1 of 3

**STEEL CREEK WATER QUALITY; L-LAKE/STEEL CREEK
BIOLOGICAL MONITORING PROGRAM NOVEMBER 1985 -
DECEMBER 1991 (U)**

by

James A. Bowers

Westinghouse Savannah River Company

Savannah River Site

Aiken, South Carolina 29808

M. J. Chimney

Normandeau Associates Inc.

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NAI-SR-144

Steel Creek Water Quality:
L-Lake/Steel Creek Biological
Monitoring Program
November 1985 - December 1991

Donald W. Kretchmer
Michael J. Chimney

Normandeau Associates Inc.
102 South Boundary
New Ellenton, South Carolina 29809

April 1992

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for Westinghouse Savannah River Co.
Savannah River Laboratory
Aiken, South Carolina 29808

James A. Bowers

Program Director

Normandeau Associates Inc.
102 South Boundary
New Ellenton, South Carolina 29809

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PREFACE

The Savannah River Site (SRS) encompasses 300 sq mi of the Atlantic Coastal Plain in west-central South Carolina. The Savannah River forms the western boundary of the site (Figure 1). Five major tributaries of the Savannah River -- Upper Three Runs Creek, Four Mile Creek, Pen Branch, Steel Creek, and Lower Three Runs Creek -- drain the site. All but Upper Three Runs Creek receive, or in the past received, thermal effluents from nuclear production reactors. In 1985, L Lake, a 400-hectare cooling reservoir, was built on the upper reaches of Steel Creek to receive effluent from the restart of L-Reactor, and protect the lower reaches from thermal impacts. The lake has an average width of approximately 600 m and extends along the Steel Creek valley approximately 7000 m from the dam to the headwaters. Water level is maintained at a normal pool elevation of 58 m above mean sea level by overflow into a vertical intake tower that has multilevel discharge gates. The intake tower is connected to a horizontal conduit that passes through the dam and releases water into Steel Creek.

The Steel Creek Biological Monitoring Program was designed to meet environmental regulatory requirements associated with the restart of L-Reactor and complements the Biological Monitoring Program for L Lake. This extensive program was implemented to address portions of Section 316(a) of the Clean Water Act. The Department of Energy (DOE) must demonstrate that the operation of L-Reactor will not significantly alter the established aquatic ecosystems.

Steel Creek Description

Steel Creek and its main tributary, Meyer's Branch (Figure 1), drain approximately 35 sq mi of the Aiken Plateau before descending to the Coastal

Figure 1. A map of the Savannah River Site showing the major aquatic systems.

Terrace. The headwaters of Steel Creek are located approximately 19 km from the Savannah River. L Lake was created near L-Reactor by construction of a dam across Steel Creek about 5 km upstream of the Steel Creek delta.

Steel Creek received thermal effluents directly from both P- and L-Reactors between 1954 and 1963 (maximum of 835 cfs; Smith et al. 1981; DOE 1984), and then from L-Reactor alone until 1968. The increased flow scoured the upper reaches of Steel Creek and deposited the sediments in a delta where the creek enters the river swamp. The increased sedimentation and the elevated water temperature destroyed all the in-stream vegetation along the upper reaches of the creek and the mature swamp forest at the site of the expanding delta. When thermal discharges ceased in the late 1960s, vegetation became reestablished and ecological succession began. The stream characteristics before the construction of L Lake included shallow braided channels and scrub-shrub or emergent wetland (marsh) communities. Diverse floral and faunal communities existed (Smith et al. 1981 and references therein). Potential influences of L-Reactor on Steel Creek physical parameters include changes in depth, flow, velocity, channel morphology, and water quality.

Biological Monitoring Program

The Steel Creek Biological Monitoring Program is designed to assess various components of the system and identify any changes due to the operation of L-Reactor or discharge from L Lake, the once-through cooling reservoir for the reactor. An intensive ecological assessment program prior to the construction of the lake (Paller et al. 1986; Firth et al. 1986; and others) provided baseline data with which to compare data accumulated after the lake was filled and began discharging into the creek.

This report summarizes the results of six years' data from Steel Creek under the L-Lake/Steel Creek Monitoring Program. L Lake is discussed separately from Steel Creek in Volumes NAI-SR-138 through NAI-SR-143.

Each major component of the Steel Creek portion of the biological monitoring program is presented in a separate volume as follows:

NAI-SR-144 Water Quality

NAI-SR-145 Fish

NAI-SR-146 Macroinvertebrates

NAI-SR-147 Primary Producers: Periphyton and
Seston

NAI-SR-148 Habitat Formers: Floodplain Habitat
and Channel Mapping

EXECUTIVE SUMMARY

1. This study has documented the status of water quality at 13 sampling stations located throughout the Steel Creek corridor, marsh, swamp, and channel. Water quality data were collected at all stations on a monthly basis from November 1985 to December 1989. Changes to the original scope-of-work were implemented in January 1990 which included reducing the number of stations (retaining only four of the original 13 sites, namely 290, 330, 350, and 370), changing the sampling frequency for most parameters from a monthly to a quarterly schedule, and eliminating the monitoring of dissolved metals. This report presents data for those water quality parameters collected from November 1985 through December 1990.
2. Flow velocity in the Steel Creek system was positively related to the volume of discharge at the L-Lake Dam, which varied with the status of L-Reactor operations. This relationship was strongest at Station 275, which was located immediately below the L-Lake Dam, but was also very evident at the other corridor and channel stations. Peak flows occurred during the years 1985 to 1988 when L-Reactor was in operation.
3. During at least part of this study, downstream gradients (either for yearly means or individual values) were observed between corridor Stations 275 and 290 for temperature, dissolved oxygen, pH, total organic and inorganic carbon, ortho- and total phosphorus, nitrite-nitrogen, nitrate-nitrogen, and ammonia-nitrogen, total inorganic nitrogen, silica, total aluminum, total and dissolved iron, total and dissolved sodium,

chloride, total and dissolved magnesium, total and dissolved potassium, and total and dissolved calcium. These differences were attributed to natural conditions such as cooling, outgassing, metabolic activity of stream organisms, or chemical reactions.

4. Differences (either for yearly means or individual values) between the swamp and marsh stations were noted during at least a portion of this study for temperature, ortho- and total phosphorus, nitrate-nitrogen, total inorganic nitrogen, total and dissolved sodium, and sulfate. However, no consistent differences were evident. Such variation would not be unexpected between stations located in different habitat types.
5. Inspection of pre- and post-impoundment data for the years 1985 to 1989 (see Chimney and Westbury 1990) indicated that increases in temperature, conductivity, total phosphorus, nitrate-nitrogen, ammonia-nitrogen, total sodium, dissolved sodium, and chloride, and decreases in pH have occurred relative to pre-impoundment conditions documented during the CCW study. These changes reflected differences between water being released from L Lake (which was dominated by Savannah River water) and the natural drainage of the Steel Creek basin, but were not thought to be limiting to the establishment and/or maintenance of a balanced biological community in Steel Creek.
6. A strong correspondence in the pattern of long-term variation for certain water quality parameters (e.g., alkalinity, total aluminum, total calcium, total sodium, chloride and sulfate) was observed between the pelagic zone

of L-Lake and the Steel Creek corridor stations. There was less similarity between L-Lake and conditions monitored in the Steel Creek swamp and marsh. It was expected that L-Lake discharge would dominate the water quality in the Steel Creek corridor.

7. Many water quality variables were markedly different at Station 300 relative to the other swamp and marsh sites during the summers of 1986, 1987, and 1988 (i.e., higher levels at Station 300 for conductivity, total dissolved solids, total inorganic carbon, alkalinity, ammonia-nitrogen, total and dissolved calcium, total iron, total and dissolved magnesium, total and dissolved manganese, and total and dissolved potassium; and lower concentrations at Station 300 for ortho-phosphorus and sulfate). Coincidentally, the abundance of macrophytes at Station 300 greatly reduced flow velocities at these times; channels through this site were completely closed by the end of summer in all years. Reduced flow velocities at Station 300 were thought to have impeded water exchange with the rest of the swamp and marsh which, in turn, may have contributed to the observed differences in water chemistry. Water quality differences between Station 300 and the swamp and marsh sites, while still evident for a number of variables during the summer of 1989, were much reduced compared to previous years.
8. Steel Creek water quality during this study was found to be similar to the range of values reported for other regional lotic systems and judged to be typical of southeastern surface waters in general.

1.0 INTRODUCTION

The array of physical and chemical characteristics that determine the suitability of water for some specified purpose is referred to as water quality (McKee and Wolf 1963). Surface-water characteristics in systems such as creeks and riverine swamps are dictated primarily by the interaction of local and regional drainages and secondarily by the activities of the local biota (Hynes 1970). Water quality plays a crucial role in regulating both the structure (i.e., species composition) and function (e.g., productivity, respiration, reproduction) of freshwater communities (Odum 1971; Wetzel 1983). The anticipated effects on water quality in the Steel Creek ecosystem from the start-up and operation of L-Reactor and the impoundment of L Lake include:

1. the introduction of Savannah River water, with higher alkalinity, nutrients, and dissolved solids, into the Steel Creek drainage;
2. at least initial increases in suspended solids dislodged by increased flows;
3. the introduction of reservoir plankton into the lotic system; and
4. temperature changes that will depend upon both the depth at which water is released from the L-Lake dam and the changes in residence time of water in the swamp and marsh areas.

The objectives of this portion of the L-Lake/Steel Creek Biological Monitoring Program are to document the current status of water quality in the Steel Creek system, assess the overall impact of L-Lake operation on Steel Creek water quality, determine whether ecologically important alterations in the water quality of Steel Creek have occurred, and compare Steel Creek water quality with other southeastern lotic systems. The data presented in this report cover the period November 1985 through December 1991.

2.0 METHODS AND MATERIALS

2.1 FIELD PROCEDURES

Water quality data were collected from 13 sampling stations in the Steel Creek corridor, marsh, swamp, and channel (Figure 2-1) on a monthly basis from November 1985 to December 1989. Field and laboratory methods employed during this period have been detailed in Chimney and Westbury (1990). Changes to the original scope-of-work were implemented in January 1990 which included reducing the number of sampling stations, altering the sampling frequency, and eliminating the measurement of a number of dissolved materials. Steel Creek water quality data for 1990 and 1991 were compiled from the following sampling plans:

1. Sampling Plan #1

- a. Stream velocity (m/sec), temperature ($^{\circ}\text{C}$), dissolved oxygen (mg/L), pH (standard units), and conductivity ($\mu\text{S}/\text{cm}$) were measured in situ on a weekly basis at Station 275 (Figure 2-1) using a Hydrolab Surveyor II water quality analyzer, or similar meters, and a Marsh McBirney Model 201D remote-reading flowmeter. Also, water samples were collected by hand from a depth of 0.1 m and analyzed for ammonia-nitrogen ($\mu\text{g N/L}$). Stream velocity was measured at the center of the channel from a depth equivalent to 0.6 of the total stream depth;

Figure 2-1. Location of Steel Creek water quality sampling stations. Only the stations enclosed in boxes were sampled in 1990 and 1991.

- b. On one date in both February and August, a series of diel temperature, dissolved oxygen, and pH measurements was made at Stations 290, 330, 350, and 370 (Figure 2-1) at 10 time intervals equally spaced over a 24-hour period.

2. Sampling Plan #2

- a. Unreplicated water samples were collected by hand at a depth of 0.1 m from Stations 290, 330, 350, and 370 on a quarterly basis (February, May, August, and December) and analyzed for solids (total dissolved solids [mg/L] and total suspended solids [mg/L]) and macronutrients (nitrite-nitrogen [$\mu\text{g N/L}$], nitrate-nitrogen [$\mu\text{g N/L}$], ammonia-nitrogen [$\mu\text{g N/L}$], total Kjeldahl nitrogen [$\mu\text{g N/L}$], total phosphorus [$\mu\text{g P/L}$], and ortho-phosphorus [$\mu\text{g P/L}$]);
- b. In February and August, a series of water samples was collected from these stations on a diel basis at 10 time intervals equally spaced over a 24 hour period and analyzed for total dissolved solids, total suspended solids, total Kjeldahl nitrogen, and total phosphorus.

3. Sampling Plan #3

- a. Unreplicated water samples were collected by hand from a depth of 0.1 m at Stations 290, 330, 350, and 370 on a quarterly basis (February, May, August, and December) and analyzed for carbon (total organic carbon [mg C/L], dissolved organic carbon [mg C/L], total inorganic carbon [mg C/L], and alkalinity [mg CaCO_3/L]), cations (total aluminum [$\mu\text{g/L}$], total calcium [mg/L], total iron [$\mu\text{g/L}$], total magnesium [mg/L], total manganese [$\mu\text{g/L}$], total potassium

[mg/L], and total sodium [mg/L]), and anions (chloride [mg/L], hydrogen sulfide [mg H₂S/L], and sulfate [mg SO₄/L];

- b. In February and August, a series of water samples were collected from these stations on a diel basis at 10 time intervals equally spaced over a 24-hour period and analyzed for total organic carbon, dissolved organic carbon, total inorganic carbon, total iron, and total magnesium.

Field sampling for Plans #2 and #3 was always conducted simultaneously. Where possible, field sampling for Plan #1 was concurrent with Plans #2 and #3. Sampling dates for the entire study (1985 to 1991) are presented in Table 2-1. All water quality samples were collected and stored in acid-washed polyethylene bottles, placed on ice in a light-tight cooler upon collection, and returned to the laboratory for analysis.

2.2 LABORATORY PROCEDURES

The water quality variables measured and associated analytical methods, references, instrumentation, and detection limits are summarized in Table 2-2. Note that instrumentation has changed for some procedures during the course of this study. NAI has verified the accuracy of results by comparing the performance of old and new instruments in analyzing common samples. Details of these efforts have been provided in previous reports (see Chimney and Westbury 1990). For the analysis of dissolved materials, an aliquot from each sample was initially filtered through a 0.45- μ m Gelman GN6 Metrical membrane filter to remove all particulate material. All water samples were stored in a dark, locked cooler at 4°C until processed. Chain-of-custody procedures, sample holding

Table 2-1. Sampling dates for Steel Creek water quality. November 1985 - December 1991.

1985

November 4
December 10

1986

January 20
February 17
March 17
April 21
May 19
June 16
July 23
August 18
September 22
October 20
November 17
December 15

1987

January 19
February 16
March 16
April 20
May 18
June 15
July 20
August 17
September 14
October 19
November 2
December 14

1988

January 18
February 22
March 21
April 18
May 16
June 20
July 18
August 15
September 19
October 17
November 21
December 19

1989

January 16
February 21
March 20
April 17
May 22
June 19
July 24
August 21
September 18
October 23
November 20
December 18

1990 Weekly Sampling Program #1

January 9, 15, 22, 29
February 5, 12, 21, 28
March 7, 14, 21, 28
April 4, 11, 18, 25
May 2, 9, 16, 23, 30
June 6, 13, 18, 27
July 2, 11, 16, 25
August 1, 8, 15, 22, 29
September 5, 12, 19, 26
October 3, 10, 17, 24, 31
November 7, 14, 20, 28
December 5, 12, 19, 26

Table 2-1 (continued). Sampling dates for Steel Creek water quality.
November 1985 - December 1991.

1990 Quarterly Sampling Programs #2 and #3

February 27
May 22
August 21
December 27

1990 Biannual Diel Sampling Programs #1, #2, and #3

February 27-28
August 21-22

1991 Weekly Sampling Program #1

January 2, 9, 16, 23, 30
February 6, 13, 20, 27
March 6, 13, 20, 27
April 3, 10, 17, 24
May 1, 8, 15, 22, 29
June 5, 12, 19, 26
July 3, 10, 17, 24, 31
August 7, 14, 21, 28
September 4, 11, 18, 25
October 2, 9, 16, 23, 30
November 6, 13, 20, 27
December 4, 11, 18, 26

1991 Quarterly Sampling Programs #2 and #3

February 19
May 20
August 20
November 19

1991 Biannual Diel Sampling Programs #1, #2, and #3

February 19
August 20

Table 2-2. Variables measured and methods, references, instrumentation, and detection limits for analysis of Steel Creek water quality. November 1985 - December 1991.

Parameter	Method	Reference	Instrument	Detection Limit
Alkalinity	potentiometric, automatic titration	EPA ^a , 310.1	Fisher computer-aided titrimeter	1 mg CaCO ₃ /L
Carbon TOC DOC TIC	combustion, infrared absorption	EPA, 415.1 EPA, 415.1 APHA ^b 505A	Beckman 915A TOC analyzer Dohrmann DC-80 ^c	1 mg C/L 1 mg C/L 1 mg C/L
Chloride	colorimetric, automated ferricyanide	EPA, 325.2 same	Technicon AA II Technicon TRAACS 800 ^d	0.5 mg/L 0.5 mg/L
Conductivity	Wheatstone bridge	EPA, 120.1	Cole-Palmer 1481-50 or Hydrolab	1 µS/cm
Dissolved oxygen	membrane electrode	EPA, 360.1	Hydrolab or YSI 58 O ₂ meter	0.1 mg/L
Hydrogen sulfide	colorimetric methylene blue	APHA 427C (modified)	Bausch and Lomb Spectronic 1001	0.1 mg/H ₂ S/L

^aEPA 1983.

^bAPHA 1985.

^cBegan use in June 1990.

^dBegan February 12, 1987.

Table 2-2 (continued). Variables measured and methods, references, instrumentation, and detection limits for analysis of Steel Creek water quality. November 1985 - December 1991.

Parameter	Method	Reference	Instrument	Detection Limit
Metals ^a	flame atomic absorption		IL 251 AA/AE spectrophotometer	0.1 mg/L
Al		EPA, 202.1		0.02 mg/L
Ca		EPA, 215.1		0.02 mg/L
Fe		EPA, 236.1		0.02 mg/L
K		EPA, 258.1		0.05 mg/L
Na		EPA, 273.1		0.01 mg/L
Mg		EPA, 242.1		
Mn	furnace atomic absorption	EPA, 243.2	Perkin Elmer Zeeman 500 AA spectrophotometer	0.002 mg/L
Mn	flame atomic absorption	EPA, 243.1	IL 251 AA/AE spectrophotometer	0.02 mg/L
Metals ^f	inductively coupled plasma		Perkin Elmer plasma II emission spectrophotometer	0.05 mg/L
Al		EPA, 200.7		0.01 mg/L
Ca		EPA, 200.7		0.02 mg/L
Fe		EPA, 200.7		0.2 mg/L
K		EPA, 200.7		0.05 mg/L
Na		EPA, 200.7		0.02 mg/L
Mg		EPA, 200.7		0.01 mg/L
Mn		EPA, 200.7		

^aNovember 1985 - February 1987.

^fMarch 1987 - December 1991.

Table 2-2 (continued). Variables measured and methods, references, instrumentation, and detection limits for analysis of Steel Creek water quality. November 1985 - December 1991.

Parameter	Method	Reference	Instrument	Detection Limit
Nitrogen NO ₂	colorimetric	EPA, 353.2 EPA, 353.1 ⁹	Technicon AA II Technicon TRAACS 800	0.001 mg N/L
Nitrogen NO ₃	colorimetric	EPA, 353.2 EPA, 353.1 ⁹	Technicon AA II Technicon TRAACS 800	0.01 mg N/L
Nitrogen NH ₄	colorimetric automated phenate	EPA, 350.1	Technicon AA II	0.01 mg N/L
Nitrogen total Kjeldahl	potentiometric ion selective electrode	EPA, 351.4	Orion 701A pH meter	0.1 mg N/L
pH	glass electrode	SM, 402	Orion 701A pH meter or Hydrolab	0.1 pH units
Phosphorus total ortho	colorimetric ascorbic acid, single reagent	EPA, 365.2 EPA, 365.2	Baush and Lomb Spectronic 1001	0.005 mg P/L 0.005 mg P/L

⁹Begun January 11, 1990.

Table 2-2 (continued). Variables measured and methods, references, instrumentation, and detection limits for analysis of Steel Creek water quality. November 1985 - December 1991.

Parameter	Method	Reference	Instrument	Detection Limit
Sulfate	turbidimetric	EPA, 375.4	Hitachi 100-60 UV-VIS spectro- photometer	1 mg SO ₄ /L
Temperature	thermistor thermometer		YSI 58 O ₂ meter or Hydrolab	0.1°C
Total dis- solved solids	gravimetric, dried @ 180°C	EPA, 160.1	Mettler AE 163 microbalance	1 mg/L
Total sus- pended solids	glass fiber filtration gravimetric, dried @ 103-105°C	EPA, 160.2	Mettler AE 163 microbalance	1 mg/L

times, and analytical methods used by NAI are currently approved by EPA and/or South Carolina DHEC.

2.3 DATA PRESENTATION AND ANALYSES

Changes to the scope-of-work implemented in January 1990 necessitated altering the report format for the 1990 and 1991 data from that used in previous reports (i.e., the water quality parameters presented, inclusion of tables and figures, etc.; see Chimney and Westbury 1990). This report presents data collected from November 1985 through December 1991 for those water quality parameters sampled under the new scope-of-work. Tables and figures from previous reports containing appropriate 1985-1989 data are presented along with the 1990 and 1991 data. Only limited comparisons can be made between data collected from 1985/86 to 1989 (monthly sampling) with those from 1990 and 1991 (weekly or quarterly sampling) due to the differences in sampling frequency, locations, and parameters measured. For example, it was difficult (and sometimes impossible) to ascertain if 1990 and 1991 water quality parameters conformed to seasonal trends observed in previous years. It was also difficult to draw meaningful comparisons between descriptive statistics with different sample sizes.

In previous reports (see Chimney and Westbury 1990), sampling stations were grouped into two major categories: those upstream of the Steel Creek swamp/marsh (Stations 275, 280, 285, 290, and 400) and those located in the swamp/marsh and the channel that drains them (Stations 300, 310, 320, 330, 340, 350, 360, and 370 [Figure 2-1]). Stations 300, 310, 320, and 330 were located in the open-canopy marsh and subject to direct insolation; Stations 340 and 350 were located in the closed-canopy swamp and well-shaded during much of the year; and Stations 360 and 370 were located in the stream channel that drained both the swamp and marsh.

Detailed descriptions of the vegetation cover and other habitat characteristics of these areas are presented in Hooker (1989) and Breiner (1989). The 1990 scope-of-work retained only a single sampling station in the corridor (Station 290), marsh (Station 330), swamp (Station 350), and channel (Station 370) respectively. In addition, weekly measurement of some water quality parameters was conducted at Station 275 (corridor).

The detection limits for water quality variables given in Table 2-2 represent the minimum level of accuracy that could be reliably attained with each analytical technique. These limits were determined through in-house quality control procedures and/or from the literature (APHA 1985; ASTM 1984; EPA 1983). Results from determinations that fell below the detection limit were entered into the data base unaltered. This was done to facilitate plotting the raw data and to avoid potential statistical problems associated with analyzing highly censored data sets. All descriptive statistics in this report have been rounded to the accuracy of the respective detection limit, and the detection limit, if applicable, has been specified in figure legends. Individual statistics that fell below the detection limit have been reported as "< N," where N is the detection limit. Where the detection limit has changed during the course of this study (e.g., see metals Table 2-2) the most conservative limit has been used in reporting the data. All conductivity values were adjusted to 25°C before they were entered into the data base.

All statistics for Steel Creek water quality data were calculated using SAS (SAS 1985a, 1985b for the 1985-1989 data and SAS 1988a, 1988b for the 1990 and 1991 data), with reference made to Elliott (1971), Green (1979), Sokal and Rohlf (1981), and Steel and Torrie (1960). Data for each year from the monthly and

quarterly sampling programs have been summarized by standard descriptive statistical procedures: the annual mean, median (Med), number of observations (N), standard deviation (SD), coefficient of variation (CV), maximum value (Max), and minimum value (Min) for each station are calculated for the 1985-1989 data and the annual mean, number of observations, standard error (SE), maximum value, and minimum value are reported for the 1990 and 1991 data. Data collected from November 1985 through December 1986 have been treated as the same "year," and designated as "1985/86." Descriptive statistics were calculated by pooling all observations for a station over the entire sampling period (i.e., January to December).

Differences among stations for the water quality parameters monitored in the 1990 and 1991 biannual diel sampling program were compared statistically using Friedman's two-way analysis by ranks test, a non-parametric unreplicated ANOVA method (Elliott 1971; Sokal and Rohlf 1981). Mean values for each water quality parameter (temperature, dissolved oxygen, pH, total dissolved solids, total suspended solids, Kjeldahl nitrogen, total phosphorus, total organic carbon, dissolved carbon, total inorganic carbon, total iron, and total magnesium) were computed within stations and sampling dates. Stations were then ranked based on their mean value for each parameter and separate two-way comparisons of main effect differences (station and date) were made using PROC GLM and the rank scores (SAS 1988b). This analysis assumes that no station-date interactions exist within the data. Measurements from sampling periods 9 and 10 in August 1990 were discarded from the analysis because heavy runoff from a severe thunderstorm was suspected of having influenced the water quality at some stations.

3.0 RESULTS AND DISCUSSION

3.1 SAMPLING PLAN #1

3.1.1 Stream Flow Velocity

The velocity with which water flows through any portion of a stream channel varies with depth and proximity to the streambank and is highly influenced by longitudinal changes in channel morphology (i.e., cross-sectional area and sinuosity), streambed slope, roughness of the bottom, and volume of water being discharged (Hynes 1970). Stream velocities (m/sec) in Steel Creek are presented in Figures 3-1 and 3-2. Velocity measurements from 1985 to 1989 were made in conjunction with several NAI sampling programs and intended only to document conditions at the time of sample collection. As such, some inter- and intra-station variability in Figure 3-1 can be attributed to variation in measurement location within the channel (note that the protocol for velocity measurements at Station 275 in 1990 and 1991 was standardized as detailed in Section 2.1). Nevertheless, these data are useful in illustrating the general pattern of flow velocity throughout Steel Creek.

From 1985 through 1989, stream velocities were generally higher at corridor and channel stations (up to 1.6 m/sec), where flow was confined to a relatively small, well-defined channel, than in the swamp or marsh (Figure 3-1). Changes in velocity were related to L-Reactor operation and associated pumping into L Lake, which had a direct impact on the outflow volume at the dam (see Chimney and Westbury 1990; Figure 3-1). This relationship was most evident in the corridor (especially at Station 275), which experienced the largest overall variation in velocity and, to a lesser extent, in the channel. Reduced pumping into L Lake during the summer shutdowns of L-Reactor in 1986 and 1987 (July to October) and

Figure 3-1. Stream flow velocities (m/sec) at representative Steel Creek water quality sampling stations. November 1985 - December 1989.

Figure 3-2. Stream flow velocities (m/sec) at Steel Creek water quality Station 275. January 1990-December 1991.

the prolonged shutdown in 1988 and 1989 resulted in decreased flow velocities at a number of stations; velocities during this period did not exceed 0.8 m/sec.

Weekly flow velocity data collected at Station 275 during 1990 and 1991 are presented in Appendix Table 1 and descriptive statistics for 1990 and 1991 in Appendix Table 2. L-Reactor remained shut down throughout 1991. Flow velocities at Station 275 during this period exceeded 0.8 m/sec on only three occasions (Figure 3-2) in 1990 and were comparable to measurements made in 1989 and the last half of 1988 at this station (Figure 3-1). In 1991, flow velocities at Station 275 exceeded 0.8 m/sec on ten occasions (Figure 3-2). In general, flow velocities from March through August 1991 exceeded 1990 values for the same period by 0.2-0.3 m/sec. These somewhat higher velocities were comparable to velocities observed in the first half of 1988 and prior to that period.

3.1.2 Temperature

Weekly temperature data collected at Station 275 during 1990 and 1991 are presented in Appendix Table 1. Inspection of annual descriptive statistics for temperature from all stations from 1985/86 to 1989 (Appendix Table 4) indicated that (1) a consistent downstream decrease in mean temperature (1.3 to 2.0°C) existed between Stations 275 and 290, (2) mean temperatures in the corridor were generally higher than those in the swamp, marsh, or channel, (3) no consistent differences in mean temperatures between open-canopy marsh and closed-canopy swamp stations could be detected, and (4) the mean and minimum/maximum values at each station were similar among years. The 1991 mean (19.5°C), minimum (10.3°C), and maximum (28.1°C) temperatures at Station 275 (Appendix Table 4) were similar to values recorded at this location in previous years.

From 1985 to 1989, temperatures at corridor stations ranged between 7 and 30°C (Figure 3-3) and exhibited a pronounced seasonal cycle. Variation in weekly temperatures of a comparable magnitude was also noted at Station 275 in 1990 and 1991 (Figure 3-4). The lowest temperatures occurred from December to February and the highest temperatures from June to August in each year. In general, warmer L-Lake water cooled as it traveled downstream and there was a consistent decrease in temperature (ca. 1 - 2°C) between Stations 275 and 290 on most sampling dates. In a stream reach such as Steel Creek, the small volume of water relative to the surface area in contact with the atmosphere, coupled with turbulent mixing, would allow for a rapid equilibration of water temperature to prevailing ambient conditions (Petts 1985). Noticeably cooler temperatures in Meyer's Branch were attributed to the fact that this stream had a closed, overstory canopy which shaded it from direct insolation and that it did not receive warm L-Lake water; temperatures in Meyer's Branch generally ranged between 5 and 27°C.

Temperature variation throughout the swamp, marsh, and channel from 1985 to 1989 also exhibited a pronounced seasonal cycle; most values ranged between 9 and 27°C (Figure 3-3). As observed in the corridor stations, minimum temperatures in the swamp, marsh, and channel occurred in the winter and maximum values in the summer. There were no consistent open/closed-canopy differences, although at times, open-canopy stations were 1 to 2°C warmer than closed-canopy stations. This can be attributed, in part, to increased insolation received at the open-canopy stations.

Results of the biannual diel temperature surveys during 1990 and 1991 at Stations 290, 330, 350 and 370 are presented in Appendix Table 3. Results from

Figure 3-3. Temperature ($^{\circ}\text{C}$) at representative Steel Creek water quality sampling stations. November 1985 - December 1989. Top panel: Stations 275-290, 400; bottom panel: Stations 300-370.

Figure 3-4. Temperature (°C) at Steel Creek water quality Station 275. January 1990-December 1991.

1991 show diel temperature variation ranged from 0.7°C at Stations 350 and 370 in August to 4.4°C at Station 370 in February (values derived from data in Appendix Table 3). The largest observed diel temperature variations occurred during the February sampling event at the swamp marsh and channel stations. Observed diel temperature variations during the August 1991 sampling event were, in general, smaller than those observed in February; the highest variation on that sampling date was at Station 290 (ca 3.2°C) in the Steel Creek Corridor. Diel temperature variation results from 1990 were similar to 1991 in magnitude; however, the greatest temperature variation was observed during the August event in 1990. Results of these diel surveys are highly dependent on weather conditions at the time of sampling and should, therefore, be interpreted with caution.

3.1.3 Dissolved Oxygen

Weekly dissolved oxygen (DO) measurements recorded at Station 275 during 1990 and 1991 are presented in Appendix Table 1. Inspection of annual descriptive statistics for DO from 1985/86 to 1989 (Appendix Table 5) indicated that (1) a small, consistent downstream decrease in mean DO (ca. 1 mg/L) levels existed between Stations 275 and 290 in 1985/86, 1987, 1988 and 1989, (2) mean DO concentrations in the corridor were generally higher than those in the swamp, marsh, or channel, (3) no consistent differences in the mean DO concentrations between open- and closed-canopy stations could be detected, and (4) the mean and minimum/maximum DO values at each station were similar among years. The 1991 mean (9.4 mg/L) and the minimum (7.3 mg/L) DO concentrations at Station 275 were slightly higher than values from previous years at this station. The maximum DO concentration at Station 275 was similar to values from previous years.

The pattern of temporal variation in Steel Creek DO concentrations from 1985 to 1989 (Figure 3-5) was the opposite of that noted for temperature (Figure 3-3); DO levels were generally highest from December through March (ca. 9 to 12 mg/L), when temperatures were lowest, and lowest from June to September (ca. 2 to 6 mg/L), when temperatures were highest. To some extent, the seasonal DO cycle is a function of water temperature. The solubility of oxygen in freshwater is inversely proportional to temperature; i.e., cold water can hold more oxygen than warm water (Mortimer 1981; Wetzel 1983). However, of equal or greater importance in many lotic ecosystems is the effect that temperature has on community metabolism; i.e., higher metabolic rates at elevated temperatures can remove DO from the water faster than it can be replaced from the atmosphere or from photosynthesis (Hynes 1970). DO levels in the corridor and Meyer's Branch were generally above 5.0 mg/L throughout this study. However, DO at the marsh and swamp stations often fell considerably below 5.0 mg/L during the summer months. The 1991 DO levels at Station 275 (Figure 3-6) were comparable to those in 1985/86 through 1989. Concentrations in 1991 were similar to those observed in 1990 except that concentrations in the fall of 1990 did not increase to the high levels observed in previous years.

Results of the biannual diel dissolved oxygen surveys at Stations 290, 330, 350 and 370 during 1990 and 1991 are presented in Appendix Table 3. Results from 1991 exhibit a diel variation in DO concentrations ranging from 0.3 mg/L at Station 330 in August to 4.5 mg/L at Station 350 in February (values derived from data in Appendix Table 3). The largest observed diel DO variations occurred during the February 1991 survey at the swamp and marsh stations. Observed diel DO variations during the August survey were smaller than those observed in February; the largest variation on that sampling date was observed at Station 290

Figure 3-5. Dissolved oxygen (mg/L) at representative Steel Creek water quality sampling stations. November 1985 - December 1989. Top panel: Stations 275-290, 400; bottom panel: Stations 300-370.

Figure 3-6. Dissolved oxygen at Steel Creek water quality Station 275. January 1990-December 1991.

(ca 2.3 mg/L) in the Steel Creek Corridor. Diel DO variation in February 1990 was somewhat smaller than that observed in February 1991. In the August surveys, diel DO variation was greater in 1990 than 1991. Results of the diel DO surveys are highly dependent on weather conditions at the time of sampling and should therefore be interpreted with caution.

3.1.4 pH

Weekly pH measurements recorded at Station 275 during 1990 and 1991 are presented in Appendix Table 1. Inspection of annual descriptive statistics for pH from 1985/86 to 1989 (Appendix Table 6) indicated that (1) a small, consistent downstream decrease in mean pH values (0.1 to 0.9 units) occurred between Stations 275 and 290, (2) mean pH values in the corridor were generally 0.1 to 0.3 units higher than those at the other stations, (3) there were no consistent differences in mean pH between open- and closed- canopy stations, and (4) the mean and minimum/maximum pH values at each station were similar among years. The 1991 mean (6.3), minimum (5.6), and maximum (7.2) pH values at Station 275 were comparable to values observed at this station in previous years.

Temporal variation in pH at corridor stations did not appear to be associated with a consistent seasonal pattern; most values ranged between 5.7 and 7.0 units (Figures 3-7 and 3-8). pH did tend to decrease downstream between Stations 275 and 290, but this trend was more pronounced in 1985/86 than in 1987, 1988, or 1989. The maximum difference in pH between stations on any given sampling date was usually ca. 0.5 to 1.0 units, but was as large as 2.9 units in June 1986. Changes in pH in Meyer's Branch closely paralleled those at the corridor stations. This suggested that variability in pH at the corridor

Figure 3-7. pH at representative Steel Creek water quality sampling stations. November 1985 - December 1989. Top panel: Stations 275-290, 400; bottom panel: Stations 300-370.

Figure 3-8. pH at Steel Creek water quality Station 275. January 1990-December 1991.

stations was influenced by factors other than L-Reactor operation and its impact on Steel Creek water quality.

There were no distinct seasonal trends detected for pH in the swamp, marsh, or channel from 1985 to 1989 (Figure 3-7). pH usually ranged between 5.7 and 6.8 units. The maximum difference among stations on any given date was generally on the order of 0.1 to 1.0 units. Station 300 exhibited the largest variation of any of these stations; its pH values ranged between 4.8 and 7.3 units. However, no consistent open/closed-canopy differences among the other stations were obvious.

Results of the biannual diel pH surveys at Stations 290, 330, 350 and 370 during 1990 and 1991 are presented in Appendix Table 3. Results from 1991 show a diel pH variation ranging from 0.8 units at Station 330 to 1.4 units at Station 290 in August (values derived from data in Appendix Table 3). There was no consistent pattern of pH variation by station or sampling date. Similar results were observed during the 1990 diel surveys.

3.1.5 Conductivity

Weekly conductivity measurements at Station 275 during 1990 and 1991 are presented in Appendix Table 1. Inspection of annual descriptive statistics for conductivity from 1985/86 to 1989 (Appendix Table 7) indicated that (1) a small, consistent downstream decrease in mean conductivity (3 to 7 $\mu\text{S}/\text{cm}$) between Stations 275 and 290 occurred in 1987, 1988, and 1989 but not in 1985/86, (2) there were no consistent differences in mean conductivity among corridor, swamp, marsh, or channel stations, and (3) mean conductivity at most stations in 1988 and 1989 was about 5 to 10 $\mu\text{S}/\text{cm}$ higher than corresponding values in either 1985/86 or 1987. The 1991 mean (58 $\mu\text{S}/\text{cm}$), minimum (18 $\mu\text{S}/\text{cm}$), and maximum (66

$\mu\text{S}/\text{cm}$) conductivity at Station 275 were approximately 10 to 40 $\mu\text{S}/\text{cm}$ lower than values observed in 1990 and 20 to 60 $\mu\text{S}/\text{cm}$ lower than values observed in previous years.

Conductivity in the Steel Creek corridor generally ranged between 65 and 90 $\mu\text{S}/\text{cm}$ throughout this study (Figures 3-9 and 3-10). However, values rose to between 110 and 130 $\mu\text{S}/\text{cm}$ in September 1988. The range of annual variation in conductivity at each station (except in 1988, and again in 1991) was relatively small (ca. 10 to 20 $\mu\text{S}/\text{cm}$). From 1985 to 1989, the lowest values tended to occur from December to April and the highest values from June to September. This seasonal pattern was not evident at Station 275 in 1990 or 1991. On September 4, 1991, the lowest conductivity value yet recorded (18 $\mu\text{S}/\text{cm}$) was observed at Station 275 immediately downstream of the L-Lake dam. On a number of occasions there was a distinct decrease in conductivity between Stations 275 and 290, although this downstream gradient was not as consistent as that noted for temperature (Figure 3-3). Conductivity at Station 400 was approximately 10 to 20 $\mu\text{S}/\text{cm}$ lower than in Steel Creek throughout this study; most values at this station ranged between 45 and 70 $\mu\text{S}/\text{cm}$, which reflected differences in water quality between the water discharged from L Lake and the natural drainage entering Meyer's Branch. In general, the temporal changes in conductivity in Meyer's Branch paralleled those in the corridor stations.

Conductivity did not appear to vary seasonally in the swamp, marsh, or channel; most values ranged from 65 to 100 $\mu\text{S}/\text{cm}$ (Figure 3-9). Low values (ca. 25 $\mu\text{S}/\text{cm}$) in December 1985 and February 1986, at Station 300, may have been associated with periods of heavy precipitation which temporarily introduced low-conductivity water into the swamp. The large decrease and subsequent

Figure 3-9. Conductivity ($\mu\text{S}/\text{cm}$ @ 25°C) at representative Steel Creek water quality sampling stations. November 1985 - December 1989. Top panel: Stations 275-290, 400; bottom panel Stations 300-370.

Figure 3-10. Conductivity at Steel Creek water quality Station 275. January 1990-December 1991.

recovery of conductivity at most stations from October 1986 through June 1987 was not associated with similar changes in other water quality parameters in the corridor and may have reflected hydrological events that were limited to the swamp and marsh. Station 300 had the highest individual conductivity readings ($>115 \mu\text{S}/\text{cm}$); this site exhibited a distinct summer peak in conductivity, which coincided with periods of low flow velocity in 1985/86, 1987, and 1988 (Chimney and Westbury 1990; Figure 3-1). The isolation of the water mass at Station 300, accompanied by the decomposition of aquatic macrophytes at this time, is assumed to have contributed to the high conductivity measurements. This pattern did not reoccur in 1989.

3.1.6 Ammonia-Nitrogen

Weekly ammonia-nitrogen ($\text{NH}_4\text{-N}$) concentrations at Station 275 during 1990 and 1991 are presented in Appendix Table 1. Inspection of annual descriptive statistics for $\text{NH}_4\text{-N}$ from 1985/86 to 1989 (Appendix Table 8) indicated that (1) an overall, downstream decrease in mean $\text{NH}_4\text{-N}$ values (3 to $94 \mu\text{g N/L}$) existed between Stations 275 and 290, although the highest mean was observed at Station 280 in three of the four years, (2) mean $\text{NH}_4\text{-N}$ concentrations in the corridor were markedly higher than those in the swamp, marsh, or channel in any given year, (3) there were no consistent differences in mean values between open- and closed-canopy stations, and (4) mean and maximum $\text{NH}_4\text{-N}$ levels in the corridor decreased markedly over this entire period. The 1991 mean values in the corridor (39 and $35 \mu\text{g N/L}$) were roughly equivalent to 1990 values and were one-half to one-third the magnitude of 1985/86 values (85 to $115 \mu\text{g N/L}$; Appendix Table 8); the maximum individual concentration in 1991 was larger ($246 \mu\text{g N/L}$) than the maximum observed in 1990 ($120 \mu\text{g N/L}$) and more similar to maximum concentrations

observed prior to 1990. Mean values in 1986 and 1987 were highly influenced by the peak concentrations that occurred during these years (Figure 3-11).

NH₄-N levels in the corridor did not exhibit a distinct seasonal pattern. Most values ranged between the detection limit (10 µg N/L; Table 2-2) and 100 µg N/L (Figures 3-11 and 3-12). There were four periods of high concentrations (>150 µg N/L) which coincided with events in L Lake: November 1986 (fall turnover), May to July 1987 (hypolimnetic release), August to October 1988 (fall turnover and possible release of hypolimnetic water), and October to November 1989 (fall turnover). Except for the peak concentrations noted above, NH₄-N levels in Meyer's Branch were quite similar to those in Steel Creek.

NH₄-N levels in the swamp, marsh, and channel from 1985 to 1989 generally varied between the detection limit (10 µg N/L) and 100 µg N/L (Figure 3-11). NH₄-N at Station 300 was somewhat elevated from September to November 1986 and July to August 1987. These periods coincided with high NH₄-N concentrations in the corridor. NH₄-N levels in the swamp, marsh, and channel in 1991 varied between the detection limit (10 µg N/L) and 46 µg N/L (Appendix Table 8). These concentrations were slightly lower than those observed in 1990 and years prior to 1990.

3.2 SAMPLING PLAN #2 - SOLIDS/MACRONUTRIENTS

3.2.1 Total Dissolved Solids

Quarterly total dissolved solids (TDS) measurements at Stations 290, 330, 350, and 370 during 1990 and 1991 are presented in Appendix Table 9. Mean values were very similar among Steel Creek stations throughout this study (44 to 66 mg/L); no consistent trends between groups of stations could be discerned,

Figure 3-11. Ammonia-nitrogen ($\mu\text{g N/L}$) at representative Steel Creek water quality sampling stations. November 1985 - December 1989. Top panel: Stations 275-290, 400; bottom panel: Stations 300-370. The detection limit was 10 $\mu\text{g N/L}$.

Figure 3-12. Ammonia-nitrogen ($\mu\text{g N/L}$) at Steel Creek water quality Station 275. January 1990-December 1991. The detection limit was $10 \mu\text{g N/L}$. Note the difference in scale from that used in Figure 3-11.

although mean values at all stations increased slightly (by 2 to 11 mg/L) between 1985/86 and 1990 and decreased again by 9 to 13 mg/L in 1991 (Appendix Table 11). Minimum and maximum TDS values at Steel Creek stations in 1991 were similar to those observed in previous years.

TDS at corridor stations generally ranged between 30 and 70 mg/L during this study (Figures 3-13 and 3-14), although they were near the lower end of this range in 1991. There was an indication of a repeated seasonal trend; a July/August concentration pulse occurred in 1987, 1988, and 1989. This trend was present to a lesser degree in 1990 and 1991. No consistent downstream gradient was detected between Stations 275 and 290. TDS at Meyer's Branch was often slightly lower than in Steel Creek (e.g., November 1985 to June 1986, December 1987 to March 1988, February to April 1989), although these differences were usually only ca. 5 to 10 mg/L.

TDS values in the swamp, marsh, and channel generally ranged between 30 and 80 mg/L and exhibited a seasonal cycle (Figures 3-13 and 3-14). Concentrations were lowest from December through April and highest from June to August in all years except 1991. In 1991, TDS concentrations were highest in the spring and summer and lowest in the fall. There were no consistent open/closed-canopy differences, although TDS levels were relatively high at Station 300 compared to the other stations during the summers of 1986 and 1987. These differences were not evident in either 1988 or 1989.

Results of the biannual diel sampling at Stations 290, 330, 350 and 370 for TDS during 1990 and 1991 are presented in Appendix Table 10. Results from 1991 exhibit a diel variation in TDS concentrations ranging from 4 mg/L at Station 350

Figure 3-13. Total dissolved solids (mg/L) at representative Steel Creek water quality sampling stations. November 1985 - December 1989. Top panel: Stations 275-290, 400; bottom panel: Stations 300-370. The detection limit was 1 mg/L.

Figure 3-14. Total dissolved solids (mg/L) at Steel Creek water quality Stations 290, 330, 350, and 370. Winter, Spring, Summer, and Fall 1990 and 1991. The detection limit was 1 mg/L.

in August to 63 mg/L at Station 330 in February (values derived from data in Appendix Table 10). There was no consistent pattern in diel TDS concentrations among stations or between sampling dates. Similar results were obtained for the 1990 diel surveys.

3.2.2 Total Suspended Solids

Quarterly total suspended solids (TSS) measurements from Stations 290, 330, 350, and 370 during 1990 and 1991 are presented in Appendix Table 9. Inspection of annual descriptive statistics for TSS from 1985/86 to 1989 (Appendix Table 12) indicated that (1) there was no consistent downstream difference in mean TSS levels between Stations 275 and 290, (2) mean TSS concentrations in the corridor were generally higher than those at the other Steel Creek stations in 1985/86 and 1987, but not in 1988 nor 1989; the highest corridor values were always at Station 280, (3) mean TSS was often slightly lower at the closed-canopy stations relative to the open-canopy sites, and (4) except for high values in the corridor during 1985/86, the mean and minimum/maximum values at each station were similar among years. Mean, minimum, and maximum TSS levels at Steel Creek stations in 1991 (all were 1 to 4 mg/L; Appendix Table 12) while higher than those reported in 1990, were lower than values in years prior to 1990.

There were several occasions (November/December 1985, May and September 1986, February 1987, July 1988, and February 1989) on which TSS levels at corridor stations were greater than 50 mg/L, which was considerably above normal levels (1 to 10 mg/L; Figures 3-15 and 3-16; the detection limit was 1 mg/L [Table 2-2]). These events may have been related to high TSS levels in L-Lake discharge waters, increased discharge volume from L Lake or storm events which eroded the bank and increased sediment transport, or enhanced bank erosion at a

particular station (e.g., Station 280). TSS did not exceed 4 mg/L in 1991. There was no clear pattern among sampling stations or sampling dates in 1991. TSS levels at Meyer's Branch were quite similar to the baseline values observed in Steel Creek.

As noted in the corridor, most TSS values in the swamp, marsh, and channel ranged from ca. 1 to 10 mg/L throughout this study (Figures 3-15 and 3-16). Pulses in TSS were noted at Station 300 during the summers of 1986 and 1987, but not in 1988 or 1989. Samples were not taken at Station 300 in 1990 or 1991. There were no consistent patterns among stations or seasons during 1991.

Results of the biannual TSS surveys at Stations 290, 330, 350, and 370 during 1990 and 1991 are presented in Appendix Table 10. Results from 1991 exhibit a diel variation in TSS concentrations ranging from 0.0 mg/L at Station 330 to 6.0 mg/L at Station 370 in August (values derived from Appendix Table 10). Diel variation in TSS was roughly equivalent between the two sampling dates in 1991. There was no clear pattern of diel variability among water quality stations during either the February or August sampling dates. Diel survey results in 1990 were similar to 1991; however, much larger diel variability in TSS was noted at Stations 290 and 370 during the August 1990 survey.

3.2.3 Nitrite-Nitrogen

The presence of nitrite-nitrogen ($\text{NO}_2\text{-N}$) in significant quantities in effluent waters is often regarded as an indication of pollution (Sawyer and McCarty 1967). However, $\text{NO}_2\text{-N}$ can exist in minute quantities in unpolluted freshwaters, where it is the product of natural decomposition of organic matter and/or reduction of nitrate-nitrogen by algae and bacteria (Hutchinson 1957).

Figure 3-15. Total suspended solids (mg/L) at representative Steel Creek water quality sampling stations. November 1985 - December 1989. Top panel: Stations 275-290, 400; bottom panel: Stations 300-370. The detection limit was 1 mg/L.

Figure 3-16. Total suspended solids at Steel Creek water quality Stations 290, 330, 350, and 370. Winter, Spring, Summer, and Fall 1990 and 1991. Note that TSS concentrations Stations 330, 350, and 370 in the fall of 1990 were 0.0 mg/L.

Quarterly $\text{NO}_2\text{-N}$ measurements at Stations 290, 330, 350, and 370 during 1990 and 1991 are presented in Appendix Table 9. Inspection of annual descriptive statistics for $\text{NO}_2\text{-N}$ from 1985/86 to 1989 (Appendix Table 13) indicated that (1) a downstream increase in mean concentrations (2 to 13 $\mu\text{g N/L}$) between Stations 275 and 290 was observed in 1987, 1988, and 1989 but the highest mean value always occurred at either Station 290 or 285, (2) mean values at corridor stations were somewhat higher than those recorded throughout the swamp, marsh, or channel in each year, and (3) the means and ranges of values at each station were generally comparable among years; higher mean and maximum values in 1987 reflected the concentration pulse that occurred in the summer of this year (Figure 3-17). No differences in mean values existed among stations in 1991. Maximum concentrations in the corridor during 1991 were not higher than those in the swamp, marsh, or channel (Appendix Table 13). Examination of 1990 data yielded the same conclusions.

Temporal variation in $\text{NO}_2\text{-N}$ levels in the corridor did not exhibit a consistent seasonal pattern. Most values ranged between the detection limit (1 $\mu\text{g N/L}$; Table 2-2) and 20 $\mu\text{g N/L}$ (Figures 3-17 and 3-18). There were several periods of higher $\text{NO}_2\text{-N}$ concentrations which coincided with specific events in L Lake: November/December 1985 (initial flooding of L-Lake basin), November/December 1986 (fall turnover and possible bottom release from L Lake), May to July 1987 (hypolimnetic discharge water from L Lake), and September to November 1989 (fall turnover). There was no clear seasonal pattern in the corridor in 1991. $\text{NO}_2\text{-N}$ concentrations in Meyer's Branch displayed little seasonal variation; values generally ranged between 1 and 3 $\mu\text{g N/L}$. Samples were not taken in Meyer's Branch in 1990 and 1991.

Figure 3-17. Nitrite-nitrogen ($\mu\text{g N/L}$) at representative Steel Creek water quality sampling stations. November 1985 - December 1989. Top panel: Stations 275-290, 400; bottom panel: Stations 300-370. The detection limit was $1 \mu\text{g N/L}$.

Figure 3-18. Nitrite-nitrogen ($\mu\text{g N/L}$) at Steel Creek water quality Stations 290, 330, 350, and 370. Winter, Spring, Summer, and Fall 1990 and 1991. The detection limit was $1 \mu\text{g N/L}$. Note the difference in scale from that used in Figure 3-17.

NO₂-N levels throughout the swamp, marsh, and channel ranged from the detection limit (1 µg N/L) to 10 µg N/L (Figures 3-17 and 3-18). The NO₂-N concentration pulses observed in the corridor from May to July 1987 and September to November 1989 were reflected in slightly elevated NO₂-N concentrations in the swamp and marsh, although on a much smaller scale than observed in the corridor. Values in 1991 were always less than 4 µg N/L (Figure 3-18) and, as such, slightly lower than 1990 and years prior to 1990.

3.2.4 Nitrate-Nitrogen

Quarterly nitrate-nitrogen (NO₃-N) concentrations at Stations 290, 330, 350, and 370 during 1990 and 1991 are presented in Appendix Table 9. Inspection of annual descriptive statistics for NO₃-N from 1985/86 to 1989 (Appendix Table 14) indicated that (1) mean NO₃-N values exhibited a consistent downstream increase (63 to 110 µg N/L) between Stations 275 and 290, (2) higher mean NO₃-N levels at open-canopy marsh stations relative to the closed-canopy swamp stations were observed in 1985/86, 1987, and 1988 (generally at least 20 µg N/L difference) but not in 1989, and (3) the means and range of values at corridor and swamp stations in 1989 were comparable to those observed in 1985/86, 1987, and 1988, while means for marsh and channel stations in 1989 were lower than in previous years. Mean and minimum concentrations in 1991 were among the highest values recorded during this study, but were slightly lower than those observed in 1990 (Appendix Table 14).

Temporal fluctuations in NO₃-N levels at corridor stations were probably related more to events in L Lake than to seasonal factors within the corridor itself. Most values ranged between the detection limit (10 µg N/L; Table 2-2) and 200 µg N/L (Figures 3-19 and 3-20). Distinct concentration pulses occurred

Figure 3-19. Nitrate-nitrogen ($\mu\text{g N/L}$) at representative Steel Creek water quality sampling stations. November 1985 - December 1989. Top panel: Stations 275-290, 400; bottom panel: Stations 300-370. The detection limit was $10 \mu\text{g N/L}$.

Figure 3-20. Nitrate-nitrogen (µg N/L) at Steel Creek water quality Stations 290, 330, 350, and 370. Winter, Spring, Summer, and Fall 1990 and 1991. The detection limit was 10 µg N/L.

in November/December 1985 (initial flooding of basin), May/June 1986 (possible bottom release from L Lake), December 1986 to February 1987 (fall turnover and possible release of bottom water), May to July 1987 (hypolimnetic release), December 1987 to February 1988 (possible bottom release), October 1988 to February 1989, and October to December 1989. From April to November 1986, April to November 1987, April 1988 to February 1989, and May to November 1989, there was a consistent downstream increase in $\text{NO}_3\text{-N}$ between Stations 275 and 290. $\text{NO}_3\text{-N}$ levels in Meyer's Branch were not as variable as in Steel Creek. No clear pattern of seasonal variation in the corridor was evident in 1990 or 1991 (Figure 3-20). Concentrations in Meyer's Branch generally ranged from the detection limit to $125\text{ }\mu\text{g N/L}$. Samples were not taken in Meyer's Branch in 1990 or 1991.

$\text{NO}_3\text{-N}$ levels in the swamp, marsh, and channel did not appear to vary seasonally, nor were there any consistent open/closed-canopy differences (Figures 3-19 and 3-20). Changes in concentrations often paralleled those occurring in the corridor. Most concentration values ranged from the detection limit ($10\text{ }\mu\text{g N/L}$; Table 2-2) to $200\text{ }\mu\text{g N/L}$. Peak $\text{NO}_3\text{-N}$ concentrations at open-canopy Stations 300 and 330 were among the highest values recorded during this study (e.g., November/December 1985, February 1986, December 1986 to February 1987, May to July 1987, December 1987 to February 1988, December 1989). Data from 1990 and 1991 showed no clear seasonal pattern, nor was there any clear pattern among stations.

3.2.5 Ammonia-Nitrogen

Quarterly ammonia-nitrogen ($\text{NH}_4\text{-N}$) concentrations at Stations 290, 330, 350, and 370 during 1990 and 1991 are presented in Appendix Table 9. Temporal and spatial trends in $\text{NH}_4\text{-N}$ from 1985 to 1991 have been previously discussed in

Section 3.1.6. The range of $\text{NH}_4\text{-N}$ values observed during quarterly sampling (ca. 10 to 100 $\mu\text{g N/L}$; Figure 3-21) were comparable to those measured weekly at Station 275 in 1990 and 1991 (Figure 3-12) and monthly from 1985 to 1989 (Figure 3-11).

3.2.6 Total Kjeldahl Nitrogen

Quarterly total Kjeldahl nitrogen (TKN) concentrations at Stations 290, 330, 350, and 370 during 1990 and 1991 are presented in Appendix Table 9. TKN was not monitored in Steel Creek prior to 1990. Mean values in 1991 ranged from 291 to 334 $\mu\text{g N/L}$ (Appendix Table 15). Values in 1991 were slightly higher than those concentrations observed in 1990. Most individual values ranged between 200 and 500 $\mu\text{g N/L}$ (Figure 3-22). There did not appear to be any consistent relationship with concentrations differences among stations or seasons.

Results of the biannual diel TKN surveys at stations 290, 330, 350, and 370 during 1990 and 1991 are presented in Appendix Table 10. Results from 1991 exhibit diel variation in TKN concentrations ranging from 80 $\mu\text{g/L}$ at Station 370 in February and Station 330 in August to 220 $\mu\text{g/L}$ at Station 290 in August (values derived from Appendix Table 10). There was no clear pattern of variability in diel TKN concentrations between sampling dates or among stations. The 1990 biannual TKN surveys yielded similar results.

3.2.7 Ortho-Phosphorus

Quarterly ortho-phosphorus (OP) concentrations at Stations 290, 330, 350, and 370 during 1990 and 1991 are presented in Appendix Table 9. Inspection of annual descriptive statistics for OP from 1985/86 to 1989 (Appendix Table 16) indicated that (1) an overall downstream decrease in mean OP between Stations 275

Figure 3-21. Ammonia-nitrogen ($\mu\text{g N/L}$) at Steel Creek water quality Stations 290, 330, 350, and 370. Winter, Spring, Summer, and Fall 1990 and 1991. The detection limit was $10 \mu\text{g N/L}$. Note the difference in scale from that used in Figure 3-11.

Figure 3-22. Total Kjeldahl nitrogen ($\mu\text{g N/L}$) at Steel Creek water quality Stations 290, 330, 350, and 370. Winter, Spring, Summer, and Fall 1990 and 1991. The detection limit was $100 \mu\text{g N/L}$.

and 290 occurred in 1985/86 and 1987 (6 and 13 $\mu\text{g P/L}$, respectively) and was followed by an overall increase in 1988 and 1989 (5 and 7 $\mu\text{g P/L}$, respectively), (2) higher closed-canopy mean OP values, relative to open-canopy stations, were observed in 1985/86 and 1987, and to a lesser extent in 1988 and 1989, and (3) the means and ranges of values at each station were generally similar among years. Mean, minimum, and maximum values in 1991 (Appendix Table 16) were comparable to those recorded in previous years.

Temporal variation in OP concentrations at corridor stations did not exhibit a repeatable seasonal cycle; OP generally ranged from 5 to 55 $\mu\text{g P/L}$ (Figures 3-23 and 3-24). There were several pulses in OP levels which coincided with events occurring in L Lake: November/December 1985 (initial flooding of the basin), November 1986 (fall turnover and bottom water discharge), and July 1987 (discharge of hypolimnetic water). At these times, there was a substantial downstream decline in concentration between Stations 275 and 290 (note that on other dates, however, this trend was often reversed, with a downstream increase in OP, or no trend was evident at all). Concentration pulses of similar magnitude were not observed in the following years. OP levels in Meyer's Branch were much less variable and generally lower (ca. 0 to 15 $\mu\text{g P/L}$) than those in Steel Creek.

Fluctuations in OP levels in the swamp, marsh, and channel ranged from ca. 5 to 60 $\mu\text{g P/L}$ throughout this study and appeared to vary seasonally (Figures 3-23 and 3-24). Concentrations were generally lowest during the winter and highest in the spring/summer in each year. However, this seasonal pattern was not as evident in 1989 nor 1990 as in the previous years. It was apparent again in 1991. From May to November 1986 and May to December 1987 there were distinct

Figure 3-23. Ortho-phosphorus ($\mu\text{g P/L}$) at representative Steel Creek water quality sampling stations. November 1985 - December 1989. Top panel: Stations 275-290, 400; bottom panel: Stations 300-370. Detection limit was $5 \mu\text{g P/L}$.

Figure 3-24. Ortho-phosphorus ($\mu\text{g P/L}$) at Steel Creek water quality Stations 290, 330, 350, and 370. Winter, Spring, Summer, and Fall 1990 and 1991. The detection limit was 5 $\mu\text{g P/L}$.

open/closed-canopy differences; OP levels at these times were consistently lower at open-canopy marsh Stations 300 and 330 (and were actually below the detection limit of 5 $\mu\text{g P/L}$ at Station 300 from July to October 1986) than at the closed-canopy swamp stations. This trend was not repeated in 1988 nor 1989.

3.2.8 Total Phosphorus

Quarterly total phosphorus (TP) concentrations at Stations 290, 330, 350, and 370 during 1990 and 1991 are presented in Appendix Table 9. Inspection of annual descriptive statistics for TP from 1985/86 to 1989 (Appendix Table 17) indicated that (1) an overall downstream decrease (8 to 20 $\mu\text{g P/L}$) in mean TP values between Stations 275 and 290 was noted in 1985/86, 1987, and 1988, and to a lesser extent, in 1989 (1 $\mu\text{g P/L}$), (2) there were no consistent differences between corridor, swamp, marsh, and channel, and (3) the means and ranges of values at each station in 1989 were generally similar to those observed in 1985/86, 1987, and 1988. Mean minimum and maximum concentrations in 1991 (Appendix Table 17) were slightly lower than those in previous years.

No consistent seasonal cycle was evident for TP concentrations at corridor stations. Values generally ranged from 20 to 100 $\mu\text{g P/L}$ (Figures 3-25 and 3-26). As noted for OP (Figure 3-23), TP exhibited several distinct periods of elevated concentrations that coincided with events in L Lake: November/December 1985 (initial flooding of basin), September to November 1986 (fall turnover and possible release of bottom water), and July 1987 (hypolimnetic release). TP concentrations did not exhibit a consistent downstream gradient between Stations 275 and 290. TP levels in Meyer's Branch (ca. 10 to 30 $\mu\text{g P/L}$) were much less variable, and consistently lower, than those in Steel Creek.

Figure 3-25. Total phosphorus ($\mu\text{g P/L}$) at representative Steel Creek water quality sampling stations. November 1985 - December 1989. Top panel: Stations 275-290, 400; bottom panel: Stations 300-370. The detection limit was $5 \mu\text{g P/L}$.

Figure 3-26. Total phosphorus ($\mu\text{g P/L}$) at Steel Creek water quality Stations 290, 330, 350, and 370. Winter, Spring, Summer, Fall 1990 and 1991. The detection limit was 5 $\mu\text{g P/L}$.

TP levels in the swamp, marsh, and channel generally ranged from 20 to 100 $\mu\text{g P/L}$ (Figures 3-25 and 3-26) and, like OP (Figure 3-23), varied seasonally. TP concentrations were generally lowest in winter and highest in spring and summer. There were no consistent open/closed-canopy differences.

Results of the biannual diel TP surveys at Stations 290, 330, 350, and 370 during 1990 and 1991 are presented in Appendix Table 10. Diel variability in total phosphorus concentrations was generally low (ca. 4-15 $\mu\text{g/L}$, values derived from data in Appendix Table 10) on both sampling dates in 1991. This contrasts with data from the August survey in 1990 where observed TP variability was ca 29-259 $\mu\text{g/L}$. The highest TP concentrations reported during the August 1990 survey (332 $\mu\text{g/L}$) as well as the highest variability in TP concentrations (259 $\mu\text{g/L}$) were reported at Station 330. The lowest dissolved oxygen concentrations reported during the August 1990 survey were also reported at Station 330. It is speculated that elevated TP concentrations at this station in August may be related to anoxic release of phosphorus from the sediments. There was no consistent pattern in diel TP variability between sampling dates in 1991 (unlike 1990), nor was there a consistent pattern among stations.

3.3 SAMPLING PLAN #3 - CARBON/CATIONS/ANIONS

3.3.1 Total Organic Carbon

Quarterly total organic carbon (TOC) concentrations at Stations 290, 330, 350, and 370 during 1990 and 1991 are presented in Appendix Table 18. Inspection of annual descriptive statistics for TOC from 1985/86 to 1989 (Appendix Table 20) indicated that (1) differences in mean TOC values among stations were relatively small within a given year (1 to 2 mg C/L) and (2) no consistent trends between groups of stations were detected in this study. Mean, minimum, and maximum TOC

concentrations in 1991 (Appendix Table 20) were similar to most statistics from previous years.

TOC concentrations in the corridor generally ranged between 3 and 8 mg C/L and did not exhibit a repeatable seasonal cycle (Figures 3-27 and 3-28). There appeared to have been a small overall decrease in TOC levels throughout this study from those first observed in 1985 when most values ranged from 5 to 7 mg C/L to levels in 1990 and 1991 when most values ranged from 3 to 5 mg C/L. No consistent downstream gradient in TOC between Stations 275 and 290 was evident. TOC levels in Meyer's Branch were generally comparable to those found in the corridor.

TOC concentrations in the swamp, marsh, and channel generally varied between 4 and 8 mg C/L and did not exhibit a distinct seasonal cycle (Figures 3-27 and 3-28). The large TOC pulse that occurred in October 1989 did not correspond to any event of similar magnitude in the corridor (it did however parallel an OP pulse at these stations [Figure 3-23]). There were no consistent open/closed-canopy differences. Unlike the slight decreasing trend observed for the corridor stations, there appeared to have been no change in TOC levels throughout this study in the swamp, marsh, and channel from those first observed in 1985 when most values ranged from 5 to 7 mg C/L to levels in 1991.

Results of the biannual diel TOC surveys at Stations 290, 330, 350, and 370 during 1990 and 1991 are presented in Appendix Table 19. Results from 1991 exhibit a diel variability in TOC ranging from 0.3 mg/L at Stations 290, 330 and 350 in February to 3.1 mg/L at Station 370 in August (values derived from data in Appendix Table 19). The largest diel TOC variability was observed at

Figure 3-27. Total organic carbon (mg C/L) at representative Steel Creek water quality sampling stations. November 1985 - December 1989. Top panel: Stations 275-290, 400; bottom panel: Stations 300-370. The detection limit was 1 mg C/L.

Figure 3-28. Total organic carbon (mg C/L) at Steel Creek water quality Stations 290, 330, 350, and 370. Winter, Spring, Summer, and Fall 1990 and 1991. The detection limit was 1 mg C/L.

Station 370 on both sampling dates in 1991. There appeared to be a slight downstream gradient in TOC variability in 1991. This pattern was not observed in 1990. There appeared to be no difference in TOC variability between the February sampling event and the August sampling event in either 1990 or 1991.

3.3.2 Dissolved Organic Carbon

Quarterly dissolved organic carbon (DOC) concentrations at Stations 290, 330, 350, and 370 during 1990 and 1991 are presented in Appendix Table 18. Inspection of annual descriptive statistics for DOC from 1985/86 to 1989 (Appendix Table 21) indicated that (1) differences in mean values among stations were relatively small within a given year (1 to 2 mg C/L), 2) no consistent trends between groups of stations could be detected, and (3) the mean values at each station were quite similar among years. Mean, minimum, and maximum DOC concentrations in 1991 (Appendix Table 21) were similar to statistics from previous years.

As noted for TOC at corridor stations (Figures 3-27 and 3-28), DOC concentrations did not vary seasonally nor could a persistent downstream concentration gradient between Stations 275 and 290 be discerned (Figures 3-29 and 3-30). DOC generally ranged between 3 and 7 mg C/L throughout the study. DOC levels in Meyer's Branch were comparable to those in the corridor.

DOC levels in the swamp, marsh, and channel generally ranged between 3 and 7 mg C/L (Figures 3-29 and 3-30). No consistent open/closed-canopy differences or seasonal trends were detected during this study. A large DOC pulse occurred in October 1989 which coincided with the pulse recorded for OP (Figure 3-23) and TOC (Figure 3-27).

Figure 3-29. Dissolved organic carbon (mg C/L) at representative Steel Creek water quality sampling stations. November 1985 - December 1989. Top panel: Stations 275-290, 400; bottom panel: Stations 300-375. The detection limit was 1 mg C/L.

Figure 3-30. Dissolved organic carbon (mg C/L) at Steel Creek water quality Stations 290, 330, 350, 370. Winter, Spring, Summer, and Fall 1990 and 1991. The detection limit was 1 mg C/L.

Results of the biannual diel DOC surveys at Stations 290, 330, 350, and 370 during 1990 and 1991 are presented in Appendix Table 19. Results from 1991 exhibit diel variation in TOC concentrations ranging from 0.3 mg/L at Station 350 in February to 2.2 mg/L at Station 330 in August (values derived from data in Appendix Table 19). There was no clear pattern of variability between sampling dates or among stations. Similar results were obtained in 1990.

3.3.3 Total Inorganic Carbon

Quarterly total inorganic carbon (TIC) concentrations at Stations 290, 330, 350, and 370 during 1990 and 1991 are presented in Appendix Table 18. Inspection of annual descriptive statistics for TIC from 1985/86 to 1989 (Appendix Table 22) indicated that (1) differences in mean values among stations were relatively small (1 to 2 mg C/L), (2) no consistent trends between groups of stations were detected in this study, and (3) the mean, minimum, and maximum values at each station were quite similar among years. Mean, minimum, and maximum TIC concentrations in 1991 (Appendix Table 22) were comparable to statistics from previous years.

TIC levels at corridor stations generally ranged between 2 and 7 mg C/L during this study and did not exhibit a consistent seasonal pattern or temporal variation (Figures 3-31 and 3-32). There were no consistent downstream gradients between Stations 275 and 290. TIC levels in Meyer's Branch were often higher than those in Steel Creek by ca. 1-2 mg C/L.

TIC levels in the swamp, marsh, and channel generally ranged between 3 and 6.5 mg C/L during this study and exhibited no consistent seasonal trends (Figures 3-31 and 3-32). Temporal variation at these stations generally paralleled that

Figure 3-31. Total inorganic carbon (mg C/L) at representative Steel Creek water quality sampling stations. November 1985 - December 1989. Top panel: Stations 275-290, 400; bottom panel: Stations 300-370. The detection limit was 1 mg C/L.

Figure 3-32. Total inorganic carbon (mg C/L) at Steel Creek water quality Stations 290, 330, 350, and 370. Winter, Spring, Summer, and Fall 1990 and 1991. The detection limit was 1 mg C/L.

observed in the corridor. There were no indications of consistent open/closed-canopy differences. Station 300 exhibited markedly higher TIC concentrations (up to 13 mg C/L) during the summers of 1986, 1987, and 1988. This corresponded with periods of abundant macrophyte growth (pers. obs.) and reduced flow velocities at this site (Chimney and Westbury 1990; Figure 3-1).

Results of the biannual diel TIC surveys at Stations 290, 330, 350, and 370 during 1990 and 1991 are presented in Appendix Table 19. Results from 1991 showed diel variation in TIC concentrations ranging from 0.3 mg/L at Stations 290 and 370 in February to 1.2 mg/L at Station 350 in August (values derived from data in Appendix Table 19). There was no clear pattern of variability between sampling dates or among stations. Similar results were obtained in 1990.

3.3.4 Alkalinity

Quarterly alkalinity measurements at Stations 290, 330, 350, and 370 during 1990 and 1991 are presented in Appendix Table 18. Inspection of annual descriptive statistics for alkalinity from 1985/86 to 1989 (Appendix Table 23) indicated that (1) differences in mean values among Steel Creek stations were relatively small within a single year (2 to 4 mg CaCO₃/L), (2) no consistent trends between groups of stations were detected during this study, and (3) the mean, minimum, and maximum alkalinity at each station in 1989 were slightly lower than those observed in 1985/86, 1987, and 1988. Statistics for alkalinity in 1991 (Appendix Table 23) were similar to those from 1989 and 1990.

Alkalinity at corridor stations generally ranged between 10 and 22 mg CaCO₃/L during this study and did not exhibit a consistent seasonal pattern (Figures 3-33 and 3-34). There were no consistent downstream concentration

Figure 3-33. Alkalinity ($\text{mg CaCO}_3/\text{L}$) at representative Steel Creek water quality sampling stations. November 1985 - December 1989. Top panel: Stations 275-290, 400; bottom panel: Stations 300-370. The detection limit was $1 \text{ mg CaCO}_3/\text{L}$.

Figure 3-34. Alkalinity (mg CaCO_3/L) at Steel Creek water quality Stations 290, 330, 350, 370. Winter, Spring, Summer, and Fall 1990 and 1991. The detection limit was 1 mg CaCO_3/L .

gradients detected between Stations 275 and 290. Overall, 1991 alkalinity values appeared to decrease at all corridor stations from values first observed in 1985 (ca. 13 to 18 mg CaCO_3/L) to values around 10 mg CaCO_3/L in 1990 and 1991. Alkalinity was more variable at Meyer's Branch than at the corridor stations. Alkalinity was often higher in Meyer's Branch (up to 29 mg CaCO_3/L) relative to Steel Creek.

Alkalinity at swamp, marsh, and channel stations (except Station 300) generally ranged between 12 and 22 mg CaCO_3/L during this study (Figures 3-33 and 3-34). The pattern of temporal variation in alkalinity from 1985 to 1989 was similar to that observed for TIC (Figure 3-31). There were no consistent seasonal or open/closed-canopy trends. A small, overall decrease in alkalinity from 1985 to 1991 was noted at all swamp, marsh, and channel stations, and of the same magnitude as observed in the corridor. Station 300 exhibited markedly higher alkalinity (up to 50 mg CaCO_3/L) during the summer and fall of 1986 and 1987, and to a lesser extent in 1988, when aquatic macrophytes were abundant (pers. obs.) and flow velocity was substantially reduced at this site (Chimney and Westbury 1990; Figure 3-1). The summer alkalinity pulses at Station 300 became progressively smaller from 1986 to 1988. Station 300 also had the lowest alkalinity value recorded at any station (ca. 2 mg CaCO_3/L in 1985).

3.3.5 Total Aluminum

Quarterly total aluminum (Al) concentrations at Stations 290, 330, 350, and 370 during 1990 and 1991 are presented in Appendix Table 18. Inspection of annual descriptive statistics for total Al from 1985/86 to 1989 (Appendix Table 24) indicated that (1) no consistent downstream concentration gradient existed between Stations 275 and 290, (2) in 1985/86 and 1987 mean values at the

open-canopy stations were consistently higher than those at the closed-canopy stations; however, by 1988 all mean values were below the detection limit of 100 $\mu\text{g/L}$ (Table 2-2), and (3) the mean, minimum, and maximum values at stations in 1988 and 1989 were lower than corresponding values in either 1985/86 or 1987. All 1990 and 1991 mean and minimum values were below the detection limit (Appendix Table 24). Maximum values in 1991 were only slightly above the detection limit (Appendix Table 24).

Total Al concentrations at corridor stations generally ranged from 40 to 300 $\mu\text{g/L}$ during this study (although concentrations at some stations exceeded 500 $\mu\text{g/L}$ on several dates) and did not exhibit a consistent seasonal trend (Figures 3-35 and 3-36). High November 1985 values were associated with the initial flooding of the L-Lake basin. The concentrations' peaks, in September 1986 and January 1987, did not correspond with changes in any other water quality parameter. No consistent downstream gradients between Stations 275 and 290 were evident. Overall, total Al levels in Meyer's Branch were similar to those in Steel Creek.

Total Al in the swamp, marsh, and channel generally ranged from below the detection limit (100 $\mu\text{g/L}$; Table 2-2) to 200 $\mu\text{g/L}$ and did not exhibit a discernible seasonal trend (Figures 3-35 and 3-36). There were no consistent open/closed-canopy differences. High values in November 1985 paralleled concentration peaks observed in the corridor. Total Al concentrations for 1991 in the swamp, marsh and channel were among the lowest reported to date. Only two measurements at these stations in 1991 were above the detection limit (Appendix Table 18).

Figure 3-35. Total aluminum ($\mu\text{g/L}$) at representative Steel Creek water quality sampling stations. November 1985 - December 1989. Top panel: Stations 275-290, 400; bottom panel: Stations 300-370. The detection limit was $100 \mu\text{g/L}$.

Figure 3-36. Total aluminum (µg/L) at Steel Creek water quality Stations 290, 330, 350, and 370. Winter, Spring, Summer, and Fall 1990 and 1991. The detection limit was 100 µ/L. Note the difference in scale from that used in Figure 3-35.

3.3.6 Total Calcium

Quarterly total calcium (Ca) concentrations at Stations 290, 330, 350, and 370 during 1990 and 1991 are presented in Appendix Table 18. Inspection of annual descriptive statistics for total Ca from 1985/86 to 1991 (Appendix Table 25) indicated that (1) mean values consistently increased slightly downstream between Stations 275 and 290 (0.17 to 0.81 mg/L), (2) there were no consistent differences in mean values among corridor, swamp, marsh, or channel stations, and (3) the mean, minimum, and maximum values at most stations in 1988 and 1989 were generally lower (ca. 1 to 2 mg/L) than corresponding values in 1985/86 and 1987. Statistics for 1991 (Appendix Table 25) were comparable to those for 1989 and 1990.

Total Ca levels at corridor stations generally ranged between 2.0 and 5.0 mg/L (Figures 3-37 and 3-38). There was no discernible seasonal cycle nor was there a consistent downstream gradient between Stations 275 and 290 evident during this study. Total Ca concentrations decreased overall from levels prior to mid-1987 (ca. 3 to 5 mg/L) to those recorded in 1990 and 1991 (below 3 mg/L). Total Ca levels in Meyer's Branch (generally between 6 and 10 mg/L) were markedly higher than those observed in Steel Creek.

Except for Station 300, no seasonal trend for total Ca was evident in the swamp, marsh, and channel where values generally ranged between 2.5 and 5.0 mg/L (Figures 3-37 and 3-38). Overall, total Ca levels in the swamp, marsh, and channel declined from mid-1987 to 1991 in a fashion similar to that observed in the corridor. No consistent open/closed-canopy differences were detected throughout this study. At Station 300, total Ca concentrations were relatively high during the summers of 1986 and 1987, but not in 1988 or 1989. This

Figure 3-37. Total calcium (mg/L) at representative Steel Creek water quality sampling stations. November 1985 - December 1989. Top panel: Stations 275-290, 400; bottom panel: Stations 300 - 370. The detection limit was 0.02 mg/L.

Figure 3-38. Total calcium (mg/L) at Steel Creek water quality Stations 290, 330, 350, and 370. Winter, Spring, Summer, and Fall 1990 and 1991. The detection limit was 0.01 mg/L.

coincided with periods of abundant aquatic macrophyte growth (pers. obs.) and reduced flow velocity at this station (Chimney and Westbury 1990; Figure 3-1).

3.3.7 Total Iron

Quarterly total iron (Fe) levels at Stations 290, 330, 350, and 370 during 1990 and 1991 are presented in Appendix Table 18. Inspection of annual descriptive statistics for total Fe from 1985/86 to 1989 (Appendix Table 26) indicated that (1) a consistent downstream increase in total Fe (90 to 397 $\mu\text{g/L}$) existed between Stations 275 and 290, (2) mean values were often substantially higher at swamp, marsh, and channel stations compared to the corridor during all four years, (3) there were no consistent differences in mean values between open- and closed-canopy stations, and (4) mean, minimum, and maximum values at most stations in 1988 and 1989 were lower than corresponding values in 1985/86 or 1987. Mean, minimum, and maximum concentrations in 1991 (Appendix Table 26) were comparable to those in 1989 and 1990.

Total Fe levels at corridor stations generally varied between the detection limit (20 $\mu\text{g/L}$; Table 2-2) and 1000 $\mu\text{g/L}$ (Figures 3-39 and 3-40). Concentrations were noticeably elevated on several occasions (e.g., over 2000 $\mu\text{g/L}$ in September and November 1986 and February 1989), but otherwise displayed no discernible seasonal trends. The November 1986 peak coincided with the end of fall turnover in L Lake. There was a consistent downstream increase in concentrations between Stations 275 and 290 from January to September 1986, but no consistent trend was evident in 1987, 1988, or 1989. There was no discernable seasonal cycle in total Fe concentrations in the corridor in 1990. A very slight increase in total Fe concentrations was observed in spring and summer samples in

Figure 3-39. Total iron ($\mu\text{g/L}$) at representative Steel Creek water quality sampling stations. November 1985 - December 1989. Top panel: Stations 275-290, 400; bottom panel: Stations 300-370. The detection limit was $20 \mu\text{g/L}$.

Figure 3-40. Total iron ($\mu\text{g/L}$) at Steel Creek water quality Stations 290, 330, 350, and 370. Winter, Spring, Summer, and Fall 1990 and 1991. The detection limit was 20 $\mu\text{g/L}$. Note the difference in scale from that used in Figure 3-39.

the corridor in 1991 (Figure 3-40). Total Fe levels in Meyer's Branch were generally similar to those in Steel Creek.

At swamp, marsh, and channel stations, total Fe concentrations generally ranged between 200 and 2000 $\mu\text{g/L}$ (Figures 3-39 and 3-40). The highest concentration observed during this study was at Station 300 in the summer of 1986, when a value of ca. 7500 $\mu\text{g/L}$ was recorded. Summertime peak measurements at Station 300 declined steadily in each successive year. There were no consistent open/closed-canopy differences. The total Fe concentration pulse in October 1989 corresponded with similar events noted for TOC (Figure 3-27), DOC (Figure 3-29), and OP (Figure 3-23). Summer peak measurements were observed at swamp, marsh, and channel stations (particularly at Station 330) in 1990 and 1991 (Figure 3-40). Peak concentrations at these stations in 1990 and 1991 were comparable to those reported prior to 1991.

Results of the biannual diel total Fe surveys at Stations 290, 330, 350, and 370 during 1990 and 1991 are presented in Appendix Table 19. Results from 1991 exhibit diel variation in total Fe ranging from 51 mg/L at Station 350 in February to 800 mg/L at Station 350 in August (values derived from data in Appendix Table 19). Variation during the August survey was greater at all stations than variation during the February survey. In general, there was no consistent downstream pattern in variation among stations. Total Fe diel variation results in 1990 were similar to 1991 results in that August variation was greater than February and no pattern existed among stations, although the maximum reported variation in 1990 was considerably higher than any reported in 1991 (1420 mg/L at Station 330 in August, Appendix Table 19).

3.3.8 Total Magnesium

Quarterly total magnesium (Mg) levels at Stations 290, 330, 350, and 370 during 1990 and 1991 are presented in Appendix Table 18. Inspection of annual descriptive statistics for total Mg from 1985/86 to 1989 (Appendix Table 27) indicated that (1) a small, consistent downstream decrease (0.04 to 0.10 mg/L) in mean total Mg levels existed between Stations 275 and 290, (2) no consistent differences in mean values were detected between corridor, swamp, marsh, and channel stations, and (3) the mean, minimum, and maximum values at each station were similar among years. The 1991 mean, minimum, and maximum values (Appendix Table 27) were comparable to those from previous years.

Total Mg concentrations at corridor stations generally ranged between 0.8 and 1.4 mg/L throughout this study (Figures 3-41 and 3-42). There appeared to have been a slight overall decrease of ca. 0.3 mg/L from initial values in 1985 to those recorded in 1991. There were no consistent seasonal trends nor downstream gradients between Stations 275 and 290. Total Mg in Meyer's Branch was consistently lower than in Steel Creek; values in Meyer's Branch ranged between 0.4 and 0.7 mg/L.

Except for Station 300, total Mg levels at swamp, marsh, and channel stations exhibited no consistent seasonal trends, nor were there any obvious open/closed-canopy differences (Figures 3-41 and 3-42). Concentrations generally ranged between 1.0 and 1.5 mg/L throughout the study, and as with concentrations in the corridor, appeared to have decreased slightly from 1985 to 1991. Total Mg was substantially higher at Station 300 than elsewhere in Steel Creek during the summers of 1986, 1987, and 1988 (but not 1989), periods which coincided with abundant macrophyte growth (pers. obs.) and reduced flow velocity at this

Figure 3-41. Total magnesium (mg/L) at representative Steel Creek water quality sampling stations. November 1985 - December 1989. Top panel: Stations 275-290, 400; bottom panel: Stations 300-370. The detection limit was 0.01 mg/L.

Figure 3-42. Total magnesium (mg/L) at Steel Creek water quality Stations 290, 330, 350, and 370. Winter, Spring, Summer, and Fall 1990 and 1991. The detection limit was 0.02 mg/L.

sampling site (Chimney and Westbury 1990; Figure 3-1). There was a progressive decline in the magnitude of summertime peak total Mg concentrations at Station 300 from 1986 to 1989.

Results of the biannual diel total Mg surveys at Stations 290, 330, 350, and 370 during 1990 and 1991 are presented in Appendix Table 19. Results from 1991 exhibit diel variation in total Mg concentrations ranging from 0.06 mg/L at Stations 290 and 350 in August to 0.22 mg/L at Station 330 in February (values derived from data in Appendix Table 19). There was no pattern in total Mg variation between sampling dates or among stations. Total Mg variation in 1990 (0.11 to 0.41 mg/L) was somewhat larger than that reported in 1991. August 1990 variation was also higher than February 1990 variation. There was no pattern in total Mg variation among stations in 1990.

3.3.9 Total Manganese

Quarterly total manganese (Mn) levels at Stations 290, 330, 350, and 370 during 1990 and 1991 are presented in Appendix Table 18. Inspection of annual descriptive statistics for total Mn from 1985/86 to 1989 (Appendix Table 28) indicated that (1) no consistent concentration gradient for mean Mn existed between Stations 275 and 290, (2) the mean total Mn concentration at Station 300 was markedly higher than at any other station in all four years; otherwise, there were no consistent differences in mean values between corridor, swamp, marsh, and channel stations, (3) mean total Mn values in the corridor during 1988 and 1989 were approximately one-half those observed in 1985/86 and 1987, and (4) except for Station 300, the mean, minimum, and maximum values for total Mn at each station in 1989 were generally comparable to those from 1985/86, 1987, and 1988.

The 1991 mean, minimum, and maximum values (Appendix Table 28) were comparable to those from 1988, 1989, and 1990.

Total Mn concentrations at corridor stations generally ranged between the detection limit (20 $\mu\text{g/L}$; Table 2-2) and 300 $\mu\text{g/L}$ (Figures 3-43 and 3-44). Total Mn concentrations in Meyer's Branch were comparable to levels observed in Steel Creek.

Except for Station 300, total Mn in the swamp, marsh, and channel exhibited little temporal variability throughout this study; values generally ranged from the detection limit (20 $\mu\text{g/L}$; Table 2-2) to 300 $\mu\text{g/L}$ (Figures 3-43 and 3-44). Total Mn reached very high concentrations (ca. 3000 to 4000 $\mu\text{g/L}$) at Station 300 during the summers of 1986, 1987, and 1988; periods that coincided with abundant macrophyte growth (pers. obs.) and reduced flow velocity at this sampling site (Chimney and Westbury 1990; Figure 3-1). The summertime concentration pulse in 1989 was markedly lower. There were no other open/closed-canopy differences noted. The summer pulse in total Mn at Station 330 in 1990 was not present in 1991 (Figure 3-44).

3.3.10 Total Potassium

Quarterly total potassium (K) levels at Stations 290, 330, 350, and 370 during 1990 and 1991 are presented in Appendix Table 18. Inspection of annual descriptive statistics for total K from 1985/86 to 1989 (Appendix Table 29) indicated that (1) a consistent, overall downstream decrease in mean total K (0.01 to 0.18 mg/L) existed between Stations 275 and 290, (2) there were no consistent differences in mean values between corridor, swamp, marsh, and channel stations, and (3) the mean, minimum, and maximum values for total K at each

Figure 3-43. Total manganese ($\mu\text{g/L}$) at representative Steel Creek water quality sampling stations. November 1985 - December 1989. Top panel: Stations 275-290, 400; bottom panel: Stations 300-370. The detection limit was $10 \mu\text{g/L}$.

Figure 3-44. Total manganese ($\mu\text{g/L}$) at Steel Creek water quality Stations 290, 330, 350, and 370. Winter, Spring, Summer, and Fall 1990 and 1991. The detection limit was 20 $\mu\text{g/L}$. Note the difference in scale from that used in Figure 3-43.

station in 1989 were comparable to those observed in 1985/86, 1987, and 1988. Mean, minimum, and maximum values in 1991 (Appendix Table 29) were comparable to statistics from previous years.

Total K did not vary seasonally at corridor stations during this study, nor was there a consistent downstream gradient between Stations 275 and 290 (Figures 3-45 and 3-46). Most concentrations ranged from 1.0 to 2.0 mg/L. Total K levels in Meyer's Branch were consistently lower than in Steel Creek and generally ranged from 0.1 to 0.7 mg/L.

No seasonal trends were detected for total K in the swamp, marsh, or channel, nor were there any consistent open/closed-canopy differences (Figures 3-45 and 3-46). In general, concentrations ranged between 1.0 to 2.0 mg/L throughout this study.

3.3.11 Total Sodium

Quarterly total sodium (Na) levels at Stations 290, 330, 350, and 370 during 1990 and 1991 are presented in Appendix Table 18. Inspection of annual descriptive statistics for total Na from 1985/86 to 1989 (Appendix Table 30) indicated that (1) a consistent, overall downstream decrease in total Na (0.63 to 1.18 mg/L) existed between Stations 275 and 290, (2) there were no consistent differences in mean values between corridor, swamp, marsh, and channel stations, and (3) the mean, minimum, and maximum values for total Na at each Steel Creek station in 1988 and 1989 were slightly higher than corresponding values in 1985/86 and 1987; mean values throughout Steel Creek increased by ca. 1 to 2 mg/L from 1985/86 to 1989. Mean, minimum, and maximum 1990 values (Appendix Table 30)

Figure 3-45. Total potassium (mg/L) at representative Steel Creek water quality sampling stations. November 1985 - December 1989. Top panel: Stations 275-290, 400; bottom panel: Stations 300-370. The detection limit was 0.02 mg/L.

Figure 3-46. Total potassium (mg/L) at Steel Creek water quality Stations 290, 330, 350, and 370. Winter, Spring, Summer, and Fall 1990 and 1991. The detection limit was 0.02 mg/L.

were markedly lower than any other values recorded from previous years. Corresponding values from 1991 were slightly lower than 1990 values.

Total Na in the corridor did not vary seasonally; levels generally ranged from 5.0 to 13.5 mg/L throughout the study (Figures 3-47 and 3-48). There was an overall increase in mid-1987 to mid-1988 from initial total Na levels (ca. 5 to 7 mg/L) to the highest concentrations seen (ca. 10 to 13 mg/L), followed by a decrease in 1990 and a further decrease in 1991 to the lowest values recorded during this study. Concentrations often decreased between Stations 275 and 290. Total Na in Meyer's Branch was consistently lower than in Steel Creek and usually varied between 1.5 and 3.5 mg/L.

There were no recurring seasonal trends for total Na in the swamp, marsh, and channel; most values ranged between 5.0 and 12.0 mg/L (Figures 3-47 and 3-48). As noted for the corridor, total Na levels generally increased in mid-1987 to mid-1988 and then decreased in 1990 and again in 1991. No consistent open/closed-canopy differences were detected.

3.3.12 Chloride

Quarterly chloride (Cl) levels at Stations 290, 330, 350, and 370 during 1990 and 1991 are presented in Appendix Table 18. Inspection of annual descriptive statistics for total Cl from 1985/86 to 1989 (Appendix Table 31) indicated that (1) a slight downstream decrease in mean values (0.2 to 0.7 mg/L) occurred between Stations 275 and 290, (2) there were no consistent differences in mean values between corridor, swamp, marsh, and channel stations during this study, and (3) the mean, minimum, and maximum values at Steel Creek stations in 1988 and 1989 were somewhat higher than those in 1985/86 and 1987. Mean,

STATION ●—● 275 ---- 280 ---x--- 285 --- 290 ●—● 300
 ●—● 330 ---x--- 340 ---x--- 350 --- 370 ●—● 400

STATION ●—● 275 ---- 280 ---x--- 285 --- 290 ●—● 300
 ●—● 330 ---x--- 340 ---x--- 350 --- 370 ●—● 400

Figure 3-47. Total sodium (mg/L) at representative Steel Creek water quality sampling stations. November 1985 - December 1989. Top panel: Stations 275-290, 400; bottom panel: Stations 300-370. The detection limit was 0.05 mg/L.

Figure 3-48. Total sodium (mg/L) at Steel Creek water quality Stations 290, 330, 350, and 370. Winter, Spring, Summer, and Fall 1990 and 1991. The detection limit was 0.05 mg/L.

minimum, and maximum 1991 concentrations (Appendix Table 31) were among the lowest values recorded throughout this study.

Cl concentrations did not vary seasonally at corridor stations; most values ranged between 5 and 11 mg/L (Figures 3-49 and 3-50). As noted for total Na (Figure 3-47), Cl often decreased between Stations 275 and 290; this trend was fairly consistent in 1987, 1988, and 1989. Cl levels increased overall in mid-1987 to mid-1988 and decreased again in 1990 (the same trend was observed for total Na [Figures 3-47 and 3-48]). Cl levels decreased further in 1991. Cl levels were, in general, markedly lower in Meyer's Branch (ca. 2 - 5 mg/L) compared to Steel Creek throughout this study.

Cl concentrations in the swamp, marsh, and channel did not appear to vary seasonally; levels generally ranged between 4 and 11 mg/L (Figures 3-49 and 3-50). As noted in the corridor, Cl levels increased overall in mid-1987 to mid-1988 and decreased in 1990. Cl levels decreased further in 1991. There were no consistent open/closed-canopy differences.

3.3.13 Hydrogen Sulfide

Quarterly hydrogen sulfide (H_2S) levels at Stations 290, 330, 350, and 370 during 1990 and 1991 are presented in Appendix Table 18. Inspection of annual descriptive statistics for H_2S from 1985/86 to 1989 (Appendix Table 32) indicated that mean, minimum, and maximum H_2S concentrations were below the detection limit of 0.1 mg H_2S /L (Table 2-2) at all stations throughout this study. All 1990 and 1991 statistics (Appendix Table 32) were also below the detection limit.

Figure 3-49. Chloride (mg/L) at representative Steel Creek water quality sampling stations. November 1985 - December 1989. Top panel: Stations 275-290, 400; bottom panel: Stations 300-370. The detection limit was 0.5 mg/L.

Figure 3-50. Chloride (mg/L) at Steel Creek water quality Stations 290, 330, 350, and 370. Winter, Spring, Summer, and Fall 1990 and 1991. The detection limit was 0.5 mg/L.

H₂S concentrations were low (0.0 to 0.03 mg H₂S/L) throughout the corridor, swamp, marsh, channel, and Meyer's Branch during this study (Figures 3-51 and 3-52). H₂S is quickly oxidized by free oxygen (Hutchinson 1967; Wetzel 1983) and would not be expected to be present in appreciable quantities at the high observed DO levels (Figures 3-5 and 3-6). H₂S levels did increase at all stations from August 1986 through December 1988, relative to values at the start of this study, and then remained relatively constant in 1989, 1990, and 1991. However, all levels observed during this study were well below the detection limit of 0.1 mg H₂S/L (Table 2-2).

3.3.14 Sulfate

Quarterly sulfate (SO₄) levels at Stations 290, 330, 350, and 370 during 1990 and 1991 are presented in Appendix Table 18. Inspection of annual descriptive statistics for SO₄ from 1985/86 to 1989 (Appendix Table 33) indicated that (1) no consistent differences or gradients in mean values between Stations 275 and 290, or between corridor, swamp, marsh, and channel stations were detected during this study and (2) the mean, minimum, and maximum SO₄ values at Steel Creek stations in 1988, 1989 and 1990 were slightly higher than concentrations in 1985/86 and 1987. The mean, minimum, and maximum values in 1991 (Appendix Table 33) were comparable to those in 1985/86 and 1987.

SO₄ levels in the Steel Creek corridor were relatively high during the winter and declined steadily from spring through fall in both 1985/86 and 1987. This cycle was repeated, but not as pronounced, in 1988, 1989, and 1990 (Figures 3-53 and 3-54). This pattern was not present in 1991. There appeared to be a progressive increase in SO₄ concentrations from values initially seen in 1985 and 1986 (ca. 4 to 6 mg SO₄/L) to the high levels in 1988, 1989, and 1990 (ca. 8 to

Figure 3-51. Hydrogen sulfide ($\text{mg H}_2\text{S/L}$) at representative Steel Creek water quality sampling stations. November 1985 - December 1989. Top panel: Stations 275-290, 400; bottom panel: Stations 300-370. The detection limit was $0.1 \text{ mg H}_2\text{S/L}$.

Figure 3-52. Hydrogen sulfide (mg H₂S/L) at Steel Creek water quality Stations 290, 330, 350, and 370. Winter, Spring, Summer, and Fall. 1990 and 1991. The detection limit was 0.1 mg H₂S/L.

Figure 3-53. Sulfate (mg SO₄/L) at representative Steel Creek water quality sampling stations. November 1985 - December 1989. Top panel: Stations 275-290, 400; bottom panel: Stations 300-370. The detection limit was 1.0 mg SO₄/L.

Figure 3-54. Sulfate (mg SO₄/L) at Steel Creek water quality Stations 290, 330, 350, and 370. Winter, Spring, Summer, and Fall 1990 and 1991. The detection limit was 1.0 mg SO₄/L. Note the difference in scale from that used in Figure 3-53.

18 mg SO₄/L). Concentrations were somewhat lower again in 1991. Most concentrations varied from 3.5 to 8.5 mg SO₄/L during this study. There were no obvious downstream gradients between Stations 275 and 290. On most dates, SO₄ in Meyer's Branch was markedly lower than in Steel Creek; values in Meyer's Branch usually ranged between the detection limit (1.0 mg SO₄/L; Table 2-2) and 4.0 mg SO₄/L.

Concentrations of SO₄ in the swamp, marsh, and channel did not appear to vary seasonally; values generally ranged from 2.0 to 9.0 mg SO₄/L (Figures 3-53 and 3-54). There were no consistent open/closed-canopy differences.

3.4 STATISTICAL ANALYSIS OF WATER QUALITY

Inspection of mean values for water quality parameters, monitored as part of the biannual diel sampling program in 1990, indicated that only relatively minor differences existed among stations or between seasons for mean measurements of total organic carbon, dissolved organic carbon, total inorganic carbon, total Kjeldahl nitrogen, and total magnesium (Figure 3-55). There were more pronounced station and/or seasonal differences for the other parameters; mean values for temperature, total dissolved solids, total suspended solids, total phosphorus, and total iron were often markedly higher in August, while mean values for dissolved oxygen and pH were higher in February. In 1991, minor differences existed among stations or between stations for total organic carbon, dissolved organic carbon, total suspended solids, total dissolved solids, and total magnesium (Figure 3-56). There were more pronounced station and/or seasonal differences for the other parameters. Mean values for temperature, total phosphorus, total Kjeldahl nitrogen, total inorganic carbon and total iron were often markedly higher in August while mean values for dissolved oxygen and pH were higher in

Figure 3-55. Mean values for water quality parameters monitored at Steel Creek Stations 290, 330, 350, and 370 during biannual diel sampling in February and August 1990.

Figure 3-55 (continued). Mean values for water quality parameters monitored at Steel Creek Stations 290, 330, 350, and 370 during biannual diel sampling in February and August 1990.

Figure 3-55 (continued). Mean values for water quality parameters monitored at Steel Creek Stations 290, 330, 350, and 370 during biannual diel sampling in February and August 1990.

Figure 3-55 (continued). Mean values for water quality parameters monitored at Steel Creek Stations 290, 330, 350, and 370 during biannual diel sampling in February and August 1990.

Figure 3-56. Mean values for water quality parameters monitored at Steel Creek Stations 290, 330, 350, and 370 during biannual diel sampling in February and August 1991.

Figure 3-56 (continued). Mean values for water quality parameters monitored at Steel Creek Stations 290, 330, 350, and 370 during biannual diel sampling in February and August 1991.

Figure 3-56 (continued). Mean values for water quality parameters monitored at Steel Creek Stations 290, 330, 350, and 370 during biannual diel sampling in February and August 1991.

Figure 3-56 (continued). Mean values for water quality parameters monitored at Steel Creek Stations 290, 330, 350, and 370 during biannual diel sampling in February and August 1991.

February. However, two-way ANOVAs based on the rank order of stations within each season revealed that only station differences for dissolved oxygen and total dissolved solids were statistically significant in 1990 (Table 3-1). That is, only for these two parameters was the rank order of stations constant in both February and August. There were no statistically significant station differences in 1991.

Note that the measurement scale used for each water quality parameter in Figures 3-55 and 3-56 was the same as that employed in the respective plots of 1990 and 1991 weekly and quarterly water quality data (see Sections 3.1, 3.2, and 3.3). In all cases, the range of mean values for the biannual diel data were well within range of values observed in the other sampling programs.

3.5 COMPARISON WITH OTHER LOTIC SYSTEMS

The range of values for water quality parameters monitored during this study (monthly sampling from 1985 to 1989 and quarterly sampling in 1990 and 1991) have been compared to data available in the literature from 20 representative southeastern streams and rivers (Table 3-2). An inspection of these data indicated that, in general, Steel Creek values were well within the range of measurements observed in the other southeastern systems. However, Steel Creek was different in several respects: (1) the maximum concentrations for both total and dissolved manganese in the swamp, marsh, and channel from 1985/86 to 1988 were considerably higher than most of the southeastern values; 1989 to 1991 values were similar to most southeastern values, (2) the minimum dissolved oxygen levels in the swamp, marsh, and channel were at the low end of the concentration range of other systems, and (3) the maximum total suspended solids in 1990 and 1991 were considerably lower than in the other systems.

Table 3-1. Degrees of freedom, F values, and probabilities of a greater F associated with Friedman's two-way analysis by ranks tests of water quality parameters monitored during 1990 and 1991 biannual diel sampling at Steel Creek Stations 290, 330, 350, and 370.

Parameter	F value	Prob > F
<u>1990</u>		
Temperature	1.12	0.4807
* Dissolved Oxygen	99,999.99	<0.0001
pH	6.75	0.0743
Kjeldahl Nitrogen	1.75	0.3368
Total Phosphorus	1.44	0.3976
* Total Dissolved Solids	99,999.99	<0.0001
Total Suspended Solids	0.50	0.7436
Total Organic Carbon	0.32	0.8492
Dissolved Organic Carbon	0.50	0.7436
Total Inorganic Carbon	6.75	0.0743
Total Iron	1.75	0.3368
Total Magnesium	0.75	0.6187

Model df = 4

Error df = 3

Parameter	F value	Prob > F
<u>1991</u>		
Temperature	0.50	0.7436
Dissolved Oxygen	1.75	0.3368
pH	6.75	0.0743
Kjeldahl Nitrogen	0.19	0.9302
Total Phosphorus	0.08	0.9819
Total Dissolved Solids	1.12	0.4807
Total Suspended Solids	6.75	0.0743
Total Organic Carbon	0.32	0.8492
Dissolved Organic Carbon	1.75	0.3368
Total Inorganic Carbon	0.75	0.6187
Total Iron	1.12	0.4807
Total Magnesium	0.19	0.9302

Model df = 4

Error df = 3

* differences in station ranks statistically significant at $\alpha = 0.05$

Table 3-2. Comparative water quality data (range of values) from representative southeastern lotic systems and Steel Creek. November 1985 - December 1991.

System	Temp. (°C)	DO (mg/L)	pH	Cond. (uS/cm)	TDS (mg/L)	TSS (mg/L)	TOC (mg/L)
<u>This Study 1985/86:</u>							
Steel Creek corridor ^a	10.9 - 29.9	4.9 - 11.1	5.4 - 8.6	41 - 97	29 - 74	< 1 - 204	4 - 12
Steel Creek swamp/marsh ^b	7.6 - 27.7	0.6 - 11.3	4.8 - 7.3	22 - 135	7 - 84	< 1 - 40	3 - 13
<u>This Study 1987:</u>							
Steel Creek corridor	9.1 - 29.3	4.7 - 12.0	5.8 - 8.0	60 - 93	36 - 83	1 - 59	3 - 8
Steel Creek swamp/marsh	8.8 - 27.9	1.9 - 10.1	5.3 - 7.7	23 - 114	23 - 91	< 1 - 20	2 - 10
<u>This Study 1988:</u>							
Steel Creek corridor	6.6 - 28.4	5.2 - 11.6	5.6 - 8.5	65 - 126	44 - 80	1 - 44	3 - 7
Steel Creek swamp/marsh	1.3 - 27.5	3.3 - 12.5	5.5 - 7.3	70 - 111	45 - 84	1 - 148	1 - 7
<u>This Study 1989:</u>							
Steel Creek corridor	7.7 - 26.5	4.9 - 12.3	5.3 - 7.5	62 - 99	32 - 76	1 - 20	1 - 8
Steel Creek swamp/marsh	5.0 - 26.3	2.6 - 11.4	5.0 - 7.4	39 - 114	48 - 84	1 - 68	1 - 19
<u>This Study 1990:</u>							
Steel Creek corridor	8.4 - 28.9	5.0 - 13.0	6.1 - 7.6	58 - 84	47 - 66	1 - 2	4 - 6
Steel Creek swamp/marsh					36 - 89	1 - 2	3 - 8
<u>This Study 1991:</u>							
Steel Creek corridor	10.3 - 28.1	7.3 - 11.5	5.6 - 7.2	18 - 66	27 - 52	2	3 - 4
Steel Creek swamp/marsh					26 - 73	1 - 4	4 - 8
<u>Alabama:</u>							
Alabama/Coosa River ^c	5 - 31	5.2 - 13.8	5.6 - 7.9	81 - 203	27 - 160	2 - 90	0.3 - 36
Black Warrior River ^d	7.5 - 32	6.4 - 11.8	6.4 - 8.1	135 - 215	10 - 903	< 1 - 217	< 2 - 15.3
Tombigbee River ^d	7.5 - 32.5	5.2 - 11.0	6.2 - 8.9	35 - 175	57 - 129	4 - 330	< 2 - 21.6

Table 3-2 (continued). Comparative water quality data (range of values) from representative southeastern lotic systems and Steel Creek. November 1985 - December 1991.

System	Temp. (°C)	DO (mg/L)	pH	Cond. (uS/cm)	TDS (mg/L)	TSS (mg/L)	TOC (mg/L)
<u>Florida:</u>							
Apalachicola River*	19 - 29	5.6 - 7.8	7.1 - 7.6	80 - 135	74 - 99	< 10 - 15	5 - 8
Chattahoochee River*	17 - 29	6.0 - 9.5	6.8 - 7.8	50 - 181	42 - 126	< 10 - 103	3 - 18
Flint River*	18 - 28	6.4 - 8.1	6.9 - 8.2	90 - 145	63 - 93	< 10 - 27	1 - 8
<u>Georgia:</u>							
Beaverdam Creek ^f	3 - 26	6.7 - 13.5	5.5 - 6.9	40 - 109	< 5 - 610 ^g		2.5 - 11
Ceder Creek ^f	2 - 23.7	5.2 - 14.1	4.4 - 6.8	39 - 72	< 5 - 260		1.5 - 9.5
Coldwater Creek ^f	0.9 - 26	5.7 - 13.9	5.3 - 6.8	30 - 49	< 5 - 650		1 - 9
<u>Mississippi:</u>							
7 small creeks ^h	21.0 - 27.0	0.9 - 8.2	6.0 - 7.7	45 - 79	1 - 30	34 - 128	8 - 17
<u>South Carolina:</u>							
Little Genersotee Creek ^f	1.2 - 25	5.4 - 15.0	4.3 - 6.9	40 - 92	< 5 - 500		2 - 8.5
Rocky River ^f	3 - 23	7 - 13.4	5.6 - 7.6	40 - 75	< 5 - 430		1.5 - 7
unidentified creek ^f					< 24 - 41		14 - 34
<u>Virginia:</u>							
North Anna River ⁱ	< 5 - 31	6.4 - 13.7	6.0 - 8.5		< 5 - 360	1 - 1220	

*Stations 275-290;

^bStations 300-370;

^cGeological Survey of Alabama (1983);

^dHarmon Engineering & Testing Co., Inc. (1983);

^eWater and Air Research, Inc. (1981b, 1982);

^fWater and Air Research, Inc. (1981a);

^gData not available;

^hTheta Analysis, Inc. (1984);

ⁱSimmons (1972).

Table 3-2 (continued). Comparative water quality data (range of values) from representative southeastern lotic systems and Steel Creek. November 1985 - December 1991.

System	DOC (mg/L)	TIC (mg/L)	ALK (mg CaCO ₃ /L)	OP (ug/L)	TP (ug/L)	NO ₂ (ug/L)	NO ₃ (ug/L)
<u>This Study 1985/86:</u>							
Steel Creek corridor	4 - 9	2 - 8	6 - 24	< 5 - 87	18 - 343	1 - 20	< 10 - 402
Steel Creek swamp/marsh	3 - 12	1 - 13	2 - 50	< 5 - 46	8 - 154	< 1 - 5	< 10 - 582
<u>This Study 1987:</u>							
Steel Creek corridor	2 - 10	2 - 6	13 - 23	< 5 - 136	25 - 180	< 1 - 82	< 10 - 611
Steel Creek swamp/marsh	2 - 14	2 - 10	10 - 37	< 5 - 59	19 - 153	1 - 13	< 10 - 366
<u>This Study 1988:</u>							
Steel Creek corridor	3 - 7	3 - 6	12 - 18	< 5 - 50	29 - 129	1 - 12	< 10 - 281
Steel Creek swamp/marsh	2 - 7	3 - 10	12 - 31	< 5 - 48	21 - 449	1 - 6	< 10 - 268
<u>This Study 1989:</u>							
Steel Creek corridor	2 - 7	2 - 6	9 - 16	< 5 - 36	32 - 83	1 - 19	< 10 - 234
Steel Creek swamp/marsh	1 - 17	3 - 8	7 - 22	< 5 - 67	24 - 494	1 - 8	< 10 - 264
<u>This Study 1990:</u>							
Steel Creek corridor	3 - 7	2 - 4	11 - 14	< 5 - 12	29 - 46	2 - 6	121 - 142
Steel Creek swamp/marsh	3 - 6	2 - 6	9 - 30	7 - 34	25 - 106	1 - 7	73 - 305
<u>This Study 1991:</u>							
Steel Creek corridor	4 - 5	2 - 4	9 - 12	< 5 - 17	19 - 39	2 - 4	58 - 129
Steel Creek swamp/marsh	2 - 6	3 - 6	10 - 16	5 - 32	20 - 83	<1 - 4	26 - 269
<u>Alabama:</u>							
Alabama/Coosa River			3.3 - 71	0 - 180	40 - 330		0 - 280 ^J
Black Warrior River	< 2 - 12.7		13 - 34	< 1 - 45	10 - 650		160 - 1200 ^J
Tombigbee River	< 2 - 19.3		21 - 54	< 1 - 272	20 - 1320		10 - 660 ^J

Table 3-2 (continued). Comparative water quality data (range of values) from representative southeastern lotic systems and Steel Creek. November 1985 - December 1991.

System	DOC (mg/L)	TIC (mg/L)	ALK (mg CaCO ₃ /L)	OP (ug/L)	TP (ug/L)	NO ₂ (ug/L)	NO ₃ (ug/L)
<u>Florida:</u>							
Apalachicola River	4 - 8		25 - 47	< 10 - 30	30 - 210		40 - 320 ^j
Chattahoochee River	4 - 12		14 - 34	< 10 - 30	30 - 340		70 - 420 ^j
Flint River	< 2 - 8		25 - 57		< 5 - 130		280 - 640 ^j
<u>Georgia:</u>							
Beaverdam Creek			13 - 50	18 - 120	50 - 890		250 - 490 ^j
Ceder Creek			7 - 34	160 - 400	120 - 680		170 - 620 ^j
Coldwater Creek			7 - 30	< 2 - 130	10 - 660		180 - 430 ^j
<u>Mississippi:</u>							
7 small creeks			18 - 52	20 - 90			0 - 110 ^j
<u>South Carolina:</u>							
Little Genersotee Creek			7 - 40	10 - 100	32 - 810		200 - 460 ^j
Rocky River			19 - 47	2 - 49	8 - 590		110 - 370 ^j
unidentified creek				180 - 610	420 - 940		540 - 990 ^j
<u>Virginia:</u>							
North Anna River			11 - 33		0 - 170		0 - 260

^j(NO₂ + NO₃) - N.

Table 3-2 (continued). Comparative water quality data (range of values) from representative southeastern lotic systems and Steel Creek. November 1985 - December 1991.

System	NH ₄ (ug/L)	TIN (ug/L)	SiO ₂ (mg/L)	total Al (ug/L)	diss. Al (ug/L)	total Ca (mg/L)	diss. Ca (mg/L)
<u>This Study 1985/86:</u>							
Steel Creek corridor	11 - 764	27 - 808	3.2 - 10.7	< 100 - 991	< 100 - 905	2.6 - 4.5	2.8 - 5.8
Steel Creek swamp/marsh	< 10 - 190	21 - 664	1.2 - 13.3	< 100 - 1210	< 100 - 1270	2.7 - 9.6	2.4 - 9.5
<u>This Study 1987:</u>							
Steel Creek corridor	10 - 1080	34 - 1119	0.8 - 9.7	< 100 - 1216	< 100 - 202	3.1 - 4.8	3.1 - 4.8
Steel Creek swamp/marsh	< 10 - 157	15 - 407	0.7 - 19.1	< 100 - 449	< 100 - 155	2.6 - 7.8	2.7 - 7.8
<u>This Study 1988:</u>							
Steel Creek corridor	10 - 286	17 - 412	3.3 - 8.5	< 100 - 341	< 100 - 148	1.5 - 3.8	1.5 - 3.6
Steel Creek swamp/marsh	< 10 - 93	< 10 - 329	0.6 - 15.5	< 100 - 302	< 100 - < 100	1.9 - 4.9	1.9 - 4.9
<u>This Study 1989:</u>							
Steel Creek corridor	< 10 - 183	23 - 325	4.3 - 8.0	< 100 - 409	< 100 - 105	1.1 - 3.5	1.1 - 3.9
Steel Creek swamp/marsh	< 10 - 100	< 10 - 317	1.7 - 10.3	< 100 - 341	< 100 - 240	2.1 - 4.3	2.1 - 4.6
<u>This Study 1990:</u>							
Steel Creek corridor	< 10 - 120			< 100 - <100		1.8 - 3.1	
Steel Creek swamp/marsh	14 - 92			< 100 - 198		2.6 - 4.8	
<u>This Study 1991:</u>							
Steel Creek corridor	< 10 - 246			< 100 - 102		2.19 - 3.67	
Steel Creek swamp/marsh	< 10 - 46			< 100 - 101		2.84 - 4.48	
<u>Alabama:</u>							
Alabama/Coosa River	0 - 1600		1.9 - 6.1			5.4 - 24.0	
Black Warrior River	10 - 1700	22 - 1420				1.1 - 15.5	
Tombigbee River	< 10 - 500	10 - 880				7.5 - 23.5	

Table 3-2 (continued). Comparative water quality data (range of values) from representative southeastern lotic systems and Steel Creek. November 1985 - December 1991.

System	NH ₄ (ug/L)	TIN (ug/L)	SiO ₂ (mg/L)	total Al (ug/L)	diss. Al (ug/L)	total Ca (mg/L)	diss. Ca (mg/L)
<u>Florida:</u>							
Apalachicola River	40 - 130	90 - 340				13.0 - 15.3	
Chattahoochee River	< 10 - 120	< 80 - 530				3 - 6	
Flint River	30 - 110	300 - 750				6.2 - 16.3	
<u>Georgia:</u>							
Beaverdam Creek	22 - 190					1.9 - 4.4	
Ceder Creek	150 - 220					1.1 - 3.8	
Coldwater Creek	13 - 180					1.4 - 2.5	
<u>Mississippi:</u>							
7 small creeks	0 - 25		6.4 - 18.8			3.49 - 4.38	
<u>South Carolina:</u>							
Little Genersotee Creek	< 13 - 350					2.1 - 3.7	
Rocky River	45 - 300					2.7 - 4.0	
unidentified creek						6.7 - 9.2	
<u>Virginia:</u>							
North Anna River							

Table 3-2 (continued). Comparative water quality data (range of values) from representative southeastern lotic systems and Steel Creek. November 1985 - December 1991.

System	total Fe (mg/L)	diss. Fe (mg/L)	total Mg (mg/L)	diss. Mg (mg/L)	total Mn (ug/L)	total MnOC (ug/L)/L)
<u>This Study 1985/86:</u>						
Steel Creek corridor	0.1 - 3.8	< 0.1 - 3.2	0.74 - 1.94	0.70 - 2.01	< 20 - 563	< 20 - 466 1.06 - 1.98
Steel Creek swamp/marsh	0.3 - 7.4	0.1 - 0.7	0.63 - 2.66	0.62 - 2.59	< 20 - 3590	< 20 - 3590 1.14 - 4.12
<u>This Study 1987:</u>						
Steel Creek corridor	0.1 - 1.2	< 0.1 - 1.1	0.98 - 1.40	0.95 - 1.41	< 20 - 310	< 20 - 311 0.95 - 1.92
Steel Creek swamp/marsh	0.2 - 4.3	0.1 - 0.8	0.96 - 1.87	0.88 - 1.83	< 20 - 4173	< 20 - 4067 0.79 - 1.98
<u>This Study 1988:</u>						
Steel Creek corridor	0.1 - 0.7	< 0.1 - 0.4	0.91 - 1.28	0.87 - 1.32	< 20 - 186	< 20 - 175 0.87 - 1.77
Steel Creek swamp/marsh	0.1 - 2.0	< 0.1 - 0.7	0.87 - 1.66	0.88 - 1.64	< 20 - 2660	< 20 - 2640 0.89 - 2.32
<u>This Study 1989:</u>						
Steel Creek corridor	0.1 - 1.1	< 0.1 - 0.4	0.92 - 1.34	0.99 - 1.46	< 20 - 159	< 20 - 178 1.08 - 1.75
Steel Creek swamp/marsh	0.1 - 3.4	0.1 - 2.7	0.84 - 1.36	0.84 - 1.44	< 20 - 578	< 20 - 540 0.91 - 4.28
<u>This Study 1990:</u>						
Steel Creek corridor	0.1 - 0.6		0.83 - 1.17		33 - 99	1.1 - 1.6
Steel Creek swamp/marsh	0.3 - 1.4		0.81 - 1.43		< 20 - 265	1.1 - 1.5
<u>This Study 1991:</u>						
Steel Creek corridor	0.2 - 0.7		0.77 - 1.01		25 - 91	0.9 - 1.4
Steel Creek swamp/marsh	0.2 - 2.2		0.78 - 1.38		< 20 - 77	1.3 - 1.9
<u>Alabama:</u>						
Alabama/Coosa River	< 0.1 - 15	0 - 0.6			3 - 320	0 - 80
Black Warrior River	0.2 - 10.1	< 0.1 - 0.4	3.1 - 6.8		20 - 720	< 2 - 419 1.5 - 3.2
Tombigbee River	0.2 - 18	< 0.1 - 0.9	1.1 - 3.5		< 10 - 430	< 2 - 90 1.2 - 3.5

Table 3-2 (continued). Comparative water quality data (range of values) from representative southeastern lotic systems and Steel Creek. November 1985 - December 1991.

System	total Fe (mg/L)	diss. Fe (mg/L)	total Mg (mg/L)	diss. Mg (mg/L)	total Mn (ug/L)	total MnOC (ug/L)/L)
<u>Florida:</u>						
Apalachicola River	0.2 - 2.3	< 0.1 - 0.2	1.3 - 2.8		60 - 170	1.1 - 1.6
Chattahoochee River	0.2 - 5.0	< 0.1 - 0.2	1.0 - 4.1		50 - 220	< 50 - 120 1.6 - 2.6
Flint River	0.2 - 2	< 0.1 - 1.4	0.9 - 1.6		< 50 - 260	0.8 - 1.2
<u>Georgia:</u>						
Beaverdam Creek	0.8 - 25	< 0.2 - 1.5			< 50 - 580	< 50 - 150 1.9 - 7.2
Ceder Creek	0.9 - 16	< 0.2 - 1.8			< 50 - 240	< 50 - 120 1.5 - 3.9
Coldwater Creek	0.5 - 20	< 0.2 - 0.6			< 50 - 540	< 50 - 60 1.4 - 7.6
<u>Mississippi:</u>						
7 small creeks	0.9 - 4.3	0.2 - 3.3	1.14 - 5.84	1.07 - 5.55	111 - 1600	
<u>South Carolina:</u>						
Little Genersotee Creek	<0.2 - 2.9	< 0.2 - 0.4			< 50 - 490	< 50 - 140 1.8 - 6.6
Rocky River	0.2 - 18	< 0.2 - 0.2			< 50 - 670	< 50 - 120 1.9 - 3.9
unidentified creek	1.2 - 1.8	< 0.2 - 1.2				
<u>Virginia:</u>						
North Anna River	< 0.1 - 2.2		1.8 - 13.9		< 100 - 200	

Table 3-2 (continued). Comparative water quality data (range of values) from representative southeastern lotic systems and Steel Creek. November 1985 - December 1991.

System	diss K (mg/L)	total Na (mg/L)	diss Na (mg/L)	Cl (mg/L)	H ₂ S (mg/L)	SO ₄ (mg/L)
<u>This Study 1985/86:</u>						
Steel Creek corridor	1.00 - 1.94	4.0 - 13.1	3.7 - 12.1	6 - 8	< 0.1	3 - 11
Steel Creek swamp/marsh	1.07 - 3.35	6.0 - 14.6	6.0 - 14.8	6 - 10	< 0.1	1 - 12
<u>This Study 1987:</u>						
Steel Creek corridor	0.24 - 1.65	6.6 - 11.4	6.9 - 10.7	5 - 9	< 0.1	4 - 7
Steel Creek swamp/marsh	0.54 - 1.90	5.8 - 11.3	5.4 - 11.9	3 - 11	< 0.1	3 - 9
<u>This Study 1988:</u>						
Steel Creek corridor	0.87 - 1.72	8.3 - 13.5	8.1 - 13.3	6 - 11	< 0.1	5 - 9
Steel Creek swamp/marsh	0.68 - 2.45	8.1 - 13.1	8.1 - 12.6	5 - 12	< 0.1	4 - 9
<u>This Study 1989:</u>						
Steel Creek corridor	1.22 - 1.96	9.0 - 13.0	9.4 - 13.6	7 - 10	< 0.1	1 - 9
Steel Creek swamp/marsh	1.01 - 4.45	6.2 - 12.4	9.3 - 13.3	5 - 10	< 0.1	1 - 12
<u>This Study 1990:</u>						
Steel Creek corridor		6.7 - 7.5		6 - 7	< 0.1	4 - 7
Steel Creek swamp/marsh		5.1 - 8.0		4 - 9	< 0.1	3 - 17
<u>This Study 1991:</u>						
Steel Creek corridor		4.1 - 5.8		4.0 - 5.2	< 0.1	2 - 4
Steel Creek swamp/marsh		4.8 - 7.6		3.9 - 7.6	< 0.1	2 - 6
<u>Alabama:</u>						
Alabama/Coosa River				0 - 17		1.2 - 16.0
Black Warrior River		6.8 - 11.3		3 - 9	< 0.1 - 4.6	28 - 60
Tombigbee River		2.6 - 98		2 - 15	< 0.1 - 1.8	1 - 15

Table 3-2 (continued). Comparative water quality data (range of values) from representative southeastern lotic systems and Steel Creek. November 1985 - December 1991.

System	diss K (mg/L)	total Na (mg/L)	diss Na (mg/L)	Cl (mg/L)	H ₂ S (mg/L)	SO ₄ (mg/L)
<u>Florida:</u>						
Apalachicola River		3.6 - 6.3		4 - 6		4 - 7
Chattahoochee River		4.3 - 10.9		3 - 5		4 - 12
Flint River		3.3 - 4.4		4 - 5		< 1 - 4
<u>Georgia:</u>						
Beaverdam Creek		3.4 - 10.0		2.2 - 11.0		
Ceder Creek		1.9 - 11.0		1.9 - 7.1		
Coldwater Creek		1.0 - 2.9		1.6 - 13.0		
<u>Mississippi:</u>						
7 small creeks				2.5 - 3.7	< 0.1	2.7 - 10.0
<u>South Carolina:</u>						
Little Genersotee Creek		2.3 - 4.2		2.1 - 3.7		
Rocky River		3.3 - 5.6		2.6 - 4.7		
unidentified creek						
<u>Virginia:</u>						
North Anna River						0.4 - 16.0

Definition of parameter abbreviations in table headings:

Temp. - temperature	ALK - alkalinity	SiO ₂ - silica	SO ₄ - sulfate
DO - dissolved oxygen	OP - ortho-phosphorous	Al - aluminum	
Cond. - conductivity	TP - total phosphorous	Ca - calcium	
TDS - total dissolved solids	NO ₂ - nitrite-nitrogen	Fe - iron	
TSS - total suspended solids	NO ₃ - nitrate-nitrogen	Mg - magnesium	
TOC - total organic carbon	TIN - total inorganic nitrogen	Mn - manganese	
DOC - dissolved organic carbon	Cl - chloride	K - potassium	
TIC - total inorganic carbon	H ₂ S - hydrogen sulfide	Na - sodium	

4.0 SUMMARY AND CONCLUSIONS

This study has documented the status of water quality at 13 sampling stations located throughout the Steel Creek corridor, marsh, swamp, and channel. Water quality data were collected at all stations on a monthly basis from November 1985 to December 1989. Changes to the original scope-of-work were implemented in January 1990 which included reducing the number of stations (retaining only four of the original 13 sites), changing the sampling frequency for most parameters from a monthly to a quarterly schedule, and eliminating the monitoring of dissolved metals. This report presents data for those water quality parameters collected from November 1985 through December 1991.

Flow velocity in the Steel Creek system was positively related to the volume of discharge at the L-Lake Dam, which varied with the status of L-Reactor operations. This relationship was strongest at Station 275, which was located immediately below the L-Lake Dam, but was also very evident at the other corridor and channel stations. Peak flows occurred during the years 1985 to 1988 when L-Reactor was in operation.

During at least part of this study, downstream gradients (either for yearly means or individual values) were observed between corridor Stations 275 and 290 for temperature, dissolved oxygen, pH, total organic and inorganic carbon, ortho- and total phosphorus, nitrite-nitrogen, nitrate-nitrogen, and ammonia-nitrogen, total inorganic nitrogen, silica, total aluminum, total and dissolved iron, total and dissolved sodium, chloride, total and dissolved magnesium, total and dissolved potassium, and total and dissolved calcium. These differences were attributed to natural conditions such as cooling, outgassing, metabolic activity of stream organisms, or chemical reactions.

Differences (either for yearly means or individual values) between the swamp and marsh stations were noted during at least a portion of this study for temperature, ortho- and total phosphorus, nitrate-nitrogen, total inorganic nitrogen, total and dissolved sodium, and sulfate. However, no consistent differences were evident. Such variation would not be unexpected between stations located in different habitat types.

Inspection of pre- and post-impoundment data for the years 1985 to 1989 (see Chimney and Westbury 1990) indicated that increases in temperature, conductivity, total phosphorus, nitrate-nitrogen, ammonia-nitrogen, total sodium, dissolved sodium, and chloride, and decreases in pH have occurred relative to pre-impoundment conditions documented during the CCW study. These changes reflected differences between water being released from L Lake (which was dominated by Savannah River water) and the natural drainage of the Steel Creek basin, but were not thought to be limiting to the establishment and/or maintenance of a balanced biological community in Steel Creek.

A strong correspondence in the pattern of long-term variation for certain water quality parameters (e.g., alkalinity, total aluminum, total calcium, total sodium, chloride and sulfate) was observed between the pelagic zone of L-Lake and the Steel Creek corridor stations. There was less similarity between L-Lake and conditions monitored in the Steel Creek swamp and marsh. It was expected that L-Lake discharge would dominate the water quality in the Steel Creek corridor.

Many water quality variables were markedly different at Station 300 relative to the other swamp and marsh sites during the summers of 1986, 1987, and 1988 (i.e., higher levels at Station 300 for conductivity, total dissolved solids, total inorganic carbon, alkalinity, ammonia-nitrogen, total and dissolved

calcium, total iron, total and dissolved magnesium, total and dissolved manganese, and total and dissolved potassium; and lower concentrations at Station 300 for ortho-phosphorus and sulfate). Coincidentally, the abundance of macrophytes at Station 300 greatly reduced flow velocities at these times; channels through this site were completely closed by the end of summer in all years. Reduced flow velocities at Station 300 were thought to have impeded water exchange with the rest of the swamp and marsh which, in turn, may have contributed to the observed differences in water chemistry. Water quality differences between Station 300 and the swamp and marsh sites, while still evident for a number of variables during the summer of 1989, were much reduced compared to previous years.

Steel Creek water quality during this study was found to be similar to the range of values reported for other regional lotic systems and judged to be typical of southeastern surface waters in general.

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Appendix Table 1.

Raw data for Steel Creek Weekly Water Quality - Sampling Plan #1.

Year	Month	Day	Station	VEL	TEMP	DO	PH	COND	NH ₄
90	Jan	9	275	0.69	9.20	11.97	6.23	72	39
90	Jan	15	275	0.44	8.43	13.00	6.62	72	24
90	Jan	22	275	0.42	10.34	11.93	6.92	73	16
90	Jan	29	275	0.36	11.42	10.69	6.97	67	29
90	Feb	5	275	0.50	12.12	10.19	6.90	70	38
90	Feb	12	275	0.48	13.94	11.39	7.07	71	7
90	Feb	21	275	0.33	13.60	9.96	6.72	68	56
90	Feb	28	275	0.56	12.65	10.88	7.03	69	18
90	Mar	7	275	0.36	14.66	11.04	7.04	66	17
90	Mar	14	275	0.48	14.56	10.66	6.89	65	36
90	Mar	21	275	0.55	15.48	9.85	6.09	63	24
90	Mar	28	275	0.46	17.62	9.52	6.84	61	16
90	Apr	4	275	0.56	16.20	10.84	6.32	63	20
90	Apr	11	275	0.66	17.23	9.45	6.70	63	22
90	Apr	18	275	0.61	19.17	9.49	6.69	65	109
90	Apr	25	275	0.67	19.07	9.91	6.45	64	24
90	May	2	275	0.64	21.91	8.37	7.08	75	27
90	May	9	275	0.70	21.41	7.45	6.82	69	34
90	May	16	275	0.64	22.16	8.85	6.69	70	37
90	May	23	275	0.83	23.91	7.36	6.79	66	31
90	May	30	275	0.70	23.83	7.83	6.52	65	9
90	Jun	6	275	0.65	25.34	8.03	6.80	65	21
90	Jun	13	275	0.74	25.50	8.02	6.18	69	69
90	Jun	18	275	0.57	26.60	7.57	6.34	78	18
90	Jun	27	275	0.76	26.80	8.19	6.19	71	20
90	Jul	2	275	0.20	28.69	7.09	7.63	70	24
90	Jul	11	275	0.44	27.80	7.39	6.27	84	12
90	Jul	16	275	0.35	26.70	7.56	6.63	70	12
90	Jul	25	275	0.42	27.90	7.26	6.68	68	16
90	Aug	1	275	0.53	28.87	8.93	6.41	60	28
90	Aug	8	275	0.39	28.10	7.08	6.38	65	24
90	Aug	15	275	0.43	27.40	7.17	6.78	61	3
90	Aug	22	275	0.57	27.35	7.65	6.12	58	28
90	Aug	29	275	1.10	27.00	8.43	6.05	72	8
90	Sep	5	275	0.42	28.37	7.23	6.27	60	120
90	Sep	12	275	0.30	27.60	7.84	6.18	65	25
90	Sep	19	275	0.54	25.40	7.41	6.12	68	42
90	Sep	26	275	0.33	24.80	7.75	6.32	65	34
90	Oct	3	275	0.60	24.46	7.75	6.14	63	34
90	Oct	10	275	0.58	24.09	8.36	6.57	61	0
90	Oct	17	275	0.46	23.26	7.71	6.36	62	15
90	Oct	24	275	1.20	21.96	8.68	6.27	59	27
90	Oct	31	275	0.46	18.69	7.51	6.36	63	13

Appendix Table 1 (continued).

Raw data for Steel Creek Weekly Water Quality - Sampling Plan #1.

Year	Month	Day	Station	VEL	TEMP	DO	PH	COND	NH ₄
90	Nov	7	275	0.40	19.05	6.80	6.40	62	8
90	Nov	14	275	0.62	16.92	5.75	6.25	61	76
90	Nov	20	275	0.46	15.98	7.53	6.24	65	74
90	Nov	28	275	0.57	15.74	5.67	6.53	64	15
90	Dec	5	275	0.42	14.60	7.26	6.33	65	81
90	Dec	12	275	0.48	13.32	4.96	6.37	67	107
90	Dec	19	275	0.52	13.94	8.39	6.63	67	75
90	Dec	26	275	0.47	13.14	9.10	6.80	66	56

Appendix Table 1 (continued).

Raw data for Steel Creek Weekly Water Quality - Sampling Plan #1.

Year	Month	Day	Station	VEL	TEMP	DO	PH	COND	NH4
91	Jan	2	275	0.76	12.31	10.25	5.79	66	50
91	Jan	9	275	0.70	11.93	9.90	5.93	64	64
91	Jan	16	275	0.42	11.48	10.85	7.18	66	60
91	Jan	23	275	0.32	10.48	10.57	7.06	65	47
91	Jan	30	275	0.36	10.25	10.34	6.98	62	36
91	Feb	6	275	0.58	10.97	9.25	7.05	63	42
91	Feb	13	275	0.42	11.19	10.62	6.22	65	19
91	Feb	20	275	0.48	11.07	10.83	6.64	64	45
91	Feb	27	275	0.39	11.96	11.14	6.60	64	41
91	Mar	6	275	0.90	12.55	11.15	7.17	62	30
91	Mar	13	275	0.68	12.81	10.11	6.57	62	34
91	Mar	20	275	0.77	14.29	10.20	6.38	64	17
91	Mar	27	275	0.81	16.78	9.92	6.58	61	182
91	Apr	3	275	0.75	17.63	10.42	6.76	62	23
91	Apr	10	275	0.82	18.51	9.95	6.59	59	19
91	Apr	17	275	1.05	20.48	9.82	6.41	58	15
91	Apr	24	275	.	.	.	.	.	.
91	May	1	275	.	.	.	.	.	.
91	May	8	275	0.70	23.08	8.97	6.12	58	9
91	May	15	275	0.65	24.02	8.28	6.25	57	21
91	May	22	275	0.78	23.87	8.79	5.85	56	19
91	May	29	275	0.72	25.19	8.18	6.36	58	23
91	Jun	5	275	0.72	26.77	7.90	6.30	54	246
91	Jun	12	275	0.56	22.50	8.45	5.85	59	20
91	Jun	19	275	0.52	26.10	8.27	6.03	52	103
91	Jun	26	275	0.62	26.80	8.10	5.84	65	7
91	Jul	3	275	0.72	27.10	8.43	5.97	66	9
91	Jul	10	275	0.54	27.72	8.03	6.26	54	17
91	Jul	17	275	0.98	26.30	8.26	6.26	64	7
91	Jul	24	275	1.05	27.10	8.15	6.32	55	31
91	Jul	31	275	0.93	25.50	7.86	5.87	62	32
91	Aug	7	275	1.40	28.10	8.34	5.96	47	15
91	Aug	14	275	1.00	28.00	7.88	5.63	42	73
91	Aug	21	275	0.88	26.90	7.95	6.74	50	10
91	Aug	28	275	0.48	25.70	7.53	5.65	54	13
91	Sep	4	275	0.48	24.44	8.78	5.82	18	98
91	Sep	11	275	0.52	27.20	7.29	5.97	66	9
91	Sep	18	275	0.52	27.90	7.61	7.05	57	33
91	Sep	25	275	0.54	24.70	8.34	5.70	38	22
91	Oct	2	275	0.40	22.72	8.29	5.96	53	24
91	Oct	9	275	0.58	21.07	9.16	6.42	52	46
91	Oct	16	275	0.70	19.66	10.86	6.01	53	38

Appendix Table 1 (continued).

Raw data for Steel Creek Weekly Water Quality - Sampling Plan #1.

Year	Month	Day	Station	VEL	TEMP	DO	PH	COND	NH ₄
91	Oct	23	275	0.15	20.35	8.69	5.89	54	30
91	Oct	30	275	0.55	20.22	8.78	6.21	56	0
91	Nov	6	275	0.50	13.44	11.40	5.90	59	12
91	Nov	13	275	0.54	13.98	10.60	6.06	60	86
91	Nov	20	275	0.54	14.95	10.50	6.69	56	64
91	Nov	27	275	0.59	13.49	10.74	6.74	59	6
91	Dec	4	275	0.64	14.16	10.84	6.29	60	24
91	Dec	11	275	0.39	14.09	11.28	6.68	61	12
91	Dec	18	275	0.43	12.90	11.06	6.70	62	41
91	Dec	26	275	0.41	12.20	11.48	6.49	61	39

VEL = velocity (m/sec)
TEMP = temperature (°C)
DO = dissolved oxygen (mg/L)

PH = pH (standard units)
COND = conductivity (µS/cm @ 25°C)
NH₄ = ammonia-nitrogen (µg N/L)

Appendix Table 2.

Descriptive statistics for stream flow velocity (m/sec) in Steel Creek.

Station	Mean	N	SE	Min	Max
Year=1990					
275	0.54	51	0.03	0.20	1.20
Year=1991					
275	0.64	50	0.03	0.15	1.40

Appendix Table 3.

Raw data for Steel Creek Biannual Diel Water Quality - Sampling Plan #1.

Year	Month	Day	Station	Period	TEMP	DO	PH
90	Feb	27	290	1	10.0	11.57	7.28
90	Feb	27	290	2	11.6	11.54	7.34
90	Feb	27	290	3	13.6	12.05	7.34
90	Feb	27	290	4	14.4	11.08	7.35
90	Feb	27	290	5	13.8	10.60	7.11
90	Feb	27	290	6	11.9	9.65	7.25
90	Feb	27	290	7	11.9	9.55	7.21
90	Feb	28	290	8	11.7	9.56	7.20
90	Feb	28	290	9	10.9	9.61	7.16
90	Feb	28	290	10	10.9	9.58	7.19
90	Feb	27	330	1	9.7	9.93	6.95
90	Feb	27	330	2	9.7	9.99	7.02
90	Feb	27	330	3	10.0	10.22	7.03
90	Feb	27	330	4	10.4	10.53	7.08
90	Feb	27	330	5	10.5	10.55	7.07
90	Feb	27	330	6	10.5	10.58	6.96
90	Feb	28	330	7	10.4	9.92	6.81
90	Feb	28	330	8	10.4	9.78	6.95
90	Feb	28	330	9	10.4	9.81	6.94
90	Feb	28	330	10	10.3	9.70	6.21
90	Feb	27	350	1	9.6	10.09	6.95
90	Feb	27	350	2	9.8	10.18	6.84
90	Feb	27	350	3	10.2	10.27	7.13
90	Feb	27	350	4	10.6	10.69	7.10
90	Feb	27	350	5	10.7	10.54	7.12
90	Feb	27	350	6	10.5	9.96	7.04
90	Feb	28	350	7	10.4	10.04	6.15
90	Feb	28	350	8	10.5	9.98	5.91
90	Feb	28	350	9	10.4	9.91	5.95
90	Feb	28	350	10	10.1	9.81	5.84
90	Feb	27	370	1	9.8	10.75	7.06
90	Feb	27	370	2	9.9	10.22	7.06
90	Feb	27	370	3	10.2	10.68	7.02
90	Feb	27	370	4	10.6	11.27	7.13
90	Feb	27	370	5	10.7	10.63	7.14
90	Feb	27	370	6	10.2	10.05	7.08
90	Feb	28	370	7	10.4	9.89	7.01
90	Feb	28	370	8	10.4	9.91	7.03
90	Feb	28	370	9	10.4	9.85	6.96
90	Feb	28	370	10	10.3	9.78	7.00
90	Aug	21	290	1	27.3	6.44	6.35
90	Aug	21	290	2	28.6	6.48	6.48
90	Aug	21	290	3	29.6	6.35	6.58
90	Aug	21	290	4	29.5	6.13	6.44
90	Aug	21	290	5	28.5	5.74	6.45

Appendix Table 3 (continued).

Raw data for Steel Creek Biannual Diel Water Quality - Sampling Plan #1.

Year	Month	Day	Station	Period	TEMP	DO	PH
90	Aug	21	290	6	27.1	5.81	6.22
90	Aug	22	290	7	26.6	6.95	6.40
90	Aug	22	290	8	26.1	6.59	6.28
90	Aug	22	290	9	24.3	6.55	5.94
90	Aug	22	290	10	23.7	5.98	5.79
90	Aug	21	330	1	26.0	2.19	5.81
90	Aug	21	330	2	26.7	2.87	5.87
90	Aug	21	330	3	27.8	3.20	5.98
90	Aug	21	330	4	28.4	2.92	5.97
90	Aug	21	330	5	28.5	1.78	5.85
90	Aug	21	330	6	27.4	1.54	5.65
90	Aug	21	330	7	26.9	1.45	5.47
90	Aug	22	330	8	26.5	1.77	5.64
90	Aug	22	330	9	.	.	.
90	Aug	22	330	10	23.4	1.72	5.50
90	Aug	21	350	1	25.8	3.92	5.87
90	Aug	21	350	2	26.5	4.60	5.96
90	Aug	21	350	3	27.4	4.99	6.14
90	Aug	21	350	4	28.3	4.96	6.07
90	Aug	21	350	5	28.5	4.09	5.94
90	Aug	21	350	6	27.5	3.78	5.69
90	Aug	22	350	7	26.9	3.49	5.49
90	Aug	22	350	8	26.5	3.38	5.67
90	Aug	22	350	9	.	.	.
90	Aug	22	350	10	23.2	5.68	5.62
90	Aug	21	370	1	26.3	3.99	5.87
90	Aug	21	370	2	26.1	4.01	6.06
90	Aug	21	370	3	26.6	4.42	6.15
90	Aug	21	370	4	27.3	5.23	5.92
90	Aug	21	370	5	27.9	5.88	6.32
90	Aug	21	370	6	27.6	5.86	6.13
90	Aug	22	370	7	27.5	4.78	5.97
90	Aug	22	370	8	27.0	3.72	5.94
90	Aug	22	370	9	25.9	4.51	6.11
90	Aug	22	370	10	24.1	5.39	5.85

Appendix Table 3 (continued).

Raw data for Steel Creek Biannual Diel Water Quality - Sampling Plan #1.

Year	Month	Day	Station	PERIOD	TEMP	DO	PH
91	Feb	19	290	1	11.1	10.00	6.29
91	Feb	19	290	2	11.5	10.01	5.88
91	Feb	19	290	3	12.6	9.46	6.74
91	Feb	19	290	4	13.7	10.19	6.73
91	Feb	19	290	5	13.6	9.92	6.60
91	Feb	19	290	6	12.7	8.94	6.41
91	Feb	19	290	7	12.1	8.87	6.03
91	Feb	19	290	8	11.7	9.00	6.16
91	Feb	19	290	9	11.5	9.16	6.04
91	Feb	19	290	10	11.0	9.09	5.95
91	Feb	19	330	1	11.6	8.65	5.55
91	Feb	19	330	2	12.7	9.73	5.97
91	Feb	19	330	3	14.3	10.61	6.44
91	Feb	19	330	4	15.7	10.27	6.21
91	Feb	19	330	5	15.9	8.88	6.27
91	Feb	19	330	6	15.5	7.90	5.83
91	Feb	19	330	7	14.6	6.37	5.76
91	Feb	19	330	8	13.9	6.64	5.83
91	Feb	19	330	9	13.3	6.25	5.81
91	Feb	19	330	10	12.7	6.45	5.82
91	Feb	19	350	1	10.4	9.78	5.89
91	Feb	19	350	2	11.4	10.51	5.99
91	Feb	19	350	3	12.8	11.50	7.07
91	Feb	19	350	4	14.1	11.43	6.35
91	Feb	19	350	5	14.5	10.38	6.29
91	Feb	19	350	7	13.9	7.92	5.78
91	Feb	19	350	8	13.5	7.65	5.87
91	Feb	19	350	9	13.1	7.00	5.86
91	Feb	19	350	10	12.8	7.38	5.87
91	Feb	19	370	1	10.0	9.66	5.97
91	Feb	19	370	2	10.6	9.42	6.02
91	Feb	19	370	3	11.8	10.00	6.80
91	Feb	19	370	4	13.4	10.28	6.65
91	Feb	19	370	5	14.1	10.13	6.30
91	Feb	19	370	6	14.4	9.35	6.02
91	Feb	19	370	7	14.0	8.38	5.92
91	Feb	19	370	8	13.6	8.30	6.07
91	Feb	19	370	9	13.2	7.38	5.88
91	Feb	19	370	10	12.8	7.79	5.82
91	Aug	20	290	1	25.3	3.25	5.73
91	Aug	20	290	2	25.9	4.83	5.38

Appendix Table 3 (continued).

Raw data for Steel Creek Biannual Diel Water Quality - Sampling Plan #1.

Year	Month	Day	Station	PERIOD	TEMP	DO	PH
91	Aug	20	290	3	26.9	5.01	5.62
91	Aug	20	290	4	27.6	4.94	5.08
91	Aug	20	290	5	27.1	4.22	5.68
91	Aug	20	290	6	26.2	4.62	4.74
91	Aug	20	290	7	25.6	4.88	4.85
91	Aug	20	290	8	25.2	5.22	4.94
91	Aug	20	290	9	24.9	5.42	4.33
91	Aug	20	290	10	24.4	5.58	4.88
91	Aug	20	330	1	24.0	4.03	5.33
91	Aug	20	330	2	24.0	3.97	5.33
91	Aug	20	330	3	24.3	4.01	5.37
91	Aug	20	330	4	24.6	3.99	5.13
91	Aug	20	330	5	24.8	3.76	5.05
91	Aug	20	330	6	24.8	3.86	5.18
91	Aug	20	330	7	24.8	3.96	4.79
91	Aug	20	330	8	24.7	3.74	4.87
91	Aug	20	330	9	24.6	3.70	4.85
91	Aug	20	330	10	24.2	3.88	4.57
91	Aug	20	350	1	23.6	4.14	5.46
91	Aug	20	350	2	23.7	4.28	5.44
91	Aug	20	350	3	23.9	4.28	5.39
91	Aug	20	350	4	24.2	4.33	5.05
91	Aug	20	350	5	24.3	4.12	5.13
91	Aug	20	350	6	24.1	4.30	5.33
91	Aug	20	350	7	24.1	3.97	4.90
91	Aug	20	350	8	24.0	3.81	4.96
91	Aug	20	350	9	23.8	3.73	4.57
91	Aug	20	350	10	23.7	3.77	4.54
91	Aug	20	370	1	23.2	4.85	5.37
91	Aug	20	370	2	23.2	4.93	5.52
91	Aug	20	370	3	23.3	5.14	5.55
91	Aug	20	370	4	23.8	5.24	5.26
91	Aug	20	370	5	23.7	5.28	5.25
91	Aug	20	370	6	23.9	5.40	5.25
91	Aug	20	370	7	23.7	4.87	4.78
91	Aug	20	370	8	23.6	4.83	4.42
91	Aug	20	370	9	23.4	4.95	5.05
91	Aug	20	370	10	23.3	4.90	5.56

TEMP = temperature (°C)

DO = dissolved oxygen (mg/L)

PH = pH (standard units)

Appendix Table 4.

Descriptive statistics for temperature (°C) from Steel Creek and Meyer's Branch. November 1985 to December 1991.

Station	Mean	Med	N	SD	CV	Min	Max
Year=1985/86							
275	21.3	20.8	14	5.7	26.6	13.4	29.3
280	21.2	19.9	14	6.0	28.3	12.4	29.9
285	20.2	18.2	14	5.7	28.4	13.6	29.6
290	19.4	17.7	14	6.4	33.0	10.9	28.3
300	17.9	17.8	13	6.3	35.4	7.6	26.4
310	18.2	17.9	14	6.2	33.9	10.6	27.0
320	19.0	19.2	14	6.2	32.5	11.4	27.7
330	18.1	17.5	14	6.3	34.7	10.6	26.9
340	17.8	16.9	14	5.9	33.2	10.1	25.9
350	17.6	16.6	14	6.2	35.1	9.9	26.3
360	17.8	16.4	14	6.0	33.7	10.6	26.0
370	17.4	15.8	14	6.2	35.6	10.3	26.0
400	17.3	17.2	14	6.4	37.0	8.1	27.4
Year=1987							
275	20.4	19.5	12	5.8	28.4	12.1	29.3
280	20.4	19.6	12	5.7	28.1	12.0	29.3
285	19.1	17.9	12	5.5	28.9	10.3	27.4
290	18.5	17.4	12	6.0	32.1	9.1	27.6
300	17.9	16.0	12	6.0	33.6	9.1	26.2
310	18.2	16.5	12	5.7	31.1	10.3	26.8
320	19.0	17.5	12	6.0	31.7	10.4	27.9
330	18.2	16.7	12	5.7	31.6	10.0	26.5
340	18.1	16.9	12	5.9	32.7	8.8	26.4
350	17.9	17.0	12	6.2	34.5	9.2	26.2
360	17.8	16.5	12	5.8	32.5	10.2	26.0
370	17.7	16.3	12	5.7	32.0	10.5	26.0
400	16.8	16.5	12	5.4	32.1	6.9	24.7
Year=1988							
275	19.8	18.8	12	6.5	32.7	9.4	28.4
280	19.6	18.5	12	6.5	33.1	8.8	28.0
285	18.7	18.4	12	6.9	36.7	6.9	26.7
290	17.8	16.8	12	6.7	37.6	6.6	25.7
300	16.8	16.0	12	7.5	44.7	1.3	24.7
310	18.2	16.3	12	6.4	35.3	8.5	27.5
320	18.0	16.3	11	6.0	33.4	8.4	25.6
330	17.8	16.6	12	6.8	38.5	7.0	27.2
340	17.5	16.0	12	6.9	39.2	8.8	27.0
350	17.1	16.2	12	7.2	41.8	7.0	26.6

Appendix Table 4 (continued).

Descriptive statistics for temperature (°C) from Steel Creek and Meyer's Branch. November 1985 to December 1991.

Station	Mean	Med	N	SD	CV	Min	Max
Year=1988 (continued).							
360	17.0	16.1	12	7.1	41.7	6.1	26.5
370	16.8	16.3	12	7.2	42.8	5.1	26.2
400	15.0	14.9	12	7.0	47.1	0.9	23.4
Year=1989							
275	18.7	17.5	12	6.2	33.1	9.8	26.3
280	18.7	17.4	12	6.2	33.0	10.0	26.5
285	17.7	16.4	12	6.2	35.1	8.3	25.9
290	17.4	16.6	12	6.0	34.5	7.7	25.4
300	17.0	17.1	12	6.7	39.7	6.0	26.3
310	15.9	13.6	11	6.5	40.8	5.8	24.8
320	16.2	14.0	11	6.7	41.7	5.0	25.8
330	16.5	14.5	12	6.7	40.8	6.1	25.4
340	16.4	14.6	12	6.5	39.4	6.3	25.3
350	16.3	15.1	12	6.8	41.6	6.3	25.4
360	17.2	15.8	11	6.1	35.3	9.0	24.9
370	16.2	15.2	12	6.6	40.4	6.3	24.9
400	14.6	13.7	11	5.8	39.7	5.0	22.4
Year=1990							
275	20.3		51	0.9		8.4	28.9
Year=1991							
275	19.5		50	0.9		10.3	28.1

Appendix Table 5.

Descriptive statistics for dissolved oxygen (mg/L) from Steel Creek and Meyer's Branch. November 1985 to December 1991.

Station	Mean	Med	N	SD	CV	Min	Max
Year=1985/86							
275	8.7	8.5	14	1.4	15.6	6.3	11.4
280	8.5	8.3	14	1.4	16.1	6.3	11.1
285	7.8	7.9	14	1.5	18.9	5.3	10.1
290	7.5	7.5	14	1.8	24.0	4.9	10.6
300	6.5	7.1	13	2.7	42.4	1.8	10.7
310	6.2	6.5	14	2.1	34.0	2.1	9.0
320	5.7	6.0	14	2.8	48.6	0.6	9.5
330	6.1	6.2	14	1.8	29.4	2.6	8.9
340	6.9	6.4	13	2.3	32.9	2.9	11.3
350	6.6	6.4	14	1.8	27.6	3.5	9.3
360	6.5	6.3	14	2.1	32.8	2.9	9.4
370	6.3	6.5	14	2.2	34.4	2.9	9.2
400	8.4	8.2	14	1.6	18.5	5.8	11.4
Year=1987							
275	8.8	9.0	12	1.8	20.7	5.0	11.3
280	8.2	8.4	12	1.8	21.5	4.7	11.2
285	8.0	7.7	12	1.9	23.8	5.0	12.0
290	7.8	7.5	12	1.7	22.0	5.6	10.8
300	6.7	7.3	12	2.3	33.8	1.9	9.8
310	6.1	6.3	12	2.1	34.7	2.9	9.2
320	7.5	7.9	12	2.1	28.6	3.3	9.8
330	6.0	5.9	12	2.1	35.1	3.2	9.3
340	5.9	5.2	12	2.6	43.7	3.0	10.1
350	6.1	5.6	12	2.6	42.4	2.8	9.9
360	6.4	6.2	12	2.1	32.9	3.6	9.9
370	6.4	6.2	12	2.1	33.3	3.9	10.1
400	8.6	8.5	12	1.3	14.9	7.0	10.9
Year=1988							
275	8.9	8.5	12	1.4	15.4	6.8	11.1
280	7.9	7.2	12	2.0	25.7	5.2	11.1
285	8.0	7.8	12	1.8	22.5	5.7	10.9
290	7.6	6.9	12	2.1	27.6	5.6	11.6
300	7.8	7.9	11	2.4	31.1	3.9	11.5
310	7.7	7.6	12	2.5	33.0	4.6	12.4
320	8.1	7.7	11	2.5	31.5	4.0	12.2
330	6.5	6.1	12	2.9	45.0	3.3	11.8
340	7.4	7.1	12	2.3	31.0	4.5	12.3
350	7.0	6.0	12	2.6	38.0	3.9	12.3

Appendix Table 5 (continued).

Descriptive statistics for dissolved oxygen (mg/L) from Steel Creek and Meyer's Branch. November 1985 to December 1991.

Station	Mean	Med	N	SD	CV	Min	Max
Year=1988 (continued).							
360	7.1	6.3	12	2.8	39.1	3.7	12.4
370	7.1	6.3	12	2.8	38.9	3.7	12.5
400	8.9	7.8	12	2.1	24.2	7.0	13.9
Year=1989							
275	8.7	9.0	12	1.7	19.0	5.9	12.1
280	7.9	8.2	12	1.9	23.3	4.9	11.3
285	8.3	8.3	12	1.8	21.9	6.2	12.3
290	7.9	8.2	12	1.9	24.2	5.4	11.4
300	6.7	6.3	12	2.5	37.1	3.3	11.0
310	7.4	7.4	12	2.3	31.1	4.6	10.8
320	6.8	8.0	11	2.5	37.1	3.0	10.2
330	6.5	6.9	12	2.5	39.3	2.6	9.9
340	7.7	7.9	12	2.4	30.9	4.4	11.4
350	6.6	6.4	12	2.7	40.3	2.8	10.4
360	6.4	5.9	11	2.2	34.4	3.6	9.7
370	6.8	6.3	12	2.3	33.4	3.8	10.2
400	8.4	8.2	12	1.8	21.0	6.4	12.2
Station	Mean	N	SE	Min	Max		
Year=1990							
275	8.6	51	0.2	5.0	13.0		
Year=1991							
275	9.4	50	0.2	7.3	11.5		

Appendix Table 6.

Descriptive statistics for pH from Steel Creek and Meyer's Branch.
November 1985 to December 1991.

Station	Mean	Med	N	SD	CV	Min	Max
Year=1985/86							
275	7.1	6.8	13	0.7	10.5	6.2	8.6
280	6.8	6.6	14	0.5	7.9	6.1	7.6
285	6.6	6.4	13	0.5	8.1	5.5	7.3
290	6.2	6.3	13	0.5	8.4	5.4	7.0
300	6.3	6.3	13	0.6	9.8	4.8	7.3
310	6.3	6.2	14	0.3	4.1	5.9	6.8
320	6.3	6.4	14	0.2	3.8	5.9	6.7
330	6.3	6.2	14	0.2	3.7	6.1	6.8
340	6.3	6.2	14	0.2	3.7	6.0	6.7
350	6.3	6.3	14	0.2	3.3	6.1	6.7
360	6.3	6.2	14	0.2	3.4	6.0	6.7
370	6.3	6.3	14	0.2	3.2	5.9	6.6
400	6.3	6.3	14	0.4	7.0	5.6	7.0
Year=1987							
275	6.6	6.6	12	0.5	7.2	5.8	7.7
280	6.8	6.6	12	0.4	6.0	6.3	7.6
285	6.6	6.5	12	0.5	8.0	5.9	8.0
290	6.5	6.6	12	0.4	6.7	5.8	7.4
300	6.2	6.4	12	0.5	7.9	5.3	6.8
310	6.5	6.5	12	0.5	7.8	5.7	7.7
320	6.6	6.5	12	0.5	7.3	5.7	7.5
330	6.4	6.4	12	0.4	5.9	5.7	7.2
340	6.3	6.2	12	0.4	6.1	5.7	7.1
350	6.3	6.3	12	0.5	7.1	5.8	7.3
360	6.4	6.3	12	0.4	5.7	6.0	7.2
370	6.4	6.4	12	0.3	4.0	5.9	6.9
400	6.5	6.5	12	0.4	6.9	5.8	7.3
Year=1988							
275	6.7	6.5	12	0.9	13.2	5.8	8.5
280	6.5	6.5	12	0.7	10.4	5.6	7.9
285	6.4	6.4	12	0.5	7.5	5.8	7.5
290	6.4	6.3	12	0.5	8.2	5.6	7.5
300	6.3	6.3	12	0.5	7.5	5.6	7.3
310	6.3	6.2	11	0.4	5.7	5.6	6.8
320	6.2	6.3	10	0.4	6.5	5.5	7.0
330	6.1	6.1	11	0.4	6.2	5.5	6.7
340	6.2	6.2	11	0.4	5.7	5.7	6.8
350	6.2	6.2	11	0.3	5.4	5.6	6.6

Appendix Table 6 (continued).

Descriptive statistics for pH from Steel Creek and Meyer's Branch.
November 1985 to December 1991.

Station	Mean	Med	N	SD	CV	Min	Max
Year=1988 (continued).							
360	6.1	6.0	11	0.4	5.9	5.6	6.6
370	6.2	6.1	11	0.4	5.7	5.8	6.9
400	6.4	6.5	12	0.6	10.0	5.4	7.6
Year=1989							
275	6.5	6.6	12	0.6	9.2	5.4	7.3
280	6.4	6.5	12	0.6	9.6	5.3	7.5
285	6.3	6.4	12	0.6	9.3	5.4	7.2
290	6.3	6.3	12	0.5	7.3	5.5	7.2
300	6.1	6.3	12	0.6	10.5	5.0	6.8
310	6.2	6.1	11	0.6	9.5	5.2	6.9
320	6.1	6.0	10	0.7	10.9	5.2	7.0
330	6.0	5.9	11	0.7	11.0	5.2	7.1
340	6.2	6.3	11	0.6	9.8	5.3	6.9
350	6.1	6.0	11	0.6	10.2	5.3	7.0
360	6.2	6.1	10	0.4	7.1	5.7	7.0
370	6.2	6.1	12	0.5	8.2	5.5	7.4
400	6.4	6.3	12	0.6	9.5	5.3	7.3
Station	Mean	N	SE	Min	Max		
Year=1990							
275	6.5	51	<0.1	6.1	7.6		
Year=1991							
275	6.3	50	0.1	5.6	7.2		

Appendix Table 7.

Descriptive statistics for conductivity ($\mu\text{S}/\text{cm}$ @ 25°C) from Steel Creek and Meyer's Branch. November 1985 to December 1991.

Station	Mean	Med	N	SD	CV	Min	Max
Year=1985/86							
275	78	80	14	12	15.9	41	95
280	80	80	14	6	7.1	71	93
285	75	78	14	13	17.1	46	97
290	77	78	14	7	9.0	66	87
300	77	78	13	28	36.4	22	116
310	78	82	14	17	21.6	29	98
320	80	81	14	23	28.3	28	135
330	78	82	14	16	19.9	29	93
340	80	83	14	17	20.8	32	101
350	81	84	14	17	20.6	30	102
360	81	85	14	15	18.9	36	100
370	82	85	14	16	19.9	30	99
400	59	60	14	7	12.0	49	70
Year=1987							
275	79	79	11	8	9.7	66	93
280	79	79	11	8	10.0	66	92
285	73	72	12	9	12.3	61	87
290	72	70	11	8	11.7	60	86
300	77	70	12	18	22.7	60	114
310	69	71	12	16	23.8	29	87
320	66	69	12	15	22.7	29	85
330	70	72	12	16	23.0	29	88
340	71	78	12	19	26.9	23	90
350	70	77	12	19	27.4	27	94
360	71	76	12	18	25.6	27	91
370	71	75	12	18	25.3	29	91
400	53	53	11	10	18.5	34	67
Year=1988							
275	88	88	12	14	15.9	66	124
280	87	86	12	14	15.8	73	126
285	85	84	12	13	15.6	70	111
290	84	83	12	15	18.5	65	119
300	85	85	12	13	15.2	71	111
310	82	84	12	8	10.0	71	98
320	81	83	11	8	10.3	70	96
330	84	85	12	8	9.9	72	96
340	84	85	12	7	8.4	72	95
350	86	86	12	7	8.1	74	98

Appendix Table 7 (continued).

Descriptive statistics for conductivity ($\mu\text{S}/\text{cm}$ @ 25°C) from Steel Creek and Meyer's Branch. November 1985 to December 1991.

Station	Mean	Med	N	SD	CV	Min	Max
Year=1988 (continued).							
360	86	86	12	7	8.7	75	100
370	87	86	12	8	9.3	75	102
400	63	63	12	11	17.5	46	83
Year=1989							
275	86	88	12	8	9.7	64	96
280	85	86	12	8	9.8	65	98
285	84	83	12	8	9.5	66	97
290	83	84	12	10	11.6	62	99
300	83	81	12	10	12.4	64	97
310	79	79	11	16	20.5	39	101
320	80	79	11	11	13.2	60	98
330	79	80	12	15	19.4	39	99
340	80	81	12	11	13.8	56	96
350	81	84	12	12	15.2	50	97
360	85	86	11	10	11.8	69	101
370	86	90	12	15	17.8	56	114
400	61	60	12	13	21.8	47	97
Station	Mean		N	SE	Min	Max	
Year=1990							
275	66		51	1	58	84	
Year=1991							
275	58		50	1	18	66	

Appendix Table 8.

Descriptive statistics for ammonia-nitrogen ($\mu\text{g N/L}$) from Steel Creek and Meyer's Branch. November 1985 to December 1991.

Station	Mean	Med	N	SD	CV	Min	Max
Year=1985/86							
275	105	49	14	193	182.9	11	764
280	115	67	14	176	153.1	18	719
285	93	74	14	90	96.6	12	379
290	85	70	14	59	69.7	15	231
300	71	57	14	47	65.3	14	190
310	47	49	14	22	47.5	14	101
320	44	38	14	24	53.1	10	96
330	37	38	14	12	32.3	11	55
340	44	38	14	21	47.9	<10	85
350	34	35	14	17	50.2	<10	59
360	38	35	14	16	40.9	<10	65
370	40	35	14	17	43.4	11	67
400	41	41	14	16	39.1	<10	74
Year=1987							
275	178	57	12	304	170.6	20	1080
280	172	72	12	264	153.6	12	956
285	117	69	12	135	115.5	13	513
290	84	58	12	107	127.6	10	419
300	59	45	12	47	79.8	21	157
310	39	36	12	13	33.6	23	59
320	40	42	12	18	44.6	17	73
330	41	46	12	21	51.8	<10	71
340	41	38	12	24	58.6	15	90
350	37	31	12	17	46.0	15	64
360	32	30	12	15	45.7	17	60
370	33	34	12	18	54.7	11	65
400	34	29	12	21	61.3	11	79
Year=1988							
275	77	58	12	75	97.2	10	282
280	98	85	12	72	73.3	41	286
285	69	55	12	52	75.7	10	202
290	56	54	12	38	67.7	10	158
300	44	38	12	27	62.3	<10	93
310	35	32	12	18	50.8	10	62
320	33	40	11	20	62.5	<10	63
330	28	24	12	17	60.5	<10	61
340	34	29	12	21	63.1	<10	84
350	27	19	12	18	68.7	<10	56

Appendix Table 8 (continued).

Descriptive statistics for ammonia-nitrogen ($\mu\text{g N/L}$) from Steel Creek and Meyer's Branch. November 1985 to December 1991.

Station	Mean	Med	N	SD	CV	Min	Max
Year=1988 (continued).							
360	24	13	12	18	76.2	<10	53
370	29	28	12	19	66.8	<10	63
400	28	24	12	14	48.9	<10	50
Year=1989							
275	61	47	12	48	78.7	<10	165
280	91	85	12	42	46.2	38	183
285	64	67	12	18	28.8	27	91
290	58	61	12	20	33.9	13	89
300	33	26	12	23	70.3	<10	89
310	33	33	12	22	65.4	<10	75
320	32	32	11	12	37.7	<10	50
330	34	36	12	14	42.2	11	59
340	43	37	12	24	55.7	14	100
350	40	39	12	20	48.9	11	86
360	40	45	12	19	47.4	<10	71
370	40	44	12	16	39.2	<10	64
400	30	35	12	18	60.8	<10	55
Station	Mean	N	SE	Min	Max		
Year=1990							
275	34	51	<10	<10	120		
290	37	4	<10	28	55		
330	51	4	20	14	92		
350	37	4	13	24	76		
370	36	4	17	16	86		
Year=1991							
275	39	50	<10	<10	246		
290	35	4	15	11	80		
330	25	4	12	<10	46		
350	19	4	10	<10	41		
370	21	4	<10	<10	44		

Appendix Table 9.

Raw data for Steel Creek Quarterly Water Quality - Sampling Plan #2.

Year	Month	Day	Station	TDS	TSS	NO ₂	NO ₃	NH ₄	TKN	TP	OP
90	Feb	27	290	47	2.0	5.8	135	28	170	29	7
90	Feb	27	330	51	0.4	6.9	182	92	130	36	12
90	Feb	27	350	40	0.4	6.6	181	24	240	36	10
90	Feb	27	370	36	0.8	7.2	178	18	210	37	8
90	May	22	290	54	1.0	2.5	121	55	540	46	9
90	May	22	330	74	1.0	4.3	114	78	460	87	34
90	May	22	350	89	1.0	5.8	172	76	530	84	25
90	May	22	370	68	2.0	5.6	141	86	500	81	27
90	Aug	21	290	66	2.0	2.0	134	31	170	46	12
90	Aug	21	330	74	1.0	1.2	305	21	360	106	13
90	Aug	21	350	69	2.0	1.5	191	25	160	49	13
90	Aug	21	370	75	0.0	1.3	79	16	100	62	19
90	Dec	27	290	62	2.0	4.4	142	32	250	30	3
90	Dec	27	330	56	0.0	2.2	95	14	90	25	7
90	Dec	27	350	66	0.0	2.7	76	24	250	32	13
90	Dec	27	370	66	0.0	2.7	73	24	155	47	19
<hr/>											
Year	Month	Day	Station	TDS	TSS	NO ₂	NO ₃	NH ₄	TKN	TP	OP
91	Feb	19	290	49	2	3.8	129	80	245	19	3
91	Feb	19	330	48	2	1.2	76	46	240	24	6
91	Feb	19	350	49	1	1.2	27	41	210	20	7
91	Feb	19	370	48	2	0.8	26	44	270	32	13
91	May	20	290	52	2	1.7	98	11	410	36	10
91	May	20	330	73	2	4.0	197	0	455	83	27
91	May	20	350	72	3	3.4	242	0	390	76	32
91	May	20	370	70	2	3.7	269	8	300	70	30
91	Aug	20	290	47	2	2.2	58	28	240	39	17
91	Aug	20	330	57	2	3.8	119	44	360	65	32
91	Aug	20	350	54	1	3.5	140	31	290	58	27
91	Aug	20	370	56	2	3.8	159	28	340	52	26
91	Nov	19	290	27	2	1.8	80	21	360	21	5
91	Nov	19	330	26	2	0.2	40	8	280	20	5
91	Nov	19	350	40	1	0.9	28	5	275	25	8
91	Nov	19	370	33	4	0.8	26	5	280	36	9

TDS - total dissolved solids (mg/L)

TSS - total suspended solids (mg/L)

NO₂ - nitrite-nitrogen (µg N/L)NO₃ - nitrate-nitrogen (µg N/L)NH₄ - ammonia-nitrogen (µg N/L)

TKN - total Kjeldahl nitrogen (µg N/L)

TP - total phosphorus (µg P/L)

OP - ortho-phosphorus (µg P/L)

Appendix Table 10.

Raw data for Steel Creek Biannual Diel Water Quality - Sampling Plan #2.

Year	Month	Day	Station	Period	TDS	TSS	TKN	TP
90	Feb	27	290	1	47	2.0	170	29
90	Feb	27	290	2	46	1.0	120	29
90	Feb	27	290	3	43	2.0	240	27
90	Feb	27	290	4	50	2.0	190	32
90	Feb	27	290	5	35	2.0	210	29
90	Feb	27	290	6	27	1.0	130	27
90	Feb	27	290	7	45	2.0	250	27
90	Feb	28	290	8	48	2.0	240	29
90	Feb	28	290	9	35	2.0	160	29
90	Feb	28	290	10	40	2.0	220	25
90	Feb	27	330	1	51	0.4	130	36
90	Feb	27	330	2	34	1.0	190	32
90	Feb	27	330	3	44	1.0	180	34
90	Feb	27	330	4	47	1.0	180	34
90	Feb	27	330	5	39	2.0	160	34
90	Feb	27	330	6	41	1.0	230	32
90	Feb	28	330	7	43	1.0	270	32
90	Feb	28	330	8	46	0.8	260	32
90	Feb	28	330	9	44	1.0	260	32
90	Feb	28	330	10	40	1.0	240	34
90	Feb	27	350	1	40	0.4	240	36
90	Feb	27	350	2	44	1.0	130	37
90	Feb	27	350	3	43	1.0	70	34
90	Feb	27	350	4	46	1.0	240	34
90	Feb	27	350	5	46	1.0	250	36
90	Feb	27	350	6	45	2.0	130	36
90	Feb	28	350	7	44	1.0	60	34
90	Feb	28	350	8	44	2.0	330	34
90	Feb	28	350	9	45	1.0	210	32
90	Feb	28	350	10	44	2.0	210	42
90	Feb	27	370	1	36	0.8	210	37
90	Feb	27	370	2	49	2.0	210	37
90	Feb	27	370	3	47	1.0	150	37
90	Feb	27	370	4	50	2.0	190	36
90	Feb	27	370	5	43	1.0	340	36
90	Feb	27	370	6	43	1.0	240	32
90	Feb	28	370	7	44	1.0	240	34
90	Feb	28	370	8	44	1.0	280	36
90	Feb	28	370	9	45	1.0	260	36
90	Feb	28	370	10	48	0.6	310	34
90	Aug	21	290	1	66	2.0	170	46
90	Aug	21	290	2	69	3.0	240	41
90	Aug	21	290	3	47	3.0	320	39
90	Aug	21	290	4	53	3.0	150	39
90	Aug	21	290	5	62	5.0	210	49

Appendix Table 10 (continued).

Raw data for Steel Creek Biannual Diel Water Quality - Sampling Plan #2.

Year	Month	Day	Station	Period	TDS	TSS	TKN	TP
90	Aug	21	290	6	73	7.0	260	47
90	Aug	22	290	7	65	10.0	260	47
90	Aug	22	290	8	68	8.0	230	51
90	Aug	22	290	9	86	29.0	325	133
90	Aug	22	290	10	87	16.0	310	90
90	Aug	21	330	1	74	1.0	360	106
90	Aug	21	330	2	30	4.0	110	79
90	Aug	21	330	3	65	11.0	160	125
90	Aug	21	330	4	43	8.0	170	98
90	Aug	21	330	5	71	8.0	110	90
90	Aug	21	330	6	79	6.0	90	92
90	Aug	21	330	7	74	6.0	120	78
90	Aug	22	330	8	74	3.0	170	73
90	Aug	22	330	9	.	.	.	.
90	Aug	22	330	10	69	6.0	230	332
90	Aug	21	350	1	69	2.0	160	49
90	Aug	21	350	2	69	2.0	120	53
90	Aug	21	350	3	45	1.0	190	55
90	Aug	21	350	4	52	3.0	140	65
90	Aug	21	350	5	74	1.0	180	60
90	Aug	21	350	6	75	2.0	.	58
90	Aug	22	350	7	70	1.0	130	56
90	Aug	22	350	8	67	2.0	120	56
90	Aug	22	350	9	.	.	.	.
90	Aug	22	350	10	52	5.0	150	78
90	Aug	21	370	1	75	0.0	100	62
90	Aug	21	370	2	77	1.0	.	59
90	Aug	21	370	3	77	1.0	370	62
90	Aug	21	370	4	74	2.0	210	62
90	Aug	21	370	5	77	1.0	260	62
90	Aug	21	370	6	73	3.0	170	64
90	Aug	22	370	7	71	1.0	230	61
90	Aug	22	370	8	79	4.0	120	62
90	Aug	22	370	9	82	12.0	120	87
90	Aug	22	370	10	70	30.0	240	151

Appendix Table 10 (continued).

Raw data for Steel Creek Biannual Diel Water Quality - Sampling Plan #2.

Year	Month	Day	Station	Period	TDS	TSS	TKN	TP
91	Feb	19	290	1	49	2.0	240	19
91	Feb	19	290	2	46	2.0	260	20
91	Feb	19	290	3	49	3.0	290	25
91	Feb	19	290	4	44	2.0	380	24
91	Feb	19	290	5	47	2.0	250	20
91	Feb	19	290	6	47	1.0	320	25
91	Feb	19	290	7	50	1.0	370	24
91	Feb	19	290	8	50	1.0	200	20
91	Feb	19	290	9	52	3.0	360	29
91	Feb	19	290	10	53	0.8	290	24
91	Feb	19	330	1	48	2.0	260	24
91	Feb	19	330	2	45	2.0	200	24
91	Feb	19	330	3	45	1.0	170	20
91	Feb	19	330	4	43	1.0	200	22
91	Feb	19	330	5	46	3.0	280	24
91	Feb	19	330	6	44	1.0	220	20
91	Feb	19	330	7	46	1.0	200	19
91	Feb	19	330	8	44	1.0	160	19
91	Feb	19	330	9	46	0.2	240	19
91	Feb	19	330	10	106	1.0	170	19
91	Feb	19	350	1	49	1.0	170	20
91	Feb	19	350	2	47	0.7	170	22
91	Feb	19	350	3	41	0.8	220	22
91	Feb	19	350	4	39	0.8	220	22
91	Feb	19	350	5	44	0.8	330	24
91	Feb	19	350	7	41	1.0	170	24
91	Feb	19	350	8	37	0.8	200	22
91	Feb	19	350	9	44	0.6	170	24
91	Feb	19	350	10	46	1.0	190	22
91	Feb	19	370	1	48	2.0	170	32
91	Feb	19	370	2	38	6.0	240	47
91	Feb	19	370	3	44	4.0	210	39
91	Feb	19	370	4	40	4.0	250	37
91	Feb	19	370	5	37	3.0	210	37
91	Feb	19	370	6	43	3.0	220	36
91	Feb	19	370	7	41	2.0	190	32
91	Feb	19	370	8	41	6.0	240	37
91	Feb	19	370	9	38	6.0	230	38
91	Feb	19	370	10	49	5.0	230	42
91	Aug	20	290	1	47	2.0	305	40
91	Aug	20	290	2	41	1.0	325	41
91	Aug	20	290	3	36	2.0	460	39
91	Aug	20	290	4	37	2.0	350	41
91	Aug	20	290	5	38	2.0	240	41
91	Aug	20	290	6	37	1.0	370	42

Appendix Table 10 (continued).

Raw data for Steel Creek Biannual Diel Water Quality - Sampling Plan #2.

Year	Month	Day	Station	Period	TDS	TSS	TKN	TP
91	Aug	20	290	7	41	1.0	270	42
91	Aug	20	290	8	39	2.0	300	37
91	Aug	20	290	9	39	2.0	295	39
91	Aug	20	290	10	41	3.0	240	39
91	Aug	20	330	1	57	2.0	430	66
91	Aug	20	330	2	58	2.0	390	67
91	Aug	20	330	3	62	2.0	370	67
91	Aug	20	330	4	61	2.0	450	73
91	Aug	20	330	5	60	2.0	380	72
91	Aug	20	330	6	60	2.0	380	75
91	Aug	20	330	7	63	2.0	430	73
91	Aug	20	330	8	53	2.0	390	75
91	Aug	20	330	9	56	2.0	380	73
91	Aug	20	330	10	57	2.0	390	73
91	Aug	20	350	1	54	1.0	340	58
91	Aug	20	350	2	56	1.0	310	55
91	Aug	20	350	3	54	2.0	290	58
91	Aug	20	350	4	54	2.0	290	59
91	Aug	20	350	5	53	1.0	400	59
91	Aug	20	350	6	52	1.0	340	59
91	Aug	20	350	7	57	2.0	310	62
91	Aug	20	350	8	56	1.0	280	64
91	Aug	20	350	9	57	1.0	390	65
91	Aug	20	350	10	57	3.0	340	70
91	Aug	20	370	1	56	2.0	310	52
91	Aug	20	370	2	56	7.0	270	53
91	Aug	20	370	3	54	2.0	260	53
91	Aug	20	370	4	54	2.0	250	53
91	Aug	20	370	5	51	2.0	360	53
91	Aug	20	370	6	60	3.0	360	55
91	Aug	20	370	7	55	1.0	300	55
91	Aug	20	370	8	54	2.0	320	53
91	Aug	20	370	9	53	2.0	230	53
91	Aug	20	370	10	60	2.0	260	56

TDS = total dissolved solids (mg/L)
 TSS = total suspended solids (mg/L)
 TKN = total Kjeldahl nitrogen ($\mu\text{g N/L}$)
 TP = total phosphorus ($\mu\text{g P/L}$)

Appendix Table 11.

Descriptive statistics for total dissolved solids (mg/L) from Steel Creek and Meyer's Branch. November 1985 to December 1991.

Station	Mean	Med	N	SD	CV	Min	Max
Year=1985/86							
275	54	54	14	9	17.6	35	74
280	53	55	14	9	16.9	29	66
285	55	54	14	8	14.3	43	67
290	54	55	14	5	9.7	44	63
300	58	56	14	15	26.7	22	84
310	56	55	14	7	12.2	46	71
320	51	50	14	8	15.4	37	65
330	52	52	14	6	11.8	43	64
340	55	57	14	7	13.1	41	68
350	56	59	14	16	28.1	7	71
360	56	56	14	6	10.2	46	64
370	58	58	14	8	14.0	48	72
400	49	48	14	5	9.3	43	59
Year=1987							
275	57	56	12	9	15.9	47	79
280	55	52	12	10	18.1	43	75
285	57	56	12	11	18.9	43	83
290	54	52	12	13	23.4	36	75
300	60	54	12	19	30.8	40	91
310	57	55	12	12	20.5	44	84
320	56	56	12	13	23.5	40	86
330	57	56	12	11	18.9	43	77
340	57	60	12	13	23.6	34	77
350	57	57	12	12	21.2	41	81
360	55	53	12	12	21.6	34	78
370	59	62	12	15	25.7	23	82
400	54	52	12	12	21.6	39	75
Year=1988							
275	60	60	12	7	11.4	51	76
280	60	61	12	6	9.5	51	73
285	59	60	12	9	15.8	46	80
290	59	60	12	9	15.0	44	73
300	61	57	12	11	18.7	49	81
310	59	58	12	10	17.1	47	81
320	57	55	11	10	17.8	47	83
330	60	61	12	10	16.9	47	81
340	58	58	12	7	12.3	47	70
350	62	60	12	11	17.4	48	84

Appendix Table 11 (continued).

Descriptive statistics for total dissolved solids (mg/L) from Steel Creek and Meyer's Branch. November 1985 to December 1991.

Station	Mean	Med	N	SD	CV	Min	Max
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Year=1988 (continued).

360	61	60	12	11	18.4	45	83
370	63	58	12	12	19.0	48	82
400	55	56	12	11	19.4	39	82

Year=1989

275	61	61	12	7	11.4	47	71
280	57	61	12	10	17.7	32	68
285	60	61	12	9	14.3	41	71
290	62	61	12	9	13.9	48	76
300	60	60	12	8	14.0	49	71
310	59	58	12	7	11.7	48	68
320	60	59	11	6	10.1	50	69
330	62	61	12	6	9.2	52	71
340	64	64	12	10	15.1	50	84
350	64	65	12	9	13.5	53	82
360	65	65	12	6	9.9	57	74
370	65	66	12	9	13.3	48	76
400	54	52	12	14	25.7	33	83

Station	Mean	N	SE	Min	Max
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Year=1990

290	57	4	4	47	66
330	64	4	6	51	74
350	66	4	10	40	89
370	61	4	9	36	75

Year=1991

290	44	4	6	27	52
330	51	4	10	26	73
350	54	4	7	40	72
370	52	4	8	33	70

Appendix Table 12.

Descriptive statistics for total suspended solids (mg/L) from Steel Creek and Meyer's Branch. November 1985 to December 1991.

Station	Mean	Med	N	SD	CV	Min	Max
Year=1985/86							
275	14	6	14	23	165.4	1	90
280	24	8	14	32	132.4	3	99
285	20	7	14	53	264.0	<1	204
290	10	4	14	16	154.8	1	59
300	7	5	14	6	85.5	1	20
310	7	2	14	11	158.4	1	40
320	6	3	14	8	129.4	<1	29
330	6	3	14	8	129.4	1	31
340	2	2	14	1	46.8	1	4
350	2	1	14	1	69.7	1	5
360	4	3	14	3	83.7	1	12
370	6	5	14	4	60.4	2	17
400	5	5	14	4	71.4	1	15
Year=1987							
275	6	4	12	6	93.5	2	22
280	12	7	12	15	124.4	3	59
285	6	6	12	3	52.4	2	15
290	4	3	12	4	120.7	1	17
300	5	2	12	6	135.4	<1	20
310	2	1	12	2	77.4	1	7
320	6	3	12	5	96.4	1	18
330	2	2	12	2	92.2	1	9
340	2	1	12	3	139.1	1	10
350	1	1	12	1	69.7	1	4
360	2	2	12	1	63.8	1	6
370	6	6	12	4	60.6	2	16
400	4	3	12	4	86.6	1	13
Year=1988							
275	4	4	12	1	41.4	2	7
280	10	6	12	11	111.5	1	44
285	6	7	12	4	61.1	1	12
290	3	2	12	3	79.0	1	9
300	6	2	12	7	128.5	1	21
310	18	6	12	41	224.9	1	148
320	8	5	11	8	105.9	1	31
330	5	4	12	5	93.7	1	17
340	4	1	12	6	143.1	1	21
350	2	1	12	1	65.6	1	5

Appendix Table 12 (continued).

Descriptive statistics for total suspended solids (mg/L) from Steel Creek and Meyer's Branch. November 1985 to December 1991.

Station	Mean	Med	N	SD	CV	Min	Max
Year=1988 (continued).							
360	10	5	12	10	105.7	1	32
370	7	5	12	6	91.6	4	27
400	3	3	12	2	63.9	1	8
Year=1989							
275	4	3	12	2	42.8	2	7
280	6	4	12	5	83.0	2	20
285	4	4	12	2	49.8	1	8
290	4	3	12	3	78.4	1	11
300	6	5	12	6	93.3	1	20
310	9	3	12	19	212.6	1	68
320	3	2	11	3	106.8	1	13
330	3	3	12	2	60.3	1	8
340	2	1	12	1	69.5	1	4
350	2	2	12	1	75.3	1	6
360	6	4	12	7	116.7	1	26
370	7	5	12	9	126.0	1	36
400	9	3	12	20	216.0	1	71
Station	Mean	N	SE	Min	Max		
Year=1990							
290	2	4	<1	1	2		
330	1	4	<1	<1	1		
350	1	4	<1	<1	2		
370	1	4	<1	<1	2		
Year=1991							
290	2	4	<1	2	2		
330	2	4	<1	2	2		
350	2	4	1	1	3		
370	3	4	1	2	4		

Appendix Table 13.

Descriptive statistics for nitrite-nitrogen ($\mu\text{g N/L}$) from Steel Creek and Meyer's Branch. November 1985 to December 1991.

Station	Mean	Med	N	SD	CV	Min	Max
Year=1985/86							
275	6	4	14	5	92.2	1	20
280	7	5	14	5	74.6	2	19
285	7	5	14	4	64.1	2	18
290	6	4	14	4	68.8	2	17
300	2	2	14	1	58.2	<1	5
310	2	2	14	1	56.2	1	4
320	3	2	14	2	61.6	1	5
330	2	2	14	1	41.3	1	4
340	2	2	14	1	42.1	1	4
350	2	2	14	1	53.1	<1	3
360	2	2	14	1	41.4	<1	3
370	2	2	14	1	47.8	<1	3
400	2	2	14	1	48.4	<1	3
Year=1987							
275	4	2	12	5	121.5	<1	20
280	9	5	12	9	104.2	1	26
285	16	5	12	23	140.9	2	75
290	13	4	12	23	176.2	1	82
300	3	2	12	2	72.6	1	9
310	3	2	12	2	66.0	1	8
320	4	2	12	4	99.2	1	13
330	2	2	12	1	51.2	1	5
340	2	2	12	1	62.5	1	6
350	2	2	12	2	82.8	1	7
360	2	2	12	1	61.7	1	5
370	2	2	12	1	47.3	1	4
400	2	2	12	1	38.9	1	3
Year=1988							
275	3	3	12	2	74.8	1	9
280	5	4	12	2	47.7	1	9
285	7	6	12	3	41.3	4	12
290	5	4	12	3	61.6	2	11
300	2	2	12	1	64.0	1	6
310	2	2	12	1	53.6	1	5
320	2	2	11	1	44.8	1	3
330	2	2	12	1	58.0	1	4
340	2	2	12	1	43.7	1	4
350	2	2	12	1	42.6	1	4

Appendix Table 13 (continued).

Descriptive statistics for nitrite-nitrogen ($\mu\text{g N/L}$) from Steel Creek
and Meyer's Branch. November 1985 to December 1991.

Station	Mean	Med	N	SD	CV	Min	Max
Year=1988 (continued).							
360	2	2	12	1	48.6	1	4
370	2	2	12	1	48.7	1	4
400	2	2	12	1	55.3	1	5
Year=1989							
275	4	3	12	4	88.4	1	12
280	6	4	12	4	74.6	2	17
285	8	6	12	5	63.6	3	19
290	7	5	12	4	66.7	2	18
300	2	1	12	1	48.5	1	4
310	2	2	12	1	62.2	1	6
320	2	2	11	1	47.2	1	4
330	2	2	12	2	73.4	1	7
340	3	2	12	2	60.6	1	7
350	3	2	12	2	65.5	1	7
360	2	2	12	1	59.2	1	6
370	3	2	12	2	69.8	1	8
400	2	2	12	1	47.1	1	4
Station	Mean		N	SE	Min	Max	
Year=1990							
290	4		4	1	2	6	
330	4		4	1	1	7	
350	4		4	1	2	7	
370	4		4	1	1	7	
Year=1991							
290	2		4	<1	2	4	
330	2		4	1	<1	4	
350	2		4	1	1	4	
370	2		4	1	1	4	

Appendix Table 14.

Descriptive statistics for nitrate-nitrogen ($\mu\text{g N/L}$) from Steel Creek
and Meyer's Branch. November 1985 to December 1991.

Station	Mean	Med	N	SD	CV	Min	Max
Year=1985/86							
275	84	69	14	73	86.8	<10	224
280	117	98	14	81	69.2	25	256
285	118	110	14	54	45.5	38	221
290	157	116	14	92	58.7	71	402
300	135	110	14	149	110.7	<10	582
310	112	120	14	51	45.4	41	231
320	129	96	14	98	75.5	18	356
330	99	94	14	37	37.5	52	193
340	82	69	14	61	74.2	<10	206
350	79	42	14	76	96.2	<10	258
360	86	63	14	56	64.9	30	197
370	73	63	14	40	54.1	27	162
400	93	82	14	55	59.2	20	235
Year=1987							
275	65	37	12	66	102.5	<10	193
280	86	86	12	58	68.2	<10	197
285	160	135	12	137	86.2	27	531
290	175	139	12	161	92.2	32	611
300	132	113	12	108	81.7	<10	347
310	141	141	12	106	75.6	<10	366
320	151	121	12	113	74.7	24	366
330	124	121	12	100	80.7	<10	299
340	76	80	12	70	92.0	<10	219
350	71	61	12	64	90.1	<10	191
360	83	82	12	74	88.7	<10	226
370	86	77	12	65	76.0	<10	226
400	64	54	12	33	51.7	<10	125
Year=1988							
275	76	33	12	95	125.1	<10	281
280	100	70	12	87	86.4	19	275
285	163	161	12	62	38.2	54	271
290	155	150	12	60	39.1	42	245
300	97	84	12	56	58.1	30	248
310	113	101	12	64	56.4	35	268
320	103	95	11	58	56.1	14	222
330	103	108	12	58	56.8	21	196
340	82	67	12	64	77.9	<10	177
350	78	75	12	54	69.2	<10	154

Appendix Table 14 (continued).

Descriptive statistics for nitrate-nitrogen ($\mu\text{g N/L}$) from Steel Creek
and Meyer's Branch. November 1985 to December 1991.

Station	Mean	Med	N	SD	CV	Min	Max
Year=1988 (continued).							
360	80	80	12	39	48.6	14	139
370	79	82	12	38	48.4	16	139
400	85	90	12	19	22.3	47	106
Year=1989							
275	72	68	12	65	89.9	<10	195
280	106	92	12	63	59.2	23	219
285	134	114	12	53	39.4	73	232
290	135	127	12	48	35.1	81	234
300	42	22	12	45	107.4	<10	134
310	67	50	12	66	98.2	<10	223
320	67	61	11	40	60.4	<10	129
330	78	36	12	78	100.1	<10	264
340	77	63	12	53	68.5	13	181
350	61	51	12	50	82.2	13	205
360	47	40	12	38	80.1	<10	123
370	54	38	12	61	113.0	<10	193
400	80	70	12	36	45.1	41	149
Station	Mean	N	SE	Min	Max		
Year=1990							
290	133	4	<10	121	142		
330	174	4	47	95	305		
350	155	4	27	76	191		
370	118	4	25	73	178		
Year=1991							
290	91	4	15	58	129		
330	108	4	34	40	197		
350	109	4	52	27	242		
370	120	4	59	26	269		

Appendix Table 15.

Descriptive statistics for total Kjeldahl nitrogen ($\mu\text{g N/L}$) from
Steel Creek. November 1985 to December 1991.

Station	Mean	N	SE	Min	Max
Year=1990					
290	283	4	88	170	540
330	260	4	89	90	460
350	295	4	81	160	530
370	241	4	89	100	500
Year=1991					
290	314	4	42	240	410
330	334	4	47	240	455
350	291	4	37	210	390
370	298	4	15	270	340

Appendix Table 16.

Descriptive statistics for ortho-phosphorus ($\mu\text{g P/L}$) from Steel Creek and Meyer's Branch. November 1985 to December 1991.

Station	Mean	Med	N	SD	CV	Min	Max
Year=1985/86							
275	21	11	14	28	130.5	<5	87
280	20	15	14	21	106.4	<5	61
285	15	14	14	11	71.5	<5	34
290	13	9	14	9	71.7	<5	32
300	8	8	14	6	67.9	<5	15
310	12	14	14	5	41.9	<5	19
320	12	10	14	6	49.5	<5	22
330	15	14	14	6	40.2	7	25
340	23	27	14	13	57.0	5	39
350	29	31	14	13	46.1	7	46
360	23	26	14	10	44.1	7	36
370	23	25	14	11	47.2	5	43
400	5	5	14	<5	60.3	<5	12
Year=1987							
275	24	8	12	38	158.7	<5	136
280	20	10	12	24	125.3	<5	87
285	19	16	12	17	87.3	<5	61
290	18	16	12	19	103.5	<5	72
300	12	10	12	8	65.0	<5	29
310	13	11	12	7	52.8	<5	26
320	15	12	12	9	61.6	<5	32
330	18	15	12	11	61.9	5	42
340	29	30	12	19	62.9	5	58
350	32	33	12	20	63.1	5	59
360	26	29	12	14	53.9	5	46
370	28	28	12	15	56.0	5	57
400	6	5	12	<5	52.1	<5	12
Year=1988							
275	18	15	12	12	67.8	<5	38
280	23	22	12	11	49.5	8	47
285	27	26	12	11	39.8	12	50
290	23	22	12	12	52.0	7	48
300	14	14	12	7	51.6	5	29
310	17	16	12	10	55.2	5	33
320	18	13	11	9	49.7	7	32
330	17	15	12	10	59.5	5	35
340	17	13	12	10	61.1	7	33
350	21	21	12	12	59.1	7	40

Appendix Table 16 (continued).

Descriptive statistics for ortho-phosphorus ($\mu\text{g P/L}$) from Steel Creek and Meyer's Branch. November 1985 to December 1991.

Station	Mean	Med	N	SD	CV	Min	Max
Year=1988 (continued).							
360	22	21	12	14	63.8	8	47
370	22	20	12	13	62.0	7	48
400	6	<5	12	<5	64.7	<5	13
Year=1989							
275	9	5	12	12	132.0	<5	36
280	13	9	12	9	71.8	<5	32
285	16	13	12	6	41.0	8	25
290	16	14	12	6	38.2	6	24
300	10	9	12	<5	38.8	<5	19
310	15	14	12	8	51.3	6	30
320	15	17	11	7	47.7	<5	27
330	16	14	12	12	79.5	6	53
340	17	13	12	16	97.9	<5	67
350	22	19	12	15	70.3	9	67
360	23	20	12	13	55.8	15	62
370	23	22	12	12	53.1	13	58
400	<5	<5	12	<5	39.0	<5	7
Station	Mean	N	SE	Min	Max		
Year=1990							
290	8	4	<5	<5	12		
330	17	4	6	7	34		
350	15	4	<5	10	25		
370	18	4	<5	8	27		
Year=1991							
290	9	4	<5	<5	17		
330	18	4	7	5	32		
350	19	4	6	7	32		
370	20	4	5	9	30		

Appendix Table 17.

Descriptive statistics for total phosphorus ($\mu\text{g P/L}$) from Steel Creek and Meyer's Branch. November 1985 to December 1991.

Station	Mean	Med	N	SD	CV	Min	Max
Year=1985/86							
275	78	65	14	48	61.4	25	186
280	75	67	14	41	54.6	32	161
285	81	62	14	79	97.8	27	343
290	58	47	14	32	55.9	18	141
300	53	54	14	26	49.5	8	97
310	53	47	14	23	43.9	20	115
320	58	49	14	31	54.4	23	123
330	60	56	14	25	41.7	21	115
340	77	69	14	42	54.4	21	154
350	76	71	14	35	45.8	26	134
360	67	68	14	28	41.1	23	130
370	71	74	14	27	38.0	28	121
400	24	24	14	9	36.0	11	39
Year=1987							
275	64	52	12	41	64.1	30	180
280	71	69	12	31	43.2	36	153
285	62	59	12	25	41.2	25	117
290	53	45	12	26	49.0	26	111
300	53	39	12	37	69.4	24	153
310	45	41	12	16	35.4	24	76
320	60	58	12	32	53.5	25	139
330	50	43	12	27	53.7	25	109
340	74	74	12	41	56.3	24	141
350	71	69	12	40	56.0	19	133
360	60	59	12	27	45.6	24	105
370	60	60	12	21	35.2	31	97
400	23	26	12	8	36.3	11	40
Year=1988							
275	59	56	12	16	27.4	41	95
280	70	66	12	24	34.7	41	129
285	58	60	12	16	26.8	32	85
290	51	50	12	16	32.0	29	80
300	52	47	12	23	43.0	25	93
310	87	55	12	116	132.9	27	449
320	70	51	11	46	65.0	30	184
330	55	49	12	28	50.2	22	120
340	53	44	12	32	60.4	22	140

Appendix Table 17 (continued).

Descriptive statistics for total phosphorus ($\mu\text{g P/L}$) from Steel Creek and Meyer's Branch. November 1985 to December 1991.

Station	Mean	Med	N	SD	CV	Min	Max
Year=1988 (continued).							
350	53	51	12	25	47.4	21	93
360	76	65	12	41	54.5	25	149
370	64	53	12	35	54.6	27	142
400	20	20	12	8	38.9	7	33
Year=1989							
275	49	44	12	15	30.2	32	83
280	57	56	12	10	16.8	44	76
285	51	52	12	9	17.5	34	66
290	48	49	12	9	19.6	33	64
300	55	49	12	24	44.0	24	112
310	87	58	12	129	147.4	29	494
320	50	56	11	15	30.7	24	70
330	56	49	12	26	46.6	27	106
340	49	43	12	28	57.0	25	131
350	63	53	12	26	41.7	34	129
360	78	64	12	39	50.5	41	167
370	77	61	12	43	56.3	41	190
400	34	25	12	37	107.9	12	147
Station	Mean	N	SE	Min	Max		
Year=1990							
290	38	4	5	29	46		
330	64	4	20	25	106		
350	50	4	12	32	84		
370	57	4	10	37	81		
Year=1991							
290	29	4	5	19	39		
330	48	4	15	20	83		
350	45	4	13	20	76		
370	48	4	9	32	70		

Appendix Table 18.

Raw data for Steel Creek Quarterly Water Quality - Sampling Plan #3.

Year	Month	Day	Station	TOC	DOC	TIC	ALK	TAL	TCA	TFE
90	Feb	27	290	4.2	3.9	3.3	10.97	43	3.09	256
90	Feb	27	330	3.9	4.9	3.5	11.93	121	3.06	469
90	Feb	27	350	3.2	3.7	3.5	12.07	171	3.00	509
90	Feb	27	370	3.0	2.9	3.4	11.93	198	3.14	573
90	May	22	290	6.4	7.3	4.2	10.87	66	1.82	593
90	May	22	330	7.6	6.3	5.8	11.40	82	4.26	1351
90	May	22	350	3.7	6.3	5.8	9.07	90	4.83	1225
90	May	22	370	4.9	3.2	5.3	8.77	104	3.81	1105
90	Aug	21	290	3.5	3.3	2.8	14.34	53	2.23	140
90	Aug	21	330	2.9	2.6	4.1	30.00	36	3.04	1150
90	Aug	21	350	3.1	3.0	3.2	16.67	23	2.61	715
90	Aug	21	370	3.8	3.3	3.8	20.00	51	3.55	897
90	Dec	27	290	3.6	3.7	2.3	13.47	44	3.00	293
90	Dec	27	330	3.4	3.3	2.4	13.07	36	3.02	341
90	Dec	27	350	4.5	5.1	2.5	13.20	78	3.41	757
90	Dec	27	370	5.0	4.8	2.7	14.67	32	3.51	1200
Year	Month	Day	Station	TMG	TMN	TK	TNA	CL	H2S	S04
90	Feb	27	290	1.04	46	1.27	7.46	6.16	0.013	7.0
90	Feb	27	330	1.16	17	1.52	5.25	4.10	0.018	6.9
90	Feb	27	350	1.13	21	1.47	5.13	3.93	0.018	5.6
90	Feb	27	370	1.17	18	1.36	5.35	3.98	0.016	5.6
90	May	22	290	1.17	99	1.63	7.46	6.56	0.023	5.5
90	May	22	330	1.27	80	1.45	7.43	6.45	0.026	11.6
90	May	22	350	1.43	107	1.49	8.02	7.67	0.026	17.3
90	May	22	370	1.18	104	1.45	6.61	5.58	0.025	10.5
90	Aug	21	290	1.07	42	1.25	7.21	6.49	0.025	5.1
90	Aug	21	330	1.19	265	1.05	7.51	6.63	0.028	3.4
90	Aug	21	350	1.09	95	1.25	7.42	6.48	0.026	4.0
90	Aug	21	370	1.12	93	1.02	7.53	6.66	0.027	4.8
90	Dec	27	290	0.83	33	1.09	6.68	5.66	0.025	4.4
90	Dec	27	330	0.83	22	1.16	6.52	5.74	0.026	4.9
90	Dec	27	350	0.81	32	1.14	6.39	9.42	0.027	5.1
90	Dec	27	370	0.84	35	1.14	6.29	5.89	0.026	4.7

Appendix Table 18 (continued).

Raw data for Steel Creek Quarterly Water Quality - Sampling Plan #3.

Year	Month	Day	Station	TOC	DOC	TIC	ALK	TAL	TCA	TFE
91	Feb	19	290	4.0	3.7	3.1	11.90	53	3.67	207
91	Feb	19	330	3.8	3.7	3.4	11.73	60	3.76	235
91	Feb	19	350	4.9	4.8	2.9	10.20	67	3.43	427
91	Feb	19	370	5.0	4.8	2.8	10.20	69	3.14	588
91	May	20	290	4.2	3.8	2.4	9.67	102	2.30	651
91	May	20	330	7.7	6.0	4.1	16.27	101	4.48	2170
91	May	20	350	5.9	5.1	4.0	15.33	82	4.13	1690
91	May	20	370	5.1	4.7	3.9	15.67	77	3.94	1330
91	Aug	20	290	4.4	4.2	3.7	8.54	42	2.19	619
91	Aug	20	330	6.0	6.0	5.5	13.27	99	3.51	1900
91	Aug	20	350	6.2	5.0	5.3	13.27	101	3.42	1220
91	Aug	20	370	5.6	5.0	5.4	14.27	94	3.43	1030
91	Nov	19	290	3.3	4.5	2.9	12.17	45	2.61	391
91	Nov	19	330	3.6	2.4	3.2	13.33	17	2.84	383
91	Nov	19	350	4.5	4.4	3.8	16.33	32	3.42	515
91	Nov	19	370	4.2	4.2	3.6	16.00	37	3.21	506

Year	Month	Day	Station	TMG	TMN	TK	TNA	CL	H2S	SO4
91	Feb	19	290	0.89	25	1.18	5.77	5.08	0.024	2.1
91	Feb	19	330	1.04	18	1.29	6.19	5.10	0.027	2.4
91	Feb	19	350	0.78	18	1.27	6.17	5.05	0.027	5.1
91	Feb	19	370	0.82	15	1.38	6.26	5.32	0.027	5.1
91	May	20	290	1.00	91	1.16	5.05	5.12	0.025	4.0
91	May	20	330	1.38	77	1.60	5.99	4.56	0.028	5.7
91	May	20	350	1.30	57	1.56	5.67	4.62	0.028	5.7
91	May	20	370	1.29	60	1.54	5.12	4.53	0.027	5.2
91	Aug	20	290	0.77	57	0.88	4.06	4.04	0.022	4.4
91	Aug	20	330	0.98	41	1.29	4.78	3.94	0.023	6.1
91	Aug	20	350	1.03	39	1.42	5.08	4.10	0.021	6.1
91	Aug	20	370	1.10	40	1.37	4.87	4.12	0.020	5.7
91	Nov	19	290	1.01	59	1.44	5.36	5.16	0.020	4.2
91	Nov	19	330	1.07	29	1.73	6.05	5.99	0.021	5.0
91	Nov	19	350	1.18	27	1.86	7.62	7.57	0.023	6.3
91	Nov	19	370	1.15	25	1.85	7.18	7.26	0.019	6.0

TOC - Total organic carbon (mg C/L)

DOC - dissolved organic carbon (mg C/L)

TIC - total inorganic carbon (mg C/L)

ALK - alkalinity (mg CaCO₃)

TAL - total aluminum (μg/L)

TCA - total calcium (mg/L)

TFE - total iron (μg/L)

TMG - total magnesium (mg/L)

TMN - total manganese (μg/L)

TK - total potassium (mg/L)

TNA - total sodium (mg/L)

CL - chloride (mg/L)

H₂S - hydrogen sulfide (mg H₂S/L)SO₄ - sulfate (mg SO₄/L)

Appendix Table 19.

Raw data for Steel Creek Biannual Diel Water Quality - Sampling Plan #3.

Year	Month	Day	Station	Period	TOC	DOC	TIC	TFE	TMG
90	Feb	27	290	1	4.2	3.9	3.3	256	1.04
90	Feb	27	290	2	2.9	2.8	2.8	229	0.98
90	Feb	27	290	3	2.9	2.9	2.5	266	0.99
90	Feb	27	290	4	3.4	3.7	2.5	291	0.96
90	Feb	27	290	5	3.2	3.8	2.7	242	1.00
90	Feb	27	290	6	3.7	4.0	3.0	243	1.04
90	Feb	27	290	7	3.4	4.0	3.0	220	1.00
90	Feb	28	290	8	3.2	4.6	3.4	235	0.99
90	Feb	28	290	9	3.0	2.4	3.6	191	0.93
90	Feb	28	290	10	3.0	3.2	3.5	185	0.95
90	Feb	27	330	1	3.9	4.9	3.5	469	1.16
90	Feb	27	330	2	3.1	3.3	3.7	415	1.06
90	Feb	27	330	3	2.6	3.0	4.0	282	1.01
90	Feb	27	330	4	3.0	3.2	3.5	460	1.04
90	Feb	27	330	5	2.5	3.2	3.6	422	1.00
90	Feb	27	330	6	1.9	2.2	4.0	289	1.03
90	Feb	28	330	7	2.1	2.2	3.7	309	0.97
90	Feb	28	330	8	2.0	1.7	3.7	309	0.96
90	Feb	28	330	9	2.0	2.9	3.8	513	1.02
90	Feb	28	330	10	3.2	3.9	3.5	374	1.03
90	Feb	27	350	1	3.2	3.7	3.5	509	1.13
90	Feb	27	350	2	3.6	4.3	3.6	474	1.02
90	Feb	27	350	3	3.3	4.0	3.1	310	1.03
90	Feb	27	350	4	3.6	3.4	3.0	256	0.99
90	Feb	27	350	5	3.4	3.5	3.4	388	1.02
90	Feb	27	350	6	2.5	3.3	4.0	499	1.05
90	Feb	28	350	7	2.8	2.7	3.5	346	1.03
90	Feb	28	350	8	2.2	2.6	3.7	391	1.01
90	Feb	28	350	9	2.0	2.3	3.6	528	1.05
90	Feb	28	350	10	2.2	2.1	3.6	518	1.09
90	Feb	27	370	1	3.0	2.9	3.4	573	1.17
90	Feb	27	370	2	2.6	2.5	3.5	587	1.05
90	Feb	27	370	3	2.4	2.6	3.3	299	1.03
90	Feb	27	370	4	2.4	3.3	3.3	551	1.05
90	Feb	27	370	5	2.3	2.5	3.4	477	1.02
90	Feb	27	370	6	2.6	2.8	3.5	498	1.09
90	Feb	28	370	7	2.1	2.5	3.5	599	1.10
90	Feb	28	370	8	2.4	2.7	3.6	518	1.09
90	Feb	28	370	9	2.3	2.8	3.5	606	1.13
90	Feb	28	370	10	2.8	2.8	3.5	622	1.18
90	Aug	21	290	1	3.5	3.3	2.8	140	1.07
90	Aug	21	290	2	3.2	2.6	2.6	177	1.05
90	Aug	21	290	3	3.1	2.7	2.6	187	1.00
90	Aug	21	290	4	3.4	2.8	2.4	198	1.10
90	Aug	21	290	5	3.2	2.8	2.5	127	1.03

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Appendix Table 19.

Raw data for Steel Creek Biannual Diel Water Quality - Sampling Plan #3.

Year	Month	Day	Station	Period	TOC	DOC	TIC	TFE	TMG
90	Feb	27	290	1	4.2	3.9	3.3	256	1.04
90	Feb	27	290	2	2.9	2.8	2.8	229	0.98
90	Feb	27	290	3	2.9	2.9	2.5	266	0.99
90	Feb	27	290	4	3.4	3.7	2.5	291	0.96
90	Feb	27	290	5	3.2	3.8	2.7	242	1.00
90	Feb	27	290	6	3.7	4.0	3.0	243	1.04
90	Feb	27	290	7	3.4	4.0	3.0	220	1.00
90	Feb	28	290	8	3.2	4.6	3.4	235	0.99
90	Feb	28	290	9	3.0	2.4	3.6	191	0.93
90	Feb	28	290	10	3.0	3.2	3.5	185	0.95
90	Feb	27	330	1	3.9	4.9	3.5	469	1.16
90	Feb	27	330	2	3.1	3.3	3.7	415	1.06
90	Feb	27	330	3	2.6	3.0	4.0	282	1.01
90	Feb	27	330	4	3.0	3.2	3.5	460	1.04
90	Feb	27	330	5	2.5	3.2	3.6	422	1.00
90	Feb	27	330	6	1.9	2.2	4.0	289	1.03
90	Feb	28	330	7	2.1	2.2	3.7	309	0.97
90	Feb	28	330	8	2.0	1.7	3.7	309	0.96
90	Feb	28	330	9	2.0	2.9	3.8	513	1.02
90	Feb	28	330	10	3.2	3.9	3.5	374	1.03
90	Feb	27	350	1	3.2	3.7	3.5	509	1.13
90	Feb	27	350	2	3.6	4.3	3.6	474	1.02
90	Feb	27	350	3	3.3	4.0	3.1	310	1.03
90	Feb	27	350	4	3.6	3.4	3.0	256	0.99
90	Feb	27	350	5	3.4	3.5	3.4	388	1.02
90	Feb	27	350	6	2.5	3.3	4.0	499	1.05
90	Feb	28	350	7	2.8	2.7	3.5	346	1.03
90	Feb	28	350	8	2.2	2.6	3.7	391	1.01
90	Feb	28	350	9	2.0	2.3	3.6	528	1.05
90	Feb	28	350	10	2.2	2.1	3.6	518	1.09
90	Feb	27	370	1	3.0	2.9	3.4	573	1.17
90	Feb	27	370	2	2.6	2.5	3.5	587	1.05
90	Feb	27	370	3	2.4	2.6	3.3	299	1.03
90	Feb	27	370	4	2.4	3.3	3.3	551	1.05
90	Feb	27	370	5	2.3	2.5	3.4	477	1.02
90	Feb	27	370	6	2.6	2.8	3.5	498	1.09
90	Feb	28	370	7	2.1	2.5	3.5	599	1.10
90	Feb	28	370	8	2.4	2.7	3.6	518	1.09
90	Feb	28	370	9	2.3	2.8	3.5	606	1.13
90	Feb	28	370	10	2.8	2.8	3.5	622	1.18
90	Aug	21	290	1	3.5	3.3	2.8	140	1.07
90	Aug	21	290	2	3.2	2.6	2.6	177	1.05
90	Aug	21	290	3	3.1	2.7	2.6	187	1.00
90	Aug	21	290	4	3.4	2.8	2.4	198	1.10
90	Aug	21	290	5	3.2	2.8	2.5	127	1.03

Appendix Table 19 (continued).

Raw data for Steel Creek Biannual Diel Water Quality - Sampling Plan #3.

Year	Month	Day	Station	Period	TOC	DOC	TIC	TFE	TMG
90	Aug	21	290	6	3.1	2.7	2.6	239	1.06
90	Aug	22	290	7	3.1	2.8	2.6	275	1.08
90	Aug	22	290	8	3.2	3.0	2.6	262	1.09
90	Aug	22	290	9	4.3	3.5	2.3	650	1.13
90	Aug	22	290	10	4.9	4.4	2.1	714	1.14
90	Aug	21	330	1	2.9	2.6	4.1	1150	1.19
90	Aug	21	330	2	3.4	2.7	4.0	1140	1.19
90	Aug	21	330	3	3.1	2.7	3.9	1170	1.12
90	Aug	21	330	4	3.0	2.6	3.8	1160	1.16
90	Aug	21	330	5	3.0	2.6	3.8	1090	1.09
90	Aug	21	330	6	3.0	2.5	3.9	1180	1.16
90	Aug	21	330	7	3.0	2.6	4.0	1120	1.13
90	Aug	22	330	8	3.1	2.6	4.0	1200	1.17
90	Aug	22	330	9	.	.	.	.	.
90	Aug	22	330	10	3.6	2.9	2.8	2510	0.90
90	Aug	21	350	1	3.1	3.0	3.2	715	1.09
90	Aug	21	350	2	3.2	2.7	3.2	704	1.10
90	Aug	21	350	3	3.2	2.8	3.1	688	1.06
90	Aug	21	350	4	3.3	2.6	3.0	649	0.95
90	Aug	21	350	5	3.4	3.0	3.0	674	1.02
90	Aug	21	350	6	3.4	2.9	3.0	675	1.03
90	Aug	22	350	7	3.3	2.8	3.2	684	1.08
90	Aug	22	350	8	3.3	2.8	3.1	728	1.10
90	Aug	22	350	9	.	.	.	.	.
90	Aug	22	350	10	4.6	3.5	1.7	1030	0.69
90	Aug	21	370	1	3.8	3.3	3.8	897	1.12
90	Aug	21	370	2	4.1	3.5	3.9	834	1.20
90	Aug	21	370	3	4.0	3.6	3.8	903	1.16
90	Aug	21	370	4	3.9	3.4	3.8	832	1.12
90	Aug	21	370	5	4.0	3.4	3.7	823	1.12
90	Aug	21	370	6	3.9	3.4	3.6	885	1.11
90	Aug	22	370	7	4.0	3.5	3.6	917	1.09
90	Aug	22	370	8	3.9	3.4	3.7	878	1.09
90	Aug	22	370	9	3.9	3.4	3.7	991	1.13
90	Aug	22	370	10	4.3	3.4	2.9	1230	0.86

Appendix Table 19 (continued).

Raw data for Steel Creek Biannual Diel Water Quality - Sampling Plan #3.

Year	Month	Day	Station	Period	TOC	DOC	TIC	TFE	TMG
91	Feb	19	290	1	4.0	3.9	3.1	207	0.89
91	Feb	19	290	2	3.9	3.8	3.2	284	0.93
91	Feb	19	290	3	4.2	4.2	3.2	306	0.91
91	Feb	19	290	4	4.1	4.2	3.0	280	0.86
91	Feb	19	290	5	4.0	4.2	3.1	275	0.90
91	Feb	19	290	6	3.9	4.2	3.2	251	0.89
91	Feb	19	290	7	4.0	4.0	3.3	272	0.91
91	Feb	19	290	8	3.9	3.8	3.3	295	0.93
91	Feb	19	290	9	4.2	4.1	3.3	251	0.90
91	Feb	19	290	10	4.0	3.9	3.3	248	0.92
91	Feb	19	330	1	3.8	3.7	3.4	235	1.04
91	Feb	19	330	2	3.6	5.0	3.2	322	0.96
91	Feb	19	330	3	3.8	4.8	3.0	313	0.96
91	Feb	19	330	4	3.8	4.0	2.8	323	0.84
91	Feb	19	330	5	3.9	4.0	2.7	281	0.84
91	Feb	19	330	6	3.8	4.0	3.0	308	0.89
91	Feb	19	330	7	3.7	3.8	3.4	272	1.02
91	Feb	19	330	8	3.6	3.9	3.5	261	1.03
91	Feb	19	330	9	3.6	3.8	3.5	270	1.04
91	Feb	19	330	10	3.6	3.7	3.6	260	1.06
91	Feb	19	350	1	4.8	4.8	2.9	427	0.78
91	Feb	19	350	2	4.5	4.7	2.7	448	0.77
91	Feb	19	350	3	4.6	4.9	2.8	435	0.75
91	Feb	19	350	4	4.5	4.8	2.6	478	0.75
91	Feb	19	350	5	4.6	5.0	2.6	431	0.74
91	Feb	19	350	7	4.6	4.8	2.8	444	0.80
91	Feb	19	350	8	4.6	4.7	2.9	478	0.82
91	Feb	19	350	9	4.5	4.7	3.0	463	0.81
91	Feb	19	350	10	4.5	4.7	3.0	459	0.82
91	Feb	19	370	1	5.0	4.8	2.8	588	0.82
91	Feb	19	370	2	4.7	4.6	2.7	1090	0.81
91	Feb	19	370	3	4.7	4.6	2.7	750	0.80
91	Feb	19	370	4	4.8	3.9	2.5	767	0.79
91	Feb	19	370	5	4.8	4.7	2.5	858	0.80
91	Feb	19	370	6	4.8	4.9	2.5	736	0.78
91	Feb	19	370	7	4.6	5.0	2.7	729	0.84
91	Feb	19	370	8	4.7	4.7	2.8	889	0.81
91	Feb	19	370	9	4.6	4.8	2.8	803	0.82
91	Feb	19	370	10	7.2	4.8	2.8	856	0.86
91	Aug	20	290	1	4.4	4.2	3.7	894	0.76
91	Aug	20	290	2	5.2	5.1	3.8	846	0.77
91	Aug	20	290	3	5.1	4.9	3.5	842	0.75
91	Aug	20	290	4	5.2	5.3	3.5	779	0.74
91	Aug	20	290	5	4.6	4.8	3.7	746	0.76
91	Aug	20	290	6	4.7	4.3	3.6	767	0.72

Appendix Table 19 (continued).

Raw data for Steel Creek Biannual Diel Water Quality - Sampling Plan #3.

Year	Month	Day	Station	Period	TOC	DOC	TIC	TFE	TMG
91	Aug	20	290	7	4.8	4.2	3.5	781	0.73
91	Aug	20	290	8	4.7	4.0	3.2	630	0.76
91	Aug	20	290	9	4.4	4.8	3.2	614	0.78
91	Aug	20	290	10	4.5	3.4	3.4	750	0.77
91	Aug	20	330	1	6.9	6.0	5.5	1900	0.96
91	Aug	20	330	2	7.1	6.6	5.3	1880	0.92
91	Aug	20	330	3	7.2	6.7	5.3	2010	0.94
91	Aug	20	330	4	7.5	6.5	5.3	2090	0.93
91	Aug	20	330	5	7.5	6.8	5.2	2220	0.95
91	Aug	20	330	6	7.3	4.8	5.2	2370	0.86
91	Aug	20	330	7	7.2	7.0	5.3	2370	0.87
91	Aug	20	330	8	7.7	7.0	5.2	2360	0.90
91	Aug	20	330	9	8.0	6.7	4.9	2360	0.88
91	Aug	20	330	10	7.7	6.8	5.0	2300	0.90
91	Aug	20	350	1	6.2	5.0	5.3	1220	1.02
91	Aug	20	350	2	5.7	5.5	5.4	1190	1.03
91	Aug	20	350	3	5.9	5.8	5.3	1240	1.02
91	Aug	20	350	4	5.9	5.6	4.6	1270	1.02
91	Aug	20	350	5	5.4	5.6	5.3	1330	1.01
91	Aug	20	350	6	5.8	5.7	5.3	1400	1.00
91	Aug	20	350	7	6.4	6.0	5.5	1470	1.00
91	Aug	20	350	8	5.6	5.3	5.4	1120	1.06
91	Aug	20	350	9	6.4	6.5	5.3	1720	1.00
91	Aug	20	350	10	7.0	5.0	5.8	1920	1.01
91	Aug	20	370	1	5.6	5.0	5.4	940	1.06
91	Aug	20	370	2	5.1	5.3	5.2	931	1.08
91	Aug	20	370	3	5.3	5.0	5.2	962	1.05
91	Aug	20	370	4	5.1	5.0	5.0	1010	1.06
91	Aug	20	370	5	5.2	5.4	5.2	972	1.04
91	Aug	20	370	6	5.0	5.0	5.0	1010	1.07
91	Aug	20	370	7	6.2	5.5	5.3	1070	1.07
91	Aug	20	370	8	6.7	5.6	5.3	1610	1.02
91	Aug	20	370	9	5.2	5.0	5.0	1080	1.09
91	Aug	20	370	10	8.1	6.4	5.5	1170	1.06

TOC = total organic carbon (mg C/L)

DOC = dissolved organic carbon (mg C/L)

TIC = total inorganic carbon (mg C/L)

TFE = total iron ($\mu\text{g/L}$)

TMG = total magnesium (mg/L)

Appendix Table 20.

Descriptive statistics for total organic carbon (mg C/L) from Steel Creek and Meyer's Branch. November 1985 to December 1991.

Station	Mean	Med	N	SD	CV	Min	Max
Year=1985/86							
275	6	6	14	1	18.1	4	8
280	6	6	14	1	12.8	5	8
285	6	6	14	2	30.8	4	12
290	6	6	14	1	14.1	5	8
300	7	7	14	1	19.2	5	10
310	5	5	14	1	19.0	4	7
320	6	5	14	1	25.2	4	8
330	5	6	14	1	20.5	3	7
340	6	6	14	2	37.9	4	13
350	5	5	14	1	15.3	4	7
360	5	5	14	1	15.0	4	6
370	6	6	14	1	17.3	4	7
400	5	5	14	2	28.9	3	10
Year=1987							
275	6	6	12	1	15.4	4	7
280	6	6	12	1	17.3	4	7
285	6	5	12	1	24.2	3	8
290	6	5	12	1	26.2	3	7
300	6	5	12	2	36.0	3	10
310	5	5	12	2	31.5	2	8
320	5	5	12	1	26.5	4	8
330	6	6	12	1	19.5	4	7
340	6	6	12	2	25.3	4	9
350	6	6	12	2	26.6	4	9
360	5	5	12	1	17.8	4	7
370	5	5	12	2	33.6	3	10
400	6	6	12	2	35.0	3	10
Year=1988							
275	5	5	12	1	16.7	4	7
280	5	5	12	1	17.8	3	6
285	4	4	12	1	17.6	3	5
290	5	4	12	1	13.2	4	6
300	5	4	12	1	18.9	4	6
310	5	4	12	1	18.4	3	6
320	5	4	11	1	15.9	4	6
330	4	4	12	1	16.8	3	5
340	5	5	12	1	12.0	4	6
350	5	4	12	1	25.4	3	7

Appendix Table 20 (continued).

Descriptive statistics for total organic carbon (mg C/L) from Steel Creek and Meyer's Branch. November 1985 to December 1991.

Station	Mean	Med	N	SD	CV	Min	Max
Year=1988 (continued).							
360	5	5	12	1	22.9	3	6
370	5	5	12	2	32.0	1	7
400	5	5	12	2	36.9	1	8
Year=1989							
275	4	4	12	2	34.7	2	8
280	4	4	12	2	36.3	3	8
285	4	4	12	2	44.5	1	6
290	4	4	12	2	42.1	1	6
300	4	4	12	2	53.8	1	8
310	4	4	12	2	50.0	1	8
320	4	3	11	2	51.4	1	8
330	5	4	12	3	63.2	1	11
340	6	5	12	4	77.7	2	19
350	6	6	12	4	63.6	1	18
360	6	6	12	3	56.2	1	15
370	6	6	12	3	47.3	1	13
400	5	5	12	1	23.1	4	8
Station	Mean	N	SE	Min	Max		
Year=1990							
290	4	4	1	4	6		
330	4	4	1	3	8		
350	4	4	<1	3	5		
370	4	4	<1	3	5		
Year=1991							
290	4	4	<1	3	4		
330	6	4	1	4	8		
350	5	4	<1	5	6		
370	5	4	<1	4	6		

Appendix Table 21.

Descriptive statistics for dissolved organic carbon (mg C/L) from Steel Creek and Meyer's Branch. November 1985 to December 1991.

Station	Mean	Med	N	SD	CV	Min	Max
Year=1985/86							
275	5	5	14	1	16.0	4	6
280	5	5	14	1	13.6	4	7
285	6	5	14	1	18.1	5	9
290	6	6	14	1	19.8	4	8
300	6	6	14	1	21.8	4	9
310	5	5	14	1	20.0	4	7
320	5	5	14	1	22.4	3	7
330	5	5	14	1	16.7	3	6
340	6	6	14	2	35.7	4	12
350	5	6	14	1	22.0	3	7
360	5	5	14	1	17.5	3	6
370	5	5	14	1	14.6	4	6
400	5	5	14	2	30.9	3	9
Year=1987							
275	6	6	12	1	15.5	4	7
280	5	5	12	1	17.1	4	6
285	5	6	12	1	27.2	2	7
290	6	5	12	2	30.4	4	10
300	5	5	12	1	23.6	3	7
310	5	5	12	2	32.8	2	7
320	5	5	12	2	34.4	3	9
330	6	5	12	2	31.8	4	10
340	6	6	12	3	43.9	4	14
350	5	5	12	1	24.8	4	9
360	6	5	12	1	22.0	4	8
370	5	5	12	2	32.2	3	9
400	6	6	12	2	38.6	2	10
Year=1988							
275	4	5	12	1	16.6	3	6
280	4	4	12	1	19.6	3	7
285	4	4	12	1	21.4	3	6
290	4	4	12	1	19.2	3	6
300	5	5	12	1	20.3	4	7
310	5	4	12	1	16.5	3	6
320	4	4	11	1	17.6	4	6
330	5	4	12	1	18.3	4	6
340	5	5	12	1	11.3	4	5
350	5	5	12	1	16.8	4	6

Appendix Table 21 (continued).

Descriptive statistics for dissolved organic carbon (mg C/L) from Steel Creek and Meyer's Branch. November 1985 to December 1991.

Station	Mean	Med	N	SD	CV	Min	Max
Year=1988 (continued).							
360	5	5	12	1	15.6	4	6
370	5	5	12	1	26.5	2	7
400	4	4	12	2	37.1	1	7
Year=1989							
275	4	4	12	1	30.5	2	6
280	4	4	12	1	38.4	2	7
285	4	4	12	1	33.3	2	6
290	4	4	12	1	30.5	2	6
300	4	4	12	2	43.8	2	7
310	4	4	12	2	40.0	1	7
320	4	4	11	2	42.7	1	8
330	5	5	12	2	49.3	1	10
340	5	4	12	4	73.5	1	17
350	6	6	12	4	60.0	1	16
360	6	6	12	3	52.8	1	14
370	6	5	12	3	47.2	1	12
400	5	5	12	1	22.3	3	7
Station	Mean	N	SE	Min	Max		
Year=1990							
290	5	4	1	3	7		
330	4	4	1	3	6		
350	5	4	1	3	6		
370	4	4	<1	3	5		
Year=1991							
290	4	4	<1	4	5		
330	5	4	1	2	6		
350	5	4	<1	4	5		
370	5	4	<1	4	5		

Appendix Table 22.

Descriptive statistics for total inorganic carbon (mg C/L) from Steel Creek and Meyer's Branch. November 1985 to December 1991.

Station	Mean	Med	N	SD	CV	Min	Max
Year=1985/86							
275	5	4	14	1	22.7	3	8
280	5	4	14	1	16.8	4	7
285	4	4	14	1	20.5	2	6
290	5	5	14	1	17.9	2	6
300	6	5	14	4	58.2	1	13
310	5	5	14	1	26.0	3	9
320	5	5	14	2	29.9	3	9
330	5	5	14	1	17.6	4	7
340	5	5	14	1	22.6	2	6
350	5	5	14	1	15.2	4	6
360	5	5	14	1	16.4	4	6
370	5	5	14	1	17.5	4	7
400	5	6	14	1	22.2	4	7
Year=1987							
275	4	4	12	1	21.4	2	6
280	4	4	12	1	24.6	2	6
285	4	4	12	1	24.8	2	6
290	4	5	12	1	25.1	2	6
300	5	4	12	2	45.2	2	10
310	5	4	12	1	30.9	2	8
320	4	4	12	1	31.1	2	8
330	5	5	12	1	25.0	2	6
340	5	5	12	2	33.2	2	7
350	5	5	12	1	31.5	2	7
360	5	5	12	1	29.4	2	6
370	5	5	12	1	28.2	2	7
400	5	5	12	2	35.6	2	7
Year=1988							
275	4	4	12	1	19.3	3	5
280	4	4	12	1	21.2	3	5
285	4	4	12	1	24.5	3	6
290	4	4	12	1	21.1	3	6
300	5	5	12	2	46.4	3	10
310	4	4	12	1	30.4	3	8
320	4	4	11	1	33.0	3	8
330	5	5	12	1	27.2	3	8
340	5	5	12	1	18.6	3	6
350	5	5	12	1	23.6	4	8

Appendix Table 22 (continued).

Descriptive statistics for total inorganic carbon (mg C/L) from Steel Creek and Meyer's Branch. November 1985 to December 1991.

Station	Mean	Med	N	SD	CV	Min	Max
Year=1988 (continued).							
360	5	5	12	1	28.1	3	8
370	5	5	12	1	28.1	4	8
400	5	5	12	1	27.0	3	7
Year=1989							
275	3	3	12	1	18.8	2	4
280	3	3	12	1	15.9	3	4
285	4	4	12	1	20.9	3	6
290	4	4	12	1	18.3	3	5
300	5	5	12	1	24.5	3	8
310	4	4	12	1	17.9	3	6
320	5	5	11	1	18.9	3	6
330	5	5	12	1	24.9	3	7
340	4	4	12	1	20.0	3	6
350	5	5	12	1	21.7	3	7
360	5	5	12	1	24.4	2	7
370	5	5	12	1	23.3	3	7
400	5	5	12	1	25.0	3	6
Station	Mean	N	SE	Min	Max		
Year=1990							
290	3	4	<1	2	4		
330	4	4	1	2	6		
350	4	4	1	3	6		
370	4	4	1	3	5		
Year=1991							
290	3	4	<1	2	4		
330	4	4	1	3	6		
350	4	4	<1	3	5		
370	4	4	1	3	5		

Appendix Table 23.

Descriptive statistics for alkalinity (mg CaCO_3/L) from Steel Creek and Meyer's Branch. November 1985 to December 1991.

Station	Mean	Med	N	SD	CV	Min	Max
Year=1985/86							
275	18	18	14	2	10.4	17	24
280	18	17	14	2	10.6	16	23
285	17	17	14	4	21.1	6	22
290	18	17	14	3	20.0	9	25
300	21	17	14	13	62.8	2	50
310	19	18	14	5	29.0	7	33
320	18	18	14	5	27.6	8	32
330	18	19	14	2	13.5	13	24
340	18	18	14	3	16.1	13	25
350	18	18	14	2	11.6	15	22
360	18	19	14	3	14.4	14	23
370	18	19	14	3	14.1	14	24
400	21	21	14	5	22.4	13	29
Year=1987							
275	16	15	12	3	16.6	14	23
280	16	16	12	2	15.3	14	23
285	16	15	12	2	14.5	13	20
290	16	16	12	2	13.4	13	20
300	18	16	12	7	37.8	12	37
310	16	15	12	4	23.1	12	24
320	16	15	12	3	21.0	12	23
330	16	16	12	3	17.2	11	20
340	16	17	12	3	20.2	11	20
350	16	18	12	3	19.9	10	19
360	16	17	12	3	19.8	10	20
370	16	17	12	3	19.0	11	20
400	16	17	12	6	36.0	7	24
Year=1988							
275	15	15	12	2	10.7	12	17
280	14	14	12	1	9.8	12	16
285	14	14	12	2	13.0	12	17
290	15	14	12	2	10.5	13	18
300	18	14	12	6	36.2	14	31
310	15	14	12	3	21.9	12	24
320	15	13	11	3	18.4	12	21
330	16	14	12	3	17.1	13	22
340	16	16	12	2	11.7	12	19
350	17	16	12	3	16.8	13	22

Appendix Table 23 (continued).

Descriptive statistics for alkalinity (mg CaCO₃/L) from Steel Creek and Meyer's Branch. November 1985 to December 1991.

Station	Mean	Med	N	SD	CV	Min	Max
Year=1988 (continued).							
360	17	16	12	4	21.2	13	24
370	18	16	12	4	23.3	14	26
400	21	21	12	4	21.3	13	26
Year=1989							
275	12	12	12	2	12.7	9	14
280	12	12	12	1	10.5	9	13
285	13	13	12	1	11.8	10	15
290	13	13	12	2	13.6	9	16
300	15	14	12	4	24.4	10	22
310	13	13	12	3	18.9	10	18
320	13	13	11	3	20.6	7	17
330	14	13	12	2	15.8	11	18
340	14	14	12	2	13.0	11	18
350	15	14	12	2	13.6	11	18
360	15	14	12	3	23.4	7	20
370	15	15	12	3	20.2	11	22
400	19	20	12	5	24.5	11	24
Station	Mean	N	SE	Min	Max		
Year=1990							
290	12	4	1	11	14		
330	17	4	4	11	30		
350	13	4	2	9	17		
370	14	4	2	9	20		
Year=1991							
290	11	4	1	9	12		
330	14	4	1	12	16		
350	14	4	1	10	16		
370	14	4	1	10	16		

Appendix Table 24.

Descriptive statistics for total aluminum ($\mu\text{g/L}$) from Steel Creek and Meyer's Branch. November 1985 to December 1991.

Station	Mean	Med	N	SD	CV	Min	Max
Year=1985/86							
275	180	138	14	234	129.9	<100	959
280	237	203	14	240	101.4	<100	991
285	261	177	14	274	105.0	<100	969
290	211	141	14	191	90.5	<100	637
300	183	110	14	299	163.3	<100	1210
310	131	<100	14	156	119.6	<100	603
320	146	<100	14	172	117.5	<100	642
330	<100	<100	14	<100	83.7	<100	367
340	100	<100	14	123	122.3	<100	462
350	<100	<100	14	<100	75.9	<100	235
360	121	<100	14	115	95.5	<100	393
370	152	103	14	170	111.6	<100	715
400	127	139	14	<100	60.7	<100	233
Year=1987							
275	227	150	12	290	127.9	<100	1110
280	282	154	12	318	112.9	<100	1216
285	236	207	12	183	77.4	<100	742
290	126	128	12	<100	49.4	<100	235
300	106	<100	12	<100	88.4	<100	345
310	104	<100	12	<100	79.7	<100	309
320	161	112	12	140	86.9	<100	444
330	<100	<100	12	<100	61.3	<100	201
340	<100	<100	12	<100	56.2	<100	129
350	<100	<100	12	<100	65.3	<100	192
360	101	106	12	<100	46.8	<100	183
370	191	145	12	133	69.5	<100	449
400	169	137	12	138	81.5	<100	456
Year=1988							
275	<100	<100	12	<100	49.3	<100	178
280	171	144	12	<100	52.8	<100	341
285	119	<100	12	<100	71.9	<100	308
290	<100	<100	12	<100	42.2	<100	105
300	<100	<100	12	<100	91.4	<100	252
310	<100	<100	12	<100	80.6	<100	302
320	<100	<100	11	<100	86.0	<100	229
330	<100	<100	12	<100	69.9	<100	193
340	<100	<100	12	<100	51.8	<100	<100
350	<100	<100	12	<100	85.2	<100	173

Appendix Table 24 (continued).

Descriptive statistics for total aluminum ($\mu\text{g/L}$) from Steel Creek and Meyer's Branch. November 1985 to December 1991.

Station	Mean	Med	N	SD	CV	Min	Max
Year=1988 (continued).							
360	<100	<100	12	<100	83.1	<100	222
370	<100	<100	12	<100	35.5	<100	119
400	<100	<100	12	<100	63.6	<100	170
Year=1989							
275	<100	<100	12	<100	45.6	<100	113
280	106	<100	12	101	95.2	<100	409
285	<100	<100	12	<100	46.7	<100	<100
290	<100	<100	12	<100	44.5	<100	100
300	<100	<100	12	<100	77.5	<100	124
310	<100	<100	12	<100	85.9	<100	244
320	<100	<100	11	<100	64.4	<100	109
330	<100	<100	12	<100	131.1	<100	341
340	<100	<100	12	<100	93.7	<100	205
350	<100	<100	12	<100	112.7	<100	272
360	<100	<100	12	<100	78.8	<100	226
370	<100	<100	12	<100	77.2	<100	248
400	147	<100	12	228	154.8	<100	789
Station	Mean	N	SE	Min	Max		
Year=1990							
290	<100	4	<100	<100	<100		
330	<100	4	<100	<100	121		
350	<100	4	<100	<100	171		
370	<100	4	<100	<100	198		
Year=1991							
290	<100	4	<100	<100	102		
330	<100	4	<100	<100	101		
350	<100	4	<100	<100	101		
370	<100	4	<100	<100	<100		

Appendix Table 25.

Descriptive statistics for total calcium (mg/L) from Steel Creek and Meyer's Branch. November 1985 to December 1991.

Station	Mean	Med	N	SD	CV	Min	Max
Year=1985/86							
275	3.84	3.85	14	0.34	8.8	3.29	4.45
280	3.92	3.94	14	0.37	9.4	3.39	4.46
285	4.09	4.13	14	0.84	20.6	2.65	5.67
290	4.07	3.85	14	0.87	21.4	2.68	5.77
300	5.10	4.19	14	2.22	43.6	2.99	9.60
310	4.12	3.91	14	0.69	16.7	3.02	5.32
320	4.10	3.93	14	0.76	18.6	2.68	5.42
330	4.13	3.97	14	0.58	14.0	3.21	5.55
340	4.19	4.19	14	0.64	15.1	3.14	5.35
350	4.11	4.05	14	0.62	15.0	2.94	5.09
360	3.99	3.96	14	0.59	14.8	3.10	5.19
370	4.24	4.20	14	0.71	16.8	3.14	5.98
400	8.19	7.76	14	1.72	21.0	5.75	11.51
Year=1987							
275	3.75	3.76	12	0.31	8.3	3.12	4.22
280	3.76	3.88	12	0.35	9.3	3.16	4.38
285	3.96	3.88	12	0.49	12.4	3.18	4.79
290	4.06	3.98	12	0.45	11.1	3.27	4.80
300	4.56	3.94	12	1.44	31.5	3.23	7.79
310	3.89	3.66	12	0.63	16.1	3.21	5.46
320	3.89	3.73	12	0.62	16.0	3.14	5.27
330	3.71	3.71	12	0.49	13.1	2.73	4.60
340	3.73	3.77	12	0.43	11.5	2.65	4.35
350	3.67	3.73	12	0.43	11.7	2.74	4.45
360	3.70	3.70	12	0.43	11.5	2.72	4.23
370	3.81	3.73	12	0.44	11.6	2.98	4.48
400	7.06	7.30	12	1.54	21.9	4.35	9.10
Year=1988							
275	2.63	2.56	12	0.67	25.5	1.54	3.45
280	2.41	2.23	12	0.69	28.7	1.61	3.56
285	2.61	2.57	12	0.53	20.4	1.78	3.57
290	2.80	2.82	12	0.47	16.9	1.98	3.79
300	3.12	2.86	12	0.91	29.2	1.96	4.93
310	2.87	2.69	12	0.59	20.5	2.02	3.87
320	2.60	2.47	11	0.52	19.9	1.92	3.50
330	2.91	2.85	12	0.49	16.8	2.01	3.73
340	2.99	2.88	12	0.68	22.9	1.90	4.11
350	3.25	3.35	12	0.59	18.2	2.02	4.02

Appendix Table 25 (continued).

Descriptive statistics for total calcium (mg/L) from Steel Creek and Meyer's Branch. November 1985 to December 1991.

Station	Mean	Med	N	SD	CV	Min	Max
Year=1988 (continued).							
360	3.35	3.38	12	0.62	18.5	2.10	4.26
370	3.47	3.38	12	0.63	18.2	2.21	4.47
400	8.40	8.61	12	1.19	14.1	6.24	9.82
Year=1989							
275	1.96	2.09	12	0.56	28.4	1.17	2.84
280	1.90	1.82	12	0.58	30.5	1.13	2.82
285	2.62	2.73	12	0.61	23.2	1.70	3.45
290	2.77	2.82	12	0.59	21.2	1.84	3.52
300	2.92	2.80	12	0.69	23.5	2.15	4.11
310	2.87	2.90	12	0.57	20.0	2.14	4.03
320	2.88	2.76	11	0.48	16.5	2.10	3.72
330	3.06	3.09	12	0.49	15.9	2.34	3.85
340	3.07	3.19	12	0.57	18.7	2.25	4.08
350	3.32	3.61	12	0.58	17.4	2.24	3.80
360	3.43	3.49	12	0.46	13.4	2.82	4.13
370	3.59	3.55	12	0.43	12.0	2.98	4.34
400	8.20	8.22	12	1.13	13.7	6.57	9.73
Station	Mean	N	SE	Min	Max		
Year=1990							
290	2.54	4	0.31	1.82	3.09		
330	3.35	4	0.31	3.02	4.26		
350	3.46	4	0.48	2.61	4.83		
370	3.50	4	0.14	3.14	3.81		
Year=1991							
290	2.69	4	0.34	2.19	3.67		
330	3.65	4	0.34	2.84	4.48		
350	3.60	4	0.18	3.42	4.13		
370	3.43	4	0.18	3.14	3.94		

Appendix Table 26.

Descriptive statistics for total iron ($\mu\text{g/L}$) from Steel Creek and Meyer's Branch. November 1985 to December 1991.

Station	Mean	Med	N	SD	CV	Min	Max
Year=1985/86							
275	488	341	14	515	105.5	116	2185
280	655	453	14	560	85.5	210	2110
285	928	639	14	883	95.1	342	3780
290	885	743	14	486	54.9	365	2020
300	1585	995	14	1796	113.3	520	7400
310	964	780	14	550	57.1	428	2200
320	1138	743	14	1089	91.7	292	4250
330	1079	768	14	706	65.4	674	3296
340	1061	972	14	475	44.8	367	2007
350	1000	936	14	397	39.7	470	1778
360	1024	819	14	472	46.1	616	2300
370	1128	918	14	623	55.3	578	2625
400	711	750	14	171	24.0	426	1001
Year=1987							
275	449	391	12	349	77.8	100	1175
280	491	432	12	328	66.7	104	997
285	545	560	12	253	46.5	185	870
290	537	514	12	235	43.7	219	936
300	1057	647	12	1158	109.5	247	4310
310	612	488	12	369	60.4	201	1401
320	909	551	12	848	93.3	274	3094
330	616	569	12	286	46.4	192	1051
340	814	649	12	532	65.3	296	1859
350	750	645	12	478	63.7	275	1613
360	596	546	12	286	47.9	254	1022
370	674	695	12	280	41.5	285	1165
400	626	649	12	185	29.5	288	916
Year=1988							
275	272	223	12	174	64.1	125	705
280	284	237	12	132	46.3	141	614
285	304	318	12	69	22.8	193	390
290	362	374	12	108	29.9	219	526
300	711	516	12	536	75.5	246	1970
310	691	464	12	550	79.6	258	1910
320	450	320	11	207	46.1	290	847
330	499	410	12	337	67.6	188	1420
340	467	509	12	201	43.1	127	795
350	641	468	12	423	65.9	188	1750

Appendix Table 26 (continued).

Descriptive statistics for total iron ($\mu\text{g/L}$) from Steel Creek and Meyer's Branch. November 1985 to December 1991.

Station	Mean	Med	N	SD	CV	Min	Max
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Year=1988 (continued).

360	681	472	12	439	64.5	238	1660
370	695	493	12	426	61.3	286	1380
400	455	459	12	147	32.2	246	648

Year=1989

275	223	174	12	145	65.0	100	583
280	264	164	12	276	104.8	100	1100
285	234	229	12	43	18.3	150	327
290	415	381	12	172	41.5	178	817
300	815	738	12	496	60.9	132	1780
310	742	538	12	484	65.3	290	1870
320	467	488	11	163	34.8	167	729
330	672	560	12	460	68.4	260	1910
340	792	540	12	826	104.3	328	3350
350	881	643	12	677	76.8	537	2950
360	970	819	12	622	64.1	580	2910
370	1024	839	12	585	57.1	560	2740
400	772	504	12	842	109.1	260	3380

Station	Mean	N	SE	Min	Max
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Year=1990

290	321	4	97	140	593
330	828	4	249	341	1351
350	802	4	151	509	1225
370	944	4	139	573	1200

Year=1991

290	467	4	104	207	651
330	1172	4	502	235	2170
350	963	4	300	427	1690
370	864	4	193	506	1330

Appendix Table 27.

Descriptive statistics for total magnesium (mg/L) from Steel Creek and Meyer's Branch. November 1985 to December 1991.

Station	Mean	Med	N	SD	CV	Min	Max
Year=1985/86							
275	1.34	1.30	14	0.19	14.5	1.07	1.94
280	1.35	1.36	14	0.13	9.5	1.16	1.66
285	1.29	1.33	14	0.17	13.3	0.75	1.46
290	1.28	1.31	14	0.17	13.0	0.74	1.40
300	1.54	1.36	14	0.55	35.6	0.73	2.66
310	1.28	1.30	14	0.24	18.9	0.63	1.71
320	1.28	1.31	14	0.21	16.7	0.69	1.70
330	1.31	1.33	14	0.16	12.3	0.87	1.47
340	1.29	1.30	14	0.18	13.9	0.81	1.50
350	1.36	1.37	14	0.11	8.0	1.15	1.51
360	1.34	1.37	14	0.15	10.9	0.91	1.48
370	1.38	1.39	14	0.13	9.5	1.11	1.53
400	0.65	0.65	14	0.04	6.5	0.55	0.72
Year=1987							
275	1.21	1.22	12	0.10	8.1	0.99	1.36
280	1.23	1.22	12	0.10	8.2	1.04	1.40
285	1.17	1.18	12	0.09	7.3	0.98	1.29
290	1.14	1.14	12	0.11	9.3	0.98	1.26
300	1.29	1.21	12	0.30	23.0	1.01	1.87
310	1.19	1.23	12	0.12	10.3	0.96	1.35
320	1.18	1.20	12	0.11	9.7	0.99	1.32
330	1.19	1.22	12	0.10	8.8	0.97	1.29
340	1.18	1.17	12	0.12	10.1	0.98	1.37
350	1.18	1.20	12	0.12	10.2	0.99	1.35
360	1.20	1.20	12	0.13	10.7	0.98	1.42
370	1.23	1.22	12	0.11	8.6	1.04	1.40
400	0.58	0.57	12	0.09	14.7	0.46	0.70
Year=1988							
275	1.12	1.14	12	0.11	10.0	0.91	1.25
280	1.14	1.14	12	0.09	7.6	0.98	1.28
285	1.08	1.05	12	0.08	7.5	0.96	1.21
290	1.08	1.06	12	0.08	7.8	0.94	1.20
300	1.18	1.07	12	0.23	19.9	0.95	1.66
310	1.11	1.10	12	0.17	15.6	0.87	1.49
320	1.03	0.99	11	0.14	13.4	0.87	1.38
330	1.12	1.10	12	0.13	11.8	0.94	1.36
340	1.10	1.10	12	0.10	9.2	0.87	1.23
350	1.16	1.16	12	0.10	8.7	0.99	1.33

Appendix Table 27 (continued).

Descriptive statistics for total magnesium (mg/L) from Steel Creek and Meyer's Branch. November 1985 to December 1991.

Station	Mean	Med	N	SD	CV	Min	Max
Year=1988 (continued).							
360	1.18	1.15	12	0.13	11.4	1.02	1.40
370	1.19	1.16	12	0.14	11.5	1.04	1.44
400	0.52	0.53	12	0.07	12.9	0.42	0.68
Year=1989							
275	1.17	1.18	12	0.09	7.5	1.00	1.33
280	1.17	1.18	12	0.09	7.5	1.03	1.34
285	1.08	1.08	12	0.09	8.7	0.92	1.20
290	1.07	1.06	12	0.09	8.2	0.96	1.21
300	1.08	1.09	12	0.13	12.2	0.89	1.36
310	1.07	1.07	12	0.11	10.2	0.84	1.27
320	1.06	1.02	11	0.12	11.2	0.91	1.31
330	1.09	1.07	12	0.09	8.3	1.00	1.28
340	1.10	1.13	12	0.11	10.3	0.94	1.26
350	1.11	1.11	12	0.09	7.9	0.97	1.24
360	1.11	1.11	12	0.11	9.5	0.93	1.24
370	1.15	1.17	12	0.10	8.4	0.99	1.28
400	0.47	0.44	12	0.07	15.9	0.40	0.65
Station	Mean	N	SE	Min	Max		
Year=1990							
290	1.03	4	0.07	0.83	1.17		
330	1.11	4	0.10	0.83	1.27		
350	1.12	4	0.13	0.81	1.43		
370	1.08	4	0.08	0.84	1.18		
Year=1991							
290	0.92	4	0.06	0.77	1.01		
330	1.12	4	0.09	0.98	1.38		
350	1.07	4	0.11	0.78	1.30		
370	1.09	4	0.10	0.82	1.29		

Appendix Table 28.

Descriptive statistics for total manganese ($\mu\text{g/L}$) from Steel Creek and Meyer's Branch. November 1985 to December 1991.

Station	Mean	Med	N	SD	CV	Min	Max
Year=1985/86							
275	85	44	14	120	141.8	<20	479
280	91	50	14	119	130.3	22	483
285	124	68	14	152	122.5	38	563
290	128	70	14	127	99.1	31	432
300	623	46	14	1089	174.7	<20	3590
310	232	63	14	485	209.4	26	1870
320	181	52	14	359	198.4	<20	1330
330	117	65	14	134	114.4	42	547
340	111	73	14	100	90.0	23	318
350	87	59	14	78	90.0	32	325
360	103	56	14	114	110.8	33	463
370	123	48	14	148	120.3	37	563
400	61	60	14	25	40.4	23	117
Year=1987							
275	102	61	12	95	93.5	24	305
280	108	70	12	100	92.4	<20	310
285	105	79	12	79	75.2	26	285
290	91	73	12	70	76.9	<20	264
300	674	54	12	1364	202.3	<20	4173
310	130	44	12	194	149.7	<20	658
320	131	53	12	167	127.7	26	548
330	64	46	12	46	71.7	22	152
340	99	69	12	102	102.9	<20	360
350	87	70	12	96	110.7	<20	366
360	49	35	12	35	71.7	<20	124
370	49	42	12	34	70.2	<20	129
400	49	45	12	<20	38.7	25	82
Year=1988							
275	56	24	12	55	99.8	<20	186
280	53	29	12	49	91.8	20	176
285	50	38	12	26	51.9	22	89
290	56	44	12	28	49.2	<20	100
300	403	48	12	781	194.0	23	2660
310	122	62	12	152	125.1	27	496
320	86	41	11	122	140.7	24	445
330	83	44	12	86	103.8	21	315
340	85	80	12	61	72.5	<20	210
350	79	60	12	63	79.8	22	212

Appendix Table 28 (continued).

Descriptive statistics for total manganese ($\mu\text{g/L}$) from Steel Creek and Meyer's Branch. November 1985 to December 1991.

Station	Mean	Med	N	SD	CV	Min	Max
Year=1988 (continued).							
360	119	58	12	132	110.4	24	463
370	136	53	12	177	130.0	23	615
400	33	32	12	<20	29.9	20	49
Year=1989							
275	59	42	12	52	89.5	<20	159
280	55	47	12	41	74.4	<20	138
285	45	46	12	<20	25.8	20	60
290	67	65	12	25	37.7	20	106
300	181	63	12	225	124.4	<20	578
310	90	43	12	105	116.5	<20	371
320	47	44	11	23	49.6	<20	82
330	74	53	12	57	77.6	28	214
340	78	65	12	45	57.1	<20	148
350	83	59	12	49	59.3	33	173
360	72	63	12	38	53.1	31	164
370	95	71	12	72	75.7	<20	262
400	79	41	12	124	156.5	22	466
Station	Mean	N	SE	Min	Max		
Year=1990							
290	55	4	<20	33	99		
330	96	4	58	<20	265		
350	64	4	22	21	107		
370	63	4	21	<20	104		
Year=1991							
290	58	4	<20	25	91		
330	41	4	<20	<20	77		
350	35	4	<20	<20	57		
370	35	4	<20	<20	60		

Appendix Table 29.

Descriptive statistics for total potassium (mg/L) from Steel Creek
and Meyer's Branch. November 1985 to December 1991.

Station	Mean	Med	N	SD	CV	Min	Max
Year=1985/86							
275	1.53	1.52	14	0.13	8.3	1.32	1.74
280	1.55	1.53	14	0.13	8.7	1.32	1.76
285	1.49	1.49	14	0.26	17.3	1.06	1.98
290	1.43	1.40	14	0.21	14.4	1.19	1.98
300	1.63	1.51	14	0.54	33.1	1.14	3.12
310	1.61	1.43	14	0.51	31.5	1.21	2.81
320	1.50	1.44	14	0.28	18.5	1.28	2.39
330	1.60	1.46	14	0.41	25.8	1.17	2.78
340	1.59	1.58	14	0.20	12.9	1.29	1.91
350	1.74	1.62	14	0.70	40.3	1.36	4.12
360	1.62	1.59	14	0.34	21.0	1.16	2.50
370	1.65	1.49	14	0.40	24.1	1.22	2.77
400	0.41	0.40	14	0.15	36.3	0.23	0.74
Year=1987							
275	1.44	1.41	12	0.16	11.0	1.22	1.70
280	1.49	1.46	12	0.20	13.4	1.19	1.92
285	1.37	1.38	12	0.22	15.9	0.95	1.72
290	1.28	1.27	12	0.17	13.2	1.05	1.64
300	1.35	1.38	12	0.31	23.3	0.93	1.98
310	1.24	1.25	12	0.24	19.7	0.87	1.64
320	1.28	1.29	12	0.18	13.9	0.83	1.52
330	1.28	1.23	12	0.29	22.9	0.93	1.79
340	1.40	1.31	12	0.32	22.5	0.91	1.92
350	1.34	1.38	12	0.29	21.3	0.79	1.89
360	1.33	1.33	12	0.23	17.3	1.05	1.91
370	1.33	1.29	12	0.26	19.8	1.02	1.90
400	0.40	0.39	12	0.24	59.9	<0.02	0.76
Year=1988							
275	1.51	1.50	12	0.13	8.3	1.34	1.77
280	1.46	1.47	12	0.14	9.4	1.09	1.60
285	1.32	1.34	12	0.21	15.9	0.87	1.77
290	1.33	1.31	12	0.12	9.2	1.13	1.56
300	1.31	1.34	12	0.21	16.0	0.89	1.57
310	1.32	1.31	12	0.15	11.1	1.08	1.62
320	1.28	1.32	11	0.15	11.9	1.08	1.50
330	1.31	1.30	12	0.19	14.8	1.03	1.62
340	1.29	1.32	12	0.18	13.8	0.99	1.62
350	1.32	1.34	12	0.19	14.3	0.94	1.64

Appendix Table 29 (continued).

Descriptive statistics for total potassium (mg/L) from Steel Creek
and Meyer's Branch. November 1985 to December 1991.

Station	Mean	Med	N	SD	CV	Min	Max
Year=1988 (continued).							
360	1.35	1.35	12	0.23	17.2	0.99	1.89
370	1.51	1.46	12	0.31	20.7	1.00	2.32
400	0.28	0.25	12	0.16	57.8	<0.02	0.57
Year=1989							
275	1.57	1.56	12	0.11	7.1	1.42	1.75
280	1.54	1.52	12	0.10	6.2	1.41	1.70
285	1.38	1.38	12	0.13	9.6	1.08	1.60
290	1.41	1.39	12	0.13	9.1	1.17	1.64
300	1.36	1.35	12	0.17	12.5	1.07	1.61
310	1.58	1.38	12	0.88	55.9	0.91	4.28
320	1.47	1.37	11	0.51	34.3	1.01	2.69
330	1.41	1.48	12	0.30	21.6	1.01	1.96
340	1.40	1.36	12	0.33	23.7	0.95	2.11
350	1.46	1.41	12	0.37	25.1	0.94	2.19
360	1.51	1.44	12	0.35	23.1	0.98	2.07
370	1.55	1.50	12	0.30	19.2	1.14	2.25
400	0.27	0.25	12	0.16	57.8	<0.02	0.56
Station	Mean	N	SE	Min	Max		
Year=1990							
290	1.3	4	<0.2	1.1	1.6		
330	1.3	4	<0.2	1.1	1.5		
350	1.3	4	<0.2	1.1	1.5		
370	1.2	4	<0.2	1.0	1.5		
Year=1991							
290	1.2	4	<0.2	0.9	1.4		
330	1.5	4	<0.2	1.3	1.7		
350	1.5	4	<0.2	1.3	1.9		
370	1.5	4	<0.2	1.4	1.9		

Appendix Table 30.

Descriptive statistics for total sodium (mg/L) from Steel Creek and Meyer's Branch. November 1985 to December 1991.

Station	Mean	Med	N	SD	CV	Min	Max
Year=1985/86							
275	8.97	8.93	14	1.16	12.9	5.89	10.70
280	8.94	8.82	14	1.79	20.0	5.87	13.10
285	8.22	8.45	14	1.68	20.4	4.04	9.96
290	8.34	8.34	14	0.79	9.5	7.07	9.60
300	8.60	8.89	14	1.18	13.8	6.34	10.90
310	8.80	8.71	14	1.32	15.0	6.05	11.50
320	8.50	8.34	14	1.11	13.1	6.66	10.37
330	8.68	8.43	14	1.16	13.4	6.77	10.80
340	9.63	9.32	14	2.08	21.6	6.95	13.20
350	10.07	9.53	14	2.36	23.5	7.28	14.60
360	9.49	9.10	14	1.36	14.3	7.42	11.80
370	9.44	9.00	14	1.28	13.6	7.32	12.00
400	2.58	2.60	14	0.73	28.4	1.28	3.58
Year=1987							
275	9.33	9.65	12	1.34	14.4	6.88	11.40
280	9.11	9.31	12	1.12	12.3	6.79	10.40
285	8.51	8.51	12	0.87	10.2	6.91	10.20
290	8.16	8.03	12	1.06	13.0	6.56	10.50
300	8.35	8.42	12	1.09	13.1	6.66	10.00
310	8.16	8.43	12	0.98	12.0	6.51	9.42
320	8.25	8.36	12	0.93	11.3	6.67	9.74
330	8.35	8.43	12	1.42	16.9	6.50	11.10
340	8.32	8.59	12	1.99	23.9	5.85	11.30
350	8.44	8.67	12	1.97	23.3	5.82	11.10
360	8.58	8.57	12	1.78	20.8	5.98	11.20
370	8.70	8.99	12	1.67	19.2	6.20	11.20
400	2.56	2.50	12	0.43	16.9	2.04	3.65
Year=1988							
275	11.81	11.80	12	1.35	11.4	8.89	13.50
280	11.52	11.45	12	1.38	12.0	9.58	13.50
285	10.60	10.30	12	1.26	11.9	8.45	12.30
290	10.48	10.35	12	1.27	12.1	8.30	12.60
300	10.38	10.30	12	1.13	10.9	8.43	12.50
310	10.42	9.90	12	1.33	12.8	8.32	12.80
320	10.23	9.90	11	1.13	11.1	8.10	12.20
330	10.59	10.25	12	1.06	10.0	9.14	12.10
340	10.63	10.85	12	0.91	8.6	9.30	11.80
350	10.97	11.00	12	0.90	8.2	9.34	12.30

Appendix Table 30 (continued).

Descriptive statistics for total sodium (mg/L) from Steel Creek and Meyer's Branch. November 1985 to December 1991.

Station	Mean	Med	N	SD	CV	Min	Max
Year=1988 (continued).							
360	10.92	10.80	12	1.00	9.2	9.55	12.80
370	10.85	10.70	12	1.03	9.5	9.65	13.10
400	2.43	2.49	12	0.48	19.6	1.86	3.36
Year=1989							
275	11.54	11.60	12	0.74	6.4	10.40	13.00
280	11.56	11.85	12	0.70	6.0	10.40	12.40
285	10.55	10.45	12	0.93	8.8	9.42	11.90
290	10.36	10.15	12	0.92	8.9	8.99	12.10
300	10.25	9.96	12	1.03	10.0	8.83	11.80
310	9.84	10.05	12	1.70	17.3	6.30	11.90
320	9.93	9.89	11	1.20	12.1	7.79	11.70
330	9.95	10.15	12	1.66	16.7	6.15	12.00
340	9.98	10.05	12	1.69	16.9	6.31	12.40
350	10.06	10.70	12	1.72	17.1	6.48	11.90
360	9.92	10.10	12	1.67	16.8	7.15	12.00
370	9.84	10.24	12	1.64	16.7	6.76	11.60
400	2.08	2.08	12	0.37	17.7	1.58	2.80
Station	Mean	N	SE	Min	Max		
Year=1990							
290	7.20	4	0.18	6.68	7.46		
330	6.68	4	0.53	5.25	7.51		
350	6.74	4	0.63	5.13	8.02		
370	6.45	4	0.45	5.35	7.53		
Year=1991							
290	5.06	4	0.36	4.06	5.77		
330	5.75	4	0.33	4.78	6.19		
350	6.14	4	0.54	5.08	7.62		
370	5.86	4	0.53	4.87	7.18		

Appendix Table 31.

Descriptive statistics for chloride (mg/L) from Steel Creek and Meyer's Branch. November 1985 to December 1991.

Station	Mean	Med	N	SD	CV	Min	Max
Year=1985/86							
275	7.5	7.5	14	0.5	7.3	6.6	8.3
280	7.5	7.7	14	0.5	6.2	6.8	8.3
285	7.4	7.5	14	0.6	8.5	6.4	8.5
290	7.3	7.3	14	0.5	7.3	6.5	8.2
300	7.5	7.4	14	0.7	9.6	6.5	9.1
310	7.5	7.4	14	0.7	9.6	6.5	8.9
320	7.3	7.3	14	0.6	8.0	6.4	8.4
330	7.6	7.5	14	0.6	8.1	6.5	8.7
340	7.9	7.6	14	1.1	14.4	6.2	10.4
350	7.9	7.9	14	1.2	15.1	5.5	10.3
360	7.8	7.8	14	1.1	13.6	5.8	10.0
370	7.8	8.1	14	1.0	12.5	5.9	9.9
400	3.7	3.5	14	0.8	21.1	2.8	5.2
Year=1987							
275	6.9	7.4	12	1.0	14.9	5.1	8.0
280	6.7	7.1	12	1.2	17.4	4.9	8.7
285	6.6	6.8	12	1.0	15.0	4.8	7.9
290	6.4	6.7	12	1.1	16.6	4.7	8.0
300	6.5	6.9	12	1.0	15.1	4.9	7.8
310	6.6	6.8	12	1.0	14.8	4.9	8.0
320	6.5	6.8	12	0.9	13.3	5.0	7.5
330	6.4	6.5	12	0.9	13.9	5.0	8.1
340	6.1	6.2	12	1.7	28.1	3.1	8.4
350	6.4	6.4	12	2.0	31.3	3.4	10.7
360	6.4	6.4	12	1.6	24.9	3.8	8.5
370	6.6	6.6	12	1.7	25.4	4.1	9.1
400	3.3	3.0	12	0.9	26.0	1.9	4.4
Year=1988							
275	8.7	8.9	12	1.2	14.0	6.8	10.7
280	8.8	9.1	12	1.4	15.5	6.3	11.3
285	8.2	8.3	12	1.2	15.1	6.7	10.5
290	8.2	8.4	12	1.1	13.1	6.4	9.6
300	8.3	8.6	12	1.3	15.5	5.7	10.0
310	8.3	8.6	12	1.2	14.7	5.7	9.7
320	8.4	8.4	11	1.7	20.6	5.7	12.4
330	8.3	8.6	12	1.2	14.9	5.6	10.0
340	8.6	8.6	12	1.6	19.0	4.9	12.0
350	8.6	8.8	12	1.4	15.9	5.2	10.9

Appendix Table 31 (continued).

Descriptive statistics for chloride (mg/L) from Steel Creek and Meyer's Branch. November 1985 to December 1991.

Station	Mean	Med	N	SD	CV	Min	Max
Year=1988 (continued).							
360	8.6	8.9	12	1.3	15.2	5.5	10.5
370	8.5	8.7	12	1.4	16.0	5.0	10.3
400	3.0	3.0	12	0.5	17.4	2.1	3.7
Year=1989							
275	9.4	9.5	12	0.6	6.7	8.1	10.2
280	9.3	9.5	12	0.7	8.1	8.1	10.1
285	8.7	8.8	12	1.0	10.9	7.0	9.9
290	8.7	8.6	12	0.9	9.9	7.6	10.1
300	8.6	8.5	12	0.9	10.5	7.3	10.1
310	8.1	8.3	12	1.4	17.0	5.0	10.0
320	8.2	8.4	11	1.4	16.6	5.0	10.1
330	8.2	8.6	12	1.4	16.9	4.9	9.9
340	8.2	8.4	12	1.4	17.7	4.9	10.0
350	8.4	8.8	12	1.4	17.3	4.9	10.1
360	8.2	8.5	12	1.5	18.2	4.9	10.0
370	8.2	8.5	12	1.5	18.0	5.1	10.1
400	2.6	2.5	12	0.5	18.1	1.8	3.7
Station	Mean	N	SE	Min	Max		
Year=1990							
290	6.2	4	<0.5	5.7	6.6		
330	5.7	4	0.6	4.1	6.6		
350	6.9	4	1.2	3.9	9.4		
370	5.5	4	0.6	4.0	6.7		
Year=1991							
290	4.9	4	<0.5	4.0	5.2		
330	4.9	4	<0.5	3.9	6.0		
350	5.3	4	0.8	4.1	7.6		
370	5.3	4	0.7	4.1	7.3		

Appendix Table 32.

Descriptive statistics for hydrogen sulfide (mg H₂S/L) from Steel Creek and Meyer's Branch. November 1985 to December 1991.

Station	Mean	Med	N	SD	CV	Min	Max
Year=1985/86							
275	<0.1	<0.1	14	<0.1	156.4	<0.1	<0.1
280	<0.1	<0.1	14	<0.1	126.0	<0.1	<0.1
285	<0.1	<0.1	14	<0.1	126.5	<0.1	<0.1
290	<0.1	<0.1	14	<0.1	100.5	<0.1	<0.1
300	<0.1	<0.1	13	<0.1	130.5	<0.1	<0.1
310	<0.1	<0.1	14	<0.1	105.4	<0.1	<0.1
320	<0.1	<0.1	14	<0.1	104.9	<0.1	<0.1
330	<0.1	<0.1	14	<0.1	118.6	<0.1	<0.1
340	<0.1	<0.1	14	<0.1	111.1	<0.1	<0.1
350	<0.1	<0.1	14	<0.1	114.6	<0.1	<0.1
360	<0.1	<0.1	14	<0.1	119.6	<0.1	<0.1
370	<0.1	<0.1	14	<0.1	111.1	<0.1	<0.1
400	<0.1	<0.1	14	<0.1	113.6	<0.1	<0.1
Year=1987							
275	<0.1	<0.1	12	<0.1	45.8	<0.1	<0.1
280	<0.1	<0.1	12	<0.1	58.5	<0.1	<0.1
285	<0.1	<0.1	12	<0.1	44.9	<0.1	<0.1
290	<0.1	<0.1	12	<0.1	54.9	<0.1	<0.1
300	<0.1	<0.1	12	<0.1	48.5	<0.1	<0.1
310	<0.1	<0.1	12	<0.1	46.8	<0.1	<0.1
320	<0.1	<0.1	12	<0.1	62.3	<0.1	<0.1
330	<0.1	<0.1	12	<0.1	44.4	<0.1	<0.1
340	<0.1	<0.1	12	<0.1	46.5	<0.1	<0.1
350	<0.1	<0.1	12	<0.1	48.7	<0.1	<0.1
360	<0.1	<0.1	12	<0.1	42.2	<0.1	<0.1
370	<0.1	<0.1	12	<0.1	45.9	<0.1	<0.1
400	<0.1	<0.1	12	<0.1	52.7	<0.1	<0.1
Year=1988							
275	<0.1	<0.1	12	<0.1	54.2	<0.1	<0.1
280	<0.1	<0.1	12	<0.1	53.4	<0.1	<0.1
285	<0.1	<0.1	12	<0.1	26.9	<0.1	<0.1
290	<0.1	<0.1	12	<0.1	29.9	<0.1	<0.1
300	<0.1	<0.1	12	<0.1	23.4	<0.1	<0.1
310	<0.1	<0.1	12	<0.1	19.0	<0.1	<0.1
320	<0.1	<0.1	11	<0.1	18.0	<0.1	<0.1
330	<0.1	<0.1	12	<0.1	14.0	<0.1	<0.1
340	<0.1	<0.1	12	<0.1	15.7	<0.1	<0.1
350	<0.1	<0.1	12	<0.1	14.1	<0.1	<0.1

Appendix Table 32 (continued).

Descriptive statistics for hydrogen sulfide (mg H₂S/L) from Steel Creek and Meyer's Branch. November 1985 to December 1991.

Station	Mean	Med	N	SD	CV	Min	Max
Year=1988 (continued).							
360	<0.1	<0.1	12	<0.1	14.4	<0.1	<0.1
370	<0.1	<0.1	12	<0.1	14.4	<0.1	<0.1
400	<0.1	<0.1	12	<0.1	30.2	<0.1	<0.1
Year=1989							
275	<0.1	<0.1	12	<0.1	30.2	<0.1	<0.1
280	<0.1	<0.1	12	<0.1	26.2	<0.1	<0.1
285	<0.1	<0.1	12	<0.1	20.4	<0.1	<0.1
290	<0.1	<0.1	12	<0.1	37.3	<0.1	<0.1
300	<0.1	<0.1	12	<0.1	17.0	<0.1	<0.1
310	<0.1	<0.1	12	<0.1	16.2	<0.1	<0.1
320	<0.1	<0.1	11	<0.1	16.8	<0.1	<0.1
330	<0.1	<0.1	12	<0.1	16.2	<0.1	<0.1
340	<0.1	<0.1	12	<0.1	15.0	<0.1	<0.1
350	<0.1	<0.1	12	<0.1	15.6	<0.1	<0.1
360	<0.1	<0.1	12	<0.1	14.6	<0.1	<0.1
370	<0.1	<0.1	12	<0.1	13.3	<0.1	<0.1
400	<0.1	<0.1	12	<0.1	23.8	<0.1	<0.1
Station	Mean	N	SE	Min	Max		
Year=1990							
290	<0.1	4	<0.1	<0.1	<0.1		
330	<0.1	4	<0.1	<0.1	<0.1		
350	<0.1	4	<0.1	<0.1	<0.1		
370	<0.1	4	<0.1	<0.1	<0.1		
Year=1991							
290	<0.1	4	<0.1	<0.1	<0.1		
330	<0.1	4	<0.1	<0.1	<0.1		
350	<0.1	4	<0.1	<0.1	<0.1		
370	<0.1	4	<0.1	<0.1	<0.1		

Appendix Table 33.

Descriptive statistics for sulfate (mg SO₄/L) from Steel Creek and Meyer's Branch. November 1985 to December 1991.

Station	Mean	Med	N	SD	CV	Min	Max
Year=1985/86							
275	5	5	14	1	18.5	4	6
280	5	5	14	1	17.3	4	7
285	5	5	14	2	43.0	3	11
290	5	5	14	1	24.1	3	8
300	4	4	14	3	63.4	2	12
310	4	5	14	2	38.5	2	9
320	4	4	14	2	41.1	1	8
330	4	4	14	1	23.6	3	7
340	6	6	14	1	17.2	4	8
350	6	6	14	1	11.3	5	7
360	5	5	14	1	15.7	4	7
370	5	5	14	1	12.0	4	6
400	3	3	14	1	29.5	2	4
Year=1987							
275	5	5	12	1	18.6	4	7
280	6	5	12	1	18.1	5	7
285	6	5	12	1	18.0	4	7
290	5	5	12	1	16.4	4	7
300	5	5	12	1	25.6	3	7
310	5	5	12	1	24.8	3	7
320	5	5	12	1	24.9	3	7
330	6	5	12	1	20.3	4	7
340	6	6	12	1	18.9	4	8
350	6	6	12	1	19.4	4	8
360	6	6	12	1	23.2	5	9
370	6	6	12	1	20.4	5	8
400	3	2	12	2	59.3	1	7
Year=1988							
275	7	7	12	1	9.7	6	8
280	7	7	12	1	10.7	6	8
285	7	7	12	1	13.9	5	9
290	7	7	12	1	13.2	6	8
300	6	6	12	1	22.4	4	8
310	7	7	12	1	14.2	5	8
320	7	7	11	1	15.8	5	8
330	7	7	12	1	15.7	5	8
340	7	7	12	1	15.5	5	9
350	7	7	12	1	18.8	5	9

Appendix Table 33 (continued).

Descriptive statistics for sulfate (mg SO₄/L) from Steel Creek and Meyer's Branch. November 1985 to December 1991.

Station	Mean	Med	N	SD	CV	Min	Max
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Year=1988 (continued).

360	7	7	12	1	21.0	5	9
370	7	7	12	1	20.5	5	9
400	2	2	12	1	49.2	1	4

Year=1989

275	8	8	12	1	8.5	6	8
280	8	8	12	1	9.9	6	9
285	7	7	12	1	7.5	6	8
290	7	7	12	<1	6.2	6	7
300	6	6	12	1	12.7	5	8
310	6	7	12	1	10.4	6	8
320	7	7	11	2	23.0	6	11
330	6	6	12	1	11.6	5	7
340	7	7	12	1	11.8	6	8
350	7	7	12	1	17.9	6	10
360	7	6	12	2	31.4	5	12
370	7	6	12	2	25.0	5	11
400	3	2	12	1	49.9	1	6

Station	Mean	N	SE	Min	Max
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Year=1990

290	6	4	1	4	7
330	7	4	2	3	12
350	8	4	3	4	17
370	6	4	1	5	11

Year=1991

290	4	4	1	2	4
330	5	4	1	2	6
350	6	4	<1	5	6
370	6	4	<1	5	6

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