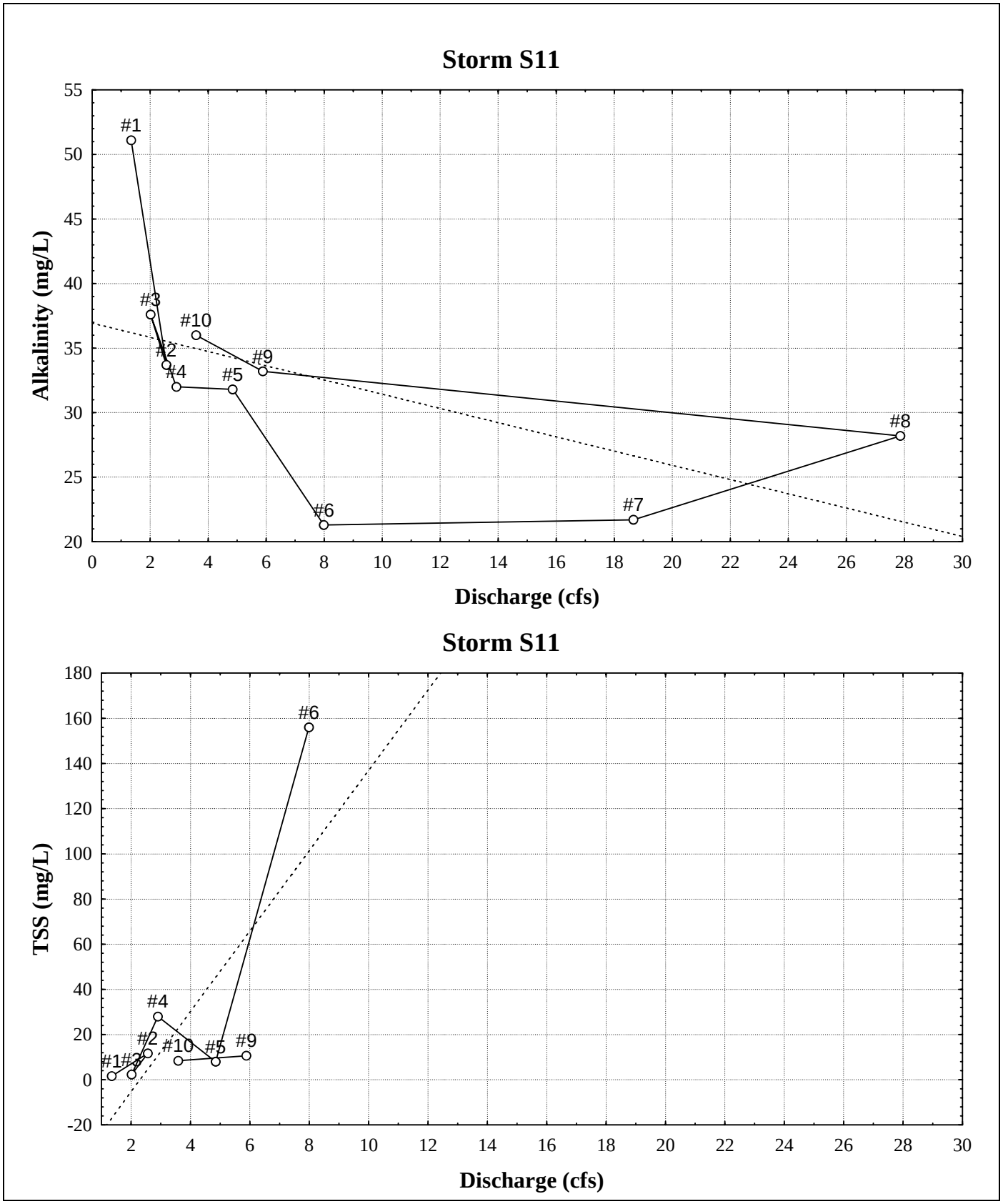

Figure C-10. Alkalinity and TSS hysteresis for autosampler sequential samples collected from Panther Creek (A326) during storm event S11. Dashed line indicates best fit linear regression; numbers indicate temporal sequence of sampling. Note missing data in TSS graph.

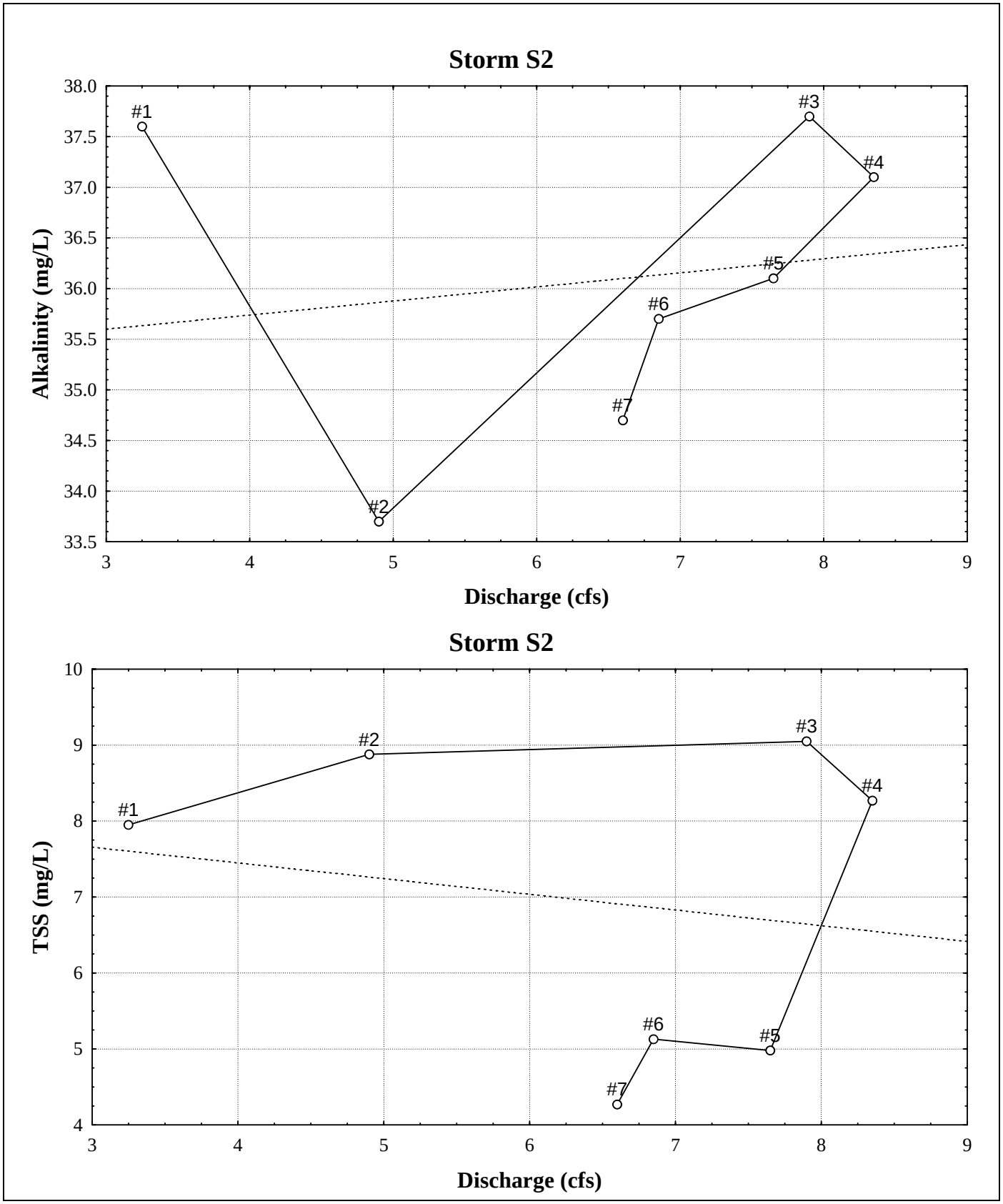

Figure C-11. Alkalinity and TSS hysteresis for autosampler sequential samples collected from Newaukum tributary @ 236th SE (D322) during storm event S2. Dashed line indicates best fit linear regression; numbers indicate temporal sequence of sampling.

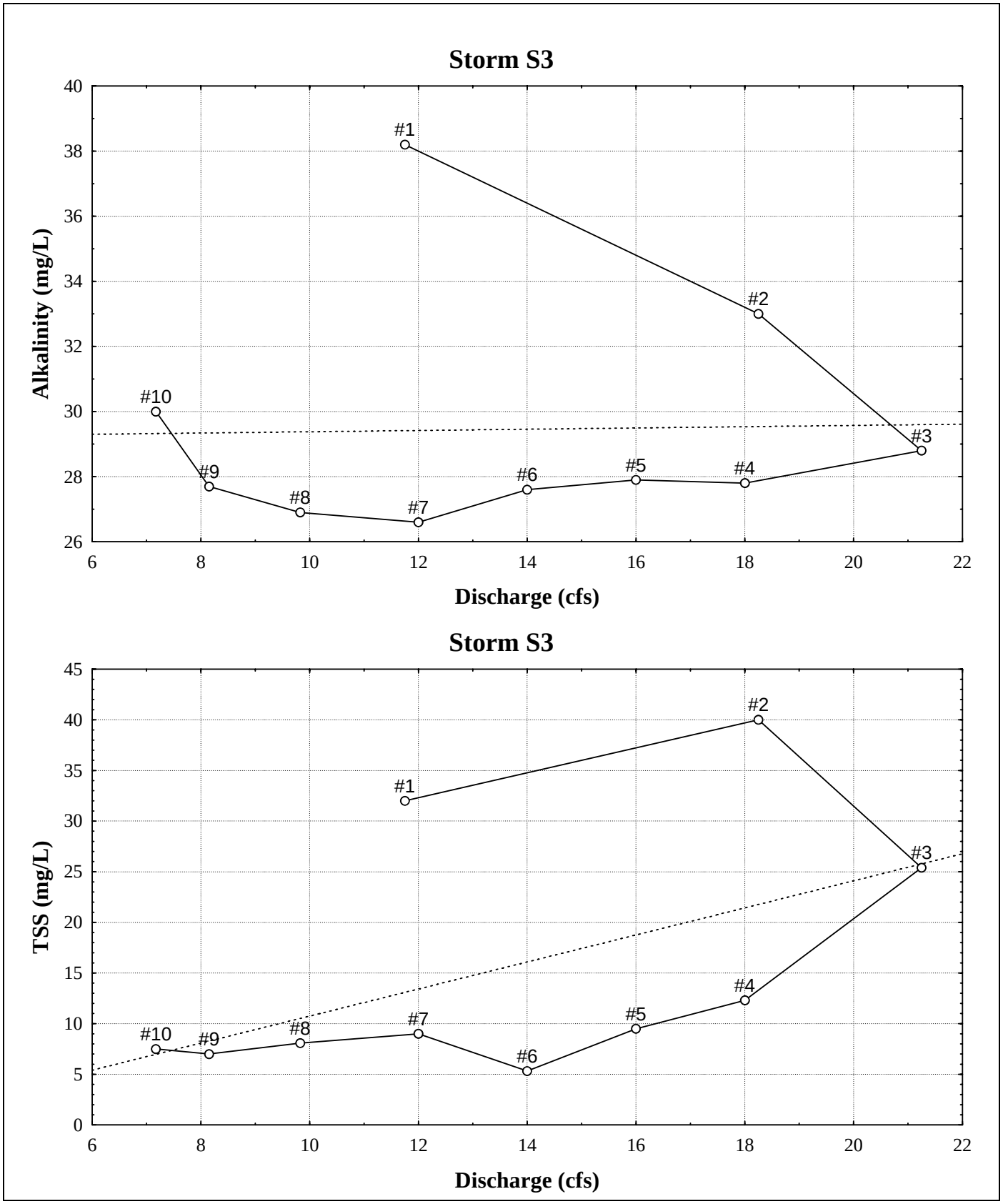

Figure C-12. Alkalinity and TSS hysteresis for autosampler sequential samples collected from Newaukum tributary @ 236th SE (D322) during storm event S3. Dashed line indicates best fit linear regression; numbers indicate temporal sequence of sampling.

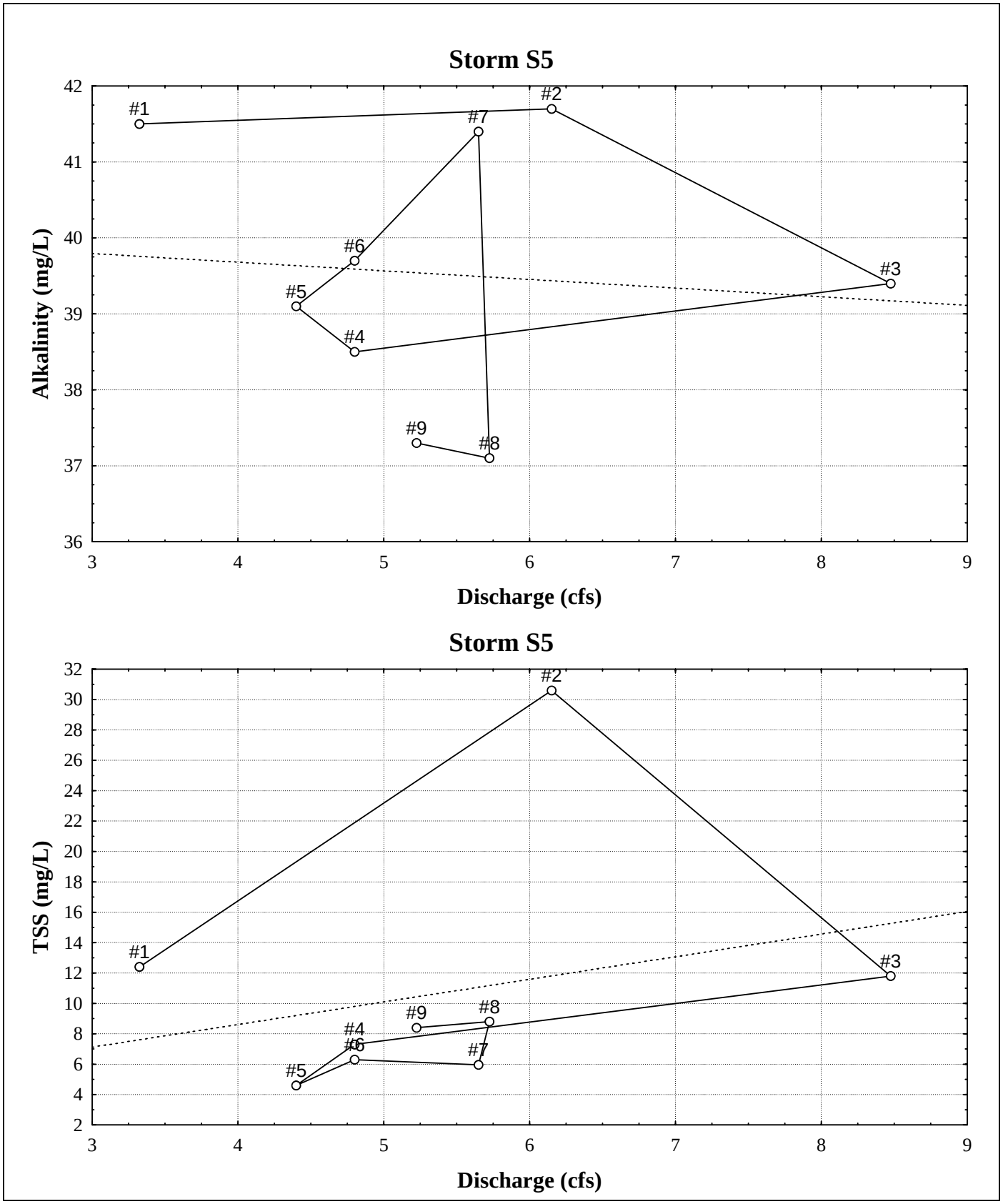

Figure C-13. Alkalinity and TSS hysteresis for autosampler sequential samples collected from Newaukum tributary @ 236th SE (D322) during storm event S5. Dashed line indicates best fit linear regression; numbers indicate temporal sequence of sampling.

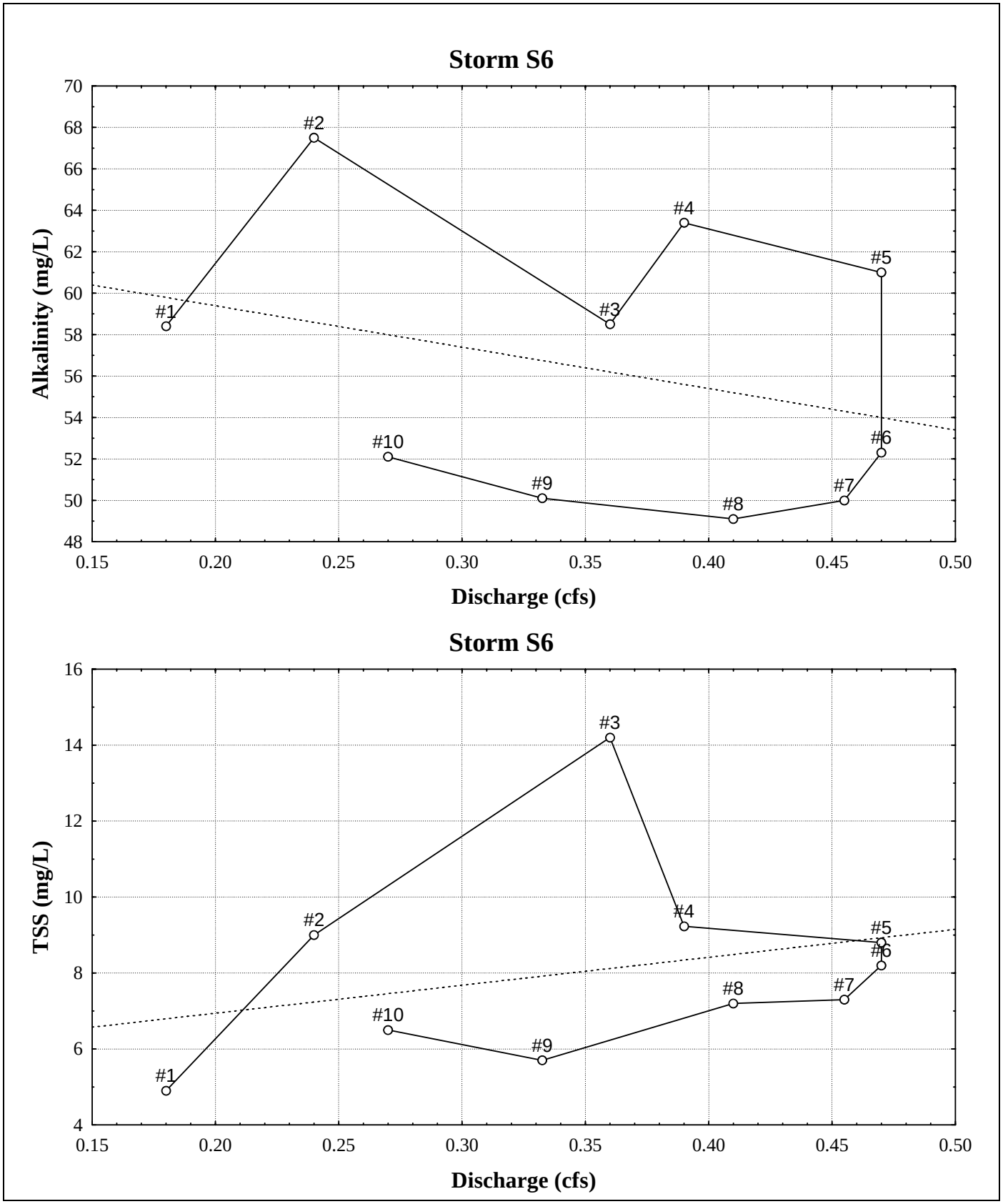

Figure C-14. Alkalinity and TSS hysteresis for autosampler sequential samples collected from Newaukum tributary @ 236th SE (D322) during storm event S6. Dashed line indicates best fit linear regression; numbers indicate temporal sequence of sampling.

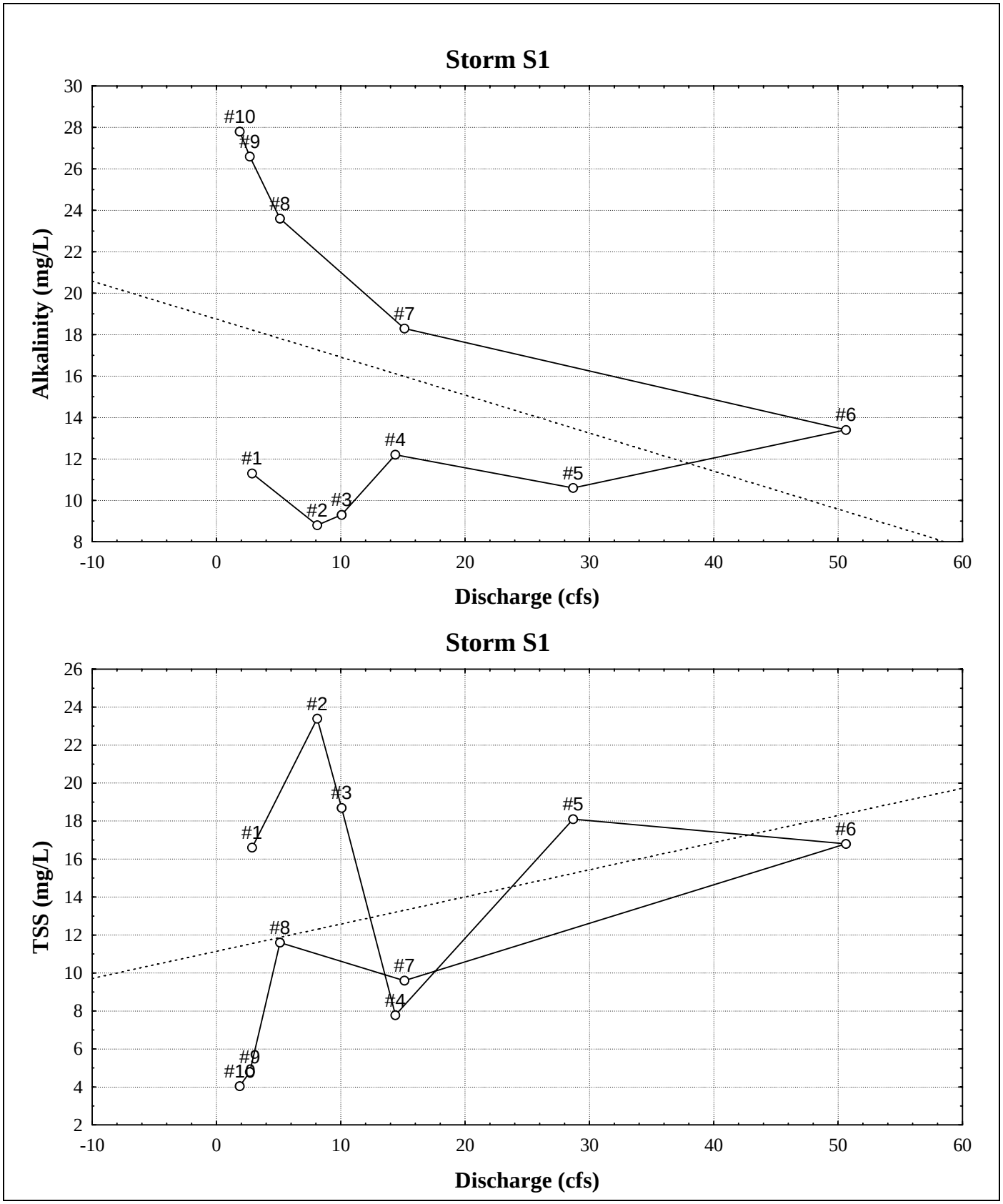

Figure C-15. Alkalinity and TSS hysteresis for autosampler sequential samples collected from Newaukum tributary @ Enumclaw (I322B) during storm event S1. Dashed line indicates best fit linear regression; numbers indicate temporal sequence of sampling.

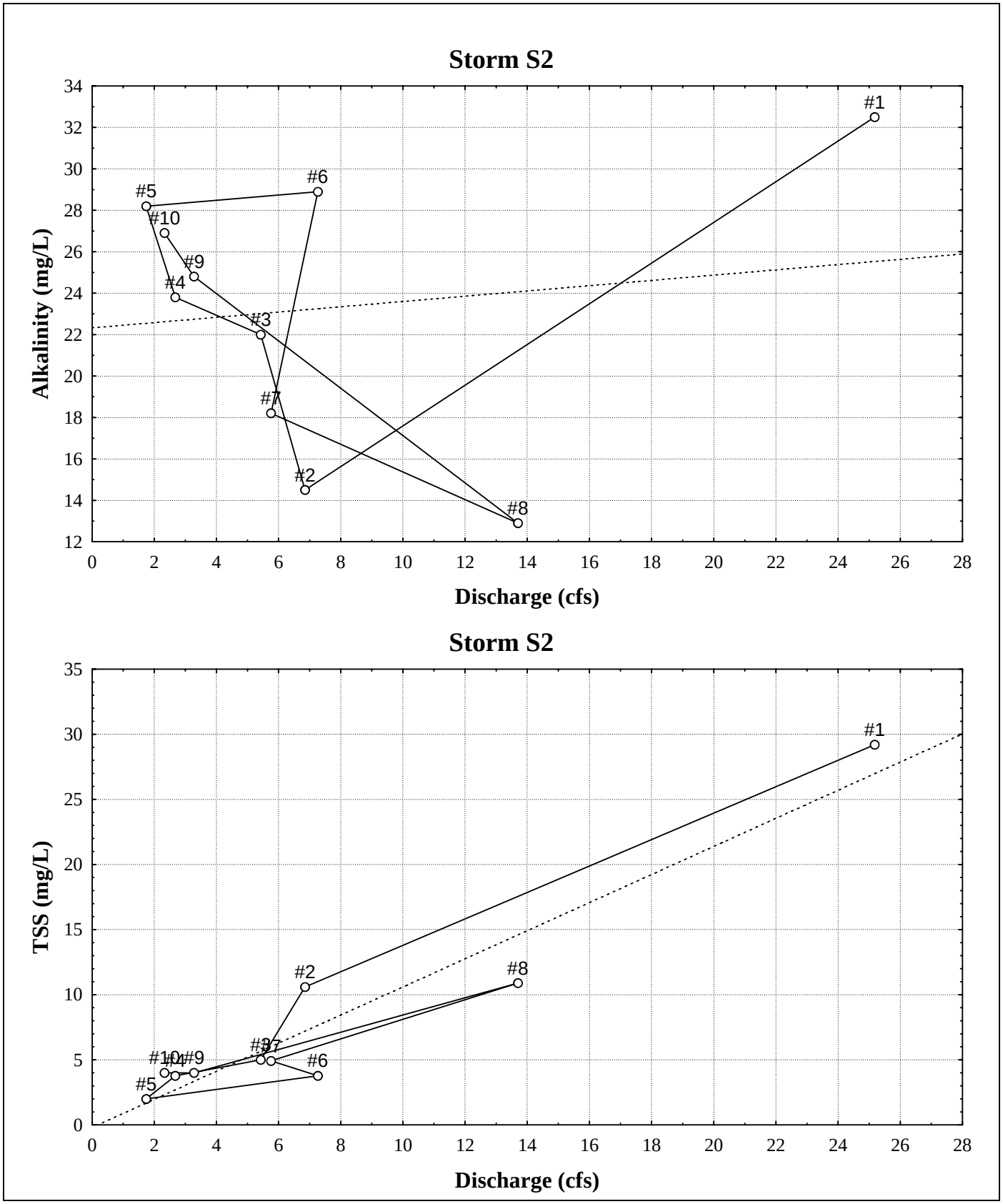

Figure C-16. Alkalinity and TSS hysteresis for autosampler sequential samples collected from Newaukum tributary @ Enumclaw (I322B) during storm event S2. Dashed line indicates best fit linear regression; numbers indicate temporal sequence of sampling.

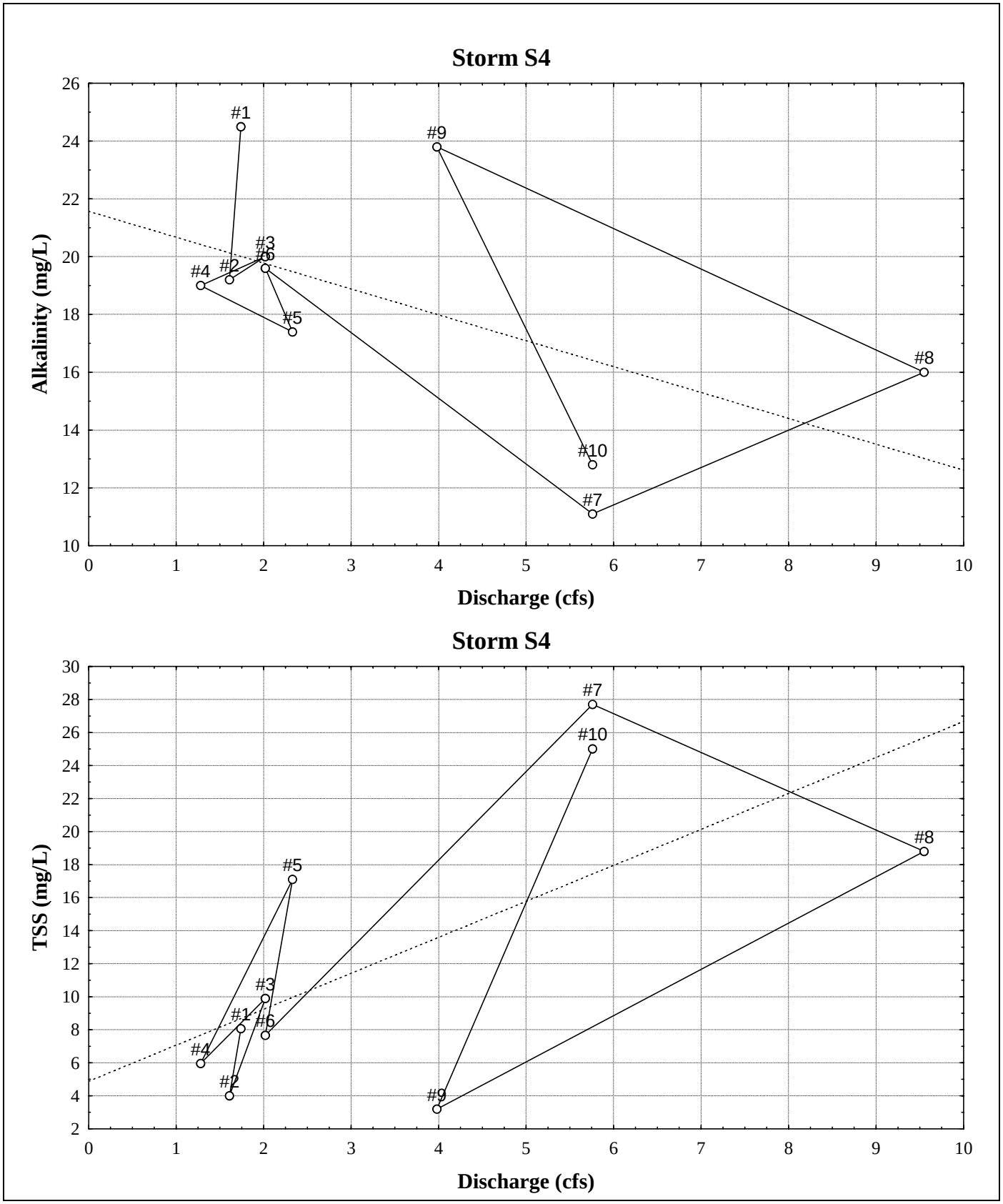

Figure C-17. Alkalinity and TSS hysteresis for autosampler sequential samples collected from Newaukum tributary @ Enumclaw (I322B) during storm event S4. Dashed line indicates best fit linear regression; numbers indicate temporal sequence of sampling.

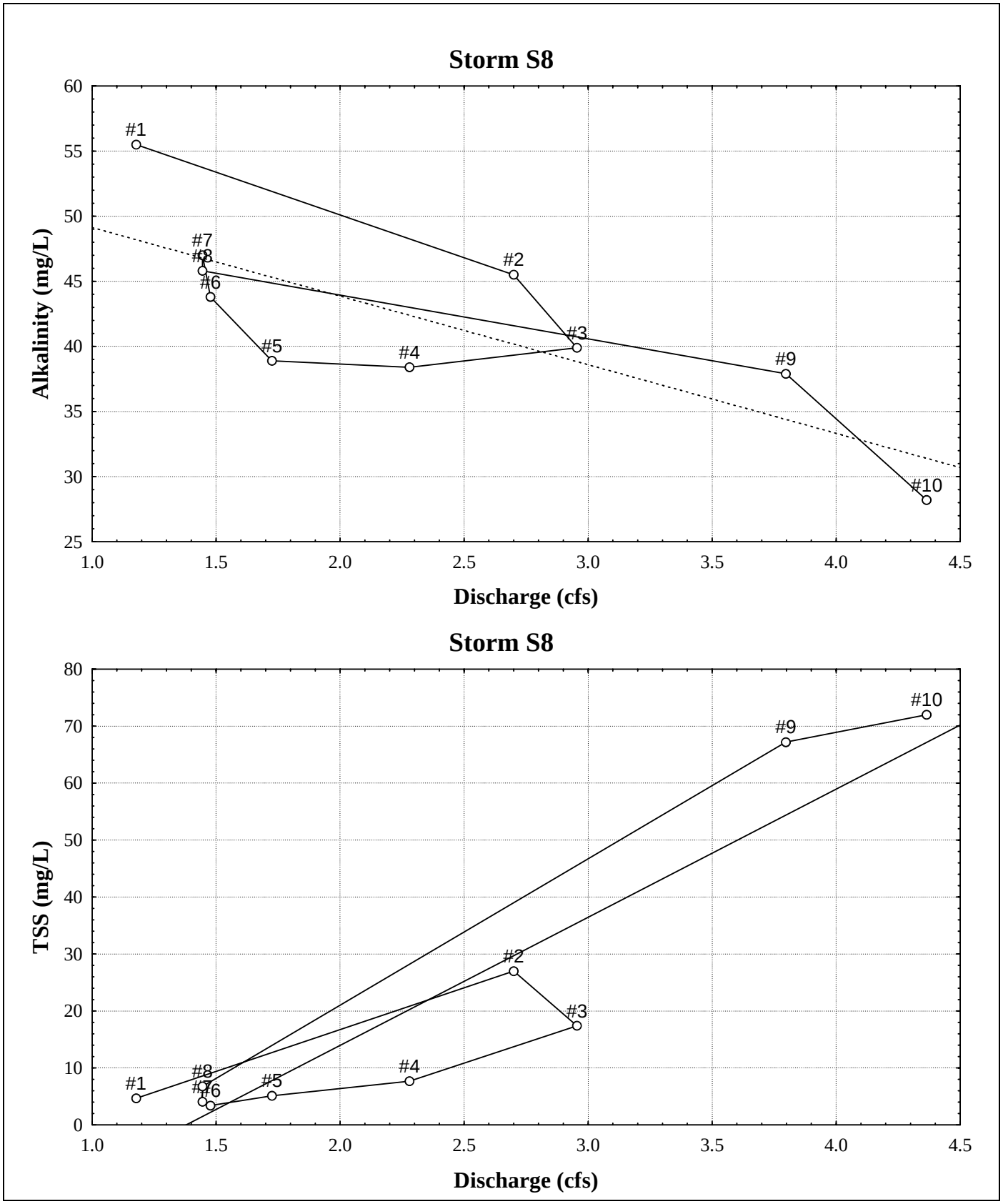

Figure C-18. Alkalinity and TSS hysteresis for autosampler sequential samples collected from Newaukum tributary below Weyerhauser (S322) during storm event S8. Dashed line indicates best fit linear regression; numbers indicate temporal sequence of sampling.

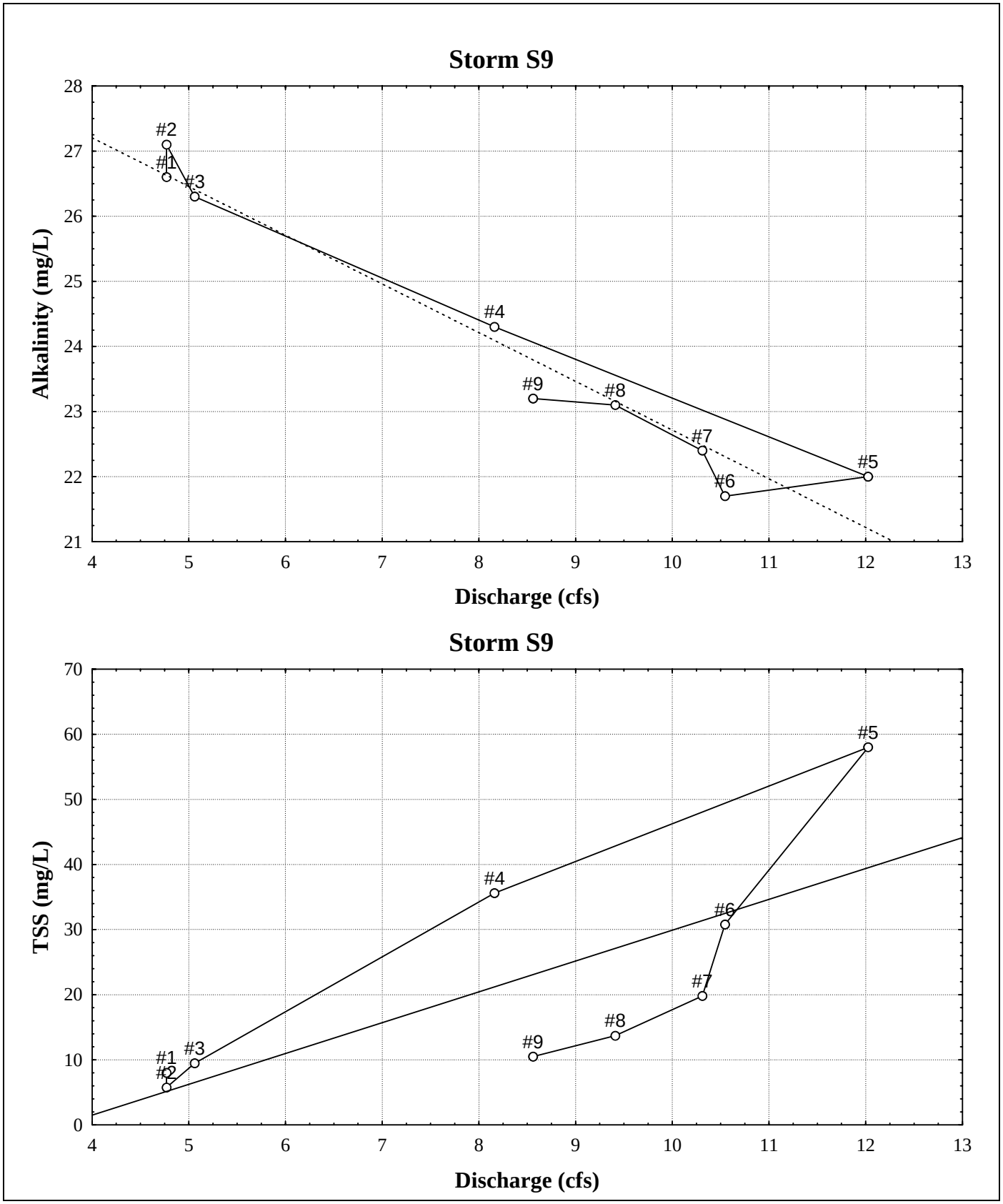

Figure C-19. Alkalinity and TSS hysteresis for autosampler sequential samples collected from Newaukum tributary below Weyerhauser (S322) during storm event S9. Dashed line indicates best fit linear regression; numbers indicate temporal sequence of sampling.

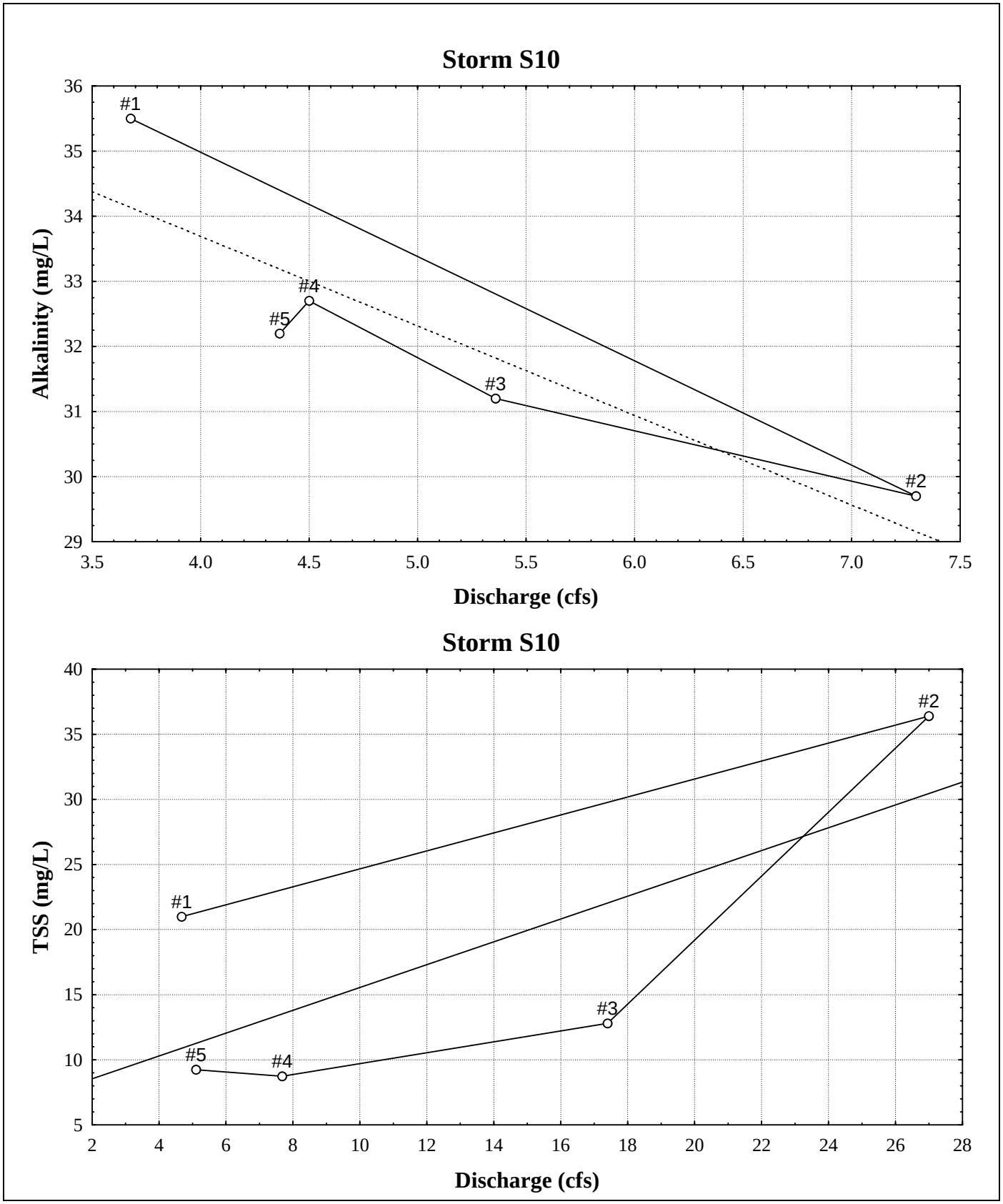

Figure C-20. Alkalinity and TSS hysteresis for autosampler sequential samples collected from Newaukum tributary below Weyerhauser (S322) during storm event S10. Dashed line indicates best fit linear regression; numbers indicate temporal sequence of sampling.

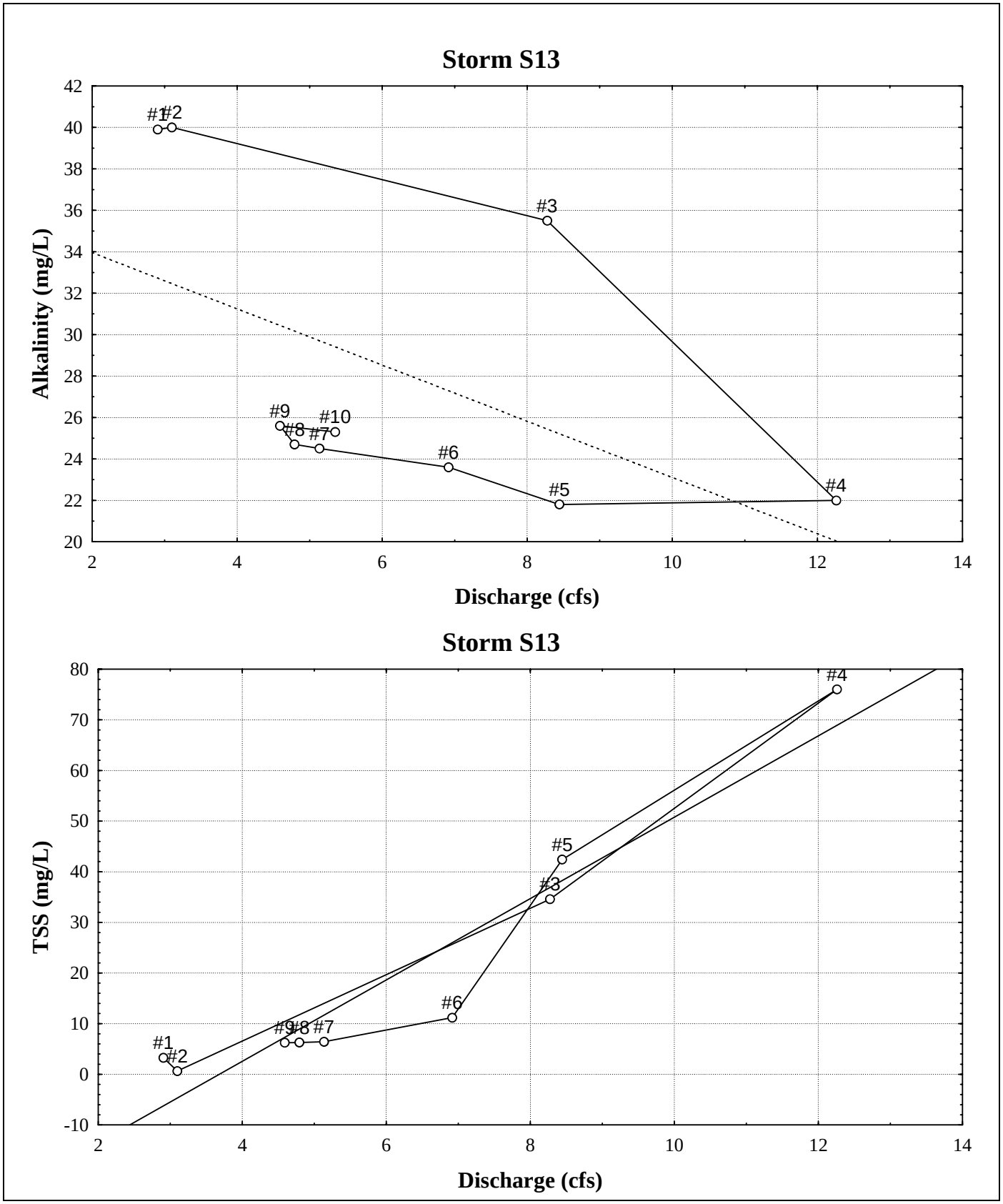

Figure C-21. Alkalinity and TSS hysteresis for autosampler sequential samples collected from Newaukum tributary below Weyerhauser (S322) during storm event S13. Dashed line indicates best fit linear regression; numbers indicate temporal sequence of sampling.

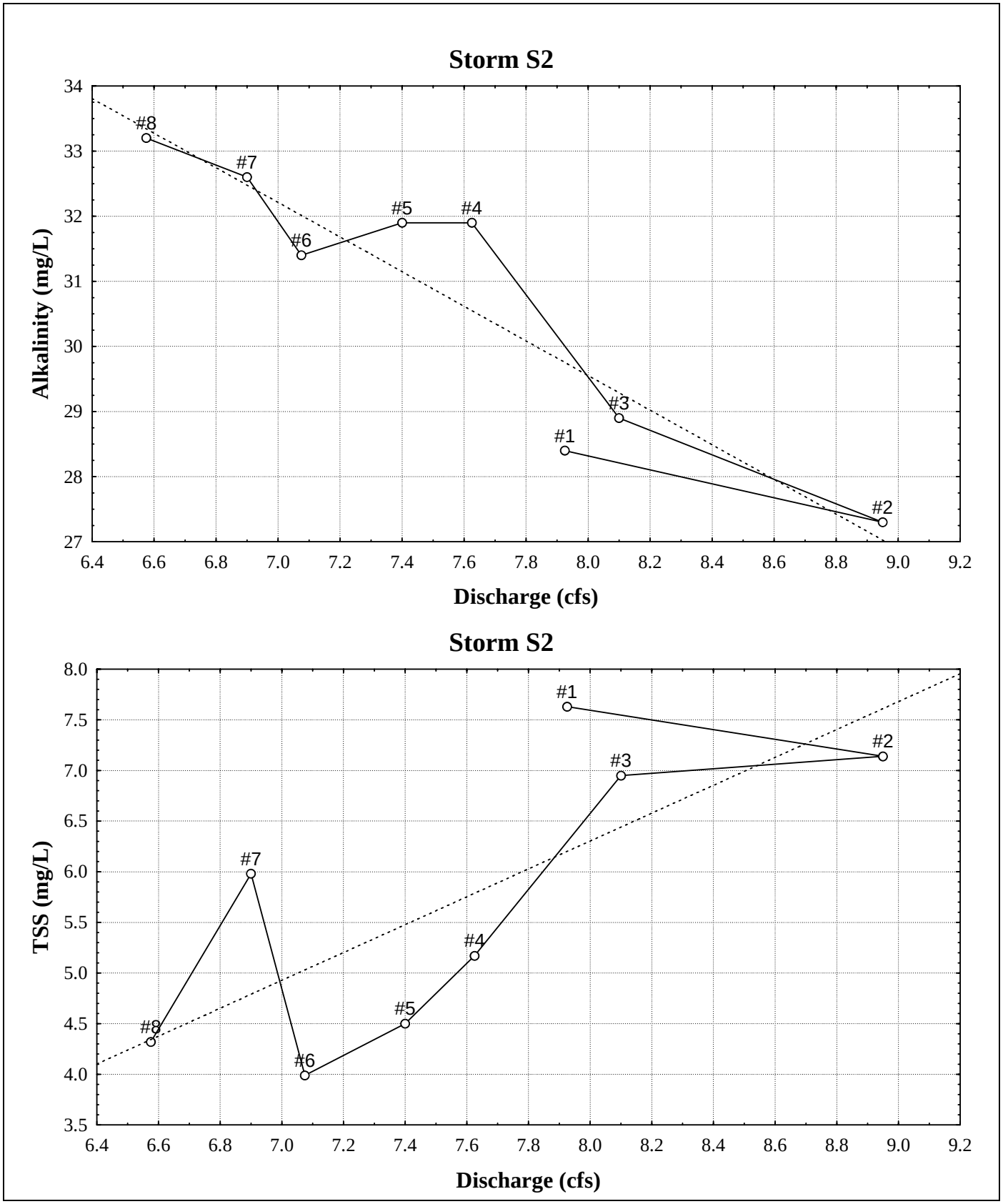

Figure C-22. Alkalinity and TSS hysteresis for autosampler sequential samples collected from Soosette Creek (Y320) during storm event S2. Dashed line indicates best fit linear regression; numbers indicate temporal sequence of sampling.

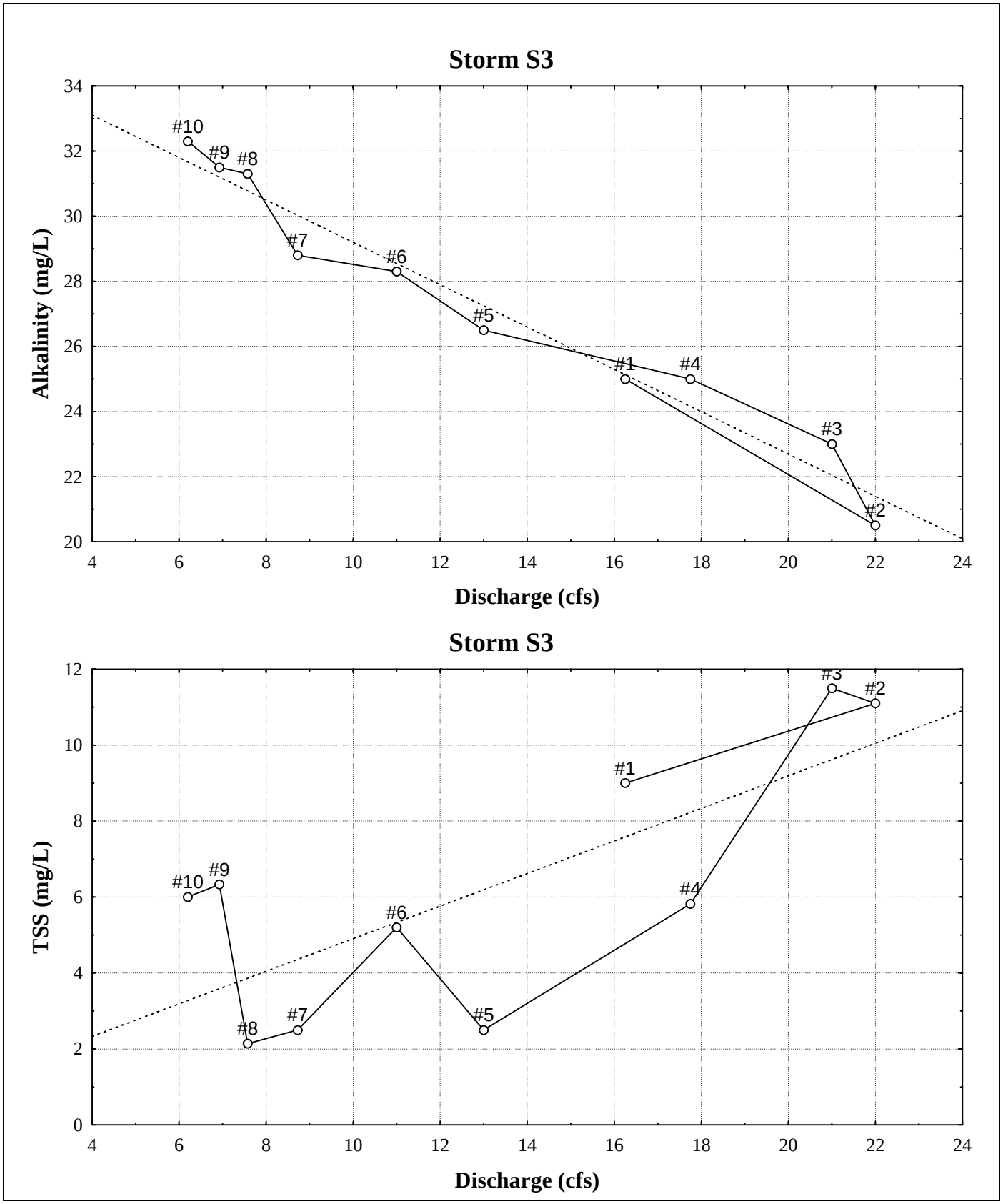

Figure C-23. Alkalinity and TSS hysteresis for autosampler sequential samples collected from Soosette Creek (Y320) during storm event S3. Dashed line indicates best fit linear regression; numbers indicate temporal sequence of sampling.

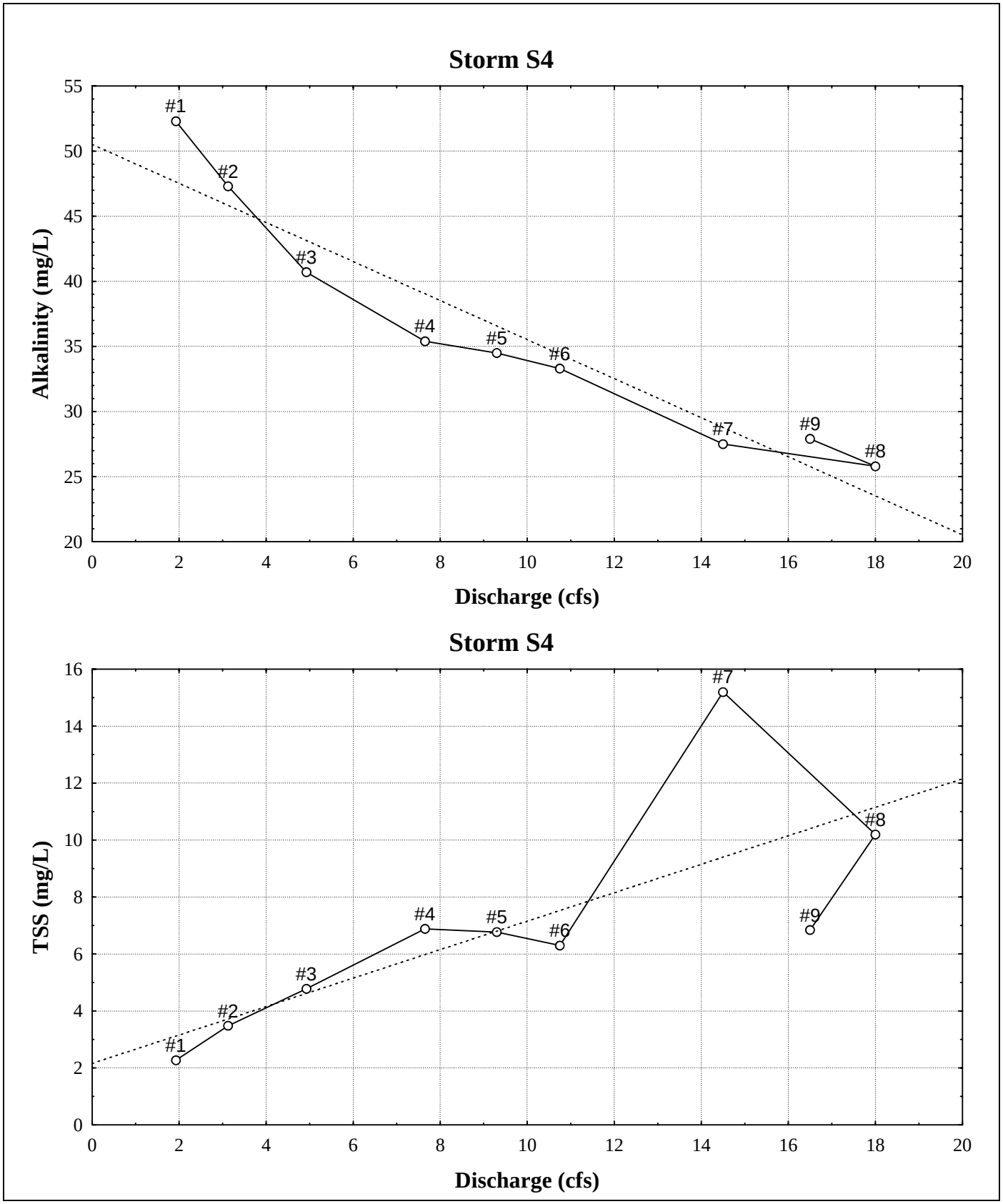

Figure C-24. Alkalinity and TSS hysteresis for autosampler sequential samples collected from Soosette Creek (Y320) during storm event S4. Dashed line indicates best fit linear regression; numbers indicate temporal sequence of sampling.

APPENDIX D

Water Quality Constituent Correlation Tables, Green-Duwamish Watershed, 2001 through 2003

Table D1. Number and percentage of sites with significant positive (and negative) correlations[a] ($\alpha < 0.05$) between constituents.

	DO	pH	SpC	Alk.	TSS	Turb.	Hard.	FC	*E. Coli*	NH_4	NO_3 +NO_2	PO_4	TP	D Cu	T Cu	D Hg	T Hg	D Zn	T Zn	D Fe	T Fe
DO	—	0 (6)	0 **(50)**	0 (18)	9 (0)	0 (18)	6 (22)	0 (36)	0 (36)	0 (10)	0 (9)	0 (27)	0 (27)	0 (0)	0 (0)	11 (0)	11 (0)	6 (6)	6 (0)	6 (6)	11 (0)
pH	0 (1)	—	28 (6)	27 (0)	0 (0)	0 (18)	39 (0)	0 (0)	0 (0)	10 (40)	0 (18)	9 (27)	0 (27)	0 (22)	0 (33)	0 **(50)**	0 (44)	6 (44)	0 (39)	0 (29)	0 (22)
SpC	0 **(9)**	5 (1)	—	**64** (36)	0 **(64)**	0 **(55)**	**89** (0)	9 (9)	9 (18)	30 (30)	18 (18)	18 (27)	9 (27)	0 **(61)**	0 **(67)**	0 **(72)**	0 **(83)**	0 (44)	0 **(61)**	6 (41)	0 (44)
Alk.	0 (2)	3 (0)	**6** (5)	—	0 **(89)**	0 **(83)**	**94** (0)	0 (39)	0 (33)	35 (35)	22 (33)	33 (39)	0 (39)	6 **(61)**	0 **(83)**	0 **(64)**	0 **(89)**	6 **(56)**	0 **(83)**	25 (31)	0 **(56)**
TSS	1 (0)	0 (0)	0 **(7)**	0 **(16)**	—	94 (22)	0 **(72)**	**67** (6)	**72** (6)	29 (18)	17 (22)	11 (17)	**67** (11)	39 (0)	**78** (6)	**50** (0)	**89** (0)	39 (6)	**72** (0)	31 (13)	**89** (0)
Turb.	0 (2)	0 (2)	0 **(6)**	0 **(15)**	**17** (4)	—	0 (67)	**50** (6)	**61** (6)	41 (6)	17 (11)	28 (22)	**78** (17)	44 (0)	**78** (0)	14 (0)	**94** (0)	33 (6)	83 (0)	44 (6)	**100** (0)
Hard.	1 (4)	7 (0)	**16** (0)	**17** (0)	0 **(13)**	0 **(12)**	—	0 (33)	0 (28)	29 (24)	33 (6)	22 (28)	0 (33)	11 **(61)**	0 **(78)**	0 **(78)**	0 **(72)**	11 **(56)**	6 **(72)**	18 (29)	0 **(50)**
FC	0 (4)	0 (0)	1 (1)	0 (7)	**12** (1)	**9** (1)	1 (5)	—	**94** (28)	18 (12)	6 (0)	39 (11)	**72** (6)	**50** (6)	**83** (0)	29 (0)	**56** (0)	33 (0)	**56** (0)	31 (0)	39 (6)
E. Coli	0 (4)	0 (0)	1 (2)	0 (6)	**13** (1)	**11** (1)	1 (4)	**16** (6)	—	12 (12)	11 (0)	33 (11)	**72** (6)	**61** (0)	**78** (0)	21 (0)	**61** (0)	33 (0)	**50** (0)	25 (6)	39 (6)
NH_4	0 (1)	1 (4)	3 (3)	6 (6)	5 (3)	7 (1)	5 (4)	3 (2)	2 (2)	—	12 (0)	41 (6)	29 (6)	24 (12)	29 (6)	0 (8)	29 (18)	24 (12)	29 (6)	**50** (0)	**53** (0)
NO_3+NO_2	0 (1)	0 (2)	2 (2)	4 (6)	3 (4)	3 (2)	6 (1)	1 (0)	2 (0)	2 (0)	—	28 (6)	11 (6)	17 (6)	17 (6)	0 (14)	11 (17)	17 (17)	17 (6)	38 (13)	22 (11)
PO_4	0 (3)	1 (3)	2 (3)	6 (7)	2 (3)	4 (5)	4 (5)	7 (2)	6 (2)	7 (1)	5 (1)	—	**61** (17)	33 (6)	28 (6)	14 (14)	28 (17)	39 (11)	28 (11)	25 (13)	17 (6)
TP	0 (3)	0 (3)	1 (3)	0 (7)	**12** (2)	**14** (3)	0 (6)	**13** (1)	**13** (1)	5 (1)	2 (1)	**11** (3)	—	**50** (6)	**72** (6)	36 (7)	**72** (0)	28 (0)	**72** (0)	31 (6)	**78** (0)
D Cu	0 (0)	0 (4)	0 **(11)**	1 **(11)**	7 (0)	8 (0)	2 **(11)**	**9** (1)	**10** (1)	4 (2)	3 (1)	6 (1)	**9** (1)	—	**100** (0)	**78** (0)	**83** (6)	**83** (0)	**83** (0)	41 (12)	39 (0)
T Cu	0 (0)	0 (6)	0 **(12)**	0 **(15)**	**14** (1)	**14** (0)	0 **(14)**	**15** (0)	**14** (0)	5 (1)	3 (1)	5 (1)	**13** (1)	**18** (0)	—	**89** (0)	**100** (0)	**67** (0)	**94** (0)	47 (18)	**72** (0)
D Hg	2 (0)	0 **(9)**	0 **(13)**	0 (9)	7 (0)	2 (0)	0 **(14)**	4 (0)	3 (0)	0 (1)	0 (2)	2 (2)	5 (1)	**14** (0)	**16** (0)	—	**100** (0)	**56** (0)	**83** (0)	41 (6)	**56** (0)
T Hg	2 (0)	0 (8)	0 **(15)**	0 **(16)**	**16** (0)	**17** (0)	0 **(13)**	**10** (0)	**11** (0)	5 (3)	2 (3)	5 (3)	**13** (0)	**15** (0)	**18** (0)	**18** (0)	—	**67** (0)	**100** (0)	41 (6)	**67** (0)
D Zn	1 (1)	1 (8)	0 (8)	1 **(10)**	7 (1)	6 (1)	2 **(10)**	6 (0)	6 (0)	4 (2)	3 (3)	7 (2)	5 (0)	**15** (0)	**12** (0)	**10** (0)	**12** (0)	—	**83** (0)	47 (12)	22 (6)
T Zn	1 (0)	0 (7)	0 **(11)**	0 **(15)**	**13** (0)	**15** (0)	1 **(13)**	**10** (0)	**9** (0)	5 (1)	3 (1)	5 (2)	**13** (0)	**15** (0)	**17** (0)	**15** (0)	**18** (0)	**15** (0)	—	41 (12)	**67** (0)
D Fe	1 (1)	0 (5)	1 (7)	4 (5)	5 (2)	7 (1)	3 (5)	5 (0)	4 (1)	**8** (0)	6 (2)	4 (2)	5 (1)	7 (2)	8 (3)	7 (1)	7 (1)	7 (3)	7 (2)	—	**65** (6)
T Fe	2 (0)	0 (4)	0 **(8)**	0 **(10)**	**16** (0)	**18** (0)	0 **(9)**	7 (1)	7 (1)	**9** (0)	4 (2)	3 (1)	**14** (0)	7 (0)	**13** (0)	**10** (0)	**12** (0)	4 (1)	**12** (0)	**11** (1)	—

Percentage

Number (n=11 – 18, depending on constituent)

[a] Correlations determined by Kendall's Tau.
Values in parentheses indicate the number of significantly negative correlations.
Bold indicates significance at greater than 50% of the sites for which there were data.

Table D2. Kendall's Tau correlation matrix for constituents measured at forested sites.

	DO	pH	SpC	Alk	TSS	Turb	Hard	FC	EC	NH_4	NO_3 $+NO_2$	PO_4	TP	D Cu	T Cu	D Hg	T Hg	D Zn	T Zn	D Fe	T Fe
DO	—							-													
pH		—		+[a]																	
SpC			—	+	-	-	+									-	-				-
Alk		+	+	—	-	-	+														
TSS			-	-	—	+					+		+		+		+		+		+
Turb			-	-	+	—	-				+		+		+		+		+		+
Hard			+	+		-	—														-
FC	-							—	+												
EC	-							+	—												
NH_4										—											
NO_3 $+NO_2$					+	+					—								+		
PO_4												—									
TP					+	+							—		+		+				+
D Cu														—	+						
T Cu					+	+							+	+	—		+		+		+
D Hg			-													—	+				
T Hg			-		+	+							+		+	+	—		+		+
D Zn																		—			
T Zn					+	+					+				+	+	+		—	+	+
D Fe																			+	—	
T Fe			-		+	+	-						+		+	+	+		+		—

[a] If a correlation was significant ($\alpha \leq 0.05$) and $\tau \geq 0.5$, a relationship was assigned a +/- value.

Table D3. Kendall's Tau correlation matrix for constituents measured at agricultural sites.

	DO	pH	SpC	Alk	TSS	Turb	Hard	FC	EC	NH_4	NO_3 $+NO_2$	PO_4	TP	D Cu	T Cu	D Hg	T Hg	D Zn	T Zn	D Fe	T Fe
DO	—	+ [a]	-					-													
pH	+	—	-																		
SpC	-		—				+														
Alk				—			+														
TSS					—	+											+				
Turb					+	—								+	+		+	+	+		
Hard			+	+			—														
FC	-							—	+			+	+								
EC								+	—												
NH_4										—		+	+	+	+			+	+		
NO_3 +NO_2											—										
PO_4								+		+		—	+	+	+		+	+	+		
TP								+		+		+	—	+	+		+	+	+		
D Cu						+				+		+	+	—	+		+	+	+		
T Cu						+				+		+	+	+	—		+	+	+		
D Hg																—	+				
T Hg					+	+						+	+	+	+	+	—	+	+		
D Zn						+				+		+	+	+	+		+	—	+		
T Zn						+				+		+	+	+	+		+	+	—		
D Fe																				—	
T Fe																					—

[a] If a correlation was significant ($\alpha \leq 0.05$) and $\tau \geq 0.5$, a relationship was assigned a +/- value.

Table D4. Kendall's Tau correlation matrix for constituents measured at low/medium development sites.

	DO	pH	SpC	Alk	TSS	Turb	Hard	FC	EC	NH_4	NO_3 $+NO_2$	PO_4	TP	D Cu	T Cu	D Hg	T Hg	D Zn	T Zn	D Fe	T Fe
DO	—																				
pH		—																			
SpC			—	+[a]			+					+									
Alk			+	—			+														
TSS					—	+	-														+
Turb					+	—	-								+		+				+
Hard			+	+			—														
FC								—	+						+				+		
EC								+	—												
NH_4										—											
NO_3 $+NO_2$											—										
PO_4			+									—									
TP													—								
D Cu														—	+	+	+	+	+		
T Cu						+		+						+	—	+	+	+	+		
D Hg														+	+	—	+	+	+		
T Hg						+								+	+	+	—		+		+
D Zn														+	+			—	+		
T Zn								+						+	+	+	+	+	—		
D Fe																				—	
T Fe					+	+											+				—

[a] If a correlation was significant ($\alpha \leq 0.05$) and $\tau \geq 0.5$, a relationship was assigned a +/- value.

Table D5. Kendall's Tau correlation matrix for constituents measured at high development sites.

	DO	pH	SpC	Alk	TSS	Turb	Hard	FC	EC	NH_4	NO_3 $+NO_2$	PO_4	TP	D Cu	T Cu	D Hg	T Hg	D Zn	T Zn	D Fe	T Fe
DO	—																				
pH		—																			
SpC			—	+[a]			+									-	-				
Alk			+	—			+														
TSS					—	+									+		+		+		+
Turb					+	—											+				+
Hard			+	+			—														
FC								—	+				+								
EC								+	—				+								
NH_4										—										+	+
NO_3 +NO_2											—										
PO_4												—									
TP								+	+				—								+
D Cu														—	+			+	+		
T Cu					+									+	—		+	+	+		
D Hg			-													—					
T Hg			-		+	+									+		—				
D Zn														+	+			—	+		
T Zn					+									+	+			+	—		
D Fe										+										—	+
T Fe					+	+				+			+							+	—

[a] If a correlation was significant ($\alpha \leq 0.05$) and $\tau \geq 0.5$, a relationship was assigned a +/- value.