

Water Quality Monitoring in the Great Smoky Mountains National Park

Outline of results from July 1991 to August 1997

**Prepared for the National Park Service, Great Smoky Mountains
National Park**

November, 1997

By:

**The Southern Appalachian Field Laboratory
Unit at the University of Tennessee, Knoxville**

**A Section of the Biological Resources Division
of the United States Geological Survey**

Terry Flum

**Joint Institute for Energy and Environment and
Department of Forestry
University of Tennessee**

John Shubzda

**Department of Forestry and
Department of Ecology and Evolutionary Biology
University of Tennessee**

Heather Rhodes

**Department of Forestry
University of Tennessee**

determine which sites may be providing redundant data. This information is provided along with an evaluation of elevational gradients in pH that allow anyone to see how the current sampling scheme allows patterns to be evaluated. The effect of eliminating particular sites on the ability to detect patterns can thus be evaluated. The analysis of correlation among variables clearly indicates that the variables being measured do not provide redundant information except to indicate the impact of limestone weathering in some streams of the west water quality district, particularly for Abrams Creek. The tools needed to evaluate and modify the stream survey in the future are presented in this report.

Table of Contents

Section	Page
Introduction	
Review of March 1997 Report.....	1
Continuation and Expansion of Monitoring Work.....	2
Methods	4
Noland Divide Watershed.....	4
Stream Survey	5
Changes in Sites Collected.....	5
Analysis of Water Quality Changes Since the 1970s	11
Basic Summary Statistical Analyses.....	12
Evaluation of Elevational Gradients	12
Evaluation of Site Similarity and Variable Correlation.....	13
Results	14
Noland Divide Watershed.....	14
Atmospheric Deposition.....	14
Elevational Differences in Deposition	19
Streamwater Chemistry	22
Storm Events	30
Stream Survey	34
Analysis of Changes Since the 1970s	34
Summary Statistics for Individual Sampling Sites	40
Elevational Gradients in Individual Stream Systems.....	40
Evaluation of Site and Variable Similarity.....	69
Discussion	70
References	111
Appendices	113

List of Tables

Table	Page
Table 1. List of water quality districts and the basis for their definition (after Flum and Nodvin, 1995).	6
Table 2. List of sites where stream water quality samples are collected and analyzed quarterly.....	7
Table 3. The five year average throughfall and precipitation deposition of SO_4^{2-} , NO_3^- , and NH_4^+ , to the Noland Divide Watershed expressed as eq/ha/yr.	16
Table 4. The Noland Divide Watershed Stream Water Chemistry Summaries Collected from 7/91 to 7/97.....	28
Table 5. Five year hydrological readings from the SW and NE streamlets at Noland Divide Watershed.....	33
Table 6. Five year Hydrolab pH readings for the SW streamlet.	33
Table 7. Average pH for sites sampled during both the 1970's (S&L) and 1990's (UT) and the average difference that occurred during the period.	35
Table 8. Overall average change in pH for all sites surveyed in the 1970's and 1990's.....	39
Table 9. Correlation coefficients for the water quality variables between October 1993 and August 1997.	101

List of Figures

Figure	Page
Figure 1. Total inorganic nitrogen inputs to the Noland Divide Watershed.	15
Figure 2. Hydrologic inputs to the Noland Divide Watershed.	15
Figure 3. Sulfate fluxes entering the Noland Divide Watershed.	17
Figure 4. Volume weighted mean sulfate concentrations collected as throughfall and precipitation.	17
Figure 5. Volume weighted mean inorganic nitrogen concentrations collected as throughfall and precipitation.	18
Figure 6. Volume weighted mean concentration of hydrogen collected as throughfall and precipitation.	18
Figure 7. Precipitation and throughfall water volumes collected at the NDW.	20
Figure 8. Three year average anion fluxes entering the Noland Divide Watershed as throughfall.	20
Figure 9. Three year average cation fluxes entering the Noland Divide Watershed as throughfall.	21
Figure 10. Three year average anion fluxes entering the Noland Divide Watershed as throughfall.	21
Figure 11. Three year average cation fluxes entering the Noland Divide Watershed as precipitation.	23
Figure 12. Cloudwater volume estimates for the Noland Divide Watershed.	23
Figure 13. Stream nitrate concentrations draining the Noland Divide Watershed.	24
Figure 14. Five year monthly weighted mean nitrate concentrations draining the Noland Divide Watershed.	25
Figure 15. Stream pH values draining the Noland Divide Watershed.	26
Figure 16. Five year average monthly weighted mean sulfate concentrations draining the Noland Divide Watershed.	27
Figure 17. Stream acid neutralizing capacity draining the Noland Divide Watershed.	29

List of Figures (continued)

Figure	Page
Figure 18. Stream calcium concentrations draining the Noland Divide Watershed.....	30
Figure 19. Minor hydrological event at the Noland Divide Watershed.....	31
Figure 20. Major hydrological event at the Noland Divide Watershed.....	32
Figure 21. Major hydrological event for the Noland Divide Watershed showing the relationship between stream discharge and pH for the SW streamlet.....	34
Figure 22. Relationship between nitrate concentrations measured using a nitrate electrode and ion chromatography from the May 1997 survey.....	41
Figure 23. Relationship between nitrate concentration measured using a nitrate electrode and ion chromatography from the August 1997 survey.	42
Figure 24. Relationship between nitrate concentrations measured using a nitrate electrode and ion chromatography from the May and August 1997 surveys.	43
Figure 25. Changes in average stream pH with elevation during different seasons on the mainstem sites of Abrams Creek.	45
Figure 26. Change in average stream pH with elevation during different seasons on the tributary sites of Abrams Creek.	46
Figure 27. Change in average stream pH with elevation during different seasons on the mainstem sites of Parsons Branch and Hesse Creek.	48
Figure 28. Change in average stream pH with elevation during different seasons on the mainstem sites of Panther Creek.	49
Figure 29. Change in average stream pH with elevation during different seasons on the mainstem sites of East Prong Little River.	50
Figure 30. Change in average stream pH with elevation during different seasons on the tributary sites of the East Prong Little River.	52
Figure 31. Changes in average stream pH with elevation during different seasons on the mainstem of the Middle Prong Little River.....	54
Figure 32. Change in average stream pH with elevation during different seasons on the tributary sites of the Middle Prong Little River.....	55

List of Figures (continued)

Figure	Page
Figure 33. Change in average stream pH with elevation during different seasons on the mainstem sites of Twentymile Creek.	56
Figure 34. Change in average stream pH with elevation during different seasons on the tributary sites of Twentymile Creek.	57
Figure 35. Change in average stream pH with elevation during different seasons on the mainstem of Eagle Creek.	59
Figure 36. Change in average stream pH with elevation during different seasons on the tributaries of Eagle Creek.	60
Figure 37. Change in average stream pH with elevation during different seasons on the mainstem of Forney Creek.	61
Figure 38. Changes in average stream pH with elevation during different seasons on the tributary sites of Forney Creek.	62
Figure 39. Change in average stream pH with elevation during different seasons on the mainstem of Noland Creek.	64
Figure 40. Change in average stream pH with elevation during different seasons on the tributary streams of Noland Creek.	65
Figure 41. Change in average stream pH with elevation during different seasons on mainstem sites of Hazel Creek.	66
Figure 42. Change in average stream pH with elevation during different seasons on the tributary sites of Hazel Creek.	67
Figure 43. Change in average stream pH with elevation during different seasons on the mainstem of Deep Creek.	69
Figure 44. Change in average stream pH with elevation during different seasons on the mainstem of the Oconaluftee River.	70
Figure 45. Change in average stream pH with elevation during different seasons on the tributary streams to the Oconaluftee River.	71
Figure 46. Change in average stream pH with elevation during different seasons on the mainstem of Bradley Fork.	74

List of Figures (continued)

Figure	Page
Figure 47. Change in average stream pH with elevation during different seasons in the tributaries on Bradley Fork.....	75
Figure 48. Change in average stream pH with elevation during different seasons for mainstem sites on Big Creek.	76
Figure 49. Change in average stream pH with elevation during different seasons for the mainstem sites of Cataloochee Creek.	77
Figure 50. Changes in average stream pH with elevation during different seasons for tributary sites in Cataloochee Creek.....	78
Figure 51. Change in average stream pH with elevation during different seasons for tributaries in Big Creek.	79
Figure 52. Change in average stream pH with elevation during different seasons on the mainstem of Straight Fork.	80
Figure 53. Change in average stream pH with elevation during different seasons on the mainstem of Bunches Creek.	81
Figure 54. Impact of Anakeesta road fill material on average pH in Beech Flats Creek by season.	83
Figure 55. Change in average stream pH with elevation during different seasons for sites on the mainstem of the Middle Prong Little Pigeon River (upper sites on Ramsay Prong).	84
Figure 56. Change in average stream pH with elevation during different seasons for tributary sites on the Middle Prong Little Pigeon River (sites along Porters Creek).	85
Figure 57. Changes in average stream pH with elevation during different seasons for mainstem sites on Roaring Fork.	86
Figure 58. Change in average stream pH with elevation during different seasons for mainstem site on LeConte Creek.	87
Figure 59. Change in average stream pH with elevation during different seasons for tributary sites on LeConte Creek.	88

List of Figures (continued)

Figure	Page
Figure 60. Change in average stream pH with elevation during different seasons for mainstem sites on the West Prong Little Pigeon River (upper sites on Walker Camp Prong).	91
Figure 61. Change in average stream pH with elevation during different seasons for tributary sites on the Mt. LeConte side of the West Prong Little Pigeon River.	92
Figure 62. Change in average stream pH with elevation during different seasons for tributary sites on the Sugarlands Mountain side of the West Prong Little Pigeon River.	93
Figure 63. Change in average stream pH with elevation during different seasons on the mainstem of Raven Fork.	94
Figure 64. Change in average stream pH with elevation during different seasons on tributaries of Raven Fork.	95
Figure 65. Change in average stream pH with elevation during different seasons on the mainstem sites of Cosby Creek.	96
Figure 66. Change in average stream pH with elevation during different seasons for tributaries in Cosby Creek.	97
Figure 67. Changes in average stream pH with elevation during different seasons for sites on the mainstem of Indian Camp Creek.	98
Figure 68. Relationship between pH and Acid Neutralizing Capacity.	102
Figure 69. Relationship between sodium and pH.	103
Figure 70. Relationship between nitrate and pH.	104
Figure 71. Relationship between magnesium and Acid Neutralizing Capacity.	105
Figure 72. Relationship between calcium and Acid Neutralizing Capacity.	106
Figure 73. Relationship between conductance and ANC.	107
Figure 74. Relationship between magnesium and conductivity.	108
Figure 75. Relationship between calcium and conductivity.	109

List of Figures (continued)

Figure	Page
Figure 76. Relationship between magnesium and calcium.	110

List of Appendices

Appendix A: List of Stream Survey Sampling Sites	121
Table A. Water quality sampling sites for each stream system	121
Appendix B: Summary Statistics for Stream Survey Sites	135
Table B. Summary statistics by site for ammonium data.	135
Table C. Summary statistics by site for Acid Neutralizing Capacity (ANC) data.	146
Table D. Summary statistics by site for calcium data.	157
Table E. Summary statistics by site for chloride data.	167
Table F. Summary statistics by site for conductivity data.	179
Table G. Summary statistics by site for pH.	190
Table H. Summary statistics by site for sulfate.	201
Table I. Summary statistics by site for sodium.	210
Table J. Summary statistics by site for nitrate.	219
Table K. Summary statistics by site for potassium.	228
Table L. Summary statistics by site for magnesium.	237

Introduction

A little over 6 months has passed since our last report was completed in March 1997. There have been relatively few events of significance during the intervening period that have impacted greatly on water quality patterns in the Park or caused substantial changes at individual sites to occur. Nevertheless, this report is useful because it affords an opportunity not only to update the water quality monitoring database for the Great Smoky Mountains National Park (GRSM), but to continue the evaluation of the data that has been collected since the water quality monitoring program was initiated in 1991. A long enough time series has been collected at Noland Divide Watershed to begin to evaluate temporal patterns in some detail. The database from the park-wide stream survey is large and extensive in the number of sites and the number of variables evaluated. We will focus on temporal patterns at Noland Divide and relationships among sites and variables across the GRSM to provide not only an update to our previous report but to expand and further evaluate the significance of the monitoring effort for the Great Smoky Mountains and the National Park Service.

Review of March 1997 Report

The March 1997 report was an assessment of the basic patterns that the water quality monitoring program developed by the University of Tennessee was designed to evaluate. Input-output budgets for several important elements were developed from monitoring at the Noland Divide Watershed. The annual nitrogen budget was particularly interesting because it indicated that a high proportion of the nitrogen deposited on the watershed from the atmosphere was being exported via the stream. This is not the situation in most forested catchments where uptake by trees and other vegetation usually sequesters nitrogen in

terrestrial biomass and prevents it from reaching streams. The high levels of nitrogen deposited from the atmosphere onto the watershed are exported via the stream as negatively charged nitrate. In the form of nitrate, nitrogen leaching triggered by atmospheric deposition can contribute to the simultaneous leaching of positively hydrogen ions, or acid, which in turn contributes to the acidification of the stream.

The March 1997 report also addressed the two main issues that the stream survey was designed to assess; longitudinal or elevational gradients in stream water chemistry and spatial patterns across the entire GRSM landscape. The pattern of decreasing pH and increasing sensitivity to acidification with increasing elevation was described. This pattern occurs in all of the major streams in the GRSM but to different degrees of severity and for different underlying reasons. As a result, the spatial pattern of water chemistry across the Park is complex. The stream survey was designed to detect these spatial patterns and provide a means to produce maps from the survey results. The maps developed in the March 1997 report enable visualization of water chemistry patterns and permit adequate identification of potential problem areas where additional research efforts can be concentrated.

Continuation and Expansion of Monitoring Work

In this report we will expand and supplement the previous report by focusing on issues that were not fully addressed. For the Noland Divide Watershed the problems associated with episodic acidification will be addressed. Episodic acidification associated with storm events and seasonally influenced changes in stream flow is a potentially important factor influencing the survival of aquatic species, particularly at high elevations where pH is chronically low.

For the stream survey we begin to examine the long term trends in stream acidification at GRSM by comparing data collected in the 1990's with data collected in the late 1970's at the same locations. There is still many issues that must be addressed before the long term trends can be adequately addressed. The next goal is to examine the adequacy of the sites and variables being monitored by comparing the similarity of water quality among all sites sampled to date and analyzing the correlation among the variables measured. Assessing the similarity among sites will allow us to determine which sites are most redundant and therefore providing the least additional information for the effort required. An assessment of the elevational gradients for pH within each stream system is made to demonstrate how the current sampling scheme allows gradients is to be observed.

Evaluating correlation among variables provides information on redundancy of the variables that are currently measured. The analysis of variable correlation also permits an assessment of relationships among variables that can provide insights into the mechanisms that regulate water quality. Exploring the relationship among variables may provide valuable information on how water quality potentially impacts aquatic biota. The analyses provided in this report can therefore serve as an important foundation for future development and application of water quality data in the GRSM.

Methods

Noland Divide Watershed

The NDW is equipped with one atmospheric deposition monitoring station at 1740 m, one soil solution station, and one stream station. A second higher elevation monitoring station, at 1920 m was sampled from August 1993 to July 1996 and is no longer in use. The active atmospheric deposition monitoring station consists of two facilities, one in which wet-only precipitation is collected, and one where throughfall is collected. The soil solution station is located at the same site as the deposition monitoring station and consists of 12 lysimeters placed at three different depths, 4 below the Oi, 4 within the A horizon, and 4 within the Bw horizon. The stream monitoring station consists of two H-flumes (which measure discharge), one hydrolab (which records continuous measurements for pH, conductivity, and temperature), and one datalogger (a device which stores all the data). The datalogger records every 15 minutes and compiles daily totals throughout the week.

Collections are made on a weekly basis for the deposition and stream stations, and monthly for the soil station. Weekly stream discharge and deposition volume measurements are coupled with their corresponding chemistries to produce weekly flux or watershed nutrient budget data. All weekly flux measurements are summed by month and year to produce monthly and annual nutrient budgets for each water year. A water year is defined as all the collections made from August 1st to July 31st in any given year. Soil solution data are organized according to the monthly samples and pooled to yield yearly estimates.

Episodic acidification at Noland Divide Watershed was evaluated by using the daily total measurements of stream discharge. Daily maximum discharge and minimum pH

values were used to evaluate episodic changes in stream chemistry. Minor storm events were defined as 2 times base flow during a period while major storms are at least 7.5 times greater than base flow. Base flow was defined as the modal flow occurring during a particular season.

Stream Survey

The basic methods employed to collect and analyze water quality samples in the GRSM have not changed since the March 1997 report. The basic monitoring plan has been changed to reduce the number of samples collected. These changes are described below. The methods used to analyze site similarity and relationships among the variables are also described below.

Changes in Sites Collected

The stream survey has evolved considerably since its inception in October 1993. The survey was initially designed to sample about 140 sites across the GRSM on a monthly basis. More complete spatial coverage across the GRSM was achieved by increasing the number of sites to about 350 in biannual surveys conducted in March and October. The survey underwent a complete overhaul beginning August 1996 whereby the sampling was reduced to about 70 sites collected quarterly (a full survey including over 300 sites was conducted in October 1996 to complete 3 years of large biannual surveys). Surveys are now scheduled for March, May, August, and October of each year.

The sites selected for continued monitoring were chosen to provide the best representation of water quality conditions across the GRSM as understood in 1996. Sites were selected from stream systems thought to represent one of the five water quality districts that have been defined for the GRSM (Flum and Nodvin, 1995). Each water quality district

was composed of stream systems having similar patterns of water quality along the elevational gradient of the stream and similar mechanisms apparently controlling water chemistry (Table 1). Once a stream system or set of stream systems was selected for sampling, sites that provided coverage of the full elevational gradient of the stream were identified for continued sample collection (Table 2). Several other sites were added to the survey for special purposes such as monitoring old mine drainage or the effects of acidic road fill materials. The list of 70 sites is believed to adequately reflect the status of water quality in the GRSM.

Table 1. List of water quality districts and the basis for their definition (after Flum and Nodvin, 1995).

District	District Name	Stream System Locations	District Characteristics
1	West	Western part of Park	Streams have high conductivity due to limestone bedrock
2	West Central	Central part of Park	Catchments logged, mainly second growth, low nitrate at low elevations
3	East	Eastern part of Park	Similar to west central but elevational gradients not as great
4	Old East	Scattered about Park	Catchments mainly old-growth forests, high stream nitrate concentrations
5	Anakeesta	Mainly around Mt. LeConte	High stream sulfate concentrations due to bedrock source

Table 2. List of sites where stream water quality samples are collected and analyzed quarterly. Some samples are collected by two local chapters of Trout Unlimited (TU) and some are collected by the University of Tennessee (UT).

Sample ID	Site Description	Stream Name	District	Elevation	Collection Info
13	Little River at boundary	East Prong Little River	2	1100	TU Quarterly
14	Little River above Y	East Prong Little River	2	1140	TU Quarterly
34	Little River at Milsap Site	East Prong Little River	2	1990	TU Quarterly
209	Lost Creek (Little River)	East Prong Little River	2	2925	TU Quarterly
210	Little River above Fish Camp Prong	East Prong Little River	2	2740	TU Quarterly
213	Goshen Prong above Fish Camp Prong	East Prong Little River	2	3360	TU Quarterly
214	Silers Creek (Little River)	East Prong Little River	2	3400	TU Quarterly
215	Ashe Camp Prong (Little River)	East Prong Little River	2	3380	TU Quarterly
474	Little River below bridge over Husky Branch	East Prong Little River	2	2440	TU Quarterly
475	Fish Camp Prong at angled barrier below War Branch	East Prong Little River	2	2960	TU Quarterly
43	Porters Creek at log bridge	Middle Prong Little Pigeon R.	2	2080	TU Quarterly
45	Shutts Prong	Middle Prong Little Pigeon R.	2	3200	TU Quarterly
46	Porters Creek above Shutts Prong	Middle Prong Little Pigeon R.	2	2750	TU Quarterly
47	Lower Cannon Creek	Middle Prong Little Pigeon R.	2	2400	TU Quarterly
49	Porters Creek at bridge to Ramsay	Middle Prong Little Pigeon R.	2	1650	TU Quarterly
50	Mid Pr Little Pigeon below Porters	Middle Prong Little Pigeon R.	2	1600	TU Quarterly
52	Mid Pr Little Pigeon at boundary	Middle Prong Little Pigeon R.	2	1350	TU Quarterly
23	Lower Middle Prong Little R.	Middle Prong Little River	2	1150	TU Quarterly
190	Thunderhead Prong at trail crossing	Middle Prong Little River	2	2160	TU Quarterly
191	Sams Creek (Middle Pr Little River)	Middle Prong Little River	2	3240	TU Quarterly

Table 2 (continued). List of sites where stream water quality samples are collected and analyzed quarterly.

Sample ID	Site Description	Stream Name	District	Elevation	Collection Info
192	Starkey Creek (Mid Pr Little River)	Middle Prong Little River	2	3200	TU Quarterly
193	Mid Pr Little River at old trailhead	Middle Prong Little River	2	1960	TU Quarterly
194	Mid Pr Little River above Tremont	Middle Prong Little River	2	1700	TU Quarterly
472	Sams Creek above Thunderhead Prong	Middle Prong Little River	2	2160	TU Quarterly
30	W Pr Little Pigeon at headquarters	West Prong Little Pigeon R.	5	1430	TU Quarterly
66	W Pr Little Pigeon at Chimneys Pic.	West Prong Little Pigeon R.	5	2680	TU Quarterly
71	Road Prong at third bridge on trail	West Prong Little Pigeon R.	5	3480	TU Quarterly
73	Walker Camp Prong above Road Prong	West Prong Little Pigeon R.	5	3360	TU Quarterly
74	Walker Camp Prong above Alum Cave Cr	West Prong Little Pigeon R.	5	3820	TU Quarterly
233	Walker Camp Prong above bridge above Alum Cave	West Prong Little Pigeon R.	5	4240	TU Quarterly
237	Walker Camp Pr at last bridge	West Prong Little Pigeon R.	5	4510	TU Quarterly
24	Lower West Prong Little R.	West Prong Little River	5	1150	TU Quarterly
473	West Prong Little Pigeon above Bearpen Br.	West Prong Little River	5	3660	TU Quarterly
156	Abrams Creek at Ranger Station	Abrams Creek	1	1110	UT Quarterly
173	Mill Creek above Abrams Creek	Abrams Creek	1	1705	UT Quarterly
174	Abrams Creek below Cades Cove	Abrams Creek	1	1705	UT Quarterly
183	Spring at Russell Field Shelter	Abrams Creek	1	4270	UT Quarterly
184	Left Fork Anthony Creek at camp 10	Abrams Creek	1	2830	UT Quarterly
186	Anthony Creek above Picnic area	Abrams Creek	1	1965	UT Quarterly
200	Anthony Creek above campsite 9	Abrams Creek	1	3720	UT Quarterly
201	Anthony Creek below Spence Field	Abrams Creek	1	4800	UT Quarterly

Table 2 (continued). List of sites where stream water quality samples are collected and analyzed quarterly.

Sample ID	Site Description	Stream Name	District	Elevation	Collection Info
488	Mill Creek at Pumphouse on Forge Cr Road	Abrams Creek	1	1750	UT Quarterly
489	Abrams Creek 300 m below trailhead bridge	Abrams Creek	1	1700	UT Quarterly
291	Bunches Creek above Balsam Mtn road	Bunches Creek	3	5320	UT Quarterly
336	Flat Creek above falls (Bunches Cr)	Bunches Creek	3	4680	UT Quarterly
337	Bunches Creek at Flat Creek Trail	Bunches Creek	3	4740	UT Quarterly
127	Pretty Hollow Cr above Palmer Cr	Cataloochee Creek	3	2860	UT Quarterly
142	Beech Creek above Lost Bottom Creek	Cataloochee Creek	3	2900	UT Quarterly
143	Lost Bottom Creek (Cataloochee Creek)	Cataloochee Creek	3	3100	UT Quarterly
144	Palmer Creek above Pretty Hollow Cr	Cataloochee Creek	3	2860	UT Quarterly
147	Lower Cataloochee Creek	Cataloochee Creek	3	2460	UT Quarterly
148	Lower Little Cataloochee Creek	Cataloochee Creek	3	2475	UT Quarterly
149	Mid Cataloochee Creek at bridge	Cataloochee Creek	3	2550	UT Quarterly
150	Cataloochee Creek below Caldwell Fork	Cataloochee Creek	3	2620	UT Quarterly
290	Bear Branch at campsite 42 (Cataloo)	Cataloochee Creek	3	5500	UT Quarterly
293	Rough Fork at Caldwell House	Cataloochee Creek	3	2730	UT Quarterly
493	Palmer Creek at Davidson Branch Trail	Cataloochee Creek	3	2790	UT Quarterly
3	Cosby Creek at boundary	Cosby Creek	4	1675	UT Quarterly
4	Lower Rock Creek	Cosby Creek	4	1680	UT Quarterly
114	Cosby Creek at log bridge	Cosby Creek	4	2510	UT Quarterly
115	Upper Cosby Creek	Cosby Creek	4	3840	UT Quarterly
137	Upper Rock Creek (Cosby Creek)	Cosby Creek	4	2750	UT Quarterly
138	Inadu Creek (Cosby Creek)	Cosby Creek	4	3240	UT Quarterly
492	Camel Hump Creek off Low Gap Trail	Cosby Creek	4	2750	UT Quarterly

Table 2 (continued). List of sites where stream water quality samples are collected and analyzed quarterly.

Sample ID	Site Description	Stream Name	District	Elevation	Collection Info
195	Spring at Spence Field Shelter	Eagle Creek	2	4500	UT Quarterly
20	Little River at Metcalf Bot.	East Prong Little River	2	1700	UT Quarterly
218	Spring at Silers Bald Shelter	East Prong Little River	2	5440	UT Quarterly
220	Double Springs Gap Shelter (TN side)	East Prong Little River	2	5500	UT Quarterly
219	Double Springs Gap Shelter (NC side)	Forney Creek	2	5510	UT Quarterly
221	Hazel Creek above cascades	Hazel Creek	2	4000	UT Quarterly
310	Bone Valley Creek (Hazel Creek)	Hazel Creek	2	2280	UT Quarterly
311	Hazel Creek below Haw Gap Creek	Hazel Creek	2	2190	UT Quarterly
479	Hazel Creek at campsite 86	Hazel Creek	2	1750	UT Quarterly
480	Haw Gap Creek at bridge near campsite 84	Hazel Creek	2	2200	UT Quarterly
481	Little Fork above Sugar Fork Trail	Hazel Creek	2	2800	UT Quarterly
482	Sugar Fork above Little Fork	Hazel Creek	2	2750	UT Quarterly
483	Sugar Fork above Haw Gap Creek	Hazel Creek	2	2400	UT Quarterly
484	Hazel Creek at Cold Spring Gap Trail	Hazel Creek	2	2400	UT Quarterly
485	Walker Creek above Hazel Creek Trail	Hazel Creek	2	2600	UT Quarterly
1	Indian Camp at Old Settlers	Indian Camp Creek	4	2200	UT Quarterly
103	Otter Creek (Indian Camp Prong)	Indian Camp Creek	4	4300	UT Quarterly
104	Copperhead Branch (Indian Camp Pr)	Indian Camp Creek	4	4160	UT Quarterly
106	Upper Indian Camp Prong	Indian Camp Creek	4	3840	UT Quarterly
107	Indian Camp below Albright Grove	Indian Camp Creek	4	3040	UT Quarterly
244	NE stream at Noland Divide Watershed	Noland Creek	2	5150	UT Quarterly

Table 2 (continued). List of sites where stream water quality samples are collected and analyzed quarterly.

Sample ID	Site Description	Stream Name	District	Elevation	Collection Info
251	Beech Flats above US 441 loop	Oconaluftee River	5	4010	UT Quarterly
252	Beech Flats below roadcut	Oconaluftee River	5	4760	UT Quarterly
253	Beech Flats above roadcut	Oconaluftee River	5	4840	UT Quarterly
266	Oconaluftee River at Visitors Center	Oconaluftee River	2	2020	UT Quarterly
268	Oconaluftee River below Smokemont	Oconaluftee River	2	2170	UT Quarterly
234	Upper Road Prong	West Prong Little Pigeon R.	4	5000	UT Quarterly

Analysis of Water Quality Changes Since the 1970s

The analysis of water quality change over time was contemplated during the initial design phase of the stream survey. Sample sites were selected to correspond with sites where water quality samples had been collected in previous surveys so comparisons could be made. The main study used in the development of the current stream survey was conducted during the late 1970's by Silsbee and Larson (1982, 1983). Due to the evolution of analytical methods since the 1970's there are only two measures we can realistically expect to compare, pH and nitrate.

The Silsbee and Larson studies utilized an ion selective electrode to measure nitrate concentrations while we employ ion chromatography. The first step required to compare the two surveys was to determine how the results from the two analytical methods are related. This was accomplished by using an [Orion] ion selective electrode and meter similar to the models used by Silsbee and Larson to measure nitrate concentration and the results obtained with the electrode to the results obtained by ion chromatography. We used a simple linear regression approach to evaluate the relationship between the two methods. A satisfactory

regression equation could be applied to the results obtained by Silsbee and Larson to produce nitrate concentrations comparable to what we currently obtain by ion chromatography. The differences between results obtained in the 1970 could then be compared to results from the 1990s to determine whether changes have occurred by calculating simple differences. The approach was the same for the pH data through no correction of the raw data was attempted for this analysis.

Basic Summary Statistical Analyses

Basic statistics were compiled for all sample sites and variables measured during the stream survey. Minimum, average, maximum, standard deviation, and total number of samples collected were calculated for each site and for each variable analyzed. These values were used to assess data quality and to establish baseline values for each site for future reference.

Evaluation of Elevational Gradients

The elevational gradient in stream pH was evaluated for each sampled stream system in the GRSM. Plots of pH versus elevation were prepared such that data from sites on the mainstem of each stream were separate of the tributary sites. Averages were calculated and displayed for each season where data was available. Seasons were defined as: 1) winter = December, January, and February, 2) spring = March, April, and May, 3) summer = June, July, August, and September, and 4) fall = October and November.

Evaluation of Site Similarity and Variable Correlation

The similarity of individual sites relative to water quality was evaluated by using a modification of a common ecological similarity metric called SIMI (Standler, 1970). SIMI is typically used to compare similarity of different assemblages of species by comparing the

abundance or biomass of each species in each assemblage. The resulting SIMI score for each pair of assemblages ranges from 0 to 1 where 0 means no species overlap among the sites and 1 means all species have the same abundance or biomass or whatever measure is used.

SIMI is calculated as:

$$SIMI_{jl} = SIM / \text{SQRT} (\text{Lambda}_j + \text{Lambda}_l)$$

where SIM is:

$$SIM = \sum p_{ij} + p_{il}$$

$$\text{Lambda} = \sum p_{ij}^2$$

and p is the proportion of individuals of species i in sample j or l . SIMI was applied to water quality data by calculating the proportion of ions of each chemical species as a function of total ionic strength (TIS). The TIS value used to calculate the proportion of ions in each sample was the maximum TIS from all samples with conductivity less than 125 $\mu\text{S}/\text{cm}$. Using a maximum TIS value made permitted differences for samples with similar proportion of each ion but different total amount of each ion to be detected. Setting a conductivity limit permitted the exclusion of data from Abrams Creek which tended to compress the overall scale and limit the ability to differentiate samples for the entire data set.

The similarity of information provided by each variable measured was determined by calculating the correlation for each pair of variables over the entire data set. Variable pairs with correlation coefficients greater than 0.30 were further analyzed by preparing bivariate plots for evaluation of relationships that might exist among the variables. Various curve fitting methods were applied to assess the relationship between variables.

Results

Noland Divide Watershed

Atmospheric Deposition

For the past 6 years the amount of inorganic nitrogen entering the NDW as throughfall (TF) averaged 1100 Eq N/ha/yr (15.5 kg N/ha/yr) and has been slightly increasing since the beginning of the study (Figure 1). This increase in nitrogen flux can be attributed to the extremely high amounts of rainfall during both the 93-94 and 95-96 water years (Figure 2). The average rainfall amount collected as TF during the study period was 258 cm (Table 3), 43 cm higher than the 3 year average reported during the IFS. The five year average nitrogen deposition coming in as wet only precipitation was 511 Eq N/ha/yr (7.5 kg N/ha/yr) (Table 3). The different rates of deposition between TF and precipitation can be attributed to both dry and cloud deposition collecting on the vegetation surface. However, nitrogen (N) species are very reactive within the canopy structure so TF measurements of N are very poor indicators of the total deposition rates (Shubzda *et al.*, 1995). The IFS estimated that approximately 850 Eq N/ha/yr (12 kg N/ha/yr) of inorganic nitrogen is retained within the canopy (these numbers are based on the NCE, net-canopy exchange = throughfall - total deposition)(Johnson and Lindberg, 1992). By using the NCE measurements made during and IFS and combining the throughfall measurements made at the NDW for the past five years, we estimate that the NDW has been receiving approximately 1950 Eq N/ha/yr (27 N/ha/yr). The rates of nitrogen deposition to the NDW are some of the highest reported values measured throughout the country and in Europe (Shubzda et al., in prep.).

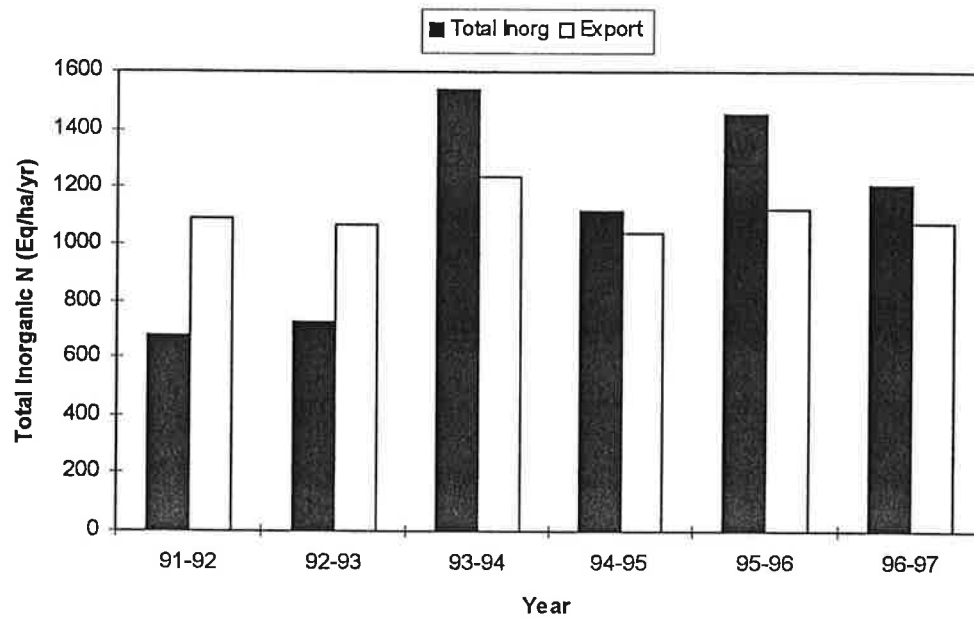


Figure 1. Total inorganic nitrogen inputs to the Noland Divide Watershed.

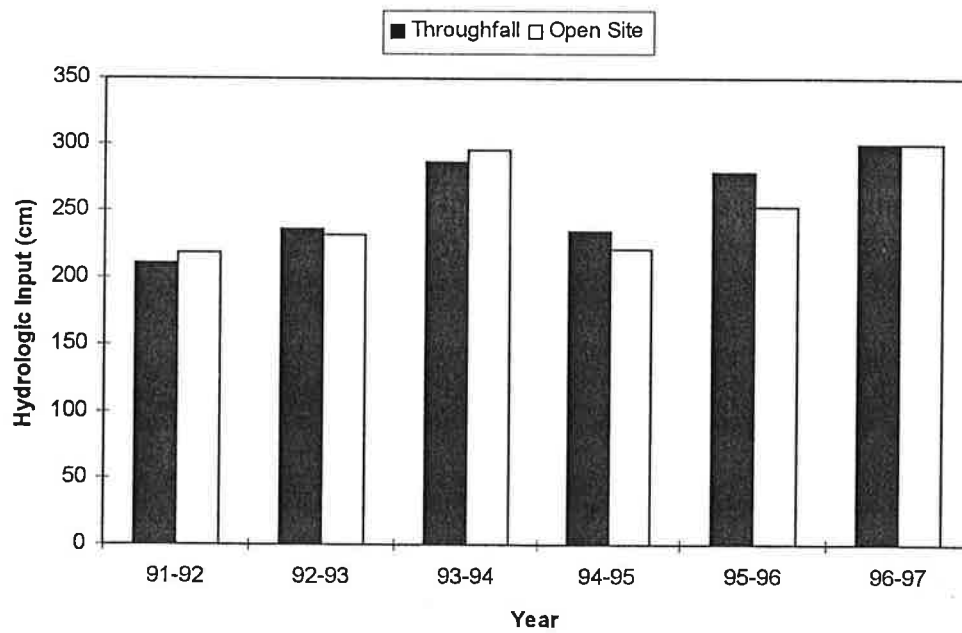


Figure 2. Hydrological inputs to the Noland Divide Watershed.

Table 3. The five year average throughfall and precipitation deposition of SO_4^{2-} , NO_3^- , and NH_4^+ , to the Noland Divide Watershed expressed as eq/ha/yr.

	Volume (cm)	pH	Sulfate	Nitrate	Ammonium
Precipitation	253	4.63	650	261	250
Throughfall	258	4.08	2100	911	209

Sulfate fluxes measured as TF during the study period are 2100 Eq/ha/yr (100 kg SO_4^{2-} /ha/yr) which is extremely high (Figure 3). The highest sulfate deposition levels measured during the IFS were collected at NDW (Johnson and Lindberg, 1992). The sulfate flux from wet precipitation was much smaller and averaged 650 Eq ha⁻¹ yr⁻¹ (30 kg SO_4^{2-} /ha/yr) (Table 3). The difference between precipitation inputs and TF inputs represents a very good estimate of the dry and cloudwater inputs to these systems (Shubzda *et al.*, 1995). Unlike nitrogen, sulfate flux represents a very good estimate of the total deposition rate entering a watershed, because foliar uptake and/or leaching is minimal (Garten *et al.*, 1988; Lindberg and Garten, 1988).

Although the depositional fluxes have remained relatively unchanged since the IFS, some of the weighted mean concentrations have shown somewhat of a decline. For example, the 3 year average weighted mean concentration for sulfate in throughfall was 115 µeq/L compared to the six year average of 82 µeq/L collected at Noland (Figure 4). In contrast, the volume weighted mean inorganic nitrogen concentration in deposition seems to have had no change over the past 10 years (Figure 5). However, the volume weighted mean hydrogen ion concentration also seems to have decreased since the measurements made during the IFS (Figure 6). The depositional fluxes haven't changed very much since the IFS because of the higher total precipitation volumes than during the IFS (Figure 7).

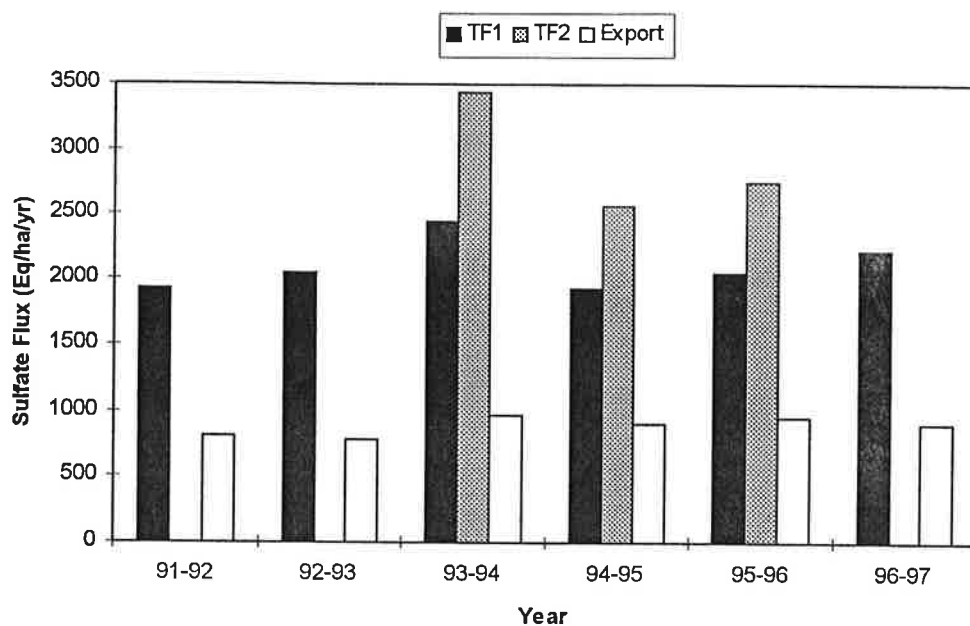


Figure 3. Sulfate fluxes entering the Noland Divide Watershed as throughfall.

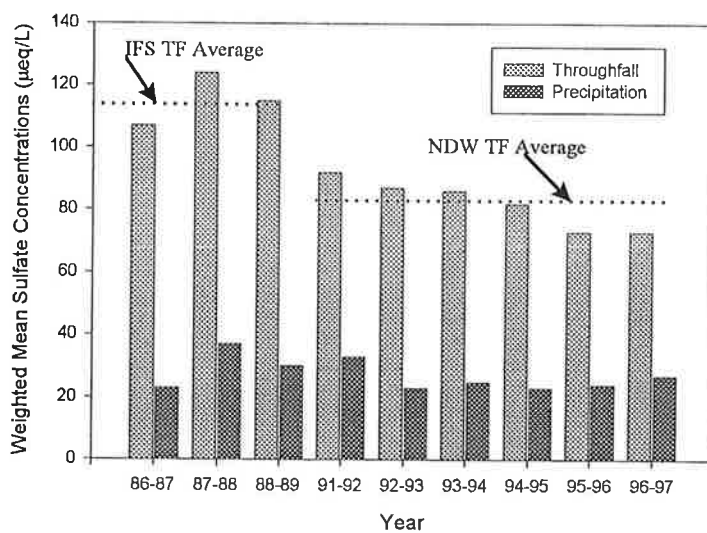


Figure 4. Volume weighted mean sulfate concentrations collected as throughfall and precipitation.

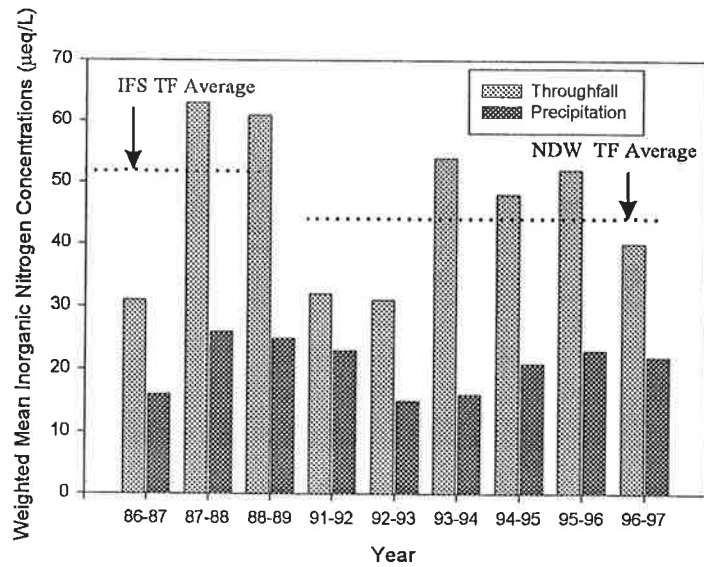


Figure 5. Volume weighted mean inorganic nitrogen concentrations collected as throughfall and precipitation.

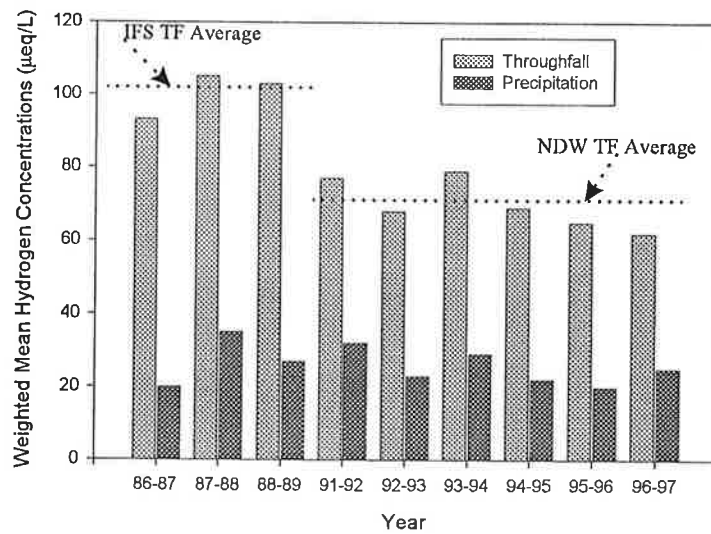


Figure 6. Volume weighted mean concentration of hydrogen collected as throughfall and precipitation.

Elevational Differences in Deposition

Elevational differences in the amount of acidic deposition entering the NDW varies considerably over small spatial scales within the watershed (Lindberg and Owens, 1993; Shubzda *et al.*, 1995). Generally, total deposition increases with increasing elevation (Lovett and Kinsman, 1990) because of higher cloud water deposition frequencies and higher wind speeds. So, in the summer of 1993, we established a second higher deposition monitoring station at 1920 m. The results indicate that sulfate deposition was ~37% higher at the upper site (2900 Eq/ha/yr, or 140 kg SO₄²⁻/ha/yr) but the inorganic N found in TF was lower at the upper site by ~34% (Figure 8). In fact, all the major ions in TF increased by 10-50% with increasing elevation, except the N species (Figure 8 & 9). There are two possible reasons for this inverse relationship with respect to N: (1) dry deposition of N is actually much higher at the lower site, and/or (2) the canopy uptake rates of N is much higher at the upper site. If anything, the dry deposition rates should increase with increasing elevation, due to higher wind speeds associated with the upper site's ridge-top location. Since there was no significant difference in the amount of anions or cations entering the NDW as precipitation (Figure 10 & 11), the higher deposition rates at the upper site must be attributed to increased cloud and/or dry deposition. Therefore, it appears that the foliar retention (NCE) is much higher at the upper site (Shubzda *et al.*, in prep). These findings further emphasize the fact that nitrogen found in TF is a poor indicator of the total deposition entering a watershed (Shubzda *et al.*, 1995).

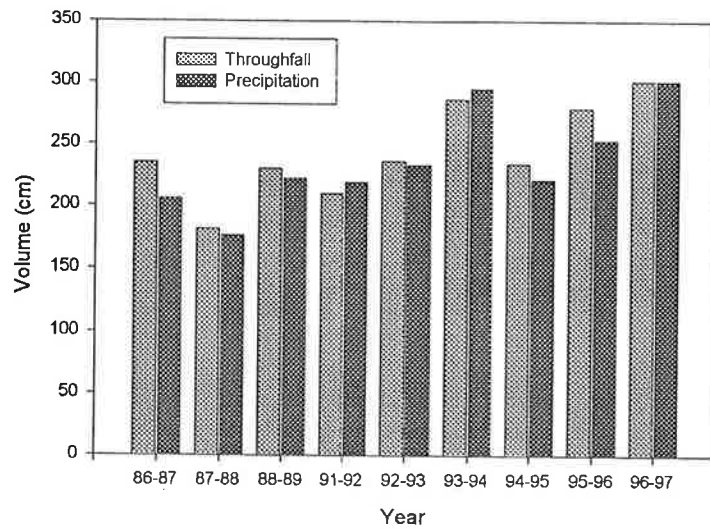


Figure 7. Precipitation and throughfall water volumes collected at the NDW.

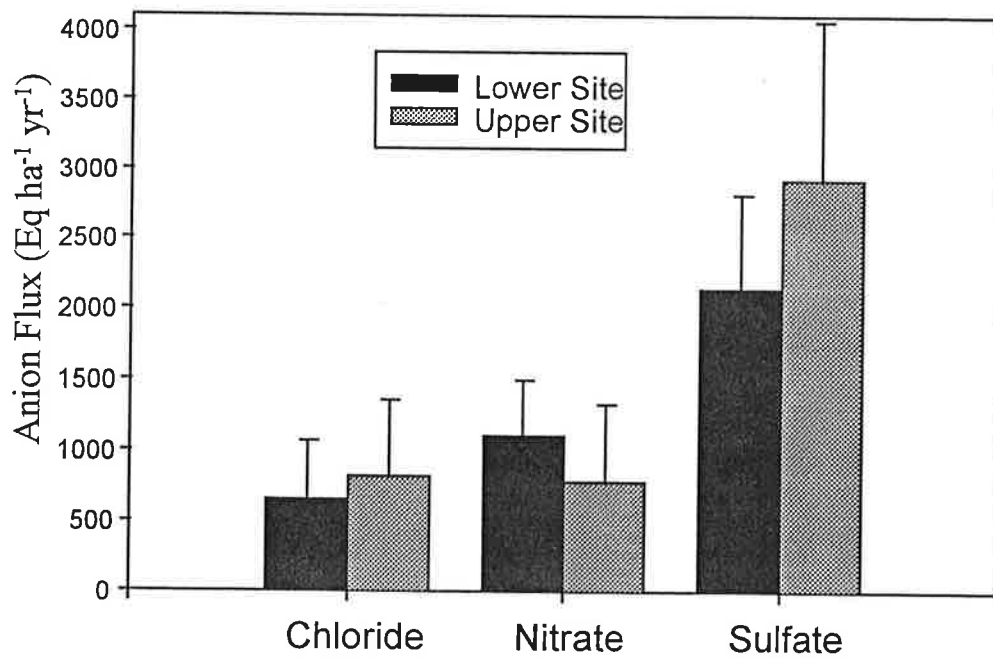


Figure 8. Three year average anion fluxes entering the Noland Divide Watershed as throughfall (Collections were made from 8-93 to 7-96). Error Bars are 95% CI of the mean (N=3).

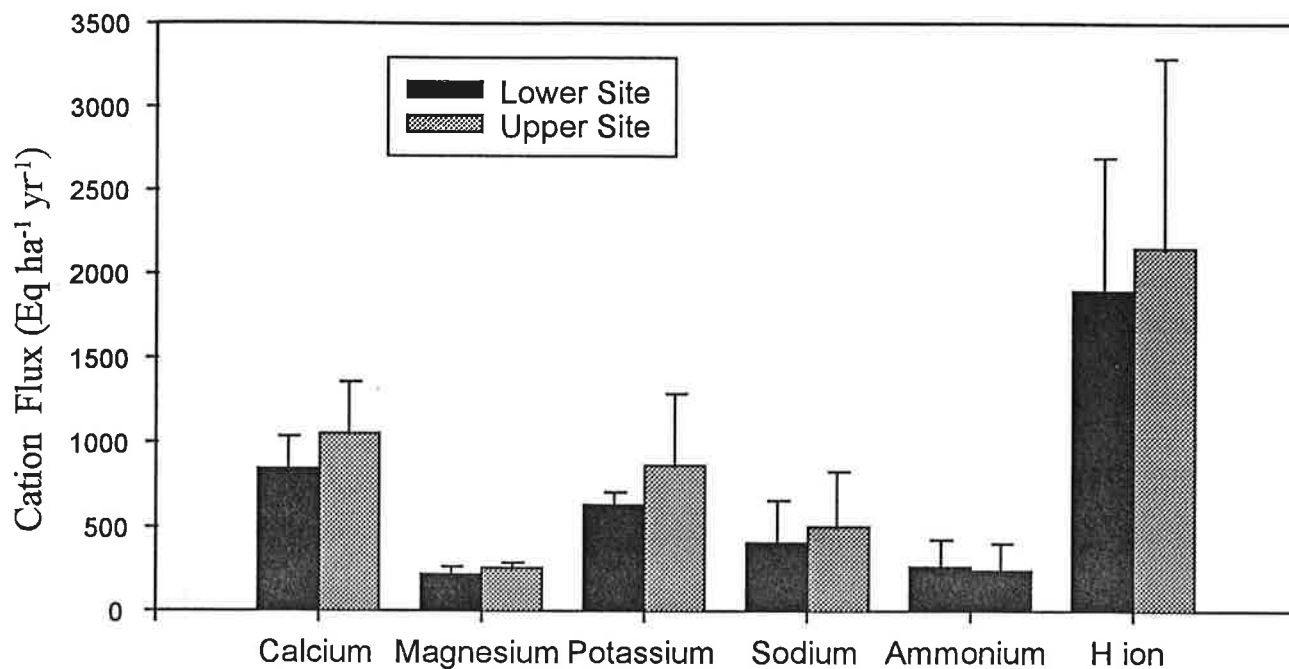


Figure 9. Three year average cation fluxes entering the Noland Divide Watershed as throughfall (Collections were made from 8-93 to 7-96). Error Bars are 95% CI of the mean (N=3).

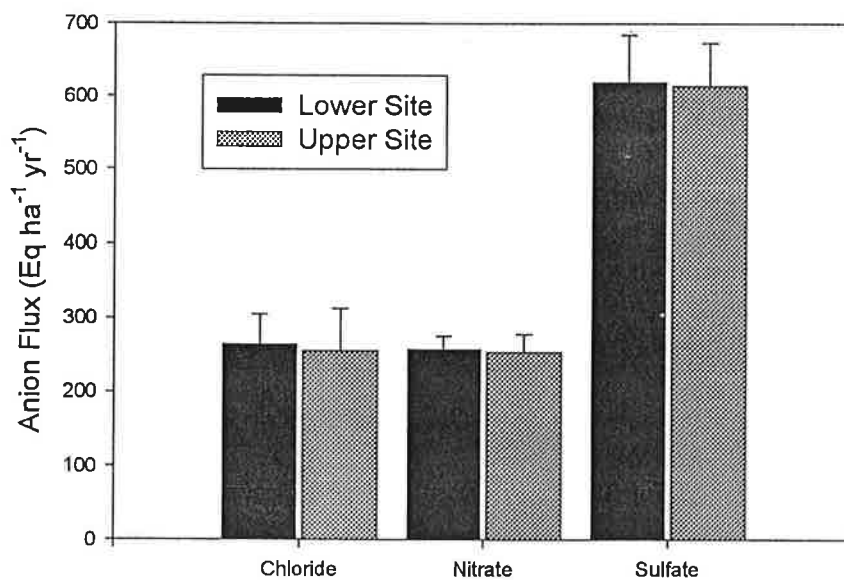


Figure 10. Three year average anion fluxes entering the Noland Divide Watershed as precipitation (Collections were made from 8-93 to 7-96). Error Bars are 95% CI of the mean (N=3).

Cloud or occult deposition is a very important process that occurs within this watershed and throughout the entire Park above cloudbase, which is ~1800 m (5500 ft.) in the GRSM (Lindberg and Owens, 1993). The exceedingly high sulfate deposition can be attributed to the high amounts of cloud water entering the watershed. Cloud water represents up to 50% or more of the total sulfate loading (Shubzda *et al.*, 1995). We estimate that the lower and upper sites annually receive ~40 and 70 cm of cloudwater, respectively (Figure 12). These estimates are based on previous work done during the IFS, for a complete description of these estimates refer to Lovett (1986).

Streamwater Chemistry

The predominant strong acid anion in the streams draining NDW during the study period was nitrate (Figure 13)(Nodvin *et al.*, 1995). The order in which anions dominate this system goes as follows:



Nitrate should not be the dominant anion in old growth forests, because biological uptake is generally balanced with inputs from internal and external sources (Likens *et al.*, 1977). Nitrate concentrations within the streams ranged from 40-80 $\mu\text{eq/L}$ (Figure 13) (Table 4) with very distinct seasonal patterns evident (Figure 14). Seasonality fluctuations in the concentrations NO_3^- are the primary force controlling stream pH values (Table 4 and Figure 15). Seasonal patterns for sulfate were not as distinct as those of nitrate (Figure 16). The sulfate levels generally range between 20-75 $\mu\text{eq/L}$ (Table 4) with the highest recorded values occurring during winter periods when flow is generally the highest. The sulfate levels are quite low given the rate of deposition and indicate considerable sulfate adsorption capacity of the watershed. Nevertheless, the concentrations of both nitrate and sulfate are

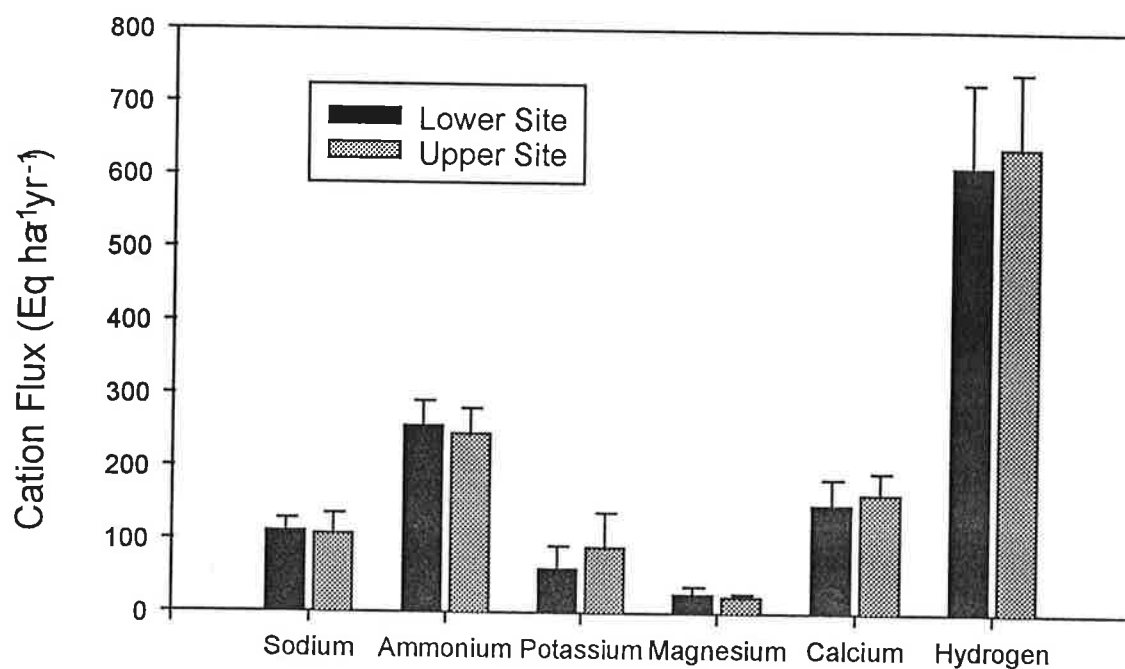


Figure 11. Three year average cation fluxes entering the Noland Divide Watershed as precipitation (Collections were made from 8-93 to 7-96). Error Bars are 95% CI of the mean (N=3).

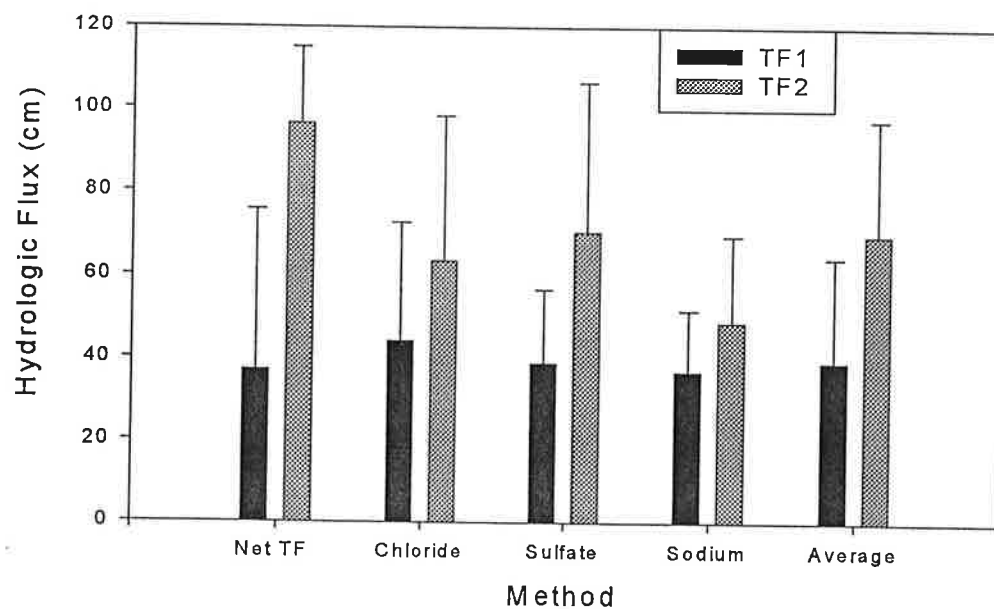
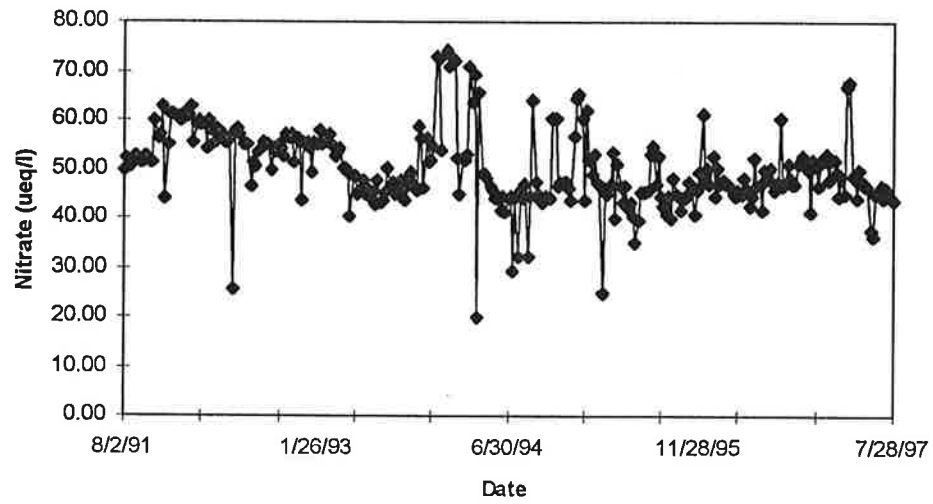


Figure 12. Cloudwater volume estimates for the Noland Divide Watershed (Collections were made from 8-93 to 7-96). Error Bars are 95% CI of the mean (N=3).

NE



SW

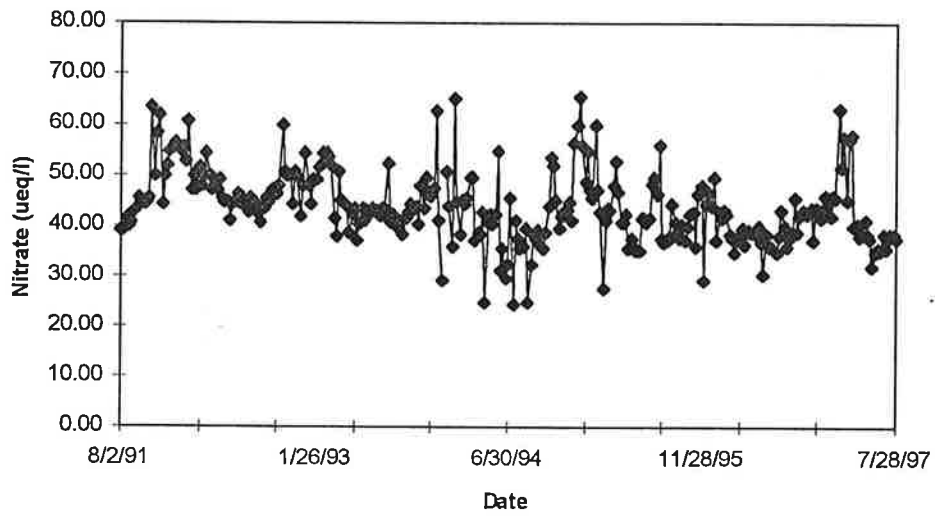


Figure 13. Stream nitrate concentrations draining the Noland Divide Watershed.

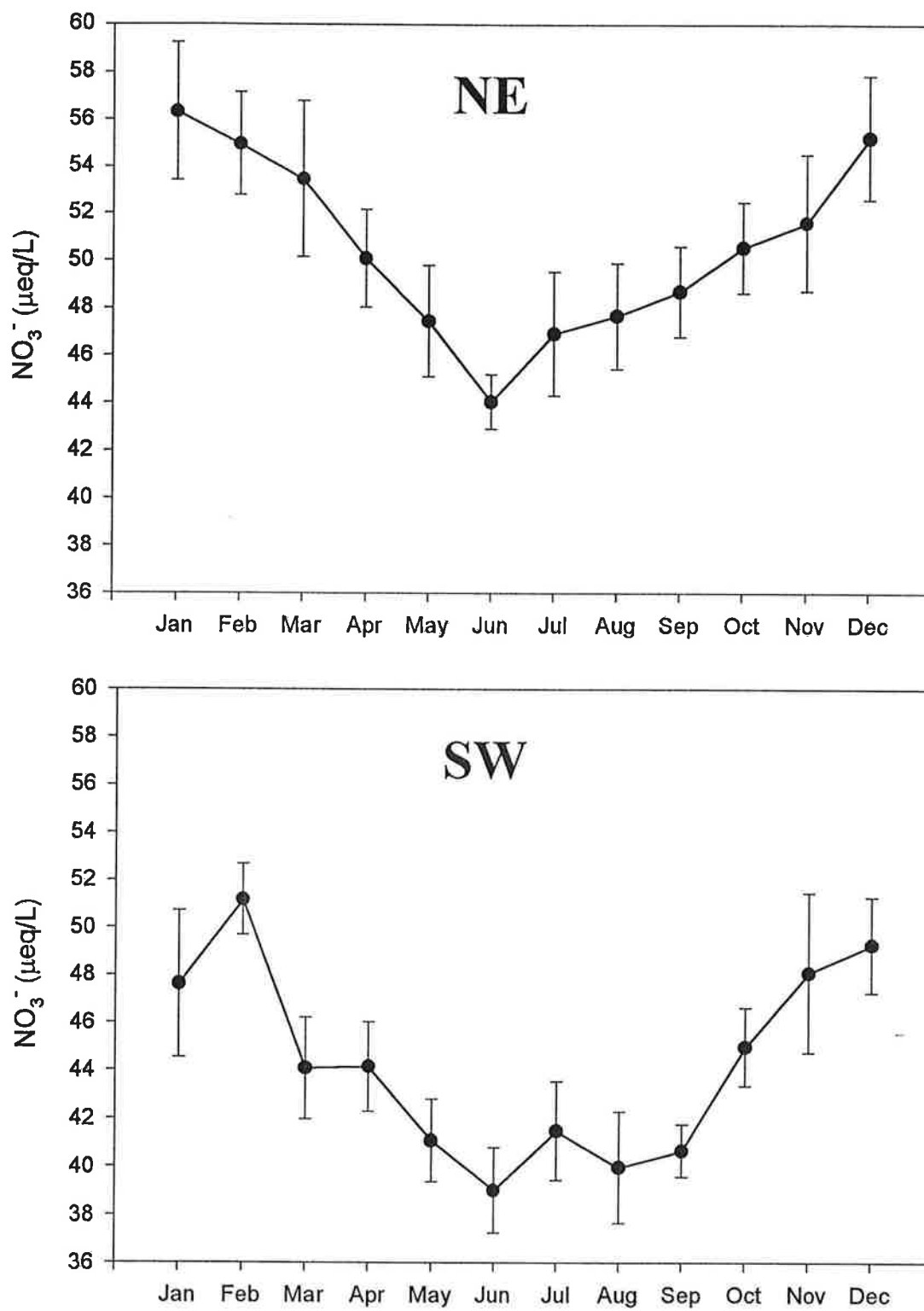
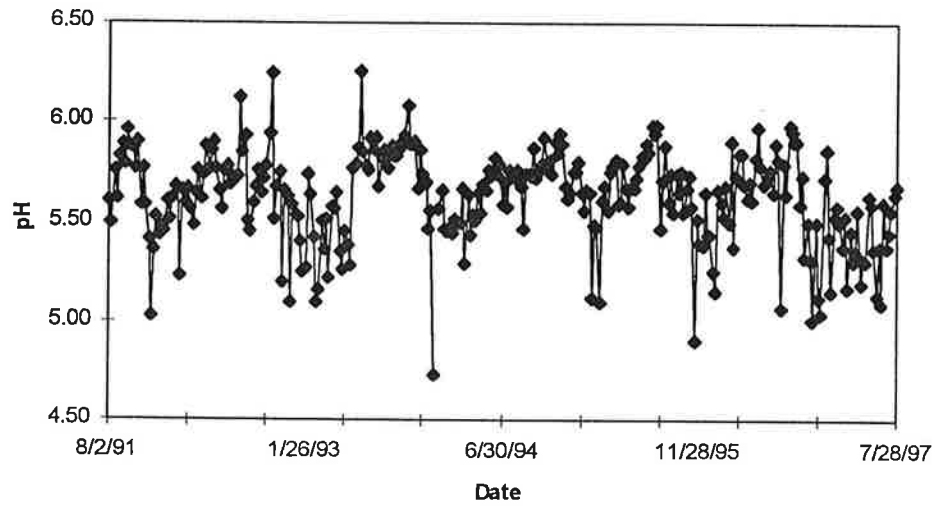


Figure 14. Five year monthly weighted mean nitrate concentrations draining the Noland Divide Watershed. Error Bars are S.E. of the mean.

NE



SW

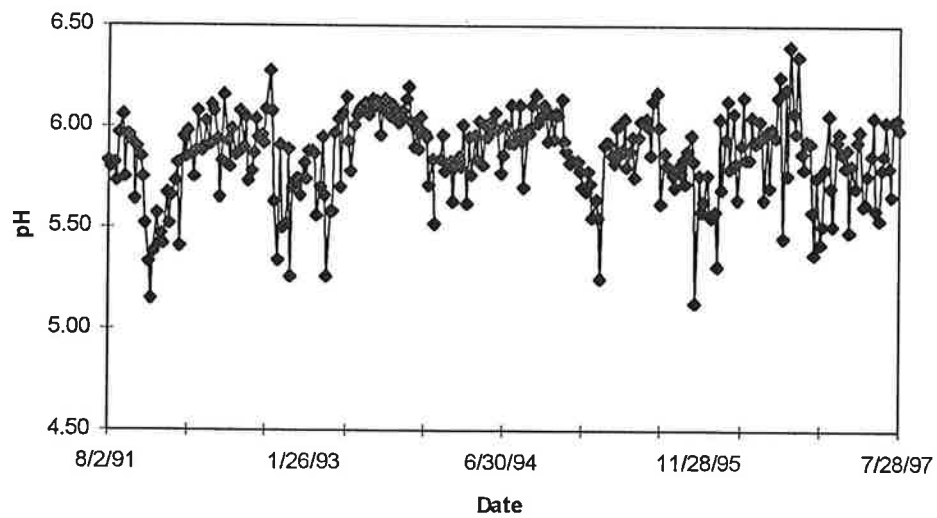


Figure 15. Stream pH values draining the Noland Divide Watershed.

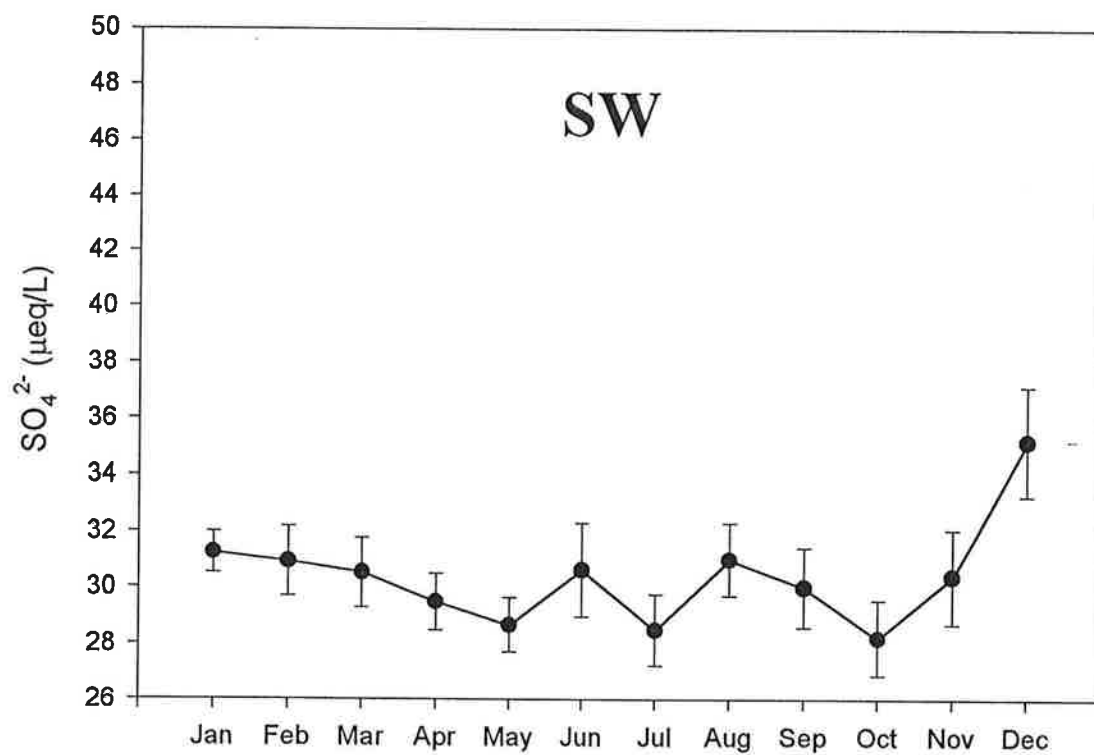
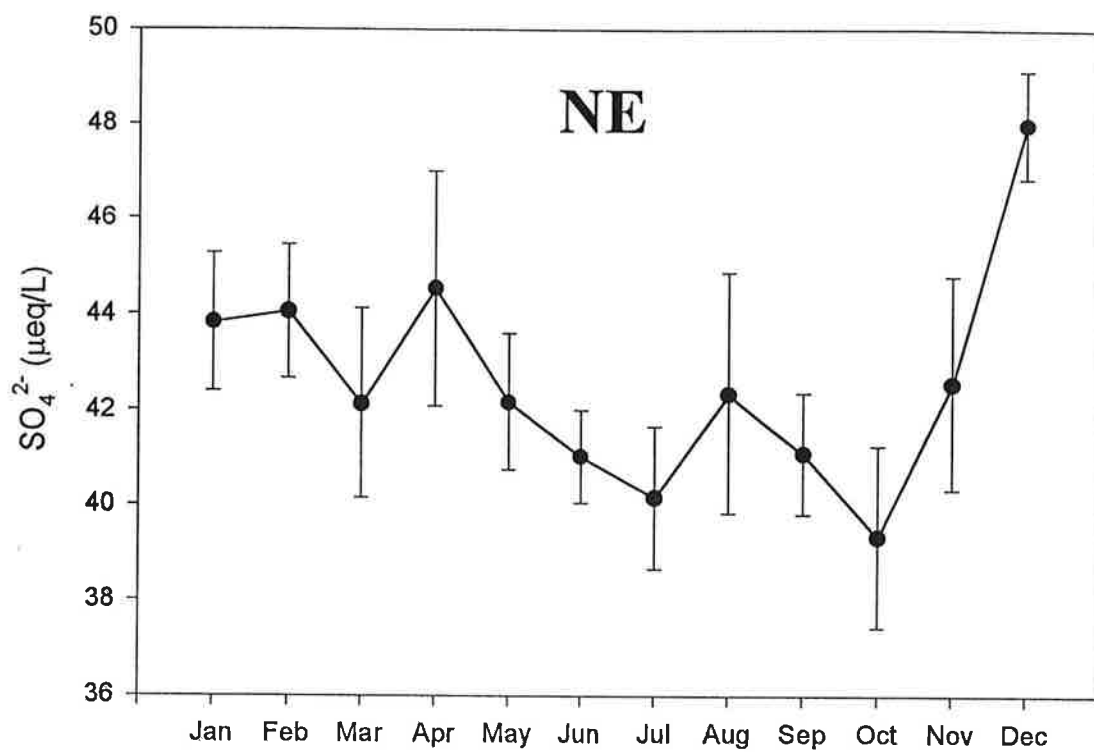
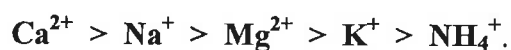


Figure 16. Five year average monthly weighted mean sulfate concentrations draining the Noland Divide Watershed. Error Bars are S.E. of the mean.

sufficiently high to contribute to the chronic stream water acidification with ANC values ranging below 40 $\mu\text{eq/L}$ (Figure 17).

The predominate cation within these systems is calcium (Figure 18). The ordering of ionic strength for cations goes as follows:



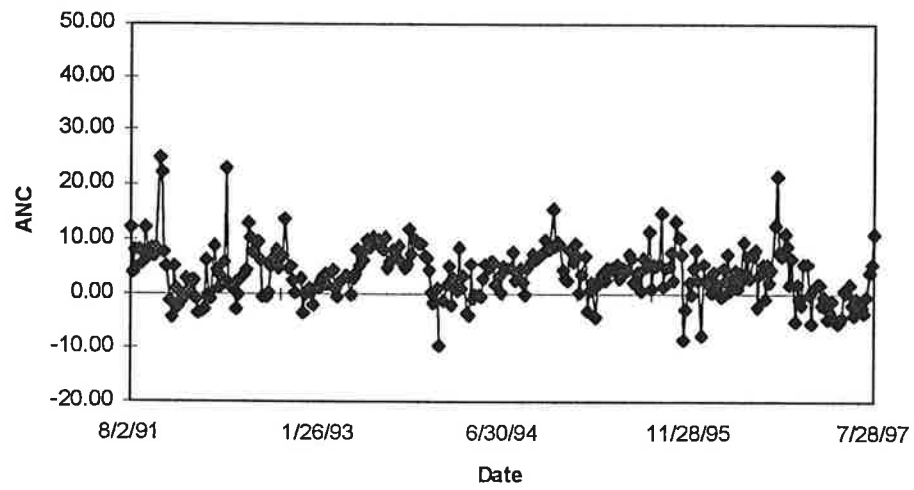
The mean calcium export seems to be increasing over time (Figure 18). The increasing calcium concentrations suggest a possible increase of calcium leaching from the watershed which might reflect a loss of exchangeable base cations from the system.

Table 4. The Noland Divide Watershed Stream Water Chemistry Summaries Collected from 7/91 to 7/97. All values are expressed as $\mu\text{eq/L}$, except pH and ANC.

	SW			NE		
	Minimum	Average	Maximum	Minimum	Average	Maximum
pH	5.13	5.86	6.28	4.73	5.63	6.26
ANC ^a	-6.40	12.33	42.41	-9.65	3.92	24.91
Cl ⁻	5.64	13.29	54.43	7.37	15.29	99.18
NO ₃ ⁻	24.36	43.74	65.72	20.01	50.23	74.09
SO ₄ ²⁻	20.79	29.88	57.35	26.97	42.11	73.91
Na ⁺	11.47	25.19	45.58	13.29	24.41	46.89
NH ₄ ⁺	0	0.73	23.96	0	0.75	15.73
K ⁺	2.28	7.96	39.94	4.07	11.10	98.03
Mg ²⁺	11.68	20.54	33.64	14.57	22.46	31.80
Ca ²⁺	37.08	60.39	86.20	40.32	64.70	93.36

^aAcid Neutralizing Capacity, Gran-Titration method.

NE



SW

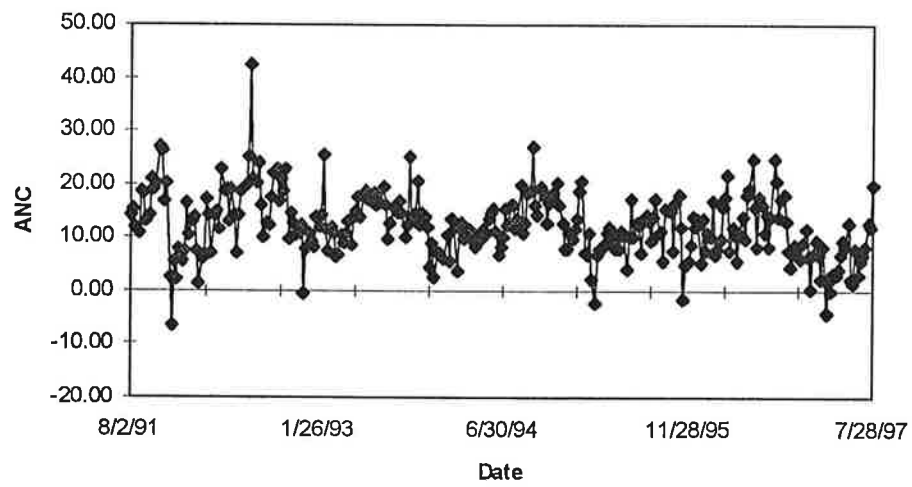
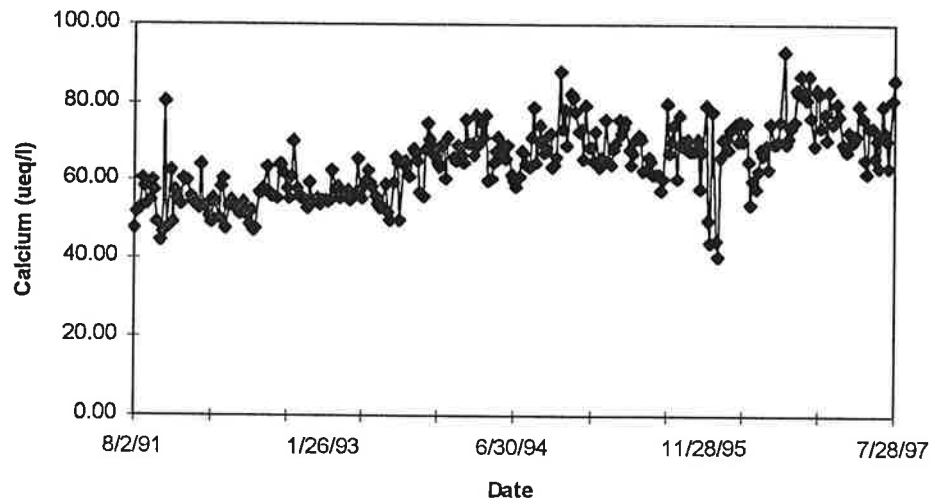


Figure 17. Stream acid neutralizing capacity (ANC) draining the Noland Divide Watershed.

NE



SW

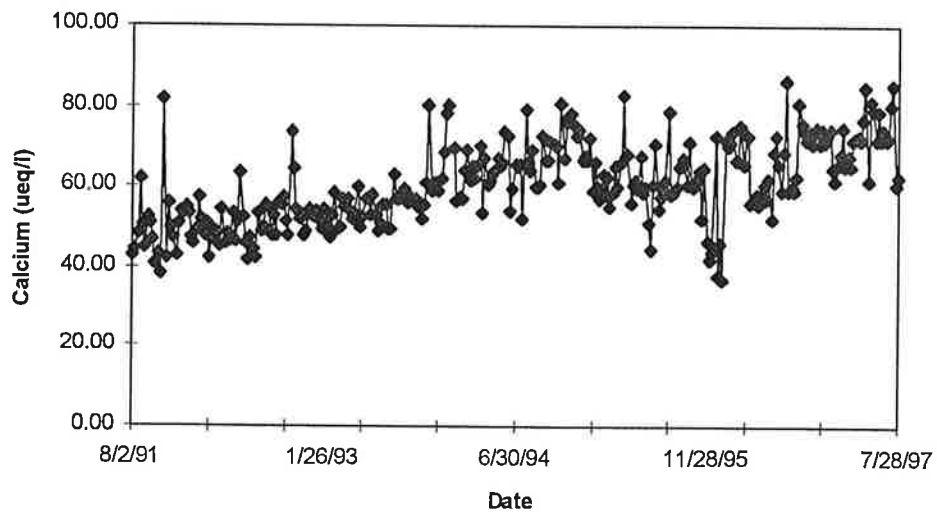


Figure 18. Stream calcium concentrations draining the Noland Divide Watershed.

Storm Events

Since 1991, stream discharge and chemistry variables including pH, conductivity, and temperature have been measured on a 15 minute interval for the Noland Divide Watershed (NDW). The streams draining the NDW suffer from both chronic and episodic acidification associated with atmospheric deposition (Nodvin *et al.*, 1995). Much of the approximately 258 cm (100 inches) of precipitation received annually at NDW, occurs as minor or major storm events (Table 3). These hydrologic events have varying results with respect to stream flow. For example, during minor hydrologic events (defined as 2 times seasonal base flow) most of the water is diverted into the SW streamlet resulting in higher flow there (Figure 19). However, during major hydrologic events (defined as 7.5 times base

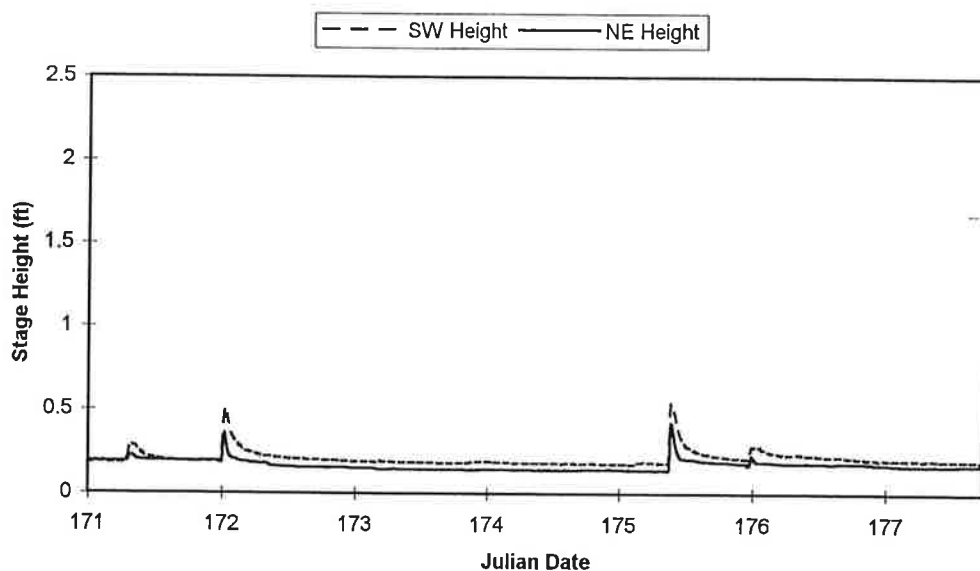


Figure 19. Minor hydrological event at the Noland Divide Watershed.

flow), the NE streamlet receives the higher proportion of the flow (Figure 20). The impact of season on the flow of the two streamlets is evident as maximum flow in the northeast streamlet is about twice as high as the southeast streamlet except during the spring when it is almost three times greater (Table 5). The frequency of minor events for both of the streams do not differ greatly, however, the frequency of major events are somewhat higher in the NE streamlet (Table 5).

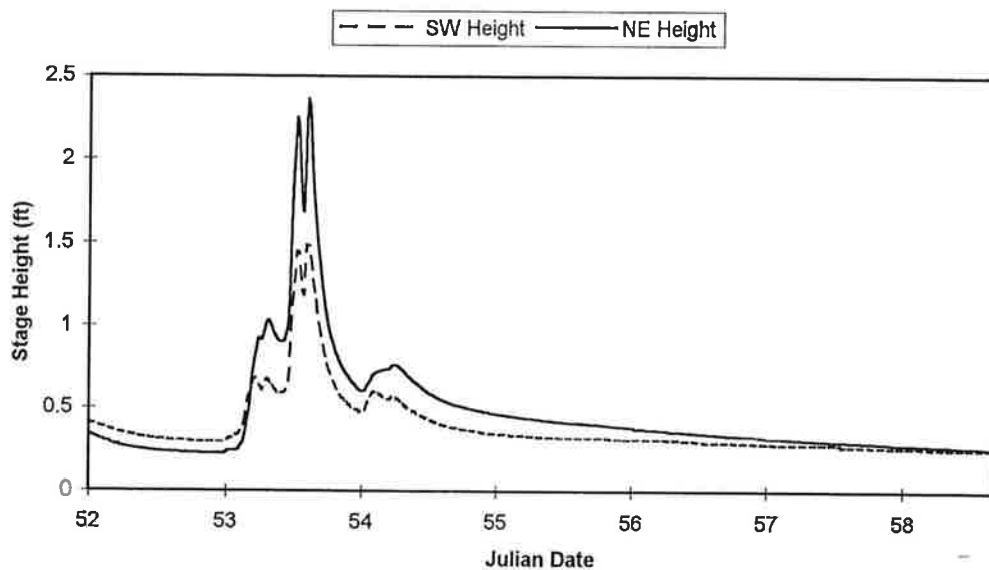


Figure 20. Major hydrological event at the Noland Divide Watershed.

Table 5. Five year hydrological readings from the SW and NE streamlets at Noland Divide Watershed.

	Spring	Summer	Fall	Winter
SW Streamlet				
Base Flow ^a	0.07	0.03	0.04	0.06
Minimum Flow ^a	0.03	0.02	0.03	0.04
Maximum Flow ^a	6.63	5.02	5.02	6.23
# of Minor Events ^b	30.9	49.4	39.3	30.4
# of Major Events ^c	0.9	4.1	4.0	3.4
NE Streamlet				
Base Flow ^a	0.07	0.03	0.04	0.06
Minimum Flow ^a	0.03	0.01	0.02	0.04
Maximum Flow ^a	18.96	11.46	13.72	14.43
# of Minor Events ^b	32.6	44.6	37.0	38.4
# of Major Events ^c	3.2	5.1	4.2	5.9

^a All values are expressed as cfs. (cubic feet per second).

^b Defined as 2X's based flow and expressed the number of days.

^c Defined as 7.5X's base flow and expressed the number of days.

Hydrologic increases in discharge have a profound influence on the resulting in decreases in pH for the two streamlets. Decreases of over 1 pH unit have been observed for the SW streamlet (Figure 21). The observed minimum pH for the SW was below 4.70 for all seasons (Table 6). The pH drops below 5.0 one to four days per season on average (Table 6).

Table 6. Five year Hydrolab pH readings for the SW streamlet.

	Spring	Summer	Fall	Winter
Average pH	5.72	5.80	5.78	5.63
Minimum pH	4.70	4.53	4.39	4.44
Maximum pH	6.25	6.28	6.28	6.16
# of Days Below 5.5	17.1	13.8	12.0	28.8
# of Days Below 5.0	1.8	2.2	1.3	4.0

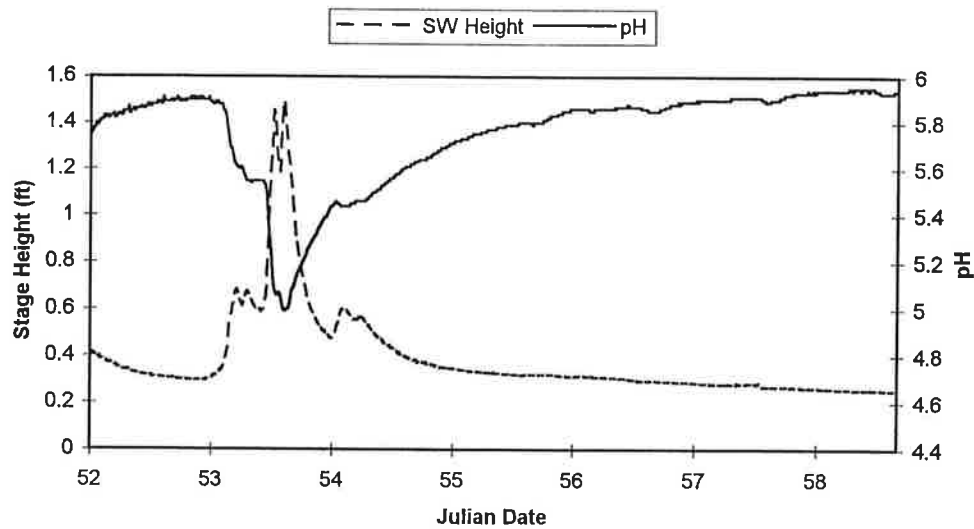


Figure 21. Major Hydrological Event for the Noland Divide Watershed Showing the Relationship Between Stream Discharge and pH for the SW Streamlet.

The pH drops below 5.5 between 12 and 29 days per season throughout the year for the SW streamlet, which demonstrates the chronic and episodic nature of the acidification experienced by this streamlet. Changes in pH in the NE streamlet are not known due to lack of instrumentation in that streamlet. Declines in pH are expected to be even greater in the NE streamlet than in the SW streamlet due to higher flows and more frequent occurrence of higher flows.

Stream Survey

Analysis of Changes Since the 1970s

Changes in overall stream water quality across the GRSM were broadly assessed by comparing the changes in average pH at sites where samples were collected during the 1970's and the 1990's (Table 7). The results of this analysis indicate that pH has, on

average, actually increased about 0.12 units since the 1970's (Table 8). Some sites did experience an overall decline in pH, though the number of sites with decreasing pH was much lower than those with higher pH values in the 1970's.

At least some of the reason for an apparent increase in pH may be due to the measurement of pH in the field during the 1970's while samples are returned to the lab for analysis now. The main difference between the field and lab analysis is temperature and pH is a temperature sensitive variable. Although pH meters attempt to compensate for the effect of temperature, the actual effectiveness of the compensation is not known. It may be necessary to evaluate the difference between field and lab pH measurements before we can confidently evaluate the change in pH that has occurred in GRSM streams since the 1970's. Given this limitation in analysis of pH, more detailed analyses of pH change that were planned were not conducted.

Table 7. Average pH for sites sampled during both the 1970's (S&L) and 1990's (UT) and the average difference that occurred during the period.

Sample Number	Site Description	S&L Average	S&L N	UT Average	UT N	Difference
91	Unnamed Trib to Ramsay Prong at 3670 ft.	4.53	3	5.95	10	1.42
236	Unnamed trib to Walker Camp Prong at site 237	4.30	2	5.42	16	1.12
80	Unnamed trib to Walker Camp at cascade	4.60	1	5.24	12	0.64
160	Middle Parsons Branch	6.40	1	7.03	5	0.63
169	Lowest trib to Panther Creek	6.30	2	6.85	3	0.55
203	Little River (b/ Fish Camp & camp 30)	6.07	3	6.60	1	0.53
95	Upper Ramsay Prong	4.69	1	5.19	2	0.49
196	Gunna Creek above Devils Race Branch	5.80	3	6.28	4	0.48
27	Scratch Britches at Uplands	6.22	233	6.69	5	0.47
174	Abrams Creek below Cades Cove	6.92	11	7.35	20	0.43
187	Abrams Creek above Picnic area	6.30	8	6.72	6	0.42

Table 7 (continued). Average pH for sites sampled during both the 1970's (S&L) and 1990's (UT) and the average difference that occurred during the period.

Sample Number	Site Description	S&L Average	S&L N	UT Average	UT N	Difference
204	Little River at campsite 30	6.15	4	6.55	1	0.40
211	Fish Camp Prong above Little River	5.98	2	6.38	16	0.40
16	Little River below 1 st bridge	6.27	4	6.67	5	0.40
18	Lower Meigs Creek	6.20	1	6.60	4	0.40
325	Deep Creek above campgrounds	6.18	4	6.57	5	0.40
17	Little River at Sinks	6.20	3	6.58	11	0.38
197	Gunna Creek at old campsite	5.87	3	6.22	3	0.36
19	Little River (b/Sinks & Metcalf)	6.28	4	6.63	4	0.35
20	Little River at Metcalf Bot.	6.22	4	6.56	24	0.34
293	Rough Fork at Caldwell House	6.20	1	6.54	20	0.34
347	Dudley Creek at the stable on US 321	6.50	1	6.83	1	0.33
245	Sassafras Branch (Noland Creek)	6.00	3	6.31	13	0.31
251	Beech Flats above US 441 loop	5.73	4	6.03	22	0.31
119	Unnamed trib to Big Creek	6.30	1	6.61	2	0.31
181	Eagle Creek at campsite 96	6.13	3	6.43	3	0.30
252	Beech Flats below roadcut	5.04	5	5.34	21	0.30
14	Little River above Y	6.36	7	6.66	17	0.30
3	Cosby Creek at boundary	6.21	8	6.48	19	0.27
35	Little River at Elkmont Campground	6.25	6	6.51	14	0.26
261	Kephart Prong at 3020 ft	6.17	3	6.42	7	0.26
41	Husky Branch at Meigs Cr trail	6.22	1	6.47	3	0.25
237	Walker Camp Pr at last bridge	4.63	12	4.87	25	0.25
74	Walker Camp Prong above Alum Cave Cr	6.10	1	6.35	22	0.25
134	Big Creek below Swallow Fork	6.25	4	6.49	14	0.24
209	Lost Creek at Little River trail	6.06	3	6.30	20	0.24
31	W Pr. L. Pig. Across from Husky Gap	6.25	4	6.49	6	0.24
233	Walker Camp Prong above 1 st bridge above Alum Cave	5.80	4	6.03	19	0.23
205	Grouse Creek at campsite 30	6.29	3	6.52	1	0.23
32	Critter Brook (W. Pr. Little Pig.)	6.26	3	6.48	6	0.22
248	Noland Creek at third crossing	6.10	4	6.31	15	0.22
24	Lower West Prong Little R.	6.53	8	6.74	23	0.21
7	Chestnut Creek at Ranger Sta	6.38	4	6.58	5	0.21
42	Little River at damaged bridge	6.20	4	6.41	14	0.21
148	Lower Little Cataloochee Creek	6.50	3	6.71	11	0.21
283	Bradley Fork above Smokemont camp	6.28	4	6.48	15	0.20
267	Raven Fork near Park housing	6.30	4	6.50	19	0.20

Table 7 (continued). Average pH for sites sampled during both the 1970's (S&L) and 1990's (UT) and the average difference that occurred during the period.

Sample Number	Site Description	S&L Average	S&L N	UT Average	UT N	Difference
94	Ramsay Prong above falls	4.90	5	5.10	3	0.20
38	Jakes Creek at Cabins/Trailhead	6.30	1	6.49	7	0.19
319	Slab Cove Branch (Noland Creek)	6.30	1	6.49	13	0.19
246	Noland Creek at campsite 61	6.04	4	6.23	15	0.19
13	Little River at boundary	6.51	14	6.70	20	0.18
90	Ramsay Prong above trib at site 91	5.25	10	5.43	6	0.18
270	Beech Flats at Kephart footbridge	6.28	5	6.45	19	0.17
268	Oconaluftee River below Smokemont	6.33	4	6.50	20	0.17
147	Lower Cataloochee Creek	6.43	3	6.61	18	0.17
40	Little River at old road gate	6.28	4	6.45	16	0.17
266	Oconaluftee River at Visitors Center	6.40	2	6.57	11	0.17
72	Road Prong at 2nd bridge on trail	6.07	7	6.24	21	0.17
173	Mill Creek above Abrams Creek	6.53	3	6.70	21	0.16
92	Unnamed trib to Ramsay Pr below falls	4.61	4	4.77	15	0.16
52	Mid Pr Little Pigeon at boundary	6.26	20	6.42	20	0.16
156	Abrams Creek at Ranger Station	7.00	6	7.16	21	0.16
312	Hazel Creek at campsite 85	6.40	1	6.56	6	0.16
122	Lower Gunter Fork (Big Creek)	6.31	7	6.47	3	0.16
15	Whiteoak Flats Br. (Little R.)	6.50	1	6.66	3	0.16
298	Parsons Branch at boundary	6.84	5	6.99	7	0.15
30	W Pr Little Pigeon at headquarters	6.30	5	6.45	22	0.15
198	Gunna Creek at 2500 ft	6.23	3	6.38	3	0.15
313	Forney Creek at Lake Shore Trail	6.30	1	6.45	1	0.15
73	Walker Camp Prong above Road Prong (1st bridge)	6.10	1	6.24	23	0.14
300	Ekaneetlee Creek above Eagle Creek	6.25	2	6.39	6	0.14
269	Oconaluftee River above Collins Creek	6.38	4	6.51	8	0.14
23	Lower Middle Prong Little R.	6.45	10	6.59	22	0.14
321	Bearpen Branch at campsite 65	6.43	23	6.57	11	0.14
281	Bradley Fork at 2750	6.15	2	6.28	12	0.13
327	Oconaluftee River at boundary	6.40	5	6.53	19	0.13
69	Bearpen Hollow at pullout between Alum Cave and Chimneys	5.53	6	5.66	16	0.13
179	Gunna Creek above Mill Creek (Eagle)	6.27	3	6.39	3	0.13
301	Eagle Creek at campsite 89	6.35	2	6.48	5	0.13
34	Little River at Milsap Site	6.34	7	6.46	13	0.12
145	Caldwell Fork above Cataloochee Creek	6.43	3	6.55	6	0.12

Table 7 (continued). Average pH for sites sampled during both the 1970's (S&L) and 1990's (UT) and the average difference that occurred during the period.

Sample Number	Site Description	S&L Average	S&L N	UT Average	UT N	Difference
135	Big Creek at Brakeshoe Springs	6.34	5	6.45	10	0.11
210	Little River above Fish Camp Prong	6.30	4	6.41	22	0.11
136	Kilby Branch (Big Creek)	6.25	4	6.34	3	0.09
199	Unnamed trib at campsite 82 (Hazel)	6.50	1	6.59	7	0.09
21	Little Brier Branch at school	6.60	1	6.69	10	0.09
299	Twentymile Creek at Ranger Station	6.43	4	6.50	14	0.08
216	Buckeye Gap Prong at campsite 25	6.30	1	6.38	4	0.08
6	Big Creek at Campground	6.42	32	6.49	12	0.08
43	Porters Creek at log bridge	5.90	15	5.97	22	0.07
93	Ramsay Prong below falls	5.12	10	5.19	14	0.07
120	Big Creek above Gunter Fork area	6.29	7	6.35	3	0.07
320	Noland Creek below campsite 64	6.33	5	6.40	11	0.06
149	Mid Cataloochee Creek at bridge	6.50	3	6.55	11	0.05
127	Pretty Hollow Cr above Palmer Cr	6.37	3	6.42	18	0.05
322	Noland Creek below Road-to-nowhere	6.41	6	6.45	14	0.04
146	Palmer Creek at Pretty Hollow trailhd	6.43	3	6.47	16	0.04
265	Couches Creek (Oconaluftee River)	6.50	2	6.54	10	0.04
83	Mid Pr Little Pigeon above Porters	6.30	7	6.33	7	0.03
29	W Pr Little Pigeon at boundary	6.49	62	6.51	18	0.03
150	Cataloochee Creek below Caldwell Fork	6.53	3	6.55	11	0.02
68	W Pr Little Pig. above Chimneys Pic	6.28	4	6.29	7	0.01
302	Eagle Creek at campsite 90	6.45	4	6.46	3	0.01
66	W Pr Little Pigeon at Chimneys Pic.	6.27	7	6.28	25	0.01
170	Lower Panther Creek	6.24	12	6.24	4	0.00
51	Mid Pr Little Pigeon near Ranger sta	6.44	7	6.43	6	-0.01
247	Noland Creek at first crossing	6.30	4	6.29	13	-0.01
260	Kephart Prong above Beech Flats	6.43	4	6.39	8	-0.03
86	Mid Pr Lit Pig. below Ramsay Prong	5.94	7	5.90	13	-0.04
194	Mid Pr Little River above Tremont	6.45	2	6.41	20	-0.04
49	Porters Creek at bridge to Ramsay	6.30	40	6.25	19	-0.04
326	Deep Creek at boundary	6.60	1	6.55	8	-0.05
89	Ramsay Prong at 2nd log bridge above trailhead	5.79	11	5.74	6	-0.05
144	Palmer Creek above Pretty Hollow Cr	6.53	3	6.48	16	-0.05
118	Upper Big Creek	6.30	2	6.24	3	-0.06
224	Hazel Creek below Proctor Creek	6.50	1	6.44	6	-0.06
253	Beech Flats above roadcut	6.42	6	6.35	21	-0.07

Table 7 (continued). Average pH for sites sampled during both the 1970's (S&L) and 1990's (UT) and the average difference that occurred during the period.

Sample Number	Site Description	S&L Average	S&L N	UT Average	UT N	Difference
175	Stony Branch (Abrams Creek)	6.70	1	6.63	18	-0.07
158	Panther Creek at Parson Branch Road	6.46	5	6.37	5	-0.09
249	Unnamed trib just below site 248	6.55	2	6.46	5	-0.09
232	Unnamed trib off US 441 at 4210 ft.	6.30	3	6.20	7	-0.10
88	Ramsay Prong above Mid Pr Lit Pig.	6.00	13	5.90	13	-0.11
186	Anthony Creek above Picnic area	6.50	1	6.39	21	-0.11
363	Straight Fork at boundary	6.50	1	6.38	5	-0.12
50	Mid Pr Little Pigeon below Porters	6.49	7	6.37	9	-0.12
1	Indian Camp at Old Settlers	6.38	4	6.25	19	-0.12
48	Porters Creek at gate	6.39	7	6.22	12	-0.17
243	Clingmans Creek (Noland Creek)	5.76	5	5.58	14	-0.18
151	Wilson Branch near Abrams Falls	6.90	1	6.69	18	-0.21
250	Beech Flats at 3500 ft.	6.60	1	6.38	8	-0.22
28	LeConte Creek at Uplands	6.54	283	6.28	5	-0.26
154	Rabbit Creek at Rabbit Cr Trail cross	6.80	1	6.50	1	-0.30
22	Upper Little Brier Branch	6.90	1	6.60	10	-0.30
263	Kephart Prong at Kephart Shelter	6.45	2	6.10	8	-0.35
195	Spring at Spence Field Shelter	6.17	3	5.76	11	-0.41
4	Lower Rock Creek	6.56	5	6.08	18	-0.48
172	Lower Tabcat Creek	6.78	6	6.22	2	-0.56
212	Fish Camp Prong below Ashe Camp Pr.	6.90	1	6.28	17	-0.62
75	Alum Cave Creek above Walker Camp Pr	5.70	11	5.04	20	-0.66
155	Scott Gap Branch at Hanna Mtn Trail	6.70	1	5.89	1	-0.81

Table 8. Overall average change in pH for all sites surveyed in the 1970's and 1990's.

Overall Average pH Difference at Each Site	Number of Sites with Positive Difference in pH Since the 1970's	Number of Sites with Negative Difference in pH Since the 1970's
0.12	106	35

The evaluation of changes in nitrate concentration since the 1970's is as problematic as for pH. Comparison of nitrate concentrations obtained from nitrate electrode (probe) and from ion chromatography yielded a good correlation coefficient ($r^2 = 0.83$) in May 1997 (Figure 22), but the results were less encouraging in August 1997 (Figure 23). Combining the data from both sampling periods resulted in a correlation coefficient of only 0.54 (Figure 24). Such poor relationships between the two measures means that conversion of results from the 1970's nitrate electrode data introduces a substantial amount of error. The variability between the two methods is probably the result of interference from other anions that affects the results from the nitrate electrode more than the ion chromatograph. The data available to date suggest that the impact of such interference may be sufficiently large to prevent a good comparison between results obtained in the 1970's and those being obtained today.

Summary Statistics for Individual Sampling Sites

Summary statistics based on data collected between October 1993 and August 1997 for each sampling site (Appendix A) have been compiled for each basic water chemistry variable measured (Appendix B). The summaries include minimum observed values, maximum observed values, average, standard deviation, coefficient of variation (standard deviation / mean as a percentage), and the number of samples collected at each site. The summary statistics are provided as a reference to the natural variation expected at each site.

Elevational Gradients in Individual Stream Systems

The overall patterns of water chemistry change over the elevational gradient traversed by each stream system in the GRSN remains as described in the March 1997 report. Since the March 1997 report did not include a detailed examination of elevational

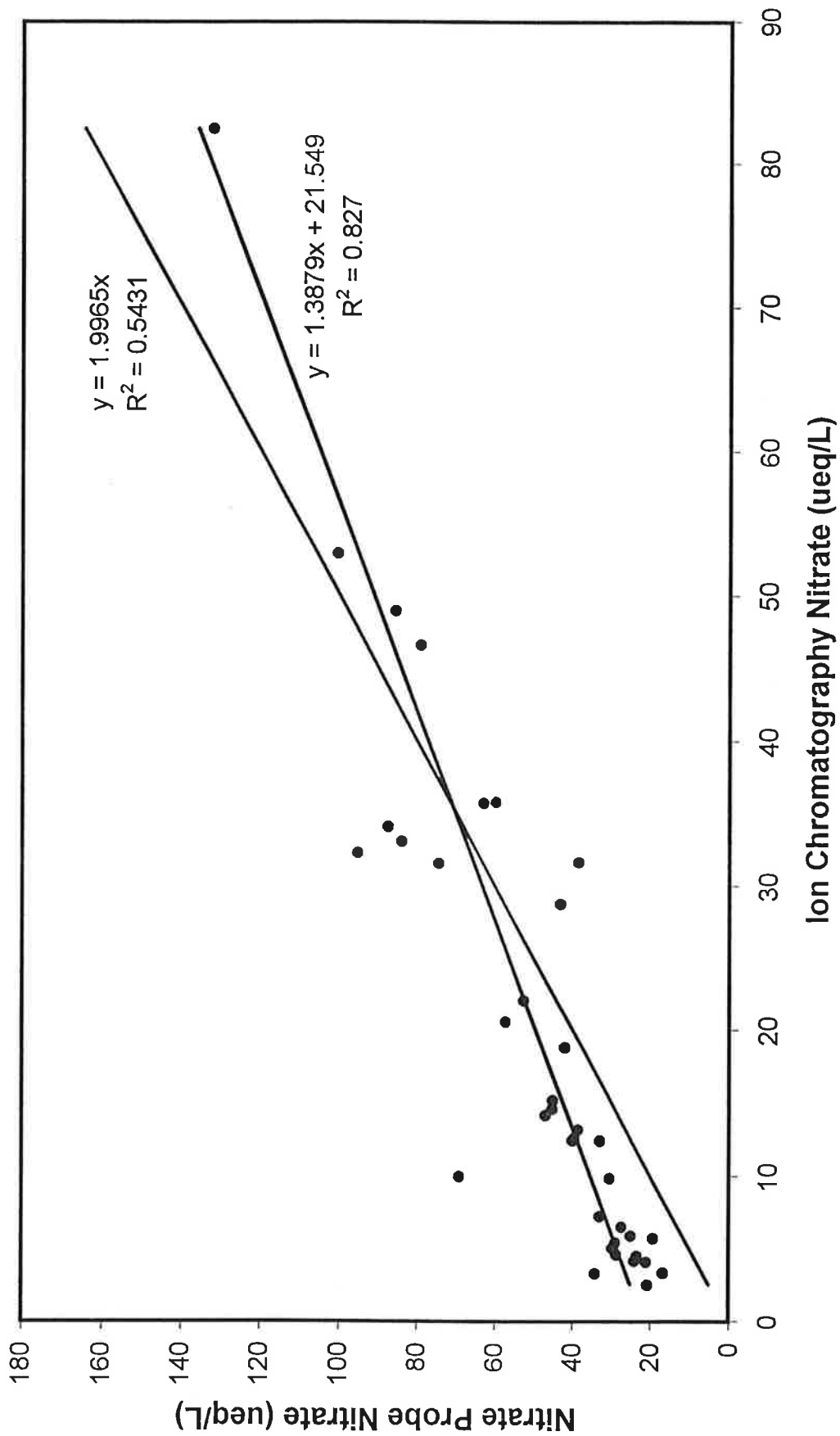


Figure 22. Relationship between nitrate concentrations measured using a nitrate electrode and ion chromatography from the May 1997 survey. The upper equation is the result of linear regression where the intercept was forced through zero.

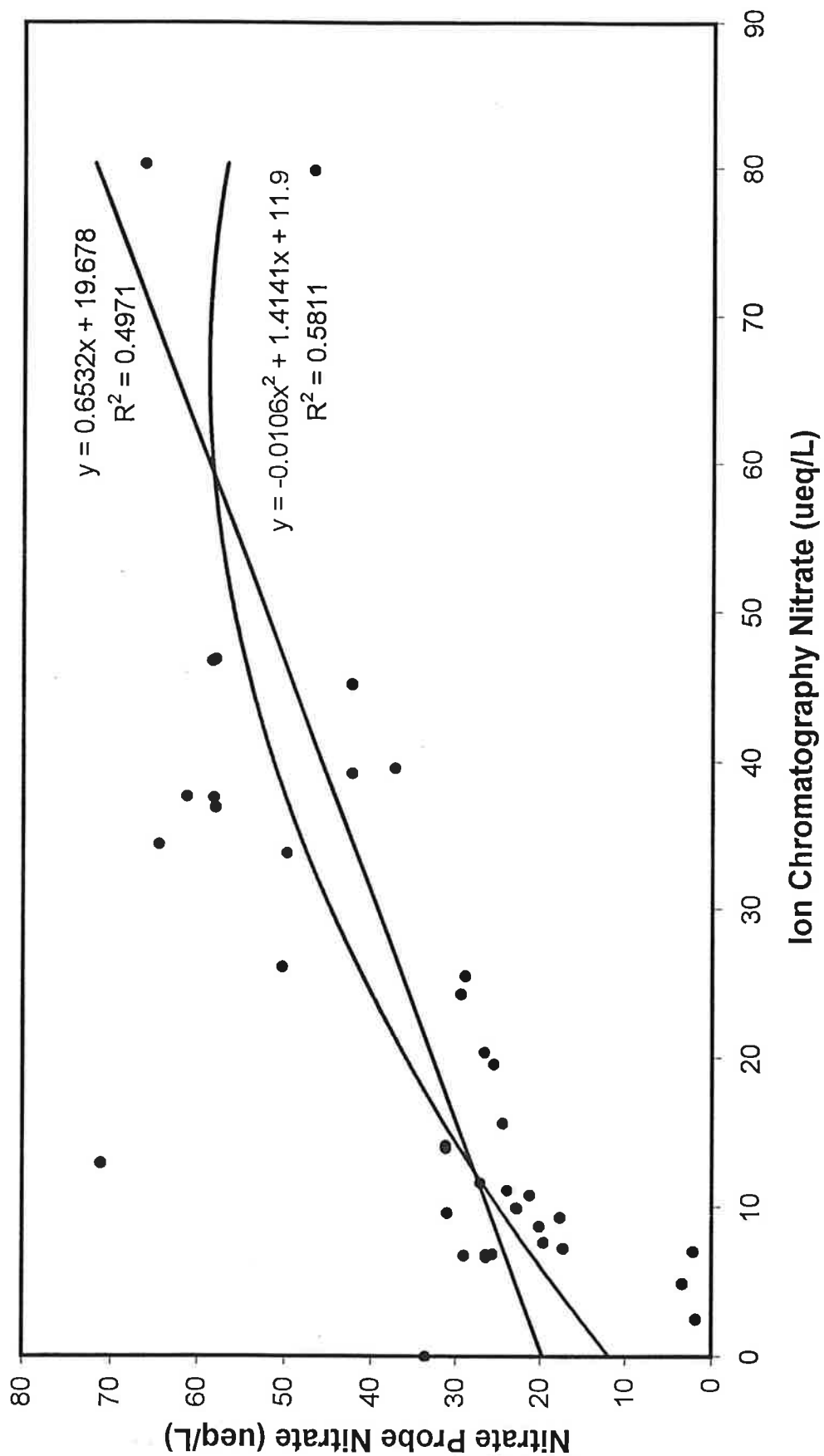


Figure 23. Relationship between nitrate concentration measured using a nitrate electrode and ion chromatography from the August 1997 survey. The upper equation is linear regression and the lower 2nd order polynomial regression.

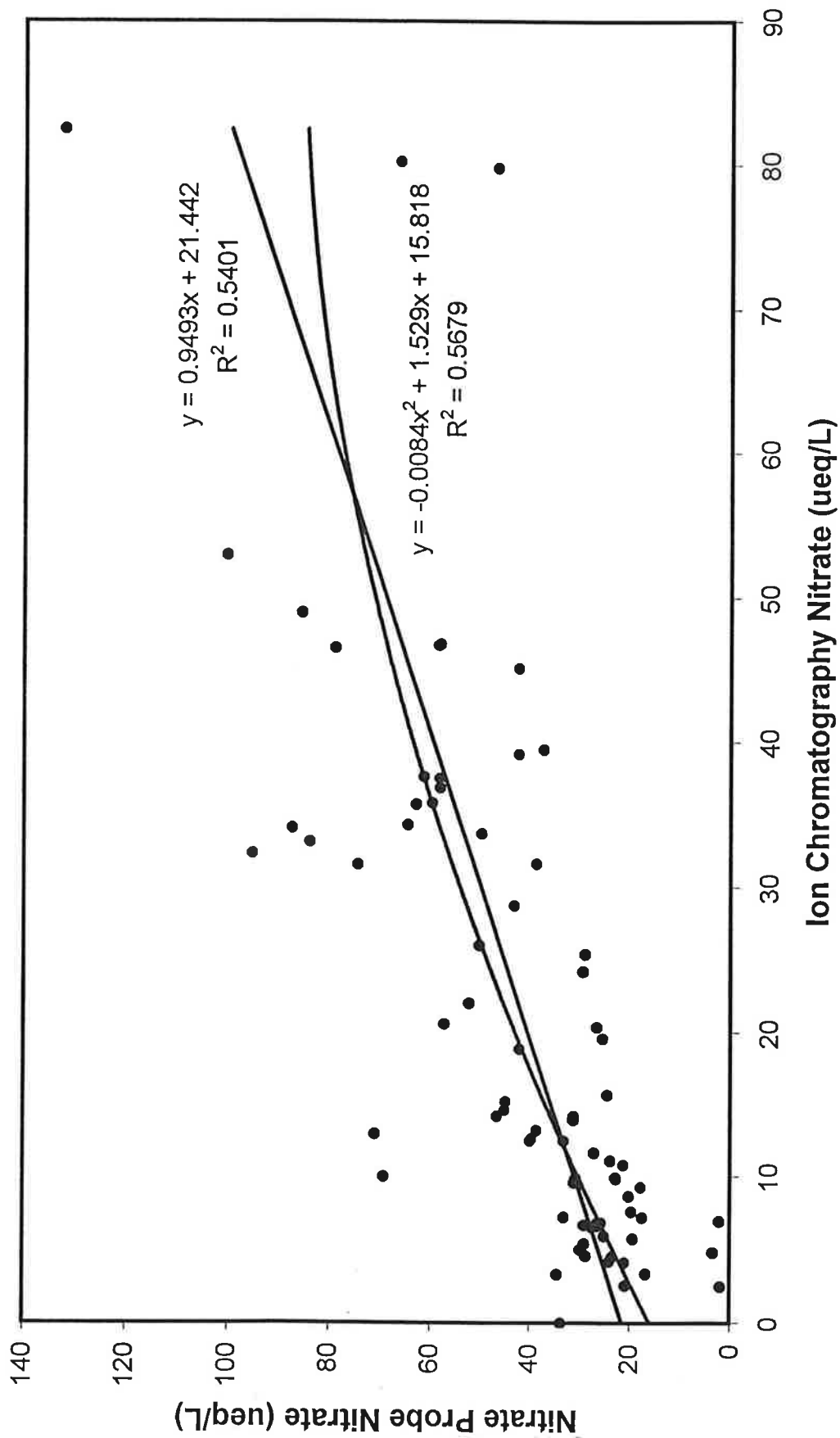


Figure 24. Relationship between nitrate concentrations measured using a nitrate electrode and ion chromatography from the May and August 1997 surveys. The upper equation is linear regression while the lower is 2nd order polynomial regression.

gradients in individual stream systems, we discuss these gradients here in terms of changes in pH. The data have been broken down by season to illustrate the potential changes that occur during the year. In general, pH is lowest in the winter months, increases slightly in spring and is highest in summer and fall. These changes in pH follow the general pattern of stream flow with low pH associated with high flows. The seasonal changes in pH may also reflect the impact of growing season processes on important factors influencing pH such as nitrate. A brief discussion of patterns in each stream system in the GRSM follows below.

Abrams Creek This stream system is the most unique in the GRSM because of the high levels of calcium and magnesium input to the stream as contact is made with the limestone bedrock exposed in the Cades Cove area. The effect of these cation inputs is to greatly increase the pH in the mainstem of the stream beginning at about 600 m in elevation and impacting the system at all points downstream (Figure 25). The variation in pH observed at the lower end of the mainstem may reflect the inputs of the tributaries described below that enter Abrams Creek at lower elevations (Figure 26).

Site Number	Abrams Creek Tributary Site Descriptions	Elevation (m)
183	Spring at Russell Field Shelter	1300
184	Left Fork Anthony Creek at camp 10	860
157	Rabbit Creek Spring off Parsons Br. Road	800
177	Forge Creek at Parsons Branch Road	660
167	Arbutus Creek at Cooper Road	610
488	Mill Creek at Pumphouse on Forge Cr Road	530
164	Wilson Branch at Cooper Road	530
173	Mill Creek above Abrams Creek	520
175	Stony Branch (Abrams Creek)	480
151	Wilson Branch near Abrams Falls	450
341	Kreider Branch (Abrams Creek)	410
342	Oak Flats (Abrams Creek)	400
366	Kingfisher Creek at Little Bottoms trail	370

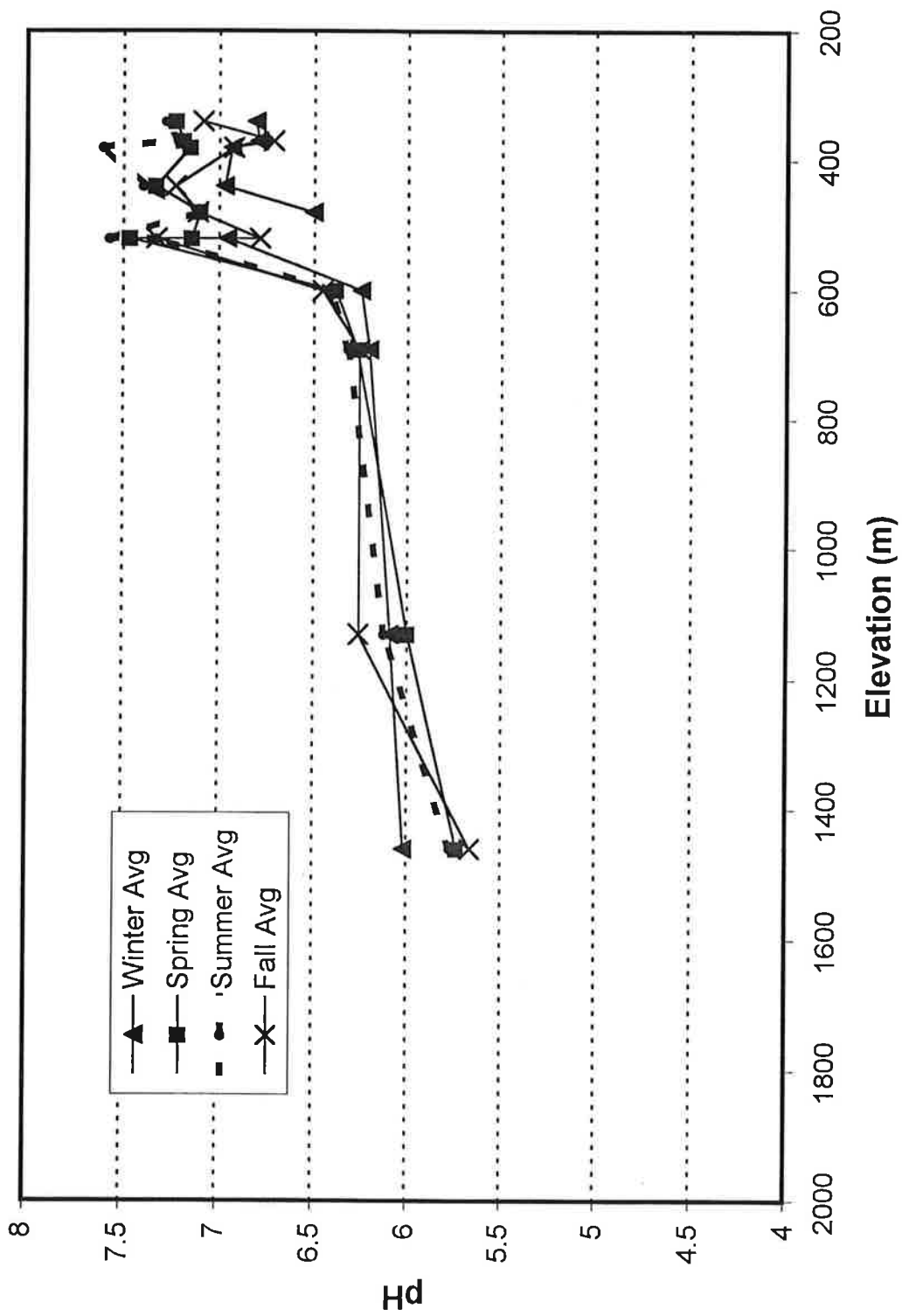


Figure 25. Changes in average stream pH with elevation during different seasons on the mainstem sites of Abrams Creek.

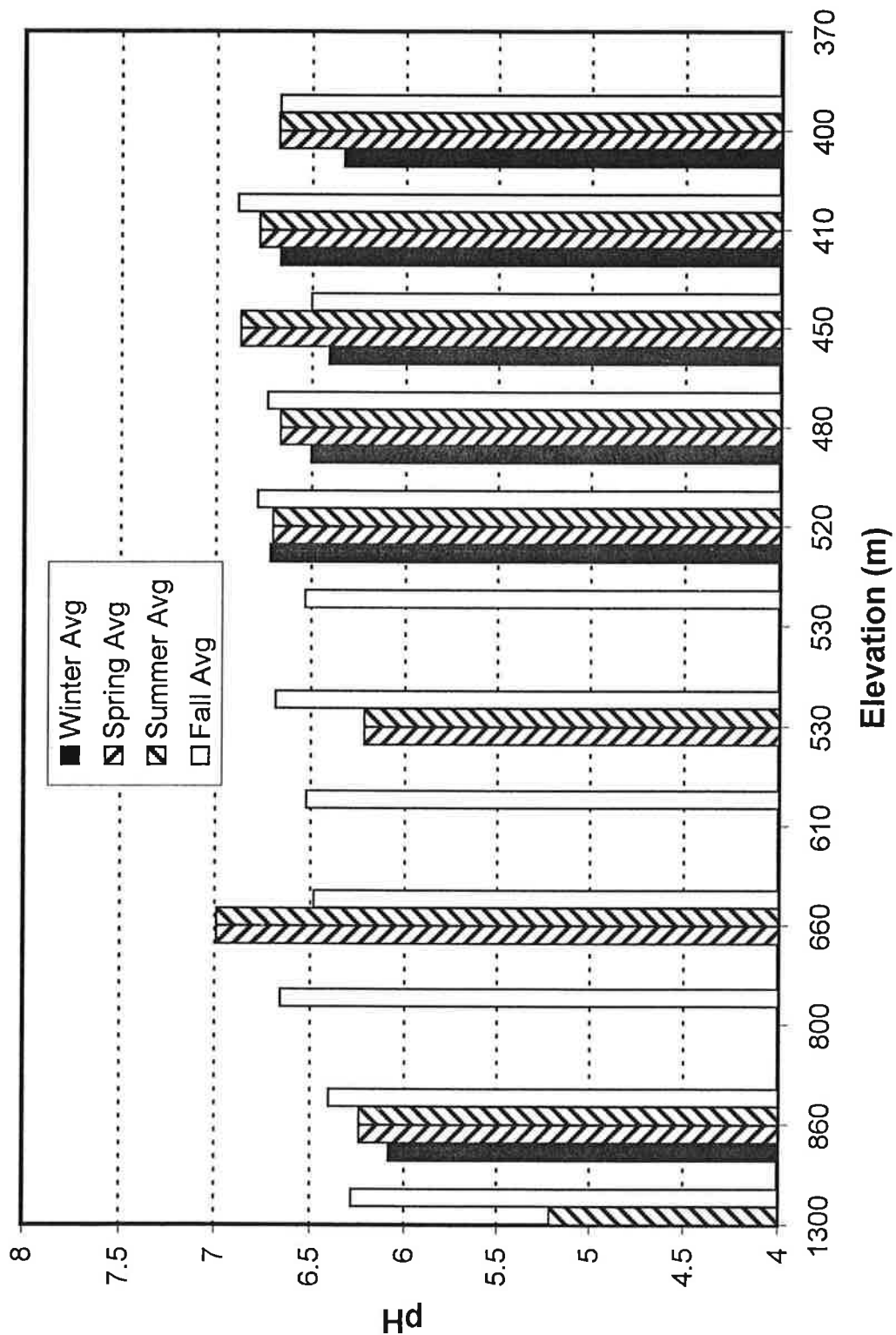


Figure 26. Change in average stream pH with elevation during different seasons on the tributary sites of Abrams Creek.

Hesse Creek and Parsons Branch These two streams are currently assigned to the west water quality district along with Abrams Creek. Both streams have elevated conductivity reflective of limestone bedrock, but the pH in Hesse Creek in particular does not necessarily have the elevated ranges expected from large inputs of calcium and magnesium (Figure 27). The Hesse Creek drainage is known to contain exposed limestone bedrock (King *et al.*, 1967) but the impact on water quality may not be pronounced enough to keep this stream in the west district. Parsons Branch clearly reaches relatively high pH levels that are occasionally above 7.0 indicating the inputs of base cations to neutralize acidity.

Panther Creek This stream is also currently assigned to the west water quality district but average pH conditions indicate this may not be warranted (Figure 28). While maximum pH levels in Panther Creek occasionally approach 7.0, most samples have pH well below 7.0 indicating insufficient base cations such as calcium and magnesium to neutralize the natural and anthropogenic acidity reaching the streams. The pH range exhibited along the entire elevational gradient of this stream from Gregory Bald on down are quite satisfactory for trout. With good access from Parsons Branch road and a substantial barrier at the lower end, Panther Creek could be considered as a potential stream for brook trout restoration.

East Prong Little River This is the main channel of the Little River that runs from Clingmans Dome through Elkmont to Townsend and eventually to Knoxville. The elevational gradient of pH in this stream appears quite pronounced though the critical area between about 1700 m and 1000 m is not presently sampled due to limited access (Figure 29). The main channel considered here is along Fish Camp Prong though conditions

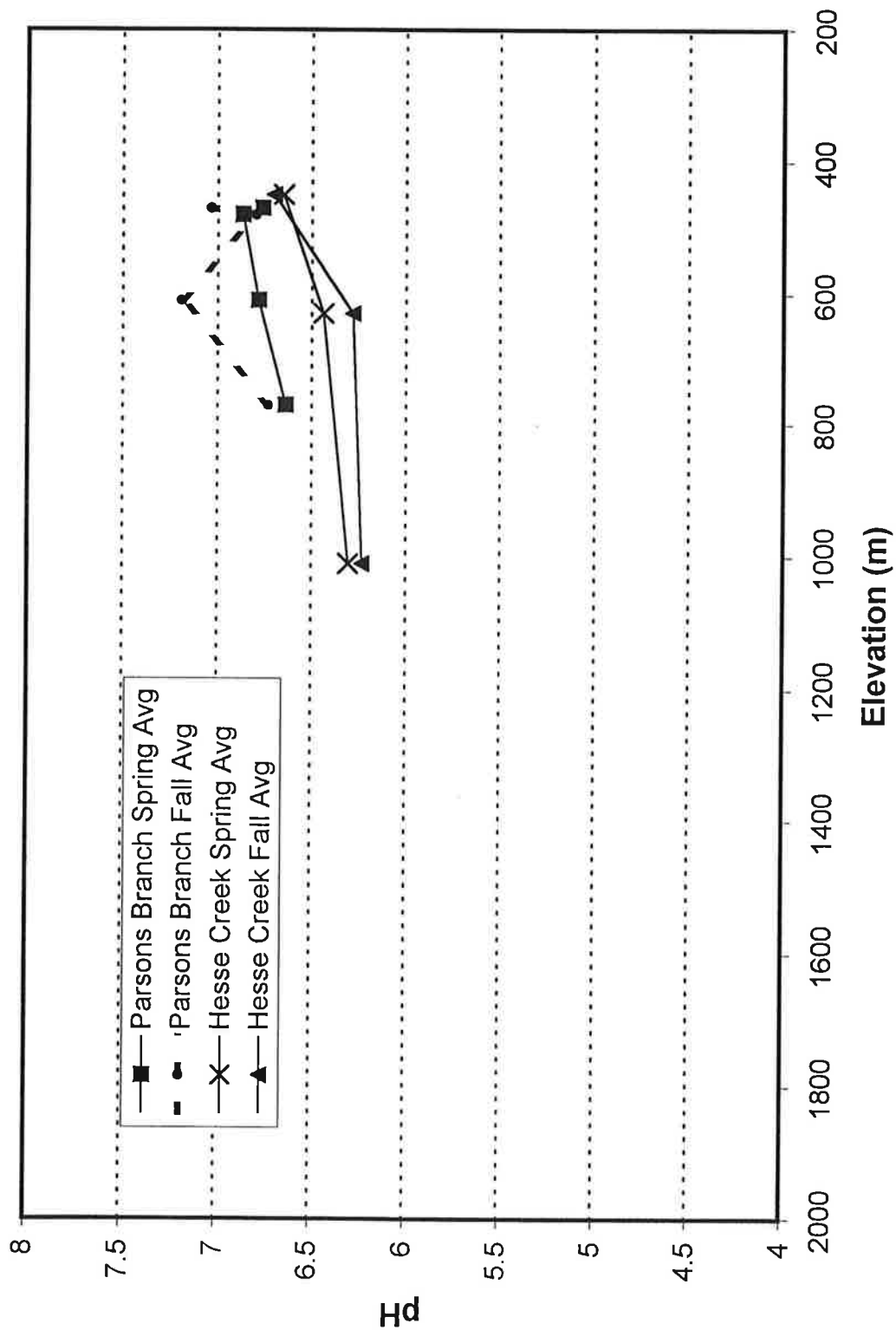


Figure 27. Change in average stream pH with elevation during different seasons on the mainstem sites of Parsons Branch and Hesse Creek.

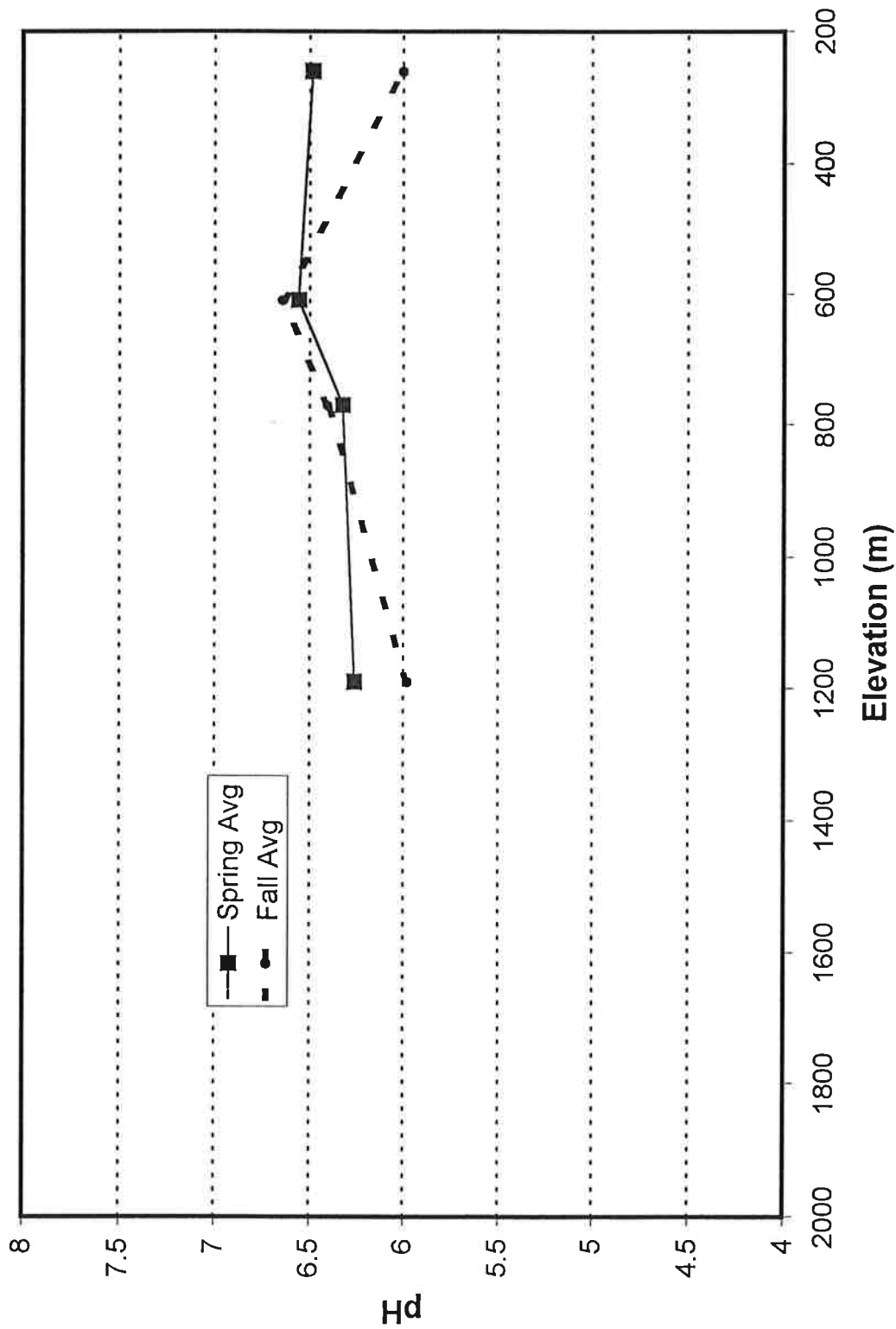


Figure 28. Change in average stream pH with elevation during different seasons on the mainstem sites of Panther Creek.

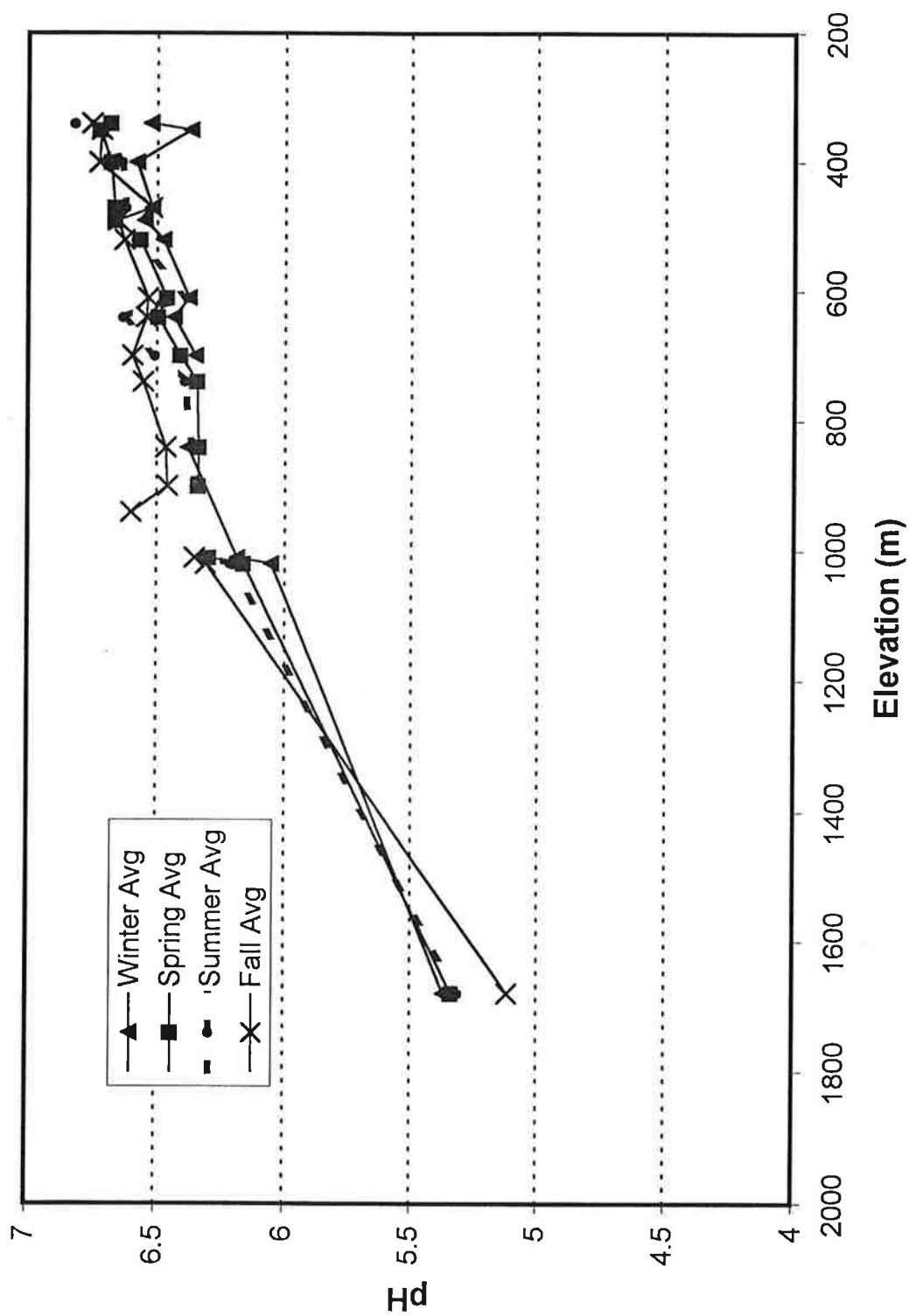


Figure 29. Change in average stream pH with elevation during different seasons on the mainstem sites of East Prong Little River.

appear to be similar along other sampled tributaries as described below (Figure 30). The pH is quite low at the spring at Silers Bald Shelter but is also a little low at the upper end of Henderson Prong along Meigs Creek trail (site 354, 870 m). In general however, pH in most of the tributaries to the Little River is well within a range expected for mountain streams. The pH of the mainstem is also well within levels suitable for trout and most other aquatic organisms that naturally inhabit mountain streams.

Site Number	East Prong Little River Tributary Site Descriptions	Elevation (m)
218	Spring at Silers Bald Shelter	1660
216	Buckeye Gap Prong at campsite 25	1100
207	Jakes Creek at campsite 27	1080
204	Little River at campsite 30	1070
205	Grouse Creek at campsite 30	1070
214	Silers Creek (Little River)	1040
215	Ashe Camp Prong (Little River)	1030
39	Middle Jakes Creek	1000
203	Little River (b/ Fish Camp & camp 30)	940
330	War Branch (Little River)	910
354	Henderson Prong (Little River)	870
210	Little River above Fish Camp Prong	840
209	Lost Creek at Little River trail	830
331	Shields Branch (Little River)	820
36	Laurel Branch at Laurel Falls	790
353	Mannis Branch at Meigs Cr trail	780
340	Kiver Branch at Meigs Cr tr.	770
41	Husky Branch at Meigs Cr trail	760
38	Jakes Creek at Cabins/Trailhead	710
355	Bunch Prong at Meigs Cr trail	690
22	Upper Little Brier Branch	610
21	Little Brier Branch at school	550
18	Lower Meigs Creek	510
15	Whiteoak Flats Br. (Little R.)	370

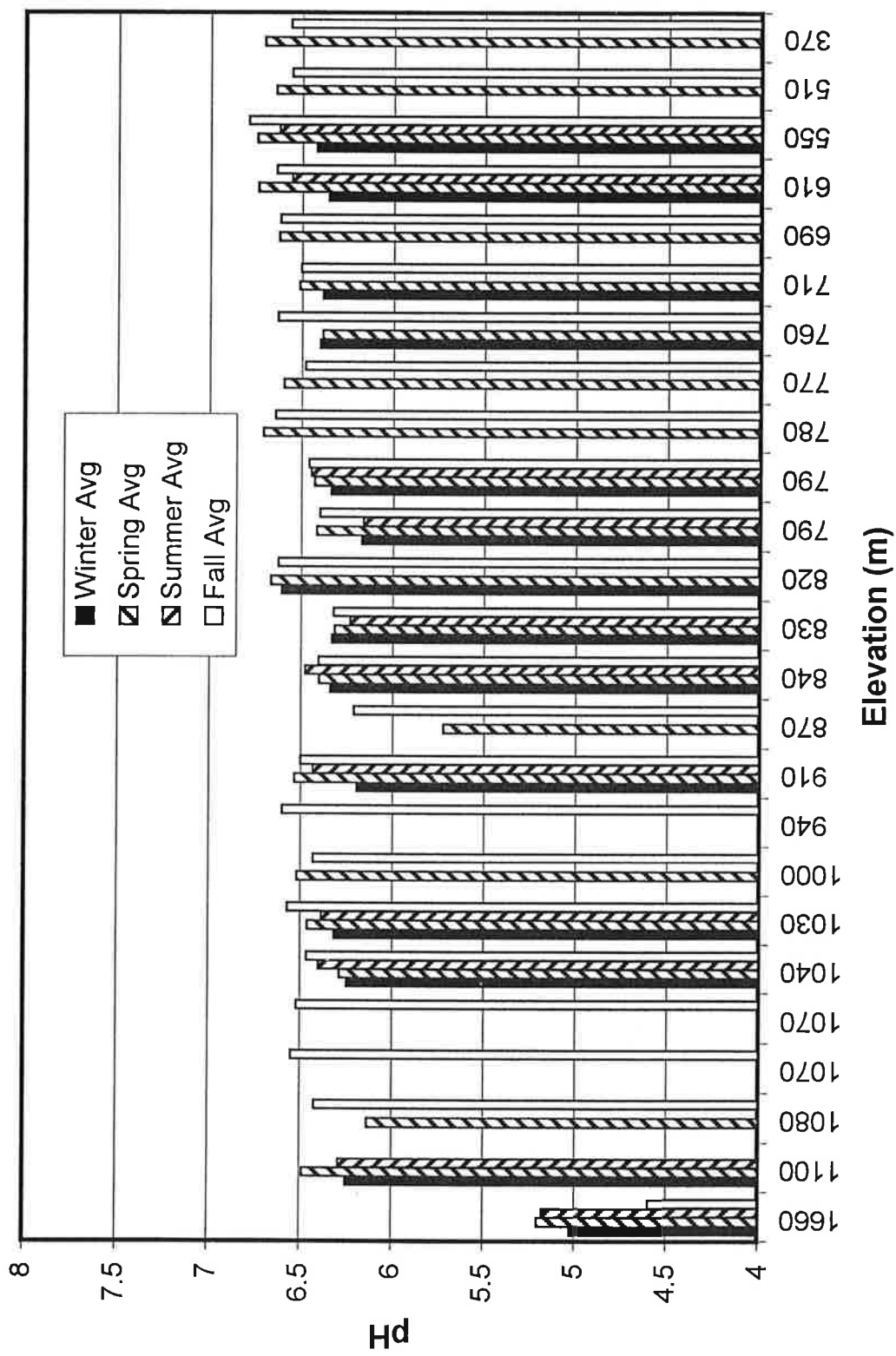


Figure 30. Change in average stream pH with elevation during different seasons on the tributary sites of the East Prong Little River.

Middle Prong Little River Conditions in this stream are nearly identical to those in the East Prong (Figure 31). The pH ranges from about 6.0 to 6.7 over the elevational range that is sampled. The pH drops slightly below 6.0 in some of the tributary streams (described below) but not to potentially damaging levels below about pH 5.5 (Figure 32). This stream is a good representative of the west central water quality district because of the relatively good water quality that occurs over the majority of the elevational gradient.

Site Number	Middle Prong Little River Tributary Site Descriptions	Elevation (m)
208	Upper Panther Creek (Middle Pr Little River)	990
192	Starkey Creek (Mid Pr Little River)	980
188	Panther Creek above Lynn Camp Prong	790
189	Lynn Camp Prong above M Pr Little R.	790
190	Thunderhead Prong at trail crossing	660

Twentymile Creek This stream is also typical of the west central water quality district with pH ranging from about 6.0 to 6.7 in the mainstem (Figure 33). Water quality is also fine in all the tributaries that are sampled (Figure 34, sites described below).

Site Number	Twentymile Creek Tributary Site Descriptions	Elevation (m)
343	Rye Patch Branch (Twentymile Creek)	900
304	Proctor Branch above 20 mile Creek	760
307	Dalton Branch above 20 mile Creek	450

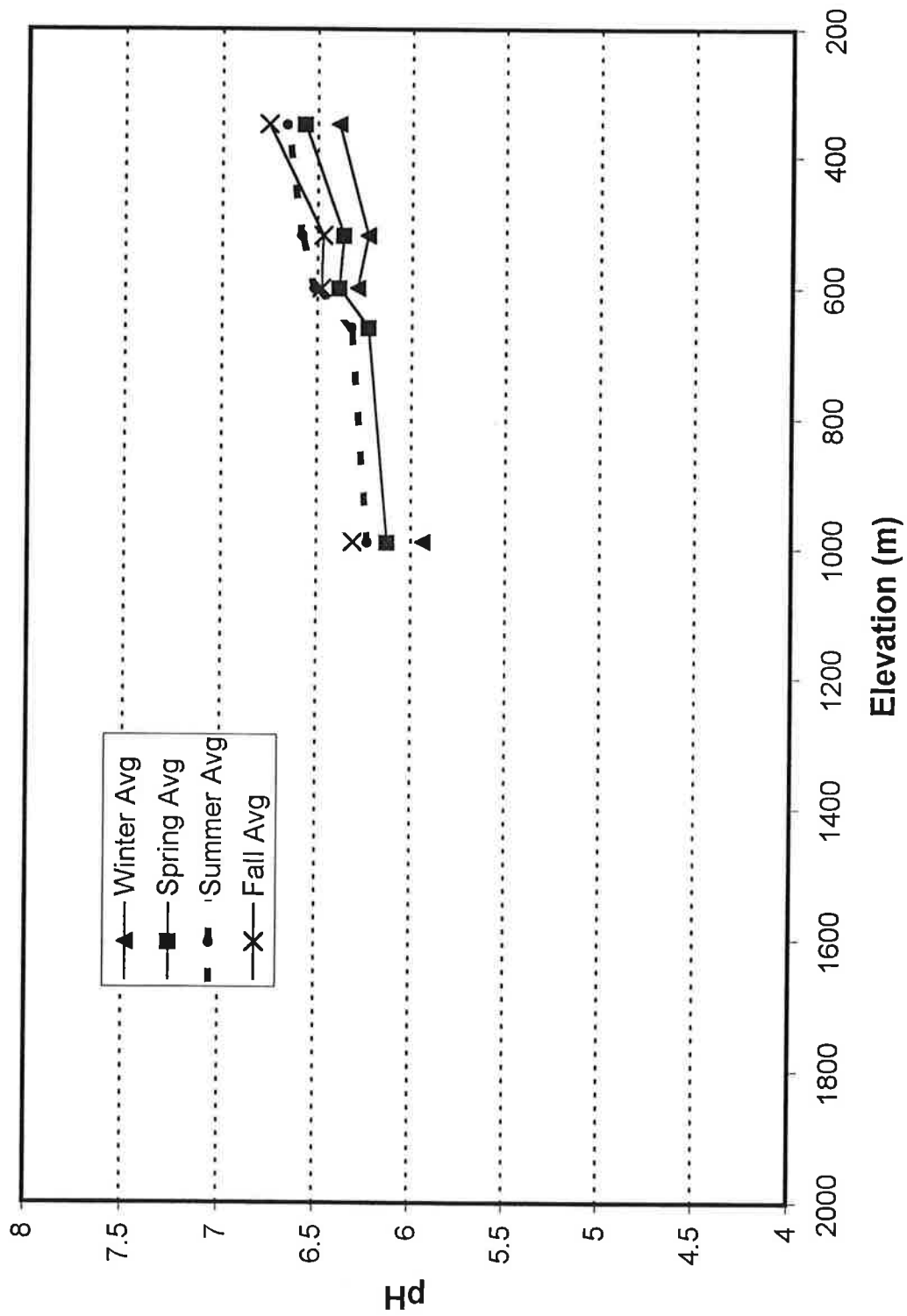


Figure 31. Changes in average stream pH with elevation during different seasons on the mainstem of the Middle Prong Little River.

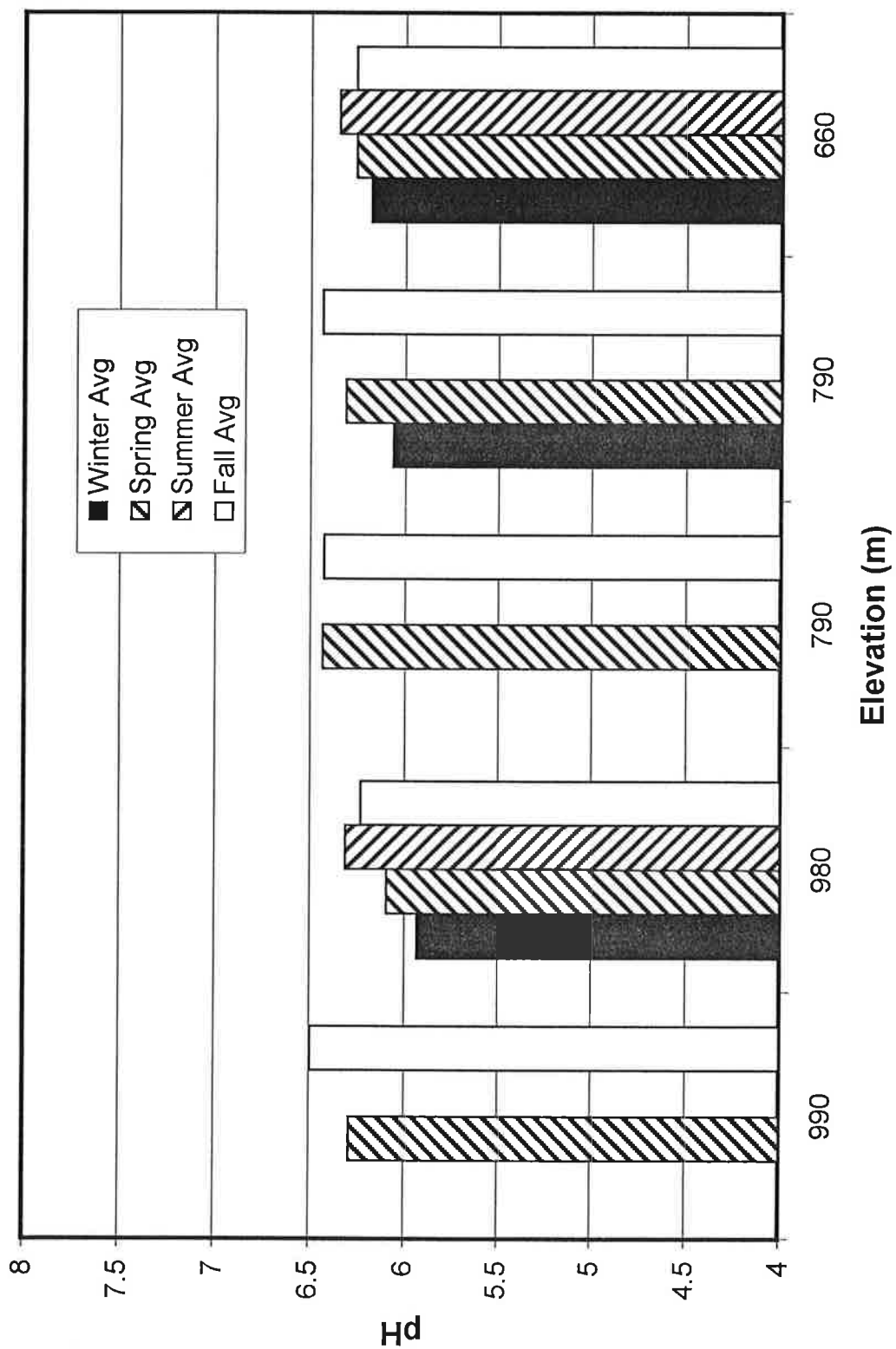


Figure 32. Change in average stream pH with elevation during different seasons on the tributary sites of the Middle Prong Little River.

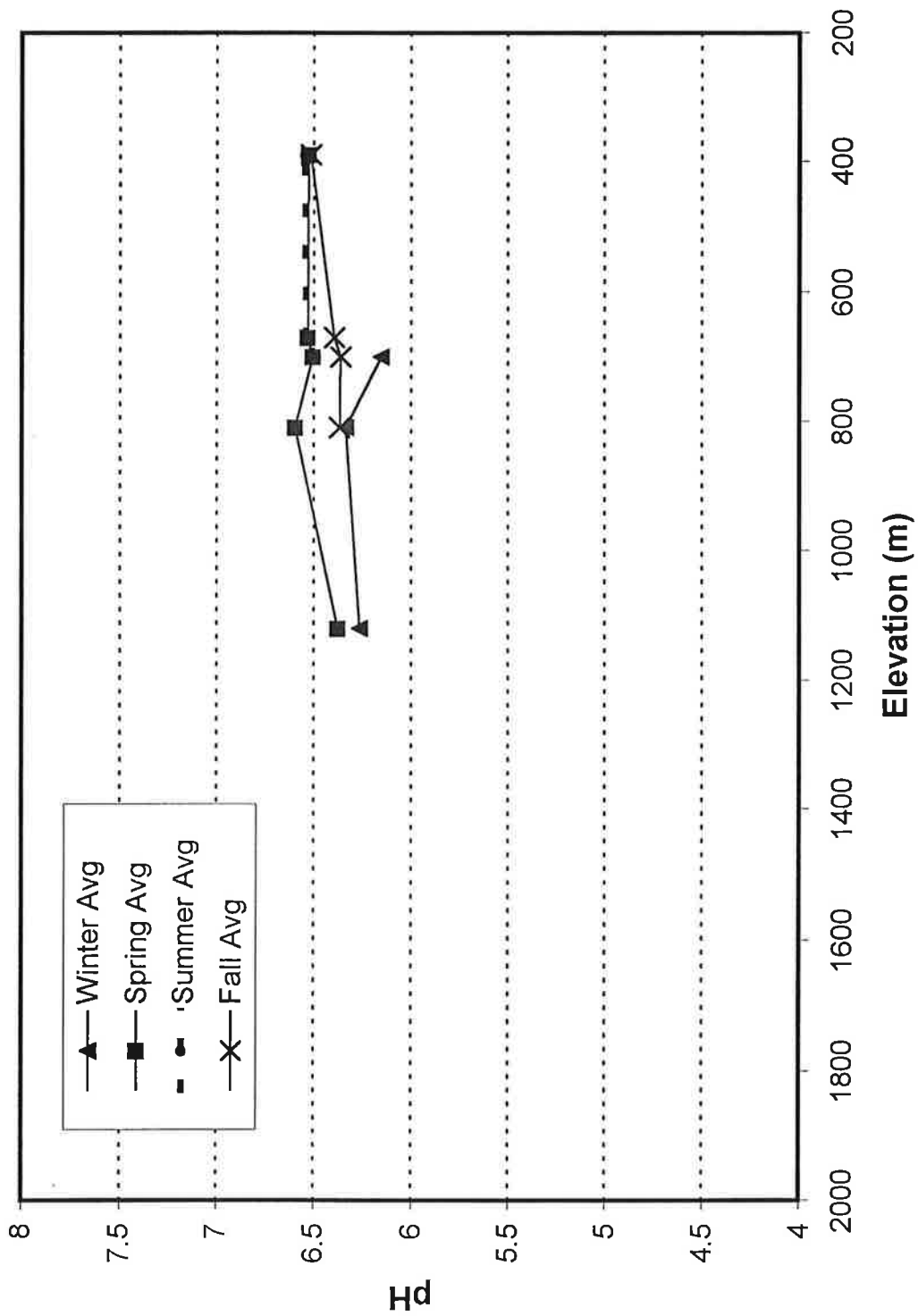


Figure 33. Change in average stream pH with elevation during different seasons on the mainstem sites of Twentymile Creek.

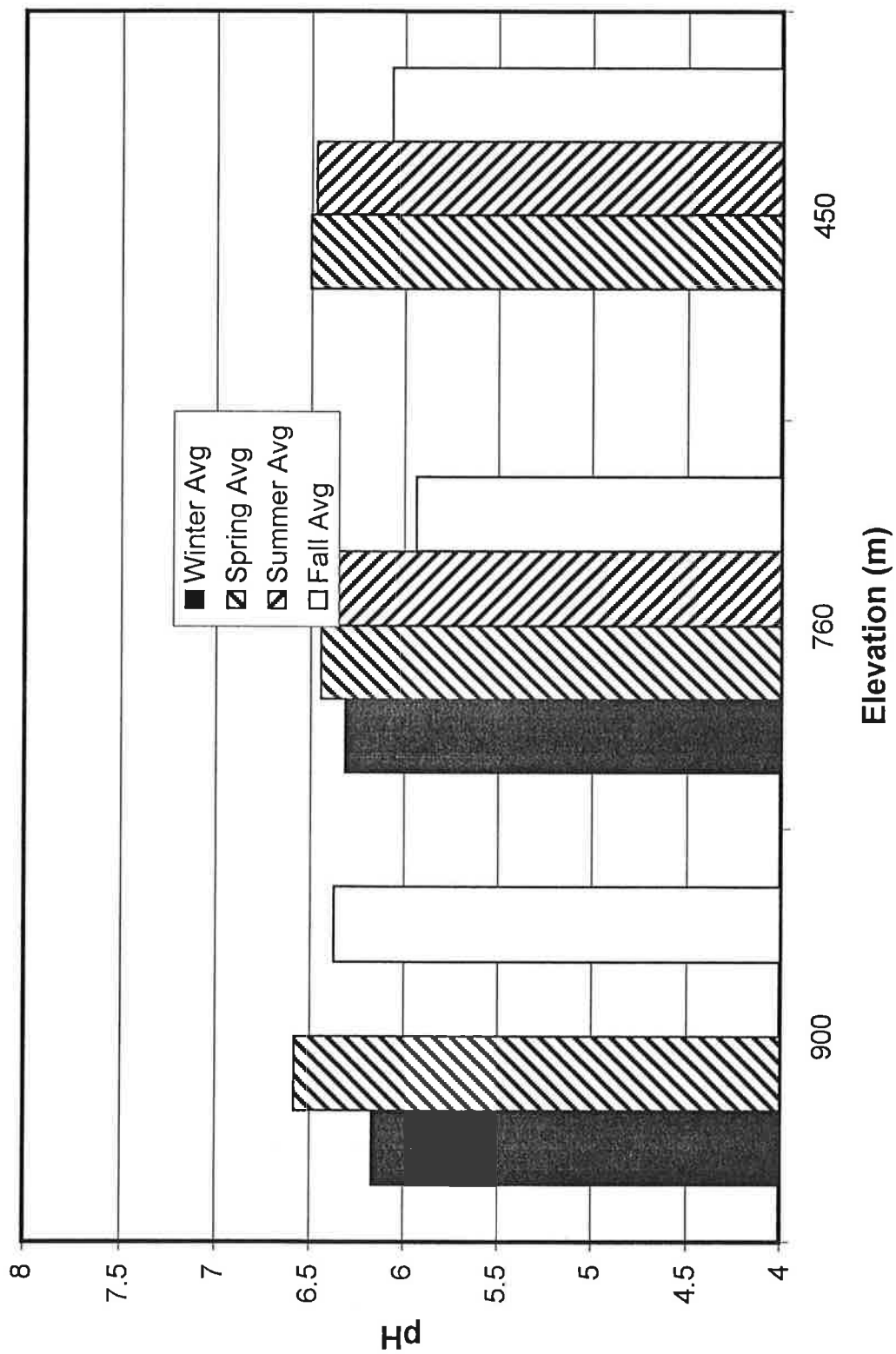


Figure 34. Change in average stream pH with elevation during different seasons on the tributary sites of Twentymile Creek.

Eagle, Forney, and Noland Creeks These streams are more similar to the East Prong Little River than to Middle Prong Little River or Twentymile Creek because of the higher elevations that are sampled. The pH at higher elevation sites is generally lower as demonstrated by these 5 streams. The pH of Eagle Creek ranges from only about 5.5 to about 6.6 in the mainstem (Figure 35). The tributaries to Eagle Creek as described below have similar pH ranges (Figure 36).

Site Number	Eagle Creek Tributary Site Descriptions	Elevation (m)
202	Unnamed trib on Jenkins Ridge Trail	1460
303	Lost Cove Creek (Eagle Creek)	890
180	Mill Creek above Eagle Creek	730
300	Ekaneetlee Creek above Eagle Creek	580
308	Pinnacle Creek above Eagle Creek	560
309	Unnamed trib to Eagle Creek	550

The situation where low pH at high elevation is most pronounced among streams of the west central district is Forney Creek (Figure 37). The pH is as low as 4.5 at the spring at Double Springs Gap Shelter on the Appalachian Trail which feeds into Huggins Creek and then into the mainstem. Other tributaries at high elevation can have pH values just as low (Figure 38, sites described below). The situation rebounds rapidly with pH values rising above about 6.0 at elevations below about 1400 m.

Site Number	Forney Creek Tributary Site Descriptions	Elevation (m)
361	Unnamed Trib on Clingmans Dome (Forney Creek)	1900
227	Steeltrap Creek (Forney Creek)	1200
316	Gray Wolf Creek at Lakeshore trail	670

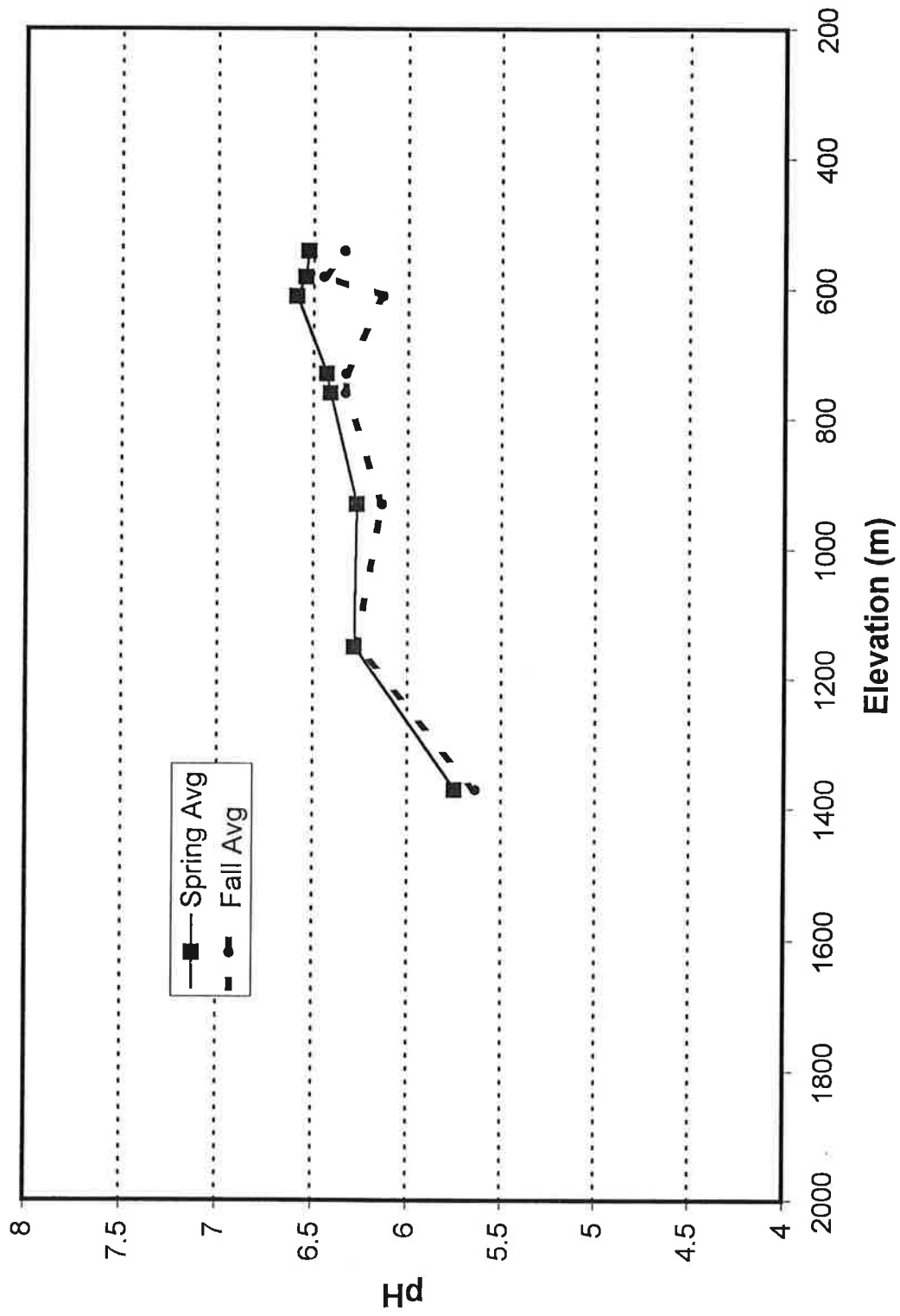


Figure 35. Change in average stream pH with elevation during different seasons on the mainstem of Eagle Creek.

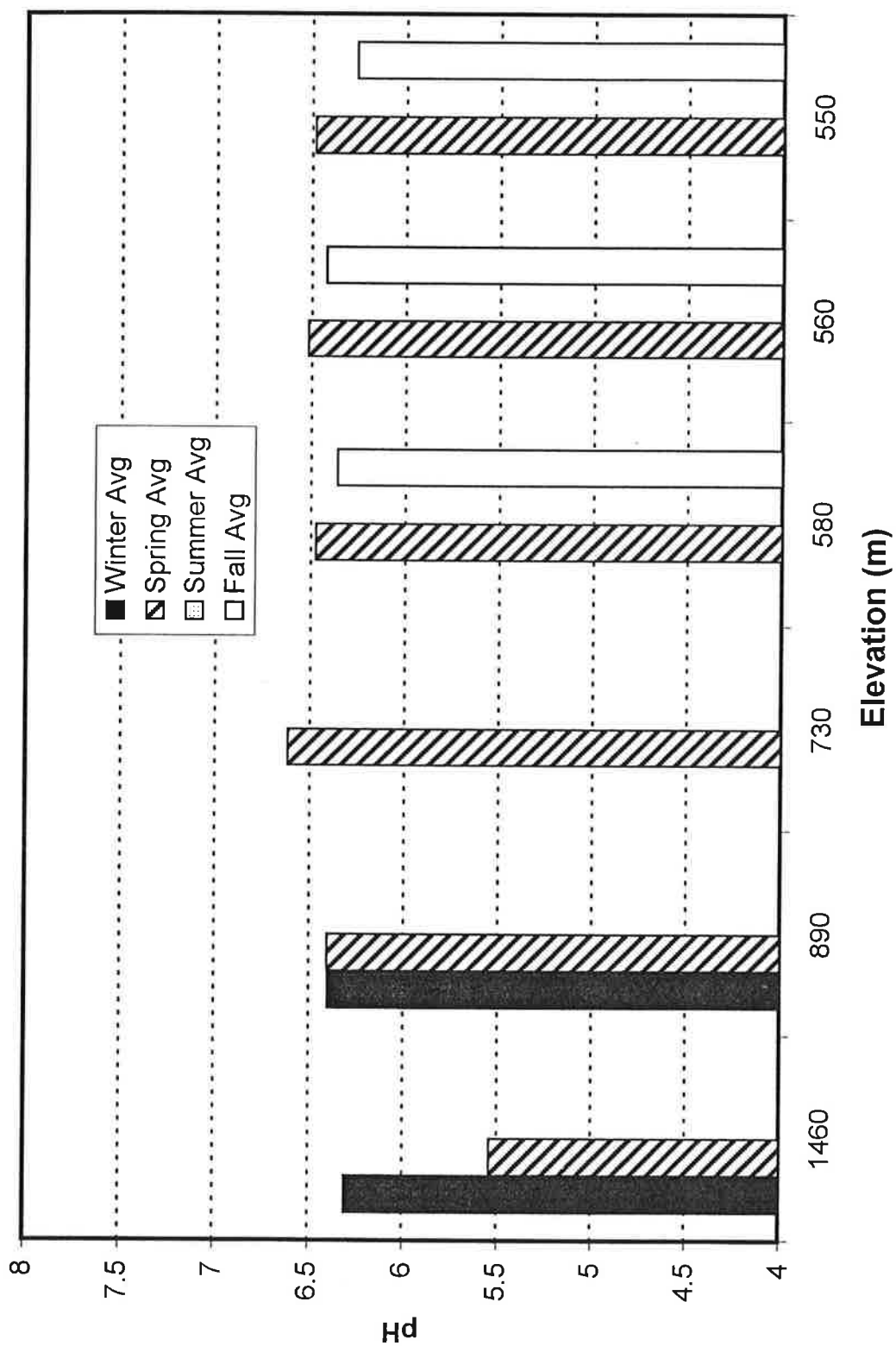


Figure 36. Change in average stream pH with elevation during different seasons on the tributaries of Eagle Creek.

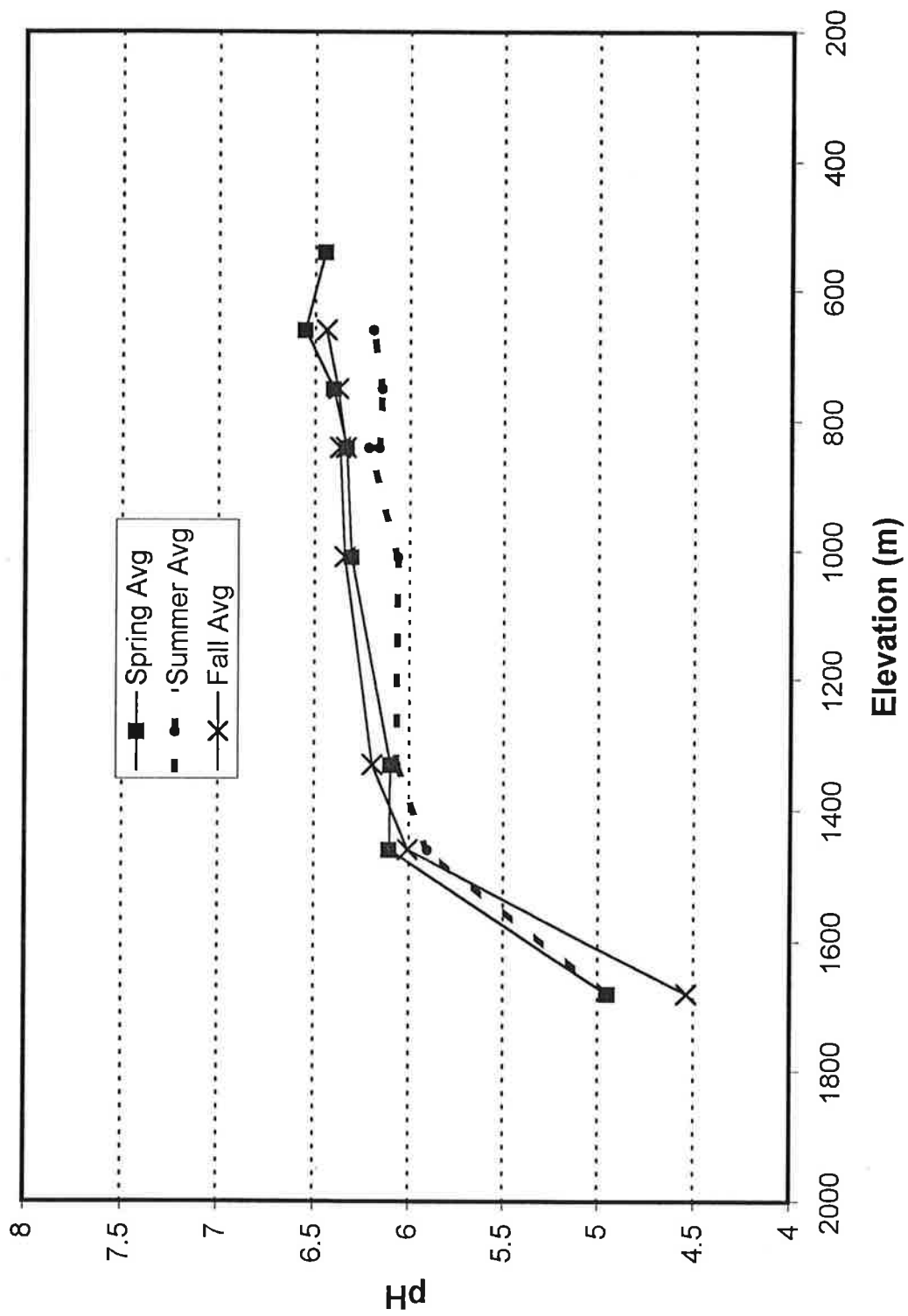


Figure 37. Change in average stream pH with elevation during different seasons on the mainstem of Forney Creek.

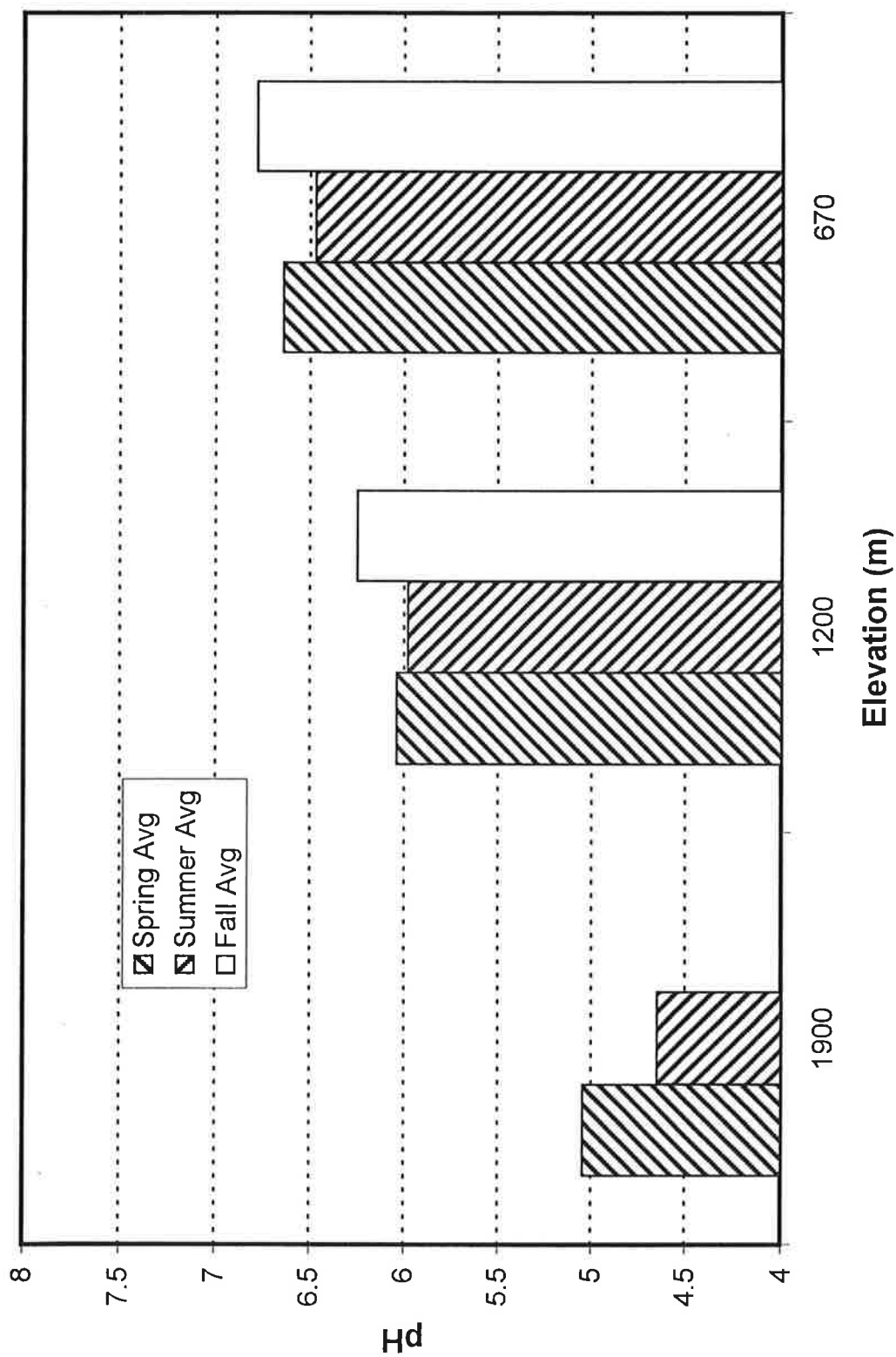


Figure 38. Changes in average stream pH with elevation during different seasons on the tributary sites of Forney Creek.

The case with Noland Creek is less severe than for Forney Creek but nevertheless, pH values at high elevations drop to around 5.5 (Figure 39). Monitoring at Noland Divide Watershed in the headwaters of Noland Creek indicates that pH drops to around 4.5 when monitored continuously. The pH can also be low for other tribs at high elevation (Figure 40, sites described below) but pH rises rapidly downstream.

Site Number	Noland Creek Tributary Site Descriptions	Elevation (m)
243	Clingmans Creek (Noland Creek)	1700
245	Sassafras Branch (Noland Creek)	1080
359	Springhouse Branch (Noland Creek)	1010
249	Unnamed trib just below site 248	900
319	Slab Cove Branch (Noland Creek)	770
317	Unnamed trib to Goldmine Branch Noland	770
318	Unnamed trib to Goldmine Branch Noland	680
321	Bearpen Branch at campsite 65	610

Hazel Creek This stream is similar to Middle Prong Little River and Twentymile Creek in having relatively high pH at the highest elevations sampled (Figure 41). Hazel Creek is unique in that there is a former copper mine draining into Little Fork that does not appear to influence pH at this time (Figure 42, sites described below).

Site Number	Hazel Creek Tributary Site Descriptions	Elevation (m)
486	Unnamed trib to Hazel on Cascades Trail	1250
223	Proctor Creek (Hazel Creek)	930
199	Unnamed trib at campsite 82 (Hazel)	850
481	Little Fork above Sugar Fork Trail	850
482	Sugar Fork above Little Fork	840
485	Walker Creek above Hazel Creek Trail	790
483	Sugar Fork above Haw Gap Creek	730
310	Bone Valley Creek (Hazel Creek)	690
480	Haw Gap Creek at bridge near campsite 84	670

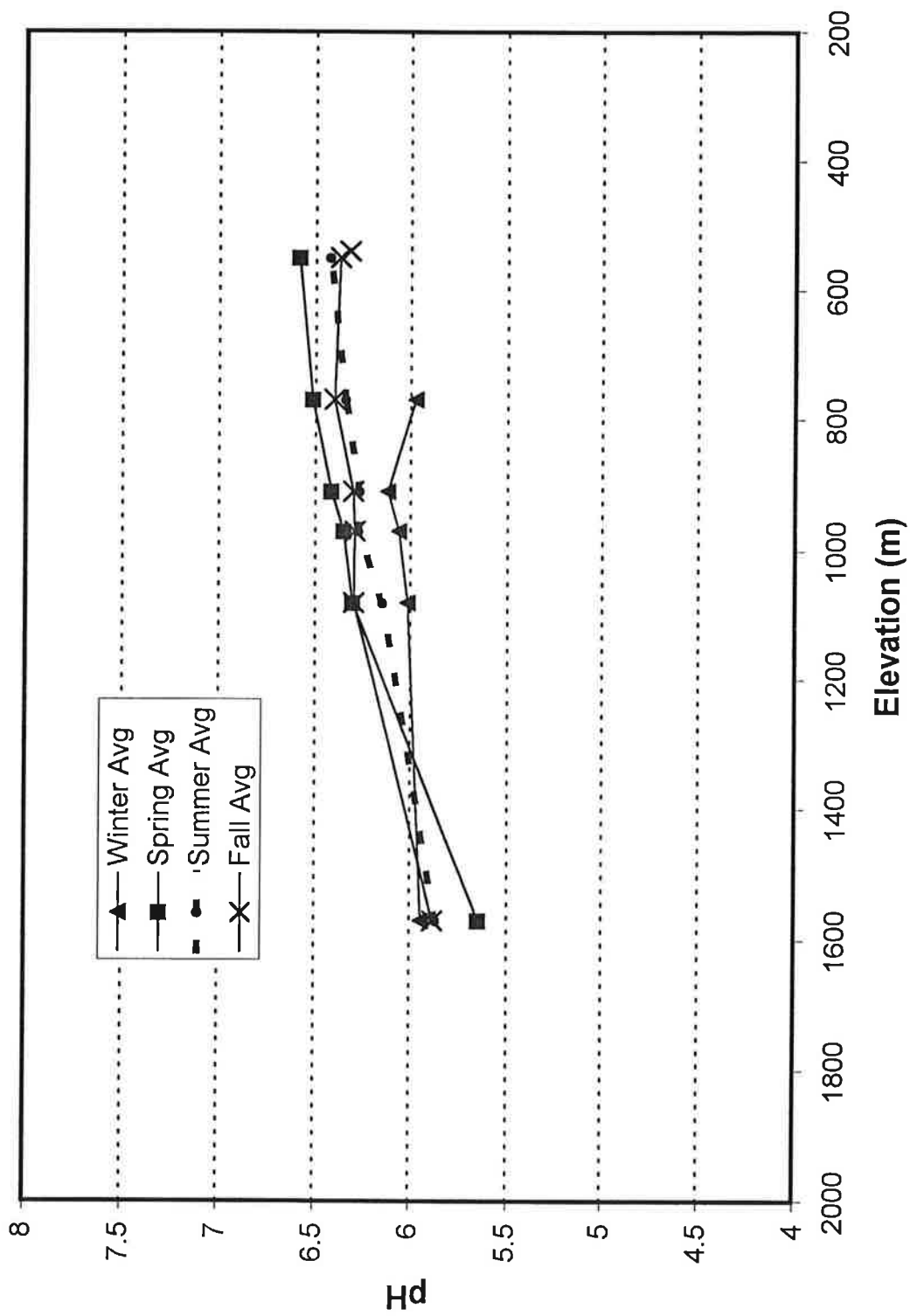


Figure 39. Change in average stream pH with elevation during different seasons on the mainstem of Noland Creek.

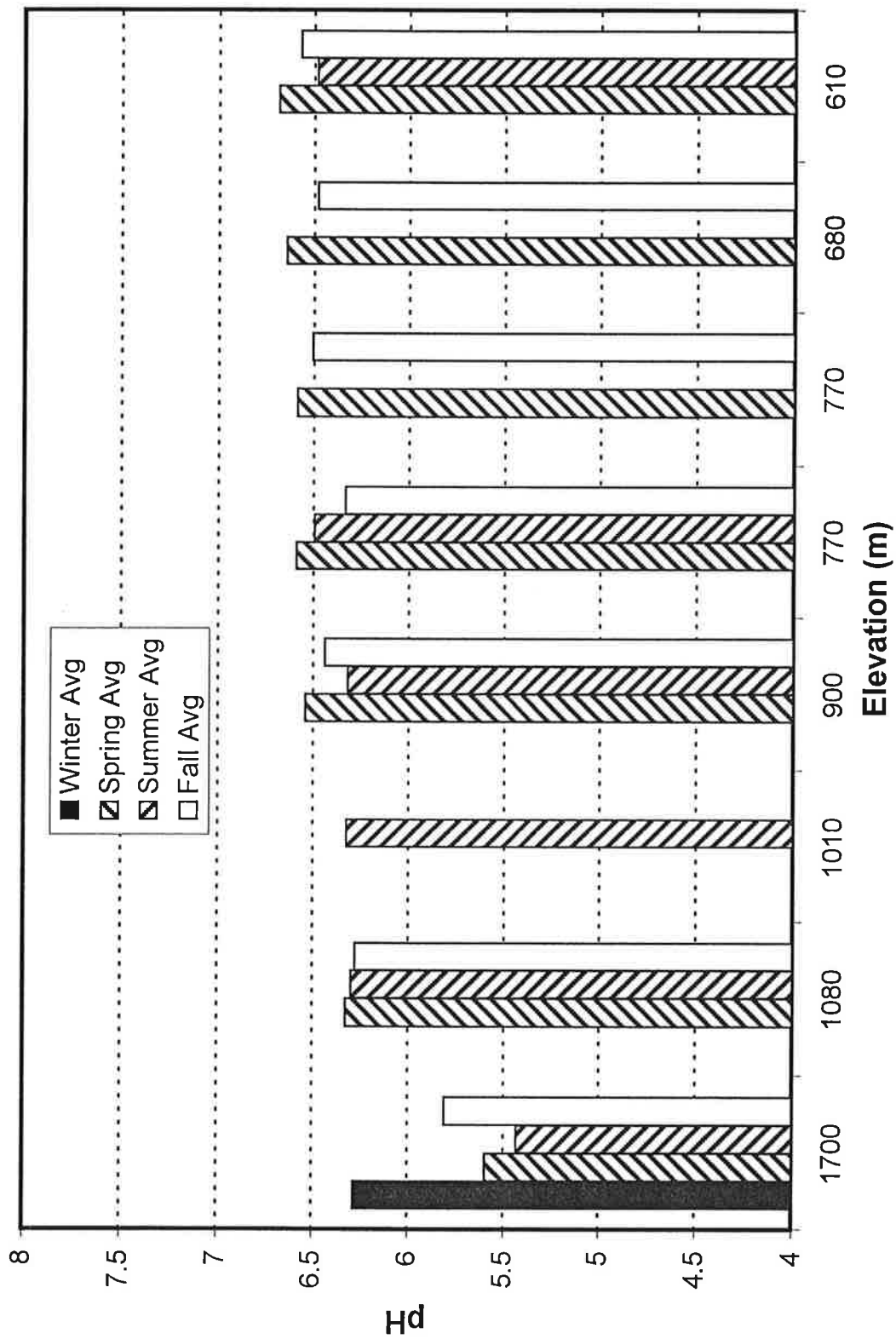


Figure 40. Change in average stream pH with elevation during different seasons on the tributary streams of Noland Creek.

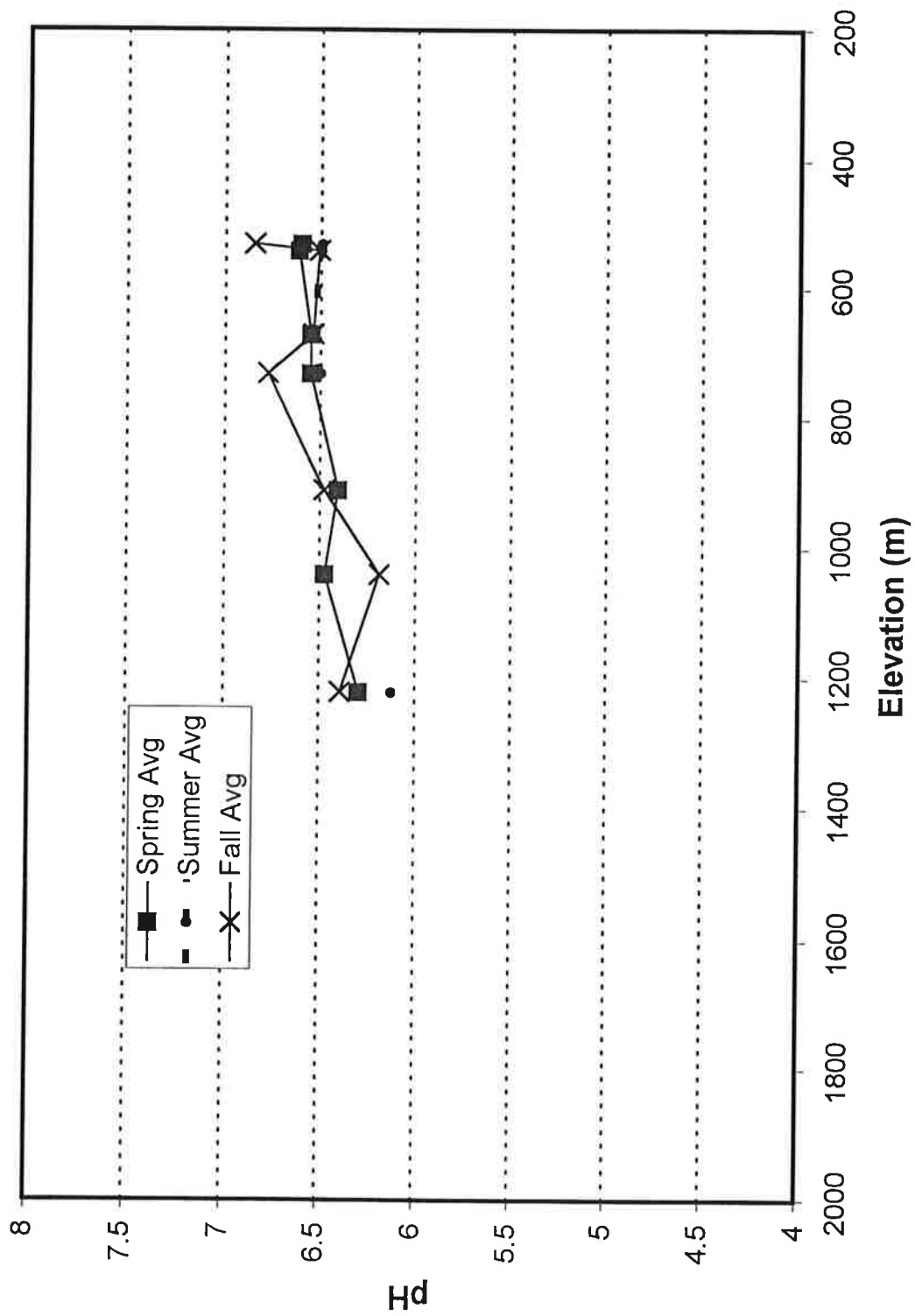


Figure 41. Change in average stream pH with elevation during different seasons on mainstem sites of Hazel Creek.

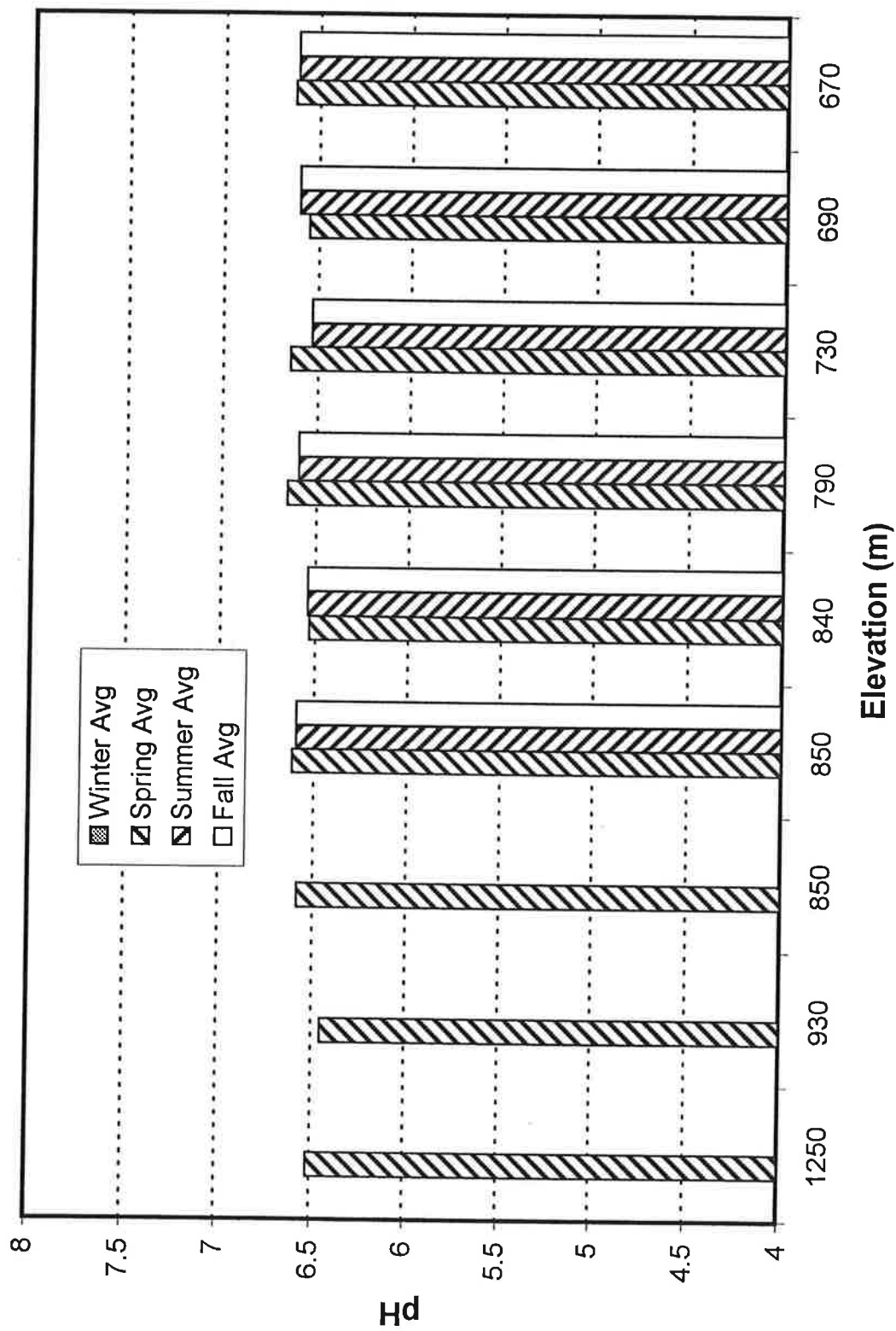


Figure 42. Change in average stream pH with elevation during different seasons on the tributary sites of Hazel Creek.

Deep Creek This stream is relatively monotonous along the sites currently being surveyed with pH values around 6.5 throughout the elevational gradient (Figure 43). Right now the sampling is being done from Thomas Divide down to Deep Creek Campground. It is possible that a completely different picture of the elevational gradient of this stream could be obtained if sampling was done along the Left Fork down from the main ridge of the GRSM. This is a stream system whose sampling regime should be carefully reconsidered.

Oconaluftee River Only the lower section of the Oconaluftee River is considered part of the west central water quality district. The upper part of this stream along Beech Flats Creek was impacted by Anakeesta bedrock that was moved into the upper catchment as roadfill for US 441 in the mid 1960s. The impact of Anakeesta weathering the release of sulfuric acid are still clearly evident today (Figure 44). The pH of the stream recovers to levels near 6.5 by the point where Beech Flats meets Kephart Prong to form the Oconaluftee River. The tributaries sampled (described below) show a gradual increase in pH as elevation declines suggesting the impact of Anakeesta is limited to the roadfill area (Figure 45).

Site Number	Oconaluftee River Tributary Site Descriptions	Elevation (m)
82	Unnamed trib Kephart Pr at Icewater	1800
264	Lower Lower Grassy Branch (Kephart)	1280
99	Lower Grassy Branch (Kephart Prong)	1090
263	Kephart Prong at Kephart Shelter	1090
262	Coon Branch (Kephart Prong)	1020
261	Kephart Prong at 3020 ft	920
362	Kinati Fork (Oconaluftee River)	870
260	Kephart Prong above Beech Flats	850
265	Couches Creek (Oconaluftee River)	640

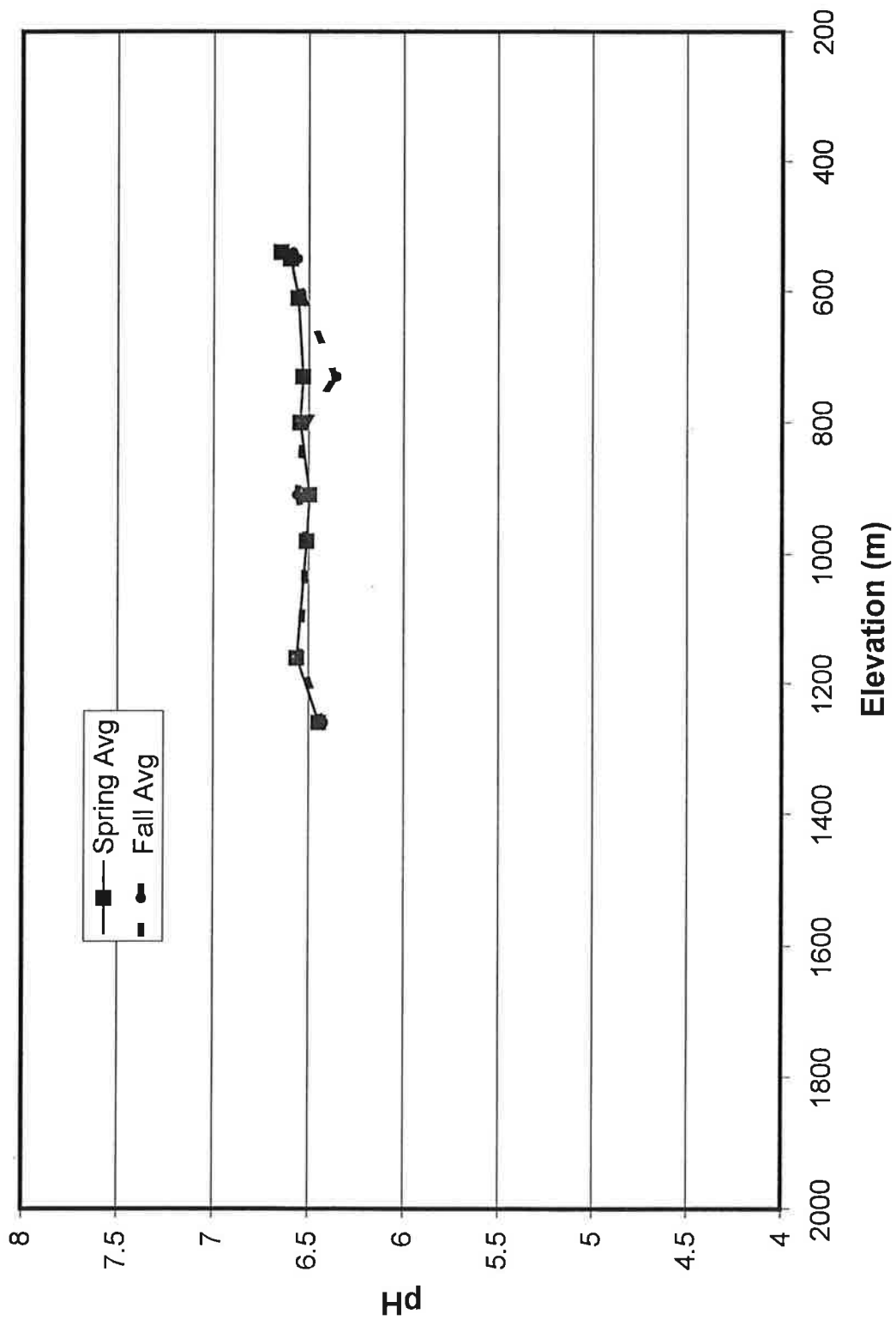


Figure 43. Change in average stream pH with elevation during different seasons on the mainstem of Deep Creek.

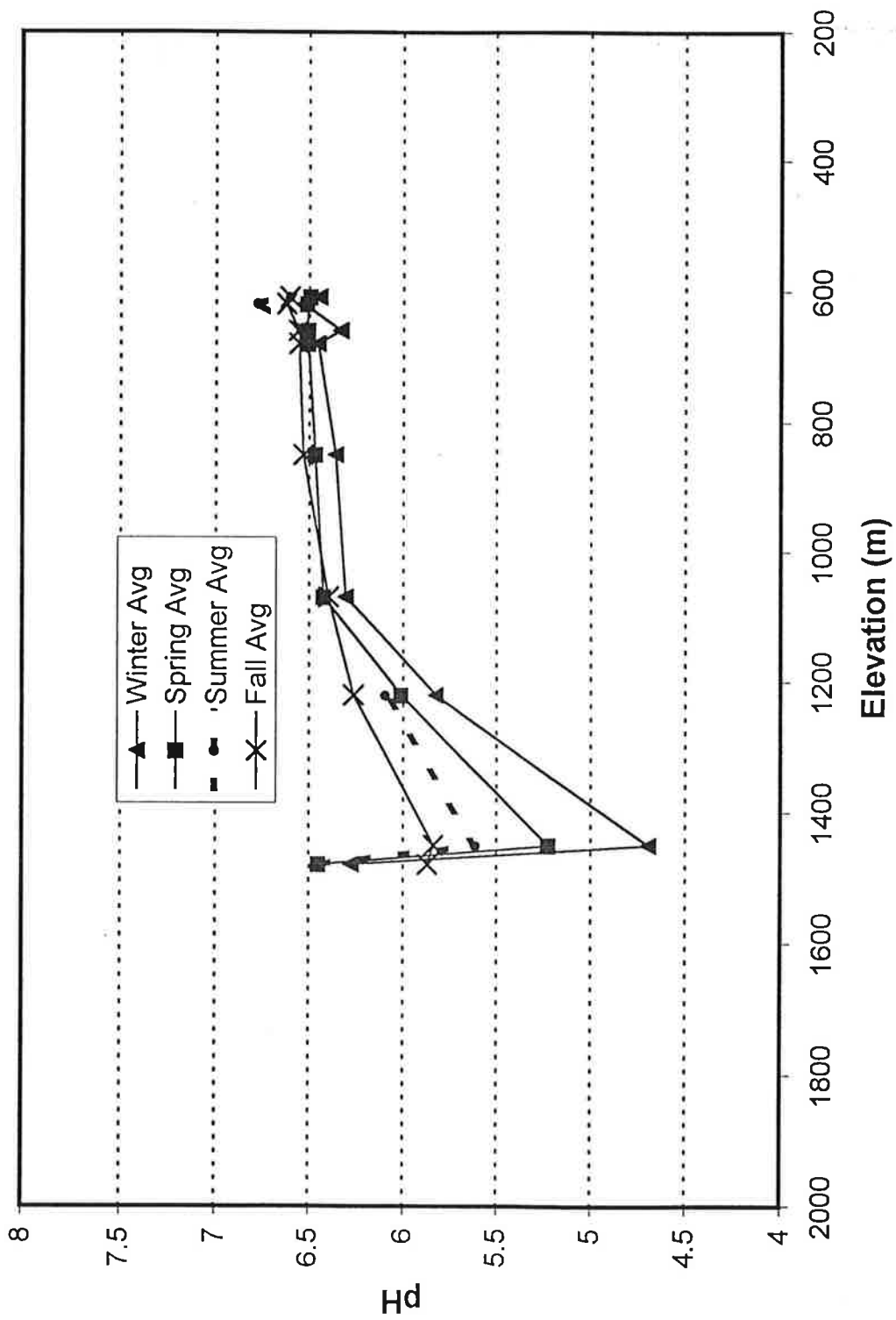


Figure 44. Change in average stream pH with elevation during different seasons on the mainstem of the Oconaluftee River.

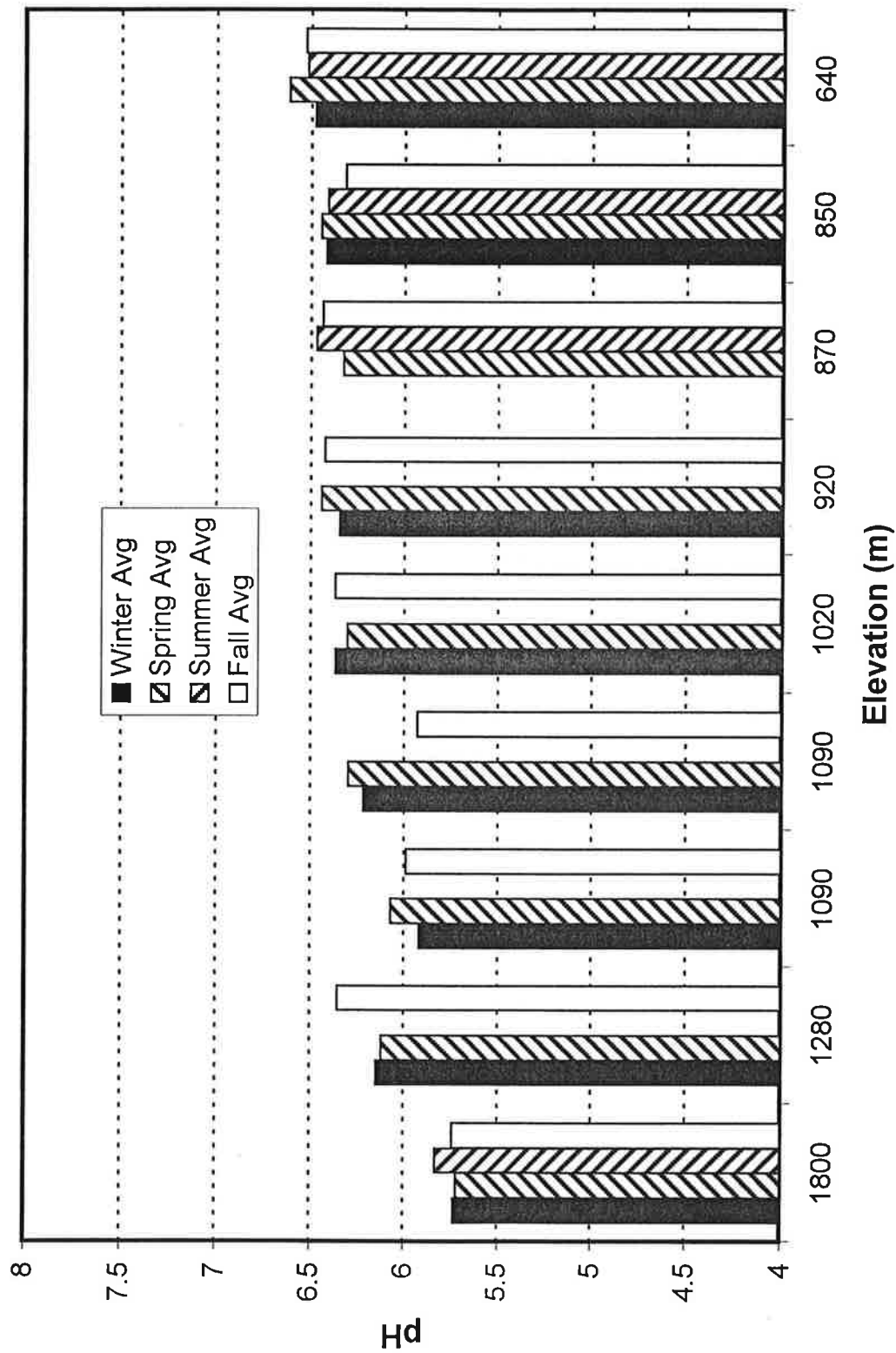


Figure 45. Change in average stream pH with elevation during different seasons on the tributary streams to the Oconaluftee River.

Bradley Fork This major tributary to the Oconaluftee River has fairly low pH considering the upper sampling sites are at less than 1100 m (Figure 46). There have been reports of reduced invertebrate abundance and shifts in species composition in this stream due speculatively to pH being below about 6.0. Most of the tributaries (described below) have average pH values above 6.0 however and Taywa Creek, site of a brook trout restoration project, appears to be in good shape at this time (Figure 47).

Site Number	Bradley Fork Tributary Site Descriptions	Elevation (m)
275	Unnamed trib to Chasteen Creek	1250
278	Upper Taywa Creek	1220
274	Unnamed trib to Chasteen Creek	1210
273	Unnamed trib to Chasteen Creek	1170
367	149C	1070
272	Unnamed trib at campsite 48	1070
279	Lower Taywa Creek	1030
271	Chasteen Creek at campsite 50	720

Big Creek, Cataloochee Creek, Bunches Creek and Straight Fork These streams form the east water quality district and they all have basically the same patterns of pH change over the elevational gradient. The pH at the upper sites can be below 6.0 such as in the main stem of Big Creek (Figure 48). This pattern does not arise in the mainstem of Cataloochee Creek mainly because Lost Bottoms Creek was chosen as the upper site for the stream (Figure 49). Other tributary sites (described below) on Cataloochee Creek have lower pH (Figure 50) as do tributaries (described below) in Big Creek (Figure 51). The same thing occurs in Straight Fork (Figure 52) and to a lesser extent in Bunches Creek

although there are only two sites in the mainstem of Bunches Creek (Figure 53). In all of these streams the pH increases to around 6.5 at lower elevations.

Site Number	Cataloochee Creek Tributary Site Descriptions	Elevation (m)
290	Bear Branch at campsite 42 (Cataloo)	1680
130	Onion Bed Branch (Cataloochee Cr)	1260
129	Pretty Hollow Creek at log bridge	1160
140	Falling Rock Creek (Cataloochee Cr)	1070
141	Beech Creek above Falling Rock Creek	1070
294	Caldwell Fork near campsite 41	990
127	Pretty Hollow Cr above Palmer Cr	870
297	Caldwell Fork below Sag Branch	850
293	Rough Fork at Caldwell House	830
145	Caldwell Fork above Cataloochee Creek	800
339	Little Cataloochee (use 148 instead)	750

Site Number	Big Creek Tributary Site Descriptions	Elevation (m)
116	Rocky Branch at Cosby Shelter	1410
117	Unnamed trib to Big Creek	1280
118	Upper Big Creek	1160
124	Upper Low Gap Branch (Big Creek)	1160
119	Unnamed trib to Big Creek	1130
120	Big Creek above Gunter Fork area	1130
122	Lower Gunter Fork (Big Creek)	1030
123	Lower Low Gap Branch (Big Creek)	980
121	Big Creek at Gunter Fork crossing	970
136	Kilby Branch (Big Creek)	570
7	Chestnut Creek at Ranger Sta	520

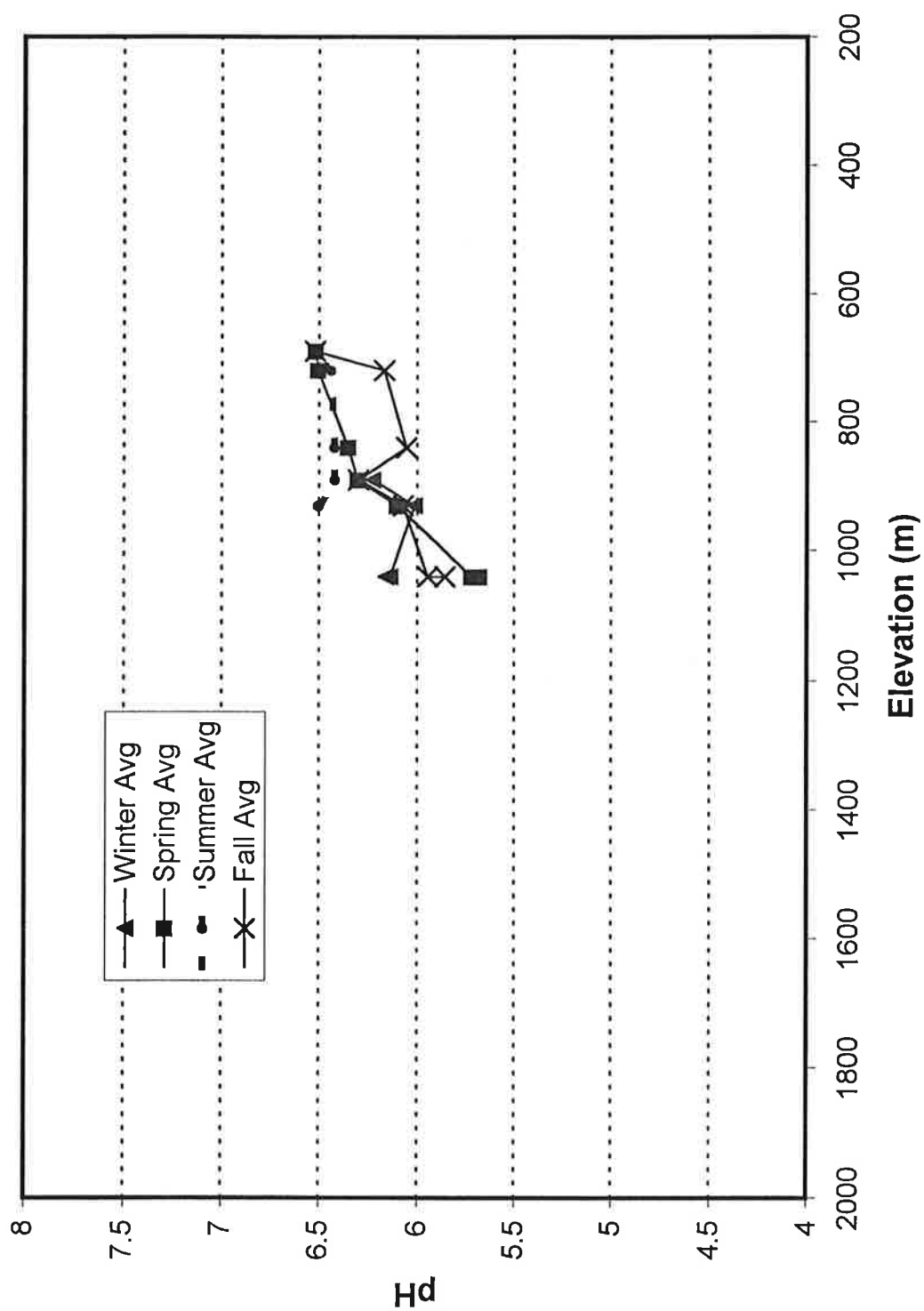


Figure 46. Change in average stream pH with elevation during different seasons on the mainstem of Bradley Fork.

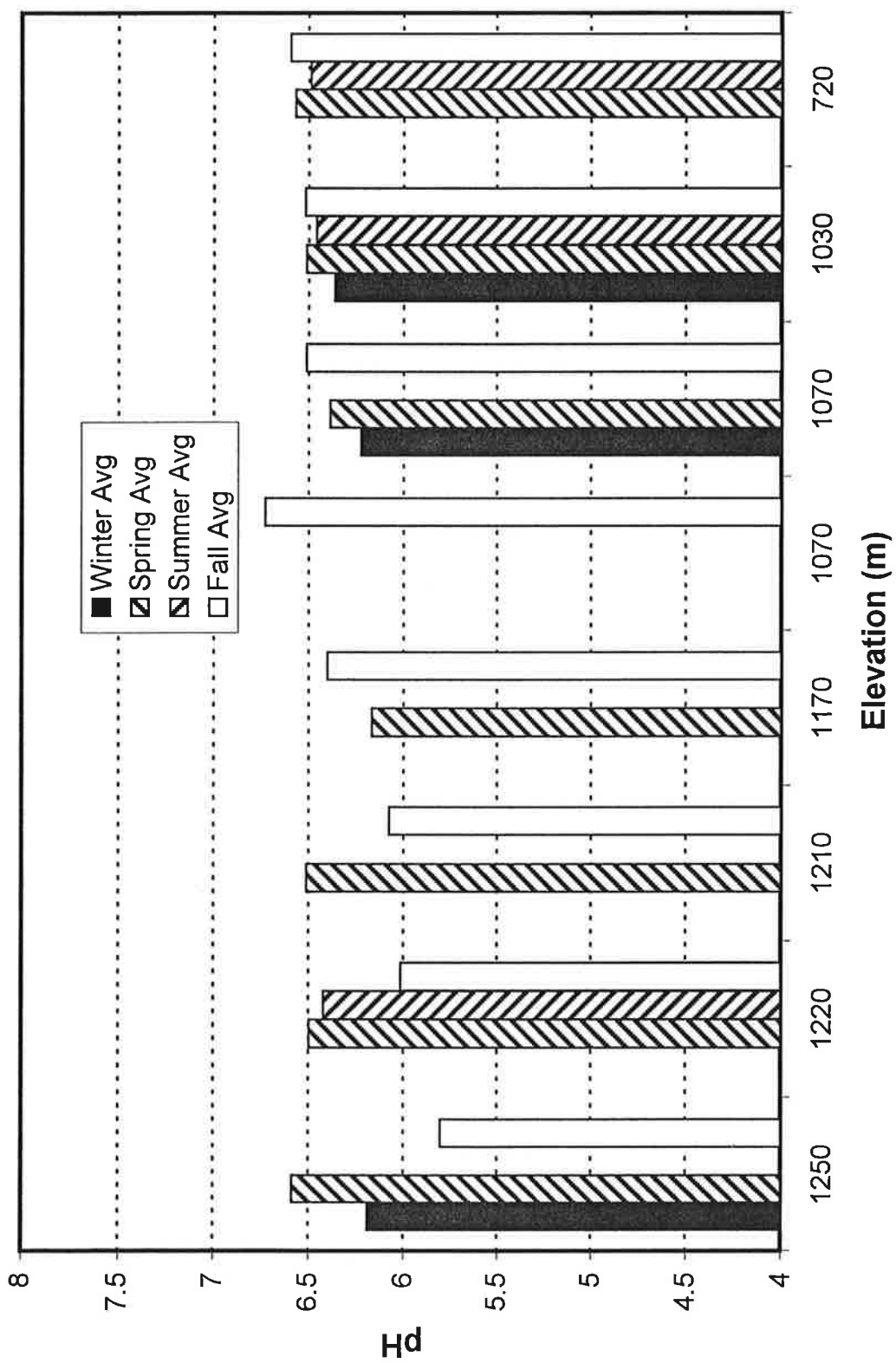


Figure 47. Change in average stream pH with elevation during different seasons in the tributaries on Bradley Fork.

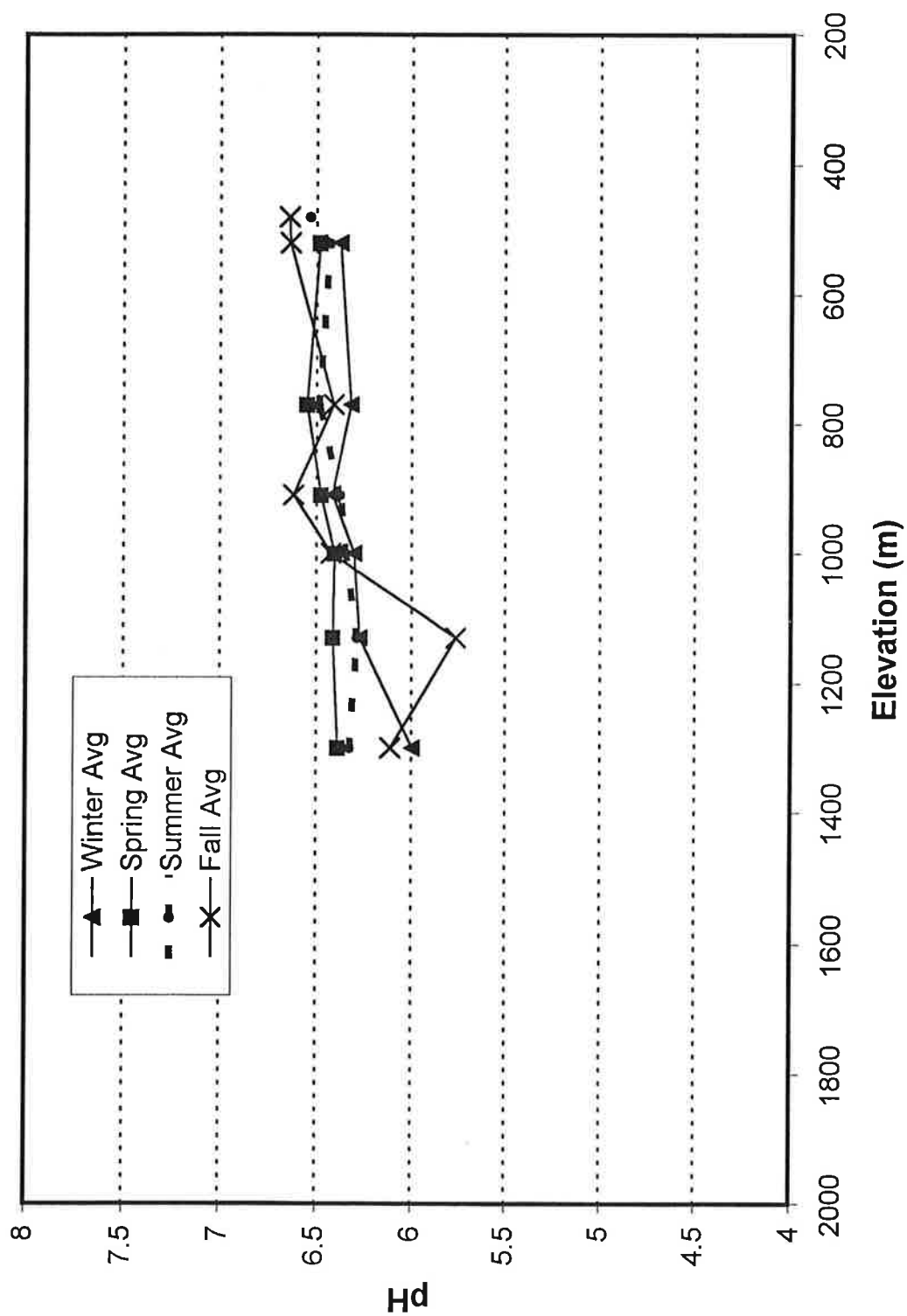


Figure 48. Change in average stream pH with elevation during different seasons for mainstem sites on Big Creek.

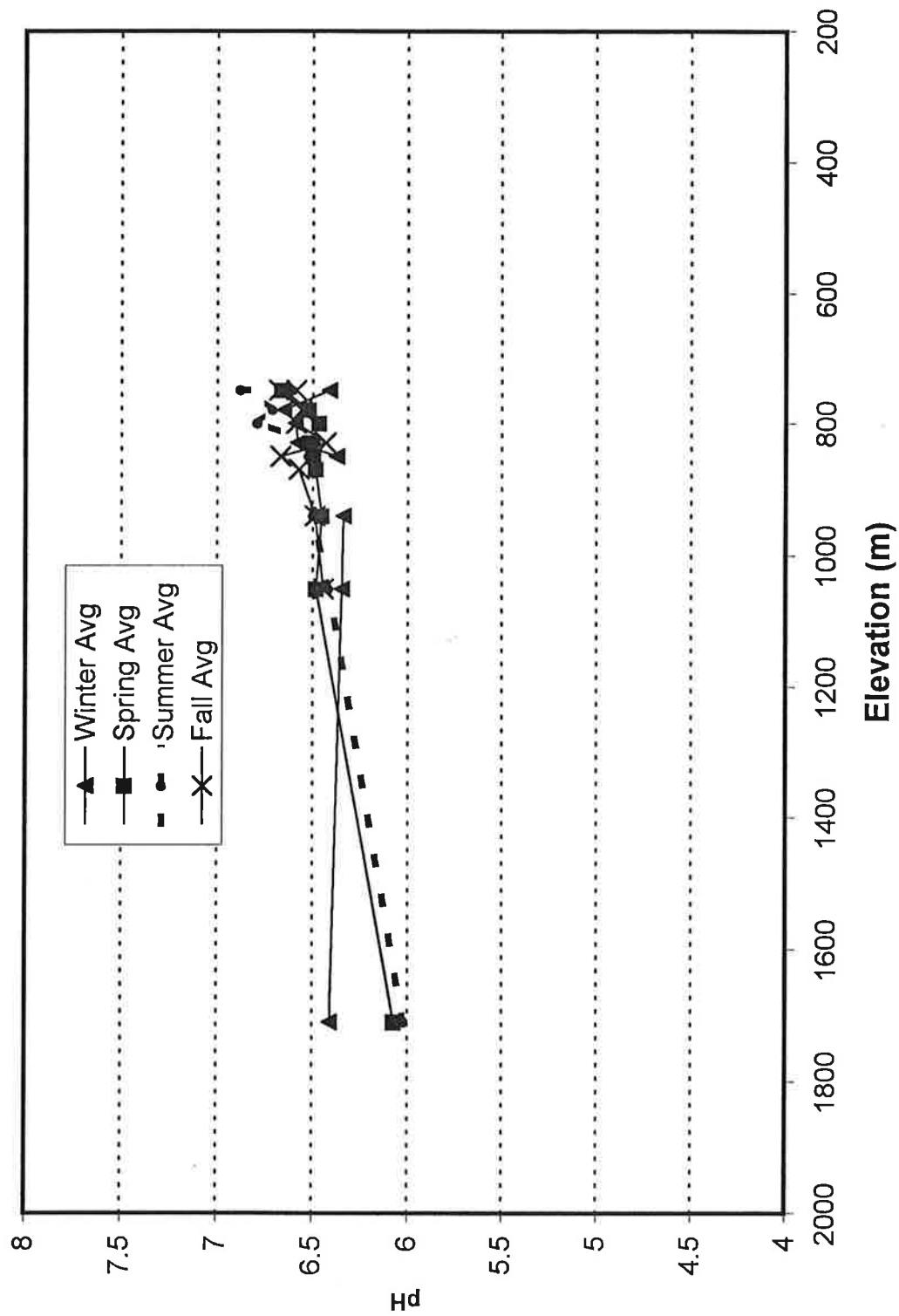


Figure 49. Change in average stream pH with elevation during different seasons for the mainstem sites of Cataloochee Creek.

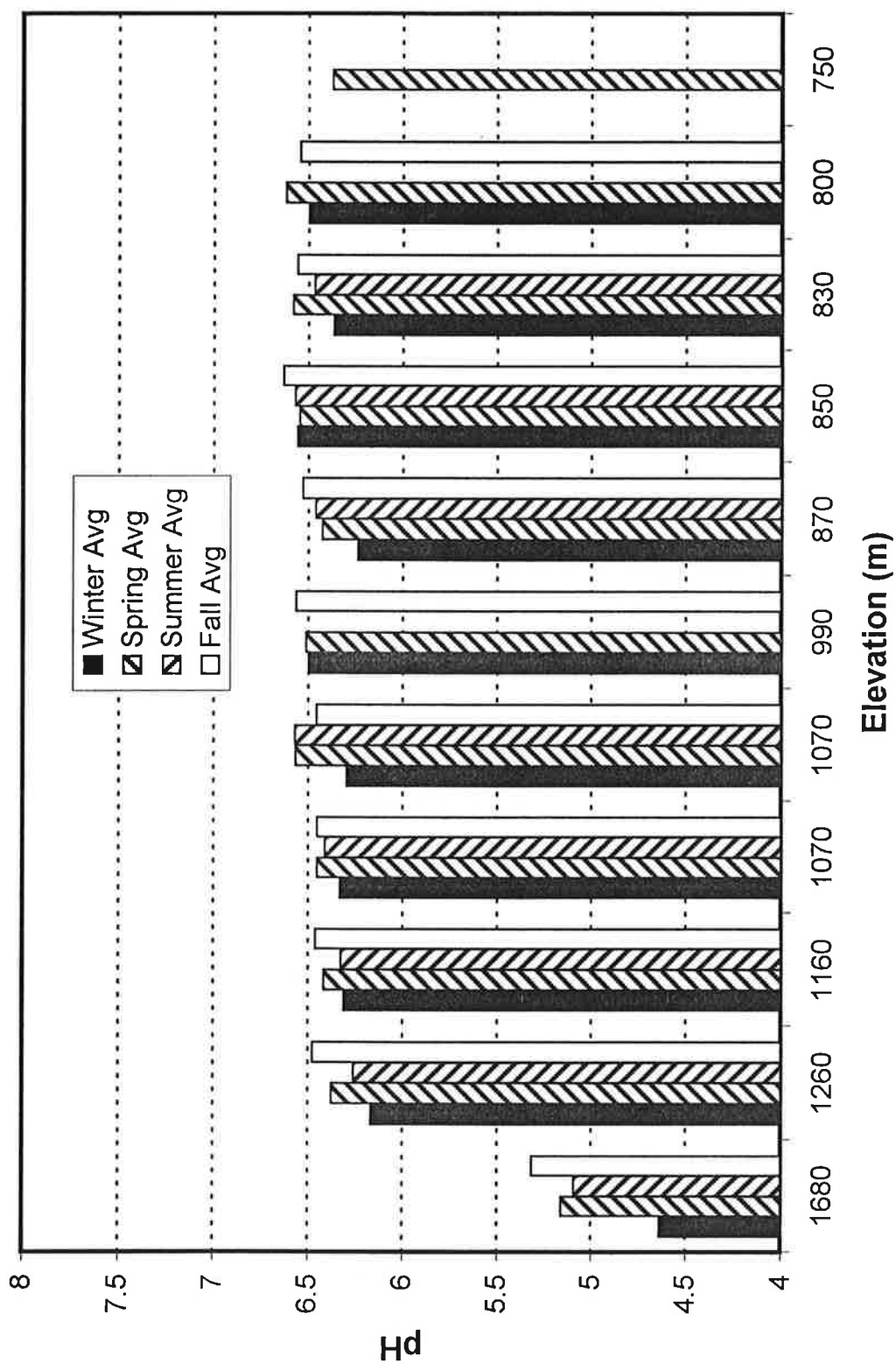


Figure 50. Changes in average stream pH with elevation during different seasons for tributary sites in Cataloochee Creek.

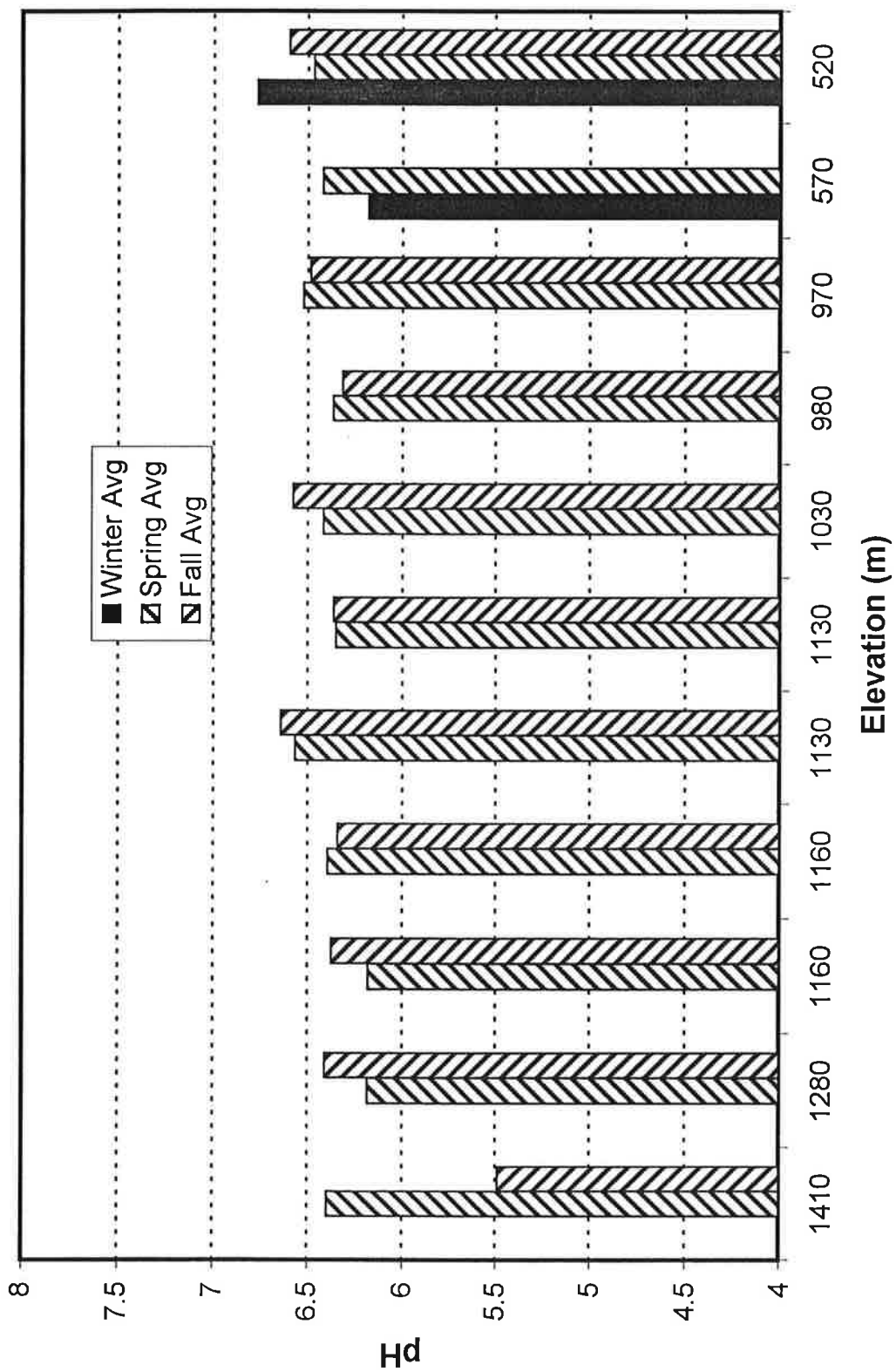


Figure 51. Change in average stream pH with elevation during different seasons for tributaries in Big Creek.

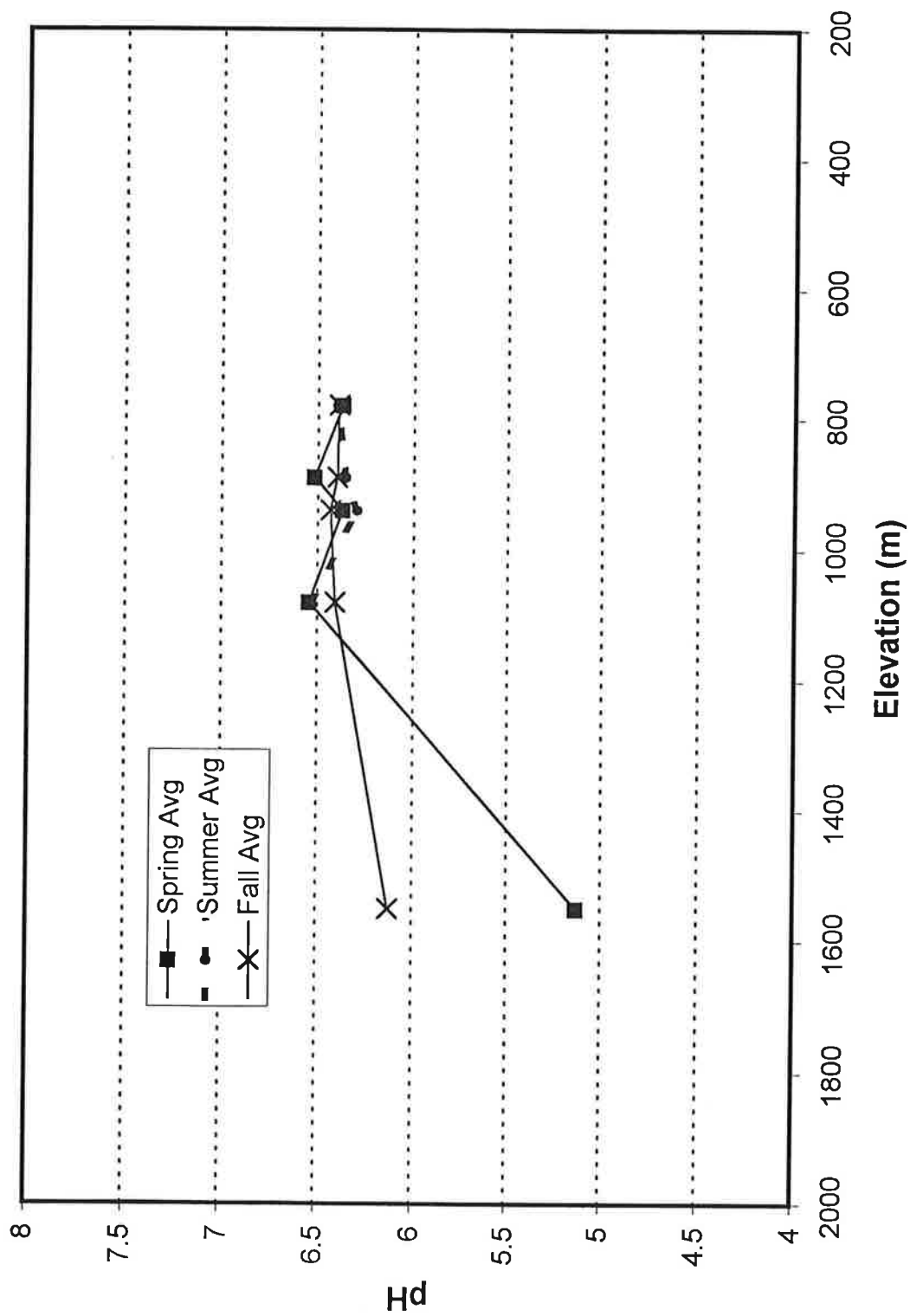


Figure 52. Change in average stream pH with elevation during different seasons on the mainstem of Straight Fork.

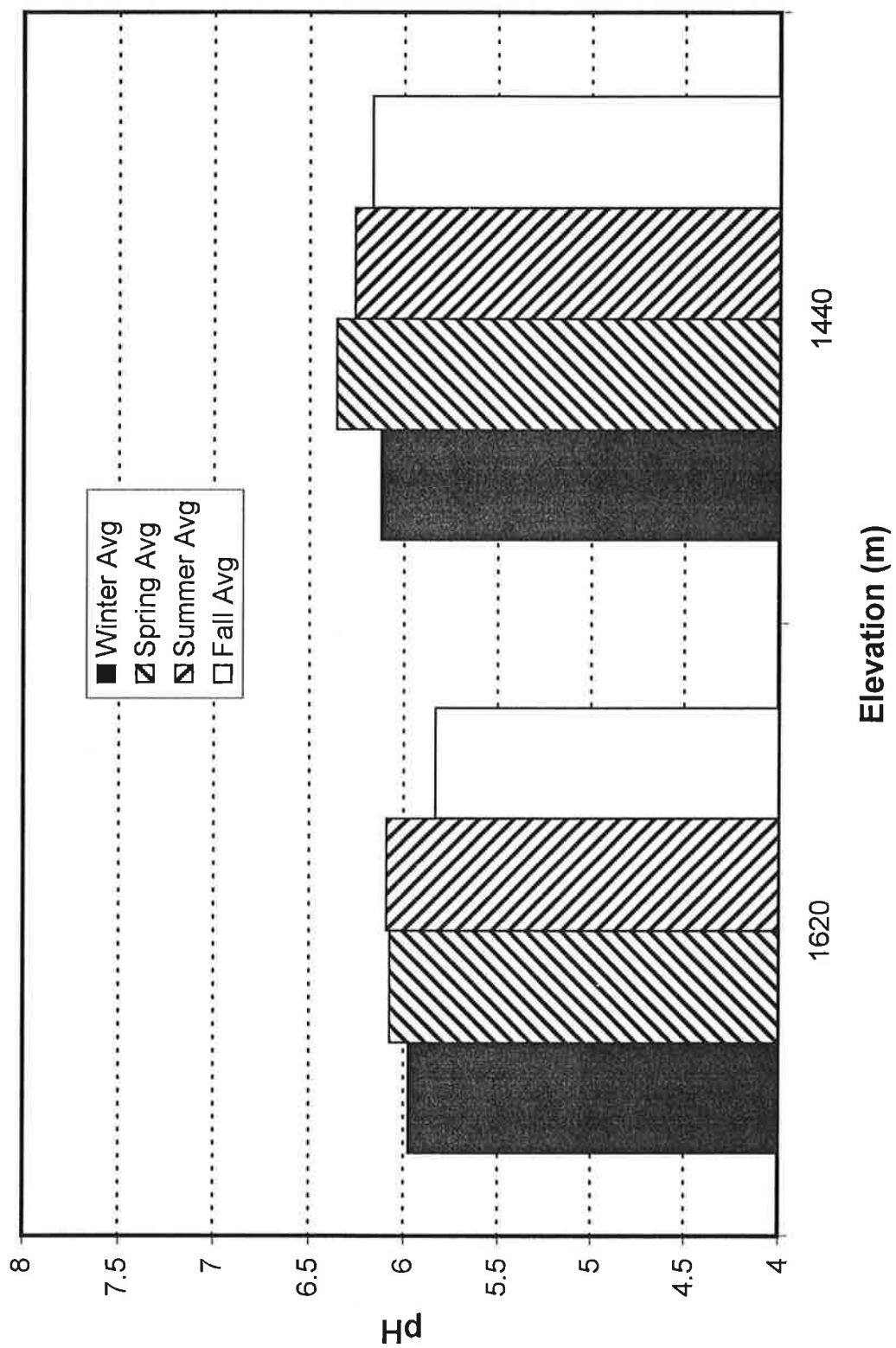


Figure 53. Change in average stream pH with elevation during different seasons on the mainstem of Bunches Creek.

Anakeesta Impacted Streams The pattern of pH change in Beech Flats Creek illustrates the effects that Anakeesta weathering has on stream water chemistry (Figure 54). The upper site at 1480 m is above the roadfill material, the site at 1450 m is just below the roadfill, and the remaining sites are downstream. The pH decline below the roadcut is obvious and is worst in the winter when flow is generally higher.

The effect of Anakeesta is marked in the *Middle Prong of the Little Pigeon River* (Figure 55). The pH in that stream does not reach 6.0 until the stream drops to about 500 m in elevation. Many of the tributary streams (described below) are also impacted by Anakeesta and have pH values below 6.0 (Figure 56).

Site Number	Select Tributaries on Middle Prong Little Pigeon	Elevation (m)
334	Trillium Branch at Brushy Mtn Tr.	1140
44	Upper Cannon Creek at 3400 ft.	1040
45	Shutts Prong at 3200 ft.	980
333	Boulevard Prong above Shutts Prong	840
46	Porters Creek above Shutts Prong	840
47	Cannon Creek above Porters Cr.	730
43	Porters Creek at log bridge	630
48	Porters Creek at gate	590
49	Porters Creek at bridge to Ramsay	500

Roaring Fork and LeConte Creek High elevation sites on both Roaring Fork (Figure 57) and LeConte Creek (Figure 58) have pH values less than 5.5 and have been measured as less than 5.0. Even small tributaries near Rainbow Falls at 1240 and 1190 m have pH between 5.0 and 5.5 though Scratch Britches Creek at Twin Creeks Laboratory at 590 m has average pH above 6.5 (Figure 59). Although King *et al.* (1967) map only very small areas

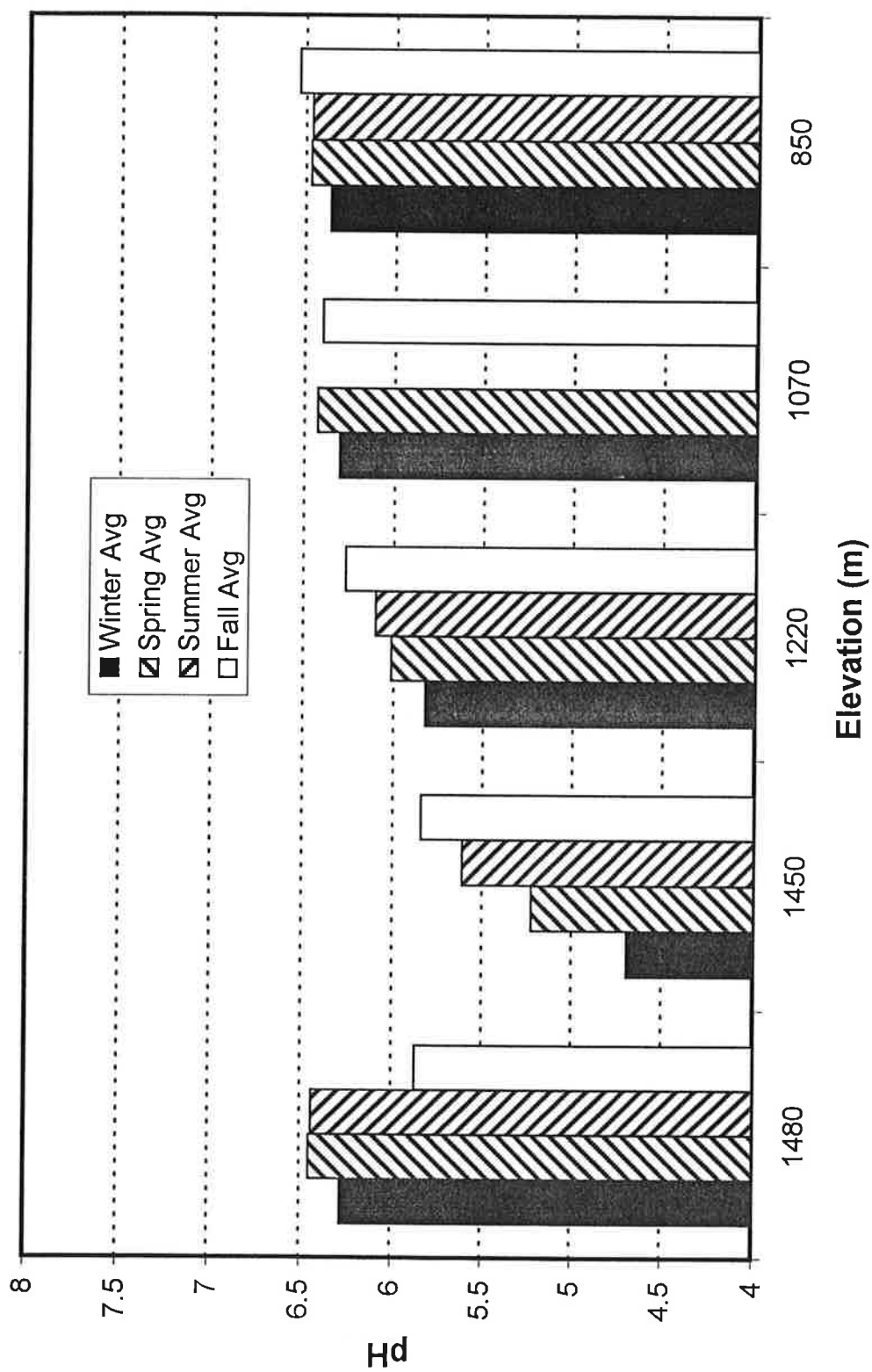


Figure 54. Impact of Anakeesta road fill material on average pH in Beech Flats Creek by season. The site at 1480 m is above the road cut, the site at 1450 m is just below, and the site at 850 m is Beech Flats at the Kephart Prong Trail bridge/trailhead.

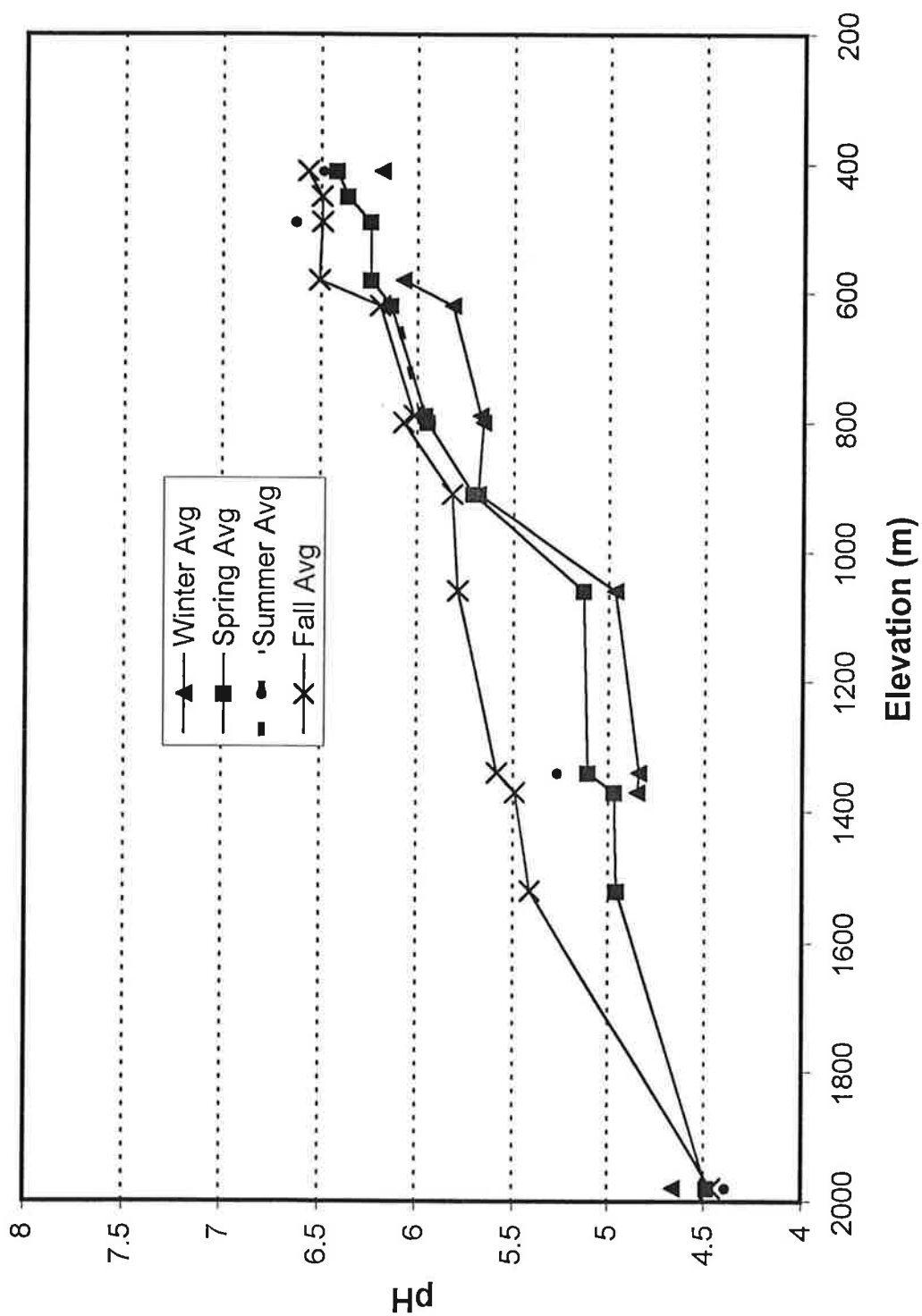


Figure 55. Change in average stream pH with elevation during different seasons for sites on the mainstem of the Middle Prong Little Pigeon River (upper sites on Ramsay Prong).

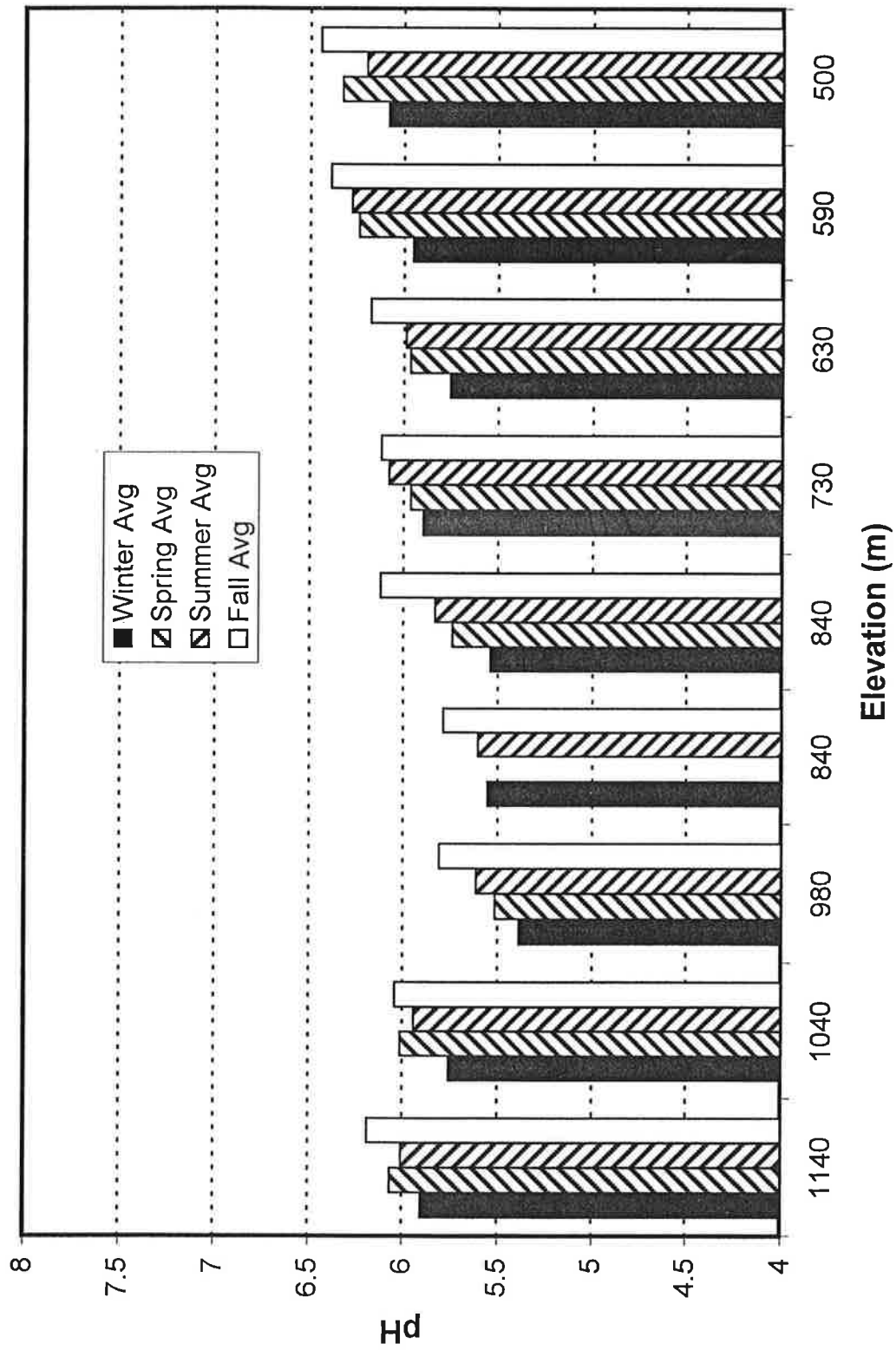


Figure 56. Change in average stream pH with elevation during different seasons for tributary sites on the Middle Prong Little Pigeon River (sites along Porters Creek).

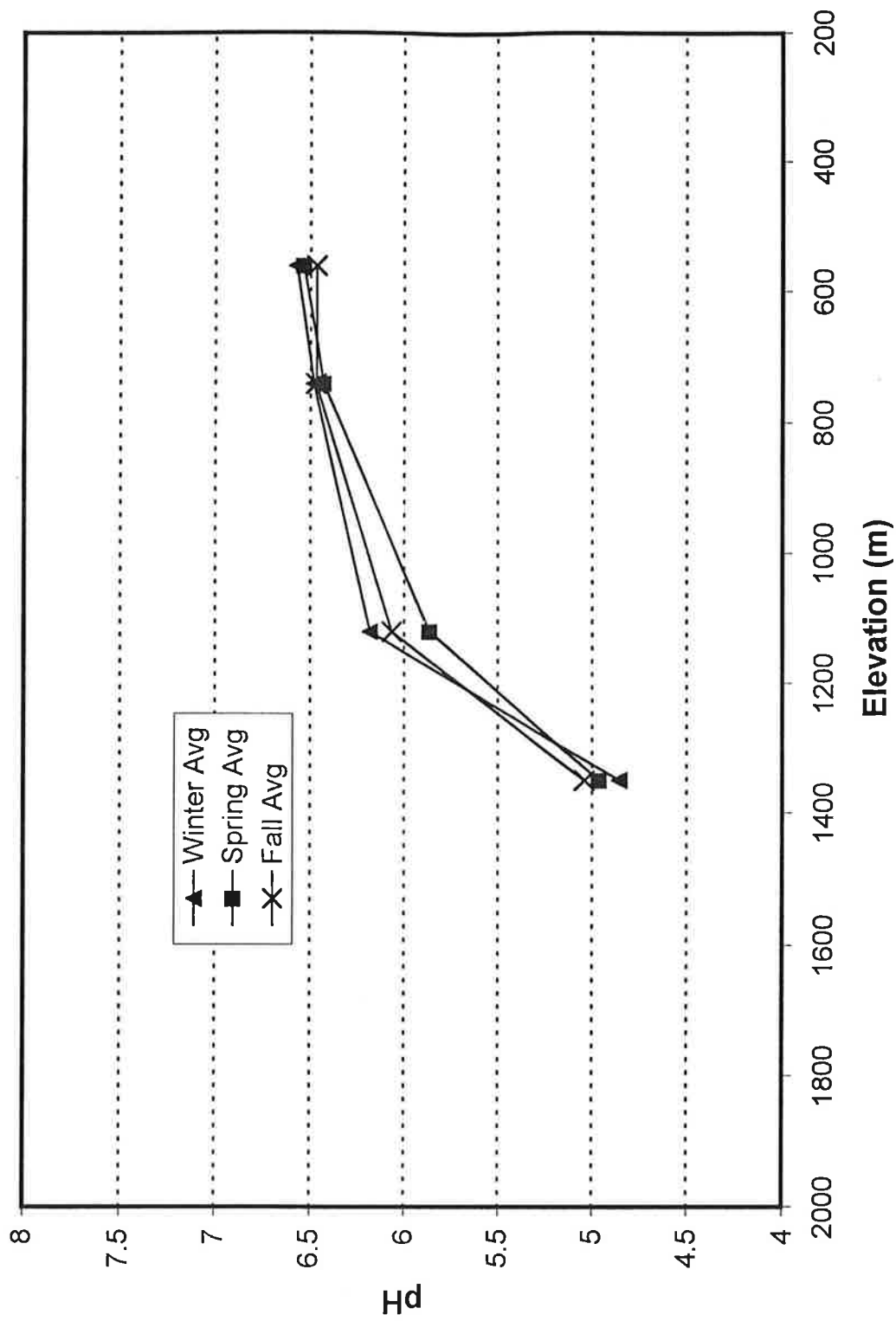


Figure 57. Changes in average stream pH with elevation during different seasons for mainstem sites on Roaring Fork.

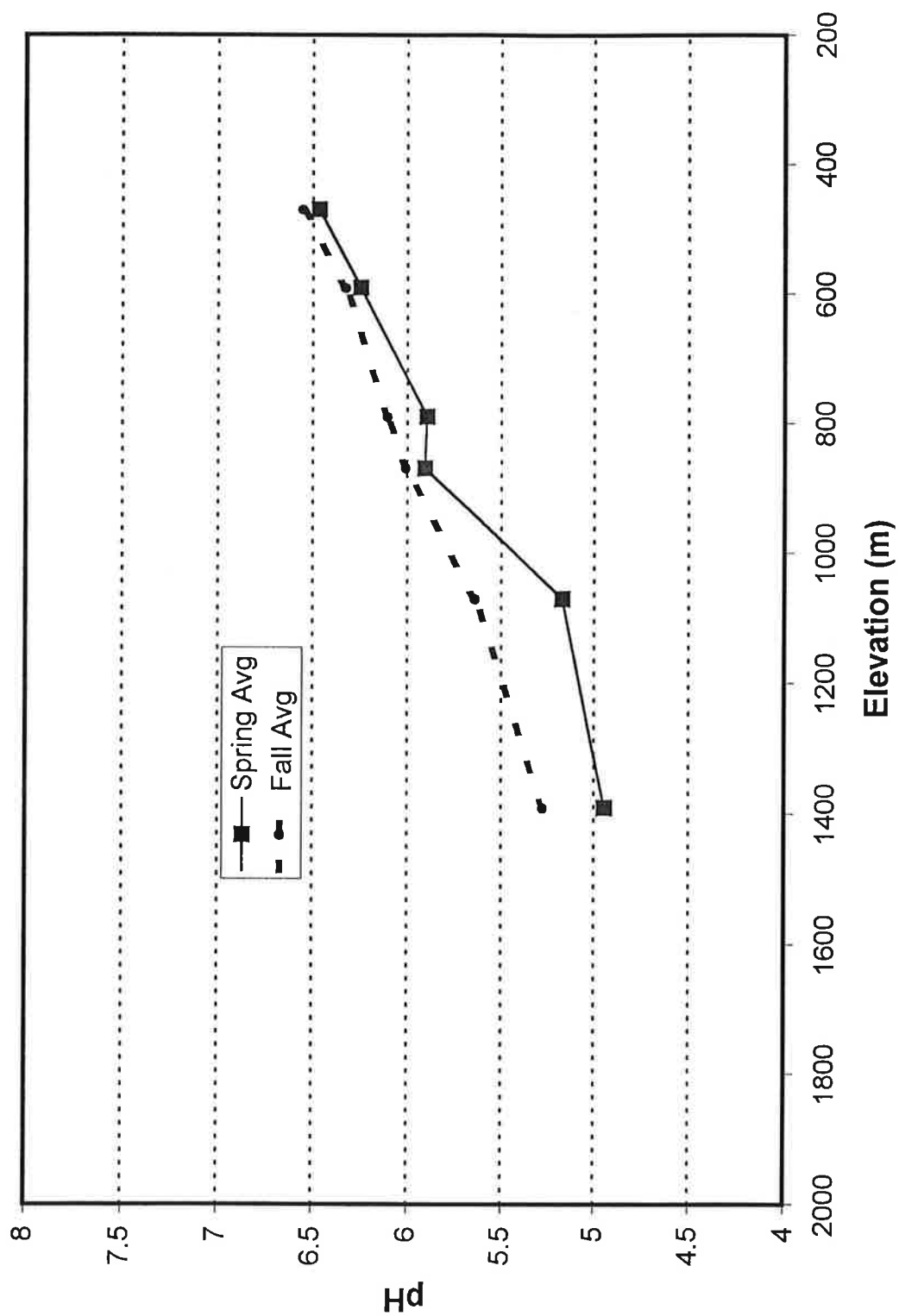


Figure 58. Change in average stream pH with elevation during different seasons for mainstem site on LeConte Creek.

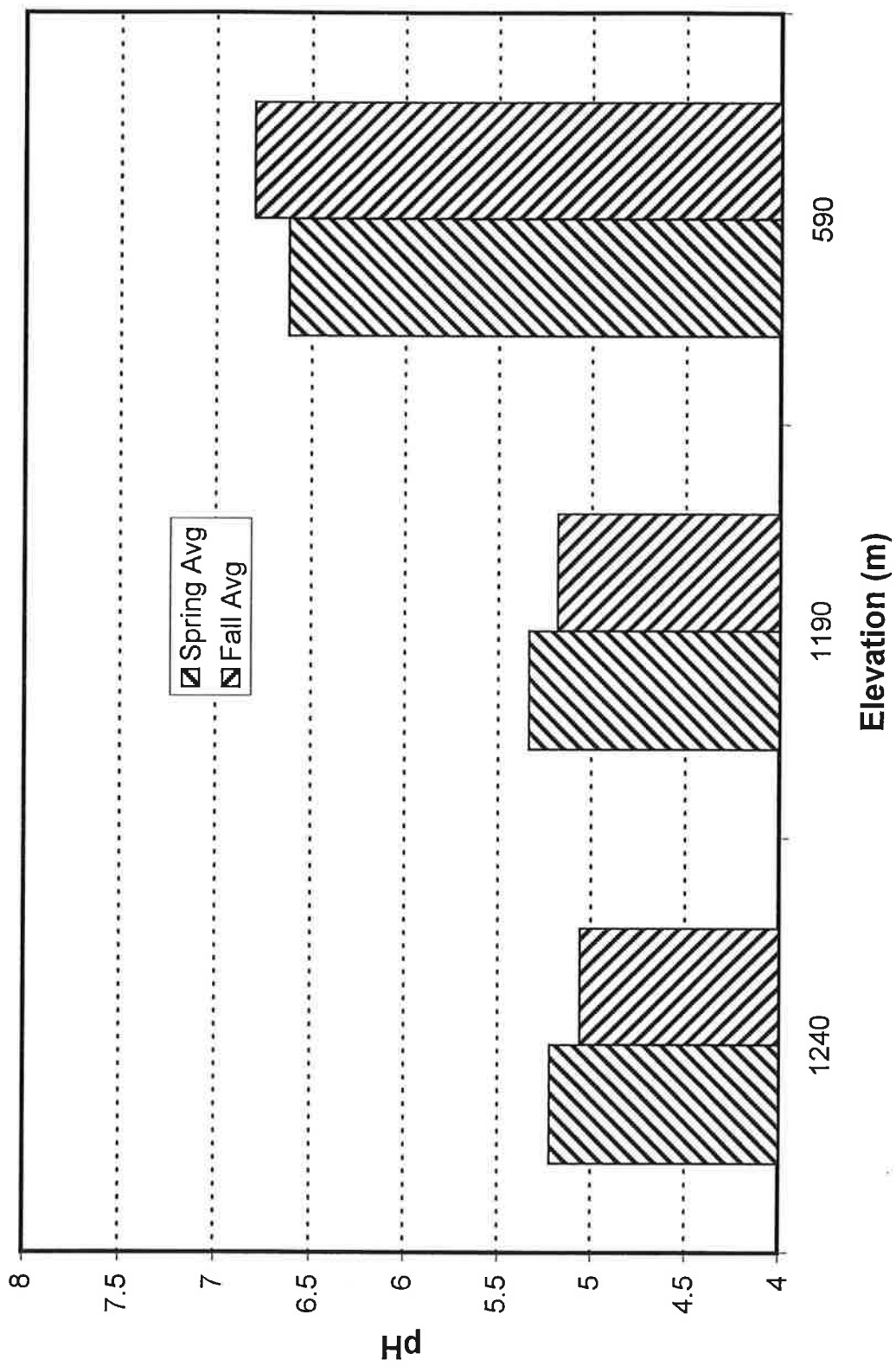


Figure 59. Change in average stream pH with elevation during different seasons for tributary sites on LeConte Creek. The site at 1240 m is near Rainbow Falls and the site at 590 m is Scratch Britches Creek at Twin Creeks Lab.

as being underlain by Anakeesta, the high sulfate signature and low pH suggest it does impact water quality in these streams.

The West Prong Little Pigeon River illustrates how the presence of Anakeesta in combination with the steep slopes of Mt. LeConte work together to impact water quality. The pH of the headwaters area at Walker Camp Prong is below 5.0 but increases rapidly to greater than 6.0 at about 1300 m (Figure 60). The tributaries entering the mainstem from the Mt. LeConte side (sites described below) are very different with respect to water quality than the tributaries entering from the Sugarland Mountain side (described below). The high elevation tributaries on both sides have relatively low pH but the pH remains low for many sites on the Mt. LeConte side (Figure 61) but increases gradually as elevation decreases in the Sugarland Mountain side (Figure 62). Despite the low pH of tributaries on the Mt. LeConte side, pH of the mainstem increases downstream.

Site Number	West Prong Little Pigeon River on Mt. LeConte Side Site Descriptions	Elevation (m)
81	Walker Camp Prong trib at 4900 ft.	1490
80	Unnamed trib to Walker Camp at cascade	1430
78	Unnamed trib to Styx Branch above flood scar	1330
77	Styx Branch above Rock Arch	1300
232	Unnamed trib off US 441 at 4210 ft.	1280
79	Alum Cave Creek above Styx Branch	1250
76	Alum Cave Creek at fish site	1190
75	Alum Cave Creek above Walker Camp Pr	1160
69	Bearpen Hollow at pullout between Alum Cave and Chimneys	1120
65	Upper Big Branch (W Pr Little Pigeon)	870
33	Lower Big Branch (W Pr Little Pig.)	790

Site Number	West Prong Little Pigeon River Sugarland Mtn. Side Site Descriptions	Elevation (m)
242	Spring at Mt Collins Shelter	1780
234	Upper Road Prong	1520
236	Unnamed trib to Walker Camp Prong at site 237	1380
235	Road Prong at only stream crossing	1220
70	Road Prong at Chimneys trail split	1150
71	Road Prong at 3rd bridge on trail	1060
72	Road Prong at 2nd bridge on trail	1020
67	Unnamed trib at Chimneys Picnic area	870
32	Critter Brook (W. Pr. Little Pig.)	620
37	Fighting Creek	470

Old East Streams This district has been referred to as the East Undisturbed district in earlier work. The streams in this district are characterized by relatively high nitrate concentrations extending downstream to relatively low elevations. Part of the Old East district is Road Prong which is a tributary to the West Prong of the Little Pigeon River on the Sugarland Mtn. Side (Figure 62). Although Road Prong has relatively high nitrate, the pH is not particularly low. Raven Fork similarly has relatively high pH (> 6.0) except for a few samples in the spring (Figure 63). A few of the high elevation tributary sites to Raven Fork (described below) such as Enloe Creek also have low pH (<5.5) (Figure 64). As a whole, however, Raven Fork does not have a problem with pH at this time. Cosby Creek does not appear to have a problem with low pH either (Figure 65) except for one tributary site (described below), Inadu Creek, which may be influenced by Anakeesta (Figure 66). There are a few samples from Indian Camp Creek, the other stream system in the Old East district, where pH is below 5.5, but pH is most around 6.0 in that stream (Figure 67).

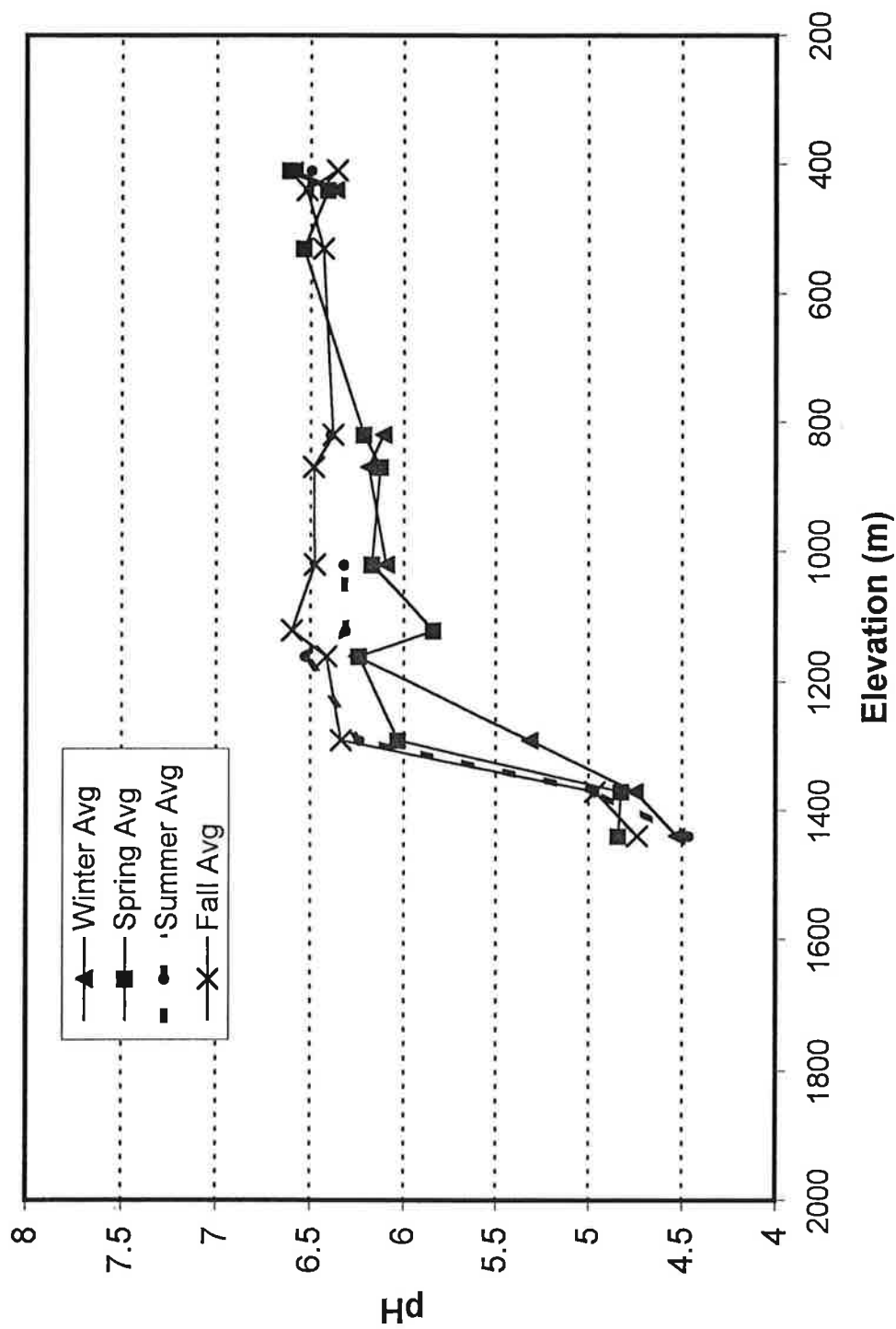


Figure 60. Change in average stream pH with elevation during different seasons for mainstem sites on the West Prong Little Pigeon River (upper sites on Walker Camp Prong).

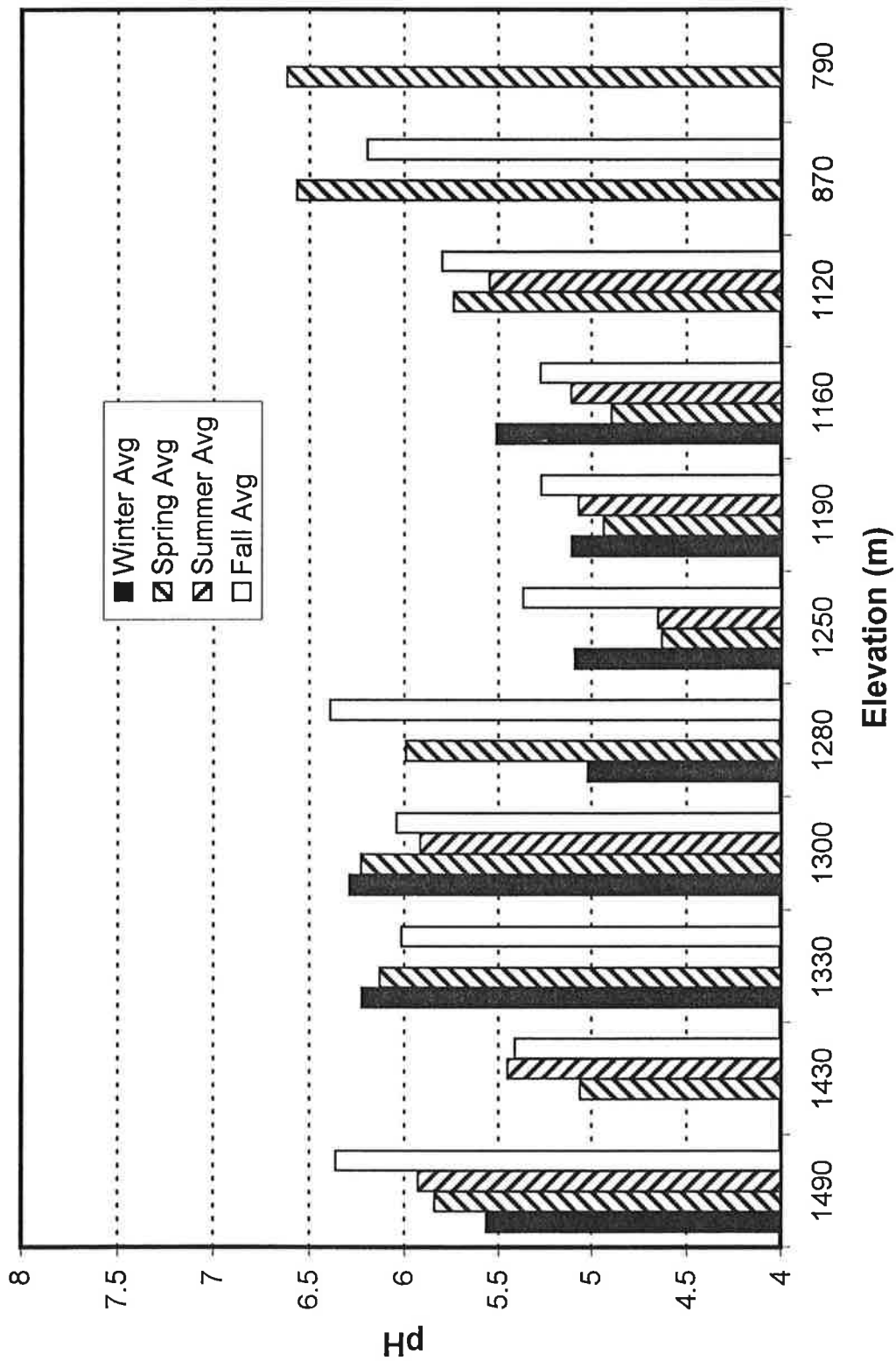


Figure 61. Change in average stream pH with elevation during different seasons for tributary sites on the Mt. LeConte side of the West Prong Little Pigeon River.

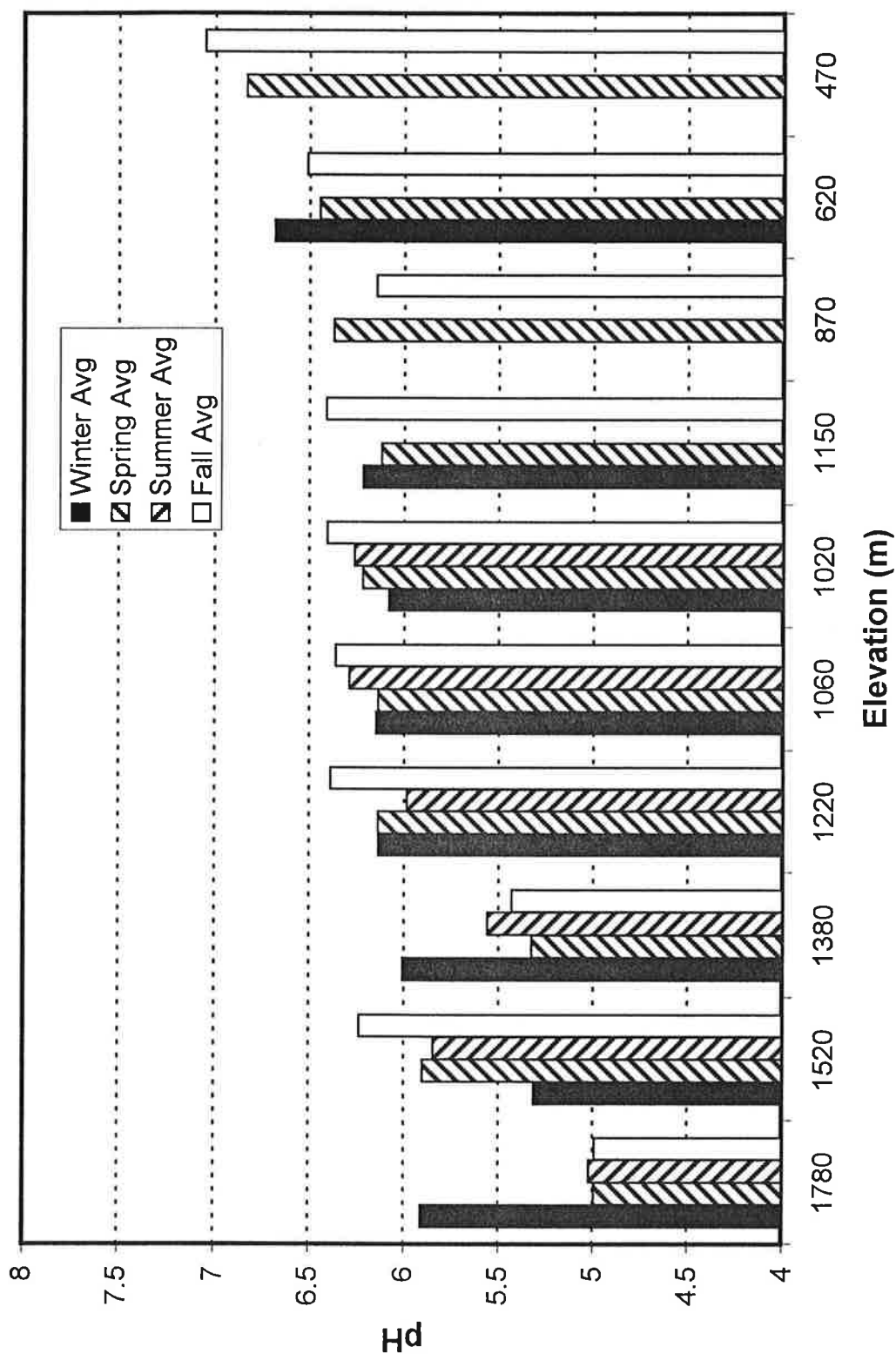


Figure 62. Change in average stream pH with elevation during different seasons for tributary sites on the Sugarlands Mountain side of the West Prong Little Pigeon River.

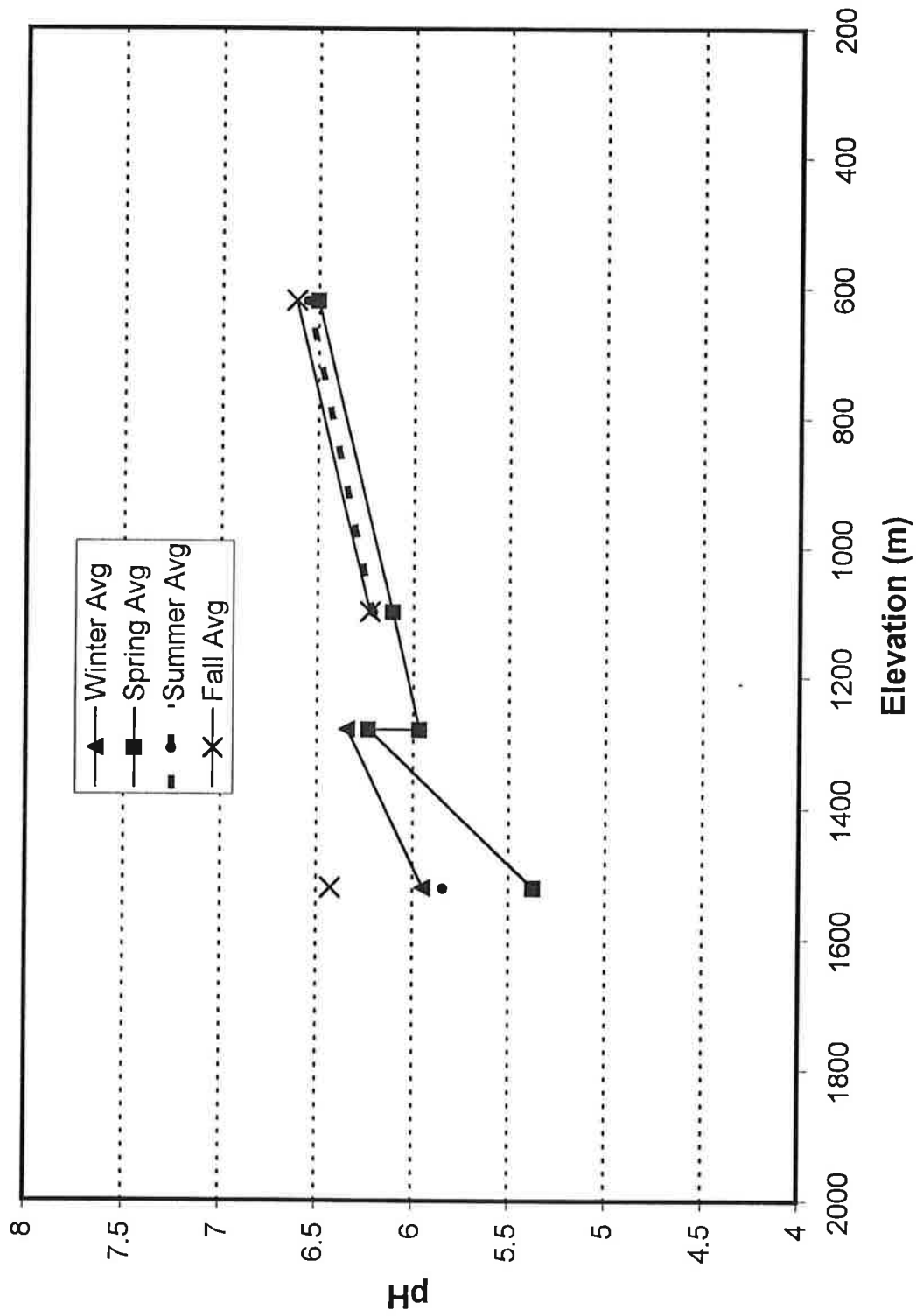


Figure 63. Change in average stream pH with elevation during different seasons on the mainstem of Raven Fork.

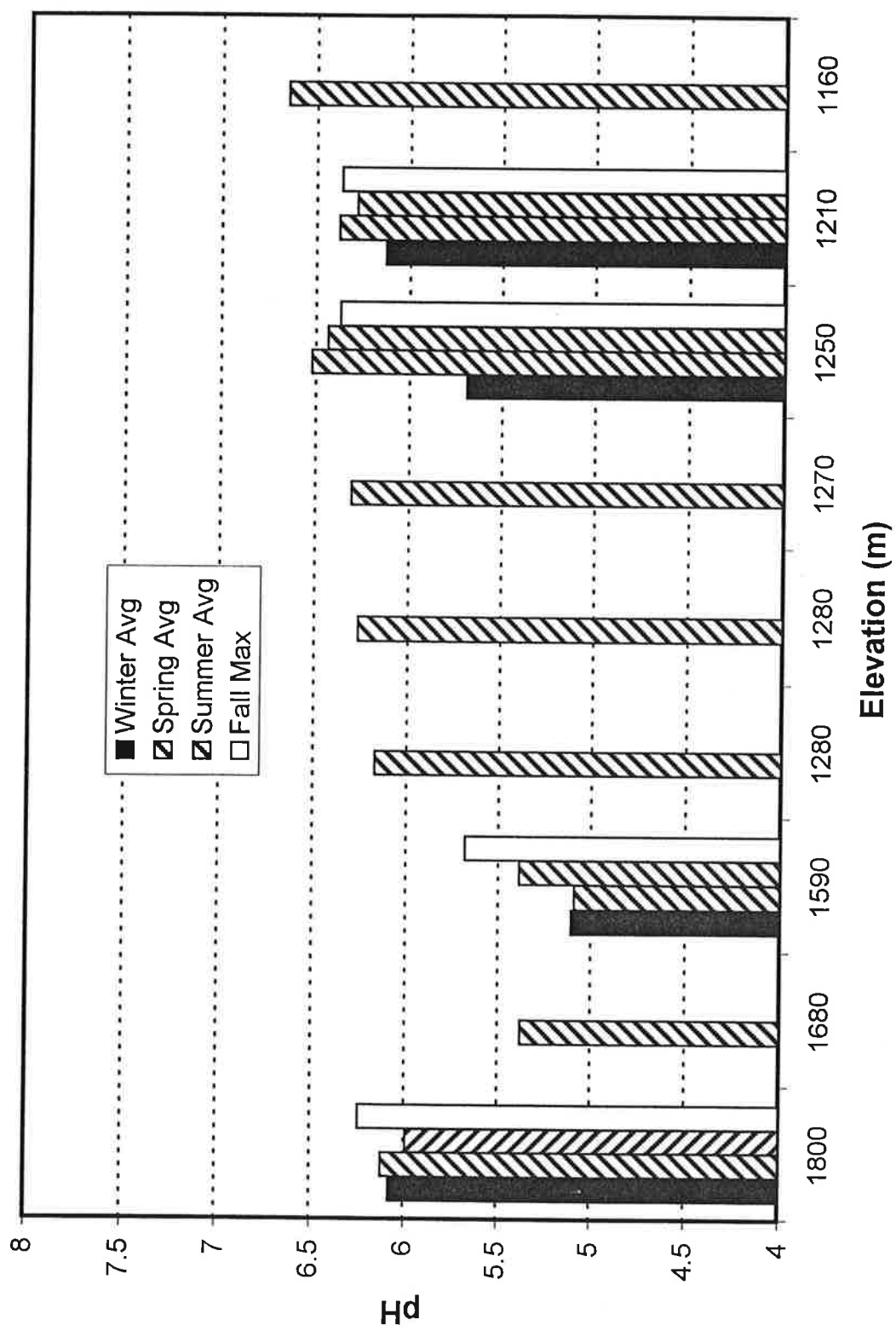


Figure 64. Change in average stream pH with elevation during different seasons on tributaries of Raven Fork.

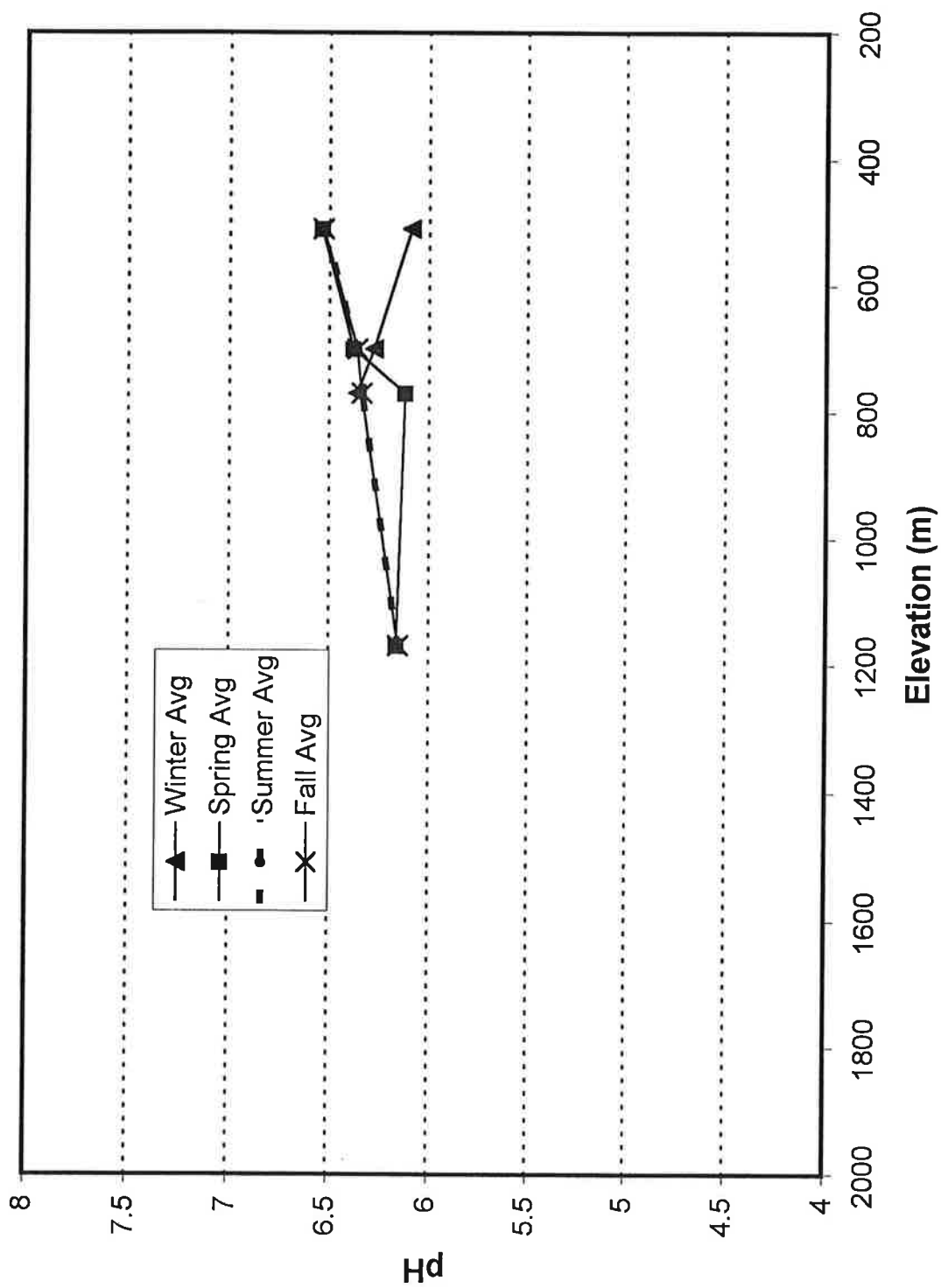


Figure 65. Change in average stream pH with elevation during different seasons on the mainstem sites of Cosby Creek.

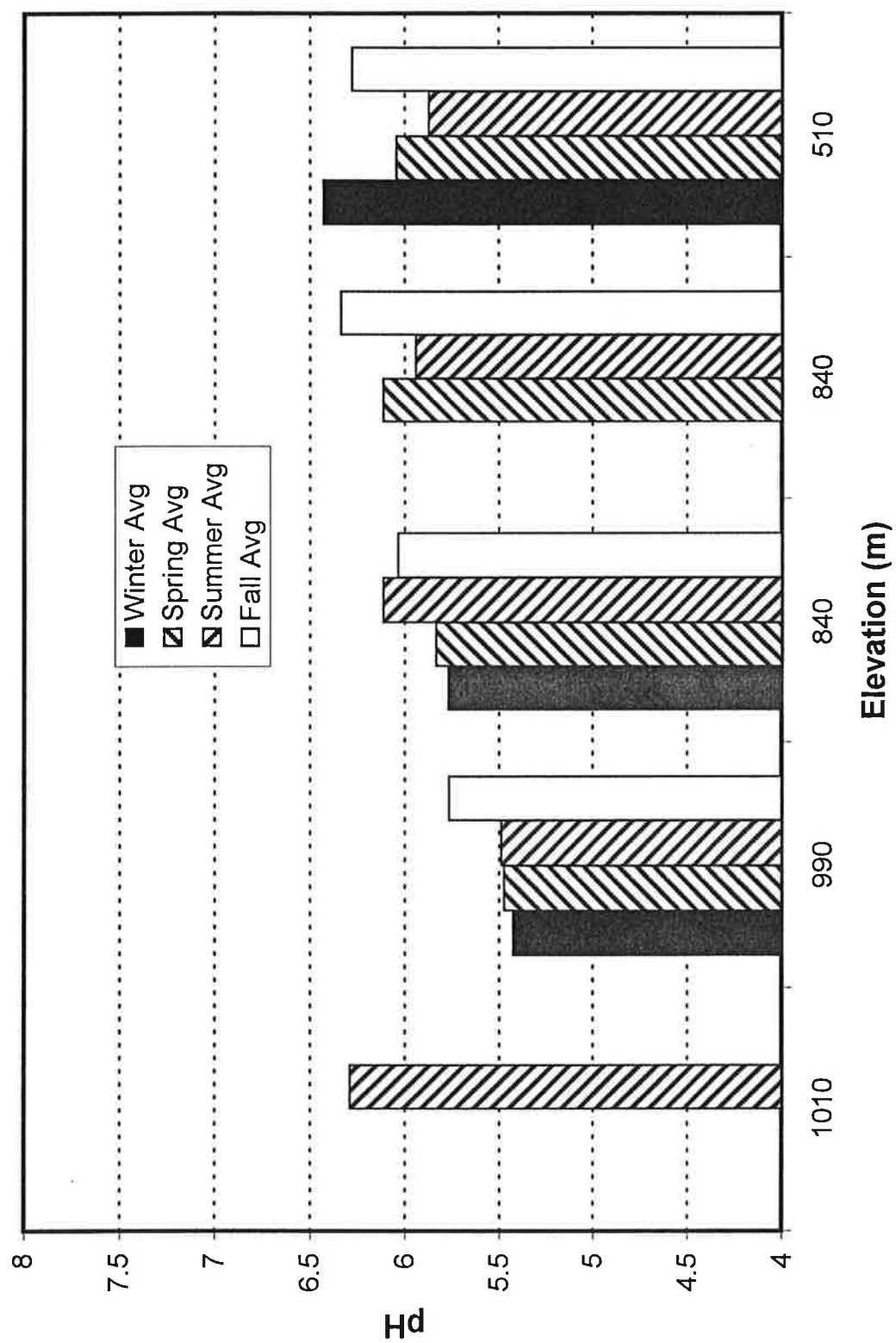


Figure 66. Change in average stream pH with elevation during different seasons for tributaries in Cosby Creek.

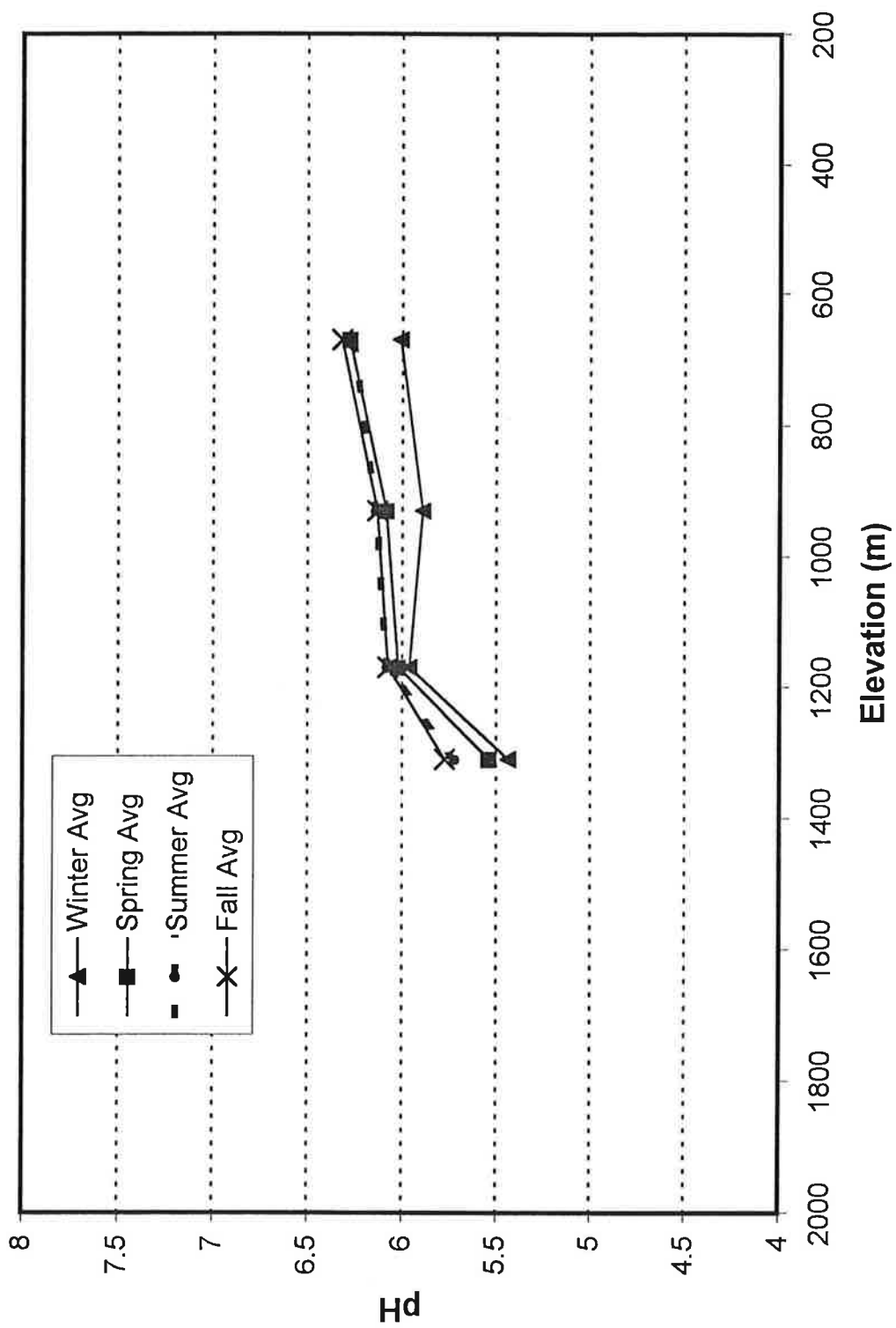


Figure 67. Changes in average stream pH with elevation during different seasons for sites on the mainstem of Indian Camp Creek.

Site Number	Raven Fork Tributaries Site Descriptions	Elevation (m)
111	Left Raven Fork at Tricorner Shelter	1800
356	Unnamed trib on Breakneck Ridge	1680
110	Enloe Creek at Pecks Corner Shelter	1590
338	Left Raven Fork above Three Forks	1280
348	Middle Raven Fork above Three Forks	1280
346	Bulldie Creek (Raven Fork)	1270
332	Trib to Raven Fork above campsite 47	1250
276	Enloe Creek at log bridge	1210
349	Trib to Raven Fork near campsite 47 (Ramp)	1160

Site Number	Cosby Creek Tributary Site Descriptions	Elevation (m)
368	Gabes Creek at Campsite 34	1010
138	Inadu Creek at Snake Den Ridge Tr.	990
137	Upper Rock Creek (Cosby Creek)	840
492	Camel Hump Creek off Low Gap Trail	840
4	Lower Rock Creek	510

Evaluation of Site and Variable Similarity

Site similarity was evaluated by calculating SIMI index scores for each pair of sites. Direct application of SIMI was not satisfactory because distinction between sites with similar proportions of each chemical but in different overall concentrations was not clear. To remedy this situation, the proportion of each chemical species in each sample was calculated as a fraction of the maximum total ionic strength for the entire data set. This served well to distinguish samples from lower Abrams Creek but failed to provide adequate distinction among the remaining sites. Finally, the samples with conductivity greater than

125 $\mu\text{S}/\text{cm}$ (basically those from lower Abrams Creek) were eliminated from the data set as they are already easily distinguished from other samples and proportions for each chemical species based on the newly resulting maximum total ionic strength were calculated. SIMI values for each pair of sites appears in Appendix C. This list is provided as a reference for future evaluation.

The correlation among each variable measured was also calculated (Table 9). The correlation coefficients for most pairs of variables was less the 0.10. The relationship between pH and ANC is better than suggested by the correlation because it appears to be nonlinear as might be expected since pH is a logarithmic function (Figure 68). Field pH also appears to be slightly related to sodium (Figure 69) and nitrate (Figure 70). The negative relationship between pH and nitrate is interesting because it implies the potential for at least some degree of causal interaction between the two variables. The other variables with strong relationships are driven primarily by the high conductance and magnesium and calcium produced by limestone bedrock weathering in Abrams Creek. The high base cation concentrations lead to high ANC (magnesium Figure 71), calcium (Figure 72) which then correlates with conductivity (Figure 73). Of course magnesium will be correlated with conductivity (Figure 74) as is calcium (Figure 75) and magnesium and calcium are correlated with each other (Figure 76).

Table 9. Correlation coefficients for the water quality variables between October 1993 and August 1997.

	Field pH	ANC	Cond.	Cl ⁻	NO ₃ ⁻	SO ₄ ²⁻	Na ⁺	NH ₄ ⁺	K ⁺	Mg ²⁺	Ca ²⁺
Field pH	1.00										
ANC	0.26	1.00									
Conductance	0.03	0.66	1.00								
Chloride	0.00	0.03	0.05	1.00							
Nitrate	0.41	0.09	0.00	0.00	1.00						
Sulfate	0.10	0.00	0.13	0.01	0.14	1.00					
Sodium	0.24	0.21	0.10	0.10	0.15	0.00	1.00				
Ammonium	0.00	0.00	0.00	0.01	0.00	0.00	0.00	1.00			
Potassium	0.05	0.08	0.05	0.12	0.03	0.00	0.22	0.13	1.00		
Magnesium	0.07	0.56	0.63	0.04	0.00	0.19	0.16	0.03	0.16	1.00	
Calcium	0.10	0.75	0.65	0.03	0.01	0.03	0.09	0.05	0.13	0.66	1.00

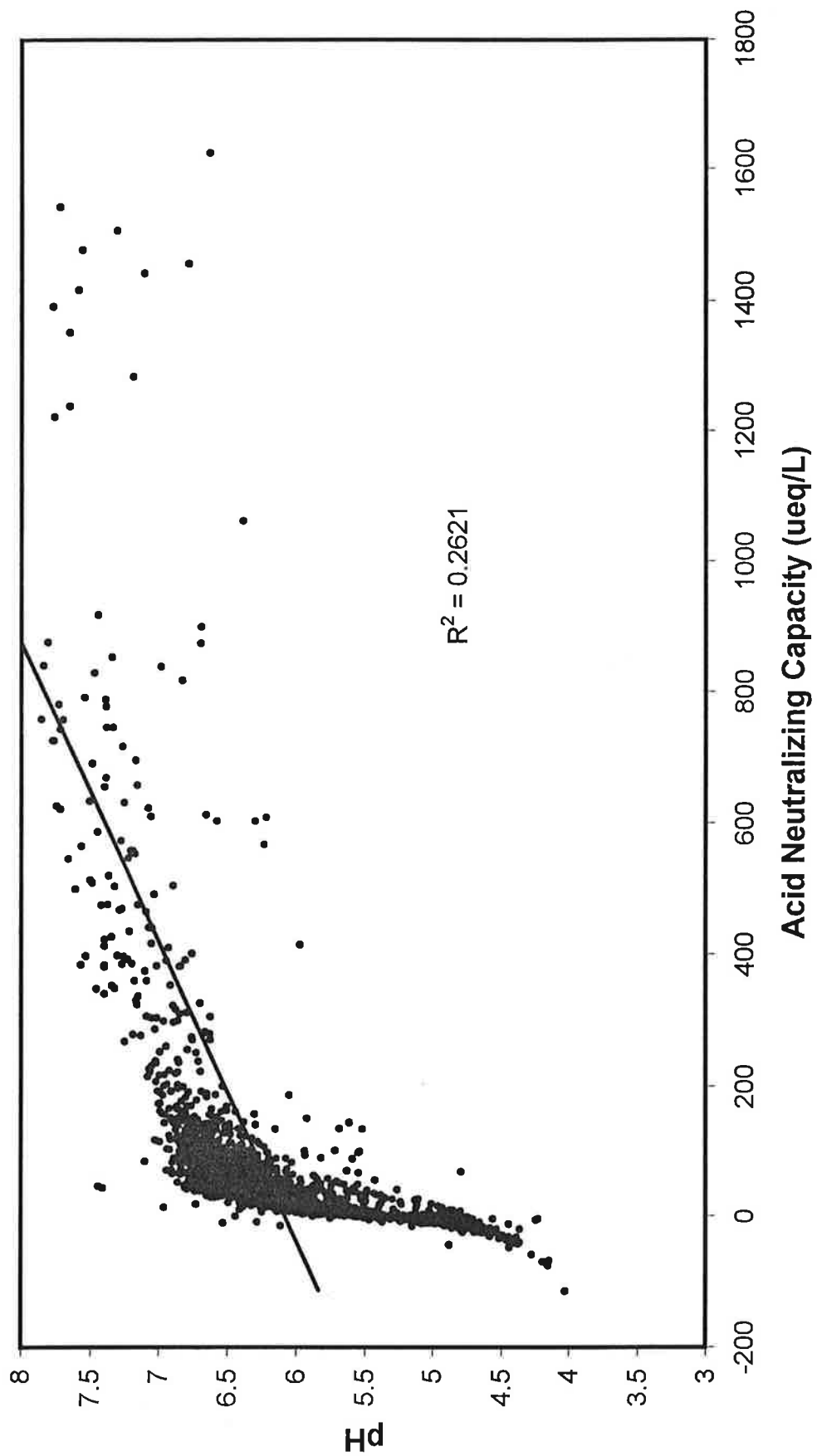


Figure 68. Relationship between pH and Acid Neutralizing Capacity.

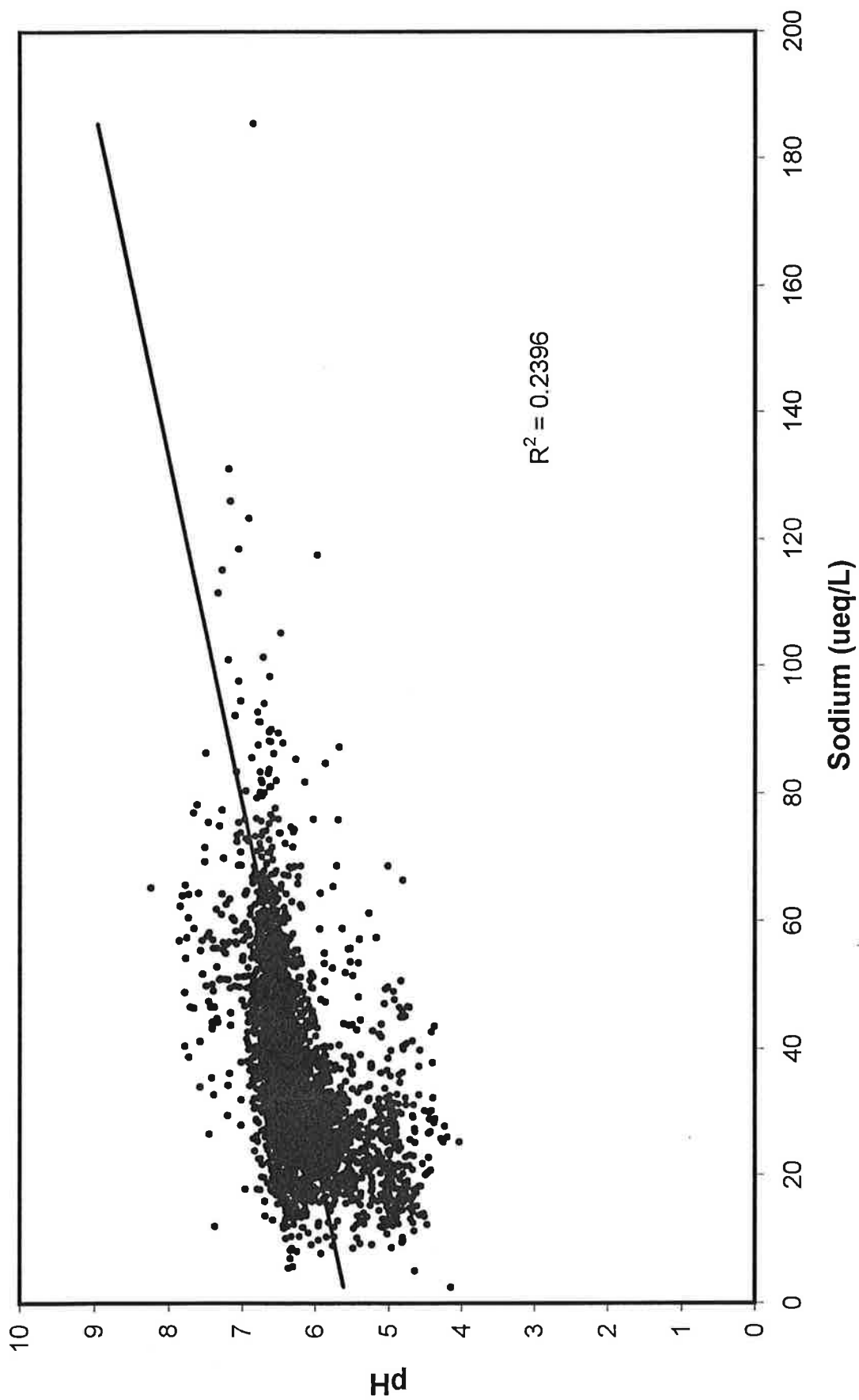


Figure 69. Relationship between sodium and pH.

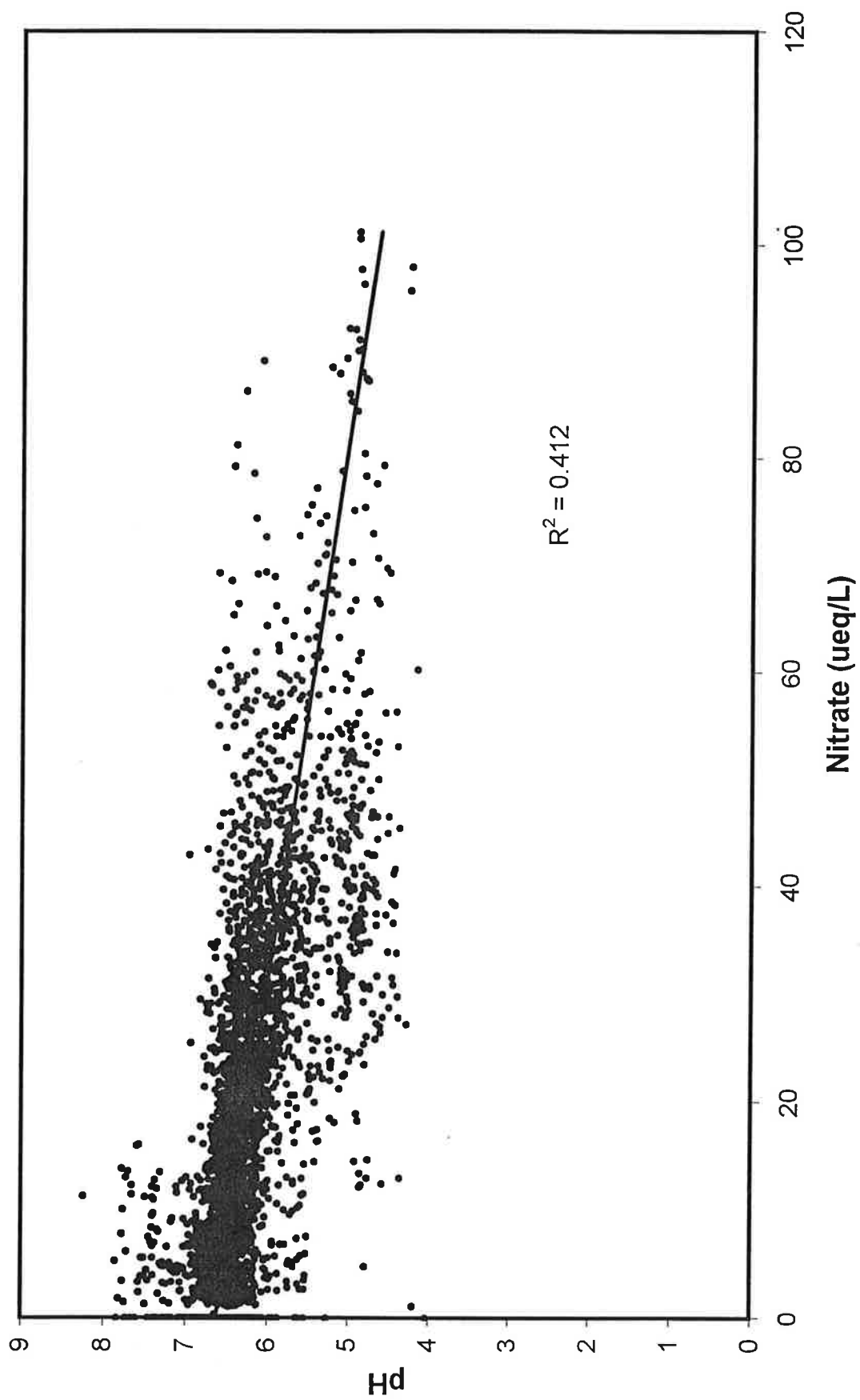


Figure 70. Relationship between nitrate and pH.

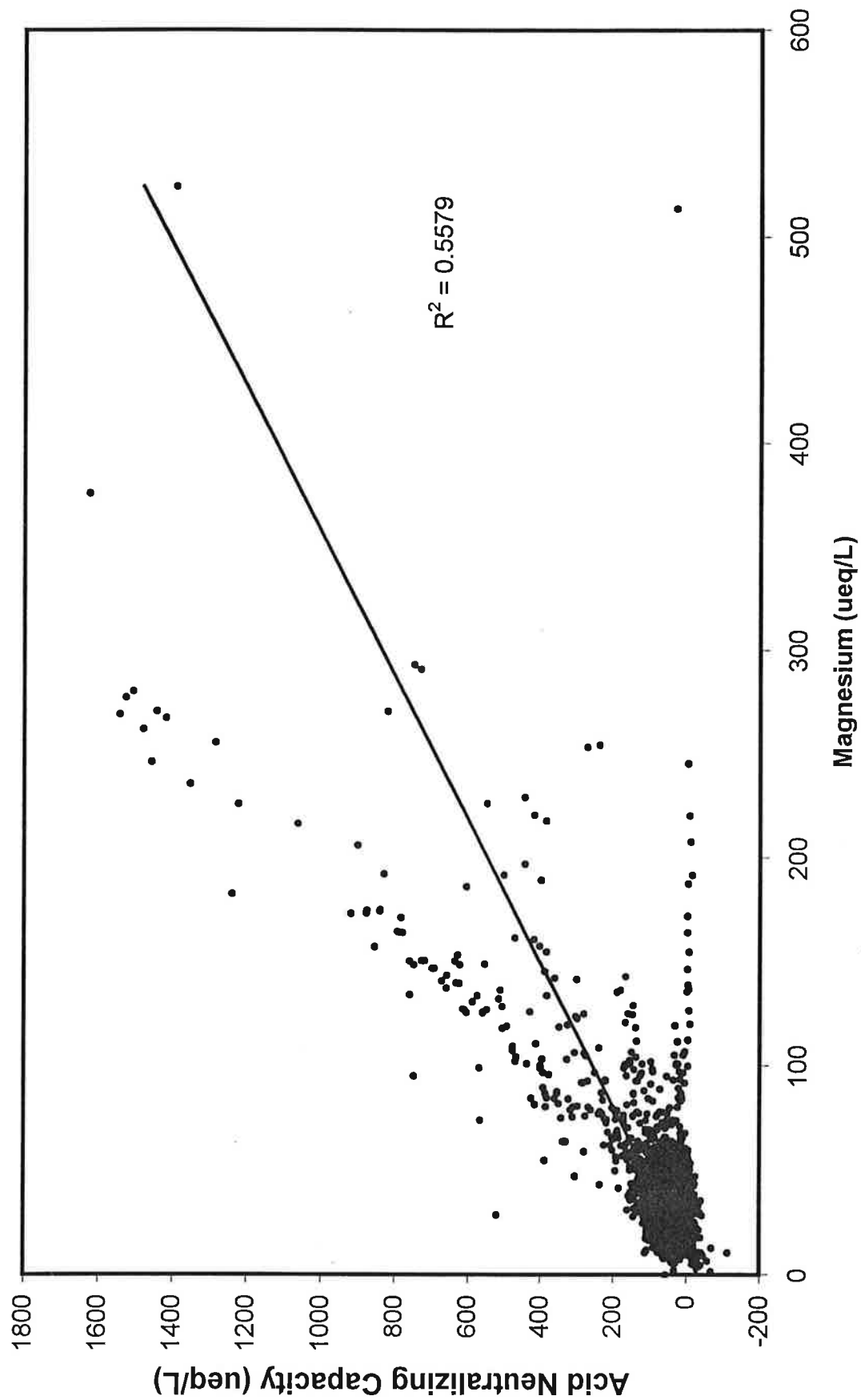


Figure 71. Relationship between magnesium and Acid Neutralizing Capacity.

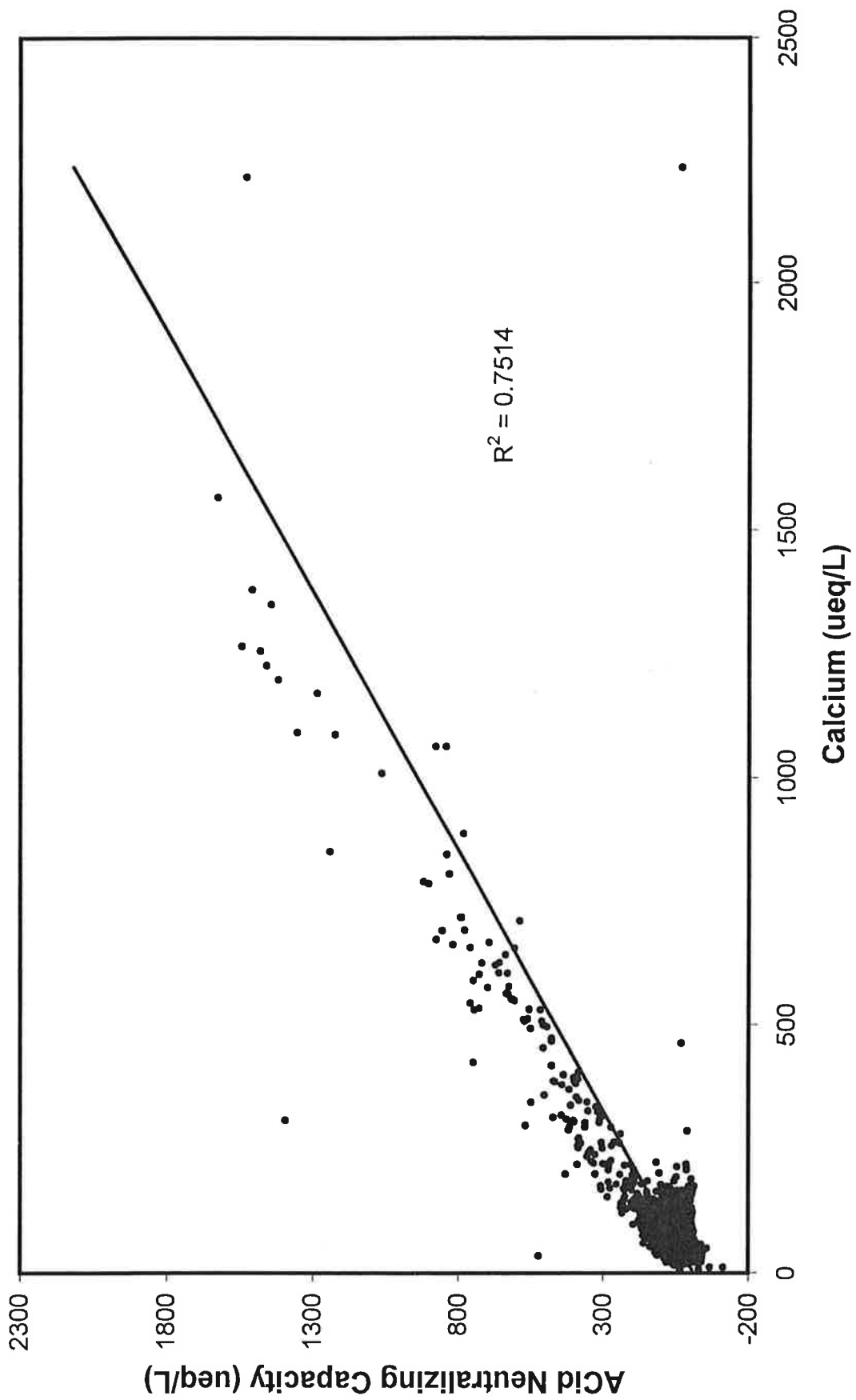


Figure 72. Relationship between calcium and Acid Neutralizing Capacity.

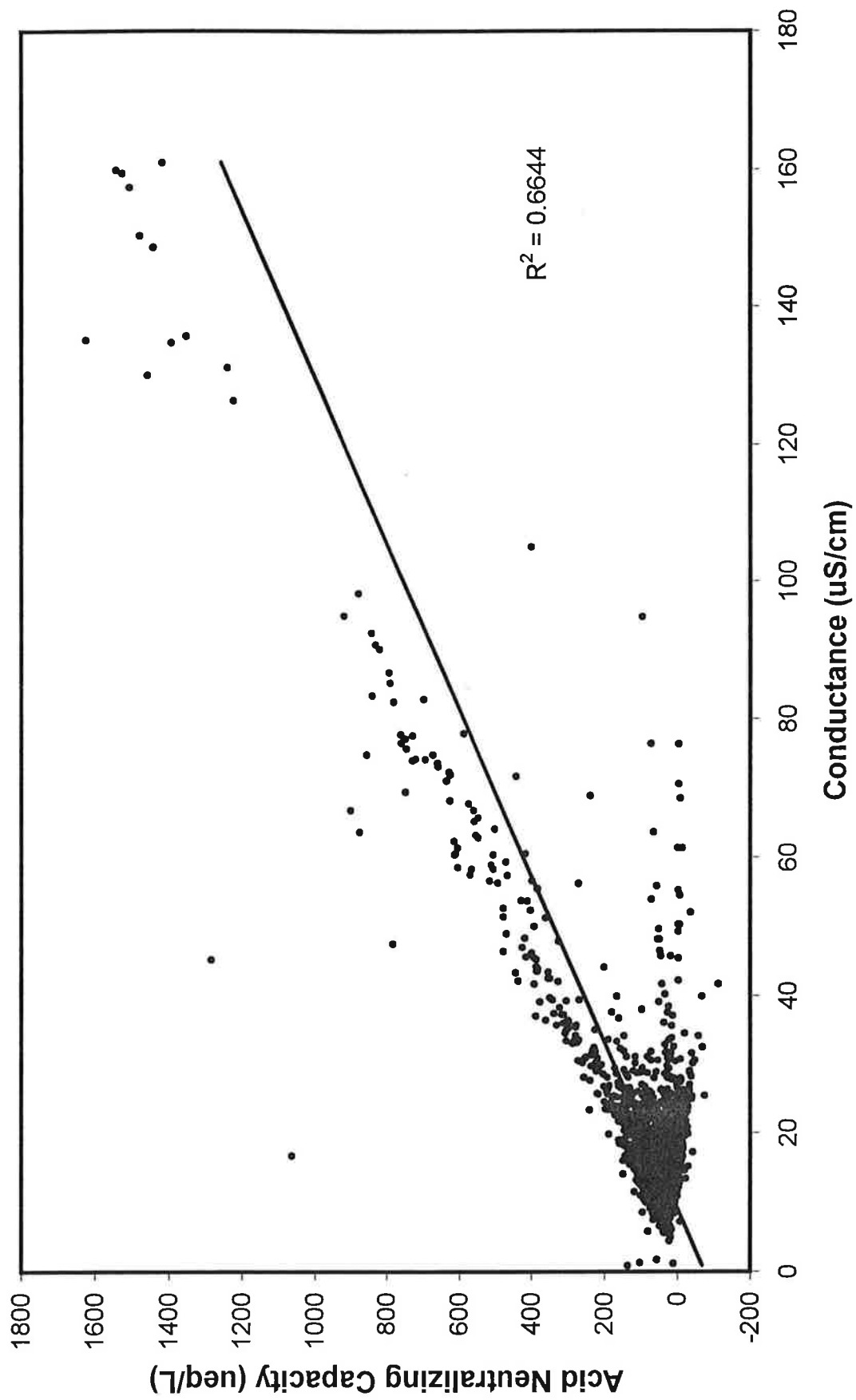


Figure 73. Relationship between conductance and ANC.

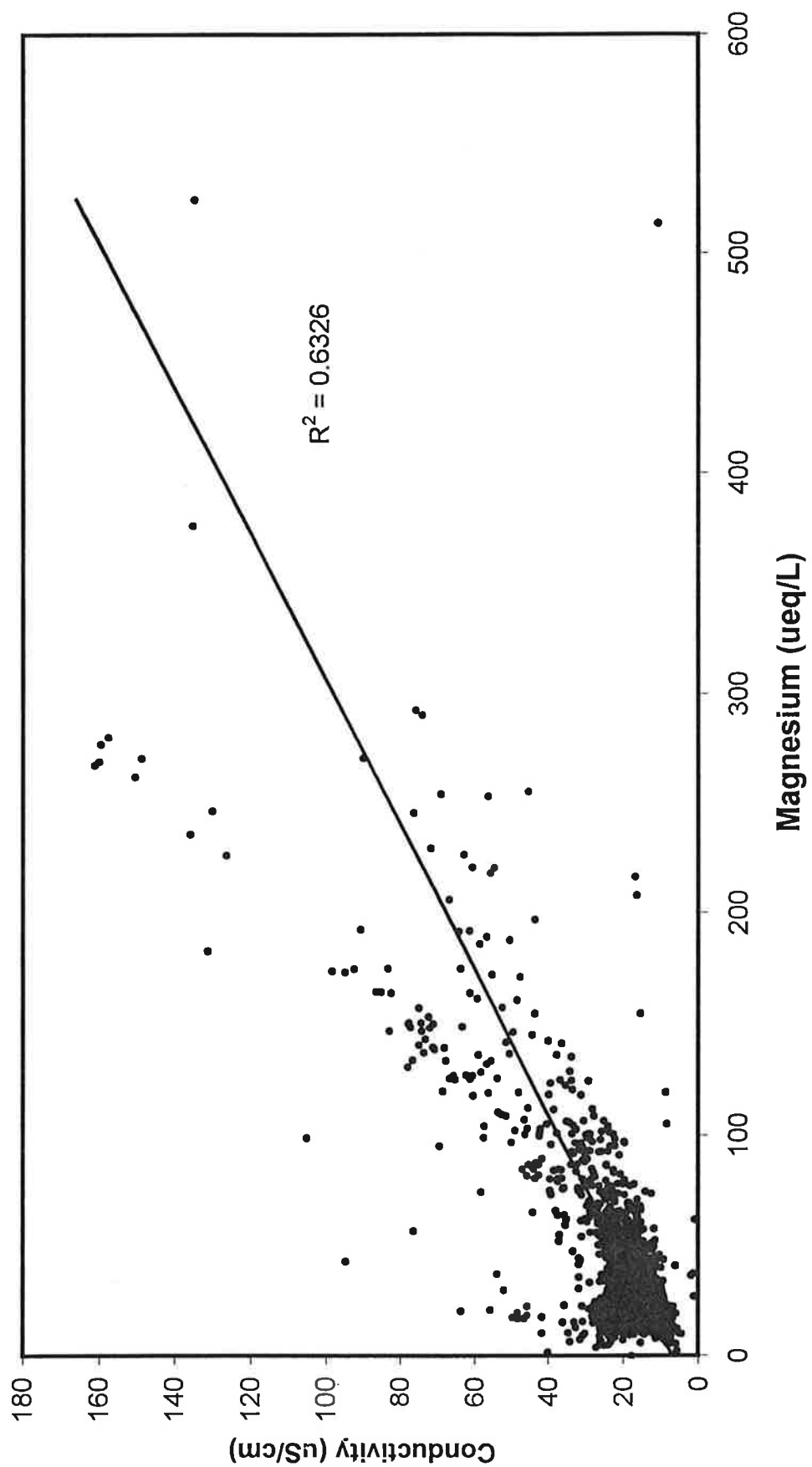


Figure 74. Relationship between magnesium and conductivity.

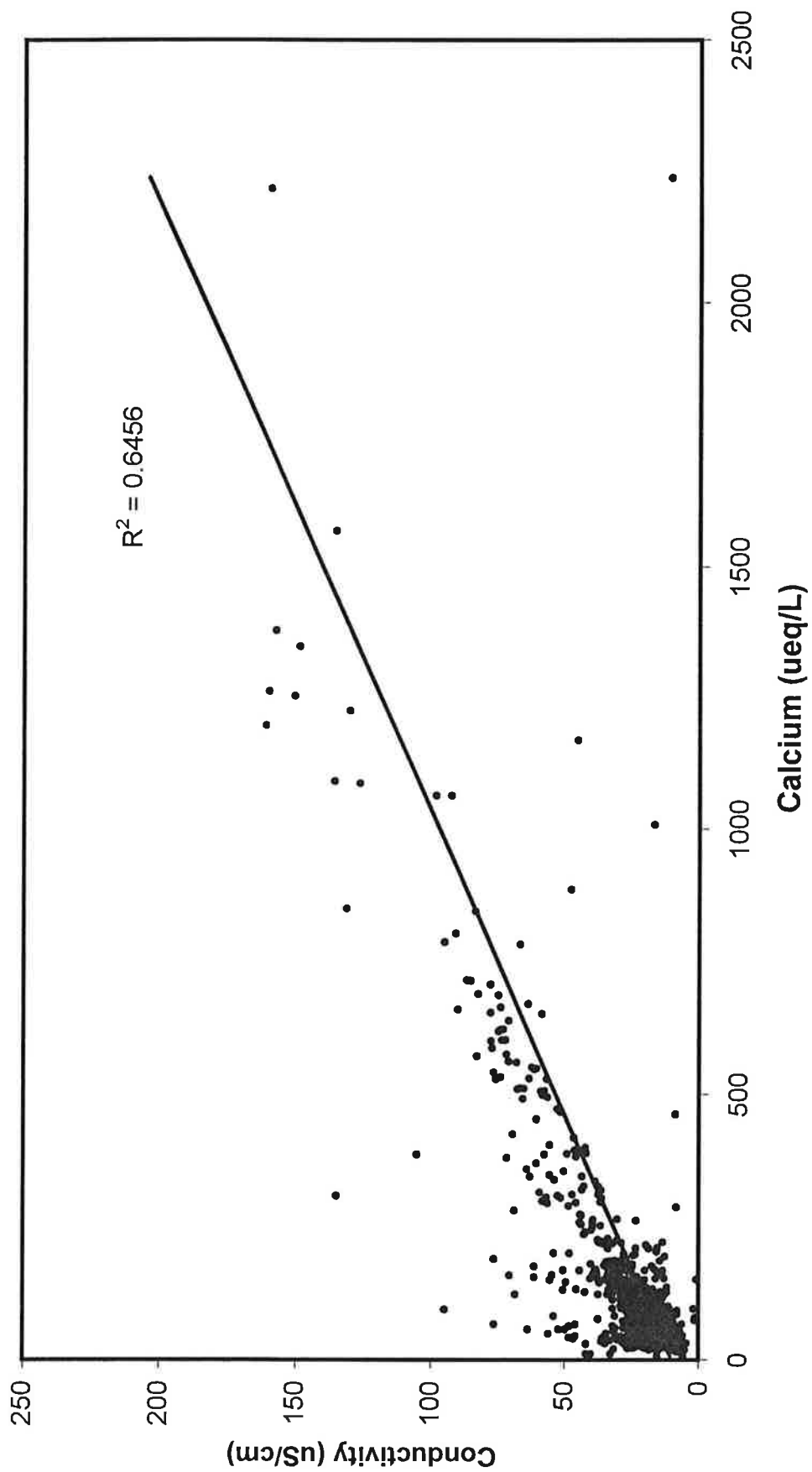


Figure 75. Relationship between calcium and conductivity.

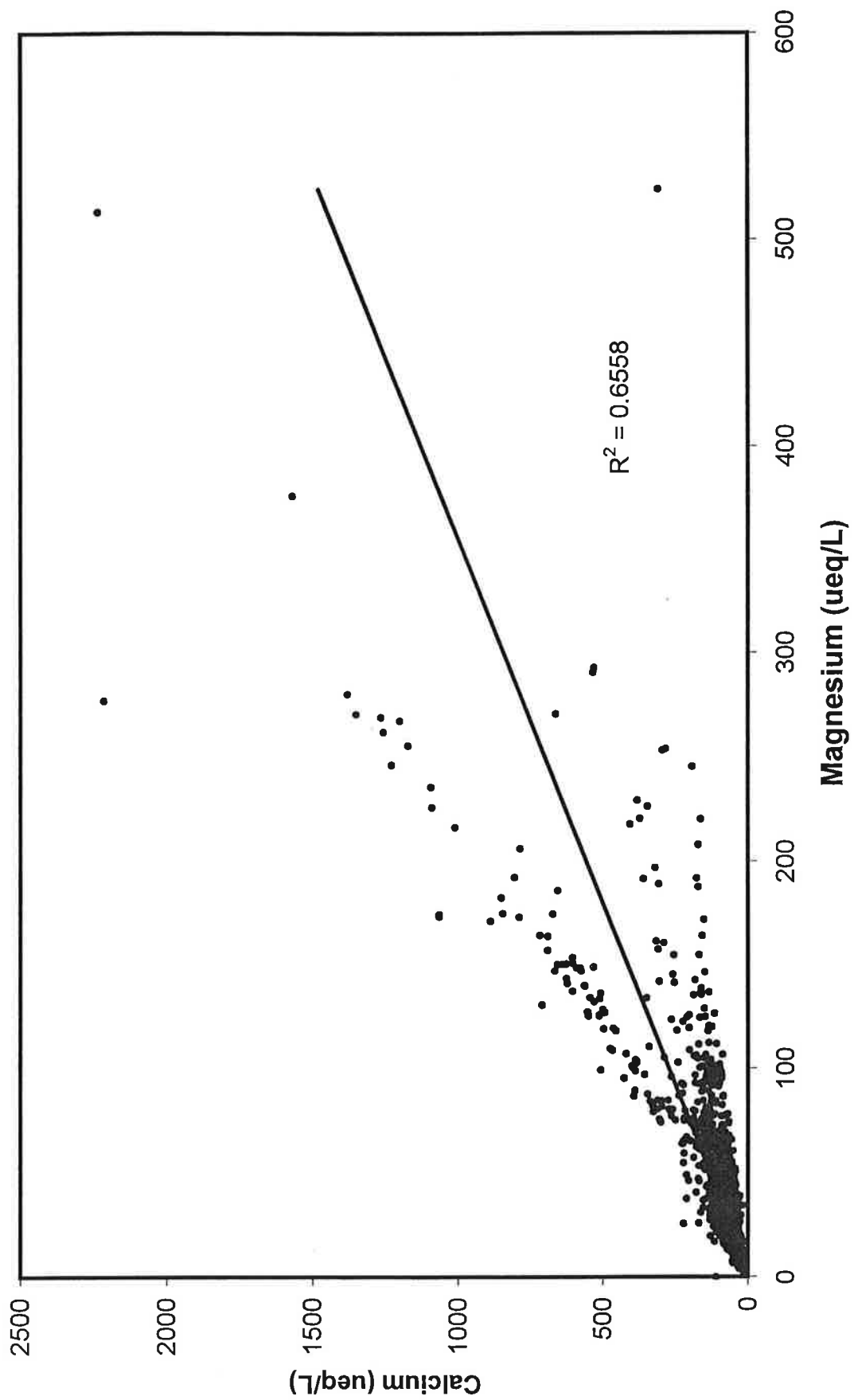


Figure 76. Relationship between magnesium and calcium.

Discussion

The results from the Noland Divide Watershed continue to indicate that the catchment is nitrogen saturated and that sulfate is being adsorbed in the system, most likely in the soil. The high rates of nitrate leaching and relatively low concentrations of base cations probably account for the low average pH of the streams (about pH 5.7). With an average pH below 5.7, Noland Creek can be considered chronically acidic at these high elevations. Storm events which are quite frequent throughout the year also cause decreases in pH in the southeastern streamlet of as much as 1 pH unit. Minimum pH in the southeast streamlet is below 4.7 for all seasons of the year. Streams with pH values below 5.0 usually suffer profound impacts to the aquatic biota.

The situation may be even worse in the northeastern streamlet but there is currently no instrumentation to measure the problem. Discharge measurements in both streams clearly show that a disproportionate amount of storm flow transfers to the northeast streamlet during large storm events. Since pH appears to be related to streamflow, this suggests that decreases in pH may be even worse than observed in the southeast streamlet.

The situation at Noland is not very different from in other parts of the GRSM. Several streams have even higher nitrate concentrations than at Noland. Our current monitoring scheme suggests that many of these streams including tributaries to the Little River, Road Prong, Enloe Creek in Raven Fork, Indian Camp Creek, and Cosby Creek do have pH values below 6.0. It is possible that these streams experience much lower pH during storm events as occurs at Noland.

This report has provided some of the information needed to provide a vigorous evaluation of the stream survey. Information on site similarity has been tabulated to determine which sites may be providing redundant data. This information is provided along with an evaluation of elevational gradients in pH that allow anyone to see how the current sampling scheme allows patterns to be evaluated. The effect of eliminating particular sites on the ability to detect patterns can thus be evaluated. The analysis of correlation among variables clearly indicates that the variables being measured do not provide redundant information except to indicate the impact of limestone weathering in some streams of the west water quality district, particularly for Abrams Creek. The tools needed to evaluate and modify the stream survey in the future are presented in this report.

Literature Cited

- Aber, J.D., Nadelhoffer, K.J., Steudler, P. and Melillo, J.M. (1989) Nitrogen saturation in northern forest ecosystems. *Bioscience* 39, 378-386.
- Baker, J.P., Van Sickle, J., Gagen, C.J., DeWalle, D.R., Sharpe, W.E., Carline, R.F., Baldigo, B.P., Murdoch, P.S., Bath, D.W., Krester, W.A., Simonin, H.A. and Wigington, P.J., Jr. (1996) Episodic acidification of small streams in the northeastern United States: effects on fish populations. *Ecol. Appl.* 6, 422-437.
- Baker, L.A., Herlihy, A.T., Kaufmann, P.R. and Eilers, J.M. (1991) Acidic lakes and streams in the United States: the role of acidic deposition. *Science* 252, 1151-1154.
- Burge, R.E., Herrmann, R. and Mathews, R.C. (1979) *Remote sensing of water quality and weather in Great Smoky Mountains National Park: phase I*, Atlanta: U.S. Department of Interior, National Park Service, Research/Resource Management Report No. 30.
- Church, M.R., Shaffer, P.W., Eshelman, K.N. and Rochelle, B.P. (1990) Potential future effects of current levels of sulfur deposition on stream chemistry in the southern blue ridge mountains, U.S. *Wat. Air Soil Pollut.* 50, 39-48.
- Cook, R.B., Elwood, J.W., Turner, R.R., Bogle, M.A., Mulholland, P.J. and Palumbo, A.V. (1994) Acid-base chemistry of high-elevation streams in the Great Smoky Mountains. *Wat. Air Soil Pollut.* 72, 331-356.
- Cosby, B.J., Ryan, P.F., Webb, J.R., Hornberger, G.M. and Galloway, J.N. (1991) Mountains of western Virginia. In: Charles, D.F. (Ed.) *Acidic deposition and aquatic ecosystems*, pp. 297-318. New York: Springer-Verlag.
- Cressie, N.A.C. (1993) *Statistics for spatial data*, New York: John Wiley & Sons.
- Delcourt, H.R. and Delcourt, P.A. (1991) *Quaternary ecology*, Chapman & Hall: New York.
- Drever, J.I. (1982) *The geochemistry of natural waters*, Englewood Cliffs, New Jersey: Prentice-Hall, Inc.
- Eilers, J.M. and Selle, A.R. (1991) Geographic overview of the regional case study areas. In: Charles, D.F. (Ed.) *Acidic deposition and aquatic ecosystems*, pp. 107-125. New York: Springer-Verlag.

- Elwood, J.W. (1991) Southeast overview. In: Charles, D.F. (Ed.) *Acidic deposition and aquatic ecosystems*, pp. 291-295. New York: Springer-Verlag.
- Elwood, J.W., Sale, M.J., Kaufmann, P.R. and Cada, G.F. (1991) The southern blue ridge province. In: Charles, D.F. (Ed.) *Acidic deposition and aquatic ecosystems*, pp. 319-364. New York: Springer-Verlag.
- Elwood, J.W. and Mulholland, P.J. (1989) Effects of acidic precipitation on stream ecosystems. In: Adriano, D.C. and Salomons, W. (Eds.) *Acidic precipitation volume 2: biological and ecological effects*, pp. 85-135. New York: Springer-Verlag.
- Flum, T. and Nodvin, S.C. (1995) Factors affecting streamwater chemistries in the Great Smoky Mountains, USA. *Water, Air, Soil Pollut.* 85, 1707-1712.
- Garten, C.T., Jr., Bondietti, E.A. and Lomax, R.D. (1988) Contribution of foliar leaching and dry deposition to sulfate in net throughfall below deciduous trees. *Atmos. Environ.* 22, 1425-1432.
- Hadley, J.B. and Goldsmith, R. (1963) Geology of the eastern Great Smoky Mountains, North Carolina and Tennessee. *U. S. Geol. Surv. Prof. Pap.* 349-B, B1-B118.
- Harrison, R.B., Johnson, D.W. and Todd, D.E. (1989) Sulfate adsorption and desorption reversibility in a variety of forest soils. *J. Environ. Qual.* 18, 419-426.
- Herlihy, A.T., Kaufmann, P.R. and Mitch, M.E. (1991) Stream chemistry in the eastern United States 2. Current sources of acidity in acidic and low acid-neutralizing capacity streams. *Wat. Resour. Res.* 27, 629-642.
- Herlihy, A.T., Kaufmann, P.R., Stoddard, J.L., Eshelman, K.N. and Bulger, A.J. (1996) *Effects of acidic deposition on aquatic resources in the southern Appalachians with a special focus on class I wilderness areas*, Southern Appalachian Mountain Initiative.
- Huckabee, J.W., Goodyear, C.P. and Jones, R.D. (1975) Acid rock in the Great Smokies: unanticipated impact on aquatic biota of road construction in regions of sulfide weathering. *Transactions of the American Fisheries Society* 104, 677-684.
- Johnson, D.W., Van Miegroet, H., Lindberg, S.E., Todd, D.E. and Harrison, R.B. (1991) Nutrient cycling in red spruce forests of the Great Smoky Mountains. *Canadian Journal of Forest Research* 21, 769-787.
- Johnson, D.W. and Cole, D.W. (1980) Anion mobility in soils: relevance to nutrient transport from forest ecosystems. *Environment International* 3, 79-90.

- Johnson, D.W. and Lindberg, S.E. (1992) *Atmospheric deposition and forest nutrient cycling*, New York: Springer-Verlag.
- Kaufmann, P.R., Herlihy, A.T., Elwood, J.W., Mitch, M.E., Overton, W.S., Sale, M.J., Messer, J.J., Cougan, K.A., Peck, D.V., Reckhow, K.H., Kinney, A.J., Christie, S.J., Brown, D.D., Hagley, C.A. and Jager, H.I. (1988) *Chemical characteristics of streams in the mid-Atlantic and southeastern United States (National Stream Survey - Phase I). Volume I: population descriptions and physio-chemical relationships*, Washington, D.C. U.S. Environmental Protection Agency.
- Keith, A. (1907) *Description of the Nantahala quadrangle [North Carolina-Tennessee]*, Washington, D.C. U.S. Geological Survey Atlas, Folio 143.
- King, P.B. (1964) Geology of the central Great Smoky Mountains, Tennessee. *U. S. Geol. Surv. Prof. Pap.* 349-C, C1-C148.
- King, P.B., Neuman, R.B. and Hadley, J.B. (1968) *Geology of the Great Smoky Mountains National Park, Tennessee and North Carolina*, Washington D.C. Geological Survey Professional Paper # 587.
- Kucken, D.J., Maas, R.P. and Patch, S.C. (1992) Great Smokies streams acidified by Anakeesta Formation exposures. *Conser. Biol.* 8, 373-378.
- Kucken, D.J., Davis, J.S., Petranka, J.W. and Smith, C.K. (1994) Anakeesta stream acidification and metal contamination: effects on a salamander community. *J. Environ. Qual.* 23, 1311-1317.
- Likens, G.E., Bormann, F.H., Pierce, R.S., Eaton, J.S. and Johnson, N.M. (1977) *Biogeochemistry of a forested ecosystem*, New York: Springer-Verlag.
- Lindberg, S.E. and Garten, C.T., Jr. (1988) Sources of sulphur in forest canopy throughfall. *Nature* 336, 148-151.
- Lindberg, S.E. and Owens, J.G. (1993) Throughfall studies of deposition to forest edges and gaps in montane ecosystems. *Biogeochemistry* 19, 173-194.
- Lovett, G.M. and Kinsman, J.D. (1990) Atmospheric pollution deposition to high-elevation ecosystems. *Atmos. Environ.* 24A, 2767-2786.
- Mathews, R.C. (1978) *Ecological survey of Abrams Creek in the Great Smoky Mountains National Park*, Gatlinburg, Tennessee: U.S. Department of Interior, National Park Service, Research/Resources Management Report No. 28.

- McMaster, W.M. and Hubbard, E.F. (1970) *Water resources of the Great Smoky Mountains National Park, Tennessee and North Carolina*, Hydrologic Investigations Atlas HA-420: U.S. Geological Survey.
- Melack, J.M. (1991) West overview. In: Charles, D.F. (Ed.) *Acidic deposition and aquatic ecosystems*, pp. 467-470. New York: Springer-Verlag.
- Melack, J.M. and Stoddard, J.L. (1991) Sierra Nevada, California. In: Charles, D.F. (Ed.) *Acidic deposition and aquatic ecosystems*, pp. 503-530. New York: Springer-Verlag.
- Messer, J.J., Ariss, C.W., Baker, J.R., Drouse, S.K., Eshelman, K.N., Kaufmann, P.R., Linthurst, R.A., Omernick, J.M., Overton, W.S., Sale, M.J., Schonbrod, R.D., Stambaugh, S.M. and Tuschall, J.R., Jr. (1986) *National Surface Water Survey: national stream survey phase I - pilot survey*, Environmental Research Laboratory, Corvallis, Oregon: U.S. Environmental Protection Agency, EPA /600 /4-86 /026.
- Morgan, R.P., II and Janicki, A.J. (1991) *Western Maryland stream survey: relationships between fish distributions, acidification, and watershed characteristics*, Annapolis, Maryland: State of Maryland Department of Natural Resources.
- Mulholland, P.J., Elwood, J.W., Palumbo, A.V. and Stevenson, R.J. (1986) Effect of stream acidification on periphyton composition, chlorophyll, and productivity. *Can. J. Fish. Aquat. Sci.* 43, 1846-1858.
- Mulholland, P.J., Elwood, J.W., Palumbo, A.V. and Rosemond, A.D. (1987) Effects of acidification on leaf decomposition in streams. *J. North Am. Benthol. Soc.* 6, 147-158.
- Munson, R.K. and Gherini, S.A. (1991) Hydrochemical assessment methods for analyzing the effects of acidic deposition on surface waters. In: Charles, D.F. (Ed.) *Acidic deposition and aquatic ecosystems*, pp. 35-63. New York: Springer-Verlag.
- Neuman, R.B. and Nelson, W.H. (1965) Geology of the western part of the Great Smoky Mountains, Tennessee. *U. S. Geol. Surv. Prof. Pap.* 349-D, D1-D81.
- Nodvin, S.C., Flum, T., Shubzda, J., Rhodes, H., Malick, M., Williams, E., Van Miegroet, H., Lindberg, S.E., Pauley, E.F., Rose, A.K. and Nicholas, N. (1995a) *A comprehensive water quality monitoring program for the Great Smoky Mountains national park*, Washington D.C. Technical Report Series, National Biological Service.

- Nodvin, S.C., Van Miegroet, H., Lindberg, S.E., Nicholas, N.S. and Johnson, D.W. (1995b) Acidic deposition, ecosystem processes, and N saturation in a high-elevation southern Appalachian watershed. *Water, Air, Soil Pollut.* 85, 1647-1652.
- Olem, H., Lietzke, D.A. and Mays, P.A. (1988) *Episodic changes in stream water quality in the Southern Blue Ridge Province*, Chattanooga, Tennessee: Tennessee Valley Authority.
- Palumbo, A.V., Bogle, M.A., Turner, R.R., Elwood, J.W. and Mulholland, P.J. (1987) Bacterial communities in acidic and circumneutral streams. *Appl. Environ. Microbiol.* 53, 337-344.
- Parker, C.R. and Pipes, D.W. (1990) *Watersheds of Great Smoky Mountains National Park: a geographical information system analysis*, Atlanta: U.S. Dept. of Interior, National Park Service Southeast Region Report SER-91/01.
- Peine, J.D., Randolph, J.C. and Presswood, J.J. (1995) Evaluating the effectiveness of air quality management within the Class I area of Great Smoky Mountains National Park. *Environ. Manag.* 19, 515-526.
- Peterjohn, W.T., Adams, M.B. and Gilliam, F.S. (1996) Symptoms of nitrogen saturation in two central Appalachian hardwood forest ecosystems. *Biogeochemistry* 35, 507-522.
- Powers, E.B. (1929) Fresh water studies. I. the relative temperature, oxygen content, alkali reserve, the carbon dioxide tension and pH of the waters of certain mountain streams at different altitudes in the Smoky Mountain National Park. *Ecology* 10, 97-112.
- Pyle, C. (1988) The type and extent of anthropogenic vegetation disturbance in the Great Smoky Mountains before the National Park Service acquisition. *Castanea* 53(3), 183-193.
- Ryan, P.F., Hornberger, G.M., Cosby, B.J., Galloway, J.N., Webb, J.R. and Rastetter, E.B. (1989) Changes in the chemical composition of stream water in two catchments in the Shenandoah National Park, Virginia, in response to atmospheric deposition of sulfur. *Wat. Resour. Res.* 25, 2091-2099.
- Sale, M.J., Kaufman, P.R., Jager, H.I., Coe, J.M., Cougan, K.A., Kinney, A.J., Mitch, M.E. and Overton, W.S. (1988) *Chemical characteristics of streams in the mid-Atlantic and southeastern United States (National Stream Survey-Phase I). Volume II: streams sampled, descriptive statistics, and compendium of physical and chemical data*, Washington, D.C. U.S. Environmental Protection Agency, EPA/600/3-88-021a.

- Shubzda, J., Lindberg, S.E., Garten, C.T., Jr. and Nodvin, S.C. (1995) Elevational trends in the fluxes of sulphur and nitrogen in throughfall in the Southern Appalachian mountains: some surprising results. *Water, Air, and Soil Pollut.* 85, 2265-2270.
- Shubzda, J., Flum, T., Rhodes, H., Lindberg, S.E. and Nodvin, S.C. (1997) Atmospheric deposition to the high elevation Noland divide watershed. *Can. J. For. Res.*
- Shubzda, J. and Nodvin, S.C. (1997) Sulfate adsorption under high atmospheric deposition at Noland divide watershed. *Soil Sci.*
- Silsbee, D.G. and Larson, G.L. (1982a) Water quality of streams in the Great Smoky Mountains National Park. *Hydrobiologia* 89, 97-115.
- Silsbee, D.G. and Larson, G.L. (1982b) Bacterial water quality: springs and streams in the Great Smoky Mountains National Park. *Environ. Manag.* 6, 353-359.
- Smith, W.H. (1990) *Air pollution and forests*, New York: Springer-Verlag.
- Stoddard, J.L. (1994) Long-term changes in watershed retention of nitrogen: its causes and aquatic consequences. In: Baker, L.A. (Ed.) *Environmental chemistry of lakes and reservoirs*, pp. 223-284. Washington D.C. Advances in Chemistry Series No. 237, American Chemical Society]
- Stottlemeyer, R. (1992) Nitrogen mineralization and streamwater chemistry, Rock Creek watershed, Denali National Park, Alaska, U.S.A. *Arctic and Alpine Research* 24, 291-303.
- Stumm, W. and Morgan, J.J. (1981) *Aquatic chemistry*, 3rd ed. New York: Wiley-Interscience.
- Swank, W.T. and Johnson, C.E. (1994) Small catchment research in the evaluation and development of forest management practices. In: Moldan, B. and Cerny, J. (Eds.) *Biogeochemistry of small catchments: a tool for environmental research*, pp. 383-408. New York: John Wiley & Sons, Ltd.
- Webb, J.R., Cosby, B.J., Galloway, J.N., Hornberger, G.M. and Ryan, P.F. (1989) *The Virginia trout stream study*, Report for Project Number F-72: Virginia Department of Game and Inland Fisheries.
- Williams, M.W., Brown, A.D. and Melack, J.M. (1993) Geochemical and hydrologic controls on the composition of surface water in a high-elevation basin, Sierra Nevada, California. *Limnol. Oceanogr.* 38, 775-797.

Winger, P.V., Lasier, P.J., Hudy, M., Fowler, D. and Van Den Avyle, M.J. (1987)
Sensitivity of high-elevation streams in the southern blue ridge province to acidic
deposition. *Water Resources Bulletin* 23, 379-386.

Appendices

Appendix A

List of Stream Survey Sampling Sites

Table A. Water quality sampling sites for each stream system.

Stream System	Site Description	Sample Number	Elevation	
			(m)	(ft)
Abrams Creek	Anthony Creek below Spence Field	201	1460	4800
Abrams Creek	Spring at Russell Field Shelter	183	1300	4270
Abrams Creek	Anthony Creek above campsite 9	200	1130	3720
Abrams Creek	Unnamed trib to Anthony Creek	329	1100	3600
Abrams Creek	Left Fork Anthony Creek at camp 10	184	860	2830
Abrams Creek	Rabbit Creek Spring off Parsons Br. Road	157	800	2620
Abrams Creek	Anthony Creek below fork (Left & R.)	185	690	2280
Abrams Creek	Forge Creek at Parsons Branch Road	177	660	2180
Abrams Creek	Arbutus Creek at Cooper Road	167	610	1990
Abrams Creek	Anthony Creek above Picnic area	186	600	1965
Abrams Creek	Abrams Creek above Picnic area	187	600	1960
Abrams Creek	Stony Branch at Cooper Road	166	590	1950
Abrams Creek	Trib to Wilson Branch	165	570	1870
Abrams Creek	Mill Creek at Pumphouse on Forge Cr Road	488	530	1750
Abrams Creek	Wilson Branch at Cooper Road	164	530	1730
Abrams Creek	Rabbit Creek at Rabbit Cr Trail cross	154	520	1720
Abrams Creek	Mill Creek above Abrams Creek	173	520	1705
Abrams Creek	Abrams Creek below Cades Cove	174	520	1705
Abrams Creek	Abrams Creek 300 m below trailhead bridge	489	520	1700
Abrams Creek	Stony Branch (Abrams Creek)	175	480	1560
Abrams Creek	Abrams Creek above Stony Branch	176	480	1560
Abrams Creek	Wilson Branch near Abrams Falls	151	450	1480
Abrams Creek	Scott Gap Branch at Hanna Mtn Trail	155	440	1450
Abrams Creek	Abrams Creek below Abrams Falls	152	440	1450
Abrams Creek	Kreider Branch (Abrams Creek)	341	410	1350
Abrams Creek	Oak Flats (Abrams Creek)	342	400	1320
Abrams Creek	Abrams Creek at Hanna Mtn Trail cross	153	380	1260
Abrams Creek	Kingfisher Creek at Little Bottoms trail	366	370	1220
Abrams Creek	Abrams Creek at campsite 17	335	370	1200
Abrams Creek	Abrams Creek at Ranger Station	156	340	1110
Abrams Creek	Chilhowee Lake at Abrams Creek	171	260	860

Table A (continued). Water quality sampling sites for each stream system.

Stream System	Site Description	Sample Number	Elevation	
			(m)	(ft)
Big Creek	Rocky Branch at Cosby Shelter	116	1410	4640
Big Creek	Unnamed trib to Swallow Fork (Big Cr)	131	1300	4280
Big Creek	Unnamed trib to Big Creek	117	1280	4200
Big Creek	Upper Big Creek	118	1160	3800
Big Creek	Upper Low Gap Branch (Big Creek)	124	1160	3800
Big Creek	Unnamed trib to Big Creek	119	1130	3700
Big Creek	Big Creek above Gunter Fork area	120	1130	3700
Big Creek	Middle Swallow Fork (Big Creek)	132	1130	3700
Big Creek	Lower Gunter Fork (Big Creek)	122	1030	3380
Big Creek	Lower Swallow Fork (Big Creek)	133	1000	3280
Big Creek	Lower Low Gap Branch (Big Creek)	123	980	3200
Big Creek	Big Creek at Gunter Fork crossing	121	970	3180
Big Creek	Big Creek below Swallow Fork	134	910	2970
Big Creek	Big Creek at Brakeshoe Springs	135	770	2520
Big Creek	Kilby Branch (Big Creek)	136	570	1880
Big Creek	Big Creek at Campground	6	520	1715
Big Creek	Chestnut Creek at Ranger Sta	7	520	1710
Big Creek	Big Creek at boundary	364	480	1560
Bradley Fork	Unnamed trib to Chasteen Creek	275	1250	4100
Bradley Fork	Upper Taywa Creek	278	1220	4000
Bradley Fork	Unnamed trib to Chasteen Creek	274	1210	3960
Bradley Fork	Unnamed trib to Chasteen Creek	273	1170	3830
Bradley Fork	Unnamed trib at campsite 48	272	1070	3500
Bradley Fork	Chasm Prong (Upper Bradley Fork)	108	1040	3400
Bradley Fork	Gulf Prong (Upper Bradley Fork)	109	1040	3400
Bradley Fork	Lower Taywa Creek	279	1030	3380
Bradley Fork	Bradley Fork at campsite 49	284	930	3040
Bradley Fork	Bradley Fork at end of road	280	890	2930
Bradley Fork	Bradley Fork at 2750	281	840	2750
Bradley Fork	Chasteen Creek at campsite 50	271	720	2370
Bradley Fork	Bradley Fork above Chasteen Creek	282	720	2370
Bradley Fork	Bradley Fork above Smokemont camp	283	690	2260
Bunches Creek	Bunches Creek above Balsam Mtn road	291	1620	5320
Bunches Creek	Trib to Bunches on Flat Creek Trail	350	1450	4750
Bunches Creek	Bunches Creek at Flat Creek Trail	337	1440	4740
Bunches Creek	Flat Creek above falls (Bunches Cr)	336	1430	4680

Table A (continued). Water quality sampling sites for each stream system.

Stream System	Site Description	Sample Number	Elevation	
			(m)	(ft)
Cataloochee Creek	Unnamed trib at Laurel Gap Shelter	139	1710	5600
Cataloochee Creek	Bear Branch at campsite 42 (Cataloo)	290	1680	5500
Cataloochee Creek	Onion Bed Branch (Cataloochee Cr)	130	1260	4150
Cataloochee Creek	Pretty Hollow Creek at log bridge	129	1160	3790
Cataloochee Creek	Falling Rock Creek (Cataloochee Cr)	140	1070	3500
Cataloochee Creek	Beech Creek above Falling Rock Creek	141	1070	3500
Cataloochee Creek	Unnamed trib to Pretty Hollow Creek	128	1050	3440
Cataloochee Creek	Caldwell Fork near campsite 41	294	990	3240
Cataloochee Creek	Lost Bottom Creek (Cataloochee Creek)	143	940	3100
Cataloochee Creek	Hurricane Creek above Rough Fork	285	920	3030
Cataloochee Creek	Rough Fork above Hurricane Creek	286	920	3030
Cataloochee Creek	Snake Branch (Cataloochee Creek)	296	920	3020
Cataloochee Creek	Caldwell Fork at Rabbit Ridge trail	295	910	3000
Cataloochee Creek	Rough Fork below Messer Fork	287	900	2950
Cataloochee Creek	Beech Creek above Lost Bottom Creek	142	880	2900
Cataloochee Creek	Palmer Creek above Pretty Hollow Cr	144	870	2860
Cataloochee Creek	Pretty Hollow Cr above Palmer Cr	127	870	2860
Cataloochee Creek	Caldwell Fork below Sag Branch	297	850	2800
Cataloochee Creek	Palmer Creek at Davidson Branch Trail	493	850	2790
Cataloochee Creek	Rough Fork at Caldwell House	293	830	2730
Cataloochee Creek	Palmer Creek at Pretty Hollow trailhd	146	830	2730
Cataloochee Creek	Cataloochee Creek below Caldwell Fork	150	800	2620
Cataloochee Creek	Caldwell Fork above Cataloochee Creek	145	800	2620
Cataloochee Creek	Mid Cataloochee Creek at bridge	149	780	2550
Cataloochee Creek	Lower Little Cataloochee Creek	148	750	2475
Cataloochee Creek	Lower Cataloochee Creek	147	750	2460
Cosby Creek	Upper Cosby Creek at Low Gap tr.	115	1170	3840
Cosby Creek	Gabes Creek at Campsite 34	368	1010	3300
Cosby Creek	Inadu Creek at Snake Den Ridge Tr.	138	990	3240
Cosby Creek	Upper Rock Creek (Cosby Creek)	137	840	2750
Cosby Creek	Camel Hump Creek off Low Gap Trail	492	840	2750
Cosby Creek	Cosby Creek at log bridge	114	770	2510
Cosby Creek	Cosby Creek at Campground	5	700	2300
Cosby Creek	Lower Rock Creek	4	510	1680
Cosby Creek	Cosby Creek at boundary	3	510	1675
Deep Creek	Upper Deep Creek	254	1260	4120

Table A (continued). Water quality sampling sites for each stream system.

Stream System	Site Description	Sample Number	Elevation	
			(m)	(ft)
Deep Creek	Deep Creek at 3820	255	1160	3820
Deep Creek	Deep Creek at 3215	256	980	3215
Deep Creek	Deep Creek at campsite 53	257	910	3000
Deep Creek	Deep Creek at campsite 54	258	800	2640
Deep Creek	Deep Creek at campsite 58	259	730	2400
Deep Creek	Deep Creek at 1 st large bridge	323	610	2000
Deep Creek	Indian Creek at trail bridge	324	570	1880
Deep Creek	Deep Creek above campgrounds	325	550	1820
Deep Creek	Deep Creek at boundary	326	540	1780
Dunn Creek	Dunn Creek at boundary	2	610	1990
Eagle Creek	Unnamed trib on Jenkins Ridge Trail	202	1460	4800
Eagle Creek	Spring at Spence Field Shelter	195	1370	4500
Eagle Creek	Gunna Creek above Devils Race Branch	196	1150	3780
Eagle Creek	Gunna Creek at old campsite	197	930	3040
Eagle Creek	Lost Cove Creek (Eagle Creek)	303	890	2920
Eagle Creek	Gunna Creek at 2500 ft	198	760	2500
Eagle Creek	Mill Creek above Eagle Creek	180	730	2400
Eagle Creek	Gunna Creek above Mill Creek (Eagle)	179	730	2400
Eagle Creek	Eagle Creek at campsite 96	181	610	1990
Eagle Creek	Eagle Creek at campsite 89	301	580	1890
Eagle Creek	Ekaneetlee Creek above Eagle Creek	300	580	1890
Eagle Creek	Pinnacle Creek above Eagle Creek	308	560	1850
Eagle Creek	Unnamed trib to Eagle Creek	309	550	1800
Eagle Creek	Eagle Creek at campsite 90	302	540	1760
East Prong Little River	Double Springs Gap Shelter (TN side)	220	1680	5500
East Prong Little River	Spring at Silers Bald Shelter	218	1660	5440
East Prong Little River	Little River at 5100 ft	241	1550	5100
East Prong Little River	Little River at 4800 ft	240	1460	4800
East Prong Little River	Little River at 4400 ft	239	1340	4400
East Prong Little River	Buckeye Gap Prong at 4200 ft	217	1280	4200
East Prong Little River	Little River at 4160 ft	238	1270	4160

Table A (continued). Water quality sampling sites for each stream system.

Stream System	Site Description	Sample Number	Elevation	
			(m)	(ft)
East Prong Little River	Little River at 3900 ft	206	1190	3900
East Prong Little River	Buckeye Gap Prong at campsite 25	216	1100	3600
East Prong Little River	Jakes Creek at campsite 27	207	1080	3540
East Prong Little River	Grouse Creek at campsite 30	205	1070	3500
East Prong Little River	Little River at campsite 30	204	1070	3500
East Prong Little River	Silers Creek (Little River)	214	1040	3400
East Prong Little River	Ashe Camp Prong (Little River)	215	1030	3380
East Prong Little River	Goshen Prong above Fish Camp Prong	213	1020	3360
East Prong Little River	Fish Camp Prong below Ashe Camp Pr.	212	1010	3300
East Prong Little River	Middle Jakes Creek	39	1000	3275
East Prong Little River	Little River (b/ Fish Camp & camp 30)	203	940	3100
East Prong Little River	War Branch (Little River)	330	910	3000
East Prong Little River	Fish Camp Prong at angled barrier below War Branch	475	900	2960
East Prong Little River	Henderson Prong (Little River)	354	870	2860
East Prong Little River	Fish Camp Prong above Little River	211	840	2740
East Prong Little River	Little River above Fish Camp Prong	210	840	2740
East Prong Little River	Lost Creek at Little River trail	209	830	2720
East Prong Little River	Shields Branch (Little River)	331	820	2700
East Prong Little River	Laurel Branch at Laurel Falls	36	790	2600
East Prong Little River	Little River at damaged bridge	42	790	2590
East Prong Little River	Mannis Branch at Meigs Cr trail	353	780	2560

Table A (continued). Water quality sampling sites for each stream system.

Stream System	Site Description	Sample Number	Elevation	
			(m)	(ft)
East Prong Little River	Kiver Branch at Meigs Cr tr.	340	770	2520
East Prong Little River	Husky Branch at Meigs Cr trail	41	760	2500
East Prong Little River	Little River below bridge over Husky Branch	474	740	2440
East Prong Little River	Jakes Creek at Cabins/Trailhead	38	710	2320
East Prong Little River	Little River at old road gate	40	700	2300
East Prong Little River	Bunch Prong at Meigs Cr trail	355	690	2270
East Prong Little River	Little River at Elkmont Campground	35	640	2090
East Prong Little River	Upper Little Brier Branch	22	610	2000
East Prong Little River	Little River at Milsap Site	34	610	1990
East Prong Little River	Little Brier Branch at school	21	550	1790
East Prong Little River	Little River at Metcalf Bot.	20	520	1700
East Prong Little River	Lower Meigs Creek	18	510	1680
East Prong Little River	Little River (b/Sinks & Metcalf)	19	490	1600
East Prong Little River	Little River at Sinks	17	470	1550
East Prong Little River	Little River below 1st bridge	16	400	1300
East Prong Little River	Whiteoak Flats Br. (Little R.)	15	370	1200
East Prong Little River	Little River above Y	14	350	1140
East Prong Little River	Little River at boundary	13	340	1100
Fontana Lake Tribs	Unnamed trib on Lakeshore Tr at camp 75	477	610	2000
Fontana Lake Tribs	Pilkey Creek at Lakeshore Trail	478	580	1900
Fontana Lake Tribs	Chambers Creek at campsite 98	476	580	1900
Forney Creek	Clingmans Dome (Forney Creek)	361	1900	6240
Forney Creek	Double Springs Gap Shelter (NC side)	219	1680	5510

Table A (continued). Water quality sampling sites for each stream system.

Stream System	Site Description	Sample Number	Elevation	
			(m)	(ft)
Forney Creek	Upper Forney Creek	225	1460	4800
Forney Creek	Forney Creek below Keeyuga Creek	226	1330	4370
Forney Creek	Steeltrap Creek (Forney Creek)	227	1200	3930
Forney Creek	Bee Gum Branch (Forney Creek)	358	1100	3610
Forney Creek	Forney Creek above Little Steeltrap	228	1010	3310
Forney Creek	Forney Creek at campsite 69	230	840	2760
Forney Creek	Huggins Creek at campsite 69	229	840	2760
Forney Creek	Forney Creek at Jonas Creek Trail	231	750	2460
Forney Creek	Gray Wolf Creek at Lakeshore trail	316	670	2200
Forney Creek	Forney Creek at campsite 71	315	660	2160
Forney Creek	Forney Creek at Lake Shore Trail	313	540	1770
Hazel Creek	Unnamed trib to Hazel on Cascades Trail	486	1250	4100
Hazel Creek	Hazel Creek above cascades	221	1220	4000
Hazel Creek	Hazel Creek at 3400 ft.	222	1040	3400
Hazel Creek	Proctor Creek (Hazel Creek)	223	930	3060
Hazel Creek	Hazel Creek below Proctor Creek	224	910	3000
Hazel Creek	Little Fork above Sugar Fork Trail	481	850	2800
Hazel Creek	Unnamed trib at campsite 82 (Hazel)	199	850	2800
Hazel Creek	Sugar Fork above Little Fork	482	840	2750
Hazel Creek	Walker Creek above Hazel Creek Trail	485	790	2600
Hazel Creek	Sugar Fork above Haw Gap Creek	483	730	2400
Hazel Creek	Hazel Creek at Cold Spring Gap Trail	484	730	2400
Hazel Creek	Bone Valley Creek (Hazel Creek)	310	690	2280
Hazel Creek	Haw Gap Creek at bridge near campsite 84	480	670	2200
Hazel Creek	Hazel Creek below Haw Gap Creek	311	670	2190
Hazel Creek	Hazel Creek at campsite 85	312	540	1770
Hazel Creek	Hazel Creek at campsite 86	479	530	1750
Hesse Creek	Hesse Creek at old Rich Mtn shelter	12	1010	3300
Hesse Creek	Shell Branch at Ace Gap trail	9	630	2060
Hesse Creek	Hesse Creek at Rich Mtn Rd	8	630	2060
Hesse Creek	Upper Beard Cane Creek	163	500	1650
Hesse Creek	Lower Beard Cane Creek	11	460	1520
Hesse Creek	Hesse Creek at Campsite 3	10	450	1480
Indian Camp Creek	Otter Creek (Indian Camp Prong)	103	1310	4300
Indian Camp Creek	Unnamed trib to Otter Creek	105	1300	4250
Indian Camp Creek	Copperhead Branch (Indian Camp Pr)	104	1270	4160

Table A (continued). Water quality sampling sites for each stream system.

Stream System	Site Description	Sample Number	Elevation	
			(m)	(ft)
Indian Camp Creek	Upper Indian Camp Prong	106	1170	3840
Indian Camp Creek	Indian Camp below Albright Grove	107	930	3040
Indian Camp Creek	Indian Camp at Old Settlers	1	670	2200
LeConte Creek	LeConte Creek above Rainbow Falls	63	1390	4550
LeConte Creek	Unnamed trib to LeConte Creek below rainbow falls	62	1240	4060
LeConte Creek	Unnamed trib to LeConte Creek at 3400 ft	61	1190	3900
LeConte Creek	LeConte Creek at log bridge	60	1070	3520
LeConte Creek	LeConte Creek below log bridge at 2850 ft.	64	870	2850
LeConte Creek	LeConte Creek near Bullhead trail	59	790	2600
LeConte Creek	Scratch Britches at Uplands	27	590	1950
LeConte Creek	LeConte Creek at Uplands	28	590	1950
LeConte Creek	LeConte Creek at boundary	26	470	1550
Little Tennessee Tribs	Shop Creek above impoundment	352	270	900
Little Tennessee Tribs	Lower Tabcat Creek	172	270	890
Middle Prong Little Pigeon R.	Ramsay Prong on AT near Mt Guyot	113	1980	6500
Middle Prong Little Pigeon R.	Buck Fork on AT near Tricorner Knob	112	1870	6120
Middle Prong Little Pigeon R.	Upper Ramsay Prong	95	1520	5000
Middle Prong Little Pigeon R.	Ramsay Prong above falls	94	1370	4480
Middle Prong Little Pigeon R.	Ramsay Prong below falls	93	1340	4380
Middle Prong Little Pigeon R.	Unnamed trib to Ramsay Pr below falls	92	1300	4280
Middle Prong Little Pigeon R.	Buck Fork at 3800 ft.	98	1160	3800
Middle Prong Little Pigeon R.	Trillium Branch at Brushy Mtn Tr.	334	1140	3750
Middle Prong Little Pigeon R.	Unnamed Trib to Ramsay Prong at 3670 ft.	91	1120	3670
Middle Prong Little Pigeon R.	Ramsay Prong above trib at site 91	90	1060	3480
Middle Prong Little Pigeon R.	Upper Cannon Creek at 3400 ft.	44	1040	3400
Middle Prong Little Pigeon R.	Shutts Prong at 3200 ft.	45	980	3200

Table A (continued). Water quality sampling sites for each stream system.

Stream System	Site Description	Sample Number	Elevation	
			(m)	(ft)
Middle Prong Little Pigeon R.	Ramsay Prong at 2 nd log bridge above trailhead	89	910	3000
Middle Prong Little Pigeon R.	Eagle Rocks Creek above Buck Fork	96	910	2980
Middle Prong Little Pigeon R.	Buck Fork above Eagle Rocks Creek	97	910	2980
Middle Prong Little Pigeon R.	Middle Pr Little Pig below Buck Fork	345	870	2850
Middle Prong Little Pigeon R.	Boulevard Prong above Shutts Prong	333	840	2760
Middle Prong Little Pigeon R.	Porters Creek above Shutts Prong	46	840	2750
Middle Prong Little Pigeon R.	Ramsay Prong above Mid Pr Lit Pig.	88	800	2610
Middle Prong Little Pigeon R.	Mid Pr Lit Pig. above Ramsay Prong	87	800	2610
Middle Prong Little Pigeon R.	Mid Pr Lit Pig. Below Ramsay Prong	86	790	2600
Middle Prong Little Pigeon R.	Cannon Creek above Porters Cr.	47	730	2400
Middle Prong Little Pigeon R.	Little Laurel Branch at Ramsay Pr. Trailhead	365	640	2090
Middle Prong Little Pigeon R.	Porters Creek at log bridge	43	630	2080
Middle Prong Little Pigeon R.	Mid Pr Lit Pig. At Ramsay Trailhead	84	620	2040
Middle Prong Little Pigeon R.	Porters Creek at gate	48	590	1950
Middle Prong Little Pigeon R.	Mid Pr Little Pigeon above Porters	83	580	1890
Middle Prong Little Pigeon R.	Porters Creek at bridge to Ramsay	49	500	1650
Middle Prong Little Pigeon R.	Mid Pr Little Pigeon below Porters	50	490	1600
Middle Prong Little Pigeon R.	Mid Pr Little Pigeon near Ranger sta	51	450	1470
Middle Prong Little Pigeon R.	Mid Pr Little Pigeon at boundary	52	410	1350
Middle Prong Little River	Sams Creek (Middle Pr Little River)	191	990	3240
Middle Prong Little River	Upper Panther Creek (Middle Pr Little River)	208	990	3240

Table A (continued). Water quality sampling sites for each stream system.

Stream System	Site Description	Sample Number	Elevation	
			(m)	(ft)
Middle Prong Little River	Starkey Creek (Mid Pr Little River)	192	980	3200
Middle Prong Little River	Panther Creek above Lynn Camp Prong	188	790	2590
Middle Prong Little River	Lynn Camp Prong above M Pr Little R.	189	790	2590
Middle Prong Little River	Thunderhead Prong at trail crossing	190	660	2160
Middle Prong Little River	Sams Creek above Thunderhead Prong	472	660	2160
Middle Prong Little River	Mid Pr Little River at old trailhead	193	600	1960
Middle Prong Little River	Mid Pr Little River above Tremont	194	520	1700
Middle Prong Little River	Lower Middle Prong Little R.	23	350	1150
Noland Creek	Clingmans Creek (Noland Creek)	243	1700	5580
Noland Creek	NE stream at Noland Divide Watershed	244	1570	5150
Noland Creek	Sassafras Branch (Noland Creek)	245	1080	3550
Noland Creek	Noland Creek at campsite 61	246	1080	3530
Noland Creek	Springhouse Branch (Noland Creek)	359	1010	3300
Noland Creek	Noland Creek at first crossing	247	970	3185
Noland Creek	Noland Creek at third crossing	248	910	2980
Noland Creek	Unnamed trib just below site 248	249	900	2950
Noland Creek	Slab Cove Branch (Noland Creek)	319	770	2540
Noland Creek	Unnamed trib to Goldmine Branch Noland	317	770	2520
Noland Creek	Noland Creek below campsite 64	320	770	2510
Noland Creek	Unnamed trib to Goldmine Branch Noland	318	680	2240
Noland Creek	Bearpen Branch at campsite 65	321	610	1990
Noland Creek	Noland Creek below Road-to-nowhere	322	550	1790
Noland Creek	Noland Creek at campsite 66	314	540	1770
Oconaluftee River	Unnamed trib Kephart Pr at Icewater	82	1800	5910
Oconaluftee River	Beech Flats above roadcut	253	1480	4840
Oconaluftee River	Beech Flats below roadcut	252	1450	4760
Oconaluftee River	Lower Lower Grassy Branch (Kephart)	264	1280	4210
Oconaluftee River	Beech Flats above US 441 loop	251	1220	4010
Oconaluftee River	Lower Grassy Branch (Kephart Prong)	99	1090	3590
Oconaluftee River	Kephart Prong at Kephart Shelter	263	1090	3590

Table A (continued). Water quality sampling sites for each stream system.

Stream System	Site Description	Sample Number	Elevation	
			(m)	(ft)
Oconaluftee River	Beech Flats at 3500 ft.	250	1070	3500
Oconaluftee River	Coon Branch (Kephart Prong)	262	1020	3360
Oconaluftee River	Kephart Prong at 3020 ft	261	920	3020
Oconaluftee River	Kinati Fork (Oconaluftee River)	362	870	2840
Oconaluftee River	Beech Flats at Kephart footbridge	270	850	2800
Oconaluftee River	Kephart Prong above Beech Flats	260	850	2800
Oconaluftee River	Oconaluftee River above Collins Creek	269	680	2220
Oconaluftee River	Oconaluftee River below Smokemont	268	660	2170
Oconaluftee River	Couches Creek (Oconaluftee River)	265	640	2100
Oconaluftee River	Oconaluftee River at Visitors Center	266	620	2020
Oconaluftee River	Oconaluftee River at boundary	327	610	1990
Panther Creek	Panther Creek below Gregory Bald	178	1190	3900
Panther Creek	Panther Creek at Parson Branch Road	158	770	2520
Panther Creek	Panther Creek above lowest trib	168	610	1990
Panther Creek	Lowest trib to Panther Creek	169	270	900
Panther Creek	Lower Panther Creek	170	260	860
Parsons Branch	Upper Parsons Branch Road	159	770	2540
Parsons Branch	Middle Parsons Branch	160	610	2000
Parsons Branch	Bible Creek above Parsons Branch	161	490	1600
Parsons Branch	Parsons Branch below Bible Creek	162	480	1580
Parsons Branch	Parsons Branch at boundary	298	470	1550
Raven Fork	Left Raven Fork at Tricorner Shelter	111	1800	5920
Raven Fork	Enloe Creek at Pecks Corner Shelter	110	1590	5230
Raven Fork	McGee Springs (Raven Fork)	126	1520	5000
Raven Fork	Raven Fork below Three Forks Pool	102	1280	4210
Raven Fork	Right Raven Fork at Three Forks	101	1280	4210
Raven Fork	Middle Raven Fork above Three Forks	348	1280	4210
Raven Fork	Left Raven Fork above Three Forks	338	1280	4210
Raven Fork	Bulldie Creek (Raven Fork)	346	1270	4180
Raven Fork	Trib to Raven Fork above campsite 47	332	1250	4100
Raven Fork	Enloe Creek at log bridge	276	1210	3970
Raven Fork	Trib to Raven Fork near campsite 47 (Ramp)	349	1160	3800
Raven Fork	Raven Fork at campsite 47	277	1100	3620
Raven Fork	Raven Fork near Park housing	267	620	2035
Roaring Fork	Surry Fork (Roaring Fork)	53	1350	4435
Roaring Fork	Roaring Fork at Grotto Falls	54	1120	3680

Table A (continued). Water quality sampling sites for each stream system.

Stream System	Site Description	Sample Number	Elevation	
			(m)	(ft)
Roaring Fork	Unnamed trib to Roaring Fork at Grotto Falls tr.	55	1100	3620
Roaring Fork	Rocky Spur near Grotto Falls trailhead	56	1040	3410
Roaring Fork	Roaring Fork at Grapeyard Trailhead	57	740	2430
Roaring Fork	Roaring Fork at boundary gate	58	560	1840
Roaring Fork	Dudley Creek at the stable on US 321	347	400	1300
Straight Fork	Right Prong of Ledge Creek near campsite 42	369	1550	5080
Straight Fork	Grass Branch (Straight Fork)	328	1190	3890
Straight Fork	Hyatt Creek (Straight Fork)	288	1110	3640
Straight Fork	Ledge Creek (Straight Fork)	125	1080	3550
Straight Fork	Trib to Straight Fork	357	1010	3300
Straight Fork	Straight Fork at concrete slab cross	289	940	3070
Straight Fork	Straight Fork at Enloe Creek Trail	292	890	2910
Straight Fork	Straight Fork at boundary	363	780	2560
Twentymile Creek	Spring at The Dungeon (20 Mile Creek)	182	1120	3660
Twentymile Creek	Rye Patch Branch (Twentymile Creek)	343	900	2950
Twentymile Creek	Twentymile Creek at campsite 92	344	810	2650
Twentymile Creek	Proctor Branch above 20 mile Creek	304	760	2500
Twentymile Creek	Twentymile Creek at upper bridge	305	700	2300
Twentymile Creek	Twentymile Creek above campsite 93	306	670	2200
Twentymile Creek	Dalton Branch above 20 mile Creek	307	450	1470
Twentymile Creek	Twentymile Creek at Ranger Station	299	390	1270
West Prong Little Pigeon R.	Spring at Mt Collins Shelter	242	1780	5830
West Prong Little Pigeon R.	Upper Road Prong	234	1520	5000
West Prong Little Pigeon R.	Walker Camp Prong near cascades	360	1440	4710
West Prong Little Pigeon R.	Unnamed trib to Walker Camp at cascade	80	1430	4690
West Prong Little Pigeon R.	Unnamed trib to Walker Camp Prong at site 237	236	1380	4520
West Prong Little Pigeon R.	Walker Camp Pr at last bridge	237	1370	4510
West Prong Little Pigeon R.	Unnamed trib to Styx Branch above flood scar	78	1330	4370
West Prong Little Pigeon R.	Styx Branch above Rock Arch	77	1300	4280

Table A (continued). Water quality sampling sites for each stream system.

Stream System	Site Description	Sample Number	Elevation	
			(m)	(ft)
West Prong Little Pigeon R.	Walker Camp Prong above 1 st bridge above Alum Cave	233	1290	4240
West Prong Little Pigeon R.	Unnamed trib off US 441 at 4210 ft.	232	1280	4210
West Prong Little Pigeon R.	Alum Cave Creek above Styx Branch	79	1250	4090
West Prong Little Pigeon R.	Road Prong at only stream crossing	235	1220	4000
West Prong Little Pigeon R.	Alum Cave Creek at fish site	76	1190	3910
West Prong Little Pigeon R.	Walker Camp Prong above Alum Cave Cr	74	1160	3820
West Prong Little Pigeon R.	Alum Cave Creek above Walker Camp Pr	75	1160	3820
West Prong Little Pigeon R.	Road Prong at Chimneys trail split	70	1150	3770
West Prong Little Pigeon R.	West Prong Little Pigeon above Bearpen Br.	473	1120	3660
West Prong Little Pigeon R.	Bearpen Hollow at pullout between Alum Cave and Chimneys	69	1120	3660
West Prong Little Pigeon R.	Road Prong at 3 rd bridge on trail	71	1060	3480
West Prong Little Pigeon R.	Road Prong at 2 nd bridge on trail	72	1020	3360
West Prong Little Pigeon R.	Walker Camp Prong above Road Prong (1 st bridge)	73	1020	3360
West Prong Little Pigeon R.	W Pr Little Pig. Above Chimneys Pic	68	870	2850
West Prong Little Pigeon R.	Unnamed trib at Chimneys Picnic area	67	870	2840
West Prong Little Pigeon R.	Upper Big Branch (W Pr Little Pigeon)	65	870	2840
West Prong Little Pigeon R.	W Pr Little Pigeon at Chimneys Pic.	66	820	2680
West Prong Little Pigeon R.	Lower Big Branch (W Pr Little Pig.)	33	790	2600
West Prong Little Pigeon R.	Critter Brook (W. Pr. Little Pig.)	32	620	2030
West Prong Little Pigeon R.	W Pr. L. Pig. across from Husky Gap	31	530	1740
West Prong Little Pigeon R.	Fighting Creek	37	470	1550

Table A (continued). Water quality sampling sites for each stream system.

Stream System	Site Description	Sample Number	Elevation	
			(m)	(ft)
West Prong Little Pigeon R.	W Pr Little Pigeon at headquarters	30	440	1430
West Prong Little Pigeon R.	W Pr Little Pigeon at boundary	29	410	1330
West Prong Little River	Laurel Creek at Schoolhouse Gap	25	460	1520
West Prong Little River	Lower West Prong Little R.	24	350	1150

Appendix B

Summary Statistics for Stream Survey Sites

Table B. Summary statistics by site for ammonium data. Values are expressed in μ eq/L.

Sample Number	Minimum	Average	Maximum	Standard Deviation	Coefficient of Variation (%)	N
1	0.00	0.31	5.92	1.36	435.89%	19
2	0.00	0.00	0.00	0.00	-	5
3	0.00	0.40	4.44	1.23	303.66%	19
4	0.00	0.10	1.84	0.43	424.26%	18
5	0.00	0.16	2.19	0.59	374.17%	14
6	0.00	0.00	0.00	0.00	-	12
7	0.00	0.00	0.00	0.00	-	5
8	0.00	0.00	0.00	0.00	-	4
9	0.00	0.00	0.00	0.00	-	3
10	0.00	0.00	0.00	0.00	-	3
11	0.00	0.00	0.00	0.00	-	3
12	0.00	0.00	0.00	0.00	-	3
13	0.00	0.08	1.64	0.37	447.21%	20
14	0.00	0.76	7.30	1.86	244.39%	17
15	0.00	0.00	0.00	0.00	-	3
16	0.00	0.00	0.00	0.00	-	5
17	0.00	0.12	1.37	0.41	331.66%	11
18	0.00	0.00	0.00	0.00	-	4
19	0.00	1.17	4.67	2.34	200.00%	4
20	0.00	0.21	3.40	0.75	361.48%	24
21	0.00	0.00	0.00	0.00	-	10
22	0.00	0.00	0.00	0.00	-	10
23	0.00	0.11	2.38	0.51	469.04%	22
24	0.00	0.25	3.14	0.84	332.50%	23
25	0.00	0.24	2.63	0.79	331.66%	11
26	0.00	0.00	0.00	0.00	-	6
27	0.00	0.00	0.00	0.00	-	5
28	0.00	0.00	0.00	0.00	-	5
29	0.00	0.17	3.01	0.71	424.26%	18
30	0.00	0.16	1.59	0.44	269.46%	21
31	0.00	0.00	0.00	0.00	-	6
32	0.00	0.00	0.00	0.00	-	6

Table B (continued). Summary statistics by site for ammonium data. Values are expressed in $\mu\text{eq/L}$.

Sample Number	Minimum	Average	Maximum	Standard Deviation	Coefficient of Variation (%)	N
33	0.00	0.00	0.00		-	1
34	0.00	3.88	47.00	12.97	334.15%	13
35	0.00	0.00	0.00	0.00	-	14
36	0.00	0.89	7.14	2.52	282.84%	8
37	0.00	0.00	0.00	0.00	-	5
38	0.00	0.13	0.93	0.35	264.58%	7
39	0.00	0.61	3.50	1.42	232.83%	6
40	0.00	0.00	0.00	0.00	-	16
41	0.00	0.00	0.00	0.00	-	3
42	0.00	0.23	3.15	0.84	374.17%	14
43	0.00	0.28	6.17	1.32	469.04%	22
44	0.00	0.00	0.00	0.00	-	9
45	0.00	0.38	4.75	1.29	339.11%	24
46	0.00	0.00	0.00	0.00	-	21
47	0.00	0.79	10.91	2.64	334.95%	18
48	0.00	0.25	3.02	0.87	346.41%	12
49	0.00	0.19	3.52	0.81	435.89%	19
50	0.00	0.32	2.84	0.95	300.00%	9
51	0.00	0.00	0.00	0.00	-	6
52	0.00	0.00	0.00	0.00	-	21
53	0.00	0.48	2.14	0.87	179.17%	7
54	0.00	0.33	1.66	0.64	190.62%	7
55	0.00	0.00	0.00	0.00	-	8
56	0.00	0.39	2.30	0.86	221.13%	7
57	0.00	0.00	0.00	0.00	-	7
58	0.00	0.00	0.00	0.00	-	8
59	0.00	0.00	0.00	0.00	-	5
60	0.00	0.67	3.35	1.50	223.61%	5
61	0.00	0.00	0.00	0.00	-	5
62	0.00	0.00	0.00	0.00	-	5
63	0.00	0.41	2.06	0.92	223.61%	5
64	0.00	0.58	2.89	1.29	223.61%	5
65	0.00	1.68	3.35	2.37	141.42%	2
66	0.00	0.20	3.95	0.81	405.44%	25
67	0.00	0.00	0.00	0.00	-	5
68	0.00	0.00	0.00	0.00	-	7

Table B (continued). Summary statistics by site for ammonium data. Values are expressed in $\mu\text{eq/L}$.

Sample Number	Minimum	Average	Maximum	Standard Deviation	Coefficient of Variation (%)	N
69	0.00	0.00	0.00	0.00	-	16
70	0.00	0.31	2.51	0.89	282.84%	8
71	0.00	0.14	2.07	0.48	344.73%	22
72	0.00	0.15	3.11	0.68	458.26%	21
73	0.00	0.16	2.65	0.59	360.94%	23
74	0.00	0.34	5.94	1.29	384.41%	22
75	0.00	0.06	1.16	0.26	447.21%	20
76	0.00	0.08	1.40	0.33	424.26%	18
77	0.00	0.22	2.37	0.72	331.66%	11
78	0.00	1.14	2.28	1.61	141.42%	2
79	0.00	0.00	0.00	0.00	-	15
80	0.00	0.24	2.90	0.84	346.41%	12
81	0.00	1.05	6.56	2.45	234.27%	7
82	0.00	0.00	0.00	0.00	-	11
83	0.00	0.00	0.00	0.00	-	7
84	0.00	0.13	1.85	0.49	374.17%	14
86	0.00	0.29	3.77	1.045111	360.56%	13
87	0.00	0.00	0.00	0.00	-	14
88	0.00	0.00	0.00	0.00	-	13
89	0.00	0.00	0.00	0.00	-	6
90	0.00	0.51	3.06	1.25	244.95%	6
91	0.00	0.35	3.55	1.12	316.23%	10
92	0.00	1.46	4.59	1.90	130.45%	15
93	0.00	0.86	4.39	1.50	173.00%	14
94	0.00	0.00	0.00	0.00	-	3
95	0.00	0.00	0.00	0.00	-	2
96	0.00	1.44	5.09	2.45	170.62%	4
97	0.00	0.00	0.00	0.00	-	2
99	0.00	0.00	0.00	0.00	-	4
100	0.00	0.00	0.00	0.00	-	2
101	0.00	0.00	0.00		-	1
102	0.00	0.00	0.00		-	1
103	0.00	0.36	4.37	1.034514	289.60%	22
104	0.00	0.46	5.78	1.39	298.94%	22
105	0.00	0.02	0.38	0.09	424.26%	18
106	0.00	0.08	0.84	0.24	295.32%	18

Table B (continued). Summary statistics by site for ammonium data. Values are expressed in $\mu\text{eq/L}$.

Sample Number	Minimum	Average	Maximum	Standard Deviation	Coefficient of Variation (%)	N
107	0.00	0.21	2.18	0.57	270.03%	22
108	0.00	0.00	0.00	0.00	-	2
109	0.00	0.00	0.00	0.00	-	2
110	0.00	0.23	3.25	0.87	374.17%	14
111	0.00	0.20	2.40	0.69	346.41%	12
112	0.00	0.82	7.39	2.46	300.00%	9
113	0.00	0.53	3.34	1.19	225.50%	11
114	0.00	0.34	3.76	1.14	331.66%	11
115	0.00	0.00	0.00	0.00	-	7
116	0.00	0.00	0.00	0.00	-	2
117	0.00	1.25	2.50	1.77	141.42%	2
118	0.00	0.00	0.00	0.00	-	3
119	0.00	0.00	0.00	0.00	-	2
120	0.00	0.00	0.00	0.00	-	3
121	0.00	0.00	0.00	0.00	-	5
122	0.00	0.00	0.00	0.00	-	3
123	0.00	0.00	0.00	0.00	-	5
124	0.00	0.00	0.00	0.00	-	5
125	0.00	0.00	0.00	0.00	-	13
126	0.00	0.34	3.78	1.14	331.66%	11
127	0.00	0.70	6.43	1.63	233.98%	18
128	0.00	0.00	0.00	0.00	-	8
129	0.00	0.00	0.00	0.00	-	10
130	0.00	8.04	76.79	24.18	300.69%	10
131	0.00	0.00	0.00	0.00	-	10
132	0.00	0.00	0.00	0.00	-	11
133	0.00	0.04	0.49	0.15	331.66%	11
134	0.00	0.14	1.99	0.53	374.17%	14
135	0.00	0.44	4.44	1.40	316.23%	10
136	0.00	0.00	0.00	0.00	-	3
137	0.00	0.29	5.46	1.25	435.89%	19
138	0.00	0.61	4.70	1.44	235.44%	19
139	0.00	0.29	1.16	0.58	200.00%	4
140	0.00	0.00	0.00	0.00	-	15
141	0.00	0.00	0.00	0.00	-	16
142	0.00	0.00	0.00	0.00	-	17

Table B (continued). Summary statistics by site for ammonium data. Values are expressed in $\mu\text{eq/L}$.

Sample Number	Minimum	Average	Maximum	Standard Deviation	Coefficient of Variation (%)	N
143	0.00	1.75	20.61	4.93	281.13%	18
144	0.00	0.00	0.00	0.00	-	16
145	0.00	0.00	0.00	0.00	-	6
146	0.00	0.00	0.00	0.00	-	16
147	0.00	0.00	0.00	0.00	-	18
148	0.00	0.00	0.00	0.00	-	11
149	0.00	0.00	0.00	0.00	-	11
150	0.00	0.53	5.80	1.75	331.66%	11
151	0.00	0.42	5.16	1.31	313.17%	17
152	0.00	0.94	5.14	1.80	191.67%	17
153	0.00	1.13	8.45	2.80	247.32%	13
154	2.04	2.04	2.04		0.00%	1
155	0.00	0.00	0.00		-	1
156	0.00	0.89	4.03	1.601858	179.28%	20
157	0.00	0.00	0.00	0.00	-	4
158	0.00	1.55	7.77	3.48	223.61%	5
159	0.00	0.38	1.88	0.84	223.61%	5
160	0.00	0.00	0.00	0.00	-	5
161	0.00	0.00	0.00	0.00	-	5
162	0.00	0.00	0.00	0.00	-	5
163	0.00	0.05	0.15	0.09	173.21%	3
164	0.00	0.00	0.00	0.00	-	3
165	0.00	0.00	0.00	0.00	-	3
166	0.00	0.00	0.00	0.00	-	3
167	0.00	0.00	0.00	0.00	-	3
168	0.00	0.00	0.00	0.00	-	4
169	0.00	0.00	0.00	0.00	-	3
170	0.00	0.00	0.00	0.00	-	4
171	0.00	1.98	5.95	3.43	173.21%	3
172	0.00	0.00	0.00	0.00	-	2
173	0.00	0.00	0.00	0.00	-	20
174	0.00	0.63	5.31	1.65	260.56%	20
175	0.00	0.00	0.00	0.00	-	17
176	0.00	0.32	3.47	0.94	290.78%	16
177	0.00	0.00	0.00	0.00	-	9
178	0.00	0.00	0.00	0.00	-	4

Table B (continued). Summary statistics by site for ammonium data. Values are expressed in $\mu\text{eq/L}$.

Sample Number	Minimum	Average	Maximum	Standard Deviation	Coefficient of Variation (%)	N
179	0.00	0.00	0.00	0.00	-	3
180	0.00	0.00	0.00	0.00	-	2
181	0.00	0.00	0.00	0.00	-	3
182	0.00	0.00	0.00	0.00	-	2
183	0.00	0.21	3.15	0.81	387.30%	15
184	0.00	0.86	7.49	1.97	230.48%	18
185	0.00	0.42	6.33	1.63	387.30%	15
186	0.00	0.23	4.92	1.07	458.26%	21
187	0.00	0.00	0.00	0.00	-	6
188	0.00	0.00	0.00	0.00	-	5
189	0.00	0.13	0.92	0.35	264.58%	7
190	0.00	0.05	0.85	0.20	424.26%	18
191	0.00	0.34	3.38	0.98	286.57%	17
192	0.00	0.27	3.11	0.83	312.76%	20
193	0.00	0.69	13.20	3.03	435.89%	19
194	0.00	0.19	3.60	0.83	435.89%	19
195	0.00	0.00	0.00	0.00	-	11
196	0.00	3.51	11.08	5.24	149.03%	4
197	0.00	0.00	0.00	0.00	-	3
198	0.00	0.00	0.00	0.00	-	3
199	0.00	0.00	0.00	0.00	-	7
200	0.00	0.07	1.35	0.31	435.89%	19
201	0.00	0.00	0.00	0.00	-	14
202	0.00	0.00	0.00		-	1
203	0.00	0.00	0.00		-	1
204	0.00	0.00	0.00		-	1
205	0.00	0.00	0.00		-	1
207	0.00	0.00	0.00	0	-	5
208	0.00	0.00	0.00	0.00	-	6
209	0.00	0.14	2.63	0.60	435.89%	19
210	0.00	0.00	0.00	0.00	-	21
211	0.00	0.00	0.00	0.00	-	16
212	0.00	0.14	2.18	0.55	400.00%	16
213	0.00	0.11	2.21	0.48	458.26%	21
214	0.00	0.67	4.97	1.58	235.83%	25
215	0.00	0.00	0.00	0.00	-	23

Table B (continued). Summary statistics by site for ammonium data. Values are expressed in $\mu\text{eq/L}$.

Sample Number	Minimum	Average	Maximum	Standard Deviation	Coefficient of Variation (%)	N
216	0.00	0.00	0.00	0.00	-	4
218	0.00	1.49	9.61	2.95	197.51%	18
219	0.00	0.00	0.00	0.00	-	17
220	0.00	0.91	10.10	2.53	277.76%	17
221	0.00	0.18	1.95	0.59	331.66%	11
222	0.00	0.00	0.00	0.00	-	4
223	0.00	0.00	0.00	0.00	-	7
224	0.00	0.04	0.25	0.10	244.95%	6
225	0.00	0.00	0.00	0.00	-	6
226	0.00	0.17	1.03	0.42	244.95%	6
227	0.00	0.00	0.00	0.00	-	6
228	0.00	0.87	5.20	2.12	244.95%	6
229	0.00	0.00	0.00	0.00	-	6
230	0.00	0.58	2.88	1.15	198.87%	6
231	0.00	0.00	0.00	0.00	-	6
232	0.00	0.00	0.00	0.00	-	7
233	0.00	0.23	4.42	1.02	435.89%	19
234	0.00	0.37	3.60	1.07	292.39%	18
235	0.00	0.15	1.38	0.46	300.00%	9
236	0.00	0.45	6.25	1.56	346.68%	16
237	0.00	0.24	2.96	0.72	296.65%	25
242	0.00	0.29	2.32	0.76	256.39%	14
243	0.00	0.30	4.24	1.13	374.17%	14
244	0.00	0.61	5.97	1.61	264.68%	14
245	0.00	0.00	0.00	0.00	-	13
246	0.00	0.46	3.62	1.14	246.62%	15
247	0.00	0.63	7.16	1.98	316.87%	13
248	0.00	0.00	0.00	0.00	-	15
249	0.00	1.79	8.93	3.99	223.61%	5
250	0.00	0.45	3.59	1.27	282.84%	8
251	0.00	0.25	5.60	1.19	469.04%	22
252	0.00	0.22	2.72	0.70	322.22%	21
253	0.00	0.12	2.51	0.55	458.26%	21
254	0.00	0.00	0.00	0.00	-	7
255	0.00	0.00	0.00	0.00	-	5
256	0.00	0.24	1.22	0.55	223.61%	5

Table B (continued). Summary statistics by site for ammonium data. Values are expressed in $\mu\text{eq/L}$.

Sample Number	Minimum	Average	Maximum	Standard Deviation	Coefficient of Variation (%)	N
257	0.00	0.00	0.00	0.00	-	5
258	0.00	0.00	0.00	0.00	-	5
259	0.00	0.00	0.00	0.00	-	4
260	0.00	0.00	0.00	0.00	-	8
261	0.00	0.00	0.00	0.00	-	7
262	0.00	0.00	0.00	0.00	-	7
263	0.00	0.00	0.00	0.00	-	8
264	0.00	0.00	0.00	0.00	-	6
265	0.00	0.79	7.86	2.49	316.23%	10
266	0.00	0.28	3.09	0.93	331.66%	11
267	0.00	0.31	4.92	1.14	362.68%	19
268	0.00	0.31	6.26	1.40	447.21%	20
269	0.00	0.20	1.60	0.57	282.84%	8
270	0.00	0.32	3.40	0.94	296.99%	18
271	0.00	0.00	0.00	0.00	-	13
272	0.00	0.38	1.90	0.85	223.61%	5
273	0.00	0.85	3.42	1.71	200.00%	4
274	0.00	0.00	0.00	0.00	-	4
275	0.00	0.00	0.00	0.00	-	3
276	0.00	0.00	0.00	0.00	-	15
277	0.00	0.09	1.39	0.35	400.00%	16
278	0.00	0.00	0.00	0.00	-	11
279	0.00	0.00	0.00	0.00	-	10
280	0.00	0.00	0.00	0.00	-	11
281	0.00	1.46	11.51	3.60	246.69%	11
282	0.00	0.00	0.00	0.00	-	12
283	0.00	0.04	0.65	0.17	387.30%	15
284	0.00	0.00	0.00	0.00	-	2
285	0.00	0.73	3.63	1.62	223.61%	5
286	0.00	0.00	0.00	0.00	-	5
287	0.00	0.37	1.74	0.70	190.66%	6
288	0.00	0.00	0.00	0.00	-	11
289	0.00	1.13	8.22	2.47	218.63%	14
290	0.00	0.31	3.39	0.92	299.20%	18
291	0.00	0.00	0.00	0.00	-	17
292	0.00	0.52	3.65	1.28	244.97%	13

Table B (continued). Summary statistics by site for ammonium data. Values are expressed in $\mu\text{eq/L}$.

Sample Number	Minimum	Average	Maximum	Standard Deviation	Coefficient of Variation (%)	N
293	0.00	0.00	0.00	0.00	-	20
294	0.00	0.00	0.00	0.00	-	6
295	0.00	0.29	1.74	0.71	244.95%	6
296	0.00	0.23	0.91	0.46	200.00%	4
297	0.00	0.00	0.00	0.00	-	4
298	0.00	0.00	0.00	0.00	-	7
299	0.00	0.45	6.37	1.70	374.17%	14
300	0.00	0.00	0.00	0.00	-	6
301	0.00	0.00	0.00	0.00	-	5
302	0.00	2.32	6.96	4.02	173.21%	3
303	0.00	0.00	0.00		-	1
304	0.00	0.00	0.00	0	-	12
305	0.00	0.00	0.00	0.00	-	14
306	0.00	0.38	2.87	0.92	243.17%	12
307	0.00	0.37	6.23	1.51	412.31%	17
308	0.00	0.00	0.00	0.00	-	4
309	0.00	0.00	0.00	0.00	-	3
310	0.00	0.00	0.00	0.00	-	12
311	0.00	0.44	2.53	0.83	190.53%	11
312	0.00	0.00	0.00	0.00	-	6
313	0.00	0.00	0.00		-	1
314	0.00	0.00	0.00		-	1
315	0.00	0.00	0.00	0	-	6
316	0.00	0.00	0.00	0.00	-	3
317	0.00	0.00	0.00	0.00	-	4
318	0.00	0.00	0.00	0.00	-	3
319	0.00	0.00	0.00	0.00	-	13
320	0.00	0.87	9.57	2.89	331.66%	11
321	0.00	0.00	0.00	0.00	-	11
322	0.00	0.11	1.60	0.43	374.17%	14
323	0.00	0.00	0.00	0.00	-	5
324	0.00	0.00	0.00	0.00	-	4
325	0.00	0.00	0.00	0.00	-	5
326	0.00	0.00	0.00	0.00	-	8
327	0.00	0.86	5.51	1.85	216.10%	18
328	0.00	1.93	11.40	4.32	223.18%	11

Table B (continued). Summary statistics by site for ammonium data. Values are expressed in $\mu\text{eq/L}$.

Sample Number	Minimum	Average	Maximum	Standard Deviation	Coefficient of Variation (%)	N
329	0.00	0.00	0.00	0.00	-	11
330	0.00	0.00	0.00	0.00	-	15
331	0.00	1.96	4.25	2.28	116.26%	4
332	0.00	0.00	0.00	0.00	-	10
333	0.00	0.00	0.00	0.00	-	3
334	0.00	0.00	0.00	0.00	-	7
335	0.00	1.48	6.71	2.82	190.15%	13
336	0.00	1.03	7.01	2.18	211.86%	14
337	0.00	0.37	2.58	0.91	244.83%	13
338	0.00	0.00	0.00	0.00	-	2
339	0.00	0.00	0.00		-	1
340	0.00	1.35	5.38	2.69109	200.00%	4
341	0.00	0.23	2.50	0.75	331.66%	11
342	0.00	0.00	0.00	0.00	-	11
343	0.00	0.00	0.00	0.00	-	2
344	0.00	0.00	0.00	0.00	-	2
345	0.00	0.00	0.00		-	1
346	0.00	0.00	0.00		-	1
347	0.00	0.00	0.00		-	1
348	32.27	32.27	32.27		0.00%	1
349	0.00	0.00	0.00		-	1
350	0.00	0.00	0.00	0	-	5
351	0.00	0.00	0.00		-	1
352	0.00	0.00	0.00	0	-	4
353	0.00	0.00	0.00	0.00	-	3
354	0.00	0.00	0.00	0.00	-	4
355	0.00	0.00	0.00	0.00	-	4
356	0.00	0.00	0.00		-	1
357	0.00	0.00	0.00	0	-	7
358	0.00	0.00	0.00		-	1
359	0.00	0.00	0.00		-	1
360	0.00	0.00	0.00	0	-	5
361	0.00	2.50	5.01	3.54	141.42%	2
362	0.00	0.00	0.00	0.00	-	4
363	0.00	0.00	0.00	0.00	-	5
364	0.00	0.39	1.58	0.79	200.00%	4

Table B (continued). Summary statistics by site for ammonium data. Values are expressed in $\mu\text{eq/L}$.

Sample Number	Minimum	Average	Maximum	Standard Deviation	Coefficient of Variation (%)	N
365	0.00	0.00	0.00		-	1
366	0.00	0.00	0.00	0.00	-	3
367	0.00	0.00	0.00		-	1
368	0.00	0.00	0.00		-	1
369	0.00	0.81	1.62	1.15	141.42%	2
377	0.00	0.00	0.00	0.00	-	2
392	0.00	0.00	0.00		-	1
393	0.00	0.00	0.00	0.00	-	2
399	0.00	0.00	0.00		-	1
400	0.00	0.00	0.00		-	1
401	0.00	0.00	0.00		-	1
402	0.00	0.00	0.00		-	1
472	0.00	0.00	0.00	0.00	-	5
473	0.00	0.00	0.00	0.00	-	7
474	0.00	0.55	3.85	1.45	264.58%	7
475	0.00	5.14	25.39	10.16	197.47%	6
479	0.00	0.00	0.00	0.00	-	7
480	0.00	0.00	0.00	0.00	-	7
481	0.00	0.00	0.00	0.00	-	7
482	0.00	0.00	0.00	0.00	-	5
483	0.00	0.00	0.00	0.00	-	7
484	0.00	0.00	0.00	0.00	-	6
485	0.00	0.00	0.00	0.00	-	8
486	0.00	0.00	0.00		-	1
487	0.00	0.00	0.00	0.00	-	3
488	0.00	0.34	2.35	0.89	264.58%	7
489	0.00	0.00	0.00	0.00	-	5
490	3.72	3.72	3.72		0.00%	1
492	0.00	1.07	6.40	2.61	244.95%	6
493	0.00	0.00	0.00	0.00	-	4
494	0.00	0.00	0.00		-	1

Table C. Summary statistics by site for Acid Neutralizing Capacity (ANC) data.
Values are expressed in $\mu\text{eq/L}$.

Sample Number	Minimum	Average	Maximum	Standard Deviation	Coefficient of Variation	N
1	19.29	39.73	90.40	14.95	37.64%	19
2	50.04	61.44	72.25	9.71	15.80%	5
3	9.68	76.81	114.09	24.71	32.16%	19
4	5.55	33.59	103.11	31.01	92.31%	18
5	45.46	73.35	104.60	19.85	27.06%	15
6	41.14	65.91	89.64	13.99	21.23%	12
7	47.49	91.46	133.55	35.13	38.41%	5
8	33.41	62.33	80.37	20.68	33.18%	4
9	47.25	101.88	162.09	57.63	56.56%	3
10	77.10	134.05	170.36	49.93	37.25%	3
11	90.90	148.70	189.46	51.44	34.59%	3
12	32.40	53.39	76.16	21.93	41.08%	3
13	51.64	111.86	192.18	39.14	34.99%	20
14	42.72	106.71	190.61	39.38	36.90%	17
15	56.81	80.83	100.87	22.30	27.59%	3
16	56.72	85.82	122.78	28.33	33.01%	5
17	48.85	90.44	122.48	28.29	31.28%	11
18	59.14	72.09	86.28	11.23	15.57%	4
19	47.98	75.19	114.50	30.04	39.95%	4
20	44.43	84.84	149.29	27.58	32.51%	24
21	79.84	181.89	306.20	77.48	42.60%	10
22	94.10	232.12	818.55	216.77	93.39%	10
23	35.91	99.06	222.43	50.63	51.11%	22
24	75.19	147.24	227.74	49.08	33.34%	23
25	125.10	248.29	499.57	115.25	46.42%	11
26	66.24	88.70	112.26	17.85	20.13%	6
27	102.45	137.68	184.10	33.05	24.01%	5
28	22.89	36.19	47.29	9.81	27.10%	5
29	44.48	108.66	381.90	73.78	67.90%	18
30	29.04	64.87	108.10	22.46	34.62%	22
31	16.66	106.73	375.58	133.91	125.47%	6
32	31.94	59.93	80.42	17.51	29.23%	6
33	28.95	28.95	28.95			1
34	33.67	63.36	121.02	25.63	40.45%	13
35	32.63	68.81	141.97	29.27	42.54%	14
36	18.79	38.28	51.81	9.96	26.03%	8

Table C (continued). Summary statistics by site for Acid Neutralizing Capacity (ANC) data. Values are expressed in $\mu\text{eq/L}$.

Sample Number	Minimum	Average	Maximum	Standard Deviation	Coefficient of Variation	N
37	90.26	389.19	1284.51	512.26	131.62%	5
38	37.09	60.22	85.19	16.51	27.42%	7
39	38.44	44.26	59.04	7.52	17.00%	6
40	25.55	48.48	75.17	13.28	27.39%	16
41	31.93	49.53	75.59	23.03	46.50%	3
42	31.27	45.85	74.06	11.49	25.05%	14
43	1.96	15.62	65.06	13.18	84.41%	22
44	-0.93	10.97	40.62	12.22	111.37%	9
45	-5.77	4.75	19.45	6.99	147.17%	24
46	-2.39	6.68	20.08	6.10	91.28%	21
47	5.60	18.23	90.03	19.07	104.59%	18
48	3.68	32.27	55.11	15.05	46.65%	12
49	14.34	34.41	65.25	15.40	44.77%	19
50	17.33	46.03	86.93	23.40	50.83%	9
51	27.76	55.25	77.53	18.71	33.86%	6
52	19.65	51.95	95.98	19.97	38.43%	21
53	-10.44	-5.27	2.48	5.31	-100.74%	7
54	5.31	18.35	33.91	10.92	59.55%	7
55	1.01	22.87	38.57	10.98	48.03%	8
56	-9.25	24.12	38.78	15.95	66.12%	7
57	31.30	53.77	77.67	14.31	26.61%	7
58	23.70	79.21	112.91	28.66	36.18%	8
59	5.18	14.15	20.08	5.64	39.84%	5
60	-5.63	2.63	18.07	9.33	355.06%	5
61	-10.13	-1.35	15.61	9.93	-736.77%	5
62	-8.44	-4.78	3.00	4.52	-94.41%	5
63	-11.27	-5.73	1.23	4.96	-86.46%	5
64	-0.94	19.25	52.28	20.99	109.03%	5
65	30.08	43.94	57.79	19.59	44.59%	2
66	7.94	40.25	124.25	23.41	58.16%	25
67	15.85	34.95	44.94	12.44	35.59%	5
68	8.77	33.37	60.32	19.29	57.81%	7
69	-2.84	6.40	44.11	12.60	196.91%	16
70	5.47	24.75	50.32	16.25	65.64%	8
71	8.19	31.51	59.80	13.77	43.69%	22
72	10.77	30.70	58.78	13.93	45.39%	21

Table C (continued). Summary statistics by site for Acid Neutralizing Capacity (ANC) data. Values are expressed in $\mu\text{eq/L}$.

Sample Number	Minimum	Average	Maximum	Standard Deviation	Coefficient of Variation	N
73	-6.05	33.07	69.90	19.32	58.42%	23
74	3.18	55.30	114.97	33.62	60.80%	22
75	-24.04	-7.67	2.65	5.10	-66.46%	20
76	-24.70	-8.76	1.31	5.07	-57.81%	18
77	6.98	14.39	20.31	4.17	29.01%	11
78	14.85	26.13	37.16	11.16	42.71%	3
79	-34.31	-16.95	7.80	10.04	-59.25%	15
80	-17.57	-4.74	6.69	9.72	-204.85%	12
81	3.69	18.13	52.96	16.49	90.95%	7
82	11.90	29.40	64.21	15.40	52.38%	12
83	10.51	40.52	91.05	30.09	74.26%	7
84	0.90	19.63	35.75	10.01	50.99%	14
86	2.25	14.44	28.69	7.35	50.93%	13
87	-6.64	13.63	27.17	10.09	74.03%	14
88	4.43	19.61	91.58	22.58	115.14%	13
89	-2.63	15.11	57.20	22.10	146.26%	6
90	-8.56	6.35	32.25	14.30	225.16%	6
91	2.43	19.61	52.48	14.01	71.45%	10
92	-24.96	-15.50	-8.26	5.15	-33.25%	15
93	-16.09	-2.06	19.03	9.66	-469.28%	14
94	-11.88	-6.32	2.99	8.11	-128.41%	3
95	-8.59	-2.91	2.77	8.03	-276.04%	2
96	-2.30	5.25	14.90	7.16	136.32%	4
97	4.61	13.73	22.30	8.85	64.50%	3
99	10.01	21.98	33.03	9.51	43.28%	4
100	77.22	79.10	80.99	2.66	3.37%	2
101	20.89	21.80	22.72	1.30	5.95%	2
102	9.42	9.50	9.59	0.12	1.26%	2
103	-3.94	4.28	14.16	4.60	107.37%	22
104	-9.46	32.31	360.95	81.49	252.24%	22
105	-11.27	6.86	49.84	15.43	224.79%	18
106	3.23	18.77	58.82	11.58	61.70%	18
107	11.88	23.32	69.60	11.33	48.60%	22
108	1.63	7.57	13.51	8.40	110.96%	2
109	12.18	14.24	16.30	2.91	20.46%	2
110	-3.97	7.75	68.04	20.38	262.93%	14

Table C (continued). Summary statistics by site for Acid Neutralizing Capacity (ANC) data. Values are expressed in $\mu\text{eq/L}$.

Sample Number	Minimum	Average	Maximum	Standard Deviation	Coefficient of Variation	N
111	20.07	53.40	98.97	28.00	52.43%	12
112	-74.89	-34.74	-11.54	17.78	-51.16%	10
113	-57.45	-32.05	-13.30	12.38	-38.63%	12
114	15.82	38.88	60.22	12.21	31.40%	11
115	16.14	36.27	56.03	14.90	41.08%	7
116	23.51	30.51	37.50	9.89	32.41%	2
117	48.97	60.14	71.31	15.80	26.27%	2
118	17.95	31.88	54.52	19.78	62.04%	3
119	56.11	78.05	99.99	31.03	39.75%	2
120	25.00	40.97	60.18	17.81	43.47%	3
121	42.11	61.88	76.34	14.31	23.12%	5
122	14.59	36.59	58.39	21.90	59.85%	3
123	30.80	43.18	51.32	8.82	20.42%	5
124	39.54	51.88	62.70	10.40	20.05%	5
125	32.93	81.31	107.77	22.56	27.74%	13
126	-25.05	37.30	109.03	31.99	85.76%	11
127	30.32	49.80	86.67	16.32	32.76%	18
128	34.27	57.52	85.07	16.56	28.78%	9
129	31.51	49.13	66.29	10.84	22.06%	10
130	18.01	39.62	58.50	12.25	30.92%	10
131	2.77	44.61	61.95	16.20	36.30%	10
132	22.14	39.70	69.53	13.31	33.53%	11
133	23.75	44.31	71.32	14.81	33.42%	11
134	41.96	63.01	86.86	14.51	23.02%	14
135	35.03	62.83	87.64	18.47	29.39%	10
136	27.24	32.55	40.70	7.17	22.02%	3
137	4.67	13.43	21.45	4.29	31.96%	20
138	-2.98	4.80	23.12	6.17	128.54%	20
139	21.66	25.36	31.31	4.18	16.48%	4
140	31.54	52.19	99.52	18.55	35.54%	15
141	36.17	67.99	98.55	15.74	23.15%	16
142	35.07	58.15	86.61	13.82	23.77%	17
143	29.90	52.07	78.17	12.23	23.49%	18
144	27.96	59.13	107.98	19.13	32.36%	16
145	39.34	68.27	96.46	18.89	27.67%	6
146	35.42	61.55	91.08	13.70	22.26%	16

Table C (continued). Summary statistics by site for Acid Neutralizing Capacity (ANC) data. Values are expressed in $\mu\text{eq/L}$.

Sample Number	Minimum	Average	Maximum	Standard Deviation	Coefficient of Variation	N
147	54.41	86.47	114.94	18.77	21.70%	18
148	66.84	115.00	148.59	29.10	25.31%	11
149	62.41	82.53	111.13	16.93	20.51%	11
150	59.43	83.01	113.10	19.27	23.22%	11
151	53.09	146.44	792.15	164.68	112.46%	18
152	207.72	556.09	918.52	233.87	42.06%	18
153	191.87	433.62	758.74	179.91	41.49%	14
154	62.87	62.87	62.87			1
155	27.83	27.83	27.83			1
156	183.61	443.33	781.70	186.22	42.00%	21
157	49.22	192.53	397.18	147.94	76.84%	4
158	31.10	45.76	59.49	10.88	23.78%	5
159	78.19	135.16	215.07	52.51	38.85%	5
160	98.02	321.14	545.33	194.80	60.66%	5
161	43.81	124.84	325.23	115.78	92.74%	5
162	99.29	183.74	299.10	82.27	44.78%	5
163	79.41	196.28	271.01	102.51	52.23%	3
164	64.08	114.22	142.42	43.53	38.11%	3
165	74.33	161.91	280.73	106.69	65.89%	3
166	56.98	98.65	128.87	37.28	37.80%	3
167	51.61	81.28	96.61	25.70	31.62%	3
168	51.30	83.56	109.56	24.08	28.81%	4
169	93.94	189.43	348.58	138.74	73.24%	3
170	58.25	76.25	99.45	20.00	26.23%	4
171	277.40	415.67	586.57	157.14	37.80%	3
172	102.01	119.26	136.51	24.39	20.45%	2
173	45.85	122.41	611.39	117.97	96.37%	21
174	409.96	1073.95	1624.49	409.22	38.10%	20
175	41.81	129.43	874.96	187.98	145.23%	18
176	43.50	384.72	876.65	250.97	65.23%	17
177	36.07	48.26	60.21	8.11	16.80%	9
178	22.27	27.50	40.00	8.37	30.43%	4
179	32.10	40.47	49.56	8.75	21.63%	3
180	35.12	41.03	46.94	8.36	20.37%	2
181	40.98	47.21	54.96	7.11	15.06%	3
182	30.71	40.39	50.06	13.68	33.88%	2

Table C (continued). Summary statistics by site for Acid Neutralizing Capacity (ANC) data. Values are expressed in $\mu\text{eq/L}$.

Sample Number	Minimum	Average	Maximum	Standard Deviation	Coefficient of Variation	N
183	-113.12	23.24	129.07	58.45	251.46%	14
184	16.96	34.45	55.61	9.81	28.49%	17
185	27.01	41.21	60.60	9.99	24.25%	14
186	32.35	59.89	219.85	40.84	68.20%	21
187	36.14	164.36	469.22	176.66	107.48%	6
188	32.82	38.43	51.99	7.77	20.22%	5
189	20.28	38.06	56.34	13.41	35.23%	7
190	18.11	30.61	40.83	7.93	25.91%	19
191	6.69	20.67	42.56	8.88	42.94%	18
192	3.00	21.28	47.24	10.67	50.15%	20
193	15.69	54.91	97.01	22.78	41.49%	20
194	22.40	46.83	78.14	17.30	36.93%	20
195	21.16	29.76	38.31	5.16	17.34%	11
196	25.00	34.35	43.43	7.60	22.13%	4
197	19.36	26.55	30.89	6.27	23.63%	3
198	34.27	39.13	42.23	4.26	10.90%	3
199	84.12	92.92	115.47	10.87	11.69%	7
200	14.07	28.95	57.24	12.30	42.47%	19
201	20.30	36.02	67.78	11.64	32.32%	15
202	0.69	0.69	0.69			1
203	66.41	66.41	66.41			1
204	76.89	76.89	76.89			1
205	50.72	50.72	50.72			1
207	19.47	38.94	52.09	12.25	31.45%	5
208	34.42	41.42	62.02	10.32	24.91%	6
209	21.60	36.06	50.24	7.51	20.82%	20
210	31.13	49.78	70.95	10.89	21.87%	22
211	27.45	41.68	72.64	10.92	26.21%	16
212	11.69	34.67	71.22	15.22	43.90%	17
213	5.20	23.45	48.53	9.02	38.48%	21
214	16.91	38.62	69.61	12.06	31.24%	25
215	26.69	49.27	78.53	13.17	26.72%	23
216	24.65	33.06	38.30	6.58	19.91%	4
218	-6.94	7.42	26.67	10.60	142.86%	18
219	-9.69	0.57	15.99	6.93	1220.64%	17
220	-3.40	11.29	108.91	25.99	230.08%	17

Table C (continued). Summary statistics by site for Acid Neutralizing Capacity (ANC) data. Values are expressed in $\mu\text{eq/L}$.

Sample Number	Minimum	Average	Maximum	Standard Deviation	Coefficient of Variation	N
221	22.80	31.73	53.82	9.12	28.74%	11
222	31.25	35.76	39.92	4.17	11.66%	4
223	48.36	55.21	69.09	7.87	14.25%	7
224	44.80	54.13	70.88	12.51	23.10%	6
225	7.10	16.13	27.13	8.34	51.70%	6
226	5.40	17.57	35.56	11.09	63.09%	6
227	7.84	19.62	34.56	10.74	54.76%	6
228	14.18	27.72	43.07	11.53	41.58%	6
229	19.64	36.30	52.01	11.15	30.72%	6
230	21.35	36.12	53.59	12.73	35.24%	6
231	36.28	46.10	56.96	8.91	19.32%	6
232	-8.04	31.62	66.31	27.54	87.08%	7
233	-19.97	26.50	62.11	21.69	81.85%	19
234	5.83	18.80	56.68	10.80	57.47%	18
235	11.50	23.45	46.40	13.75	58.60%	9
236	-15.10	-1.17	19.25	8.32	-714.13%	16
237	-42.76	-14.97	-2.08	7.34	-49.03%	25
242	-6.03	4.73	15.99	6.16	130.13%	14
243	-4.02	4.33	14.83	6.37	147.26%	14
244	-0.02	8.34	22.32	6.88	82.56%	14
245	32.71	40.69	49.51	5.30	13.01%	13
246	18.33	28.86	46.07	8.78	30.42%	15
247	22.55	32.63	47.20	7.40	22.68%	13
248	18.99	37.13	51.63	9.64	25.97%	15
249	52.43	69.19	84.65	13.02	18.82%	5
250	23.35	54.92	143.43	38.91	70.85%	8
251	-3.27	19.86	63.85	14.16	71.31%	22
252	-14.64	11.93	81.14	31.79	266.51%	21
253	-2.18	76.38	95.79	21.76	28.49%	21
254	39.46	63.43	98.71	18.71	29.49%	7
255	48.96	64.10	80.92	12.99	20.27%	5
256	44.63	54.09	69.88	10.33	19.10%	5
257	44.67	55.46	72.91	11.98	21.60%	5
258	47.46	58.11	73.15	11.22	19.31%	5
259	43.47	54.04	63.77	8.59	15.90%	4
260	37.36	49.72	83.67	15.22	30.61%	8

Table C (continued). Summary statistics by site for Acid Neutralizing Capacity (ANC) data. Values are expressed in $\mu\text{eq/L}$.

Sample Number	Minimum	Average	Maximum	Standard Deviation	Coefficient of Variation	N
261	31.18	44.27	63.94	11.97	27.03%	7
262	27.79	48.00	95.09	25.91	53.98%	7
263	-23.09	25.45	43.86	21.29	83.69%	8
264	16.20	31.99	50.92	13.27	41.47%	6
265	53.60	66.22	78.70	9.62	14.53%	10
266	47.15	72.38	106.50	21.37	29.53%	11
267	40.06	66.84	88.63	16.68	24.95%	19
268	24.45	65.70	105.56	19.19	29.20%	20
269	37.94	55.27	89.99	17.70	32.02%	8
270	22.84	48.07	66.31	12.88	26.78%	19
271	32.38	76.08	100.75	19.44	25.55%	13
272	21.47	67.65	96.25	25.56	37.78%	6
273	15.33	53.91	84.30	26.06	48.35%	5
274	38.01	52.51	68.48	13.49	25.69%	4
275	39.88	71.13	100.85	24.93	35.05%	4
276	20.72	35.67	51.21	9.16	25.66%	15
277	11.22	24.47	40.17	8.04	32.87%	16
278	41.70	61.56	71.85	7.60	12.34%	12
279	45.22	62.03	74.90	9.72	15.67%	11
280	17.99	36.78	68.84	16.12	43.82%	12
281	24.88	43.96	68.07	12.06	27.44%	12
282	16.81	65.38	91.85	25.47	38.96%	13
283	33.97	61.27	98.67	18.83	30.72%	15
284	20.85	41.00	64.07	21.76	53.07%	3
285	56.71	112.94	151.21	35.91	31.79%	5
286	50.73	74.10	117.75	26.64	35.95%	5
287	54.92	89.49	132.54	28.84	32.22%	6
288	60.30	73.87	87.46	10.52	14.23%	11
289	28.03	52.46	79.70	14.63	27.88%	14
290	-40.51	-4.11	32.51	16.57	-403.17%	18
291	3.75	23.84	58.52	14.34	60.14%	17
292	41.41	62.01	107.67	19.37	31.23%	13
293	63.07	86.61	106.70	11.57	13.36%	20
294	50.52	66.96	93.13	15.06	22.49%	6
295	62.72	73.79	87.51	10.35	14.03%	6
296	63.87	90.44	119.91	23.07	25.51%	4

Table C (continued). Summary statistics by site for Acid Neutralizing Capacity (ANC) data. Values are expressed in $\mu\text{eq/L}$.

Sample Number	Minimum	Average	Maximum	Standard Deviation	Coefficient of Variation	N
297	58.30	72.22	96.19	16.53	22.88%	4
298	95.32	279.52	427.07	133.85	47.89%	7
299	29.80	67.69	93.88	14.92	22.05%	14
300	39.33	61.64	83.84	15.12	24.53%	6
301	37.28	54.78	74.22	14.32	26.14%	5
302	53.15	58.35	64.91	6.00	10.27%	3
303	69.50	69.50	69.50			1
304	47.17	71.44	102.09	19.10	26.73%	12
305	37.14	58.35	77.05	11.20	19.19%	14
306	46.23	68.52	88.22	11.28	16.46%	12
307	32.52	56.97	80.01	12.10	21.24%	17
308	35.79	63.60	98.76	28.66	45.06%	4
309	52.96	61.44	70.00	8.52	13.87%	3
310	50.84	76.29	108.97	14.32	18.77%	12
311	50.71	68.79	90.13	12.57	18.28%	11
312	54.49	69.17	86.48	13.72	19.84%	6
313	46.50	46.50	46.50			1
314	68.53	68.53	68.53			1
315	43.84	57.78	70.59	11.86	20.53%	6
316	74.40	86.80	108.63	18.97	21.85%	3
317	67.26	80.56	96.31	13.04	16.19%	4
318	68.81	81.73	97.38	14.48	17.71%	3
319	46.62	73.40	92.32	11.77	16.04%	13
320	38.31	54.40	90.37	16.07	29.54%	11
321	39.77	84.78	106.52	21.88	25.81%	11
322	37.78	52.48	68.84	7.95	15.16%	14
323	50.19	60.58	75.42	11.23	18.53%	5
324	51.44	66.37	81.24	12.29	18.52%	4
325	53.39	67.03	85.94	12.87	19.20%	5
326	27.60	67.68	95.70	19.70	29.11%	8
327	42.26	72.11	99.47	17.44	24.18%	19
328	19.25	45.47	111.98	28.50	62.67%	11
329	38.54	60.75	83.21	14.70	24.20%	10
330	13.30	58.10	86.09	19.41	33.41%	15
331	47.79	87.06	127.37	33.65	38.65%	4
332	3.52	61.56	77.72	20.94	34.02%	10

Table C (continued). Summary statistics by site for Acid Neutralizing Capacity (ANC) data. Values are expressed in $\mu\text{eq/L}$.

Sample Number	Minimum	Average	Maximum	Standard Deviation	Coefficient of Variation	N
333	1.98	9.48	18.20	8.18	86.26%	3
334	6.90	14.74	19.18	3.80	25.76%	8
335	52.94	418.28	726.40	194.21	46.43%	14
336	38.70	53.24	118.02	19.89	37.37%	14
337	24.80	41.18	57.80	11.69	28.40%	13
338	4.41	27.15	49.89	32.16	118.44%	2
339	100.60	100.60	100.60			1
340	49.77	72.65	95.56	20.49	28.21%	4
341	72.23	119.90	179.26	34.72	28.95%	12
342	40.14	85.74	163.36	41.92	48.89%	12
343	58.03	61.17	64.31	4.44	7.26%	2
344	56.85	61.23	65.60	6.19	10.11%	2
345	10.19	10.19	10.19			1
346	23.88	23.88	23.88			1
347	160.86	160.86	160.86			1
348	33.08	33.08	33.08			1
349	72.15	72.15	72.15			1
350	42.72	61.30	111.80	28.85	47.07%	5
351	415.02	415.02	415.02			1
352	159.04	373.44	567.59	173.56	46.48%	4
353	47.78	74.57	93.55	23.86	32.00%	3
354	47.00	56.46	66.21	7.98	14.14%	4
355	60.91	84.84	108.80	23.67	27.90%	4
356	-4.30	-4.30	-4.30			1
357	36.00	84.82	115.32	25.11	29.60%	7
358	79.79	79.79	79.79			1
359	58.71	58.71	58.71			1
360	-34.17	-23.42	-13.62	8.67	-37.03%	5
361	-17.47	-13.21	-8.94	6.03	-45.69%	2
362	44.18	54.04	58.80	6.66	12.32%	4
363	52.28	73.39	90.36	15.04	20.50%	5
364	64.70	82.87	100.15	14.94	18.03%	4
365	46.00	46.00	46.00			1
366	37.21	109.32	145.40	62.45	57.13%	3
367	96.31	96.31	96.31			1
368	48.39	48.39	48.39			1

Table C (continued). Summary statistics by site for Acid Neutralizing Capacity (ANC) data. Values are expressed in $\mu\text{eq/L}$.

Sample Number	Minimum	Average	Maximum	Standard Deviation	Coefficient of Variation	N
369	12.16	18.46	24.76	8.91	48.26%	2
377	135.34	202.86	270.37	95.48	47.07%	2
392	53.82	53.82	53.82			1
393	60.35	61.61	62.86	1.77	2.87%	2
399	49.48	49.48	49.48			1
400	53.12	53.12	53.12			1
401	42.01	42.01	42.01			1
402	54.44	54.44	54.44			1
472	18.37	38.06	68.03	18.60	48.87%	5
473	4.70	28.58	64.10	23.29	81.51%	7
474	31.55	58.82	95.69	19.97	33.95%	7
475	23.49	35.68	51.00	10.96	30.73%	6
479	41.34	65.98	89.79	14.63	22.18%	7
480	74.19	87.93	106.21	12.73	14.47%	7
481	70.43	92.98	134.32	22.30	23.98%	7
482	73.26	101.05	147.96	29.77	29.46%	5
483	71.37	87.28	121.65	17.65	20.23%	7
484	46.82	56.38	69.68	8.11	14.39%	6
485	56.80	73.63	102.78	14.61	19.85%	8
486	55.86	55.86	55.86			1
487	65.10	97.33	142.96	40.63	41.74%	3
488	31.25	45.96	63.82	10.47	22.77%	7
489	297.69	891.04	1457.13	494.98	55.55%	5
490	67.29	67.29	67.29			1
492	17.52	32.42	49.22	11.27	34.78%	6
493	56.24	71.21	85.40	13.34	18.73%	4
494	92.72	92.72	92.72			1
999	-67.48	-67.48	-67.48			1

Table D. Summary statistics by site for calcium data. Values are expressed in $\mu\text{eq/L}$.

Sample Number	Minimum	Average	Maximum	Standard Deviation	Coefficient of Variation	N
1	42.97	82.54	119.71	20.36	24.67%	19
2	50.53	68.83	92.33	17.09	24.83%	5
3	71.23	92.29	111.30	11.76	12.74%	18
4	39.88	69.01	88.12	14.39	20.85%	17
5	32.46	92.83	121.19	21.18	22.82%	14
6	31.89	81.18	186.60	37.29	45.93%	12
7	57.39	77.08	100.88	16.06	20.83%	5
8	36.77	67.42	90.54	22.62	33.55%	4
9	39.24	86.78	144.30	53.24	61.34%	3
10	63.33	112.03	138.91	42.26	37.72%	3
11	108.19	158.07	185.69	43.28	27.38%	3
12	30.68	51.86	65.97	18.68	36.02%	3
13	56.86	106.93	203.76	35.06	32.79%	20
14	48.27	96.88	135.79	25.33	26.14%	17
15	61.53	80.90	108.87	24.81	30.67%	3
16	61.10	83.58	98.78	15.75	18.84%	5
17	56.26	87.65	120.30	19.32	22.05%	11
18	39.12	57.30	79.90	18.92	33.02%	4
19	58.69	83.50	94.12	16.81	20.13%	4
20	50.94	88.36	124.25	19.00	21.51%	24
21	71.21	120.81	184.88	37.71	31.22%	10
22	69.84	168.06	662.25	183.08	108.94%	10
23	25.96	89.30	156.41	31.78	35.59%	22
24	55.43	120.86	187.23	37.52	31.04%	23
25	95.40	186.24	360.06	86.59	46.49%	11
26	73.19	95.05	115.84	16.28	17.13%	6
27	71.80	103.64	131.84	28.01	27.03%	5
28	52.55	77.60	96.55	19.50	25.13%	5
29	60.19	131.78	349.16	58.04	44.05%	18
30	72.90	114.81	215.71	27.66	24.09%	21
31	59.72	131.64	263.32	69.29	52.64%	6
32	62.73	112.56	152.95	35.21	31.28%	6
33	52.77	52.77	52.77			1
34	27.49	77.37	110.11	24.18	31.25%	13
35	45.91	76.04	117.43	18.97	24.94%	14
36	19.77	42.92	66.57	17.09	39.81%	8
37	58.65	322.61	1171.27	480.01	148.79%	5

Table D (continued). Summary statistics by site for calcium data. Values are expressed in $\mu\text{eq/L}$.

Sample Number	Minimum	Average	Maximum	Standard Deviation	Coefficient of Variation	N
38	33.39	60.61	84.16	18.79	31.01%	7
39	40.22	53.94	69.55	11.14	20.65%	6
40	34.71	62.61	83.96	13.09	20.91%	16
41	47.17	50.10	54.33	3.75	7.49%	3
42	43.47	64.05	99.01	14.51	22.65%	14
43	38.87	64.81	84.94	11.39	17.57%	22
44	38.91	71.03	221.05	58.34	82.14%	9
45	54.46	77.34	101.54	12.14	15.70%	24
46	49.60	66.93	85.35	9.72	14.52%	21
47	39.22	65.21	211.43	38.32	58.78%	18
48	39.30	77.08	147.73	26.67	34.60%	12
49	48.91	71.57	102.25	14.43	20.16%	19
50	36.16	81.76	121.71	24.39	29.83%	9
51	60.03	79.18	103.36	17.08	21.58%	6
52	41.15	80.75	124.28	19.41	24.04%	20
53	50.96	61.62	76.53	8.03	13.03%	7
54	73.33	91.43	112.33	13.19	14.43%	7
55	47.08	78.83	100.65	16.99	21.55%	8
56	54.15	83.25	103.03	20.71	24.88%	7
57	44.62	73.68	110.32	22.25	30.20%	7
58	42.74	81.71	118.57	28.64	35.06%	8
59	26.09	68.91	96.36	26.88	39.01%	5
60	65.86	71.62	78.40	5.62	7.85%	5
61	67.91	72.81	79.71	4.99	6.86%	5
62	66.70	70.38	77.65	4.64	6.59%	5
63	56.97	67.30	77.27	8.68	12.89%	5
64	43.39	72.86	87.19	18.02	24.73%	5
65	53.01	84.56	116.11	44.62	52.77%	2
66	58.35	106.63	150.86	21.33	20.01%	24
67	104.04	128.96	166.27	24.38	18.91%	5
68	56.68	94.82	126.22	21.41	22.58%	7
69	38.03	72.76	119.99	23.54	32.36%	16
70	45.60	78.62	117.92	21.83	27.77%	7
71	58.01	88.23	153.59	19.99	22.65%	22
72	46.96	81.82	131.18	19.30	23.59%	21
73	79.68	112.33	168.63	21.62	19.24%	23

Table D (continued). Summary statistics by site for calcium data. Values are expressed in $\mu\text{eq/L}$.

Sample Number	Minimum	Average	Maximum	Standard Deviation	Coefficient of Variation	N
74	84.41	134.94	224.95	35.06	25.98%	22
75	28.03	49.22	70.34	9.17	18.62%	19
76	18.09	50.58	76.15	13.16	26.02%	18
77	26.09	63.89	91.99	17.03	26.65%	11
78	104.94	120.51	136.09	22.02	18.27%	2
79	22.90	45.12	84.40	12.50	27.70%	15
80	32.15	58.87	81.42	15.24	25.88%	12
81	44.86	72.60	101.27	20.54	28.29%	7
82	23.79	63.40	120.69	31.53	49.73%	11
83	35.25	97.83	209.81	58.02	59.31%	7
84	32.15	62.11	79.16	11.87	19.11%	14
86	32.77	56.47	70.67	10.46	18.52%	13
87	35.80	59.66	81.59	13.11	21.98%	14
88	28.76	53.84	78.50	13.82	25.68%	13
89	31.50	48.08	63.74	11.45	23.82%	6
90	38.35	94.14	287.72	95.85	101.82%	6
91	37.40	59.03	95.24	15.79	26.75%	10
92	25.30	39.63	59.26	11.04	27.85%	15
93	37.11	49.04	72.87	9.29	18.94%	14
94	39.48	43.66	47.08	3.86	8.84%	3
95	41.20	62.61	84.02	30.28	48.36%	2
96	37.50	53.84	65.46	12.47	23.17%	4
97	70.45	73.85	77.26	4.82	6.52%	2
99	29.33	41.84	62.68	14.64	34.98%	4
100	67.49	77.95	88.42	14.80	18.98%	2
101	39.56	39.56	39.56			1
102	39.42	39.42	39.42			1
103	67.56	95.25	120.31	14.82	15.56%	22
104	62.97	100.55	304.95	49.42	49.15%	22
105	51.60	83.65	113.43	17.92	21.42%	18
106	55.46	95.41	117.59	17.11	17.94%	18
107	55.28	87.00	130.10	17.28	19.86%	22
108	57.58	61.66	65.75	5.77	9.36%	2
109	77.26	91.76	106.26	20.50	22.35%	2
110	35.77	49.61	81.26	14.55	29.32%	13
111	39.99	73.43	170.88	38.53	52.47%	11

Table D (continued). Summary statistics by site for calcium data. Values are expressed in µeq/L.

Sample Number	Minimum	Average	Maximum	Standard Deviation	Coefficient of Variation	N
112	22.45	34.47	58.97	10.10	29.31%	9
113	22.91	37.47	50.58	9.15	24.41%	11
114	47.95	92.25	111.12	19.75	21.40%	11
115	37.28	73.29	91.93	18.36	25.05%	7
116	28.01	46.27	64.53	25.82	55.81%	2
117	35.58	64.65	93.73	41.12	63.60%	2
118	31.91	51.49	89.57	32.98	64.06%	3
119	42.46	69.23	96.01	37.87	54.70%	2
120	35.58	58.18	90.91	29.02	49.87%	3
121	42.19	71.25	96.84	20.28	28.47%	5
122	42.55	67.41	104.00	32.36	48.00%	3
123	30.67	51.54	79.04	18.76	36.40%	5
124	32.77	51.18	75.50	16.99	33.19%	5
125	30.93	57.99	85.48	17.55	30.26%	13
126	34.44	53.62	113.73	21.85	40.74%	11
127	35.78	54.69	75.13	10.07	18.41%	18
128	37.21	50.50	74.68	11.60	22.97%	8
129	35.63	50.00	69.30	11.02	22.03%	10
130	36.51	264.22	2237.96	693.54	262.49%	10
131	44.98	64.18	96.78	14.28	22.24%	10
132	34.23	53.39	83.46	14.06	26.33%	11
133	43.19	60.09	74.76	9.63	16.03%	11
134	51.77	79.98	110.30	17.95	22.44%	14
135	54.30	71.11	103.60	15.65	22.01%	10
136	14.84	19.59	24.47	4.82	24.59%	3
137	39.35	72.47	93.21	16.20	22.36%	19
138	32.44	59.10	128.44	21.49	36.36%	19
139	28.62	35.11	45.18	7.26	20.67%	4
140	25.68	46.14	83.21	15.00	32.52%	15
141	28.72	52.87	95.45	15.04	28.44%	16
142	28.12	55.00	79.23	14.35	26.08%	17
143	25.78	52.38	76.31	14.51	27.71%	18
144	26.19	54.41	87.20	14.67	26.96%	16
145	44.68	59.10	86.95	16.00	27.06%	6
146	33.34	53.62	74.78	11.43	21.31%	16
147	44.73	66.79	89.63	12.31	18.43%	18

Table D (continued). Summary statistics by site for calcium data. Values are expressed in $\mu\text{eq/L}$.

Sample Number	Minimum	Average	Maximum	Standard Deviation	Coefficient of Variation	N
148	32.35	81.04	120.99	25.59	31.57%	11
149	43.50	70.65	98.99	15.82	22.39%	11
150	47.93	68.34	90.70	14.05	20.56%	11
151	36.75	115.43	717.15	157.16	136.15%	17
152	176.95	521.74	1064.51	248.77	47.68%	17
153	170.06	400.78	656.02	174.94	43.65%	13
154	28.15	28.15	28.15			1
155	30.86	30.86	30.86			1
156	36.60	389.06	887.09	208.58	53.61%	20
157	22.62	133.46	306.39	127.68	95.67%	4
158	26.59	46.87	69.17	16.75	35.73%	5
159	33.85	85.60	130.98	42.71	49.89%	5
160	68.81	214.65	345.94	130.61	60.85%	5
161	23.58	85.75	201.04	71.84	83.78%	5
162	44.42	118.65	222.13	73.60	62.03%	5
163	47.96	208.58	295.36	139.25	66.76%	3
164	47.59	88.24	125.84	39.21	44.44%	3
165	53.57	116.20	209.53	82.39	70.90%	3
166	26.84	82.11	117.18	48.44	58.99%	3
167	31.96	63.05	88.99	28.87	45.78%	3
168	35.53	65.25	83.22	20.86	31.96%	4
169	83.65	137.49	244.82	92.95	67.61%	3
170	39.47	69.72	95.07	25.09	35.99%	4
171	218.65	444.66	709.67	247.82	55.73%	3
172	82.44	107.49	132.55	35.44	32.97%	2
173	24.70	87.19	127.28	27.41	31.44%	20
174	309.43	928.06	2217.72	490.63	52.87%	20
175	39.23	112.61	672.29	146.25	129.87%	17
176	48.46	376.68	1064.51	249.74	66.30%	16
177	26.79	61.19	84.94	15.98	26.11%	9
178	21.02	28.73	37.81	7.52	26.16%	4
179	26.44	37.65	55.16	15.36	40.80%	3
180	24.22	27.29	30.35	4.34	15.90%	2
181	27.21	36.55	49.89	11.86	32.45%	3
182	29.50	30.67	31.85	1.66	5.42%	2
183	7.80	40.92	115.55	27.13	66.30%	15

Table D (continued). Summary statistics by site for calcium data. Values are expressed in $\mu\text{eq/L}$.

Sample Number	Minimum	Average	Maximum	Standard Deviation	Coefficient of Variation	N
184	38.70	66.14	85.89	12.06	18.24%	18
185	37.04	65.73	125.55	20.12	30.62%	15
186	36.66	78.62	180.67	28.76	36.58%	21
187	38.45	134.68	315.72	110.38	81.96%	6
188	13.94	32.25	43.34	14.32	44.40%	5
189	28.38	44.76	58.68	12.86	28.72%	7
190	32.02	56.97	77.30	13.97	24.52%	18
191	30.52	55.77	128.15	23.72	42.53%	17
192	31.92	64.05	93.72	14.33	22.38%	20
193	27.25	58.33	89.13	15.77	27.03%	19
194	29.46	61.15	124.82	21.85	35.73%	19
195	17.14	35.14	56.43	13.68	38.93%	11
196	27.28	34.23	43.71	6.86	20.05%	4
197	26.48	36.11	48.51	11.27	31.22%	3
198	26.73	38.17	53.31	13.67	35.81%	3
199	42.18	71.21	109.72	22.22	31.21%	7
200	32.24	58.26	78.26	14.44	24.78%	19
201	25.36	44.52	65.50	11.26	25.29%	14
202	34.74	34.74	34.74			1
203	70.07	70.07	70.07			1
204	79.59	79.59	79.59			1
205	60.29	60.29	60.29			1
207	25.70	40.84	54.54	11.82	28.95%	5
208	19.16	39.82	59.19	13.70	34.39%	6
209	29.19	47.50	101.13	15.79	33.24%	19
210	41.52	80.98	168.20	26.04	32.16%	21
211	29.64	53.87	94.89	15.73	29.20%	16
212	24.94	50.57	73.99	13.91	27.50%	16
213	26.64	49.37	70.75	11.42	23.13%	21
214	26.43	49.23	81.43	13.05	26.51%	25
215	34.67	66.05	161.05	25.46	38.55%	23
216	26.68	146.54	464.03	211.89	144.59%	4
218	31.05	55.13	85.05	19.80	35.92%	18
219	30.92	49.46	85.08	15.12	30.57%	17
220	27.87	60.20	115.69	21.98	36.51%	17
221	22.77	49.95	70.82	14.67	29.36%	11

Table D (continued). Summary statistics by site for calcium data. Values are expressed in $\mu\text{eq/L}$.

Sample Number	Minimum	Average	Maximum	Standard Deviation	Coefficient of Variation	N
222	24.65	38.97	54.10	12.82	32.90%	4
223	23.67	47.22	73.89	16.46	34.86%	7
224	35.14	53.25	75.19	13.41	25.18%	6
225	39.14	63.07	76.97	17.21	27.28%	6
226	32.67	48.18	55.95	8.24	17.10%	6
227	29.70	53.24	78.33	16.84	31.62%	6
228	28.47	51.63	71.17	14.13	27.36%	6
229	27.22	48.18	73.09	16.72	34.70%	6
230	25.89	50.12	74.66	16.65	33.23%	6
231	25.22	49.12	67.57	14.84	30.21%	6
232	75.89	130.28	195.03	41.39	31.77%	7
233	61.10	121.07	167.43	28.11	23.22%	19
234	40.05	64.78	87.00	15.07	23.26%	18
235	46.65	74.01	115.97	21.04	28.43%	9
236	35.55	69.54	98.12	18.48	26.57%	16
237	28.10	51.16	84.93	13.59	26.57%	25
242	21.19	33.07	40.55	5.39	16.31%	14
243	39.16	66.93	91.77	14.61	21.82%	14
244	46.13	66.27	86.71	12.58	18.98%	14
245	7.58	27.64	54.24	12.22	44.23%	13
246	26.23	48.29	68.43	11.08	22.95%	15
247	25.10	46.99	65.77	11.51	24.50%	13
248	33.10	46.49	61.83	8.47	18.21%	15
249	29.27	47.46	65.75	14.57	30.70%	5
250	40.55	65.06	88.27	14.40	22.13%	8
251	46.33	120.85	168.75	38.14	31.56%	22
252	113.89	147.41	190.58	21.04	14.28%	21
253	64.46	117.43	156.19	24.32	20.71%	21
254	41.54	74.03	97.80	21.72	29.35%	7
255	35.46	57.75	79.41	17.40	30.13%	5
256	33.30	54.83	82.42	18.52	33.79%	5
257	32.46	50.64	81.49	21.12	41.70%	5
258	27.29	45.11	74.83	18.36	40.70%	5
259	27.14	48.72	71.82	18.87	38.72%	4
260	31.32	53.40	77.06	16.31	30.55%	8
261	23.54	43.15	57.01	11.23	26.04%	7

Table D (continued). Summary statistics by site for calcium data. Values are expressed in $\mu\text{eq/L}$.

Sample Number	Minimum	Average	Maximum	Standard Deviation	Coefficient of Variation	N
262	26.32	43.90	72.46	16.74	38.13%	7
263	28.48	48.21	72.70	12.93	26.81%	8
264	18.84	41.57	69.83	20.01	48.15%	6
265	19.72	42.12	68.82	16.83	39.95%	10
266	27.41	64.65	97.40	21.00	32.48%	11
267	33.18	67.85	95.05	16.43	24.22%	19
268	31.05	63.91	91.03	15.98	25.01%	20
269	30.53	54.95	81.81	16.23	29.54%	8
270	28.84	56.42	81.64	13.89	24.61%	18
271	35.34	57.89	82.93	13.44	23.21%	13
272	39.56	62.33	79.73	15.03	24.11%	5
273	36.13	52.37	65.93	12.69	24.24%	4
274	22.45	39.92	53.75	14.03	35.14%	4
275	30.44	46.14	63.20	16.42	35.59%	3
276	33.04	47.46	68.91	9.71	20.46%	15
277	36.50	48.98	59.39	7.58	15.47%	16
278	40.66	51.16	74.43	11.08	21.66%	11
279	33.55	51.85	71.94	11.30	21.80%	10
280	35.12	59.45	84.63	15.89	26.73%	11
281	42.28	63.28	82.59	11.68	18.46%	11
282	40.34	60.50	76.54	12.19	20.14%	12
283	38.76	62.60	80.34	12.67	20.24%	15
284	67.45	77.92	88.40	14.82	19.01%	2
285	58.17	95.03	123.04	25.16	26.47%	5
286	56.54	72.00	91.39	13.90	19.31%	5
287	49.22	78.88	121.49	28.22	35.77%	6
288	45.95	59.77	79.78	10.66	17.84%	11
289	47.15	65.84	94.02	13.67	20.76%	14
290	22.11	43.16	87.34	17.66	40.93%	18
291	27.19	60.23	83.81	15.24	25.30%	17
292	44.45	64.27	95.78	16.02	24.93%	13
293	43.13	75.01	101.98	15.16	20.21%	20
294	41.14	58.34	78.74	13.74	23.56%	6
295	45.13	57.38	84.42	16.61	28.95%	6
296	41.85	66.89	98.20	24.87	37.18%	4
297	45.37	57.06	85.71	19.16	33.57%	4

Table D (continued). Summary statistics by site for calcium data. Values are expressed in $\mu\text{eq/L}$.

Sample Number	Minimum	Average	Maximum	Standard Deviation	Coefficient of Variation	N
298	45.21	180.99	290.16	87.08	48.11%	7
299	24.05	44.52	54.63	10.45	23.48%	14
300	16.32	42.51	75.20	21.11	49.65%	6
301	25.99	54.54	89.00	26.05	47.77%	5
302	26.81	37.07	51.36	12.76	34.43%	3
303	31.84	31.84	31.84			1
304	26.17	56.70	81.41	14.04	24.77%	12
305	22.38	41.23	54.83	10.26	24.89%	14
306	33.02	46.61	57.00	8.37	17.95%	12
307	21.60	41.04	60.17	11.00	26.81%	17
308	25.84	54.87	84.62	26.08	47.54%	4
309	27.88	36.69	49.66	11.47	31.26%	3
310	33.86	68.05	88.42	16.28	23.93%	12
311	30.64	61.34	88.98	17.84	29.09%	11
312	27.46	56.30	86.08	22.03	39.12%	6
313	45.28	45.28	45.28			1
314	61.69	61.69	61.69			1
315	24.34	46.68	65.48	15.01	32.15%	6
316	27.12	37.59	51.82	12.78	33.99%	3
317	28.16	40.09	54.50	13.19	32.90%	4
318	22.12	44.62	58.94	19.73	44.21%	3
319	26.45	47.81	66.94	13.33	27.88%	13
320	32.71	49.23	67.62	9.89	20.09%	11
321	37.57	55.12	78.28	13.03	23.65%	11
322	25.95	48.28	68.42	12.12	25.10%	14
323	26.19	50.44	77.18	18.53	36.74%	5
324	28.96	44.04	68.17	17.98	40.82%	4
325	24.54	47.04	76.53	21.68	46.09%	5
326	30.53	58.60	79.30	15.34	26.18%	8
327	35.46	67.19	94.33	15.90	23.66%	18
328	22.26	44.80	90.56	21.12	47.13%	11
329	35.30	59.78	74.78	11.89	19.89%	11
330	32.66	70.80	129.84	22.14	31.28%	15
331	56.02	82.92	108.43	21.46	25.89%	4
332	42.77	74.61	176.55	37.87	50.76%	10
333	72.07	75.04	77.30	2.69	3.58%	3

Table D (continued). Summary statistics by site for calcium data. Values are expressed in $\mu\text{eq/L}$.

Sample Number	Minimum	Average	Maximum	Standard Deviation	Coefficient of Variation	N
334	38.14	48.84	58.31	6.51	13.33%	7
335	57.23	382.89	602.31	179.81	46.96%	13
336	37.23	56.77	80.63	12.91	22.74%	14
337	27.25	54.86	80.13	16.78	30.59%	13
338	43.25	53.44	63.63	14.42	26.97%	2
339	72.15	72.15	72.15			1
340	48.26	62.49	74.79	14.27	22.84%	4
341	85.58	124.39	164.83	27.25	21.90%	11
342	51.38	78.92	106.59	18.27	23.15%	11
343	33.73	41.93	50.13	11.60	27.66%	2
344	32.63	40.69	48.75	11.40	28.01%	2
345	48.17	48.17	48.17			1
346	38.84	38.84	38.84			1
347	76.63	76.63	76.63			1
348	45.00	45.00	45.00			1
349	47.95	47.95	47.95			1
350	42.45	53.52	70.94	11.54	21.56%	5
351	371.79	371.79	371.79			1
352	145.09	318.63	507.84	159.20	49.96%	4
353	61.65	85.04	100.23	20.55	24.17%	3
354	46.94	72.69	113.17	29.31	40.32%	4
355	44.98	64.37	79.60	14.42	22.41%	4
356	34.85	34.85	34.85			1
357	44.95	65.30	91.88	17.59	26.94%	7
358	40.36	40.36	40.36			1
359	34.71	34.71	34.71			1
360	38.24	44.13	49.56	4.56	10.33%	5
361	60.12	75.06	90.00	21.13	28.16%	2
362	51.49	58.67	73.92	10.53	17.96%	4
363	59.62	72.20	85.92	10.14	14.04%	5
364	72.03	87.67	107.23	14.74	16.81%	4
365	64.00	64.00	64.00			1
366	69.62	138.01	186.97	61.04	44.23%	3
367	55.38	55.38	55.38			1
368	104.42	104.42	104.42			1
369	55.24	60.72	66.19	7.74	12.75%	2

Table D (continued). Summary statistics by site for calcium data. Values are expressed in $\mu\text{eq/L}$.

Sample Number	Minimum	Average	Maximum	Standard Deviation	Coefficient of Variation	N
377	106.80	167.67	228.54	86.08	51.34%	2
392	46.92	46.92	46.92			1
393	61.94	64.92	67.91	4.22	6.50%	2
399	48.61	48.61	48.61			1
400	47.35	47.35	47.35			1
401	43.14	43.14	43.14			1
402	49.50	49.50	49.50			1
472	48.61	62.56	78.37	10.75	17.18%	5
473	92.89	123.10	170.24	26.19	21.28%	7
474	67.05	77.85	89.69	9.17	11.77%	7
475	44.48	63.98	76.37	11.61	18.15%	6
479	48.08	67.03	85.89	13.64	20.35%	7
480	57.80	74.76	93.98	14.38	19.23%	7
481	64.93	78.64	112.35	17.26	21.94%	7
482	69.86	77.46	86.56	6.73	8.69%	5
483	58.22	76.57	95.60	12.63	16.50%	7
484	57.58	65.48	77.68	7.93	12.11%	6
485	63.87	70.82	85.94	8.58	12.12%	8
486	59.50	59.50	59.50			1
487	65.74	80.91	96.76	15.52	19.18%	3
488	48.92	66.14	77.73	10.70	16.18%	7
489	319.16	785.88	1226.56	369.42	47.01%	5
490	91.48	91.48	91.48			1
492	89.10	95.46	107.88	7.22	7.57%	6
493	69.67	77.95	88.88	8.20	10.51%	4
494	80.15	80.15	80.15			1
999	12.31	12.31	12.31			1

Table E. Summary statistics by site for chloride data. Values are expressed in $\mu\text{eq/L}$.

Sample Number	Minimum	Average	Maximum	Standard Deviation	Coefficient of Variation	N
1	8.62	13.05	18.07	2.68	20.56%	19
2	10.18	14.65	25.22	6.16	42.03%	5
3	8.62	12.88	25.98	4.41	34.22%	19
4	7.31	11.84	15.82	2.22	18.78%	18
5	9.07	12.63	16.62	1.81	14.30%	14

Table E (continued) . Summary statistics by site for chloride data. Values are expressed in $\mu\text{eq/L}$.

Sample Number	Minimum	Average	Maximum	Standard Deviation	Coefficient of Variation	N
6	8.50	12.22	16.52	2.29	18.71%	12
7	10.92	13.18	16.41	2.91	22.09%	5
8	13.54	15.03	17.19	1.71	11.35%	4
9	14.22	15.76	18.41	2.31	14.65%	3
10	13.73	19.38	30.44	9.58	49.44%	3
11	16.45	19.00	22.00	2.80	14.76%	3
12	10.98	12.30	14.77	2.13	17.35%	3
13	10.58	14.38	23.47	3.60	25.05%	20
14	9.72	13.84	21.70	3.09	22.35%	17
15	13.45	21.95	38.45	14.29	65.12%	3
16	10.96	19.85	39.16	11.42	57.55%	5
17	10.88	15.76	38.82	7.92	50.28%	11
18	11.07	11.94	13.09	0.84	7.05%	4
19	13.06	21.51	37.26	10.75	49.97%	4
20	6.40	12.87	22.11	3.24	25.13%	24
21	10.52	18.73	40.93	11.46	61.17%	10
22	8.92	18.19	39.88	8.22	45.21%	10
23	11.24	16.99	50.75	9.83	57.85%	22
24	10.59	14.76	27.76	3.63	24.57%	23
25	12.14	17.95	35.38	6.59	36.69%	10
26	12.27	14.47	16.54	1.63	11.26%	6
27	11.37	14.27	17.36	2.13	14.91%	5
28	11.69	15.06	22.89	4.46	29.61%	5
29	13.42	21.65	86.28	16.61	76.76%	18
30	11.24	15.62	22.74	3.19	20.41%	20
31	14.20	19.77	42.26	11.04	55.84%	6
32	11.79	15.25	22.29	3.88	25.42%	6
33	15.31	15.31	15.31			1
34	10.70	15.07	37.87	7.24	48.01%	13
35	10.39	14.69	26.65	4.75	32.36%	14
36	11.28	21.52	39.26	9.39	43.64%	8
37	14.81	19.26	24.58	3.71	19.26%	5
38	10.61	13.15	16.70	2.12	16.09%	7
39	10.56	12.49	17.23	2.41	19.30%	6
40	10.04	13.48	24.23	4.38	32.49%	16
41	10.83	13.43	17.31	3.43	25.50%	3

Table E (continued) . Summary statistics by site for chloride data. Values are expressed in $\mu\text{eq/L}$.

Sample Number	Minimum	Average	Maximum	Standard Deviation	Coefficient of Variation	N
42	7.29	12.84	25.04	4.25	33.10%	14
43	8.29	12.25	17.86	2.48	20.22%	22
44	8.63	14.98	33.05	7.34	49.01%	9
45	9.31	14.14	26.84	4.42	31.26%	24
46	8.95	13.10	25.15	3.64	27.77%	21
47	4.94	13.23	32.19	6.47	48.93%	18
48	9.37	15.30	33.36	7.34	47.98%	12
49	8.96	12.41	22.58	2.78	22.42%	19
50	9.89	14.07	19.33	3.58	25.43%	9
51	10.62	12.06	14.28	1.30	10.76%	6
52	10.01	14.97	54.52	9.67	64.60%	21
53	10.22	19.93	42.94	11.41	57.25%	7
54	10.77	16.14	23.68	4.44	27.49%	7
55	11.79	16.20	26.77	4.96	30.59%	8
56	12.01	16.23	21.10	3.64	22.43%	7
57	0.00	9.84	15.42	6.86	69.68%	7
58	11.27	15.23	20.82	3.46	22.70%	8
59	11.14	12.44	13.47	0.95	7.60%	5
60	13.52	24.23	59.11	19.58	80.83%	5
61	13.10	17.28	21.90	4.22	24.40%	5
62	11.49	16.61	28.09	6.70	40.37%	5
63	12.25	17.75	27.08	5.87	33.07%	5
64	13.14	17.81	32.64	8.33	46.79%	5
65	16.75	17.66	18.56	1.28	7.28%	2
66	10.93	13.78	23.21	2.54	18.47%	25
67	11.73	15.04	20.72	3.45	22.93%	5
68	10.63	14.05	18.81	2.67	18.98%	7
69	12.67	17.67	26.55	3.78	21.38%	16
70	10.88	13.63	21.22	3.22	23.63%	8
71	10.21	15.86	49.38	8.63	54.41%	22
72	10.41	14.25	22.62	3.06	21.46%	21
73	11.82	15.29	25.94	3.19	20.88%	23
74	10.20	14.24	21.57	2.42	16.98%	22
75	10.66	13.25	19.45	2.21	16.70%	20
76	10.28	13.58	24.95	3.33	24.51%	18
77	10.64	14.20	24.48	3.81	26.81%	11

Table E (continued) . Summary statistics by site for chloride data. Values are expressed in $\mu\text{eq/L}$.

Sample Number	Minimum	Average	Maximum	Standard Deviation	Coefficient of Variation	N
78	18.50	18.96	19.41	0.64	3.39%	2
79	10.14	15.32	23.38	3.90	25.43%	15
80	7.14	12.07	17.73	3.08	25.55%	12
81	7.63	11.32	15.24	2.60	22.93%	7
82	10.03	14.37	30.06	5.70	39.66%	11
83	11.96	16.87	30.20	6.38	37.82%	7
84	9.68	14.22	21.96	3.67	25.82%	14
86	10.58	15.19	39.09	7.47	49.18%	13
87	11.12	15.34	34.52	6.27	40.87%	14
88	10.54	14.54	25.09	3.84	26.43%	13
89	11.61	14.12	18.29	2.45	17.38%	6
90	10.92	14.85	18.94	2.98	20.04%	6
91	13.42	15.97	19.47	1.89	11.83%	10
92	10.48	16.44	21.94	2.84	17.30%	15
93	11.25	16.56	33.42	6.49	39.17%	14
94	10.37	14.90	18.07	4.03	27.02%	3
95	11.68	13.41	15.14	2.44	18.20%	2
96	10.81	17.24	28.13	7.75	44.94%	4
97	9.94	11.65	14.09	2.17	18.63%	3
99	8.38	12.73	17.78	4.11	32.27%	4
100	11.01	12.46	13.91	2.06	16.50%	2
101	11.72	14.84	17.96	4.42	29.77%	2
102	12.64	13.19	13.74	0.77	5.87%	2
103	9.26	14.08	29.70	4.65	33.03%	22
104	9.25	16.91	56.10	10.83	64.09%	22
105	9.36	13.60	32.80	5.46	40.12%	18
106	7.70	12.79	17.76	2.83	22.16%	18
107	8.74	11.42	18.46	1.89	16.50%	22
108	14.74	15.40	16.05	0.93	6.05%	2
109	15.61	16.64	17.67	1.46	8.76%	2
110	13.34	21.18	38.37	6.90	32.59%	14
111	7.14	23.73	157.20	42.20	177.85%	12
112	9.38	27.01	136.72	41.47	153.51%	9
113	6.89	11.53	20.53	4.29	37.19%	11
114	9.75	15.89	40.25	8.64	54.39%	11
115	9.95	17.51	35.17	9.64	55.03%	7

Table E (continued) . Summary statistics by site for chloride data. Values are expressed in $\mu\text{eq/L}$.

Sample Number	Minimum	Average	Maximum	Standard Deviation	Coefficient of Variation	N
116	11.85	16.33	20.82	6.34	38.84%	2
117	11.84	23.54	35.24	16.55	70.31%	2
118	8.88	12.82	18.03	4.71	36.71%	3
119	10.29	10.39	10.48	0.13	1.26%	2
120	8.67	9.67	10.52	0.94	9.69%	3
121	9.28	16.97	35.17	10.82	63.77%	5
122	11.42	11.70	11.98	0.28	2.39%	3
123	9.57	16.73	33.33	9.49	56.70%	5
124	10.06	18.47	35.96	10.38	56.21%	5
125	9.44	12.26	19.92	2.78	22.71%	13
126	11.47	18.68	38.11	8.27	44.27%	11
127	9.70	15.77	32.77	5.43	34.44%	18
128	10.88	17.69	27.84	4.91	27.76%	8
129	11.45	15.61	20.21	2.67	17.12%	10
130	11.74	21.38	29.97	5.53	25.89%	10
131	10.47	17.64	37.91	7.77	44.07%	10
132	8.99	12.98	16.77	2.26	17.42%	11
133	9.84	14.82	27.70	4.74	32.00%	11
134	8.29	13.47	26.82	5.19	38.50%	14
135	11.28	16.26	25.28	5.81	35.75%	10
136	9.57	17.63	22.62	7.04	39.95%	3
137	10.02	13.88	20.99	3.45	24.82%	19
138	10.08	15.33	31.01	5.24	34.19%	19
139	11.00	15.96	23.33	5.46	34.19%	4
140	9.88	12.08	18.20	1.98	16.43%	15
141	9.11	12.20	16.11	2.10	17.22%	16
142	9.23	12.27	16.05	1.83	14.89%	17
143	8.94	14.02	20.34	3.01	21.48%	18
144	9.94	15.86	68.02	14.00	88.29%	16
145	11.68	13.87	17.10	1.83	13.16%	6
146	9.69	12.31	16.34	2.08	16.88%	16
147	3.74	12.56	18.57	3.39	27.01%	18
148	8.31	12.71	17.36	2.79	21.96%	11
149	10.13	13.58	19.97	3.02	22.27%	11
150	9.24	13.44	16.42	2.64	19.64%	11
151	12.93	17.16	42.03	6.71	39.11%	17

Table E (continued) . Summary statistics by site for chloride data. Values are expressed in $\mu\text{eq/L}$.

Sample Number	Minimum	Average	Maximum	Standard Deviation	Coefficient of Variation	N
152	9.09	18.88	42.79	6.99	37.05%	17
153	14.23	18.75	26.01	3.89	20.74%	13
154	24.33	24.33	24.33			1
155	17.51	17.51	17.51			1
156	12.33	21.57	43.05	8.17	37.85%	20
157	11.69	15.94	17.79	2.85	17.91%	4
158	13.72	16.09	20.49	2.76	17.13%	5
159	10.37	20.39	41.12	12.34	60.49%	5
160	17.84	28.04	49.03	14.14	50.41%	5
161	15.00	21.77	42.66	11.75	54.00%	5
162	16.33	25.27	51.38	15.00	59.33%	5
163	16.68	19.04	23.10	3.53	18.52%	3
164	12.94	14.96	18.29	2.91	19.45%	3
165	15.05	22.85	38.29	13.38	58.55%	3
166	18.31	22.32	29.21	6.00	26.87%	3
167	14.36	16.61	20.47	3.36	20.20%	3
168	12.91	14.44	15.60	1.29	8.97%	4
169	13.61	17.64	20.57	3.61	20.47%	3
170	13.48	16.23	20.67	3.20	19.74%	4
171	23.36	31.91	42.44	9.69	30.36%	3
172	16.11	26.58	37.04	14.79	55.67%	2
173	12.13	17.71	43.08	8.38	47.30%	19
174	1.66	20.35	32.18	5.70	28.00%	20
175	13.54	16.06	20.37	2.24	13.94%	17
176	14.59	19.31	40.47	6.80	35.20%	16
177	10.56	13.86	20.17	2.81	20.25%	9
178	13.49	21.60	40.81	12.98	60.09%	4
179	11.59	11.95	12.20	0.32	2.71%	3
180	10.98	11.30	11.62	0.45	3.96%	2
181	11.11	12.31	13.80	1.37	11.11%	3
182	14.55	15.48	16.42	1.32	8.51%	2
183	9.25	14.46	20.14	3.56	24.62%	15
184	12.46	17.80	26.38	4.54	25.51%	18
185	12.27	18.35	50.54	9.41	51.27%	15
186	11.34	16.19	28.61	4.14	25.59%	21
187	11.96	21.43	45.27	12.25	57.15%	6

Table E (continued) . Summary statistics by site for chloride data. Values are expressed in $\mu\text{eq/L}$.

Sample Number	Minimum	Average	Maximum	Standard Deviation	Coefficient of Variation	N
188	10.89	12.69	15.15	1.63	12.88%	5
189	11.82	15.30	20.08	3.02	19.73%	7
190	9.66	13.22	18.05	2.09	15.83%	18
191	9.85	14.74	34.26	5.68	38.52%	17
192	6.01	13.40	36.33	6.88	51.33%	20
193	9.35	13.26	17.39	2.48	18.69%	19
194	9.48	14.08	22.41	3.45	24.53%	19
195	10.90	14.26	22.45	3.32	23.31%	11
196	11.68	17.62	22.90	5.40	30.64%	4
197	11.80	12.48	13.44	0.85	6.84%	3
198	11.96	13.16	14.80	1.47	11.17%	3
199	13.12	15.73	19.01	2.01	12.77%	7
200	9.59	16.65	38.13	6.53	39.22%	18
201	7.93	11.62	15.84	2.00	17.23%	15
202	11.70	11.70	11.70			1
203	12.90	12.90	12.90			1
204	9.84	9.84	9.84			1
205	12.02	12.02	12.02			1
207	10.52	12.67	16.94	2.54	20.04%	5
208	11.23	14.95	23.63	4.42	29.54%	6
209	7.76	13.01	23.44	3.23	24.79%	19
210	9.15	12.66	27.27	4.23	33.42%	21
211	10.26	14.01	26.64	3.72	26.54%	16
212	9.61	14.08	34.67	5.93	42.07%	16
213	10.43	12.77	16.65	1.63	12.77%	21
214	9.21	14.64	24.95	3.94	26.90%	24
215	10.71	14.44	24.60	3.42	23.65%	22
216	15.90	16.85	18.49	1.23	7.32%	4
218	7.34	17.26	34.73	7.20	41.72%	18
219	5.71	13.66	18.80	3.13	22.90%	17
220	8.75	11.48	15.58	1.66	14.45%	17
221	11.04	13.78	21.43	3.66	26.56%	11
222	10.32	13.02	14.74	1.91	14.70%	4
223	11.96	15.42	21.94	3.22	20.90%	7
224	11.09	14.76	21.23	3.97	26.89%	6
225	10.76	16.34	25.18	5.49	33.58%	6

Table E (continued) . Summary statistics by site for chloride data. Values are expressed in $\mu\text{eq/L}$.

Sample Number	Minimum	Average	Maximum	Standard Deviation	Coefficient of Variation	N
226	7.75	11.96	16.54	3.47	29.03%	6
227	9.06	12.87	17.34	2.97	23.07%	6
228	9.55	14.34	25.93	5.96	41.56%	6
229	9.85	13.18	14.89	1.94	14.75%	6
230	10.36	13.36	20.25	3.61	26.99%	6
231	10.05	12.81	17.22	2.47	19.28%	6
232	12.36	21.61	52.89	14.12	65.34%	7
233	11.57	15.76	26.64	3.73	23.69%	19
234	12.09	15.73	21.77	2.65	16.85%	18
235	12.13	14.65	21.45	3.30	22.53%	9
236	8.27	13.04	26.02	4.17	31.97%	16
237	5.30	12.46	28.69	4.20	33.72%	25
242	10.63	14.71	29.87	4.73	32.12%	14
243	8.10	11.81	16.22	2.36	19.98%	14
244	8.35	13.65	17.88	2.59	18.95%	14
245	8.00	13.61	36.94	7.27	53.37%	13
246	5.52	16.36	67.70	14.45	88.35%	15
247	9.07	17.32	48.89	11.75	67.85%	13
248	9.10	13.75	38.03	6.93	50.37%	15
249	10.61	11.84	12.64	0.79	6.71%	5
250	10.30	14.72	18.96	2.74	18.61%	8
251	9.13	16.72	24.03	4.05	24.20%	22
252	12.70	16.87	24.10	3.00	17.78%	20
253	10.82	18.87	53.00	8.56	45.37%	21
254	12.82	15.00	19.50	2.27	15.17%	7
255	11.77	13.04	14.76	1.27	9.78%	5
256	10.16	11.67	14.22	1.54	13.16%	5
257	10.43	12.57	17.30	2.85	22.64%	5
258	8.68	12.18	17.31	3.35	27.51%	5
259	8.78	11.22	14.65	2.55	22.73%	4
260	8.43	11.22	15.95	2.34	20.87%	8
261	8.01	11.06	15.28	2.45	22.18%	7
262	9.46	10.35	11.76	0.87	8.38%	7
263	8.53	14.12	23.39	5.43	38.47%	8
264	9.47	16.93	29.68	8.82	52.09%	6
265	9.65	15.73	32.44	6.82	43.37%	10

Table E (continued) . Summary statistics by site for chloride data. Values are expressed in $\mu\text{eq/L}$.

Sample Number	Minimum	Average	Maximum	Standard Deviation	Coefficient of Variation	N
266	9.49	13.94	34.83	7.35	52.70%	11
267	11.43	17.50	45.90	7.49	42.83%	19
268	8.69	17.55	63.81	12.75	72.64%	20
269	9.68	16.17	35.50	8.22	50.80%	8
270	8.72	12.23	19.18	2.58	21.07%	19
271	9.31	10.63	13.29	1.18	11.14%	13
272	9.20	19.19	43.70	12.63	65.82%	6
273	10.05	13.21	15.53	2.13	16.14%	5
274	9.33	13.46	22.51	6.13	45.56%	4
275	9.16	14.98	27.42	8.48	56.64%	4
276	11.32	15.25	21.48	3.31	21.73%	15
277	10.29	13.62	20.18	2.58	18.94%	16
278	10.12	15.14	39.08	8.30	54.84%	12
279	8.35	15.60	62.54	15.73	100.81%	11
280	10.47	13.33	24.12	3.82	28.69%	12
281	9.15	14.40	35.14	6.96	48.36%	12
282	9.72	11.91	19.51	2.56	21.48%	13
283	9.44	13.60	25.54	4.16	30.59%	15
284	10.36	12.00	14.79	2.43	20.21%	3
285	13.15	17.23	23.34	4.60	26.71%	5
286	12.36	16.52	20.96	3.27	19.82%	5
287	12.57	16.73	22.40	3.36	20.06%	6
288	9.63	13.04	19.96	3.37	25.80%	11
289	10.43	14.53	28.67	4.64	31.91%	15
290	11.09	16.39	24.50	3.56	21.72%	18
291	10.10	14.57	25.37	4.13	28.33%	17
292	9.69	12.52	18.17	2.17	17.37%	13
293	9.61	14.95	46.65	7.72	51.60%	20
294	11.36	15.60	23.08	5.16	33.07%	6
295	10.89	15.57	24.28	5.01	32.17%	6
296	11.22	12.48	13.89	1.14	9.10%	4
297	11.77	17.22	22.53	4.49	26.06%	4
298	16.79	26.26	53.94	15.29	58.21%	7
299	11.29	16.29	41.11	7.63	46.83%	13
300	10.72	12.06	16.44	2.17	17.98%	6
301	10.71	13.45	18.89	3.15	23.39%	5

Table E (continued) . Summary statistics by site for chloride data. Values are expressed in $\mu\text{eq/L}$.

Sample Number	Minimum	Average	Maximum	Standard Deviation	Coefficient of Variation	N
302	11.60	11.87	12.14	0.38	3.22%	2
304	12.42	19.45	62.24	13.70	70.47%	12
305	5.76	14.64	38.05	7.17	48.99%	14
306	11.04	16.52	37.96	7.10	43.00%	12
307	11.43	16.04	41.95	6.88	42.89%	17
308	11.82	16.25	22.92	4.99	30.70%	4
309	13.76	14.13	14.78	0.57	4.03%	3
310	10.03	17.21	56.84	12.91	75.04%	12
311	11.23	17.28	60.58	14.49	83.83%	11
312	9.38	13.28	17.47	2.90	21.81%	6
313	11.57	11.57	11.57			1
314	11.64	11.64	11.64			1
315	8.43	15.32	38.12	11.30	73.77%	6
316	12.12	12.19	12.26	0.07	0.57%	3
317	9.74	12.27	14.07	1.99	16.21%	4
318	11.14	12.15	14.10	1.69	13.94%	3
319	11.08	15.56	40.64	7.93	50.99%	13
320	9.34	16.87	43.85	10.27	60.87%	11
321	9.05	17.11	52.01	12.10	70.69%	11
322	9.79	14.66	44.75	8.88	60.57%	14
323	10.24	11.98	15.78	2.28	19.03%	5
324	10.95	14.14	18.07	3.07	21.73%	4
325	9.51	10.59	11.57	0.86	8.11%	5
326	9.47	11.46	17.48	2.63	22.98%	8
327	10.96	17.69	35.61	6.64	37.54%	18
328	9.75	17.91	45.69	10.24	57.19%	11
329	10.62	14.69	26.11	4.50	30.64%	11
330	2.62	12.35	24.96	4.63	37.44%	15
331	13.52	20.45	28.38	6.14	30.04%	4
332	7.98	14.02	26.26	6.16	43.91%	10
333	12.36	14.59	15.84	1.94	13.28%	3
334	9.48	12.40	14.76	1.99	16.06%	7
335	11.36	19.62	44.70	8.25	42.03%	13
336	10.36	14.71	19.73	2.64	17.95%	14
337	9.59	13.24	22.42	3.52	26.62%	13
338	12.43	13.06	13.70	0.90	6.88%	2

Table E (continued) . Summary statistics by site for chloride data. Values are expressed in $\mu\text{eq/L}$.

Sample Number	Minimum	Average	Maximum	Standard Deviation	Coefficient of Variation	N
339	11.61	11.61	11.61			1
340	11.37	16.13	21.72	4.75	29.46%	4
341	14.54	17.14	21.58	2.42	14.14%	11
342	13.45	15.87	22.37	2.47	15.54%	11
343	12.19	13.12	14.05	1.31	10.02%	2
344	13.33	13.72	14.11	0.55	4.01%	2
345	11.85	11.85	11.85			1
346	11.77	11.77	11.77			1
347	15.83	15.83	15.83			1
348	53.75	53.75	53.75			1
349	10.30	10.30	10.30			1
350	10.10	13.17	15.11	2.23	16.91%	5
351	21.99	21.99	21.99			1
352	16.74	18.96	21.02	1.75	9.24%	4
353	11.51	13.34	15.72	2.16	16.22%	3
354	12.11	15.17	18.09	2.45	16.14%	4
355	12.13	12.52	13.03	0.45	3.58%	4
356	16.16	16.16	16.16			1
357	8.99	12.34	19.06	3.46	27.99%	7
358	15.92	15.92	15.92			1
359	11.42	11.42	11.42			1
360	10.87	13.76	16.77	2.70	19.60%	5
361	10.39	11.01	11.63	0.87	7.93%	2
362	8.61	12.03	19.31	4.93	40.93%	4
363	9.73	14.68	22.97	5.30	36.10%	5
364	11.02	12.85	16.45	2.47	19.21%	4
365	14.11	14.11	14.11			1
366	13.41	15.33	17.75	2.21	14.43%	3
367	9.10	9.10	9.10			1
368	8.87	8.87	8.87			1
369	10.78	13.56	16.35	3.94	29.02%	2
377	14.92	15.67	16.41	1.05	6.71%	2
392	7.77	7.77	7.77			1
393	10.64	11.09	11.53	0.62	5.63%	2
399	17.01	17.01	17.01			1
400	13.09	13.09	13.09			1

Table E (continued) . Summary statistics by site for chloride data. Values are expressed in $\mu\text{eq/L}$.

Sample Number	Minimum	Average	Maximum	Standard Deviation	Coefficient of Variation	N
401	14.01	14.01	14.01			1
402	12.91	12.91	12.91			1
472	10.87	11.61	13.19	0.94	8.13%	5
473	10.55	14.20	20.95	3.26	22.92%	7
474	10.79	12.79	15.09	1.26	9.88%	7
475	11.92	14.53	17.00	1.99	13.72%	6
479	5.23	11.51	13.57	2.89	25.09%	7
480	10.16	11.27	13.15	0.98	8.71%	7
481	10.27	11.51	14.28	1.36	11.81%	7
482	9.77	11.77	13.33	1.57	13.35%	5
483	10.90	11.87	13.58	0.89	7.48%	7
484	10.70	13.57	17.94	3.16	23.29%	6
485	9.81	12.90	20.74	3.45	26.73%	8
486	11.24	11.24	11.24			1
487	14.87	16.70	19.20	2.24	13.40%	3
488	12.76	13.45	14.58	0.77	5.69%	7
489	16.21	18.52	20.88	1.75	9.45%	5
490	13.70	13.70	13.70			1
492	10.58	13.63	21.37	4.01	29.38%	6
493	9.31	11.42	13.58	1.75	15.28%	4
494	12.05	12.05	12.05			1
999	11.77	11.77	11.77			1

Table F. Summary statistics by site for conductivity data. Values are expressed in μ S/cm.

Sample Number	Minimum	Average	Maximum	Standard Deviation	Coefficient of Variation	N
1	8.00	14.98	18.52	2.55	17.05%	19
2	14.50	16.33	18.55	1.59	9.76%	5
3	13.09	16.82	22.80	2.42	14.39%	19
4	1.17	13.51	17.37	3.44	25.43%	18
5	15.06	18.01	23.30	2.43	13.48%	15
6	12.00	15.69	18.81	1.93	12.30%	12
7	13.77	17.32	24.70	4.44	25.66%	5
8	11.43	15.25	19.40	4.13	27.10%	4
9	15.40	20.61	27.40	6.16	29.87%	3
10	17.38	26.43	32.40	7.97	30.15%	3
11	22.40	32.03	40.00	8.92	27.84%	3
12	8.91	11.44	15.40	3.47	30.33%	3
13	12.21	18.47	26.60	4.33	23.45%	20
14	12.15	18.71	26.30	4.10	21.93%	17
15	14.86	17.48	19.45	2.36	13.52%	3
16	13.45	17.24	22.70	3.59	20.85%	5
17	12.68	16.94	21.90	3.17	18.72%	11
18	10.46	12.62	15.83	2.28	18.06%	4
19	13.60	16.81	23.00	4.28	25.43%	4
20	11.45	15.51	21.00	2.73	17.60%	23
21	13.05	23.78	35.00	8.42	35.43%	10
22	12.47	29.67	90.10	22.49	75.79%	10
23	1.35	16.29	29.03	6.16	37.83%	22
24	14.75	22.57	35.10	5.59	24.78%	23
25	21.50	32.46	64.20	14.18	43.68%	11
26	14.96	18.63	22.50	2.70	14.48%	6
27	15.00	19.67	24.20	4.02	20.46%	5
28	13.36	16.38	20.70	2.69	16.42%	5
29	0.89	21.88	55.60	10.18	46.55%	18
30	17.89	20.88	28.80	2.56	12.26%	21
31	11.68	21.64	39.20	9.41	43.49%	6
32	12.67	18.19	24.40	4.12	22.64%	6
33	14.52	14.52	14.52			1
34	9.17	13.62	19.56	2.77	20.37%	13
35	12.03	15.03	23.30	3.17	21.10%	13
36	6.58	11.07	22.90	5.00	45.12%	8

Table F (continued). Summary statistics by site for conductivity data. Values are expressed in $\mu\text{S}/\text{cm}$.

Sample Number	Minimum	Average	Maximum	Standard Deviation	Coefficient of Variation	N
37	15.67	28.28	45.30	14.41	50.94%	5
38	10.18	11.82	14.77	1.62	13.68%	7
39	7.83	9.39	11.67	1.33	14.13%	6
40	10.35	13.68	18.28	2.20	16.09%	16
41	10.87	12.56	13.61	1.48	11.77%	3
42	7.63	13.00	15.51	2.22	17.10%	14
43	12.40	15.59	19.90	1.94	12.43%	21
44	10.11	13.26	19.90	3.57	26.90%	6
45	12.10	18.63	22.40	2.52	13.53%	19
46	13.07	16.91	21.80	2.19	12.95%	21
47	9.65	12.63	19.30	2.27	17.93%	18
48	12.30	16.83	26.50	3.81	22.64%	12
49	10.07	15.62	22.80	3.11	19.91%	19
50	12.55	15.87	19.90	2.45	15.42%	9
51	13.57	16.50	20.50	2.53	15.33%	6
52	10.96	16.06	21.90	2.41	15.02%	21
53	16.30	21.90	30.80	4.82	21.99%	7
54	12.22	17.03	19.40	2.31	13.57%	7
55	11.53	16.57	24.80	4.52	27.29%	8
56	12.28	17.43	25.60	4.04	23.18%	7
57	13.61	16.51	22.50	3.15	19.09%	7
58	14.30	17.81	26.20	4.10	23.01%	8
59	13.61	16.87	23.00	3.63	21.52%	5
60	17.55	20.95	25.90	3.76	17.96%	5
61	19.24	20.37	21.40	0.95	4.67%	5
62	16.31	21.94	27.50	4.09	18.63%	5
63	18.26	21.25	27.90	3.95	18.61%	5
64	10.10	16.62	20.50	4.28	25.74%	5
65	14.81	17.61	20.40	3.95	22.45%	2
66	9.90	19.21	24.10	2.80	14.59%	25
67	18.36	24.35	28.90	3.91	16.04%	5
68	16.69	19.39	23.90	2.80	14.44%	7
69	15.79	18.49	23.00	2.01	10.86%	16
70	13.85	15.65	17.68	1.30	8.30%	8
71	12.60	16.12	20.00	1.46	9.04%	22
72	13.08	16.03	19.60	1.90	11.87%	20

Table F (continued). Summary statistics by site for conductivity data. Values are expressed in $\mu\text{S}/\text{cm}$.

Sample Number	Minimum	Average	Maximum	Standard Deviation	Coefficient of Variation	N
73	15.60	20.49	24.80	2.49	12.17%	22
74	16.17	24.09	31.20	3.93	16.30%	21
75	15.55	18.59	22.90	1.73	9.30%	19
76	15.50	19.00	23.00	1.98	10.44%	17
77	6.10	15.46	18.64	3.71	24.02%	9
78	10.56	17.89	21.80	6.35	35.50%	3
79	14.61	21.85	28.90	4.13	18.90%	14
80	15.95	18.59	21.40	1.80	9.69%	12
81	11.40	16.25	18.89	2.77	17.03%	7
82	10.08	14.42	18.96	2.93	20.36%	12
83	11.51	15.38	19.10	2.94	19.13%	7
84	12.27	15.54	21.70	2.83	18.20%	14
86	12.65	15.01	23.10	2.82	18.79%	12
87	13.01	15.02	20.30	1.81	12.07%	13
88	11.15	16.73	45.80	9.03	53.96%	13
89	11.74	14.19	19.70	2.82	19.87%	6
90	8.42	16.59	28.10	6.89	41.52%	6
91	12.48	14.42	20.80	2.40	16.63%	10
92	7.27	19.10	25.50	4.15	21.73%	15
93	14.86	17.81	21.80	2.02	11.32%	14
94	14.30	20.50	24.20	5.40	26.36%	3
95	15.80	19.95	24.10	5.87	29.42%	2
96	14.35	16.15	18.46	1.99	12.32%	4
97	14.69	15.33	15.97	0.64	4.18%	3
99	7.32	8.92	10.16	1.27	14.21%	4
100	12.53	13.56	14.59	1.46	10.74%	2
101	11.31	11.32	11.32	0.01	0.06%	2
102	11.25	11.85	12.45	0.85	7.16%	2
103	15.90	19.92	22.90	2.00	10.04%	22
104	15.51	20.61	51.40	7.47	36.23%	21
105	15.11	18.75	22.90	2.57	13.72%	18
106	15.35	18.00	23.20	1.80	10.01%	18
107	7.99	16.17	22.00	2.63	16.29%	22
108	14.87	15.73	16.58	1.21	7.69%	2
109	17.14	17.78	18.42	0.91	5.09%	2
110	11.09	17.15	22.20	2.87	16.76%	14

Table F (continued). Summary statistics by site for conductivity data. Values are expressed in $\mu\text{S}/\text{cm}$.

Sample Number	Minimum	Average	Maximum	Standard Deviation	Coefficient of Variation	N
111	10.06	14.76	38.10	7.64	51.75%	12
112	23.90	29.88	52.20	8.42	28.18%	10
113	18.77	25.13	34.20	4.30	17.09%	12
114	15.56	19.03	30.82	4.17	21.91%	11
115	12.51	14.64	16.32	1.27	8.71%	7
116	14.01	14.78	15.54	1.08	7.32%	2
117	14.51	15.49	16.47	1.39	8.95%	2
118	7.98	11.48	14.39	3.25	28.27%	3
119	13.49	14.46	15.42	1.36	9.44%	2
120	10.99	12.58	14.27	1.64	13.05%	3
121	12.97	15.14	18.26	2.15	14.18%	5
122	13.38	21.81	35.70	12.12	55.59%	3
123	10.15	12.21	13.80	1.67	13.69%	5
124	10.66	12.84	14.54	1.59	12.41%	5
125	10.40	12.39	15.50	1.52	12.30%	13
126	11.17	15.49	23.00	2.90	18.71%	11
127	8.66	11.45	13.67	1.43	12.46%	18
128	9.06	12.60	24.40	4.66	37.02%	9
129	9.16	11.63	16.86	2.13	18.28%	10
130	9.52	12.03	14.68	1.50	12.44%	10
131	1.81	13.34	17.97	4.74	35.54%	10
132	9.83	15.22	54.00	12.90	84.74%	11
133	11.37	14.51	17.03	1.75	12.07%	11
134	12.87	16.42	20.80	2.11	12.84%	13
135	12.63	16.37	20.80	2.74	16.72%	10
136	6.64	7.18	8.18	0.87	12.12%	3
137	10.38	15.17	17.95	1.83	12.06%	20
138	10.94	13.79	16.66	1.39	10.07%	20
139	8.01	9.17	11.28	1.45	15.79%	4
140	8.34	13.22	48.26	9.81	74.16%	15
141	9.11	10.98	13.08	1.41	12.85%	16
142	8.35	10.83	13.09	1.43	13.22%	17
143	8.86	11.09	13.39	1.36	12.25%	17
144	9.33	11.03	13.37	1.62	14.67%	15
145	10.18	12.72	16.41	2.15	16.94%	6
146	8.80	11.35	14.35	1.48	13.00%	15

Table F (continued). Summary statistics by site for conductivity data. Values are expressed in $\mu\text{S}/\text{cm}$.

Sample Number	Minimum	Average	Maximum	Standard Deviation	Coefficient of Variation	N
147	10.53	14.44	18.60	2.30	15.92%	18
148	13.37	16.74	20.90	2.69	16.08%	11
149	11.81	14.44	18.06	1.88	12.99%	11
150	11.57	14.30	18.00	2.16	15.12%	11
151	14.31	27.52	86.70	20.25	73.58%	18
152	30.00	58.66	95.00	22.67	38.65%	18
153	23.40	53.21	105.10	23.44	44.05%	14
154	13.29	13.29	13.29			1
155	11.80	11.80	11.80			1
156	24.40	48.98	77.20	15.69	32.05%	20
157	9.81	26.08	56.70	20.87	80.05%	4
158	9.48	10.60	13.20	1.52	14.35%	5
159	13.10	18.94	29.60	6.73	35.51%	5
160	19.11	38.28	62.90	17.89	46.73%	5
161	10.92	20.37	48.00	15.63	76.72%	5
162	18.19	25.16	35.30	7.19	28.58%	5
163	18.99	48.10	69.00	25.99	54.05%	3
164	15.08	21.69	26.00	5.81	26.80%	3
165	18.32	24.61	33.70	8.06	32.78%	3
166	14.19	23.16	28.80	7.86	33.91%	3
167	11.69	15.58	17.85	3.38	21.72%	3
168	16.33	19.72	23.60	3.00	15.22%	4
169	19.32	28.11	39.80	10.54	37.52%	3
170	17.72	18.42	18.80	0.48	2.62%	4
171	35.80	56.43	77.90	21.06	37.32%	3
172	17.37	20.24	23.10	4.05	20.02%	2
173	11.30	19.92	60.50	10.27	51.56%	21
174	16.81	105.01	161.10	45.80	43.61%	20
175	13.12	21.90	63.70	11.16	50.93%	18
176	15.29	46.51	98.30	24.51	52.70%	17
177	9.53	15.00	45.80	11.63	77.54%	9
178	6.90	14.65	31.40	11.27	76.94%	4
179	8.31	9.15	10.21	0.97	10.59%	3
180	7.87	8.16	8.44	0.40	4.94%	2
181	8.75	9.98	10.80	1.09	10.88%	3
182	11.04	11.13	11.21	0.12	1.08%	2

Table F (continued). Summary statistics by site for conductivity data. Values are expressed in $\mu\text{S}/\text{cm}$.

Sample Number	Minimum	Average	Maximum	Standard Deviation	Coefficient of Variation	N
183	7.96	14.05	41.80	10.23	72.78%	15
184	10.48	13.84	17.30	2.04	14.76%	18
185	10.40	13.43	16.99	1.94	14.43%	15
186	6.60	14.23	25.80	3.83	26.89%	21
187	9.33	25.93	59.40	18.36	70.82%	6
188	6.67	8.47	9.70	1.39	16.44%	5
189	9.15	10.46	11.79	0.98	9.38%	7
190	9.79	12.19	16.80	1.54	12.63%	19
191	9.17	10.93	13.05	1.08	9.85%	15
192	10.94	13.61	17.51	1.83	13.45%	16
193	8.86	12.07	17.20	2.55	21.12%	20
194	8.97	14.50	48.29	8.42	58.03%	20
195	6.73	8.51	12.22	1.62	19.02%	11
196	7.82	13.74	21.40	6.02	43.80%	4
197	7.86	8.59	9.01	0.63	7.39%	3
198	8.04	9.68	10.88	1.47	15.20%	3
199	12.73	15.25	17.54	1.53	10.02%	7
200	10.39	12.22	14.49	1.19	9.73%	19
201	7.87	11.17	13.54	1.62	14.52%	15
202	8.82	8.82	8.82			1
203	14.75	14.75	14.75			1
204	16.05	16.05	16.05			1
205	15.63	15.63	15.63			1
207	8.45	8.97	10.20	0.76	8.47%	5
208	6.28	8.67	11.12	1.88	21.70%	6
209	7.76	11.94	41.76	7.18	60.10%	20
210	12.22	16.19	49.75	7.79	48.11%	21
211	9.84	14.40	46.59	9.03	62.70%	15
212	9.19	12.65	32.96	5.45	43.09%	17
213	9.37	11.75	18.30	1.87	15.91%	21
214	9.28	12.34	36.12	5.61	45.49%	21
215	8.90	15.67	55.93	9.99	63.72%	19
216	8.76	9.66	10.79	0.84	8.70%	4
218	12.91	21.53	28.10	4.17	19.36%	18
219	9.25	23.65	28.08	4.97	21.03%	16
220	12.80	18.08	25.40	3.02	16.69%	17

Table F (continued). Summary statistics by site for conductivity data. Values are expressed in $\mu\text{S}/\text{cm}$.

Sample Number	Minimum	Average	Maximum	Standard Deviation	Coefficient of Variation	N
221	8.60	10.61	14.85	1.65	15.57%	11
222	8.42	9.85	11.25	1.18	11.96%	4
223	8.29	10.43	12.59	1.46	13.96%	7
224	8.45	10.69	13.49	1.67	15.67%	6
225	9.52	13.76	18.60	3.14	22.80%	6
226	9.42	11.76	16.29	2.53	21.53%	6
227	8.04	11.34	14.11	2.26	19.95%	6
228	9.43	11.12	13.37	1.61	14.46%	6
229	7.66	10.13	12.40	1.54	15.20%	6
230	8.80	12.00	21.35	4.70	39.14%	6
231	8.89	10.53	13.10	1.57	14.92%	6
232	12.50	23.74	39.20	8.16	34.38%	7
233	16.60	23.11	31.82	4.00	17.29%	19
234	14.29	16.05	17.53	0.92	5.70%	18
235	12.43	15.69	18.13	2.16	13.78%	8
236	-2.50	17.21	21.40	5.53	32.14%	16
237	-14.26	18.42	23.40	7.34	39.86%	23
242	16.17	20.11	24.50	2.29	11.36%	14
243	11.34	15.34	17.62	1.88	12.24%	14
244	12.00	14.96	18.20	1.57	10.49%	14
245	5.59	7.00	8.47	0.98	14.01%	13
246	9.18	10.91	12.53	0.96	8.78%	15
247	8.19	11.29	22.55	3.52	31.22%	13
248	8.88	10.33	12.10	1.00	9.72%	15
249	7.63	10.09	11.63	1.50	14.88%	5
250	9.18	15.83	24.20	5.73	36.17%	7
251	9.33	29.32	40.30	8.90	30.35%	21
252	-4.68	41.33	76.40	20.78	50.27%	20
253	17.93	28.45	94.81	17.58	61.81%	21
254	13.64	15.18	19.83	2.11	13.88%	7
255	12.20	12.91	14.29	0.84	6.54%	5
256	11.28	12.23	13.37	0.94	7.67%	5
257	11.24	11.80	12.61	0.55	4.66%	5
258	6.59	9.84	11.24	1.90	19.33%	5
259	9.10	10.15	11.04	0.84	8.26%	4
260	7.83	12.12	18.10	3.73	30.78%	8

Table F (continued). Summary statistics by site for conductivity data. Values are expressed in $\mu\text{S}/\text{cm}$.

Sample Number	Minimum	Average	Maximum	Standard Deviation	Coefficient of Variation	N
261	8.10	11.06	17.00	3.21	29.05%	7
262	7.75	10.23	16.70	3.01	29.42%	7
263	7.79	10.85	15.70	2.60	23.97%	8
264	5.00	10.40	14.80	3.56	34.28%	6
265	7.49	11.25	18.30	3.20	28.45%	8
266	10.05	13.65	17.60	2.33	17.04%	10
267	11.62	14.68	20.40	2.46	16.78%	18
268	9.72	13.43	21.40	2.40	17.87%	20
269	9.87	12.91	17.40	2.99	23.13%	7
270	9.93	12.70	19.00	2.26	17.76%	17
271	9.06	12.17	17.87	2.59	21.25%	13
272	10.01	12.61	14.58	1.91	15.17%	6
273	9.66	11.94	14.44	1.88	15.74%	5
274	5.99	8.39	10.42	1.87	22.24%	4
275	8.34	9.68	11.00	1.17	12.08%	4
276	9.16	11.03	12.65	1.06	9.64%	15
277	9.98	11.68	13.72	0.94	8.07%	16
278	8.81	10.44	15.34	1.79	17.16%	12
279	7.90	10.04	13.63	1.64	16.33%	11
280	7.66	13.32	16.63	2.33	17.46%	12
281	11.23	13.60	18.80	2.38	17.46%	12
282	10.16	13.14	19.74	2.70	20.52%	13
283	10.93	14.14	20.60	2.86	20.22%	15
284	13.14	14.57	16.01	1.44	9.85%	3
285	12.86	17.65	22.80	3.63	20.59%	5
286	13.21	15.10	17.03	1.40	9.27%	5
287	14.03	16.30	19.24	1.77	10.83%	6
288	9.31	12.96	16.55	2.25	17.39%	11
289	10.69	13.56	18.38	1.87	13.78%	15
290	12.62	16.59	31.70	4.63	27.91%	18
291	11.54	13.94	17.79	1.87	13.39%	17
292	10.58	12.57	15.99	1.28	10.21%	13
293	13.06	16.34	19.04	1.87	11.42%	19
294	11.33	13.61	16.22	1.67	12.24%	6
295	11.41	14.00	16.48	1.82	13.02%	6
296	12.89	14.29	16.83	1.75	12.24%	4

Table F (continued). Summary statistics by site for conductivity data. Values are expressed in $\mu\text{S}/\text{cm}$.

Sample Number	Minimum	Average	Maximum	Standard Deviation	Coefficient of Variation	N
297	11.51	13.40	15.47	1.67	12.44%	4
298	16.80	34.43	53.90	14.62	42.48%	7
299	8.04	11.28	15.35	2.00	17.73%	14
300	8.27	9.96	11.68	1.19	11.99%	6
301	7.73	9.63	11.10	1.30	13.45%	5
302	8.58	9.91	11.21	1.32	13.27%	3
303	11.50	11.50	11.50			1
304	9.44	14.41	21.10	3.34	23.16%	12
305	7.30	10.24	12.38	1.37	13.39%	14
306	9.39	11.58	13.33	1.35	11.65%	12
307	5.84	10.12	13.23	1.75	17.32%	17
308	8.99	11.17	16.11	3.32	29.68%	4
309	10.50	11.83	12.97	1.25	10.54%	3
310	10.01	12.69	17.09	2.30	18.12%	12
311	9.26	11.40	14.48	1.79	15.70%	11
312	9.66	11.37	13.34	1.39	12.22%	6
313	7.94	7.94	7.94			1
314	11.20	11.20	11.20			1
315	8.35	10.78	12.94	1.90	17.67%	6
316	10.23	12.21	14.99	2.48	20.30%	3
317	10.06	11.91	14.40	1.85	15.51%	4
318	10.01	12.70	17.24	3.95	31.13%	3
319	9.19	11.63	13.62	1.40	12.01%	13
320	7.69	10.69	12.48	1.43	13.40%	11
321	8.96	12.88	16.06	2.27	17.63%	11
322	8.85	10.31	11.83	1.00	9.73%	14
323	9.77	10.70	11.82	0.93	8.68%	5
324	8.32	10.21	11.61	1.49	14.60%	4
325	9.45	11.30	15.08	2.24	19.83%	5
326	10.72	13.38	18.61	2.67	19.94%	8
327	11.41	14.68	18.30	2.32	15.79%	18
328	6.82	10.25	17.30	3.27	31.90%	11
329	9.84	12.40	13.76	1.19	9.56%	10
330	4.45	16.57	63.70	13.54	81.71%	15
331	10.28	17.24	22.00	6.16	35.74%	3
332	9.58	12.57	17.41	2.13	16.97%	10

Table F (continued). Summary statistics by site for conductivity data. Values are expressed in $\mu\text{S}/\text{cm}$.

Sample Number	Minimum	Average	Maximum	Standard Deviation	Coefficient of Variation	N
333	17.63	17.91	18.19	0.28	1.56%	3
334	10.37	12.38	15.35	1.73	13.97%	8
335	13.26	47.56	77.60	19.90	41.83%	14
336	10.54	11.82	14.73	1.04	8.78%	14
337	7.33	12.03	17.35	2.67	22.17%	12
338	12.24	12.90	13.55	0.93	7.18%	2
339	13.87	13.87	13.87			1
340	12.05	14.23	17.49	2.35	16.51%	4
341	18.12	26.90	37.70	6.36	23.63%	12
342	13.10	19.61	28.20	4.99	25.43%	12
343	8.37	9.69	11.00	1.86	19.20%	2
344	8.30	9.51	10.72	1.71	17.99%	2
345	13.88	13.88	13.88			1
346	11.36	11.36	11.36			1
347	19.06	19.06	19.06			1
348	13.25	13.25	13.25			1
349	10.85	10.85	10.85			1
350	11.40	12.23	13.21	0.80	6.53%	4
351	60.60	60.60	60.60			1
352	36.80	52.08	71.80	15.84	30.41%	4
353	12.83	15.72	18.86	3.02	19.22%	3
354	11.78	13.77	15.38	1.52	11.06%	4
355	10.86	13.91	17.19	3.17	22.81%	4
356	12.26	12.26	12.26			1
357	10.63	12.72	14.79	1.92	15.09%	5
358	12.13	12.13	12.13			1
359	10.75	10.75	10.75			1
360	19.42	24.04	29.10	3.43	14.28%	5
361	26.30	26.35	26.40	0.07	0.27%	2
362	8.47	10.19	11.11	1.22	11.92%	4
363	10.61	13.06	14.19	1.40	10.73%	5
364	16.86	17.63	18.07	0.67	3.81%	3
365	9.45	9.45	9.45			1
366	15.92	23.64	32.00	8.06	34.09%	3
367	14.31	14.31	14.31			1
368	20.20	20.20	20.20			1

Table F (continued). Summary statistics by site for conductivity data. Values are expressed in $\mu\text{S}/\text{cm}$.

Sample Number	Minimum	Average	Maximum	Standard Deviation	Coefficient of Variation	N
369	10.40	15.50	20.60	7.21	46.53%	2
377	19.80	26.70	33.60	9.76	36.55%	2
392	10.89	10.89	10.89			1
393	9.44	10.27	11.09	1.17	11.37%	2
399	7.88	7.88	7.88			1
400	8.42	8.42	8.42			1
401	7.82	7.82	7.82			1
402	8.37	8.37	8.37			1
472	11.03	12.08	13.39	0.98	8.15%	5
473	17.84	20.59	25.20	2.44	11.84%	7
474	11.13	13.09	14.44	1.25	9.55%	7
475	10.34	11.77	13.42	1.43	12.19%	6
479	6.95	10.96	12.32	1.90	17.30%	7
480	10.08	13.50	15.95	1.98	14.64%	7
481	14.36	16.51	21.40	2.43	14.69%	7
482	11.16	13.54	15.85	1.72	12.73%	5
483	11.44	14.13	16.75	1.94	13.70%	7
484	8.88	10.42	12.05	1.06	10.23%	6
485	9.13	11.25	13.63	1.50	13.35%	8
486	8.96	8.96	8.96			1
487	15.57	16.30	17.17	0.81	4.97%	3
488	8.72	11.51	13.90	1.70	14.73%	7
489	36.30	89.92	135.80	42.19	46.92%	5
490	12.18	12.18	12.18			1
492	14.36	17.46	21.60	2.46	14.10%	6
493	11.19	12.39	13.86	1.16	9.33%	4
494	15.53	15.53	15.53			1
999	40.00	40.00	40.00			1

Table G. Summary statistics by site for pH.

SampleID	MinOfField pH	AvgOfField pH	MaxOfField pH	StDevOfField pH	CountOfField pH
1	5.85	6.25	6.68	0.20	19
2	5.71	6.28	6.54	0.33	5
3	5.79	6.48	6.70	0.20	19
4	5.54	6.08	6.68	0.32	18
5	6.02	6.38	6.56	0.15	15
6	6.30	6.49	6.81	0.15	12
7	6.40	6.58	6.80	0.19	5
8	6.23	6.33	6.44	0.09	4
9	6.16	6.46	6.67	0.27	3
10	6.61	6.68	6.79	0.09	3
11	6.61	6.63	6.65	0.02	3
12	6.18	6.26	6.31	0.07	3
13	6.19	6.70	6.94	0.19	20
14	6.26	6.66	6.99	0.21	17
15	6.56	6.66	6.78	0.11	3
16	6.58	6.67	6.79	0.08	5
17	6.28	6.58	6.72	0.15	11
18	6.28	6.60	6.83	0.23	4
19	6.50	6.63	6.81	0.14	4
20	6.14	6.56	6.83	0.22	24
21	6.37	6.69	7.05	0.21	10
22	6.28	6.60	6.86	0.25	10
23	5.71	6.59	6.97	0.28	22
24	6.38	6.74	7.07	0.20	23
25	6.53	6.90	7.61	0.29	10
26	6.30	6.50	6.71	0.16	6
27	6.52	6.69	6.95	0.18	5
28	6.07	6.28	6.59	0.22	5
29	5.52	6.51	6.85	0.32	18
30	6.18	6.45	6.83	0.19	22
31	6.11	6.49	7.10	0.34	6
32	6.29	6.48	6.64	0.15	6
33	6.62	6.62	6.62		1
34	6.28	6.46	6.70	0.12	13
35	6.30	6.51	6.73	0.16	14
36	5.97	6.32	6.45	0.16	8
37	6.68	6.89	7.19	0.19	5

Table G (continued). Summary statistics by site for pH.

SampleID	MinOfField pH	AvgOfField pH	MaxOfField pH	StDevOfField pH	CountOfField pH
38	6.31	6.49	6.73	0.16	7
39	6.13	6.47	6.74	0.26	6
40	6.15	6.45	6.67	0.15	16
41	6.38	6.47	6.63	0.14	3
42	6.13	6.41	6.59	0.12	14
43	5.65	5.97	6.46	0.21	22
44	5.48	5.89	6.34	0.28	9
45	5.23	5.55	6.11	0.22	24
46	5.13	5.77	6.18	0.27	21
47	5.79	6.00	6.17	0.12	18
48	5.53	6.22	6.60	0.27	12
49	5.96	6.25	6.60	0.17	19
50	6.11	6.37	6.63	0.20	9
51	6.30	6.43	6.68	0.15	6
52	5.93	6.42	6.77	0.19	20
53	4.86	4.98	5.17	0.12	7
54	5.65	6.00	6.23	0.24	7
55	5.66	6.09	6.24	0.18	8
56	6.12	6.25	6.44	0.12	7
57	6.32	6.46	6.58	0.10	7
58	6.24	6.53	6.76	0.18	8
59	5.70	5.98	6.21	0.18	5
60	4.99	5.36	5.67	0.28	5
61	4.99	5.27	6.02	0.43	5
62	4.89	5.16	5.74	0.34	5
63	4.86	5.08	5.31	0.19	5
64	5.43	5.95	6.44	0.38	5
65	6.20	6.38	6.57	0.26	2
66	5.74	6.28	6.75	0.25	25
67	6.14	6.30	6.73	0.25	5
68	5.69	6.29	6.77	0.34	7
69	5.29	5.66	6.49	0.35	16
70	5.79	6.18	6.45	0.22	8
71	5.69	6.22	6.48	0.19	22
72	5.93	6.24	6.59	0.16	21
73	5.47	6.24	6.55	0.26	23
74	5.50	6.35	6.65	0.27	22

Table G (continued). Summary statistics by site for pH.

SampleID	MinOfField pH	AvgOfField pH	MaxOfField pH	StDevOfField pH	CountOfField pH
75	4.70	5.04	5.47	0.17	20
76	4.78	5.05	5.38	0.13	18
77	5.75	6.05	6.96	0.33	11
78	5.90	6.09	6.36	0.24	3
79	4.51	4.78	5.84	0.33	15
80	4.80	5.24	5.82	0.45	12
81	5.69	5.94	6.36	0.22	7
82	5.24	5.76	6.27	0.36	12
83	5.98	6.33	6.87	0.35	7
84	5.65	6.05	6.38	0.20	14
86	5.51	5.90	6.16	0.19	13
87	4.89	5.91	6.35	0.37	14
88	5.51	5.90	6.28	0.21	13
89	5.40	5.74	6.17	0.29	6
90	4.97	5.43	5.97	0.41	6
91	5.59	5.95	6.63	0.29	10
92	4.64	4.77	4.92	0.09	15
93	4.71	5.19	6.10	0.33	14
94	4.85	5.10	5.49	0.34	3
95	4.96	5.19	5.41	0.32	2
96	5.33	5.67	5.86	0.24	4
97	5.65	5.93	6.09	0.24	3
99	5.51	6.01	6.63	0.46	4
100	6.32	6.47	6.61	0.21	2
101	6.21	6.23	6.26	0.03	2
102	5.93	5.97	6.00	0.05	2
103	5.13	5.62	5.83	0.18	22
104	5.01	5.75	7.18	0.47	22
105	4.85	5.58	6.38	0.48	18
106	5.74	6.04	6.25	0.13	18
107	5.74	6.08	6.27	0.14	22
108	5.68	5.77	5.86	0.13	2
109	5.72	5.83	5.95	0.16	2
110	4.92	5.30	6.34	0.40	14
111	5.78	6.12	6.42	0.20	12
112	4.15	4.40	4.63	0.12	10
113	4.27	4.49	4.75	0.13	12

Table G (continued). Summary statistics by site for pH.

SampleID	MinOffField pH	AvgOffField pH	MaxOffField pH	StDevOffField pH	CountOffField pH
114	5.49	6.26	6.47	0.26	11
115	6.00	6.18	6.27	0.10	7
116	5.49	5.94	6.40	0.64	2
117	6.18	6.30	6.41	0.16	2
118	6.08	6.24	6.37	0.15	3
119	6.57	6.61	6.65	0.05	2
120	6.35	6.35	6.36	0.01	3
121	6.45	6.50	6.56	0.05	5
122	6.39	6.47	6.58	0.10	3
123	6.24	6.33	6.39	0.06	5
124	6.28	6.36	6.44	0.07	5
125	6.18	6.49	6.72	0.18	13
126	4.58	5.69	6.59	0.63	11
127	6.11	6.42	6.74	0.13	18
128	6.30	6.44	6.52	0.07	9
129	6.27	6.39	6.59	0.10	10
130	6.10	6.33	6.62	0.14	10
131	5.43	6.21	6.60	0.37	10
132	4.80	6.19	6.45	0.47	11
133	6.24	6.38	6.60	0.12	11
134	6.30	6.49	6.90	0.16	14
135	6.03	6.45	6.69	0.19	10
136	6.18	6.34	6.46	0.14	3
137	5.55	5.92	6.41	0.21	20
138	5.29	5.53	5.85	0.16	20
139	5.94	6.06	6.24	0.13	4
140	6.30	6.43	6.57	0.09	15
141	6.16	6.50	6.67	0.15	16
142	6.21	6.49	6.67	0.11	17
143	6.28	6.46	6.63	0.10	18
144	6.24	6.48	6.74	0.12	16
145	6.42	6.55	6.69	0.11	6
146	6.26	6.47	6.67	0.12	16
147	6.29	6.61	6.78	0.12	18
148	6.57	6.71	6.96	0.11	11
149	6.37	6.55	6.71	0.12	11
150	6.29	6.55	6.79	0.15	11

Table G (continued). Summary statistics by site for pH.

SampleID	MinOfField pH	AvgOfField pH	MaxOfField pH	StDevOfField pH	CountOfField pH
151	5.92	6.69	7.54	0.33	18
152	6.69	7.27	7.84	0.29	18
153	6.66	7.22	7.85	0.36	14
154	6.50	6.50	6.50		1
155	5.89	5.89	5.89		1
156	6.30	7.16	7.73	0.34	21
157	5.65	6.28	7.26	0.69	4
158	6.27	6.37	6.54	0.11	5
159	6.52	6.69	7.08	0.22	5
160	6.77	7.03	7.66	0.37	5
161	6.40	6.63	7.16	0.33	5
162	6.69	6.83	6.99	0.14	5
163	6.58	6.64	6.71	0.07	3
164	6.42	6.55	6.64	0.12	3
165	6.36	6.55	6.68	0.17	3
166	6.46	6.52	6.57	0.05	3
167	6.49	6.56	6.63	0.07	3
168	6.47	6.60	6.79	0.15	4
169	6.47	6.85	7.46	0.53	3
170	5.55	6.24	6.49	0.46	4
171	7.02	7.20	7.45	0.23	3
172	5.68	6.22	6.76	0.76	2
173	5.87	6.70	7.45	0.30	21
174	6.39	7.35	8.24	0.43	20
175	6.28	6.63	6.81	0.14	18
176	6.22	7.00	7.81	0.45	17
177	6.31	6.56	7.41	0.33	9
178	5.66	6.12	6.35	0.32	4
179	6.32	6.39	6.49	0.09	3
180	6.43	6.62	6.80	0.26	2
181	6.13	6.43	6.79	0.33	3
182	6.36	6.38	6.40	0.03	2
183	4.03	5.61	6.74	0.78	15
184	5.80	6.23	6.63	0.19	18
185	5.90	6.27	6.61	0.20	15
186	6.00	6.39	6.87	0.21	21
187	6.31	6.72	7.27	0.38	6

Table G (continued). Summary statistics by site for pH.

SampleID	MinOffField pH	AvgOffField pH	MaxOffField pH	StDevOffField pH	CountOffField pH
188	6.35	6.43	6.50	0.07	5
189	6.03	6.33	6.56	0.23	7
190	6.00	6.27	6.43	0.13	19
191	5.84	6.15	6.48	0.16	18
192	5.86	6.14	6.73	0.20	20
193	6.21	6.43	6.69	0.13	20
194	6.16	6.41	6.81	0.18	20
195	5.53	5.76	5.98	0.15	11
196	6.20	6.28	6.36	0.07	4
197	6.13	6.22	6.37	0.13	3
198	6.31	6.38	6.51	0.11	3
199	6.42	6.59	6.77	0.13	7
200	5.57	6.09	6.40	0.19	19
201	5.37	5.76	6.26	0.28	15
202	5.54	5.54	5.54		1
203	6.60	6.60	6.60		1
204	6.55	6.55	6.55		1
205	6.52	6.52	6.52		1
207	5.63	6.25	6.50	0.36	5
208	6.06	6.39	6.59	0.20	6
209	6.15	6.30	6.57	0.09	20
210	6.12	6.41	6.66	0.12	22
211	6.20	6.38	6.58	0.10	16
212	5.97	6.28	6.54	0.13	17
213	5.82	6.18	6.49	0.15	21
214	6.13	6.33	6.69	0.13	25
215	6.15	6.42	6.72	0.16	23
216	6.25	6.38	6.49	0.13	4
218	4.24	5.12	5.90	0.35	18
219	4.23	4.90	5.51	0.26	17
220	4.82	5.31	6.40	0.37	17
221	6.06	6.29	6.57	0.15	11
222	6.19	6.40	6.52	0.15	4
223	6.21	6.48	6.73	0.20	7
224	6.11	6.44	6.65	0.21	6
225	5.62	6.02	6.32	0.24	6
226	5.95	6.14	6.43	0.18	6

Table G (continued). Summary statistics by site for pH.

SampleID	MinOffField pH	AvgOffField pH	MaxOffField pH	StDevOffField pH	CountOffField pH
227	5.95	6.13	6.38	0.16	6
228	6.06	6.28	6.46	0.13	6
229	6.13	6.33	6.56	0.15	6
230	6.16	6.31	6.52	0.13	6
231	6.15	6.35	6.52	0.13	6
232	5.24	6.20	6.64	0.46	7
233	4.65	6.03	6.60	0.51	19
234	5.26	5.94	6.48	0.27	18
235	5.65	6.15	6.59	0.28	9
236	4.90	5.42	5.97	0.29	16
237	4.66	4.87	6.11	0.28	25
242	4.90	5.00	5.12	0.07	14
243	5.02	5.58	6.14	0.34	14
244	5.48	5.78	6.28	0.20	14
245	6.11	6.31	6.43	0.09	13
246	5.94	6.23	6.46	0.16	15
247	6.01	6.29	6.52	0.13	13
248	6.06	6.31	6.54	0.15	15
249	6.32	6.46	6.66	0.14	5
250	6.15	6.38	6.76	0.20	8
251	5.68	6.03	6.38	0.21	22
252	4.56	5.34	6.71	0.78	21
253	4.82	6.35	6.69	0.37	21
254	6.20	6.43	6.62	0.14	7
255	6.33	6.55	6.71	0.14	5
256	6.37	6.51	6.59	0.09	5
257	6.38	6.53	6.70	0.12	5
258	6.43	6.53	6.64	0.08	5
259	6.24	6.44	6.56	0.14	4
260	6.16	6.39	6.81	0.20	8
261	6.14	6.42	6.79	0.21	7
262	5.93	6.34	6.70	0.23	7
263	4.61	6.10	6.60	0.63	8
264	6.07	6.24	6.50	0.15	6
265	6.38	6.54	6.90	0.15	10
266	6.36	6.57	6.90	0.17	11
267	6.02	6.50	6.92	0.21	19

Table G (continued). Summary statistics by site for pH.

SampleID	MinOfField pH	AvgOfField pH	MaxOfField pH	StDevOfField pH	CountOfField pH
268	6.19	6.50	6.75	0.15	20
269	6.40	6.51	6.71	0.12	8
270	6.24	6.45	6.86	0.15	19
271	6.23	6.53	6.78	0.14	13
272	6.05	6.45	6.63	0.21	6
273	5.92	6.26	6.44	0.20	5
274	6.02	6.29	6.52	0.26	4
275	5.54	6.19	6.72	0.51	4
276	6.13	6.33	6.65	0.14	15
277	5.59	6.14	6.42	0.20	16
278	5.63	6.37	6.65	0.28	12
279	6.22	6.48	6.65	0.11	11
280	5.89	6.30	6.65	0.21	12
281	5.82	6.28	6.58	0.24	12
282	5.59	6.34	6.73	0.32	13
283	6.12	6.48	6.72	0.17	15
284	6.07	6.23	6.51	0.24	3
285	6.45	6.65	6.78	0.13	5
286	6.32	6.58	6.86	0.21	5
287	6.44	6.59	6.66	0.08	6
288	6.26	6.50	6.72	0.16	11
289	6.10	6.36	6.63	0.13	15
290	4.42	5.12	6.21	0.43	18
291	5.60	6.04	6.47	0.22	17
292	5.97	6.41	6.64	0.19	13
293	6.20	6.54	6.74	0.14	20
294	6.42	6.54	6.77	0.12	6
295	6.33	6.53	6.60	0.10	6
296	6.58	6.66	6.80	0.10	4
297	6.53	6.57	6.63	0.04	4
298	6.67	6.99	7.35	0.26	7
299	6.15	6.50	6.59	0.11	14
300	6.24	6.39	6.61	0.16	6
301	6.28	6.48	6.61	0.14	5
302	6.33	6.46	6.62	0.15	3
303	6.41	6.41	6.41		1
304	5.94	6.40	6.85	0.23	12

Table G (continued). Summary statistics by site for pH.

SampleID	MinOffField pH	AvgOffField pH	MaxOffField pH	StDevOffField pH	CountOffField pH
305	6.15	6.46	6.60	0.12	14
306	6.34	6.51	6.64	0.10	12
307	6.07	6.44	6.65	0.15	17
308	6.40	6.47	6.53	0.06	4
309	6.26	6.41	6.55	0.14	3
310	6.29	6.57	6.84	0.16	12
311	6.23	6.55	6.82	0.14	11
312	6.23	6.56	6.79	0.20	6
313	6.45	6.45	6.45		1
314	6.32	6.32	6.32		1
315	6.19	6.44	6.61	0.16	6
316	6.59	6.69	6.78	0.10	3
317	6.27	6.54	6.74	0.22	4
318	6.21	6.53	6.75	0.29	3
319	6.29	6.49	6.71	0.12	13
320	6.12	6.40	6.63	0.15	11
321	6.36	6.57	6.76	0.13	11
322	5.97	6.45	6.68	0.18	14
323	6.43	6.55	6.69	0.10	5
324	6.46	6.54	6.63	0.08	4
325	6.34	6.57	6.78	0.16	5
326	6.10	6.55	6.78	0.23	8
327	6.13	6.53	6.94	0.18	19
328	6.04	6.27	6.60	0.16	11
329	6.04	6.32	6.56	0.18	11
330	5.92	6.40	6.66	0.22	15
331	6.48	6.63	6.77	0.12	4
332	5.69	6.38	6.67	0.27	10
333	5.56	5.65	5.79	0.12	3
334	5.85	6.01	6.19	0.11	8
335	6.20	7.07	7.77	0.47	14
336	6.24	6.43	6.63	0.12	14
337	5.96	6.27	6.40	0.13	12
338	5.65	6.17	6.69	0.73	2
339	6.37	6.37	6.37		1
340	6.41	6.54	6.66	0.10	4
341	6.63	6.76	6.89	0.09	12

Table G (continued). Summary statistics by site for pH.

SampleID	MinOfField pH	AvgOfField pH	MaxOfField pH	StDevOfField pH	CountOfField pH
342	6.17	6.58	6.74	0.16	12
343	6.37	6.48	6.58	0.14	2
344	6.37	6.48	6.60	0.16	2
345	6.04	6.04	6.04		1
346	6.31	6.31	6.31		1
347	6.83	6.83	6.83		1
348	6.26	6.26	6.26		1
349	6.65	6.65	6.65		1
350	5.97	6.35	6.58	0.24	5
351	5.97	5.97	5.97		1
352	6.24	6.70	7.05	0.34	4
353	6.64	6.69	6.72	0.04	3
354	5.70	5.96	6.65	0.46	4
355	6.39	6.62	6.84	0.19	4
356	5.38	5.38	5.38		1
357	6.25	6.66	7.10	0.35	6
358	6.47	6.47	6.47		1
359	6.33	6.33	6.33		1
360	4.47	4.62	4.84	0.16	5
361	4.65	4.85	5.04	0.28	2
362	6.18	6.39	6.47	0.14	4
363	6.17	6.38	6.58	0.16	5
364	6.46	6.59	6.82	0.16	4
365	6.20	6.20	6.20		1
366	5.61	6.30	6.85	0.63	3
367	6.73	6.73	6.73		1
368	6.29	6.29	6.29		1
369	5.13	5.63	6.13	0.70	2
377	6.41	6.41	6.41		1
392	6.39	6.39	6.39		1
393	6.34	6.40	6.45	0.08	2
399	6.48	6.48	6.48		1
400	6.26	6.26	6.26		1
401	6.53	6.53	6.53		1
402	6.68	6.68	6.68		1
472	6.14	6.25	6.40	0.11	5
473	5.46	6.08	6.60	0.44	7

Table G (continued). Summary statistics by site for pH.

SampleID	MinOffField pH	AvgOffField pH	MaxOffField pH	StDevOffField pH	CountOffField pH
474	6.28	6.41	6.69	0.14	7
475	6.25	6.36	6.46	0.08	6
479	6.31	6.61	6.85	0.20	7
480	6.52	6.64	6.83	0.11	7
481	6.46	6.64	6.88	0.17	7
482	6.48	6.58	6.78	0.12	5
483	6.46	6.63	6.83	0.14	7
484	6.41	6.58	6.78	0.13	6
485	6.50	6.66	6.80	0.12	8
486	6.52	6.52	6.52		1
487	6.58	6.61	6.66	0.05	3
488	5.88	6.40	6.69	0.26	7
489	6.79	7.24	7.65	0.38	5
490	6.42	6.42	6.42		1
492	5.77	6.09	6.34	0.20	6
493	6.42	6.55	6.67	0.11	4
494	6.46	6.46	6.46		1
999	4.15	4.15	4.15		1

Table H. Summary statistics by site for sulfate. Values are expressed in $\mu\text{eq/L}$.

Sample Number	Minimum Sulfate	Average Sulfate	Maximum Sulfate	Standard Deviation	N
1	17.88	45.62	74.03	12.06	19
2	27.24	31.19	39.21	5.36	5
3	25.23	36.63	48.39	6.45	19
4	16.86	40.07	51.71	11.58	18
5	29.00	40.90	53.64	6.55	14
6	37.84	42.61	50.80	3.86	12
7	34.10	39.01	48.34	5.53	5
8	54.16	62.13	72.57	8.30	4
9	43.54	65.94	80.08	19.62	3
10	71.51	91.24	103.15	17.21	3
11	106.63	128.87	146.73	20.41	3
12	24.96	27.86	32.53	4.08	3
13	26.49	38.74	72.18	10.47	20
14	27.98	37.41	56.91	7.85	17
15	35.14	46.53	56.88	10.91	3
16	34.58	36.97	40.57	2.37	5
17	27.12	34.39	39.01	2.91	11
18	23.94	27.50	31.19	3.04	4
19	33.32	36.04	40.38	3.26	4
20	23.13	35.51	63.22	9.45	24
21	25.23	35.24	42.76	6.06	10
22	12.00	49.59	106.31	28.49	10
23	20.68	34.54	82.35	11.94	22
24	27.41	43.20	67.68	7.76	23
25	31.36	58.91	78.15	14.93	10
26	33.78	42.81	47.95	6.71	6
27	19.12	22.35	28.10	3.40	5
28	43.01	52.26	58.79	7.52	5
29	49.43	63.04	95.69	12.26	18
30	40.01	62.28	77.43	8.59	20
31	46.61	62.00	70.55	8.74	6
32	35.48	44.05	53.04	5.85	6
33	57.10	57.10	57.10		1
34	21.56	32.68	41.92	5.87	13
35	30.52	35.47	48.97	5.11	13
36	17.06	32.58	69.94	17.58	8
37	29.39	46.34	64.22	13.48	5
38	21.90	25.88	30.69	3.27	7
39	13.51	19.52	34.88	7.95	6
40	16.13	35.27	50.63	7.82	16
41	26.09	31.33	36.25	5.08	3
42	24.67	36.79	65.51	8.90	14
43	18.59	62.64	80.86	14.31	22
44	15.77	68.26	204.21	58.61	9
45	56.62	88.19	142.14	17.88	24
46	45.93	73.80	93.07	14.09	20

Table H (continued). Summary statistics by site for sulfate. Values are expressed in μ eq/L.

Sample Number	Minimum Sulfate	Average Sulfate	Maximum Sulfate	Standard Deviation	N
47	30.07	48.91	176.08	32.51	18
48	35.07	62.60	138.25	27.43	11
49	37.45	52.85	73.00	9.60	19
50	35.56	47.68	64.86	9.96	9
51	36.22	46.28	58.33	7.56	6
52	34.19	49.45	81.03	10.34	21
53	73.97	79.49	85.35	4.57	7
54	0.00	64.84	87.87	29.25	7
55	46.17	63.51	90.30	15.82	8
56	56.84	63.65	78.76	7.08	7
57	0.00	27.99	52.36	20.28	7
58	27.12	37.42	47.14	6.73	8
59	16.32	52.89	65.01	20.82	5
60	71.03	77.08	90.44	8.09	5
61	50.65	79.80	93.41	17.01	5
62	63.53	84.34	98.89	13.97	5
63	69.88	77.62	89.40	7.85	5
64	30.04	59.41	71.37	17.13	5
65	59.20	63.13	67.06	5.55	2
66	47.88	68.51	89.89	8.47	25
67	65.31	116.47	146.43	30.51	5
68	58.77	65.42	69.98	4.42	7
69	30.93	60.11	86.36	13.48	16
70	37.75	48.52	74.97	12.63	8
71	37.98	50.35	159.51	24.77	22
72	34.68	50.23	134.47	20.66	21
73	54.55	78.16	140.50	17.23	23
74	43.27	86.34	123.92	16.12	22
75	47.05	73.43	91.52	10.45	20
76	41.06	70.55	90.74	10.61	18
77	39.23	53.26	60.25	6.66	11
78	112.46	116.54	120.61	5.77	2
79	59.86	80.62	100.07	12.00	15
80	36.95	67.89	84.48	11.34	12
81	50.71	62.87	71.81	6.52	7
82	15.81	39.91	70.64	15.22	11
83	38.92	56.15	124.88	30.56	7
84	35.74	45.28	61.13	6.98	14
86	37.37	45.49	53.02	3.98	13
87	32.19	47.91	62.34	8.21	14
88	33.46	41.10	48.08	5.19	13
89	33.49	39.71	45.33	4.89	6
90	36.81	44.39	55.49	6.95	6
91	27.28	37.67	44.32	5.77	10
92	50.07	56.78	70.61	5.98	15

Table H (continued). Summary statistics by site for sulfate. Values are expressed in μ eq/L.

Sample Number	Minimum Sulfate	Average Sulfate	Maximum Sulfate	Standard Deviation	N
93	41.04	45.44	53.62	3.81	14
94	38.71	41.49	44.01	2.66	3
95	41.26	44.30	47.34	4.30	2
96	44.55	51.06	54.24	4.40	4
97	36.03	45.58	50.56	8.27	3
99	19.01	24.09	29.62	4.41	4
100	21.74	23.17	24.61	2.03	2
101	13.29	17.11	20.94	5.42	2
102	23.92	24.39	24.85	0.65	2
103	64.00	69.43	79.85	4.02	22
104	40.26	60.77	94.58	11.84	22
105	30.66	65.81	94.77	17.61	18
106	49.73	58.90	79.62	7.21	18
107	46.22	52.80	58.04	3.26	22
108	52.17	65.71	79.25	19.14	2
109	74.58	78.65	82.72	5.75	2
110	8.84	19.38	31.05	4.63	14
111	10.41	18.62	40.35	8.34	12
112	48.29	72.14	85.42	10.94	9
113	44.53	64.86	87.46	14.49	11
114	31.62	45.10	55.82	6.09	11
115	35.27	48.29	84.85	17.66	7
116	12.80	14.80	16.79	2.82	2
117	23.69	26.18	28.67	3.52	2
118	27.91	37.05	44.62	8.46	3
119	18.01	18.40	18.80	0.56	2
120	30.40	38.62	44.63	7.37	3
121	38.36	42.96	45.82	2.93	5
122	42.52	45.32	49.27	3.52	3
123	27.91	29.94	31.79	1.58	5
124	18.59	20.43	21.40	1.09	5
125	8.00	9.74	11.92	1.33	13
126	4.36	9.46	38.82	10.18	11
127	10.78	20.12	28.86	4.08	18
128	12.72	16.82	22.56	3.17	8
129	12.10	16.69	22.99	3.44	10
130	12.37	20.27	30.85	5.47	10
131	25.76	34.92	50.23	6.41	10
132	24.99	29.09	34.96	3.11	11
133	29.18	39.19	54.56	6.73	11
134	33.65	45.06	54.69	6.02	14
135	43.74	51.78	69.07	8.04	10
136	12.72	17.79	21.53	4.56	3
137	44.54	55.04	83.00	10.17	19
138	34.42	40.56	63.59	7.35	19

Table H (continued). Summary statistics by site for sulfate. Values are expressed in μ eq/L.

Sample Number	Minimum Sulfate	Average Sulfate	Maximum Sulfate	Standard Deviation	N
139	17.53	20.02	26.28	4.19	4
140	8.54	16.82	21.08	3.10	15
141	8.38	13.43	20.56	2.99	16
142	12.03	17.47	34.73	5.53	17
143	12.47	20.67	35.14	6.04	18
144	13.39	18.31	29.81	4.82	16
145	17.92	25.23	46.55	10.69	6
146	15.14	18.93	29.61	3.56	16
147	5.46	20.60	32.75	5.71	18
148	12.66	21.23	43.37	8.07	11
149	17.60	22.72	31.41	4.46	11
150	16.38	20.78	33.48	4.82	11
151	27.04	57.28	80.45	11.54	17
152	33.82	39.65	57.24	5.75	17
153	36.72	42.95	57.66	5.99	13
154	39.08	39.08	39.08		1
155	22.50	22.50	22.50		1
156	19.36	42.41	60.31	7.88	20
157	14.16	16.69	21.30	3.19	4
158	18.97	22.10	26.35	3.32	5
159	22.20	26.21	31.95	4.08	5
160	43.46	47.51	53.48	3.78	5
161	27.97	30.13	32.49	1.80	5
162	26.86	35.96	43.84	6.15	5
163	75.52	240.32	351.21	145.54	3
164	55.36	65.72	83.02	15.08	3
165	33.07	48.82	57.89	13.69	3
166	37.19	77.61	99.77	35.06	3
167	33.35	39.17	47.07	7.09	3
168	61.60	66.17	75.59	6.39	4
169	61.23	68.69	81.15	10.86	3
170	61.13	65.81	74.09	6.02	4
171	41.23	101.21	162.56	60.68	3
172	27.21	29.74	32.26	3.57	2
173	16.82	30.71	77.92	14.01	19
174	3.91	49.90	64.59	12.35	20
175	25.44	61.17	82.86	16.35	17
176	34.54	51.40	76.38	13.45	16
177	19.15	21.85	27.58	2.61	9
178	8.67	12.06	14.02	2.34	4
179	19.08	20.13	21.20	1.06	3
180	13.12	13.68	14.23	0.79	2
181	16.66	17.71	18.60	0.98	3
182	4.68	7.14	9.60	3.48	2
183	5.39	20.15	58.11	18.35	15

Table H (continued). Summary statistics by site for sulfate. Values are expressed in μ eq/L.

Sample Number	Minimum Sulfate	Average Sulfate	Maximum Sulfate	Standard Deviation	N
184	20.46	29.72	45.86	6.82	18
185	24.02	29.87	46.53	5.34	15
186	21.71	31.42	53.17	7.50	21
187	7.23	42.36	80.07	23.74	6
188	10.88	16.35	21.44	4.01	5
189	16.16	27.20	31.95	5.37	7
190	25.11	33.05	49.58	5.92	18
191	19.53	31.55	107.14	20.26	17
192	31.44	43.50	61.46	7.15	20
193	15.83	25.56	39.30	6.08	19
194	22.82	30.75	44.52	5.63	19
195	6.21	8.00	9.33	0.86	11
196	10.52	16.75	23.52	7.20	4
197	21.10	22.71	24.36	1.63	3
198	21.01	21.42	21.82	0.57	2
199	18.60	22.38	24.95	2.03	7
200	13.13	27.86	39.66	6.40	18
201	7.76	15.27	27.71	4.35	15
202	28.89	28.89	28.89		1
203	41.04	41.04	41.04		1
204	41.42	41.42	41.42		1
205	42.73	42.73	42.73		1
207	8.32	13.59	19.96	5.29	5
208	10.08	13.96	20.41	3.73	6
209	14.89	27.09	70.40	11.20	19
210	19.39	41.39	66.30	8.80	21
211	21.78	31.86	66.82	10.63	16
212	19.68	28.88	50.63	7.35	16
213	25.53	30.07	43.57	4.02	21
214	12.71	25.07	60.64	9.00	24
215	21.93	36.21	80.81	11.37	23
216	18.05	26.28	37.61	8.19	4
218	25.11	57.38	71.97	10.57	18
219	28.97	54.60	65.99	10.32	17
220	21.37	33.13	63.09	13.82	17
221	13.16	16.95	22.62	3.01	11
222	10.81	15.15	17.29	2.94	4
223	11.05	14.84	19.95	2.78	7
224	14.59	16.37	20.87	2.32	6
225	35.16	44.50	58.21	8.68	6
226	28.25	35.20	42.85	4.85	6
227	23.27	37.91	50.05	10.73	6
228	25.04	34.29	49.79	8.26	6
229	14.86	23.63	27.74	4.90	6
230	20.32	29.00	43.39	7.70	6

Table H (continued). Summary statistics by site for sulfate. Values are expressed in μ eq/L.

Sample Number	Minimum Sulfate	Average Sulfate	Maximum Sulfate	Standard Deviation	N
231	16.63	24.28	39.44	7.79	6
232	66.94	113.40	144.20	25.64	7
233	18.19	98.04	122.13	22.81	19
234	16.72	27.14	51.33	7.23	18
235	22.89	43.35	73.11	15.60	9
236	63.96	76.35	91.58	7.74	16
237	25.30	68.44	86.63	11.76	25
242	26.27	44.73	60.76	7.57	14
243	22.51	51.88	71.63	15.09	14
244	23.62	40.57	50.69	7.36	14
245	5.48	7.21	10.74	1.83	13
246	6.94	22.97	39.12	7.80	15
247	9.94	20.22	31.91	6.44	13
248	14.44	20.54	31.08	5.62	15
249	8.17	11.52	19.89	4.89	5
250	26.07	46.61	68.09	13.95	8
251	26.18	156.51	262.37	68.34	22
252	73.29	301.80	511.48	132.82	20
253	22.63	56.44	360.99	70.27	21
254	9.53	31.13	88.83	34.38	7
255	9.07	13.37	23.27	5.66	5
256	16.39	19.68	23.75	2.77	5
257	16.56	19.60	22.32	2.23	5
258	13.55	17.32	19.64	2.36	5
259	15.99	18.62	20.37	2.01	4
260	21.56	25.85	34.22	4.32	8
261	21.16	24.52	30.04	3.51	7
262	16.78	24.57	30.04	4.34	7
263	28.93	40.42	84.97	18.63	8
264	21.33	28.37	50.95	11.51	6
265	7.99	9.89	12.64	1.37	10
266	17.24	23.88	32.82	4.64	11
267	15.26	24.71	57.28	9.06	19
268	12.34	30.93	77.74	15.69	20
269	23.98	29.33	35.64	4.17	8
270	17.39	31.43	70.71	11.73	19
271	12.20	19.03	68.91	15.03	13
272	10.36	19.66	57.69	18.71	6
273	9.16	21.16	57.26	20.40	5
274	6.29	8.34	9.36	1.41	4
275	6.60	10.06	12.66	2.58	4
276	13.49	15.79	22.76	2.33	15
277	14.14	23.08	33.84	4.24	16
278	5.98	8.80	19.95	3.86	12
279	6.81	11.44	41.71	10.16	11

Table H (continued). Summary statistics by site for sulfate. Values are expressed in μ eq/L.

Sample Number	Minimum Sulfate	Average Sulfate	Maximum Sulfate	Standard Deviation	N
280	10.96	43.18	69.38	15.46	12
281	29.15	39.03	54.47	8.40	12
282	10.36	26.57	51.18	15.18	13
283	23.26	34.14	61.20	11.62	15
284	32.05	42.22	49.82	9.16	3
285	12.49	17.71	23.74	5.01	5
286	12.31	22.42	29.24	6.20	5
287	12.45	22.22	28.19	5.30	6
288	8.46	13.11	15.87	2.11	11
289	22.20	26.04	33.14	3.06	15
290	13.48	24.30	62.24	13.56	18
291	13.43	26.98	53.34	10.44	17
292	7.28	22.65	33.34	6.04	13
293	15.37	23.24	37.61	4.57	20
294	16.80	19.25	22.04	2.12	6
295	16.82	20.18	27.40	3.86	6
296	22.22	23.47	25.25	1.28	4
297	18.48	20.98	23.45	2.85	4
298	27.92	35.00	37.76	3.37	7
299	10.68	15.46	19.09	2.30	13
300	11.19	13.51	15.23	1.46	6
301	15.31	16.85	21.50	2.63	5
302	15.95	16.75	17.54	1.12	2
303					0
304	10.94	25.82	39.73	9.80	12
305	5.05	13.32	19.75	3.98	14
306	11.25	17.13	30.12	6.05	12
307	9.99	16.94	21.65	2.66	17
308	14.59	19.87	22.56	3.58	4
309	16.93	22.14	28.89	6.13	3
310	16.83	21.52	28.66	4.21	11
311	14.40	18.08	27.26	3.69	11
312	13.62	18.78	24.30	3.86	6
313	16.51	16.51	16.51		1
314	18.94	18.94	18.94		1
315	13.34	19.67	29.58	5.35	6
316	11.47	12.58	13.89	1.23	3
317	8.34	13.98	17.03	4.05	4
318	14.33	15.37	16.79	1.28	3
319	8.85	19.68	57.21	11.65	13
320	11.87	18.26	32.24	6.49	11
321	13.10	15.99	18.71	1.76	11
322	13.70	19.34	42.61	7.36	14
323	16.30	18.62	21.27	1.77	5
324	11.42	13.66	16.23	2.07	4

Table H (continued). Summary statistics by site for sulfate. Values are expressed in μ eq/L.

Sample Number	Minimum Sulfate	Average Sulfate	Maximum Sulfate	Standard Deviation	N
325	11.33	16.73	19.63	3.18	5
326	16.39	25.70	61.06	14.67	8
327	13.46	24.28	46.60	6.75	18
328	8.48	13.30	27.32	5.30	11
329	6.55	18.50	31.72	5.72	11
330	8.58	37.03	70.66	13.01	15
331	23.93	64.01	165.17	67.64	4
332	14.11	25.80	121.69	33.72	10
333	64.42	69.70	76.43	6.13	3
334	25.15	32.09	40.16	4.97	7
335	13.01	41.53	56.30	10.09	13
336	7.39	11.61	24.79	4.99	14
337	10.10	17.33	38.70	7.72	13
338	33.74	34.38	35.02	0.91	2
339	25.44	25.44	25.44		1
340	23.53	30.89	38.67	6.19	4
341	78.48	106.00	125.49	16.45	11
342	62.81	72.68	88.90	8.20	11
343	7.96	10.58	13.21	3.71	2
344	11.79	12.15	12.51	0.50	2
345	47.36	47.36	47.36		1
346	17.67	17.67	17.67		1
347	17.88	17.88	17.88		1
348	28.80	28.80	28.80		1
349	11.51	11.51	11.51		1
350	6.78	11.56	16.89	3.73	5
351	211.90	211.90	211.90		1
352	40.02	114.82	220.02	87.29	4
353	30.11	33.46	38.81	4.68	3
354	10.54	19.02	38.79	13.25	4
355	22.61	25.33	30.64	3.71	4
356	15.55	15.55	15.55		1
357	7.74	12.61	23.30	4.96	7
358	9.06	9.06	9.06		1
359	10.93	10.93	10.93		1
360	68.82	72.81	76.68	3.11	5
361	72.09	73.23	74.37	1.61	2
362	14.51	16.13	17.34	1.33	4
363	20.82	22.67	25.30	1.65	5
364	39.73	42.98	45.38	2.36	4
365	37.45	37.45	37.45		1
366	53.43	69.51	88.24	17.56	3
367	15.00	15.00	15.00		1
368	48.36	48.36	48.36		1
369	41.16	55.44	69.72	20.20	2

Table H (continued). Summary statistics by site for sulfate. Values are expressed in μ eq/L.

Sample Number	Minimum Sulfate	Average Sulfate	Maximum Sulfate	Standard Deviation	N
377	39.93	46.44	52.95	9.21	2
392	18.42	18.42	18.42		1
393	13.95	14.03	14.10	0.11	2
399	9.94	9.94	9.94		1
400	9.82	9.82	9.82		1
401	10.28	10.28	10.28		1
402	12.43	12.43	12.43		1
472	28.12	32.35	36.64	3.26	5
473	70.67	79.89	97.20	9.61	7
474	29.23	34.87	45.36	5.20	7
475	24.64	29.70	39.48	5.55	6
479	7.51	16.18	20.16	4.21	7
480	17.21	20.74	28.99	3.99	7
481	28.74	44.43	62.23	12.32	7
482	18.36	20.31	21.76	1.60	5
483	19.62	25.34	31.40	4.26	7
484	13.94	17.38	21.82	2.77	6
485	12.48	16.37	23.95	4.11	8
486	17.54	17.54	17.54		1
487	43.00	44.50	45.76	1.39	3
488	12.32	20.81	26.08	4.46	7
489	38.36	44.69	51.30	5.93	5
490	33.91	33.91	33.91		1
492	34.68	39.38	46.83	4.66	6
493	14.71	16.95	19.18	2.05	4
494	21.51	21.51	21.51		1
999	89.12	89.12	89.12		1

Table I. Summary statistics by site for sodium. Values are expressed in $\mu\text{eq/L}$.

Sample Number	Minimum Sodium	Average Sodium	Maximum Sodium	Standard Deviation	N
1	23.89	35.76	53.63	7.47	19
2	26.54	34.73	46.37	7.83	5
3	31.96	50.59	65.24	8.94	19
4	15.82	35.95	64.47	13.45	18
5	27.56	41.76	50.61	5.79	14
6	27.05	35.52	43.56	4.15	12
7	36.69	53.74	67.02	12.52	5
8	51.75	60.53	68.35	8.34	4
9	41.73	56.95	77.80	18.68	3
10	45.75	73.22	92.81	24.50	3
11	66.17	71.19	76.69	5.27	3
12	28.52	39.03	47.66	9.71	3
13	30.12	41.78	68.95	10.05	20
14	28.33	40.74	52.54	8.34	17
15	38.05	45.93	50.92	6.91	3
16	32.23	37.93	48.00	6.03	5
17	29.68	39.28	52.61	7.75	11
18	47.83	51.75	56.83	3.78	4
19	31.05	38.42	50.61	8.46	4
20	24.81	37.72	50.61	7.77	24
21	45.29	69.46	98.31	20.90	10
22	52.59	69.96	91.30	10.44	10
23	20.32	35.47	53.95	9.06	22
24	33.21	51.43	72.45	9.35	23
25	37.87	61.47	78.26	11.69	11
26	44.76	52.53	59.27	5.21	6
27	56.31	67.68	83.16	10.52	5
28	27.63	33.52	38.51	4.87	5
29	30.99	54.85	185.40	34.68	18
30	12.21	33.02	45.53	8.50	21
31	21.87	39.66	92.19	26.46	6
32	38.34	43.68	48.69	3.65	6
33	27.86	27.86	27.86		1
34	10.40	34.19	45.98	9.68	13
35	25.21	34.54	52.87	7.41	14
36	24.70	37.54	42.67	5.52	8
37	61.10	87.01	123.35	26.50	5
38	25.69	36.73	55.15	10.50	7
39	25.10	33.53	40.17	5.36	6
40	19.65	30.78	41.22	5.92	16
41	29.79	36.87	47.87	9.65	3
42	18.09	29.62	38.84	5.55	14
43	12.65	25.59	33.09	5.75	22
44	8.59	19.91	25.76	6.57	9
45	9.13	22.53	44.10	6.93	24
46	17.92	25.71	35.70	4.82	21

Table I (continued). Summary statistics by site for sodium. Values are expressed in μ eq/L.

Sample Number	Minimum Sodium	Average Sodium	Maximum Sodium	Standard Deviation	N
47	10.98	24.17	34.18	5.77	18
48	21.07	32.29	41.63	6.90	12
49	15.82	31.46	42.54	7.17	19
50	20.95	34.87	50.38	8.74	9
51	32.08	38.40	41.78	3.77	6
52	18.22	35.74	48.37	7.70	21
53	16.12	26.70	57.44	13.95	7
54	8.94	24.89	35.19	9.07	7
55	24.10	28.76	32.40	3.17	8
56	19.08	28.90	32.83	4.85	7
57	26.74	37.40	45.57	6.61	7
58	31.08	48.74	80.23	15.71	8
59	23.55	26.88	28.30	1.98	5
60	17.94	36.09	87.32	28.86	5
61	15.86	26.02	33.05	7.13	5
62	15.22	21.92	30.82	5.61	5
63	16.70	29.93	49.50	13.31	5
64	22.01	33.46	50.64	10.97	5
65	28.13	31.51	34.88	4.77	2
66	15.50	24.47	40.96	5.81	25
67	8.12	19.64	27.45	7.19	5
68	15.35	24.81	33.07	5.92	7
69	9.29	21.53	28.52	5.13	16
70	16.68	27.42	32.94	6.13	8
71	21.50	27.71	33.60	4.12	22
72	16.22	26.37	40.35	5.61	21
73	16.95	23.21	34.03	4.31	23
74	12.59	23.27	35.00	5.79	22
75	10.84	15.91	26.05	3.51	20
76	11.81	15.13	17.55	1.85	18
77	9.16	16.65	25.30	4.08	11
78	18.27	20.06	21.85	2.53	2
79	5.07	16.40	29.31	5.59	15
80	9.85	21.68	45.98	8.94	12
81	12.88	24.00	33.35	8.87	7
82	17.95	26.54	51.51	9.26	11
83	19.57	32.24	41.59	7.92	7
84	19.53	33.33	50.06	7.70	14
86	11.80	31.79	55.02	9.95	13
87	17.86	33.42	75.90	13.13	14
88	23.88	32.32	40.36	4.92	13
89	20.63	28.08	37.15	5.55	6
90	23.99	31.12	40.47	6.02	6
91	19.77	32.13	43.34	7.32	10
92	20.94	30.98	40.59	5.66	15

Table I (continued). Summary statistics by site for sodium. Values are expressed in μ eq/L.

Sample Number	Minimum Sodium	Average Sodium	Maximum Sodium	Standard Deviation	N
93	21.66	32.53	57.18	9.77	14
94	21.45	24.81	29.24	4.00	3
95	8.64	17.84	27.04	13.01	2
96	17.90	28.67	47.42	13.14	4
97	34.74	39.10	43.47	6.17	2
99	22.12	24.52	27.59	2.64	4
100	46.15	47.67	49.20	2.15	2
101	37.33	37.33	37.33		1
102	36.11	36.11	36.11		1
103	21.27	29.81	40.78	4.60	22
104	19.11	36.01	131.11	25.57	22
105	16.56	24.96	34.21	4.84	18
106	14.62	27.54	35.19	5.28	18
107	15.73	26.63	32.40	4.29	22
108	25.38	27.76	30.14	3.36	2
109	17.86	23.77	29.68	8.36	2
110	18.03	33.83	53.51	8.91	14
111	28.15	40.83	74.73	13.56	12
112	22.90	32.73	43.70	7.21	9
113	16.71	25.58	32.87	5.09	11
114	19.95	35.15	40.91	5.52	11
115	21.26	30.40	40.77	7.01	7
116	24.54	31.26	37.97	9.50	2
117	45.05	49.24	53.42	5.92	2
118	17.49	30.64	37.36	11.39	3
119	24.76	39.43	54.10	20.74	2
120	14.76	24.16	34.92	10.15	3
121	17.73	31.71	37.78	7.99	5
122	19.93	26.89	35.50	7.91	3
123	14.11	26.61	31.45	7.08	5
124	17.60	33.27	39.32	8.92	5
125	16.47	46.52	62.17	12.95	13
126	30.19	41.67	61.21	9.12	11
127	17.55	36.27	48.81	8.56	18
128	34.01	44.94	58.91	8.79	8
129	30.87	42.19	53.58	8.81	10
130	8.26	39.72	51.61	12.52	10
131	18.81	38.16	50.69	9.24	10
132	25.23	32.16	41.56	6.11	11
133	14.94	33.32	53.00	9.91	11
134	15.59	34.54	51.17	8.81	14
135	26.94	36.56	49.64	7.99	10
136	24.34	27.64	29.60	2.87	3
137	23.51	31.88	47.80	5.87	19
138	10.18	27.61	43.94	7.33	19

Table I (continued). Summary statistics by site for sodium. Values are expressed in μ eq/L.

Sample Number	Minimum Sodium	Average Sodium	Maximum Sodium	Standard Deviation	N
139	17.80	27.09	39.46	9.02	4
140	20.71	31.80	54.01	8.32	15
141	23.21	36.27	53.37	8.39	16
142	21.21	35.87	46.92	6.77	17
143	20.79	36.93	47.26	7.53	18
144	20.67	38.06	49.72	7.85	16
145	17.88	39.86	51.53	11.92	6
146	11.67	37.18	53.09	9.35	16
147	22.66	46.44	67.42	13.15	18
148	21.49	63.64	81.73	17.44	11
149	17.93	47.18	63.16	12.27	11
150	17.85	45.81	62.19	11.85	11
151	30.24	53.78	82.12	15.63	17
152	29.56	50.73	69.25	10.18	17
153	32.11	50.89	71.49	9.33	13
154	36.76	36.76	36.76		1
155	21.95	21.95	21.95		1
156	12.03	51.06	86.33	15.92	20
157	24.79	41.77	55.60	13.73	4
158	22.77	37.34	54.23	11.61	5
159	28.75	59.34	83.50	19.96	5
160	32.28	60.27	76.98	18.80	5
161	33.40	65.89	126.12	35.72	5
162	33.18	60.40	75.96	17.79	5
163	47.65	77.60	101.39	27.39	3
164	32.67	50.92	60.78	15.83	3
165	53.16	59.52	68.48	7.98	3
166	65.79	78.04	86.26	10.81	3
167	53.06	55.77	57.83	2.45	3
168	28.58	51.01	70.75	17.38	4
169	55.31	73.01	88.24	16.61	3
170	30.33	47.20	55.67	11.42	4
171	47.47	58.89	68.68	10.70	3
172	55.75	65.80	75.85	14.21	2
173	25.21	43.90	67.70	11.90	20
174	32.90	54.33	74.93	9.59	20
175	31.59	55.08	83.41	15.19	17
176	38.56	53.65	81.09	10.82	16
177	22.31	37.89	51.20	8.42	9
178	19.51	29.90	43.52	10.08	4
179	18.35	25.21	33.00	7.37	3
180	20.46	23.42	26.39	4.20	2
181	20.41	27.23	35.85	7.87	3
182	25.45	25.73	26.02	0.41	2
183	18.37	32.25	62.99	10.61	15

Table I (continued). Summary statistics by site for sodium. Values are expressed in μ eq/L.

Sample Number	Minimum Sodium	Average Sodium	Maximum Sodium	Standard Deviation	N
184	18.38	38.15	54.22	10.76	18
185	12.29	37.82	50.84	9.97	15
186	14.96	40.84	85.66	13.91	21
187	15.56	58.12	115.27	39.93	6
188	28.14	33.24	43.63	6.11	5
189	19.96	29.59	41.55	7.86	7
190	21.68	32.27	44.06	6.93	18
191	10.29	29.25	81.81	14.84	17
192	9.82	23.68	32.44	5.69	20
193	17.02	33.27	50.78	9.62	19
194	17.04	32.68	65.27	11.72	19
195	17.22	23.60	27.66	3.60	11
196	21.16	40.18	68.61	20.16	4
197	18.00	21.87	25.93	3.97	3
198	18.00	24.19	29.73	5.89	3
199	27.19	44.41	65.45	13.43	7
200	18.69	31.33	49.84	8.01	19
201	16.13	25.75	31.65	4.33	14
202	19.17	19.17	19.17		1
203	34.97	34.97	34.97		1
204	34.55	34.55	34.55		1
205	37.07	37.07	37.07		1
207	25.91	29.79	33.61	3.74	5
208	23.24	37.63	62.70	13.91	6
209	21.49	31.96	40.45	4.85	19
210	19.02	30.37	37.58	4.62	21
211	18.25	30.21	37.05	5.51	16
212	18.52	29.17	36.51	5.12	16
213	11.87	27.34	34.28	5.53	21
214	12.00	29.91	43.28	8.29	25
215	8.59	33.19	44.43	9.48	23
216	18.48	29.80	50.04	13.87	4
218	11.93	29.69	49.82	10.19	18
219	13.23	23.46	38.67	6.37	17
220	12.42	24.17	29.83	4.71	17
221	19.50	32.46	54.54	8.60	11
222	19.97	28.54	33.20	6.03	4
223	20.88	34.94	49.34	8.87	7
224	28.59	36.19	48.00	6.57	6
225	17.86	27.86	39.90	7.31	6
226	18.95	25.16	33.20	4.80	6
227	14.74	24.78	31.92	6.45	6
228	18.45	29.77	42.83	8.10	6
229	19.42	30.39	37.49	6.81	6
230	19.55	30.76	43.73	9.01	6

Table I (continued). Summary statistics by site for sodium. Values are expressed in μ eq/L.

Sample Number	Minimum Sodium	Average Sodium	Maximum Sodium	Standard Deviation	N
231	18.58	30.99	38.53	7.01	6
232	17.56	36.34	105.26	31.23	7
233	16.89	23.22	32.92	4.42	19
234	19.05	33.01	45.42	7.30	18
235	17.61	28.69	38.87	7.62	9
236	12.03	22.00	35.06	6.43	16
237	9.57	16.62	25.16	3.55	25
242	16.07	27.47	47.16	7.01	14
243	14.17	21.62	28.22	4.50	14
244	11.64	24.63	33.09	5.95	14
245	10.05	30.96	40.35	8.90	13
246	18.60	30.62	42.35	7.15	15
247	21.43	31.99	46.63	6.57	13
248	22.33	32.75	42.45	5.71	15
249	29.63	40.34	48.46	7.97	5
250	22.52	34.76	51.57	10.04	8
251	14.39	39.28	65.35	11.64	22
252	39.97	52.60	84.74	11.30	21
253	33.04	53.83	89.51	11.96	21
254	13.37	40.35	62.59	15.93	7
255	30.55	40.04	48.61	8.30	5
256	24.57	34.27	40.57	6.97	5
257	19.66	30.08	44.30	10.44	5
258	21.21	31.58	38.15	7.45	5
259	22.46	33.06	38.69	7.39	4
260	23.71	32.36	41.94	5.51	8
261	18.10	30.69	38.16	6.81	7
262	19.61	28.56	40.04	6.27	7
263	17.33	28.18	34.49	6.65	8
264	18.58	28.42	44.70	10.59	6
265	24.41	38.53	48.79	7.17	10
266	24.57	41.63	61.22	10.42	11
267	25.00	47.99	90.08	14.23	19
268	18.86	37.93	49.83	8.69	20
269	22.59	34.43	48.69	7.63	8
270	20.10	34.47	42.79	6.02	18
271	18.77	45.40	63.22	12.60	13
272	27.13	48.78	59.85	13.70	5
273	29.02	37.59	50.14	9.04	4
274	17.77	28.56	45.19	12.02	4
275	30.97	37.70	43.88	6.47	3
276	13.39	33.16	42.67	7.08	15
277	13.65	35.13	42.70	6.99	16
278	30.76	40.66	58.85	7.89	11
279	27.56	38.72	46.19	6.05	10

Table I (continued). Summary statistics by site for sodium. Values are expressed in μ eq/L.

Sample Number	Minimum Sodium	Average Sodium	Maximum Sodium	Standard Deviation	N
280	20.33	32.88	45.36	7.70	11
281	27.94	37.52	73.82	13.31	11
282	27.59	44.02	56.30	10.65	12
283	16.41	41.84	66.64	12.75	15
284	41.29	42.33	43.38	1.48	2
285	17.77	63.27	91.24	28.18	5
286	18.28	45.20	66.94	17.44	5
287	23.24	46.32	58.77	12.68	6
288	17.02	48.05	67.92	13.40	11
289	33.98	42.78	50.28	5.63	14
290	14.92	30.40	43.01	7.35	18
291	17.97	32.95	43.72	6.63	17
292	20.78	41.96	65.88	11.70	13
293	13.04	50.35	65.94	12.94	20
294	17.03	41.11	58.07	13.54	6
295	40.73	45.16	52.21	4.97	6
296	19.06	40.83	57.54	16.01	4
297	44.39	46.30	51.64	3.56	4
298	33.63	61.60	77.47	15.48	7
299	25.08	42.06	57.37	9.78	14
300	22.83	35.01	42.74	8.23	6
301	13.06	27.52	39.69	10.91	5
302	23.22	29.01	35.92	6.42	3
303	24.93	24.93	24.93		1
304	24.72	47.54	63.55	11.98	12
305	23.25	39.16	49.08	8.17	14
306	24.00	42.41	53.72	9.54	12
307	26.02	40.93	54.69	8.18	17
308	13.29	34.12	54.69	20.46	4
309	24.55	37.83	46.87	11.75	3
310	25.26	39.98	61.72	9.67	12
311	24.59	39.19	54.49	8.35	11
312	23.74	36.01	47.13	8.86	6
313	32.16	32.16	32.16		1
314	38.60	38.60	38.60		1
315	19.69	35.15	60.56	14.07	6
316	31.23	42.09	58.41	14.39	3
317	30.90	43.20	56.51	11.31	4
318	37.47	47.60	55.91	9.35	3
319	29.25	42.09	56.90	9.02	13
320	24.62	36.79	47.36	6.38	11
321	34.67	50.92	66.96	11.54	11
322	23.34	37.85	49.60	6.56	14
323	27.74	36.64	46.53	7.24	5
324	24.36	38.37	54.07	12.96	4

Table I (continued). Summary statistics by site for sodium. Values are expressed in μ eq/L.

Sample Number	Minimum Sodium	Average Sodium	Maximum Sodium	Standard Deviation	N
325	25.19	38.03	49.62	9.24	5
326	24.41	40.53	55.50	10.12	8
327	22.53	48.27	88.13	15.01	18
328	24.24	40.73	85.37	18.83	11
329	30.55	41.78	68.53	10.19	11
330	7.03	31.42	47.28	11.63	15
331	17.77	44.24	73.82	23.70	4
332	19.10	43.24	51.98	9.56	10
333	17.72	21.90	28.57	5.84	3
334	20.20	26.72	34.19	5.50	7
335	34.37	54.25	111.58	19.72	13
336	31.75	39.94	46.52	4.28	14
337	25.79	35.94	46.36	5.66	13
338	26.17	30.16	34.16	5.65	2
339	55.35	55.35	55.35		1
340	40.80	48.77	54.23	6.47	4
341	32.35	48.76	66.65	11.55	11
342	30.43	41.54	60.31	9.69	11
343	37.68	38.77	39.86	1.54	2
344	38.75	40.55	42.35	2.54	2
345	23.94	23.94	23.94		1
346	34.54	34.54	34.54		1
347	56.71	56.71	56.71		1
348	14.15	14.15	14.15		1
349	54.96	54.96	54.96		1
350	23.42	35.53	41.87	7.05	5
351	117.53	117.53	117.53		1
352	55.54	86.87	118.51	26.40	4
353	32.55	45.30	64.69	17.07	3
354	36.86	49.72	68.60	14.29	4
355	29.42	53.16	80.18	23.28	4
356	28.06	28.06	28.06		1
357	38.61	48.65	55.86	6.70	7
358	48.84	48.84	48.84		1
359	39.31	39.31	39.31		1
360	12.27	15.57	19.21	3.05	5
361	17.91	21.71	25.51	5.37	2
362	27.74	32.07	36.77	3.81	4
363	33.76	42.86	51.84	6.52	5
364	34.09	39.06	41.82	3.42	4
365	39.62	39.62	39.62		1
366	19.80	24.49	27.76	4.16	3
367	66.90	66.90	66.90		1
368	34.07	34.07	34.07		1
369	24.76	28.50	32.25	5.29	2

Table I (continued). Summary statistics by site for sodium. Values are expressed in μ eq/L.

Sample Number	Minimum Sodium	Average Sodium	Maximum Sodium	Standard Deviation	N
377	72.09	77.57	83.06	7.76	2
392	34.74	34.74	34.74		1
393	37.69	38.00	38.32	0.45	2
399	36.11	36.11	36.11		1
400	32.38	32.38	32.38		1
401	29.37	29.37	29.37		1
402	32.14	32.14	32.14		1
472	10.40	26.91	40.01	11.25	5
473	16.85	22.00	27.29	3.68	7
474	13.69	30.27	42.62	9.18	7
475	5.45	28.15	41.72	12.24	6
479	5.72	35.26	45.65	13.41	7
480	32.24	44.13	50.74	6.49	7
481	38.02	43.95	54.30	5.35	7
482	40.98	44.69	49.88	3.49	5
483	40.72	46.58	55.88	4.99	7
484	31.55	36.18	40.68	3.18	6
485	17.46	37.36	48.94	9.03	8
486	33.16	33.16	33.16		1
487	45.16	50.85	56.32	5.58	3
488	24.75	36.81	42.53	5.75	7
489	44.90	52.14	58.82	5.65	5
490	33.89	33.89	33.89		1
492	29.68	36.93	45.39	5.42	6
493	38.62	46.53	53.74	7.45	4
494	46.25	46.25	46.25		1
999	2.52	2.52	2.52		1

Table J. Summary statistics by site for nitrate. Values are expressed in $\mu\text{eq/L}$.

Sample Number	Minimum Nitrate	Average Nitrate	Maximum Nitrate	Standard Deviation	N
1	6.59	24.67	58.83	12.44	19
2	16.05	19.36	22.59	2.69	5
3	0.00	18.56	44.88	9.19	19
4	0.00	22.91	49.24	13.80	18
5	16.69	30.36	46.71	9.24	14
6	0.00	12.81	23.40	7.25	12
7	0.00	7.26	17.48	6.59	5
8	0.00	0.80	1.66	0.93	4
9	0.00	1.31	3.92	2.26	3
10	0.00	0.00	0.00	0.00	3
11	0.00	0.00	0.00	0.00	3
12	0.00	1.57	4.72	2.72	3
13	0.00	7.72	25.51	5.90	20
14	0.00	8.43	31.98	7.50	17
15	0.00	1.19	2.16	1.10	3
16	0.00	7.50	16.99	6.94	5
17	0.00	7.32	16.79	5.19	11
18	0.00	1.64	3.41	1.90	4
19	0.00	7.08	16.57	7.72	4
20	0.00	9.49	29.52	7.13	24
21	0.00	1.73	11.64	3.91	10
22	0.00	5.49	35.02	10.90	10
23	0.00	8.71	25.26	5.46	22
24	0.00	4.66	7.66	2.63	23
25	0.00	2.15	4.93	2.13	10
26	5.20	11.09	21.01	5.51	6
27	1.17	4.86	7.73	2.81	5
28	11.46	19.77	34.21	8.85	5
29	5.94	19.59	47.42	10.15	18
30	8.26	25.94	35.84	7.80	20
31	11.55	23.87	42.02	12.27	6
32	0.00	47.15	86.21	28.17	6
33	22.81	22.81	22.81		1
34	0.00	8.37	17.45	6.52	13
35	0.00	11.92	31.51	7.79	14
36	0.00	10.16	57.38	19.75	8
37	0.00	0.94	2.91	1.34	5
38	0.00	3.42	9.13	3.57	7
39	0.00	4.46	8.07	3.26	6
40	0.00	13.67	39.71	8.86	16
41	0.00	7.75	11.84	6.72	3
42	0.00	11.49	25.75	7.68	14
43	9.02	24.36	34.28	6.88	22
44	17.66	34.87	74.39	17.13	9
45	16.88	32.64	70.27	10.60	24
46	18.11	27.76	39.02	6.08	21

Table J (continued). Summary statistics by site for nitrate. Values are expressed in μ eq/L.

Sample Number	Minimum Nitrate	Average Nitrate	Maximum Nitrate	Standard Deviation	N
47	10.44	25.19	69.43	12.77	18
48	0.00	23.23	74.74	18.41	12
49	0.00	18.24	28.43	6.65	19
50	0.00	17.91	36.96	11.31	9
51	0.00	13.15	29.18	10.03	6
52	0.00	17.47	28.79	7.44	21
53	22.57	35.74	51.50	9.51	7
54	0.00	30.22	59.74	18.32	7
55	21.48	32.70	47.74	9.92	8
56	22.23	31.21	43.88	8.74	7
57	0.00	12.07	26.84	9.77	7
58	4.64	11.25	18.38	5.12	8
59	2.61	23.71	44.27	15.28	5
60	23.37	35.36	52.48	11.58	5
61	23.69	37.52	54.60	14.79	5
62	22.46	41.23	56.28	13.85	5
63	22.21	38.77	61.86	16.14	5
64	1.62	24.85	45.19	15.79	5
65	26.27	27.86	29.46	2.26	2
66	19.03	32.90	47.97	7.06	25
67	25.49	34.46	45.80	9.41	5
68	19.43	31.81	42.66	8.05	7
69	27.49	44.77	61.42	9.87	16
70	23.77	35.11	44.20	7.81	8
71	20.79	33.32	59.07	8.29	22
72	19.16	33.80	60.59	8.73	21
73	20.80	35.14	66.45	9.49	23
74	22.67	33.65	53.29	7.46	22
75	17.44	31.62	40.66	6.22	20
76	16.34	32.28	41.07	6.52	18
77	29.12	42.74	51.44	5.56	11
78	16.37	16.77	17.17	0.57	2
79	18.92	33.55	44.98	7.24	15
80	25.09	36.29	58.02	9.05	12
81	30.26	36.68	42.19	4.21	7
82	6.80	19.14	29.44	7.83	11
83	2.89	27.44	89.06	28.70	7
84	18.12	27.22	36.07	6.14	14
86	18.35	30.32	39.69	7.37	13
87	12.68	30.68	47.44	10.18	14
88	16.23	27.26	35.77	6.57	13
89	16.73	29.87	40.57	8.77	6
90	9.94	31.87	52.67	18.85	6
91	12.61	28.83	49.31	12.04	10
92	12.10	30.20	52.52	16.17	15

Table J (continued). Summary statistics by site for nitrate. Values are expressed in μ eq/L.

Sample Number	Minimum Nitrate	Average Nitrate	Maximum Nitrate	Standard Deviation	N
93	5.92	38.94	53.88	11.81	14
94	21.04	34.88	46.90	13.03	3
95	19.96	33.10	46.24	18.58	2
96	26.18	35.53	39.82	6.40	4
97	26.79	32.96	42.70	8.54	3
99	5.59	15.06	25.43	9.54	4
100	9.06	10.12	11.19	1.50	2
101	30.00	32.46	34.92	3.48	2
102	34.94	35.95	36.97	1.43	2
103	32.59	49.51	68.42	9.04	22
104	0.00	42.92	62.00	15.88	22
105	18.12	40.56	63.18	14.01	18
106	32.33	43.86	58.00	7.72	18
107	27.36	36.14	46.01	5.97	22
108	16.61	20.39	24.17	5.35	2
109	25.16	28.19	31.22	4.29	2
110	0.00	63.08	86.04	21.41	14
111	9.55	26.75	44.41	12.68	12
112	27.86	43.10	66.48	13.17	9
113	12.90	45.13	79.36	22.16	11
114	24.09	40.43	50.61	6.82	11
115	17.84	22.99	39.87	7.62	7
116	20.07	21.34	22.62	1.80	2
117	13.55	15.54	17.52	2.81	2
118	6.93	11.20	18.27	6.17	3
119	12.68	20.29	27.89	10.75	2
120	5.04	14.04	18.71	7.79	3
121	0.00	8.07	15.39	6.96	5
122	13.01	20.14	24.84	6.28	3
123	12.55	13.57	16.03	1.40	5
124	15.28	19.25	21.82	2.72	5
125	0.00	5.32	9.24	2.75	13
126	8.36	42.37	57.91	17.87	11
127	0.00	15.48	25.40	7.49	18
128	0.00	16.91	32.93	12.57	8
129	3.27	18.81	34.97	10.86	10
130	9.31	27.31	43.05	10.52	10
131	18.13	23.40	33.49	4.53	10
132	0.00	12.37	19.78	6.45	11
133	0.00	18.26	33.39	10.71	11
134	0.00	15.49	27.30	8.76	14
135	0.00	18.83	33.70	10.28	10
136	3.61	3.66	3.74	0.07	3
137	15.85	36.38	59.31	11.02	19
138	23.23	38.23	61.58	11.74	19

Table J (continued). Summary statistics by site for nitrate. Values are expressed in μ eq/L.

Sample Number	Minimum Nitrate	Average Nitrate	Maximum Nitrate	Standard Deviation	N
139	4.43	11.53	17.75	5.46	4
140	0.00	10.51	15.13	3.79	15
141	0.00	5.73	13.07	2.90	16
142	0.00	7.33	13.83	3.34	17
143	0.00	8.25	14.20	3.76	18
144	0.00	7.51	12.99	3.41	16
145	0.00	9.00	14.93	6.29	6
146	1.36	9.67	15.75	3.70	16
147	0.00	7.62	14.25	4.56	18
148	0.00	3.62	7.64	3.00	11
149	0.00	7.23	14.38	4.52	11
150	0.00	7.80	19.53	6.29	11
151	0.00	1.67	7.17	2.59	17
152	0.00	5.48	9.44	2.82	17
153	0.00	3.66	5.61	1.94	13
154	0.00	0.00	0.00		1
155	17.63	17.63	17.63		1
156	0.00	3.49	12.73	3.36	20
157	0.00	0.00	0.00	0.00	4
158	0.00	6.18	12.36	6.18	5
159	0.00	0.00	0.00	0.00	5
160	0.00	2.80	5.52	2.61	5
161	0.00	0.47	1.26	0.65	5
162	0.00	0.33	1.65	0.74	5
163	0.00	0.41	1.22	0.71	3
164	0.00	0.00	0.00	0.00	3
165	0.00	0.00	0.00	0.00	3
166	0.00	1.72	3.68	1.85	3
167	0.00	0.00	0.00	0.00	3
168	0.00	0.34	1.36	0.68	4
169	0.00	1.17	3.50	2.02	3
170	0.00	1.44	4.07	1.93	4
171	0.00	3.58	6.55	3.32	3
172	0.00	4.92	9.84	6.96	2
173	0.00	5.80	11.94	3.83	19
174	0.00	11.81	16.01	3.29	20
175	0.00	1.38	7.66	2.08	17
176	0.00	4.81	12.09	3.54	16
177	0.00	6.14	9.61	3.74	9
178	2.67	9.96	16.21	5.56	4
179	4.15	5.95	7.19	1.60	3
180	1.88	2.17	2.45	0.40	2
181	1.25	3.14	4.38	1.66	3
182	20.97	21.32	21.67	0.50	2
183	0.00	6.11	23.20	5.98	15

Table J (continued). Summary statistics by site for nitrate. Values are expressed in μ eq/L.

Sample Number	Minimum Nitrate	Average Nitrate	Maximum Nitrate	Standard Deviation	N
184	17.17	26.87	44.80	6.34	18
185	0.00	19.45	27.79	6.47	15
186	0.00	17.42	31.03	7.17	21
187	0.00	11.15	38.45	15.98	6
188	0.00	1.46	4.49	2.09	5
189	0.00	5.19	13.83	5.60	7
190	1.67	17.01	26.31	5.98	18
191	5.69	23.74	69.24	14.57	17
192	11.71	25.33	47.59	8.42	20
193	0.00	6.69	9.82	3.25	19
194	0.00	10.51	18.81	5.29	19
195	2.52	3.89	5.16	0.85	11
196	6.77	14.84	19.93	5.69	4
197	6.30	11.47	15.17	4.62	3
198	4.32	7.43	10.08	2.91	3
199	0.00	4.81	9.10	4.52	7
200	9.52	25.43	48.94	9.26	18
201	5.28	17.02	32.51	6.83	15
202	14.17	14.17	14.17		1
203	0.00	0.00	0.00		1
204	5.00	5.00	5.00		1
205	0.00	0.00	0.00		1
207	3.32	8.88	19.44	6.29	5
208	0.00	1.11	6.65	2.72	6
209	0.00	7.33	27.16	6.18	19
210	0.00	15.32	37.69	8.04	21
211	0.00	14.89	26.41	7.26	16
212	0.00	19.12	33.04	8.44	16
213	0.00	21.36	34.03	7.87	21
214	2.19	15.32	30.90	6.73	24
215	0.00	13.25	33.37	6.66	23
216	4.19	17.58	24.85	9.77	4
218	24.69	50.90	95.70	15.77	18
219	7.54	84.25	101.22	23.06	17
220	37.06	66.41	88.44	14.92	17
221	11.74	23.76	40.75	7.46	11
222	16.80	17.71	18.54	0.91	4
223	0.00	6.56	11.26	4.77	7
224	0.00	6.93	13.26	5.69	6
225	10.14	23.28	32.41	8.70	6
226	2.29	13.36	26.51	8.36	6
227	0.00	15.01	36.17	14.00	6
228	0.00	10.49	20.04	7.57	6
229	0.00	8.76	23.02	10.76	6
230	0.00	5.95	15.52	6.71	6

Table J (continued). Summary statistics by site for nitrate. Values are expressed in μ eq/L.

Sample Number	Minimum Nitrate	Average Nitrate	Maximum Nitrate	Standard Deviation	N
231	0.00	7.12	15.65	6.19	6
232	29.49	42.44	54.03	9.81	7
233	0.00	35.54	72.69	14.48	19
234	20.69	57.49	68.98	10.48	18
235	24.61	39.68	56.44	10.70	9
236	26.76	40.79	75.64	11.10	16
237	23.46	35.74	75.47	11.11	25
242	25.12	44.77	55.24	7.72	14
243	25.86	38.87	47.75	6.30	14
244	33.74	43.99	55.56	5.18	14
245	0.00	0.11	1.48	0.41	13
246	5.54	21.31	47.30	9.64	15
247	0.00	14.71	23.66	6.12	13
248	0.00	12.38	18.53	5.63	15
249	0.00	0.00	0.00	0.00	5
250	0.00	14.98	30.92	10.72	8
251	15.50	36.47	58.05	10.04	22
252	42.92	54.49	78.62	9.64	20
253	7.96	54.87	79.23	13.46	21
254	0.00	34.26	45.56	15.54	7
255	7.96	22.76	42.22	12.53	5
256	6.43	17.11	27.84	8.42	5
257	3.61	15.24	22.44	7.53	5
258	0.00	6.13	10.90	4.57	5
259	2.75	6.95	10.69	3.32	4
260	0.00	5.30	13.42	4.60	8
261	0.00	4.10	9.76	3.51	7
262	0.00	5.78	11.02	4.14	7
263	0.00	9.88	27.07	8.99	8
264	0.00	6.90	28.53	10.95	6
265	0.00	0.00	0.00	0.00	10
266	0.00	7.29	24.35	7.19	11
267	5.03	18.15	28.58	5.97	19
268	0.00	12.44	81.23	17.06	20
269	0.00	7.27	13.72	5.34	8
270	0.00	11.66	49.49	9.87	19
271	0.00	5.04	20.02	5.18	13
272	0.00	9.31	24.83	9.04	6
273	1.25	13.00	24.61	9.85	5
274	1.17	2.58	3.71	1.06	4
275	1.25	1.91	2.66	0.71	4
276	12.41	23.16	30.53	4.55	15
277	20.37	28.81	37.28	5.31	16
278	0.00	6.05	14.02	4.61	12
279	0.00	5.14	15.87	4.49	11

Table J (continued). Summary statistics by site for nitrate. Values are expressed in μ eq/L.

Sample Number	Minimum Nitrate	Average Nitrate	Maximum Nitrate	Standard Deviation	N
280	5.05	16.04	22.76	5.57	12
281	8.88	15.62	22.26	4.45	12
282	0.00	8.67	25.33	8.96	13
283	0.00	10.34	17.75	4.83	15
284	12.03	17.85	22.63	5.38	3
285	0.00	7.72	28.62	11.95	5
286	5.67	25.19	40.99	12.75	5
287	0.00	11.62	20.13	8.67	6
288	4.70	12.85	20.24	4.72	11
289	2.75	20.51	29.06	7.70	15
290	31.97	52.56	73.05	10.93	18
291	29.97	38.88	47.34	4.76	17
292	0.00	14.49	23.73	7.83	13
293	6.31	17.50	28.24	5.11	20
294	0.00	13.01	27.15	9.49	6
295	0.00	7.58	15.73	6.64	6
296	0.00	3.36	4.87	2.26	4
297	0.00	10.16	16.94	7.19	4
298	0.00	1.09	5.16	2.02	7
299	0.00	2.15	6.05	1.92	13
300	0.00	0.52	3.12	1.27	6
301	0.00	1.53	2.77	1.41	5
302	0.00	0.66	1.33	0.94	2
303					0
304	1.76	10.00	20.35	6.21	12
305	0.00	3.03	7.26	2.39	14
306	0.00	4.91	21.55	5.92	12
307	0.00	2.17	8.36	2.38	17
308	0.00	0.71	2.83	1.42	4
309	0.00	0.91	2.72	1.57	3
310	0.00	3.56	8.66	3.32	12
311	0.00	4.03	8.08	2.64	11
312	0.00	2.92	5.68	2.48	6
313	6.08	6.08	6.08		1
314	0.00	0.00	0.00		1
315	0.00	3.78	10.43	4.06	6
316	0.00	0.00	0.00	0.00	3
317	0.00	0.00	0.00	0.00	4
318	0.00	0.00	0.00	0.00	3
319	0.00	4.61	50.07	13.93	13
320	0.00	6.03	14.79	6.54	11
321	0.00	1.90	7.95	2.75	11
322	0.00	9.36	57.04	13.95	14
323	0.00	3.76	8.80	3.39	5
324	0.00	1.40	5.60	2.80	4

Table J (continued). Summary statistics by site for nitrate. Values are expressed in μ eq/L.

Sample Number	Minimum Nitrate	Average Nitrate	Maximum Nitrate	Standard Deviation	N
325	0.00	1.84	6.22	2.77	5
326	0.00	6.30	26.04	8.43	8
327	0.00	13.16	23.23	5.48	18
328	0.00	11.08	22.18	5.28	11
329	0.00	7.38	28.03	8.71	11
330	0.00	10.02	27.25	7.39	15
331	0.00	25.17	69.32	31.67	4
332	7.12	15.45	63.44	17.21	10
333	24.21	34.40	47.21	11.72	3
334	19.82	25.11	30.22	3.84	7
335	0.00	4.90	25.94	6.79	13
336	19.63	26.86	40.63	5.78	14
337	2.28	24.32	31.08	7.53	13
338	34.66	35.63	36.61	1.38	2
339	1.12	1.12	1.12		1
340	0.00	4.74	12.47	5.38	4
341	0.00	1.61	7.62	2.36	11
342	0.00	0.79	5.37	1.67	11
343	1.48	2.74	4.01	1.79	2
344	0.00	0.00	0.00	0.00	2
345	35.44	35.44	35.44		1
346	30.04	30.04	30.04		1
347	2.87	2.87	2.87		1
348	29.87	29.87	29.87		1
349	3.10	3.10	3.10		1
350	0.00	14.75	20.32	8.56	5
351	0.00	0.00	0.00		1
352	0.00	0.63	2.51	1.25	4
353	11.43	23.13	29.22	10.13	3
354	18.52	23.70	28.03	4.40	4
355	0.00	3.63	11.21	5.29	4
356	64.44	64.44	64.44		1
357	0.00	11.70	40.45	13.29	7
358	0.00	0.00	0.00		1
359	1.82	1.82	1.82		1
360	34.80	42.54	56.24	8.87	5
361	70.72	80.02	89.32	13.15	2
362	3.63	6.14	8.87	2.48	4
363	2.95	11.93	18.09	7.00	5
364	0.00	9.48	16.44	7.08	4
365	8.89	8.89	8.89		1
366	0.00	2.67	8.01	4.62	3
367	1.68	1.68	1.68		1
368	33.23	33.23	33.23		1
369	12.08	30.51	48.94	26.07	2

Table J (continued). Summary statistics by site for nitrate. Values are expressed in μ eq/L.

Sample Number	Minimum Nitrate	Average Nitrate	Maximum Nitrate	Standard Deviation	N
377	0.00	1.10	2.20	1.55	2
392	2.59	2.59	2.59		1
393	0.00	1.03	2.07	1.46	2
399	4.01	4.01	4.01		1
400	2.97	2.97	2.97		1
401	2.68	2.68	2.68		1
402	2.39	2.39	2.39		1
472	14.75	17.55	20.15	2.01	5
473	19.79	35.40	48.19	9.12	7
474	0.00	13.66	21.88	6.97	7
475	0.00	14.97	22.45	8.26	6
479	0.00	2.78	4.63	1.75	7
480	0.00	1.57	3.18	1.50	7
481	0.00	0.72	2.03	0.93	7
482	0.00	2.91	5.65	2.14	5
483	0.00	1.54	3.60	1.53	7
484	0.00	6.60	13.24	4.38	6
485	0.00	2.45	4.79	1.79	8
486	4.62	4.62	4.62		1
487	0.00	1.18	3.53	2.04	3
488	2.41	11.72	27.52	7.85	7
489	10.66	11.09	11.40	0.27	5
490	0.00	0.00	0.00		1
492	42.21	47.25	54.48	4.45	6
493	0.00	6.48	10.26	4.87	4
494	0.00	0.00	0.00		1
999	60.30	60.30	60.30		1

Table K. Summary statistics by site for potassium. Values are expressed in $\mu\text{eq/L}$.

Sample Number	Minimum Potassium	Average Potassium	Maximum Potassium	Standard Deviation	N
1	6.28	12.85	38.59	7.65	19
2	6.36	10.51	14.34	2.84	5
3	5.97	10.64	15.34	2.81	19
4	4.40	9.63	18.40	3.71	18
5	6.35	10.14	22.44	4.20	14
6	6.97	10.79	16.99	2.70	12
7	7.70	10.44	12.68	2.13	5
8	13.35	15.72	18.16	1.96	4
9	26.09	34.15	41.27	7.63	3
10	17.18	26.69	37.59	10.27	3
11	11.78	18.73	31.50	11.07	3
12	8.96	10.03	11.47	1.30	3
13	7.86	12.66	21.94	2.95	20
14	10.42	14.11	20.07	2.77	17
15	9.55	11.11	13.32	1.97	3
16	11.04	13.37	17.45	2.60	5
17	9.21	12.99	20.20	3.77	11
18	15.75	17.94	18.83	1.48	4
19	10.55	13.13	18.15	3.41	4
20	4.58	11.72	18.92	3.41	24
21	6.97	9.18	11.22	1.36	10
22	4.38	9.94	22.50	6.82	10
23	5.59	10.47	19.15	3.00	22
24	5.12	13.03	22.01	3.86	23
25	7.32	12.82	21.40	3.85	11
26	10.12	11.53	13.08	1.12	6
27	9.46	10.70	11.50	0.86	5
28	9.06	10.24	11.65	1.02	5
29	6.51	13.91	39.71	8.20	18
30	3.59	8.86	12.40	2.00	21
31	5.46	10.14	13.44	3.26	6
32	13.81	16.14	20.28	2.40	6
33	12.31	12.31	12.31		1
34	9.25	12.60	17.91	2.82	13
35	7.59	11.22	18.70	2.70	14
36	15.23	22.15	50.05	11.55	8
37	13.44	28.73	54.66	18.18	5
38	7.22	10.93	14.19	2.84	7
39	7.23	10.03	12.70	1.76	6
40	5.47	9.90	19.17	2.92	16
41	10.73	12.69	15.56	2.54	3
42	5.78	10.23	16.73	2.65	14
43	2.90	5.99	9.98	1.67	22
44	4.30	7.85	11.95	2.78	9
45	0.00	4.45	9.27	2.10	24
46	0.00	3.99	8.82	1.67	21

Table K (continued). Summary statistics by site for potassium. Values are expressed in $\mu\text{eq/L}$.

Sample Number	Minimum Potassium	Average Potassium	Maximum Potassium	Standard Deviation	N
47	1.47	8.85	15.03	2.87	18
48	5.23	8.59	19.48	3.90	12
49	3.73	7.55	18.00	3.02	19
50	5.81	10.85	19.64	4.36	9
51	7.64	10.03	14.93	2.65	6
52	5.30	8.02	12.10	1.60	21
53	11.66	18.86	45.87	12.13	7
54	6.63	14.23	28.68	7.20	7
55	12.35	14.80	20.95	2.71	8
56	8.27	14.35	22.95	4.45	7
57	7.39	11.04	13.44	2.11	7
58	7.77	13.24	25.87	5.54	8
59	9.82	10.79	11.76	0.81	5
60	9.84	13.16	20.29	4.29	5
61	10.40	12.76	17.19	2.71	5
62	10.19	12.37	15.59	2.16	5
63	7.45	12.80	19.62	4.82	5
64	9.72	12.17	17.74	3.18	5
65	11.64	12.17	12.71	0.76	2
66	2.55	6.57	11.33	1.95	25
67	5.79	8.03	9.25	1.36	5
68	3.73	6.46	7.84	1.43	7
69	2.20	5.45	16.39	3.60	16
70	4.80	8.88	11.32	1.95	8
71	6.26	8.29	12.45	1.39	22
72	4.20	10.55	61.29	11.99	21
73	0.00	5.09	12.93	2.27	23
74	2.57	4.93	13.67	2.32	22
75	0.00	3.98	13.47	2.82	20
76	0.00	4.53	27.28	5.78	18
77	0.00	3.42	6.41	1.87	11
78	7.58	8.15	8.73	0.81	2
79	0.00	4.49	17.59	4.16	15
80	0.00	4.44	13.45	3.42	12
81	1.87	5.35	8.94	2.53	7
82	1.65	4.39	9.13	2.34	11
83	5.45	11.52	19.00	4.77	7
84	5.11	10.33	13.41	2.16	14
86	4.17	9.82	13.20	2.40	13
87	5.22	10.44	19.86	4.23	14
88	7.56	10.13	13.42	1.82	13
89	6.35	11.53	16.44	3.73	6
90	8.33	25.46	93.59	33.54	6
91	6.05	10.54	18.95	3.46	10
92	2.83	10.37	16.64	3.63	15

Table K (continued). Summary statistics by site for potassium. Values are expressed in $\mu\text{eq/L}$.

Sample Number	Minimum Potassium	Average Potassium	Maximum Potassium	Standard Deviation	N
93	6.27	12.20	37.49	7.90	14
94	6.75	11.91	20.63	7.59	3
95	6.31	14.97	23.64	12.25	2
96	4.29	8.60	13.03	3.65	4
97	7.57	9.96	12.36	3.39	2
99	6.33	7.97	10.18	1.63	4
100	13.68	13.87	14.05	0.26	2
101	10.89	10.89	10.89		1
102	10.42	10.42	10.42		1
103	4.67	11.29	29.46	5.02	22
104	5.97	12.70	21.99	4.41	22
105	4.30	11.68	29.37	5.55	18
106	6.90	13.26	18.07	2.42	18
107	6.53	11.36	24.14	3.38	22
108	5.91	6.10	6.29	0.27	2
109	4.55	7.30	10.06	3.89	2
110	3.78	8.48	23.59	5.85	14
111	0.00	15.12	95.52	26.40	12
112	3.43	20.46	125.18	39.36	9
113	4.36	8.17	12.98	2.67	11
114	4.68	9.12	11.66	2.18	11
115	3.88	7.04	11.83	3.18	7
116	7.19	8.54	9.89	1.91	2
117	10.07	13.93	17.79	5.46	2
118	3.09	4.78	7.95	2.75	3
119	5.65	7.11	8.57	2.06	2
120	3.11	5.66	7.21	2.22	3
121	3.27	7.65	11.00	3.32	5
122	5.10	8.36	10.75	2.92	3
123	3.43	6.21	7.96	1.67	5
124	3.86	6.16	9.38	2.02	5
125	5.61	12.10	16.53	3.09	13
126	9.76	13.59	23.72	4.36	11
127	4.04	10.92	16.03	3.49	18
128	10.32	13.82	19.28	2.97	8
129	9.67	11.99	14.56	2.10	10
130	9.30	33.02	201.74	59.36	10
131	4.64	11.67	16.54	3.84	10
132	6.83	9.47	11.82	1.65	11
133	6.67	9.50	13.13	1.98	11
134	2.95	10.90	25.96	6.10	14
135	6.53	12.41	43.71	11.15	10
136	11.49	13.72	17.54	3.32	3
137	3.04	8.58	16.02	3.26	19
138	3.09	8.54	15.31	3.04	19

Table K (continued). Summary statistics by site for potassium. Values are expressed in $\mu\text{eq/L}$.

Sample Number	Minimum Potassium	Average Potassium	Maximum Potassium	Standard Deviation	N
139	3.28	5.17	7.68	2.18	4
140	5.21	9.78	18.04	3.02	15
141	4.43	11.79	22.08	4.19	16
142	6.35	11.14	14.26	2.27	17
143	5.69	11.30	17.59	3.09	18
144	5.90	12.47	17.70	3.09	16
145	7.96	13.22	18.28	3.98	6
146	7.34	10.97	15.46	2.08	16
147	4.23	12.65	17.56	4.19	18
148	4.77	14.98	21.13	4.59	11
149	7.54	14.25	18.67	3.55	11
150	6.19	13.56	27.34	5.39	11
151	9.87	20.18	29.80	5.66	17
152	7.22	17.45	49.07	8.90	17
153	9.18	15.07	18.96	2.72	13
154	11.51	11.51	11.51		1
155	6.50	6.50	6.50		1
156	2.10	15.93	24.96	5.34	20
157	7.60	14.77	23.51	6.73	4
158	5.90	10.74	14.51	3.53	5
159	8.24	19.11	24.11	6.34	5
160	10.46	31.52	79.17	27.23	5
161	7.82	18.12	34.33	9.89	5
162	8.76	19.02	28.12	6.88	5
163	12.92	23.44	35.21	11.20	3
164	9.82	19.54	27.83	9.09	3
165	19.19	33.20	55.39	19.43	3
166	24.86	32.44	41.52	8.43	3
167	21.13	27.27	37.61	9.01	3
168	6.65	12.31	16.75	4.20	4
169	9.09	13.39	17.68	4.29	3
170	7.70	13.85	17.66	4.29	4
171	16.99	24.38	34.67	9.19	3
172	16.28	18.76	21.24	3.51	2
173	5.75	13.68	30.94	5.75	20
174	7.90	18.67	77.93	14.56	20
175	8.05	25.41	38.28	9.52	17
176	11.81	22.30	48.18	9.60	16
177	5.74	10.26	13.60	2.24	9
178	4.36	7.41	10.46	3.07	4
179	4.77	7.95	9.54	2.75	3
180	4.64	6.87	9.11	3.15	2
181	5.08	7.97	9.51	2.50	3
182	4.43	4.59	4.74	0.22	2
183	3.13	7.47	21.11	4.58	15

Table K (continued). Summary statistics by site for potassium. Values are expressed in $\mu\text{eq/L}$.

Sample Number	Minimum Potassium	Average Potassium	Maximum Potassium	Standard Deviation	N
184	5.31	11.71	23.42	4.69	18
185	7.05	10.72	13.52	1.47	15
186	6.83	11.21	14.43	1.85	21
187	2.81	9.16	16.98	5.20	6
188	2.76	6.44	8.47	2.28	5
189	5.58	9.49	14.24	3.31	7
190	5.46	7.90	10.66	1.62	18
191	4.24	9.24	25.36	4.48	17
192	3.86	5.99	9.06	1.61	20
193	3.81	9.59	15.68	2.98	19
194	4.24	9.39	16.34	3.14	19
195	3.57	5.84	7.68	1.01	11
196	7.43	12.20	16.87	4.15	4
197	4.14	6.29	7.62	1.88	3
198	5.25	7.43	8.74	1.90	3
199	8.72	13.49	16.96	2.83	7
200	5.35	9.94	14.26	2.46	19
201	3.38	8.38	11.27	2.43	14
202	8.59	8.59	8.59		1
203	13.09	13.09	13.09		1
204	10.55	10.55	10.55		1
205	12.64	12.64	12.64		1
207	8.13	8.92	10.54	0.98	5
208	4.84	7.45	10.89	2.39	6
209	3.87	9.77	15.13	2.42	19
210	5.96	10.25	14.50	2.15	21
211	4.93	9.10	14.92	2.53	16
212	4.85	9.48	16.23	2.86	16
213	4.47	8.61	16.19	2.46	21
214	3.28	9.08	13.61	2.53	25
215	4.92	8.85	13.58	1.89	23
216	4.90	9.53	14.42	3.89	4
218	5.37	13.84	20.69	4.13	18
219	2.02	12.73	42.54	8.52	17
220	4.36	11.83	15.10	2.76	17
221	7.04	10.66	20.12	4.17	11
222	5.85	9.18	11.70	2.47	4
223	5.14	10.03	14.00	3.13	7
224	8.38	11.14	14.64	2.59	6
225	4.56	11.74	23.14	6.61	6
226	4.95	9.57	16.71	4.68	6
227	4.15	9.41	20.08	5.74	6
228	4.50	9.87	16.94	4.27	6
229	5.19	9.56	13.82	3.22	6
230	4.42	9.56	13.85	3.20	6

Table K (continued). Summary statistics by site for potassium. Values are expressed in $\mu\text{eq/L}$.

Sample Number	Minimum Potassium	Average Potassium	Maximum Potassium	Standard Deviation	N
231	4.66	9.83	13.87	3.58	6
232	3.63	8.99	28.78	8.89	7
233	2.57	4.40	7.48	1.40	19
234	4.12	6.20	8.39	1.25	18
235	4.23	9.36	19.33	4.23	9
236	1.98	4.84	9.54	2.31	16
237	1.44	3.38	6.53	1.18	25
242	5.19	11.47	44.22	9.72	14
243	3.68	9.16	12.89	2.78	14
244	4.67	8.87	12.69	2.22	14
245	1.76	7.60	10.65	2.50	13
246	4.87	9.14	15.77	3.24	15
247	6.66	9.35	14.98	2.58	13
248	6.24	9.11	14.15	2.16	15
249	10.33	12.43	14.62	2.08	5
250	7.38	10.95	15.76	2.78	8
251	3.27	10.45	22.32	3.78	22
252	7.53	13.39	20.66	3.51	21
253	4.59	9.41	19.30	3.57	21
254	6.17	11.40	15.88	3.26	7
255	7.58	10.59	13.43	2.49	5
256	5.74	9.10	12.46	2.43	5
257	4.49	8.64	14.65	3.90	5
258	5.13	8.88	11.82	2.42	5
259	5.58	9.79	11.95	2.87	4
260	6.17	10.25	21.31	5.22	8
261	3.75	8.88	16.70	4.37	7
262	5.45	8.28	16.34	3.91	7
263	4.02	8.53	14.60	3.92	8
264	4.54	9.07	16.00	4.66	6
265	7.76	12.97	15.70	2.52	10
266	6.45	11.14	14.28	2.28	11
267	6.73	13.18	26.67	3.97	19
268	5.30	10.14	13.85	2.44	20
269	5.75	9.65	11.74	1.86	8
270	4.97	10.31	22.06	3.89	18
271	7.01	11.63	15.53	2.54	13
272	6.71	11.45	15.49	3.14	5
273	7.20	10.59	13.86	2.74	4
274	8.01	9.05	11.72	1.79	4
275	9.58	10.95	13.64	2.33	3
276	6.34	9.98	20.44	3.41	15
277	5.51	9.10	14.01	2.20	16
278	7.52	9.45	14.30	1.83	11
279	7.98	9.97	14.10	1.68	10

Table K (continued). Summary statistics by site for potassium. Values are expressed in $\mu\text{eq/L}$.

Sample Number	Minimum Potassium	Average Potassium	Maximum Potassium	Standard Deviation	N
280	5.38	8.29	15.13	2.70	11
281	6.94	11.26	36.88	8.82	11
282	6.67	11.24	14.80	2.77	12
283	6.03	11.10	24.45	4.60	15
284	9.06	9.54	10.02	0.68	2
285	9.52	18.14	30.55	8.54	5
286	7.23	12.47	16.53	3.48	5
287	10.66	13.85	17.07	2.38	6
288	5.38	10.68	17.75	3.38	11
289	9.23	12.89	24.35	3.87	14
290	3.98	7.91	13.71	2.58	18
291	3.65	9.87	15.59	2.83	17
292	8.02	12.82	21.99	4.75	13
293	4.59	13.94	41.83	7.07	20
294	8.18	11.97	14.26	2.03	6
295	12.14	14.27	17.51	1.93	6
296	8.87	13.35	18.37	3.92	4
297	13.75	14.56	16.81	1.50	4
298	8.64	18.35	23.79	5.15	7
299	6.53	12.15	17.75	3.04	14
300	2.23	9.39	18.04	5.41	6
301	5.36	11.11	18.23	4.68	5
302	5.85	8.54	10.10	2.34	3
303	5.13	5.13	5.13		1
304	6.29	12.35	19.75	3.76	12
305	5.23	9.79	12.30	1.92	14
306	6.25	12.21	16.93	3.17	12
307	3.58	10.39	16.70	2.84	17
308	5.79	10.38	14.46	3.74	4
309	6.89	13.98	20.15	6.68	3
310	5.60	9.99	15.71	2.88	12
311	5.93	10.55	16.83	2.98	11
312	6.28	10.12	16.30	3.43	6
313	9.79	9.79	9.79		1
314	17.77	17.77	17.77		1
315	5.09	11.35	18.57	4.91	6
316	8.81	12.87	16.52	3.87	3
317	9.86	14.83	18.06	3.53	4
318	4.90	13.71	18.55	7.64	3
319	6.73	11.71	14.63	2.50	13
320	7.98	10.22	15.72	2.57	11
321	9.05	17.17	22.61	4.12	11
322	5.87	10.54	15.22	2.24	14
323	7.17	10.66	12.94	2.44	5
324	6.01	12.47	18.34	5.11	4

Table K. $\mu_{\text{eff}}/\text{L}_0$

No. hole	Position a	Position b	Position c	Position d	Position e
323	6.86	13.48	17.78	5.72	8
327	6.86	13.48	17.78	5.72	8
329	6.83	11.67	14.19	2.06	11
330	6.83	11.67	14.19	2.06	11
331					
332	6.41	9.84	15.35	4.12	10
333	6.41	9.84	15.35	4.12	10
334					
335					
336	2.81	12.71	18.15	2.62	14
339	12.13	12.13	13.13		1
340	12.13	12.13	13.13		1
341					
342					
343					
344	11.14	11.14	11.14	9.14	2
345	11.14	11.14	11.14	9.14	1
346					
347					
348					
349	11.14	11.14	11.14	9.14	1
350	2.87	11.77	11.77	5.93	5
353	11.14	11.14	11.14	9.14	1
354	11.14	11.14	11.14	9.14	1
355					
356	11.14	11.14	11.14	9.14	1
357	1.21	11.14	11.14	9.14	7
358					
359	7.58	7.58	7.58		1
360					
361					
362					
363	8.63	12.24	16.16	2.83	5
364	8.63	12.24	16.16	2.83	5
365	21.51	23.51	23.51		1
366					
367					
368	8.45	8.45	8.45		1
369	7.63	8.65	8.65	6.52	2

Table K (continued). Summary statistics by site for potassium. Values are expressed in $\mu\text{eq/L}$.

Sample Number	Minimum Potassium	Average Potassium	Maximum Potassium	Standard Deviation	N
377	5.75	6.82	7.89	1.52	2
392	7.29	7.29	7.29		1
393	8.38	9.73	11.08	1.91	2
399	8.04	8.04	8.04		1
400	8.29	8.29	8.29		1
401	6.15	6.15	6.15		1
402	7.23	7.23	7.23		1
472	3.11	7.19	10.60	2.91	5
473	4.20	5.44	7.34	1.22	7
474	4.77	10.63	19.46	4.38	7
475	8.83	13.09	23.49	5.40	6
479	0.00	9.50	16.30	4.91	7
480	8.17	11.90	16.19	2.53	7
481	11.38	13.41	17.12	1.99	7
482	8.99	11.42	14.97	2.47	5
483	11.12	13.99	19.74	3.31	7
484	7.33	10.12	15.42	2.83	6
485	5.53	10.88	18.07	3.50	8
486	9.56	9.56	9.56		1
487	11.04	14.46	19.12	4.18	3
488	6.61	9.75	11.84	1.78	7
489	11.75	13.93	16.58	1.88	5
490	12.24	12.24	12.24		1
492	7.74	9.46	13.65	2.29	6
493	8.91	12.07	16.50	3.25	4
494	14.37	14.37	14.37		1
999	1.50	1.50	1.50		1

Table L. Summary statistics by site for magnesium. Values are expressed in $\mu\text{eq/L}$.

Samle Number	Minimum Magnesium	Average Magnesium	Maximum Magnesium	Standard Deviation	N
1	12.51	20.97	27.72	3.55	19
2	15.19	20.36	24.28	3.35	5
3	20.18	34.63	41.25	4.74	19
4	14.07	24.80	34.94	5.47	18
5	27.35	41.52	49.45	5.33	14
6	29.68	45.12	59.46	9.24	12
7	32.47	42.36	52.02	7.61	5
8	26.92	42.14	52.25	10.75	4
9	32.96	56.55	81.45	24.28	3
10	50.91	84.24	102.81	28.93	3
11	83.18	120.50	142.80	32.52	3
12	21.24	28.37	32.81	6.24	3
13	27.99	42.55	61.96	9.93	20
14	26.05	39.02	59.09	9.93	17
15	37.53	45.67	51.60	7.29	3
16	23.75	30.18	39.30	6.08	5
17	23.65	29.55	39.41	5.35	11
18	18.91	26.51	32.99	6.19	4
19	23.70	29.67	37.25	5.61	4
20	17.52	29.62	41.62	6.04	24
21	46.60	72.50	106.46	22.33	10
22	47.61	96.70	270.87	68.47	10
23	10.78	42.72	93.35	19.03	22
24	24.48	53.09	92.54	17.86	23
25	49.82	94.22	191.85	44.91	11
26	28.71	33.11	36.95	3.37	6
27	27.64	34.12	41.67	5.89	5
28	23.32	27.87	32.76	3.70	5
29	25.85	53.86	133.90	21.55	18
30	30.37	47.11	79.98	9.39	21
31	25.70	53.91	96.06	23.36	6
32	28.24	33.42	37.44	3.84	6
33	23.62	23.62	23.62		1
34	12.98	30.49	96.90	20.71	13
35	18.28	26.40	34.38	4.83	14
36	10.50	19.28	33.75	8.12	8
37	29.92	87.48	255.77	97.08	5
38	10.83	19.11	22.96	4.23	7
39	15.44	17.26	20.08	1.69	6
40	12.83	21.50	29.86	4.49	16
41	18.64	21.21	24.67	3.11	3
42	15.52	21.59	28.96	4.09	14
43	9.75	36.03	49.21	7.83	22
44	12.76	24.95	65.30	15.97	9
45	28.04	47.40	57.99	7.65	24
46	21.25	42.07	56.33	8.28	21

Table L (continued). Summary statistics by site for magnesium. Values are expressed in $\mu\text{eq/L}$.

Samle Number	Minimum Magnesium	Average Magnesium	Maximum Magnesium	Standard Deviation	N
47	16.43	23.42	37.75	5.38	18
48	16.42	35.70	51.56	8.46	12
49	14.92	30.94	43.44	7.10	19
50	14.09	30.16	38.42	6.98	9
51	16.47	30.13	36.86	7.81	6
52	16.55	30.30	40.43	6.51	21
53	15.41	20.64	23.42	2.54	7
54	21.25	28.53	32.23	3.79	7
55	15.14	24.28	29.94	4.69	8
56	15.85	23.97	27.32	3.96	7
57	15.21	24.86	33.13	5.34	7
58	15.53	27.79	37.63	7.78	8
59	7.48	23.31	31.81	9.25	5
60	17.35	25.82	29.29	4.87	5
61	16.41	27.96	37.74	7.97	5
62	19.20	25.87	30.03	4.13	5
63	16.57	26.33	32.09	6.57	5
64	14.60	23.20	30.94	6.79	5
65	24.04	36.80	49.56	18.04	2
66	27.41	46.25	73.08	10.07	25
67	46.13	55.75	67.67	9.52	5
68	26.34	44.22	56.44	9.82	7
69	33.12	49.90	65.47	8.74	16
70	17.05	27.98	49.36	10.05	8
71	18.17	30.12	46.90	6.21	22
72	0.00	26.69	36.85	8.21	21
73	33.30	51.14	71.40	8.82	23
74	34.62	53.65	88.15	12.92	22
75	15.00	41.87	67.82	11.45	20
76	30.66	44.39	59.58	6.83	18
77	35.46	53.06	70.96	12.30	11
78	65.24	69.60	73.95	6.16	2
79	23.10	36.27	67.82	10.29	15
80	17.86	33.55	52.26	9.61	12
81	23.82	37.70	52.37	11.21	7
82	9.26	26.16	52.87	13.66	11
83	13.72	28.56	48.95	10.91	7
84	12.91	23.98	29.63	4.16	14
86	12.88	22.07	29.27	5.07	13
87	14.09	24.57	34.52	6.16	14
88	10.27	19.57	30.97	5.55	13
89	11.18	18.16	24.21	4.71	6
90	16.01	34.30	105.28	34.96	6
91	12.81	21.07	28.56	4.53	10
92	8.45	16.19	29.59	5.95	15

Table L (continued). Summary statistics by site for magnesium. Values are expressed in $\mu\text{eq/L}$.

Samle Number	Minimum Magnesium	Average Magnesium	Maximum Magnesium	Standard Deviation	N
93	11.04	18.40	27.51	4.21	14
94	15.56	16.73	17.54	1.04	3
95	18.06	23.14	28.21	7.18	2
96	16.50	23.81	28.97	5.44	4
97	29.19	30.47	31.74	1.80	2
99	12.92	15.86	20.95	3.55	4
100	28.26	31.28	34.30	4.27	2
101	18.42	18.42	18.42		1
102	20.82	20.82	20.82		1
103	16.29	23.93	32.24	3.79	22
104	15.60	28.91	142.20	27.04	22
105	13.28	21.17	26.93	4.03	18
106	14.48	22.94	28.08	3.04	18
107	14.27	22.35	47.09	6.56	22
108	24.70	31.09	37.48	9.04	2
109	37.21	43.41	49.61	8.77	2
110	13.54	24.11	36.98	5.62	14
111	11.34	24.33	65.77	14.91	12
112	5.14	12.21	29.89	7.62	9
113	3.87	7.85	15.14	3.14	11
114	22.46	41.15	48.79	8.03	11
115	17.31	33.72	43.44	8.52	7
116	18.88	25.08	31.28	8.77	2
117	11.95	20.19	28.44	11.66	2
118	13.44	21.76	35.48	11.97	3
119	13.82	28.02	42.21	20.08	2
120	24.17	29.37	38.85	8.22	3
121	22.27	38.16	45.85	9.76	5
122	23.08	34.82	49.64	13.55	3
123	20.48	35.33	48.55	10.73	5
124	23.23	37.13	48.96	10.45	5
125	9.64	18.47	25.64	4.41	13
126	12.55	16.04	23.99	3.25	11
127	13.14	20.25	25.30	2.83	18
128	18.49	22.42	28.10	3.26	8
129	17.21	21.88	26.89	3.38	10
130	17.94	69.50	513.75	156.11	10
131	14.39	24.55	36.20	6.29	10
132	13.87	24.25	37.02	5.65	11
133	18.20	30.60	37.98	6.61	11
134	27.33	43.65	68.13	10.46	14
135	35.14	44.92	57.36	7.77	10
136	16.95	17.70	18.21	0.66	3
137	16.23	28.58	37.33	5.52	19
138	11.67	20.52	39.22	6.15	19

Table L (continued). Summary statistics by site for magnesium. Values are expressed in $\mu\text{eq/L}$.

Samle Number	Minimum Magnesium	Average Magnesium	Maximum Magnesium	Standard Deviation	N
139	8.06	9.10	11.44	1.57	4
140	11.21	19.31	30.96	4.51	15
141	10.00	17.46	23.66	3.85	16
142	11.34	19.40	27.31	3.93	17
143	9.87	19.20	26.08	3.60	18
144	9.93	19.53	29.25	4.37	16
145	19.03	26.92	41.63	9.06	6
146	12.49	20.81	30.93	4.04	16
147	20.15	29.42	48.48	6.55	18
148	25.71	34.54	43.70	5.65	11
149	16.99	29.69	38.77	6.43	11
150	22.25	28.18	36.90	5.51	11
151	34.81	77.03	164.74	31.10	17
152	54.89	132.64	292.98	62.65	17
153	47.36	102.77	153.63	36.74	13
154	20.71	20.71	20.71		1
155	10.48	10.48	10.48		1
156	28.76	103.35	186.21	44.06	20
157	18.76	79.20	189.46	78.01	4
158	10.25	17.46	22.81	5.21	5
159	19.27	44.77	68.16	20.02	5
160	38.46	132.38	226.52	86.64	5
161	12.42	46.80	119.72	43.24	5
162	25.66	65.74	122.72	40.17	5
163	36.27	181.40	254.43	125.68	3
164	43.69	82.14	104.35	33.43	3
165	51.62	80.21	124.87	39.18	3
166	26.78	57.41	77.34	26.92	3
167	24.47	38.47	51.52	13.55	3
168	32.38	57.15	73.81	17.86	4
169	64.82	85.37	118.70	29.13	3
170	32.48	55.85	69.41	16.64	4
171	76.23	141.72	218.05	71.53	3
172	41.54	50.05	58.55	12.03	2
173	16.74	44.47	65.57	14.09	20
174	95.47	217.92	524.50	104.46	20
175	19.96	56.10	175.05	33.48	17
176	44.10	107.63	290.79	59.95	16
177	9.78	20.23	27.09	4.91	9
178	7.52	10.77	12.18	2.18	4
179	10.30	14.82	18.95	4.34	3
180	8.70	11.37	14.04	3.78	2
181	11.00	14.46	16.58	3.02	3
182	12.50	13.09	13.67	0.82	2
183	5.96	17.07	55.95	11.85	15

Table L (continued). Summary statistics by site for magnesium. Values are expressed in $\mu\text{eq/L}$.

Samle Number	Minimum Magnesium	Average Magnesium	Maximum Magnesium	Standard Deviation	N
184	13.10	20.46	26.03	3.23	18
185	12.41	21.85	38.36	5.48	15
186	12.60	27.87	93.06	15.88	21
187	13.16	62.54	161.71	56.32	6
188	6.04	10.70	14.87	3.75	5
189	11.03	18.24	25.55	4.90	7
190	12.20	20.60	28.42	4.99	18
191	10.29	18.82	49.33	8.72	17
192	13.52	24.06	35.11	5.54	20
193	11.61	23.93	37.36	6.86	19
194	12.12	24.82	41.36	7.08	19
195	7.08	13.55	18.14	3.26	11
196	10.54	13.59	16.16	2.32	4
197	10.34	14.40	16.64	3.52	3
198	9.86	14.60	17.94	4.22	3
199	14.53	23.70	33.29	5.55	7
200	9.85	17.84	26.68	3.99	19
201	9.62	15.39	22.12	3.39	14
202	12.86	12.86	12.86		1
203	26.27	26.27	26.27		1
204	26.60	26.60	26.60		1
205	24.56	24.56	24.56		1
207	9.18	14.51	18.32	3.83	5
208	5.90	12.84	17.66	3.85	6
209	13.12	19.64	26.03	3.97	19
210	13.76	23.70	30.57	4.56	21
211	13.03	20.88	29.34	4.81	16
212	11.18	19.99	27.52	4.69	16
213	12.53	22.21	42.28	6.56	21
214	10.63	20.65	39.28	5.82	25
215	13.63	25.94	40.57	6.28	23
216	9.79	40.21	119.54	52.97	4
218	12.60	21.20	34.74	5.42	18
219	10.74	18.23	31.01	5.36	17
220	9.63	20.06	32.03	6.31	17
221	11.38	21.06	26.07	4.50	11
222	11.76	17.65	20.83	4.14	4
223	10.47	18.81	27.45	4.99	7
224	17.55	20.98	28.68	3.99	6
225	12.40	17.67	24.94	4.95	6
226	9.94	15.02	21.50	4.20	6
227	8.74	15.86	22.07	5.10	6
228	9.91	17.08	21.50	3.97	6
229	11.82	18.17	24.82	4.40	6
230	9.40	17.25	25.47	5.32	6

Table L (continued). Summary statistics by site for magnesium. Values are expressed in $\mu\text{eq/L}$.

Sample Number	Minimum Magnesium	Average Magnesium	Maximum Magnesium	Standard Deviation	N
231	10.26	18.59	23.49	4.60	6
232	32.17	52.58	73.59	17.17	7
233	41.50	56.39	74.28	10.08	19
234	19.87	30.87	42.37	6.18	18
235	16.69	29.62	48.63	9.16	9
236	24.48	40.12	60.65	9.94	16
237	18.18	31.93	55.05	9.45	25
242	11.34	17.89	22.79	3.12	14
243	13.80	19.47	24.24	3.22	14
244	13.19	20.54	25.89	3.81	14
245	2.34	11.32	19.19	4.49	13
246	10.69	18.26	25.76	3.76	15
247	10.37	18.36	23.95	3.43	13
248	13.62	18.84	23.80	2.59	15
249	15.95	21.24	26.65	4.21	5
250	17.23	30.52	43.66	8.37	8
251	17.79	74.95	111.76	31.66	22
252	57.79	138.45	245.70	50.49	21
253	30.54	56.38	164.27	26.45	21
254	16.75	28.77	38.28	7.20	7
255	13.71	23.13	27.98	5.57	5
256	13.72	22.58	29.99	5.84	5
257	13.00	20.17	29.67	7.10	5
258	11.80	20.13	30.53	6.78	5
259	12.10	20.93	27.17	6.37	4
260	13.63	21.59	31.45	6.57	8
261	9.69	17.82	24.25	4.76	7
262	10.81	18.04	28.78	5.60	7
263	11.93	22.15	37.89	8.00	8
264	10.27	16.74	25.94	6.52	6
265	9.39	18.42	29.64	6.32	10
266	12.07	25.30	33.12	6.80	11
267	11.81	22.54	30.45	4.87	19
268	13.42	28.12	48.81	8.74	20
269	13.35	24.45	32.73	6.17	8
270	13.38	23.60	32.47	4.70	18
271	12.50	21.96	41.48	7.13	13
272	17.67	23.52	37.94	8.36	5
273	14.90	22.99	36.49	9.48	4
274	11.90	13.03	14.28	1.02	4
275	21.50	26.82	34.78	7.02	3
276	11.71	17.63	23.36	3.01	15
277	12.76	18.42	20.98	2.60	16
278	8.49	15.27	24.24	4.52	11
279	11.35	17.06	30.20	5.77	10

Table L (continued). Summary statistics by site for magnesium. Values are expressed in $\mu\text{eq/L}$.

Sample Number	Minimum Magnesium	Average Magnesium	Maximum Magnesium	Standard Deviation	N
280	13.73	31.17	42.13	7.69	11
281	22.39	30.64	35.04	4.01	11
282	12.77	25.97	38.10	7.75	12
283	15.82	27.74	38.21	6.39	15
284	35.36	36.09	36.82	1.04	2
285	29.59	39.33	47.92	8.08	5
286	21.38	30.46	40.31	7.87	5
287	23.37	37.58	62.88	14.11	6
288	7.78	17.59	24.27	4.95	11
289	14.48	18.96	23.70	2.56	14
290	12.64	24.82	40.20	8.24	18
291	12.30	23.76	30.83	5.10	17
292	11.86	19.57	27.03	4.42	13
293	18.67	32.01	43.61	6.47	20
294	19.70	29.14	39.44	7.28	6
295	26.13	31.75	40.34	4.91	6
296	21.58	29.13	41.88	8.84	4
297	25.53	29.78	41.72	7.96	4
298	25.25	102.04	160.94	49.19	7
299	10.96	18.55	22.92	4.02	14
300	8.82	17.02	28.61	7.17	6
301	10.00	20.97	34.01	9.39	5
302	12.76	16.59	19.30	3.41	3
303	16.23	16.23	16.23		1
304	11.81	30.40	40.19	8.07	12
305	9.81	16.71	20.92	3.84	14
306	16.05	21.09	27.87	3.12	12
307	9.01	16.72	33.05	5.08	17
308	9.89	27.84	40.06	12.95	4
309	13.09	20.23	24.95	6.29	3
310	15.04	28.86	37.97	6.54	12
311	13.18	25.43	35.32	6.89	11
312	13.06	24.37	35.11	8.09	6
313	19.17	19.17	19.17		1
314	27.07	27.07	27.07		1
315	10.32	19.28	25.71	5.82	6
316	14.40	20.46	25.36	5.57	3
317	15.61	22.10	30.23	6.26	4
318	19.97	25.35	30.38	5.22	3
319	17.82	26.26	37.79	6.42	13
320	15.84	20.54	29.56	4.37	11
321	19.05	25.09	34.60	5.14	11
322	11.31	20.50	30.40	4.67	14
323	12.53	23.20	31.71	7.02	5
324	12.66	19.28	28.02	6.45	4

Table L (continued). Summary statistics by site for magnesium. Values are expressed in $\mu\text{eq/L}$.

Sample Number	Minimum Magnesium	Average Magnesium	Maximum Magnesium	Standard Deviation	N
325	11.11	22.43	33.16	9.33	5
326	15.16	28.35	38.42	7.11	8
327	13.13	24.11	31.51	5.20	18
328	9.01	14.36	21.97	4.38	11
329	12.60	26.40	34.47	5.63	11
330	10.01	23.63	33.41	6.16	15
331	22.99	30.24	41.70	8.27	4
332	10.63	17.07	40.57	8.54	10
333	46.91	47.54	47.98	0.55	3
334	13.75	16.34	20.83	2.79	7
335	24.56	99.28	150.89	40.43	13
336	19.02	25.16	32.20	3.58	14
337	5.77	24.13	34.87	8.35	13
338	24.12	25.01	25.91	1.26	2
339	27.83	27.83	27.83		1
340	18.68	23.52	26.24	3.39	4
341	77.06	105.40	136.60	21.49	11
342	60.58	86.21	112.01	17.18	11
343	14.64	15.45	16.26	1.14	2
344	16.02	17.22	18.42	1.69	2
345	23.49	23.49	23.49		1
346	18.39	18.39	18.39		1
347	31.04	31.04	31.04		1
348	31.08	31.08	31.08		1
349	12.53	12.53	12.53		1
350	13.07	20.71	27.49	5.25	5
351	220.74	220.74	220.74		1
352	99.36	139.35	229.48	61.16	4
353	28.45	39.84	56.04	14.41	3
354	17.35	24.72	31.91	7.71	4
355	20.35	27.27	34.13	7.59	4
356	16.09	16.09	16.09		1
357	13.30	21.66	34.20	7.47	7
358	20.16	20.16	20.16		1
359	10.59	10.59	10.59		1
360	21.37	27.04	31.77	4.05	5
361	18.69	26.15	33.60	10.54	2
362	17.21	20.36	26.99	4.48	4
363	15.41	20.20	25.93	3.77	5
364	41.64	49.49	59.46	7.62	4
365	22.74	22.74	22.74		1
366	51.61	67.93	76.32	14.13	3
367	17.84	17.84	17.84		1
368	26.70	26.70	26.70		1
369	16.42	23.00	29.58	9.31	2

Table L (continued). Summary statistics by site for magnesium. Values are expressed in $\mu\text{eq/L}$.

Sample Number	Minimum Magnesium	Average Magnesium	Maximum Magnesium	Standard Deviation	N
377	53.96	73.46	92.95	27.57	2
392	16.06	16.06	16.06		1
393	23.38	25.79	28.19	3.40	2
399	15.36	15.36	15.36		1
400	16.48	16.48	16.48		1
401	16.01	16.01	16.01		1
402	19.00	19.00	19.00		1
472	14.90	23.25	26.86	4.93	5
473	43.36	55.79	73.11	10.07	7
474	18.68	24.68	28.75	3.49	7
475	23.00	29.50	45.83	8.34	6
479	12.65	25.64	36.34	7.46	7
480	25.63	37.00	51.05	8.72	7
481	45.10	56.13	78.23	10.78	7
482	41.04	46.16	52.61	5.05	5
483	26.92	40.31	53.01	8.02	7
484	18.42	24.31	30.81	4.62	6
485	20.72	30.21	48.20	8.37	8
486	22.26	22.26	22.26		1
487	37.72	46.58	57.32	9.94	3
488	19.25	25.23	28.94	3.54	7
489	80.72	170.74	246.38	69.58	5
490	30.47	30.47	30.47		1
492	36.90	40.64	47.49	3.93	6
493	19.59	25.45	29.47	4.25	4
494	40.08	40.08	40.08		1
999	1.78	1.78	1.78		1