Nonpoint-Source Discharges and Water Quality of the Elk Creek Basin, West-Central Wisconsin

By Stephen J. Field

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CONVERSION TABLE

For readers who prefer to use SI units rather than inch-pound units, conversion factors for terms used in this report are listed below.

Multiply inch-pound unit	By	To obtain SI unit
inch (in)	25.40	millimeter (mm)
foot (ft)	0.3048	meter (m)
mile (mi)	1.609	kilometer (km)
square mile (mi^2)	2.590	square kilometer (km^2)
foot per mile (ft/mi)	0.1894	meter per kilometer (m/km)
ton per square mile (ton/mi^2)	0.3503	metric ton per square kilometer (t/km^2)
pound (lb)	0.4535	kilogram (kg)
pound per square mile (lb/mi^2)	0.1751	kilogram per square kilometer (kg/km^2)
cubic foot per second (ft^3/s)	2.832×10^{-2}	cubic meter per second (m^3)
degrees Fahrenheit (^0F)	0.5555 (F-32)	degrees Celsius (^0C)

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ABSTRACT

The Elk Creek basin in west-central Wisconsin was studied during the 1980 water year to define the water quality in relation to streamflow. Agricultural nonpoint-source discharges were suspected of contributing significantly to degraded water quality. Two water-quality and streamflow gaging stations were established--one on Elk Creek near Independence and the other on Bruce Valley Creek near Pleasantville.

Streamflow for the 1980 water year was about 28 percent greater than average, and precipitation was about 36 percent greater than average. At Elk Creek, base flow was about 68 percent of the total stream discharge and, at Bruce Valley Creek, base flow was about 56 percent of the total stream discharge. Streamflow at Elk Creek during the study ranged from 43 to 1,020 ft^3/s; Bruce Valley Creek discharges ranged from 2.8 to 306 ft^3/s. The low-flow discharges are significantly greater than the 2-year, 7-day low flow, whereas the peak discharges were between a 2-year and a 5-year flood-recurrence interval.

Suspended-sediment yields were greatest at Bruce Valley Creek. The suspended-sediment yield for Bruce Valley Creek was 215 $(ton/mi^2)/yr$ compared with 184 $(ton/mi^2)/yr$ for Elk Creek. Double mass-accumulation curves, however, indicated that loading rates were similar for both stations. Suspended-sediment and nutrient yields probably were slightly above the long-term average.

Total phosphorus, ammonia nitrogen, and organic nitrogen yields also were highest at Bruce Valley Creek. Double mass-accumulation curves indicated highest loading rates for these constituents at Bruce Valley Creek. Phosphorus yields at Bruce Valley Creek were 1,600 $(lb/mi^2)/yr$ compared with 1,350 $(lb/mi^2)/yr$ at Elk Creek. Because base flow was a greater percentage of total discharge, nitrite plus nitrate nitrogen yields and loads were highest at Elk Creek.

All phosphorus concentrations at Bruce Valley and Elk Creeks exceeded levels recommended by the U.S. Environmental Protection Agency to prevent the formation of biological nuisance growths. Only one sample, collected on March 18, 1980, at Bruce Valley Creek may have exceeded the Wisconsin Department of Natural Resources criterion of toxic levels for un-ionized ammonia (0.04 mg/L). No samples from Elk Creek exceeded the criteria.

INTRODUCTION

Background--Nonpoint Sources

In 1972, Congress mandated through Section 208 of Public Law 92-500, the Federal Water Pollution Control Act Amendments (FWPCAA) that the surface waters of the United States shall be "fishable and swimmable" by 1983 (92d Congress, 1972). The states must identify and establish programs to improve water quality to reach this goal. It was

evident that water-quality goals established by the FWPCAA could not be attained by regulation of only point sources and that nonpoint sources could be major contributors to water-quality degradation (Donigan and Crawford, 1976).

Nonpoint sources of pollution are diffuse discharge of pollutants that cannot readily be identified as point sources and include storm water and snowmelt runoff from urban and rural land surfaces, livestock operations, and construction activities. Although substandard septic systems are categorized as point sources, because of their minor contribution to the total nutrient load, nonpoint sources, as used in this report, include these septic systems.

The Wisconsin Department of Natural Resources (DNR) has been designated as the State agency responsible for water-quality protection in Wisconsin (Department of Natural Resources, 1976) and has a primary role in meeting the FWPCAA requirements. However, in order to assess nonpoint-source effects on water quality, a data base must first be established. Toward this goal, the U.S. Geological Survey, in cooperation with the DNR, began a study in 1977 to define the water quality in several areas where water quality has been degraded by nonpoint sources.

The first area chosen for study was Steiner Branch basin in Lafayette County near Blanchardville in southwest Wisconsin. That study ended in 1979 and the results published in the report "Water-Quality Assessment of Steiner Branch Basin, Lafayette County, Wisconsin" by Stephen J. Field and R. A. Lidwin.

In 1978, the Wisconsin Legislature enacted the Wisconsin Nonpoint Source Water Pollution Abatement Program (Wisconsin Fund). The program works through "priority watersheds" to provide cost sharing and technical assistance to individual property owners, cities, and villages for the control of nonpoint sources of water pollution. The area must be designated as a priority watershed to be eligible for cost sharing and technical assistance under the Wisconsin Fund. The watersheds are selected through a three-step process involving an impartially ranked list of watersheds, regional advisory groups, and the State Nonpoint Coordinating Committee. The second basin chosen for study was the Onion River basin in eastern Wisconsin (1979-81). The third basin chosen for study and the subject of this report was the Elk River basin located in Trempealeau and Buffalo Counties about 25 mi south of Eau Claire in west-central Wisconsin (fig. 1).

The drainage area of the Elk Creek basin is 113 mi^2. Bugle Lake, a manmade recreational lake that has a surface area of 35 acres, is 0.3 mi upstream from the mouth and also has a drainage area of 113 mi^2. Tributaries to Elk Creek include: Borst Valley, Chimney Rock, Bruce Valley, and North Branch Creeks. An intensive water-quality-observation program was conducted by the U.S. Geological Survey in cooperation with the DNR from October 1979 to September 1980. Two water-quality and stream-discharge monitoring sites were selected, one on Elk Creek 3.2 mi upstream from the mouth and the other on Bruce Valley Creek, 0.9 mi upstream from the mouth (fig. 1). The drainage areas at the gaging stations are 108 mi^2 and 10.1 mi^2, respectively.

The Elk Creek basin was identified in 1971 by the DNR as having many streams with water quality seriously degraded by contaminants entering the streams from nonpoint sources (Department of Natural Resources, Trempealeau County Soil and Water Conservation District, 1979). Elk Creek had high phosphorus and nitrogen concentrations caused by sediment and nutrients entering the stream from upland erosion and livestock waste. High fecal-coliform counts, caused by animal feces and improper waste management were also reported by the DNR. Several small tributaries in the upper Elk Creek basin were found to have water quality acceptable for most uses, whereas Bruce Valley Creek had the worst problems. The Trempealeau County Soil and Water Conservation District, in cooperation with assisting agencies, in 1978 found streambank and upland agricultural erosion a significant source of sediment to the streams and that a significant amount of animal waste entered the Elk Creek stream system.

Purpose

The purpose of this report is to define water quality in relation to streamflow in Elk and Bruce Valley Creeks. The period of study was from October 1979 to September 1980. Specific objectives include determination of (1) streamflow, (2) the annual loadings of suspended sediment, nitrogen, and phosphorus; (3) water temperature and

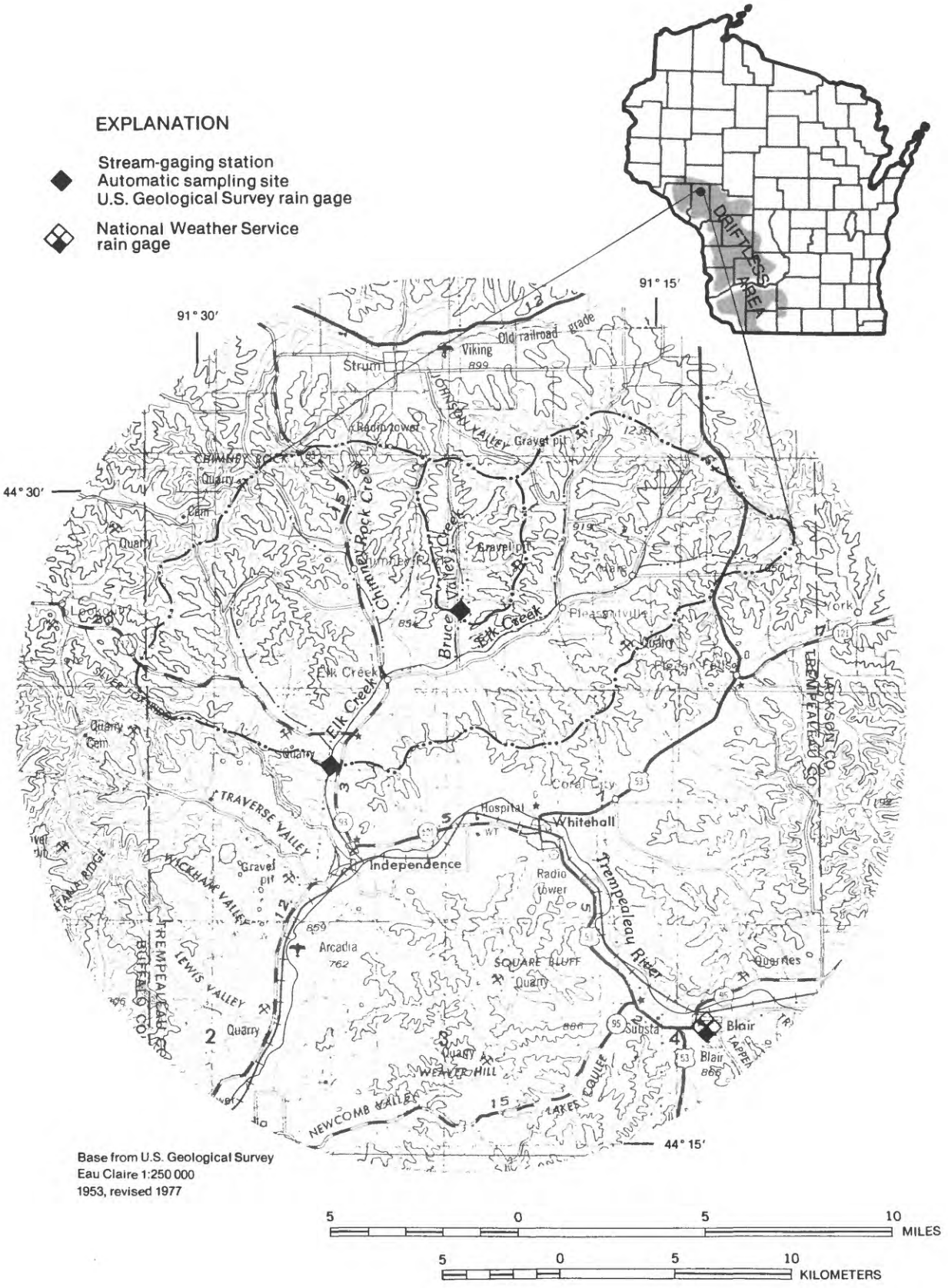

Figure 1. Location of the Elk Creek and Bruce Valley Creek basins in Wisconsin.

dissolved-solids concentrations; and (4) miscellaneous water-quality characteristics, including dissolved oxygen, pH, trace metals, alkalinity, and chloride.

PHYSICAL SETTING

Geography

Topography

Elk and Bruce Valley Creek basins have well-developed drainage systems with topography consisting of rolling to steep farmland and woodland. The stream and the topography looking upstream from each gaging station are shown in figure 2.

The elevation of the drainage divide of the Elk Creek basin is about 1,260 ft, whereas that of Bruce Valley Creek is about 1,120 ft. The elevations of the streambed at the gaging stations are about 790 and 845 ft, respectively.

Stream-Channel Characteristics

The main channel of Elk Creek, from the headwaters basin divide to the gaging station near Independence, is 17.2 mi in length and has a gradient of 27.3 ft/mi. The length of the main channel of Bruce Valley Creek from the headwaters basin divide to the gaging station near Pleasantville is 5.54 mi with a gradient of 49.6 ft/mi. Elk Creek is about 75 ft wide and about 2 ft deep at the gaging station during low-flow conditions. The stream bottom consists of sand, silt, clay, and cobbles. Bruce Valley Creek is about 15 ft wide and about 1 ft deep at the gaging station during low-flow conditions. The stream bottom of Bruce Valley Creek also consists of sand, silt, clay, and cobbles.

Climate

The climate of the basin is a continental type and has four definite seasons (Wisconsin Department of Agriculture, 1961). Winters are cold and snowy; summers have periods that are hot and humid. Monthly mean air temperatures at Blair (fig. 1) range from 14.3° for January to 71.1° in July. The mean annual temperature is 44.7°. The average annual precipitation is 31.7 in., (1951-80) with February the driest month (0.80 in.) and June the wettest month (4.58 in.). Snowfall averages 49.7 in. annually (U.S. Department of Commerce, 1981).

Geology

The Elk Creek basin is in the "Driftless Area", an area of the State that was probably not glaciated during the Pleistocene Epoch (Thwaites, 1950). The lower part of the stream valley formed by Elk Creek contains deposits of unconsolidated material more than 100 ft thick. Much of this material is alluvium, mainly very fine-grained sediment ranging from clay to medium sand, derived locally by erosion of the Cambrian sandstones. A thin blanket of wind-blown silt (loess) covers the basin from 0.5 to 4 ft thick (Young and Borman, 1973). The predominant surface bedrock in the basin is sedimentary rock of Cambrian age. The Jordan Sandstone Member and the St. Lawrence Member (either dolomite or siltstone) of the Trempealeau Formation are present in the uplands along the northern border of the basin. Elsewhere in the basin, the underlying Franconia Sandstone and the Eau Claire Sandstone form the main bedrock of the undulating uplands and are underlain by Mount Simon Sandstone. Mount Simon Sandstone forms the bedrock in the lower part of the stream valley (L.C. Trotta, oral commun., 1982).

Soils

Soil associations in the Elk Creek basin, as described by Langton (1977), are mostly of the Fayette-LaFarge-Eleva association. In general the stream and river terraces upstream of Chimney Rock Creek in the eastern part of the basin are mainly soils of the Billett-Sparta-Gotham association. In the northern and western part of the basin the valley bottoms or streams and river terraces are soils of the Ettrick-Pillot-Meridian association. This association includes soils that are poorly drained and that are well drained; the subsoil consists of loam to silty clay loam over silt loam and sand.

Two major soil associations occur in the Bruce Valley Creek basin. The uplands consist of the Fayette-LaFarge-Eleva association; the geology consists of well-drained soils that have a subsoil of

Elk Creek

Bruce Valley Creek

Figure 2. View looking upstream from the gaging stations at Elk and Bruce Valley Creeks.

sandy loam to silty-clay loam and are moderately deep to deep over sandstone. The stream and river terraces are soils of the Billett-Sparta-Gotham association. These soils are well drained to excessively drained soils that have a subsoil of sandy loam to loamy sand over sand.

Land Use

Agriculture is the principle land use in the Elk Creek basin (Department of Natural Resources, 1979) with dairy farming the main enterprise.

Land use in the basins is shown in table 1.

SAMPLING NETWORK AND DATA-COLLECTION METHODS

Sampling stations to measure streamflow, temperature, and specific conductance were installed in October 1979 at Elk Creek near Independence and at Bruce Valley Creek near Pleasantville. Isco Model[1] 1680 automatic water samplers were installed to collect samples during storm runoff for analyses of suspended-sediment and nutrient concentrations. During nonstorm periods, a local observer collected weekly suspended-sediment samples.

Elk Creek is tributary to the Trempealeau River. A stream-gaging station on the Trempealeau

Table 1. Soil-slope categories and percent of land use in the Elk and Bruce Valley Creeks basins.

Slope category	Area, in acres			
	Cropland	Pasture	Woodland	Other
	Elk Creek			
A (0-2 percent)	7,406	2,916	636	129
B (2-6 percent)	4,237	361	213	110
C (6-12 percent)	7,851	1,242	2,037	23
D (12-20 percent)	10,614	2,392	3,211	39
E (20-40 percent)	6,761	2,149	3,585	0
F (>40 percent)	4,951	3,043	7,940	5
Total	41,820	12,103	17,622	301
Percent	58	17	25	<1
	Bruce Valley Creek			
A (0-2 percent)	442	228	66	
B (2-6 percent)	196	35	18	
C (6-12 percent)	712	109	234	
D (12-20 percent)	1,174	271	352	
E (20-40 percent)	901	222	392	
F (>40 percent)	501	266	981	
Total	3,926	1,123	1,993	
Percent	56	16	28	0

[1]Trempealeau County Land Conservation Department (in preparation).

[1] The use of trade names in this report is for identification purposes only and does not constitute endorsement by the U.S. Geological Survey.

River at Dodge, 33.8 mi downstream from the Elk Creek near Independence gaging station, has been operated for 52 years (1914-19, 1934-81) by the U.S. Geological Survey. Streamflow records collected for that station, which has a drainage area of 643 mi^2, were used to aid in estimating the streamflow characteristics for Elk Creek and Bruce Valley Creek for the period of study.

Precipitation records were obtained from the National Weather Service station at Blair (fig. 1). Recording rain gages were also located at the gaging stations but were operated only during ice-free periods.

Selected samples were removed from the automatic samplers as soon as possible after a storm and treated with 10 percent sulfuric acid to a pH less than 2.0 to inhibit biological activity. They were then chilled to 4°C by a local observer. In general, four samples treated with sulfuric acid and four untreated samples were selected throughout the stream-discharge hydrograph for each storm. Those treated with sulfuric acid were analyzed by Wisconsin's State Laboratory of Hygiene for:

- Nitrite plus nitrate nitrogen
- Organic nitrogen
- Ammonia nitrogen
- Phosphorus

The four untreated samples were filtered and analyzed for:

- Chloride
- Alkalinity
- Dissolved solids, residue at 180°C

Samples were selected from the remaining bottles for suspended-sediment analyses. All water-quality concentrations (except organic nitrogen and suspended sediment) and tables for water temperature, specific conductance, and suspended sediment were published in the Water Resources Data for Wisconsin, Water Year 1980 (U.S. Geological Survey, 1981).

To insure that the automatically collected samples represented the average quality of water in the stream cross section, several stream cross-section samples were manually collected concurrently with automatically collected samples and covered a range of stream discharge. These samples were collected by the equal-width-increment method described by Guy and Norman (1970).

The dissolved-oxygen concentrations and pH were determined in the field at the time of sampling using the Leeds and Northrup model 7417 pH meter and the Yellow Springs model 54 dissolved-oxygen meter.

HYDROLOGIC CONDITIONS DURING STUDY PERIOD

Hydrologic conditions in the basin were assessed throughout the study to evaluate the water-quality data that were collected. Precipitation and streamflow are two important factors to be considered in this evaluation.

Precipitation

Total precipitation recorded at Blair for the 1980 water year was 43.0 in. This amount was 36 percent above the annual normal of 31.7 in. based on 30 years (1941-70) of record. August had the greatest monthly precipitation (10.97 in.) and February had the least (0.33 in). The maximum daily precipitation was 2.50 in. on May 31, 1980.

Streamflow

Streamflow characteristics for Elk Creek, Bruce Valley Creek, and the Trempealeau River are summarized in table 2. Daily streamflow data for Elk Creek and Bruce Valley Creek for the 1980 water year are shown in tables 7 and 8.

Based on the discharges for Trempealeau River at Dodge, discharges during the 1980 water year were 28 percent above the average for the periods 1915-19 and 1935-81. The maximum discharge was slightly greater than a flood of a 2-year recurrence interval (Conger, 1981). The minimum 7-day low flow was greater than the average 7-day low flow that occurs on the average of once every 2 years ($Q_{7,2}$) and was at about the 66 percent flow-duration level (Holmstrom, 1979).

Hydrograph separations as described by Linsley, Kohler, and Paulhus (1975) were made for both stations and are shown in figure 3. Base flow and surface runoff components are summarized in table 3. The separations show that base flow at Elk Creek was 68 percent of the total stream discharge and 56 percent of the total stream discharge for Bruce Valley Creek.

Table 2. Summary of streamflow characteristics for Elk Creek near Independence, Bruce Valley Creek near Pleasantville, and Trempealeau River at Dodge.

Streamflow characteristic	Elk Creek, 1980 water year	Bruce Valley Creek, 1980 water year	Trempealeau River	
			1980 water year	Water years 1915-19 1935-81
Total discharge, in cubic feet per second-days*	32,700	2,980	194,000	---
Average discharge, in cubic feet per second	89.5	8.15	529	414
Cubic feet per second per square mile	.83	.81	.82	---
Inches of runoff	11.29	10.98	11.20	---
Minimum 7-day mean low-flow, in cubic feet per second	45	2.9	253	106
Peak discharge, in cubic feet per second	[1]1,020	[2]306	[3]4,430	[4]17,400
Average 7-day low flow that occurs on the average of once every 2 years	---	---	---	184
Average 7-day low flow that occurs on the average of once every 10 years	---	---	---	127
2-year flood	---	---	---	4,030
5-year flood	---	---	---	6,910

Date of peak

[1]March 19
[2]September 21
[3]March 20
[4]April 4, 1956

*Total discharge, in cubic feet per second days, is the sum of the daily mean discharges for the entire year.

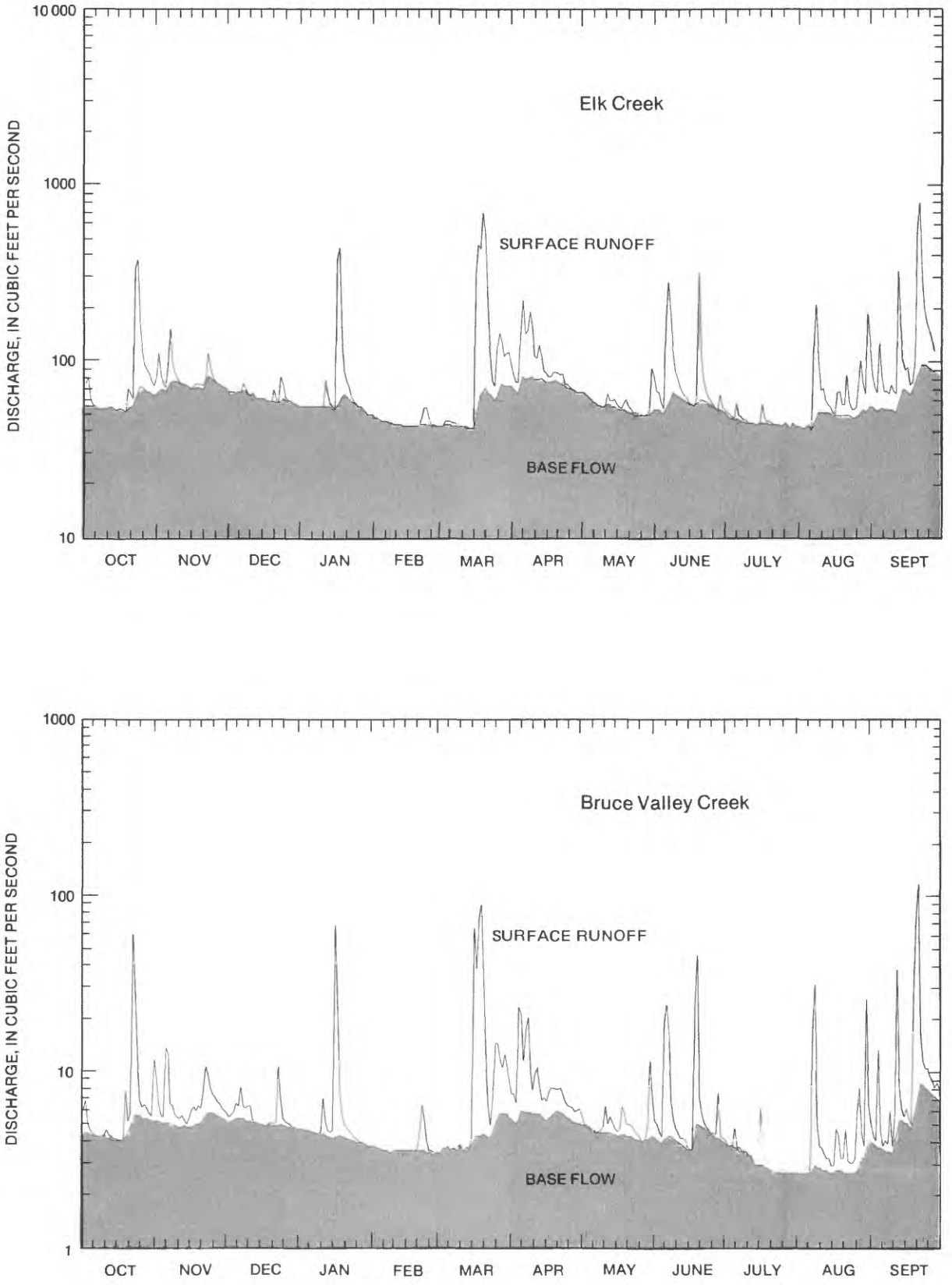

Figure 3. Hydrographs of base flow and surface runoff for Elk Creek and Bruce Valley Creek, 1980 water year.

Table 3. Base flow and surface runoff for Elk Creek near Independence and Bruce Valley Creek near Pleasantville, 1980 water year.

(Total discharge in cubic feet per second-days)

1980 water year	Elk Creek near Independence			Bruce Valley Creek near Pleasantville		
	Base flow	Surface runoff	Total discharge	Base flow	Surface runoff	Total discharge
Total discharge	22,300	10,500	32,800	1,670	1,310	2,980

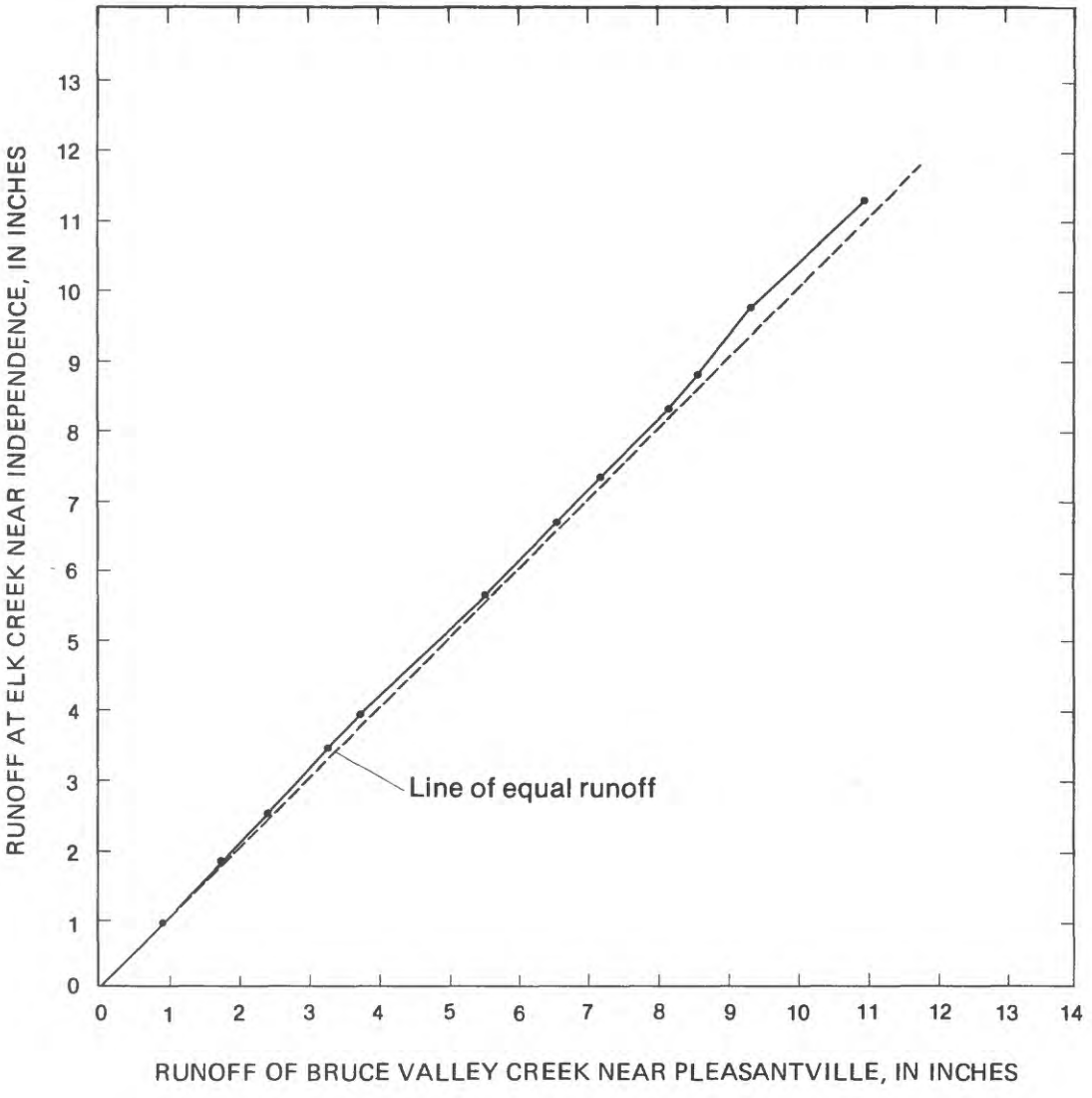

Figure 4. Graph showing double mass-accumulation curve for Elk Creek near Independence and Bruce Valley Creek near Pleasantville, 1980 water year, for runoff in inches.

In order to determine if the precipitation was uniform for both basins the runoff of Elk Creek was compared to that of Bruce Valley Creek with a double mass-accumulation curve (fig. 4). The relationship is essentially a 45° line that shows comparable runoff for both stations and indicates uniformity of precipitation on the basins during the study.

WATER QUALITY

Chemical and Physical Characteristics

The chemical composition of dissolved-solids and their discharge-weighted concentrations in water in Elk and Bruce Valley Creeks are typical of streams in west-central Wisconsin.

Nutrients and Suspended Sediment

Surface Runoff

Chemical data and particle-size distribution of suspended sediments and bed material are given in tables 6, 9, and 10. Suspended-sediment and nutrient loads computed by streamflow and concentration integration techniques described by Porterfield (1972) are given in tables 11-20. The loads of nutrients and suspended sediment for the individual runoff events sampled are shown in table 4. At Bruce Valley Creek, 9 storms were sampled during the 1980 water year and at Elk Creek 10 storms were sampled.

During the periods March 16-20, 1980, and September 18-26, 1980, most of the suspended sediment, organic-nitrogen, and total-phosphorus loads were transported; concentrations of these constituents also were generally the highest during these times. In Bruce Valley Creek, 22 and 30 percent of the suspended-sediment, 29 and 19 percent of the organic-nitrogen, and 21 percent (both periods) of the total-phosphorus annual loads were transported during the respective periods. In Elk Creek, 27 and 12 percent of the suspended sediment, 14 and 12 percent of the organic-nitrogen, and 11 and 13 percent of the total-phosphorus annual loads were transported during the respective periods. Most of the annual ammonia-nitrogen load, 46 percent at Bruce Valley Creek and 36 percent at Elk Creek, was transported during the March 16-20 period.

The high ammonia-nitrogen loads in the spring probably are due to manure in runoff from barnyards and frozen ground. High ammonia-nitrogen loads also occurred in the Onion River during the 1980 spring runoff (Field and Lidwin, in review). High ammonia-nitrogen concentrations can be expected during the spring because the manure is available, having been spread on snow-covered fields during the winter and nitrification (the biological oxidation of ammonia to nitrate by nitrifying bacteria) approaches zero at temperatures below 10°C. Optimal temperature for nitrification is 25° to 30°C (Velz, 1970).

Particle-size distribution of the suspended sediments and the bed material for both stations are shown in tables 9 and 10. Particle-size distribution of suspended sediments of Elk Creek on August 8 at 1710 hours indicates 9 percent sand, 53 percent silt, and 38 percent clay; the total concentration for the sample was 431 mg/L. A sample collected on September 21 at 1850 hours contained 29 percent sand and 71 percent silt and clay with a concentration of 316 mg/L. At Bruce Valley Creek, samples collected on June 7 at 1800 hours indicate 18 percent sand and 82 percent silt and clay with a concentration of 142 mg/L; on June 8 at 0735 hours a sample contained 9 percent sand and 91 percent silt and clay at a concentration of 70 mg/L.

Base Flow

Samples were collected at base-flow periods during the project. The concentrations of nutrients in whole water samples (unfiltered) are shown in table 5. Samples from May 1 and July 10 and 11 for nitrite plus nitrate nitrogen and ammonia nitrogen were filtered.

At Elk Creek, nitrite plus nitrate nitrogen accounted for 71 percent of the total nitrogen present, organic nitrogen accounted for 19 percent, and ammonia nitrogen 1 percent. The range in concentration of total phosphorus was 0.27 to 0.47 mg/L. The median value was 0.28 mg/L. Concentrations of ammonia nitrogen ranged from 0.02 to 0.10 mg/L, with a median of 0.06 mg/L.

At Bruce Valley Creek nitrite plus nitrate nitrogen accounted for 72 percent of the total nitrogen present, organic nitrogen accounted for 23 percent and ammonia nitrogen 5 percent. The range in concentration of total phosphorus was 0.25 to 0.44 mg/L. The median value was 0.28 mg/L. The concentrations of ammonia nitrogen ranged from 0.05 to 0.13 mg/L with a median of 0.10 mg/L.

Table 4. Constituent loads and percentage of annual loads for storms sampled for Elk and Bruce Valley Creeks, 1980 water year.

Dates	Nitrite + nitrate nitrogen		Organic nitrogen		Ammonia nitrogen		Total phosphorus		Suspended sediment	
	Load (lb)	Percentage of total load	Load (lb)	Percentage of total load	Load (lb)	Percentage of total load	Load (lb)	Percentage of total load	Load (tons)	Percentage of total load
Elk Creek										
1979										
Oct. 22-24	6,150	2.8	13,500	5.4	602	1.4	7,600	5.2	631	3.2
1980										
Jan. 16-18	7,100	3.2	19,200	7.7	9,100	21.2	9,560	6.6	858	4.3
Mar. 16-20	1,205	<1	35,800	14.4	17,400	40.6	15,500	10.6	5,420	27.2
Apr. 4-7	4,380	2.0	12,200	4.9	2,210	5.2	5,360	3.7	1,190	6.0
June 5-8	5,670	2.6	24,900	10.0	565	1.3	13,700	9.4	2,410	12.1
Aug. 7-9	2,670	1.2	7,360	2.9	297	<1	4,960	3.4	577	2.9
Aug. 30-31	1,650	<1	5,110	2.0	170	<1	2,840	2.0	273	1.4
Sept. 4	693	<1	1,640	<1	26	<1	859	<1	72	<1
Sept. 12-14	3,110	1.4	5,060	2.0	371	<1	3,890	2.7	402	2.0
Sept. 18-24	11,900	5.4	30,000	12.0	1,160	2.7	18,300	12.6	2,440	12.2
Annual loads										
Pounds per square mile	2,050		2,310		397		1,340		184 tons per square mile	
Pounds per square mile per day	5.60		6.31		1.08		3.66		0.51 tons per square mile per day	
Total	221,000	100	250,000	100	42,900	100	145,000	100	20,000	100
Bruce Valley Creek										
1979										
Oct. 22-23	445	2.9	1,660	5.3	69	1.2	796	4.9	74.9	3.4
1980										
Jan. 15-18	526	3.4	1,790	5.7	625	11.3	822	5.1	98.3	4.5
Mar. 16-20	231	1.5	9,040	29.0	2,560	46.3	3,340	20.6	482	22.2
June 5-8	533	3.4	1,280	4.1	109	2.0	713	4.4	136	6.3
Aug. 8-9	126	<1	732	2.3	42	<1	442	2.7	57.5	2.6
Aug. 30	110	<1	476	1.5	37	<1	256	1.6	28.0	1.3
Sept. 4	60	<1	199	<1	11	<1	103	<1	5.8	<1
Sept. 12	149	<1	503	1.6	46	<1	273	1.7	28.0	1.3
Sept. 18-26	1,150	7.4	5,880	18.8	275	5.0	3,410	21.1	663	30.5
Annual loads										
Pounds per square mile	1,540		3,090		547		1,600		215 tons per square mile	
Pounds per square mile per day	4.21		8.44		1.50		4.38		0.59 tons per square mile per day	
Total	15,600	100	31,200	100	5,530	100	16,200	100	2,180	100

Dissolved Solids

Specific conductance was measured continuously beginning in October at Bruce Valley Creek and November at Elk Creek. The daily maximum, minimum, and mean values are given in tables 23 and 24. Specific conductance is related to the dissolved-solids concentration. In Elk Creek, the relationship between specific conductance and the dissolved-solids concentration was:

0.860 × specific conductance (μmhos/cm) = dissolved solids (mg/L).

At Bruce Valley, the relationship was:

0.753 × specific conductance (μmhos/cm) = dissolved solids (mg/L).

Dissolved-solids loads for the study period are shown below.

	1980 Water Year	
	Dissolved solids, in tons	Load, in tons per square mile
Elk Creek	15,700	146
Bruce Valley Creek	1,140	112

The high dissolved-solids ground-water component of streamflow becomes diluted by low dissolved-solids surface-runoff water. Specific conductance ordinarily decreases in value with increases in stream discharge. In the Bruce Valley Creek watershed this pattern did not always hold true. Figure 5 illustrates the response of specific conductance to increases and decreases in stream discharge for Bruce Valley and Elk Creeks. At Bruce Valley Creek large increases in stream discharge (Aug. 30, Sept. 19, 20 storms) did cause decreases in specific conductance values; the Oct. 22 rise showed a delayed response after an initial rise. Small or moderate increases in stream discharge (Oct. 19, Feb. 21, 22, 26, and Aug. 26 storms), however, caused significant increases in specific-conductance values--the smaller the discharge increase, the larger the increase in specific-conductance values.

This large rise in specific conductance with a small increase in stream discharge could be due to the presence of feedlots or material such as manure in close proximity to the stream. Stored road salt or accumulations of other soluble material could also be the source of the dissolved solids. These sources could receive a quick "flush" from a small amount of rain. The small volume of surface runoff resulting would be insufficient to dilute greatly the increased dissolved material.

Table 5. Concentrations of nutrients in base-flow samples, Elk and Bruce Valley Creeks, 1980 water year.

Date	Nitrite plus nitrate nitrogen (in mg/L)	Ammonia nitrogen (in mg/L)	Organic nitrogen (in mg/L)	Phosphorus (in mg/L)
		Elk Creek		
Nov. 15, 1979	1.7	0.06	0.35	0.27
Mar. 4, 1980	1.6	.10	.38	.27
May 1, 1980	[1] 1.3	[1] .02	.40	.28
July 11, 1980	[1] 1.6	[1] .05	.60	.47
Mean	1.6	.06	.43	.32
Median	1.6	.06	.39	.28
		Bruce Valley Creek		
Nov. 16, 1979	1.4	.09	.32	.25
Mar. 4, 1980	1.6	.13	.34	.26
May 1, 1980	[1] .89	[1] .05	.50	.29
July 10, 1980	[1] 1.4	[1] .10	.50	.44
Mean	1.3	.09	.42	.31
Median	1.4	.10	.43	.28

[1]Dissolved

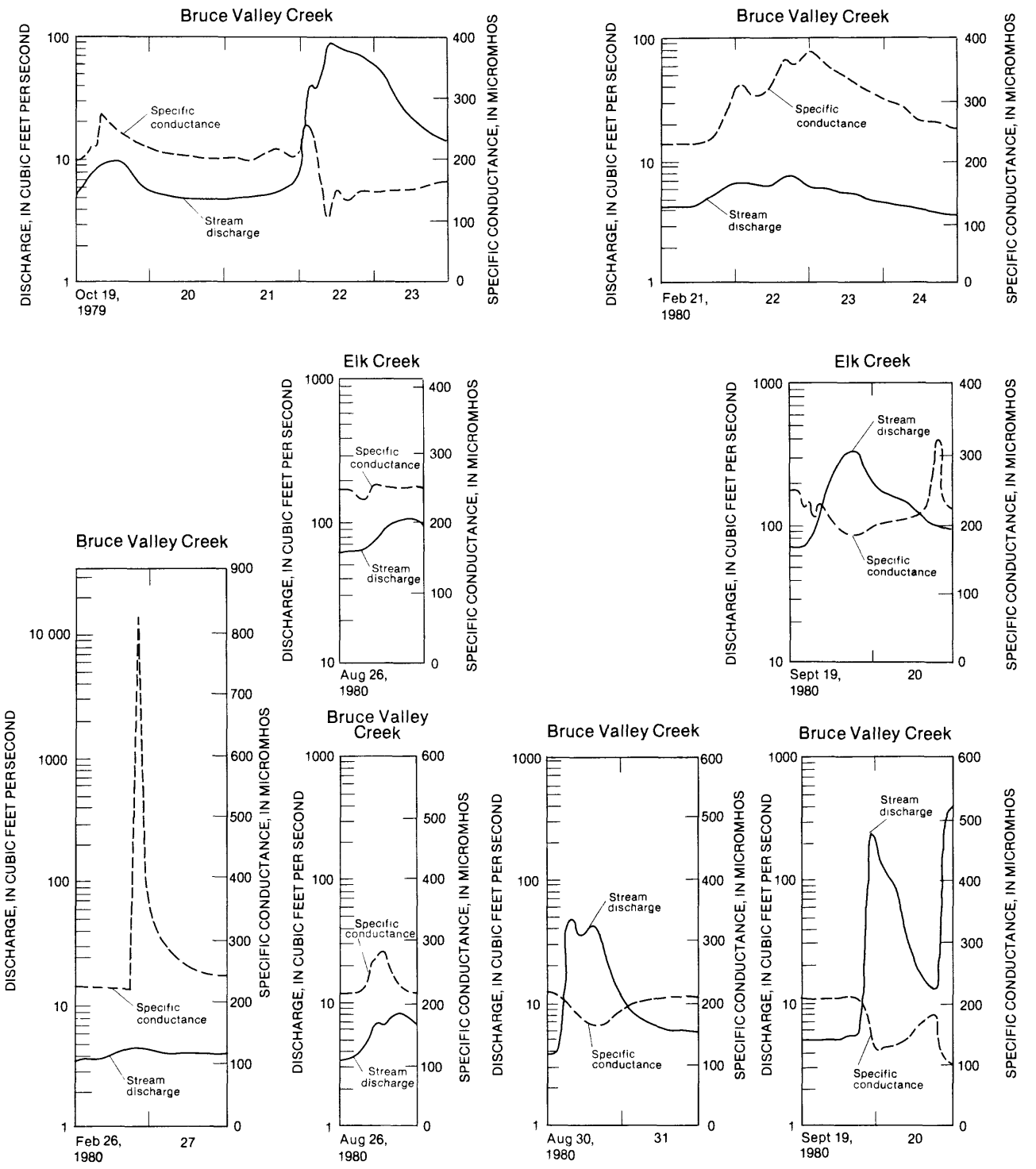

Figure 5. Stream discharge and specific conductance at Bruce Valley and Elk Creeks.

With a large increase in stream discharge, any added dissolved material could be greatly diluted by the large volume of runoff water of relatively low dissolved solids.

Elk Creek demonstrated a typical response of specific conductance to stream discharge increases and decreases except for the unusual rise in specific conductance on the trailing limb of the hydrograph from the September 19 storm. This rise is due to the increase in dissolved solids possibly from a tributary or a point source far upstream from the gaging station.

Heavy Metals

The whole-water analyses of September 26 showed low concentrations of total arsenic, copper, lead, and zinc. No cadmium was found.

Temperature

Water temperatures were measured continuously at both stations during the study period. The daily maximum, minimum, and mean values are shown in tables 21 and 22. Both streams were ice covered for part of the winter period.

Miscellaneous

Results of analyses of miscellaneous water-quality samples for Bruce Valley and Elk Creeks are shown in tables 9 and 10. The dissolved-oxygen concentration, pH, and water temperatures are given in table 6.

Both streams are slightly alkaline, with the pH at Bruce Valley Creek ranging from 6.9 to 8.0 and alkalinity as calcium carbonate ranging from 22 to 72 mg/L. At Elk Creek the pH ranged from 7.3 to 8.0 with alkalinity as calcium carbonate ranging from 29 to 92 mg/L.

Relation of Suspended Sediment and Nutrients to Streamflow

The suspended-sediment, ammonia-nitrogen, organic-nitrogen, and total-phosphorus yields were highest at Bruce Valley Creek but nitrite plus nitrate-nitrogen yields were highest at Elk Creek. A summary of the suspended-sediment and nutrient yields for Elk and Bruce Valley Creeks are given in table 4.

The suspended-sediment and nutrient yields for the 1980 water year for Elk and Bruce Valley Creeks probably are higher than the long-term averages because the stream discharges in 1980 were 28 percent above normal and precipitation was above normal by 11.31 in. However, the suspended-sediment yields for Elk and Bruce Valley Creeks are about the same as the long-term average of 200 tons/mi^2 for the Trempealeau River at Arcadia, Wis., (upstream of Trempealeau River at Dodge, Wis.) as reported by Hindall (1975).

Table 6. Dissolved-oxygen concentration, pH, and water temperature in Elk and Bruce Valley Creeks, 1980 water year.

Date	Elk Creek				Bruce Valley Creek			
	Time	Dissolved oxygen (mg/L)	pH	Temperature (°C)	Time	Dissolved oxygen (mg/L)	pH	Temperature (°C)
Oct. 11	1450	10.6	7.6	9.5	1230	9.9	7.5	9.0
Nov. 15	1630	12.8	7.4	5.5	----	---	---	---
Jan. 15	----	----	---	---	1600	11.7	---	4.0
Jan. 16	1100	11.4	8.0	0.5	----	---	---	---
Mar. 4	1100	10.1	7.7	0	1400	12.0	7.8	3.0
May 1	----	8.7	7.8	20.0	1630	11.0	8.0	17.5
May 30	1230	---	7.3	---	1300	---	7.1	20.0
July 11	----	7.7	---	19.0	1800	7.4	---	21.0
Sept. 30	----	---	---	---	1745	7.1	6.9	15.0

The total sediment load discharged to Bugle Lake from Elk Creek was 25,100 tons during the 1980 water year. This translates to an average yield of 222 tons/mi^2 from the basin. The total load was obtained by adjusting the suspended load at the Elk Creek gaging station to account for unmeasured load. Unmeasured load was estimated to be about 18 percent of the total sediment load. This estimate was based on application of the modified Einstein procedure (Stevens, 1978) to suspended sediment, bed material, and hydraulic data collected at the Elk Creek gaging station during the storms of August 8 and September 21.

Double-mass curves were constructed to analyze the loading characteristics of sediments and nutrients for Elk and Bruce Valley Creeks. By plotting the cumulative monthly constituent yield (figs. 6-8) against cumulative inches of runoff, comparisons can be made between stations and seasonal changes in loadings become apparent as well. The steeper the curve, the higher the loading.

The slopes of the curves for suspended sediment show little difference between the two stations, except during the month of September, when Bruce Valley Creek shows higher loading rates than Elk Creek. Runoff for September at both stations was similar but the rain gage at Bruce Valley for September 19, 1980, showed a greater storm intensity (0.80 in. in a 30-minute period) than at Elk Creek (0.60 in. in a 30-minute period). This may have caused the loading rates for September at Bruce Valley Creek to be greater than at Elk Creek.

The curves for total phosphorus, ammonia nitrogen, and organic nitrogen were steepest for Bruce Valley Creek and indicate higher loading rates than for Elk Creek. Nitrite plus nitrate-nitrogen curves were steepest at Elk Creek, probably because of the higher base flows. Ammonia-nitrogen loadings were greatest during the months of January and March and may reflect runoff from manure spread on frozen ground.

In general, the curves for nitrite plus nitrate nitrogen and ammonia nitrogen tend to flatten out during the growing season because of the uptake of the nutrients by plants and aquatic biota. The slopes of the phosphorus and organic nitrogen curves more closely resemble those of the suspended-sediment curves because of the sorption of phosphorus on the sediment particles and because organic nitrogen is transported in a manner similar to that of suspended sediment.

Criteria

The response of organisms to phosphorus and ammonia-nitrogen concentrations are the basis for the establishment of water-quality criteria and standards as well as the basis for management recommendations.

Most ammonia-nitrogen concentrations at Elk and Bruce Valley Creeks did not exceed the DNR criterion of 0.04 mg/L of un-ionized ammonia (NH_3-N) (Schuettpelz and Harpt, written commun., 1980) for protection of freshwater aquatic life. Concentrations of un-ionized ammonia can be determined from analyses of ammonia nitrogen ($NH_3 + NH_4^+$) if the pH and water temperature of the samples are known. The resulting concentrations, however, may be low due to possible loss of gaseous ammonia from the sample before analysis. Only the sample at Bruce Valley Creek on March 18 at 1500 may have exceeded the DNR criterion. For that sample, an estimated concentration of un-ionized ammonia (NH_3-N) of 0.04 mg/L was used, based on the recorded water temperature of 1.6°C and assuming a pH of 8.0. No samples from Elk Creek exceeded the DNR criterion. However, the sampler was inoperative for the March 18 runoff and there is a possibility that ammonia levels for that day may have also exceeded the criterion.

To prevent the formation of biological nuisance growths in flowing waters, the U.S. EPA has suggested that a concentration of 0.10 mg/L for total phosphorus not be exceeded (U.S. Environmental Protection Agency, 1976). Most total phosphorus concentrations at both stations exceeded this criteria.

SUMMARY

The U.S. Geological Survey, in cooperation with the Wisconsin Department of Natural Resources, investigated the water quality of the Elk Creek basin in west-central Wisconsin during the 1980 water year. Dairy farming and cultivation of cash crops are the major agricultural activities in the basin.

The data-collection program began in October 1979 and terminated in September 1980. Its scope included determination of: (1) The suspended-sediment, nitrogen, and phosphorus loads; (2) water discharge temperature and dissolved solids; and (3) miscellaneous water-quality constituents including

dissolved oxygen, pH, trace metals, alkalinity, and chloride.

Streamflow for the 1980 water year was about 28 percent greater than the 52-year average determined from a nearby, long-term gaging station record. Precipitation for the year was 36 percent greater than the long-term average.

Streamflow during the study period ranged from about the 66-percent duration flow at low flow to peak flows having between a 2-year and a 5-year flood recurrence interval.

Most of the annual suspended-sediment, organic-nitrogen, and total-phosphorus load was transported during two periods, March 16-20 and September 18-26, when annual peak flows were recorded at the gaging stations. At Bruce Valley Creek, 52 percent of the suspended sediment, 48 percent of the organic nitrogen, and 42 percent of the total phosphorus was transported during those periods. At Elk Creek 39 percent of the suspended sediment, 26 percent of the organic nitrogen, and 24 percent of the total phosphorus was transported during those periods. Most of the ammonia nitrogen load, 46 percent at Bruce Valley Creek and 36 percent at Elk Creek, was transported during the March 16-20 period.

Suspended-sediment yields were greatest at Bruce Valley Creek but comparison of double mass-accumulation curves shows loading rates to be generally the same for both stations. Total phosphorus, ammonia nitrogen, and organic-nitrogen yields were highest at Bruce Valley Creek. Because base flows were a greater percentage of total discharge at Elk Creek, nitrite plus nitrate nitrogen yields were greater at Elk Creek. Dissolved solids yields were highest at Elk Creek.

At Bruce Valley Creek small or moderate increases in stream discharge caused significant increases in specific conductance; this may indicate the presence of some water-soluable ionizable material near the stream.

Most ammonia concentrations at both streams did not exceed the DNR criterion for protection of freshwater aquatic life of 0.04 mg/L of un-ionized ammonia. In contrast, all total-phosphorus concentrations at both stations exceed the U.S. EPA criterion to prevent the formation of biological nuisance growths in flowing waters.

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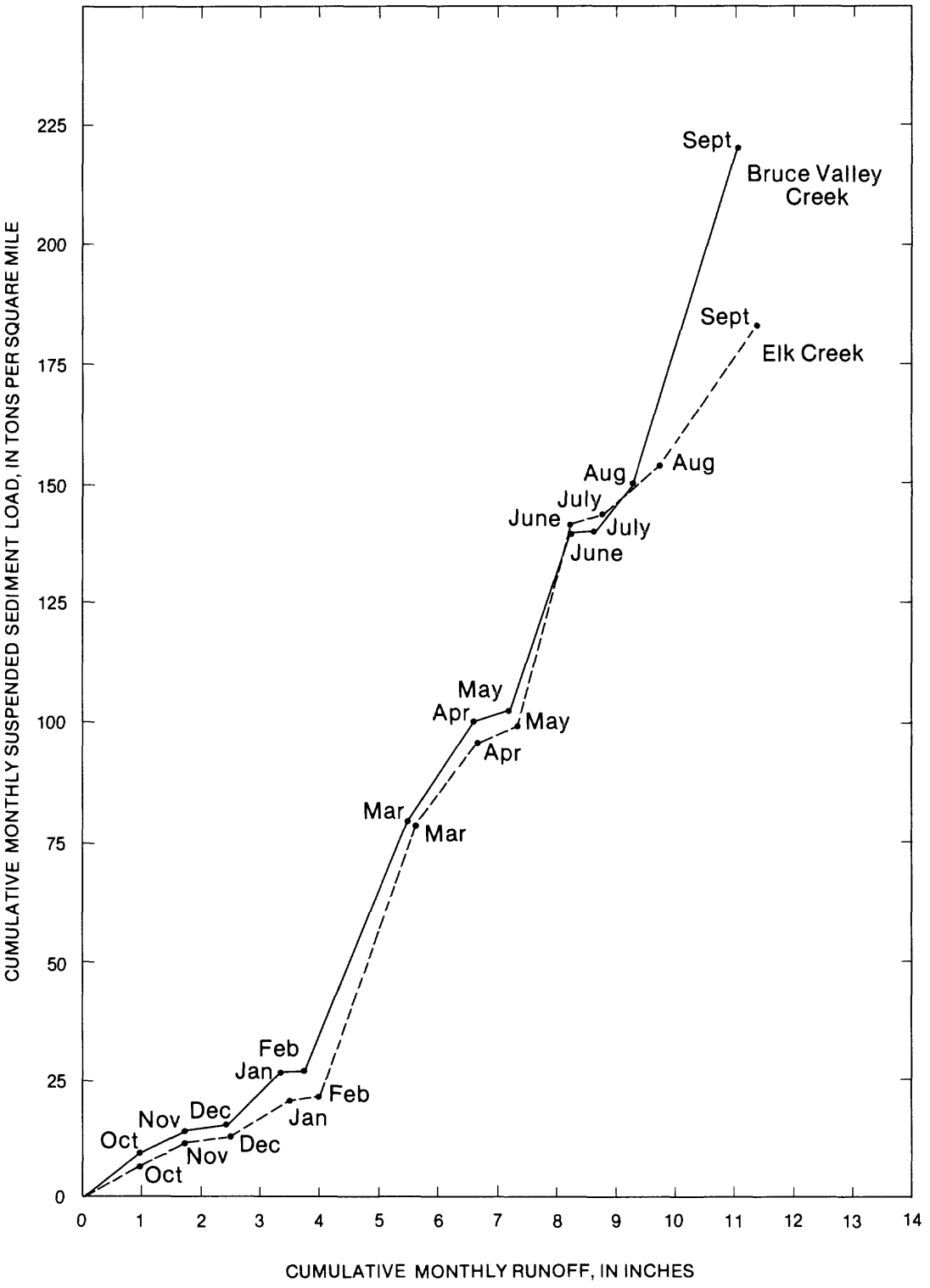

Figure 6. Double mass-accumulation curves for Elk and Bruce Valley Creeks for suspended sediment.

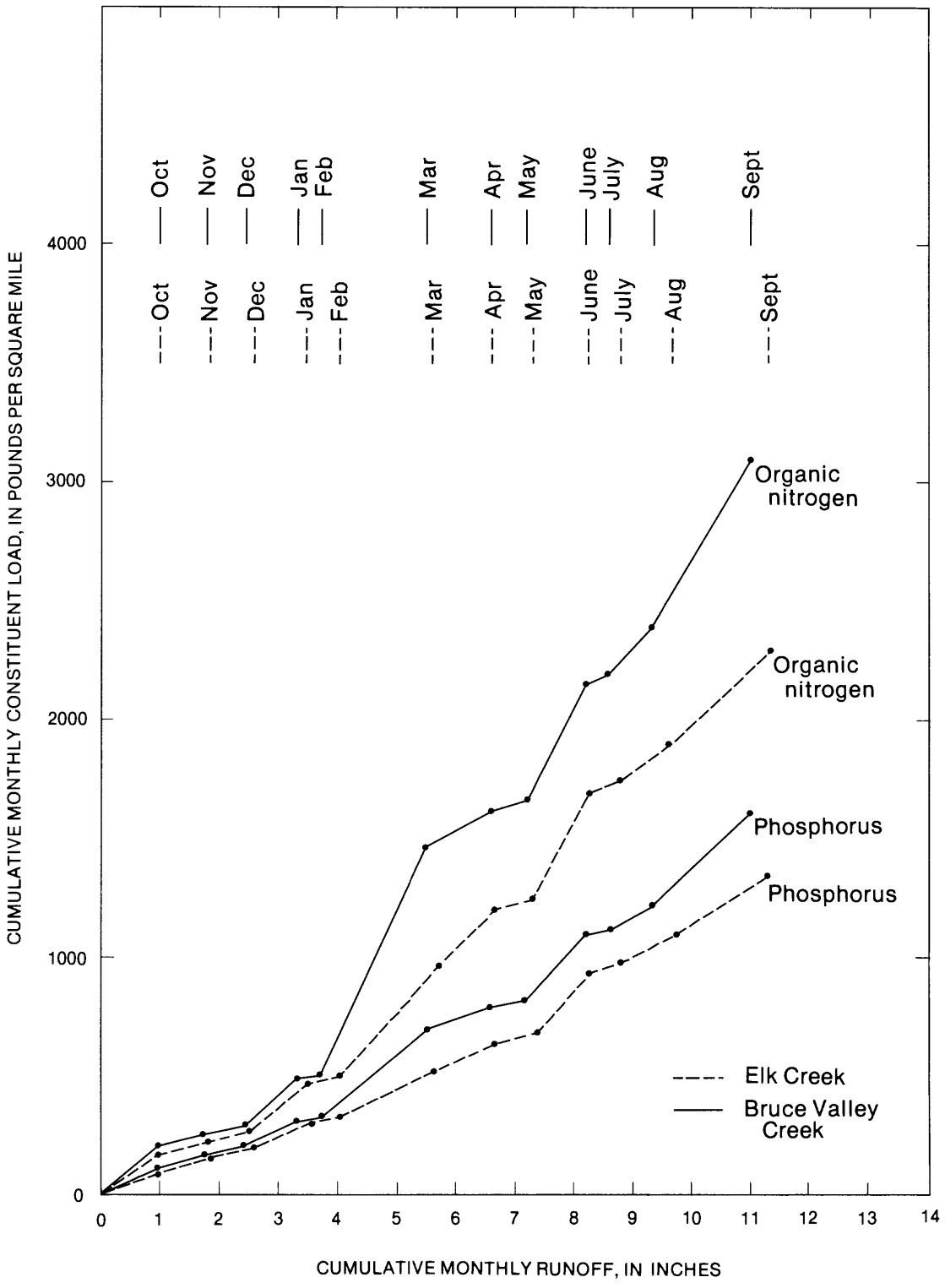

Figure 7. Double mass-accumulation curves for Elk and Bruce Valley Creeks for organic nitrogen and total phosphorous.

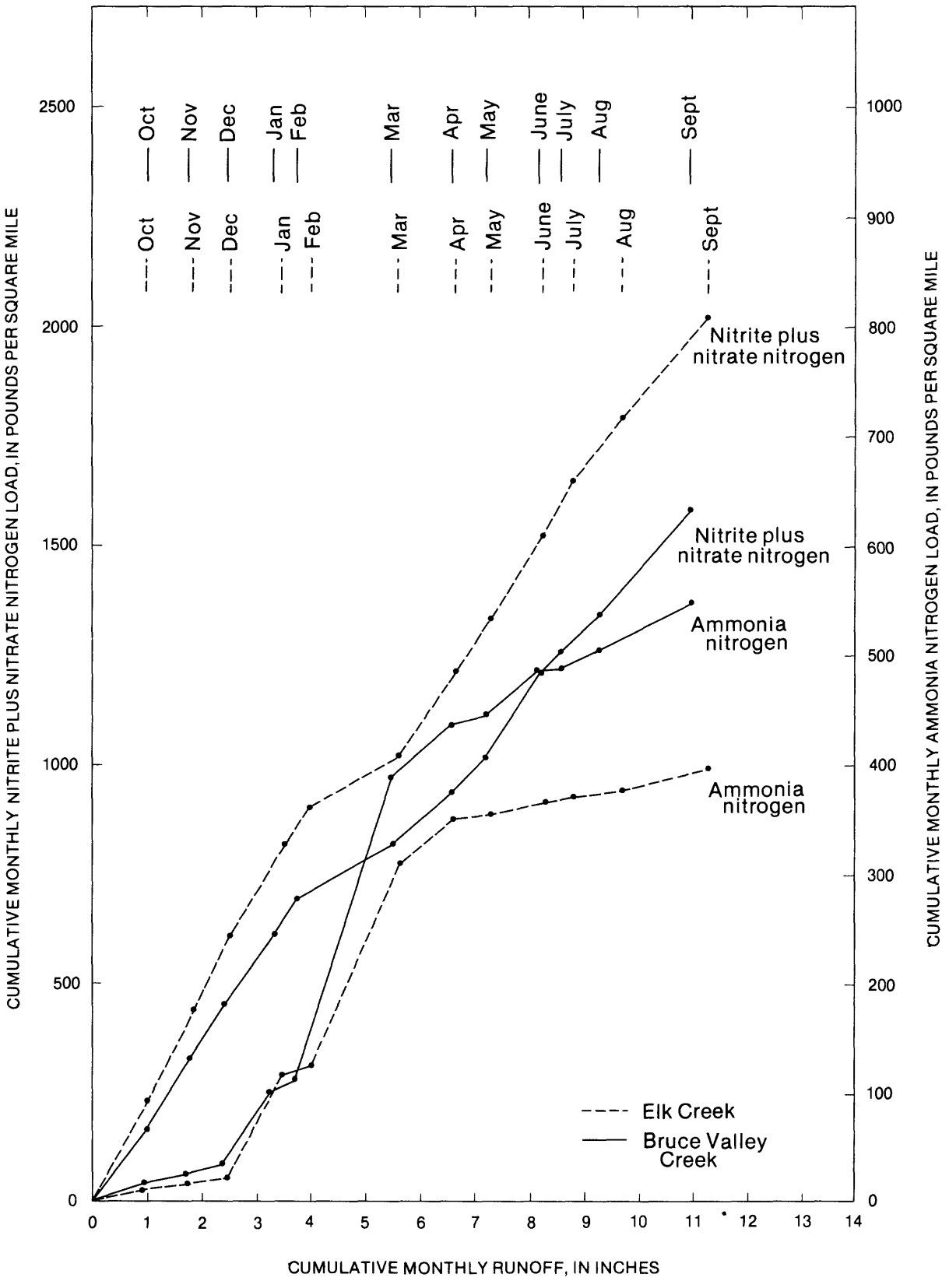

Figure 8. Double mass-accumulation curves for ammonia nitrogen and nitrite plus nitrate nitrogen.

Table 7. Stream discharges for Elk Creek near Independence, 1980 water year.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1979 TO SEPTEMBER 1980
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	78	116	70	58	50	45	88	70	71	54	45	88
2	84	87	70	58	50	45	80	68	70	53	44	75
3	63	78	70	58	49	48	80	66	61	51	44	70
4	59	74	69	58	48	48	153	64	57	50	45	134
5	58	97	70	58	48	48	232	62	174	61	46	86
6	56	159	70	58	48	47	150	61	297	52	43	71
7	56	100	78	58	47	47	156	59	194	51	127	71
8	56	89	72	58	47	46	199	59	118	49	220	69
9	56	83	68	58	46	46	166	58	92	49	109	77
10	56	79	67	58	46	45	113	59	84	47	72	71
11	57	77	69	82	46	45	109	69	75	47	74	69
12	57	77	65	68	46	45	129	63	70	47	63	341
13	56	76	64	60	45	44	113	63	67	46	60	161
14	55	74	64	58	45	44	93	64	65	46	58	104
15	56	73	64	56	45	44	90	60	61	47	54	94
16	56	76	64	397	45	324	86	58	60	60	53	97
17	55	78	62	460	45	479	86	57	59	50	70	77
18	54	77	62	139	45	455	91	61	65	48	71	80
19	73	77	62	92	45	733	91	64	337	48	60	103
20	68	76	72	81	46	554	90	59	117	47	60	579
21	64	83	64	75	50	230	88	57	82	46	88	833
22	348	116	61	66	57	118	89	54	72	46	62	330
23	390	96	85	62	57	82	78	54	66	46	57	208
24	164	85	77	60	50	76	78	54	63	45	56	174
25	117	80	65	58	45	125	75	53	60	46	58	158
26	99	78	63	58	46	151	73	52	57	47	80	140
27	93	77	62	56	45	134	72	52	56	45	106	123
28	88	75	61	54	45	112	70	53	68	44	79	112
29	80	74	60	52	45	116	70	56	58	47	69	110
30	76	72	59	52	---	118	70	96	56	45	199	103
31	85	---	58	52	---	101	---	86	---	45	135	---
TOTAL	2813	2559	2067	2718	1372	4595	3158	1911	2832	1505	2407	4808
MEAN	90.7	85.3	66.7	87.7	47.3	148	105	61.6	94.4	48.5	77.6	160
MAX	390	159	85	460	57	733	232	96	337	61	220	833
MIN	54	72	58	52	45	44	70	52	56	44	43	69
CFSM	.84	.79	.62	.81	.44	1.37	.97	.57	.87	.45	.72	1.48
IN.	.97	.88	.71	.94	.47	1.58	1.09	.66	.98	.52	.83	1.66

WTR YR 1980 TOTAL 32745 MEAN 89.5 MAX 833 MIN 43 CFSM .83 IN 11.29

Table 8. Stream discharges for Bruce Valley Creek near Pleasantville, 1980 water year.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1979 TO SEPTEMBER 1980
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	6.2	9.6	6.0	4.9	3.9	3.6	7.8	5.9	5.5	4.3	2.9	5.4
2	7.0	6.8	5.7	4.9	3.9	3.6	7.8	5.2	5.3	4.0	2.9	4.6
3	5.2	5.9	5.9	4.8	3.8	3.8	6.9	5.2	4.8	4.0	3.0	4.3
4	4.8	5.7	6.1	4.8	3.8	3.8	24	5.1	4.5	4.0	2.9	14
5	4.6	14	6.8	4.8	3.7	3.9	22	4.9	20	5.0	3.1	4.8
6	4.5	13	6.6	4.7	3.7	3.7	12	4.9	25	3.9	2.8	4.0
7	4.4	6.8	8.4	4.7	3.7	3.8	18	4.7	17	3.9	18	4.3
8	4.4	6.6	6.6	4.6	3.6	3.8	21	4.8	7.1	3.7	33	4.1
9	4.4	5.9	6.4	4.6	3.6	3.7	11	4.9	5.6	3.7	5.4	6.3
10	4.5	5.7	6.6	4.7	3.7	4.0	8.2	5.1	5.0	3.7	4.0	4.0
11	4.8	5.6	6.6	7.3	3.7	3.8	10	6.6	4.7	3.5	3.9	5.8
12	4.5	5.8	5.5	5.4	3.7	3.7	11	5.3	4.4	3.5	3.6	40
13	4.4	5.5	5.3	4.8	3.7	3.9	8.6	5.8	4.4	3.2	3.4	8.7
14	4.3	5.2	5.3	4.7	3.7	3.8	7.2	5.4	4.3	3.3	3.4	6.5
15	4.3	5.6	5.2	4.8	3.7	4.3	7.4	5.0	3.9	3.5	3.1	5.9
16	4.2	6.2	5.2	70	3.7	68	7.1	4.8	3.8	6.5	3.1	6.5
17	4.2	6.5	5.1	24	3.7	40	8.0	4.9	3.8	3.4	5.0	5.7
18	4.3	6.2	5.1	8.0	3.7	76	8.4	6.6	25	3.3	4.6	5.3
19	8.0	6.6	5.3	5.9	3.7	93	8.4	6.1	48	3.2	3.4	29
20	5.4	6.4	5.3	5.2	3.8	33	8.3	5.3	7.5	3.1	3.4	76
21	5.9	7.9	5.3	5.0	4.7	13	8.3	5.3	6.1	3.1	4.9	123
22	62	11	5.3	4.8	6.7	6.8	8.4	5.2	5.4	2.9	3.3	17
23	28	10	11	4.6	5.6	5.2	7.7	5.0	5.1	2.8	3.2	12
24	12	8.4	7.2	4.4	4.2	7.4	7.0	4.7	4.9	2.8	3.2	11
25	7.1	7.7	5.6	4.3	3.7	15	6.7	4.6	4.7	3.0	3.4	11
26	6.5	7.4	5.4	4.2	3.7	15	6.6	4.3	4.7	3.1	6.3	10
27	6.7	7.0	5.3	4.1	3.6	12	6.5	4.2	4.6	2.8	8.5	9.4
28	6.4	6.8	5.2	4.1	3.6	11	6.2	4.3	7.9	2.9	4.7	8.6
29	6.0	6.4	5.0	4.0	3.6	13	6.3	5.2	4.5	2.9	4.0	9.1
30	5.8	6.2	5.0	3.9	---	11	6.4	12	4.4	2.8	27	8.5
31	12	---	4.9	3.9	---	9.3	---	7.8	---	2.9	6.8	---
TOTAL	256.8	218.4	184.2	234.9	113.9	485.9	293.2	169.1	261.9	108.7	190.2	464.8
MEAN	8.28	7.28	5.94	7.58	3.93	15.7	9.77	5.45	8.73	3.51	6.14	15.5
MAX	62	14	11	70	6.7	93	24	12	48	6.5	33	123
MIN	4.2	5.2	4.9	3.9	3.6	3.6	6.2	4.2	3.8	2.8	2.8	4.0
CFSM	.82	.72	.59	.75	.39	1.55	.97	.54	.86	.35	.61	1.54
IN.	.95	.80	.68	.87	.42	1.79	1.08	.62	.96	.40	.70	1.71

WTR YR 1980 TOTAL 2982.0 MEAN 8.15 MAX 123 MIN 2.8 CFSM .81 IN 10.98

Table 9. Water and bed-material analyses from Elk Creek near Independence, 1980 water year.

DATE	TIME	STREAM-FLOW, INSTAN-TANEOUS (CFS)	SPE-CIFIC CON-DUCT-ANCE (UMHOS)	PH (STAND-ARD UNITS)	TEMPER-ATURE (DEG C)	OXYGEN, DIS-SOLVED (MG/L)	OXYGEN, DIS-SOLVED (PER-CENT SATUR-ATION)	ALKA-LINITY FIELD (MG/L AS CACO3)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL)	SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L)	SOLIDS, DIS-SOLVED (TONS PER AC-FT)
OCT , 1979											
22...	0600	163	--	--	--	--	--	--	--	--	--
22...	0630	178	--	--	--	--	--	60	11	158	.21
22...	1630	515	--	--	--	--	--	39	9.6	123	.17
22...	1800	522	--	--	--	--	--	--	--	--	--
23...	1400	339	--	--	--	--	--	--	--	--	--
23...	1430	332	--	--	--	--	--	39	7.6	127	.17
24...	1545	141	--	--	--	--	--	58	7.6	136	.19
24...	1615	139	--	--	--	--	--	--	--	--	--
NOV											
15...	1630	74	--	--	--	--	--	77	5.8	149	.20
MAR , 1980											
04...	1100	48	225	7.7	.0	10.1	73	85	6.0	190	.26
22...	0930	111	210	--	1.0	--	--	--	--	--	--

DATE	SOLIDS, DIS-SOLVED (TONS PER DAY)	NITRO-GEN, NITRATE TOTAL (MG/L AS N)	NITRO-GEN, NITRITE TOTAL (MG/L AS N)	NITRO-GEN, NO2+NO3 TOTAL (MG/L AS N)	NITRO-GEN, AMMONIA TOTAL (MG/L AS N)	NITRO-GEN, ORGANIC TOTAL (MG/L AS N)	NITRO-GEN, AM-MONIA + ORGANIC TOTAL (MG/L AS N)	NITEO-GEN, TOTAL (MG/L AS N)	PHOS-PHORUS, TOTAL (MG/L AS P)	PHOS-PHORUS, ORTHO, TOTAL (MG/L AS P)	CARBON, ORGANIC DIS-SOLVED (MG/L AS C)
OCT , 1979											
22...	--	1.05	.050	1.10	.180	8.0	8.2	9.3	3.00	.410	--
22...	76	--	--	--	--	--	--	--	--	--	--
22...	171	--	--	--	--	--	--	--	--	--	--
22...	--	1.15	.050	1.20	.160	3.5	3.7	4.9	2.50	.990	--
23...	--	1.47	.030	1.50	.140	1.8	1.9	3.4	1.00	.320	--
23...	114	--	--	--	--	--	--	--	--	--	--
24...	52	--	--	--	--	--	--	--	--	--	--
24...	--	1.57	.030	1.60	.050	1.1	1.1	2.7	.570	.240	--
NOV											
15...	30	1.68	.020	1.70	.060	.35	.41	2.1	.270	.140	--
MAR , 1980											
04...	25	1.59	.010	1.60	.100	.38	.48	2.1	.270	.040	--
22...	--	--	--	--	--	--	--	--	--	--	13

DATE	TIME	STREAM-FLOW, INSTAN-TANEOUS (CFS)	ALKA-LINITY FIELD (MG/L AS CACO3)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL)	SOLIDS, RESIDUE AT 105 DEG. C, DIS-SOLVED (MG/L)	NITRO-GEN, NO2+NO3 DIS-SOLVED (MG/L AS N)	NITRO-GEN, AMMONIA DIS-SOLVED (MG/L AS N)	NITRO-GEN, AM-MONIA + ORGANIC TOTAL (MG/L AS N)	PHOS-PHORUS, TOTAL (MG/L AS P)	PHOS-PHORUS, ORTHO, DIS-SOLVED (MG/L AS P)
JAN , 1980										
16...	1030	97	78	10	174	1.80	1.80	--	1.16	.430
16...	1445	420	--	--	--	2.00	3.00	--	3.42	.900
16...	1615	885	52	19	194	--	--	--	--	--
16...	2000	856	--	--	--	1.10	2.10	--	2.68	.710
16...	2045	851	39	10	146	--	--	--	--	--
17...	0245	831	--	--	--	1.10	1.50	--	2.16	.580
17...	0315	794	32	8.0	120	--	--	--	--	--
17...	0945	456	--	--	--	.980	1.40	--	1.76	.540
17...	1015	436	38	9.0	128	--	--	--	--	--
18...	1336	345	59	11	152	1.20	1.20	--	.740	.340
MAR										
16...	2115	865	--	--	--	.050	1.10	--	2.30	.800
17...	0015	814	--	--	--	.050	1.20	--	1.76	.640
20...	0915	419	--	--	--	.100	2.00	--	1.46	.380
APR										
04...	2000	341	--	--	--	<.020	.020	--	2.40	--
04...	2200	415	--	--	--	1.40	.790	--	5.40	--
04...	2400	415	--	--	--	1.40	.990	--	4.00	--
05...	0200	381	--	--	--	1.20	1.00	--	3.50	--
07...	1400	124	--	--	--	1.20	.530	--	.660	--
MAY										
01...	--	70	82	4.0	166	1.30	.020	--	.280	.131
30...	1150	125	44	8.0	168	1.30	.360	4.0	1.98	--
JUN										
05...	1130	194	59	6.0	--	--	--	--	--	.210
05...	1300	234	--	--	--	1.75	.210	7.7	3.80	--
05...	2315	292	--	--	--	1.47	.310	12	6.20	--
06...	0215	454	--	--	--	1.69	.370	12	6.40	--
06...	0345	476	39	4.0	140	--	--	--	.360	--
06...	1030	347	--	--	--	1.52	.090	6.0	3.40	--
06...	2230	154	--	--	--	1.05	.030	2.6	1.21	--
06...	2359	145	57	4.0	132	--	--	--	--	.210
07...	0715	159	--	--	--	1.17	.030	6.8	4.00	--
07...	1315	250	--	--	--	1.90	.260	12	5.50	--
08...	--	--	--	--	--	--	--	1.6	--	--
08...	0345	137	--	--	--	1.26	.090	2.1	1.07	--
08...	0515	129	71	4.0	164	--	--	--	--	.210
08...	0830	121	--	--	--	1.39	.100	1.3	.700	.182
08...	1030	117	--	--	--	--	--	6.0	--	--
JUL										
11...	1100	46	92	5.0	198	1.68	.050	.60	.470	--

Table 9. Water and bed-material analyses from Elk Creek near Independence, 1980 water year - - Continued.

DATE	TIME	STREAM-FLOW, INSTAN-TANEOUS (CFS)	ALKA-LINITY FIELD (MG/L AS CACO3)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL)	SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L)	SOLIDS, RESIDUE AT 105 DEG. C, DIS-SOLVED (MG/L)	SOLIDS, DIS-SOLVED (TONS PER AC-FT)	SOLIDS, DIS-SOLVED (TONS PER DAY)	NITRO-GEN, NO2+NO3 DIS-SOLVED (MG/L AS N)	NITRO-GEN, AMMONIA DIS-SOLVED (MG/L AS N)	PHOS-PHORUS, TOTAL (MG/L AS P)
AUG , 1980											
07...	0945	142	56	8.0	--	144	--	--	--	--	--
07...	1115	154	--	--	--	--	--	--	1.59	.270	3.60
07...	1415	172	--	--	--	--	--	--	1.46	.200	3.10
07...	1715	178	--	--	--	--	--	--	1.42	.160	2.90
07...	2315	122	--	--	--	--	--	--	1.25	.110	1.87
08...	0400	110	--	--	--	--	--	--	.940	.090	1.70
08...	0530	137	44	4.0	--	130	--	--	--	--	--
08...	1000	324	--	--	--	--	--	--	.880	.210	3.70
08...	1300	326	--	--	--	--	--	--	.780	.190	3.20
08...	1430	312	36	4.0	--	124	--	--	--	--	--
08...	1900	239	--	--	--	--	--	--	.860	.090	1.83
09...	0830	120	52	5.0	--	144	--	--	--	--	--
09...	1000	115	--	--	--	--	--	--	.630	.060	1.10
09...	1411	94	--	--	--	--	--	--	.840	.070	.740
09...	1413	94	66	5.0	--	162	--	--	--	--	--
30...	0745	99	--	--	--	--	--	--	.950	.650	--
30...	1130	218	--	--	--	--	--	--	1.17	.300	3.50
30...	1730	324	--	--	--	--	--	--	1.02	.080	2.30
30...	1900	330	53	4.0	145	--	.20	129	--	--	--
30...	2330	243	--	--	--	--	--	--	.950	.040	1.38
31...	0700	153	64	4.0	145	--	.20	60	--	--	--
31...	1430	116	--	--	--	--	--	--	.870	.030	.770
SEP											
04...	0630	116	--	--	--	--	--	--	1.25	.040	1.68
04...	0930	169	--	--	--	--	--	--	1.16	.050	1.78
04...	1230	182	--	--	--	--	--	--	1.07	.070	1.80
04...	1400	184	64	4.0	145	--	.20	72	--	--	--
04...	1530	175	--	--	--	--	--	--	.880	.030	1.36
04...	2130	119	--	--	--	--	--	--	.890	.030	1.05
12...	0315	182	--	--	--	--	--	--	1.15	.200	1.68
12...	0615	296	--	--	--	--	--	--	1.09	.330	2.50
12...	1100	443	--	--	--	--	--	--	.970	.222	2.10
12...	1400	492	--	--	--	--	--	--	.930	.190	1.76
12...	2000	349	--	--	--	--	--	--	1.06	.080	1.15
13...	0800	175	--	--	--	--	--	--	.900	.060	.850
14...	0430	110	--	--	--	--	--	--	1.26	<.020	.550
18...	1540	79	--	--	--	--	--	--	1.57	.060	.460
19...	2130	78	--	--	--	--	--	--	1.22	.040	2.20
20...	0030	557	--	--	--	--	--	--	1.15	.250	5.20
20...	0330	802	--	--	--	--	--	--	1.06	.100	3.50
20...	0500	802	29	4.0	160	--	.22	346	--	--	--
20...	0630	780	--	--	--	--	--	--	1.01	.070	2.50
20...	1230	529	--	--	--	--	--	--	1.04	.060	1.44
20...	2130	332	--	--	--	--	--	--	.840	.040	1.56
21...	0030	766	--	--	--	--	--	--	.760	.190	3.70
21...	0330	903	--	--	--	--	--	--	.800	.190	2.90
21...	0630	942	--	--	--	--	--	--	.840	.140	2.20
21...	0930	948	--	--	--	--	--	--	.770	.110	1.60
21...	1100	954	32	<2.0	145	--	.20	373	--	--	--
21...	1145	954	--	--	--	--	--	--	.820	.110	1.24
21...	1330	924	--	--	--	--	--	--	.840	.110	1.31
21...	2000	701	--	--	--	--	--	--	.830	.080	1.31
22...	0500	406	--	--	--	--	--	--	.960	.060	--
22...	1100	324	--	--	--	--	--	--	1.04	.080	.850
22...	1230	307	60	3.0	175	--	.24	145	--	--	--
22...	1415	301	--	--	--	--	--	--	1.09	.080	.750
23...	1055	219	75	4.0	185	--	.25	109	1.38	.100	2.02
24...	0900	176	--	--	--	--	--	--	1.53	.090	.440

DATE	TIME	STREAM-FLOW, INSTAN-TANEOUS (CFS)	ARSENIC TOTAL (UG/L AS AS)	CADMIUM TOTAL RECOV-ERABLE (UG/L AS CD)	COPPER, TOTAL RECOV-ERABLE (UG/L AS CU)	LEAD, TOTAL RECOV-ERABLE (UG/L AS PB)	ZINC, TOTAL RECOV-ERABLE (UG/L AS ZN)
SEP , 1980							
26...	1100	139	<10	0	4	<3	40

DATE	TIME	SEDI-MENT, SUS-PENDED (MG/L)	SED. SUSP. FALL DIAM. % FINER THAN .002 MM	SED. SUSP. FALL DIAM. % FINER THAN .004 MM	SED. SUSP. FALL DIAM. % FINER THAN .008 MM	SED. SUSP. FALL DIAM. % FINER THAN .016 MM	SED. SUSP. FALL DIAM. % FINER THAN .031 MM	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM	SED. SUSP. SIEVE DIAM. % FINER THAN .125 MM	SED. SUSP. SIEVE DIAM. % FINER THAN .250 MM	SED. SUSP. SIEVE DIAM. % FINER THAN .500 MM	SED. SUSP. SIEVE DIAM. % FINER THAN 1.00 MM
AUG , 1980												
08...	1710	431	29	38	50	64	81	91	96	99	100	--
SEP												
21...	1850	316	--	--	--	--	--	71	76	86	99	100

DATE	TIME	BED MAT. SIEVE DIAM. % FINER THAN .062 MM	BED MAT. SIEVE DIAM. % FINER THAN .125 MM	BED MAT. SIEVE DIAM. % FINER THAN .250 MM	BED MAT. SIEVE DIAM. % FINER THAN .500 MM	BED MAT. SIEVE DIAM. % FINER THAN 1.00 MM	BED MAT. SIEVE DIAM. % FINER THAN 2.00 MM	BED MAT. SIEVE DIAM. % FINER THAN 4.00 MM	BED MAT. SIEVE DIAM. % FINER THAN 8.00 MM
AUG , 1980									
08...	1710	1	3	17	75	98	99	100	--
SEP									
21...	1850	4	6	30	80	98	99	99	100

Table 10. Water and bed-material analyses from Bruce Valley Creek near Pleasantville, 1980 water year.

DATE	TIME	STREAM-FLOW, INSTAN-TANEOUS (CFS)	SPE-CIFIC CON-DUCT-ANCE (UMHOS)	PH (STAND-ARD UNITS)	TEMPER-ATURE (DEG C)	OXYGEN, DIS-SOLVED (MG/L)	OXYGEN, DIS-SOLVED (PER-CENT SATUR-ATION)	ALKA-LINITY FIELD (MG/L AS CACO3)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL)	SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L)	SOLIDS, DIS-SOLVED (TONS PER AC-FT)	SOLIDS, DIS-SOLVED (TONS PER DAY)
OCT , 1979												
22...	0215	25	--	--	--	--	--	--	--	--	--	--
22...	0245	36	--	--	--	--	--	53	24	193	.26	19
22...	0845	66	--	--	--	--	--	40	12	124	.17	22
22...	0915	75	--	--	--	--	--	--	--	--	--	--
22...	1245	86	--	--	--	--	--	31	8.4	119	.16	28
22...	1515	81	--	--	--	--	--	--	--	--	--	--
22...	1545	81	--	--	--	--	--	29	7.2	108	.15	24
23...	1145	23	--	--	--	--	--	--	--	--	--	--
NOV												
16...	0930	5.9	--	--	--	--	--	57	4.8	120	.16	1.9
MAR , 1980												
04...	1400	3.7	210	7.8	3.0	12.0	93	54	4.7	124	.17	1.1
21...	1830	14	150	--	3.0	--	--	--	--	--	--	--

DATE	NITRO-GEN, NITRATE TOTAL (MG/L AS N)	NITRO-GEN, NITRITE TOTAL (MG/L AS N)	NITRO-GEN, NO2+NO3 TOTAL (MG/L AS N)	NITRO-GEN, AMMONIA TOTAL (MG/L AS N)	NITRO-GEN, ORGANIC TOTAL (MG/L AS N)	NITRO-GEN, AMMONIA + ORGANIC TOTAL (MG/L AS N)	NITRO-GEN, TOTAL (MG/L AS N)	PHOS-PHORUS, TOTAL (MG/L AS P)	PHOS-PHORUS, ORTHO, TOTAL (MG/L AS P)	CARBON, ORGANIC DIS-SOLVED (MG/L AS C)	CARBON, ORGANIC SUS-PENDED TOTAL (MG/L AS C)
OCT , 1979											
22...	.860	.070	.930	.760	27	28	29	5.50	2.30	--	--
22...	--	--	--	--	--	--	--	--	--	--	--
22...	--	--	--	--	--	--	--	--	--	--	--
22...	.870	.050	.920	.180	4.6	4.8	5.7	2.70	.630	--	--
22...	--	--	--	--	--	--	--	--	--	--	--
22...	.670	.040	.710	.080	3.2	3.3	4.0	4.10	.290	--	--
22...	--	--	--	--	--	--	--	--	--	--	--
23...	1.17	.030	1.20	.090	1.8	1.9	3.1	1.30	.370	--	--
NOV											
16...	1.39	.010	1.40	.090	.32	.41	1.8	.250	.180	--	--
MAR , 1980											
04...	1.59	.010	1.60	.130	.34	.47	2.1	.260	.120	--	--
21...	--	--	--	--	--	--	--	--	--	10	5.6

DATE	TIME	STREAM-FLOW, INSTAN-TANEOUS (CFS)	ALKA-LINITY FIELD (MG/L AS CACO3)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL)	SOLIDS, RESIDUE AT 105 DEG. C, DIS-SOLVED (MG/L)	NITRO-GEN, NO2+NO3 DIS-SOLVED (MG/L AS N)	NITRO-GEN, AMMONIA DIS-SOLVED (MG/L AS N)	NITRO-GEN, AMMONIA + ORGANIC TOTAL (MG/L AS N)	PHOS-PHORUS, TOTAL (MG/L AS P)	PHOS-PHORUS, ORTHO, DIS-SOLVED (MG/L AS P)
JAN , 1980										
15...	1600	4.5	60	4.0	128	1.50	.120	--	.320	.141
16...	1245	60	46	11	180	--	--	--	--	--
16...	1345	83	--	--	--	1.20	2.00	--	2.10	.720
16...	1512	160	39	11	153	.040	1.90	--	2.57	.830
16...	1600	185	34	8.4	140	.820	1.80	--	2.31	.730
16...	2345	72	--	--	--	.650	.740	--	1.11	.570
17...	0045	63	22	7.4	87	--	--	--	--	--
18...	1256	17	50	4.6	117	1.30	.580	--	.460	.310
MAR										
16...	1215	65	E52	5.6	164	--	--	--	--	--
16...	1415	99	--	--	--	.030	3.40	--	2.60	.570
16...	1600	135	--	--	--	.030	1.50	--	2.70	.690
16...	1645	147	--	8.4	197	--	--	--	--	--
16...	1730	153	--	--	--	.050	1.90	--	2.70	.820
16...	1900	154	--	--	--	.050	1.80	--	2.51	.880
16...	1945	149	--	9.3	199	--	--	--	--	--
16...	2115	130	--	--	--	.050	1.00	--	2.14	.740
17...	0015	90	--	--	--	.050	1.10	--	1.64	.600
17...	0100	75	--	5.6	128	--	--	--	--	--
18...	0800	62	--	--	--	<.100	.800	--	1.67	.490
18...	1500	110	--	--	--	<.100	4.20	--	3.16	1.00
18...	1715	164	--	--	--	<.100	1.40	--	2.98	.650
18...	1845	154	--	--	--	<.100	1.40	--	2.70	.710
18...	2100	118	--	--	--	.090	1.70	--	1.79	.620
18...	2400	69	--	--	--	.280	1.50	--	1.27	.530
19...	1300	104	--	--	--	<.100	3.50	--	3.16	.960
19...	1430	167	--	--	--	<.100	2.70	--	3.16	.600
19...	1600	208	--	--	--	<.100	2.40	--	2.88	.540
19...	1815	200	--	--	--	<.100	1.40	--	2.14	.300
19...	1945	181	--	--	--	<.100	1.30	--	1.62	.340
20...	0845	16	--	--	--	.560	1.12	--	.670	.190
MAY										
01...	1630	5.6	72	3.0	136	.890	.050	--	.290	.115
30...	1300	15	64	5.0	144	.850	.260	2.4	.840	--
JUN										
05...	0900	19	--	--	--	2.20	.190	--	3.44	--
05...	0945	24	47	15	169	--	--	--	--	.410
05...	1200	34	--	--	--	1.60	.220	5.1	--	--
05...	1245	34	44	6.5	123	--	--	--	--	.240
05...	1915	20	--	--	--	1.30	.120	2.1	1.00	--
05...	2400	58	33	7.4	134	--	--	--	--	.480
06...	0100	59	--	--	--	2.00	.540	12	5.39	--
06...	0900	29	--	--	--	1.50	.270	2.0	.950	--
07...	1045	27	--	--	--	1.10	.240	2.8	1.56	--
07...	1245	29	--	--	--	.930	.200	2.5	1.39	--
07...	1545	24	46	1.9	113	--	--	--	--	.240
07...	1645	21	--	--	--	1.30	.170	2.2	.790	--
08...	0730	23	--	--	--	1.30	.160	.90	.430	.150
08...	0732	7.5	--	--	--	1.20	--	--	--	--
JUL										
10...	1900	3.6	72	4.0	162	1.47	.100	--	.440	--

Table 10. Water and bed-material analyses from Bruce Valley Creek near Pleasantville, 1980 water year - - Continued.

DATE	TIME	STREAM-FLOW, INSTAN-TANEOUS (CFS)	ALKA-LINITY FIELD (MG/L AS CACO3)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL)	SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L)	SOLIDS, RESIDUE AT 105 DEG. C, DIS-SOLVED (MG/L)	SOLIDS, DIS-SOLVED (TONS PER AC-FT)	SOLIDS, DIS-SOLVED (TONS PER DAY)	NITRO-GEN, NO2+NO3 DIS-SOLVED (MG/L AS N)	NITRO-GEN, AMMONIA DIS-SOLVED (MG/L AS N)	PHOS-PHORUS, TOTAL (MG/L AS P)
AUG , 1980											
08...	0345	23	39	3.7	--	104	--	--	--	--	--
08...	0430	51	--	--	--	--	--	--	.750	.310	5.30
08...	0515	75	35	2.8	--	99	--	--	--	--	--
08...	0600	90	--	--	--	--	--	--	.690	.410	4.00
08...	0645	88	39	2.8	--	99	--	--	--	--	--
08...	0900	47	--	--	--	--	--	--	.320	.110	1.14
08...	1030	40	--	--	--	--	--	--	.380	.100	1.27
08...	1330	44	--	--	--	--	--	--	.470	.170	1.57
08...	1415	40	24	1.9	--	108	--	--	--	--	--
08...	1500	37	--	--	--	--	--	--	.500	.190	1.95
09...	1300	41	62	2.8	--	128	--	--	1.00	.110	.890
09...	1413	40	61	4.6	--	151	--	--	--	--	--
30...	0745	49	--	--	--	--	--	--	.880	.600	4.09
30...	0830	56	48	7.4	293	--	.40	44	--	--	--
30...	1045	40	--	--	--	--	--	--	.830	.430	1.95
30...	1515	45	--	--	--	--	--	--	.690	.110	1.32
30...	2030	19	52	.90	98	--	.13	5.0	.500	.065	.860
SEP											
04...	0345	19	--	--	--	--	--	--	.750	.120	3.16
04...	0515	22	--	--	--	--	--	--	.930	.460	2.42
04...	0645	19	--	--	--	--	--	--	.840	.320	1.64
04...	0815	18	--	--	--	--	--	--	.700	.160	1.37
04...	0945	19	--	--	--	--	--	--	.640	.065	1.00
04...	1115	21	--	--	--	--	--	--	.660	.080	1.02
12...	0045	20	--	--	--	--	--	--	.870	.480	2.05
12...	0215	30	--	--	--	--	--	--	.760	.410	1.95
12...	0345	51	--	--	--	--	--	--	.790	.410	2.42
12...	0430	61	56	5.6	98	--	.13	16	--	--	--
12...	0515	65	--	--	--	--	--	--	.710	.270	2.05
12...	0945	65	--	--	--	--	--	--	.640	.200	1.24
12...	1430	40	--	--	--	--	--	--	.650	.100	.760
12...	1945	18	--	--	--	--	--	--	.720	.100	.600
12...	2030	17	42	<2.0	102	--	.14	4.7	--	--	--
18...	1300	5.3	--	--	--	--	--	--	1.20	.090	.320
19...	2115	59	--	--	--	--	--	--	.750	.065	4.09
19...	2245	262	--	--	--	--	--	--	.760	.300	5.77
20...	0015	200	--	--	--	--	--	--	.730	.190	3.07
20...	0145	117	--	--	--	--	--	--	.670	.330	2.79
20...	0315	132	--	--	--	--	--	--	.810	.130	1.95
20...	0445	121	--	--	--	--	--	--	.770	.070	1.58
20...	0615	91	--	--	121	--	.16	30	.700	.050	1.30
20...	0830	52	33	<2.0	130	--	.18	18	--	--	--
20...	1045	31	--	--	--	--	--	--	.700	.040	.760
20...	1345	18	--	--	--	--	--	--	.790	.060	.650
20...	2200	160	--	--	--	--	--	--	.570	.390	7.16
20...	2330	283	--	--	--	--	--	--	.530	.330	4.56
21...	0015	285	23	<2.0	214	--	.29	165	--	--	--
21...	1100	93	--	--	--	--	--	--	.520	.090	.880
21...	1215	72	--	--	--	--	--	--	.520	.090	1.20
21...	1645	36	--	--	--	--	--	--	.700	.090	.630
22...	0045	21	--	--	--	--	--	--	.900	.100	.480
22...	1245	17	--	--	--	--	--	--	1.00	.140	.390
26...	1045	11	--	--	--	--	--	--	1.13	.080	.320

DATE	TIME	STREAM-FLOW, INSTAN-TANEOUS (CFS)	ARSENIC TOTAL (UG/L AS AS)	CADMIUM TOTAL RECOV-ERABLE (UG/L AS CD)	COPPER, TOTAL RECOV-ERABLE (UG/L AS CU)	LEAD, TOTAL RECOV-ERABLE (UG/L AS PB)	ZINC, TOTAL RECOV-ERABLE (UG/L AS ZN)
SEP , 1980							
26...	1045	11	<10	0	3	<3	20

DATE	TIME	BED MAT. SIEVE DIAM. % FINER THAN .062 MM	BED MAT. SIEVE DIAM. % FINER THAN .125 MM	BED MAT. SIEVE DIAM. % FINER THAN .250 MM	BED MAT. SIEVE DIAM. % FINER THAN .500 MM	BED MAT. SIEVE DIAM. % FINER THAN 1.00 MM	BED MAT. SIEVE DIAM. % FINER THAN 2.00 MM	BED MAT. SIEVE DIAM. % FINER THAN 4.00 MM	BED MAT. SIEVE DIAM. % FINER THAN 8.00 MM	BED MAT. SIEVE DIAM. % FINER THAN 16.0 MM	BED MAT. SIEVE DIAM. % FINER THAN 32.0 MM
SEP , 1980											
23...	1030	1	1	6	40	88	92	94	96	98	100

E = estimated.

Table 11. Suspended-sediment discharge for Elk Creek near Independence, 1980 water year.

SEDIMENT DISCHARGE, SUSPENDED (TONS/DAY), WATER YEAR OCTOBER 1979 TO SEPTEMBER 1980
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	5.0	113	3.6	6.3	1.8	3.5	17	12	28	5.0	4.4	13
2	6.4	20	3.8	7.4	2.0	3.3	14	10	23	4.9	4.3	9.2
3	3.1	9.6	4.5	7.2	2.2	3.2	12	8.7	11	4.7	4.2	8.2
4	2.6	8.7	4.2	7.0	2.5	3.1	431	6.3	9.3	4.7	4.1	72
5	2.5	28	4.5	6.7	2.8	2.8	524	4.5	444	5.7	4.2	25
6	2.4	68	4.5	6.6	3.2	2.7	113	3.3	1500	5.0	3.8	15
7	2.4	18	5.0	6.4	3.2	2.7	123	2.4	404	4.9	161	11
8	2.4	12	4.6	6.1	2.9	2.5	165	1.8	59	4.9	370	7.6
9	2.4	10	4.4	5.8	2.7	2.5	113	1.9	17	4.9	46	12
10	2.4	8.9	4.3	5.6	2.5	2.3	29	2.1	9.7	5.1	14	13
11	2.3	8.1	4.5	7.8	2.4	2.3	24	2.6	7.2	6.6	17	11
12	1.9	7.5	4.3	6.4	2.2	2.2	36	2.6	5.7	6.8	10	338
13	2.0	6.9	4.3	5.7	2.1	2.0	30	2.8	5.3	6.7	8.2	44
14	1.9	6.3	4.5	5.5	1.9	1.9	18	3.0	5.2	6.7	6.9	20
15	2.1	5.8	4.5	5.3	1.8	1.8	17	3.1	5.0	6.8	6.2	16
16	2.1	5.9	4.7	515	2.3	638	15	3.2	4.9	16	5.9	15
17	2.2	6.1	4.7	313	2.8	696	14	3.3	5.0	9.4	7.6	11
18	2.2	5.8	4.7	30	3.4	1130	16	3.7	31	8.4	7.5	9.8
19	9.5	5.8	4.8	8.6	4.2	1850	16	4.0	2000	7.2	6.2	151
20	7.4	5.8	5.2	3.5	5.2	1110	17	3.8	55	6.3	6.3	1010
21	4.4	10	4.4	2.3	5.7	237	17	3.8	13	6.0	20	1060
22	414	25	3.7	1.5	6.1	48	18	3.7	7.2	5.5	9.9	128
23	180	15	4.7	1.0	6.0	14	16	3.8	6.4	4.1	7.1	50
24	37	10	4.0	1.0	5.0	11	17	4.3	6.0	3.8	6.7	30
25	20	7.4	3.1	1.1	4.4	39	16	4.8	5.6	4.0	6.8	22
26	16	5.7	2.8	1.2	4.4	90	15	5.4	5.3	4.3	21	18
27	14	4.3	3.1	1.2	4.0	115	14	6.0	5.0	4.2	36	14
28	13	3.3	3.5	1.3	3.9	43	13	7.2	6.1	4.2	15	11
29	11	3.4	4.1	1.3	3.6	42	12	8.5	5.2	4.5	10	9.9
30	10	3.5	4.7	1.4	---	59	12	64	5.1	4.5	227	8.1
31	22	---	5.6	1.5	---	30	---	29	---	4.6	46	---
TOTAL	806.6	447.8	133.3	980.7	97.2	6190.8	1894	225.6	4694.2	180.4	1103.3	3162.8

WTR YR 1980 TOTAL 19916.7

Table 12. Suspended-sediment discharge for Bruce Valley Creek near Pleasantville, 1980 water year.

SEDIMENT DISCHARGE, SUSPENDED (TONS/DAY), WATER YEAR OCTOBER 1979 TO SEPTEMBER 1980
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	.20	2.2	.31	.19	.09	.13	.65	.40	.71	.21	.02	.67
2	.30	.60	.28	.19	.11	.13	.58	.30	.63	.14	.02	.48
3	.20	.34	.27	.18	.12	.14	.48	.25	.54	.10	.02	.38
4	.10	.22	.26	.18	.13	.14	60	.20	.45	.11	.02	5.8
5	.10	32	.28	.18	.14	.15	48	.16	53	.15	.03	.19
6	.10	2.9	.25	.18	.16	.14	8.0	.14	61	.14	.02	.08
7	.10	.21	.29	.18	.16	.14	34	.11	21	.15	18	.08
8	.10	.22	.21	.17	.16	.14	41	.09	1.4	.16	57	.08
9	.10	.21	.19	.17	.15	.14	6.0	.10	.69	.18	.48	1.3
10	.10	.21	.20	.18	.15	.15	.71	.11	.52	.21	.21	.32
11	.09	.22	.18	.79	.15	.14	4.0	.15	.40	.30	.20	.89
12	.09	.25	.15	.43	.15	.14	6.0	.13	.31	.34	.19	28
13	.09	.25	.14	.25	.15	.14	.82	.16	.31	.32	.19	.95
14	.09	.25	.14	.17	.15	.14	.70	.15	.32	.32	.18	.46
15	.09	.29	.14	.11	.15	.20	.75	.15	.31	.34	.17	.31
16	.10	.34	.14	91	.15	87	.75	.16	.32	3.4	.17	.26
17	.10	.35	.14	6.6	.14	36	.85	.17	.34	.36	.27	.21
18	.11	.33	.14	.61	.14	121	.84	.25	147	.23	.25	.20
19	1.3	.36	.14	.39	.14	209	.76	.24	71	.17	.18	141
20	.62	.34	.14	.30	.14	29	.69	.22	.81	.12	.19	231
21	.50	.91	.14	.25	.18	7.0	.63	.24	.44	.09	1.1	283
22	69	2.4	.14	.21	.25	2.7	.58	.25	.32	.06	.11	2.6
23	5.9	.78	5.7	.18	.21	1.8	.49	.26	.24	.05	.07	1.6
24	1.1	.64	1.1	.16	.16	2.2	.41	.26	.18	.04	.08	1.4
25	.58	.56	.39	.14	.14	6.0	.40	.28	.14	.04	.09	1.3
26	.48	.50	.16	.12	.14	6.0	.39	.28	.11	.04	1.8	1.1
27	.46	.45	.15	.12	.14	4.0	.40	.29	.24	.03	2.6	.95
28	.42	.42	.18	.11	.14	3.0	.39	.32	4.6	.03	.19	.82
29	.37	.38	.18	.10	.14	4.0	.40	.45	.57	.03	.11	.81
30	.34	.33	.18	.09	---	3.0	.42	8.6	.30	.02	28	.71
31	15	---	.18	.08	---	2.0	---	1.4	---	.02	1.1	---
TOTAL	98.23	49.46	12.49	104.01	4.33	525.86	220.09	16.27	368.20	7.90	113.06	706.95

WTR YR 1980 TOTAL 2226.85

Table 13. Total organic nitrogen discharge, in pounds per day, for Elk Creek near Independence, 1980 water year.

NITROGEN, ORGANIC, TOTAL, POUNDS PER DAY, WATER YEAR OCTOBER 1979 TO SEPTEMBER 1980
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	170	415	140	88.0	110	84.0	350	151	180	180	110	509
2	200	297	140	88.0	110	84.0	260	160	170	180	100.0	335
3	110	255	140	88.0	100.0	98.0	260	140	110	160	100.0	241
4	92.0	232	130	88.0	98.0	98.0	2860	130	91.0	150	110	1640
5	88.0	289	140	88.0	98.0	98.0	5540	120	5530	260	120	450
6	81.0	455	140	88.0	98.0	93.0	2470	120	11300	170	99.0	270
7	81.0	275	170	88.0	93.0	93.0	1350	100.0	7170	160	2550	270
8	81.0	230	140	88.0	93.0	88.0	4250	100.0	885	140	4370	250
9	81.0	200	130	88.0	88.0	88.0	2440	96.0	790	140	440	340
10	81.0	180	120	88.0	88.0	84.0	750	100.0	620	130	280	270
11	85.0	170	130	370	88.0	84.0	670	160	450	152	300	211
12	85.0	170	110	230	88.0	84.0	1120	120	380	130	200	4280
13	81.0	160	110	170	84.0	79.0	750	120	330	120	180	294
14	78.0	150	110	160	84.0	79.0	410	130	310	120	160	482
15	81.0	138	110	140	84.0	79.0	370	110	260	130	130	393
16	81.0	160	110	10100	84.0	3450	320	96.0	250	250	130	353
17	78.0	170	100.0	7770	84.0	5620	320	91.0	240	150	260	244
18	75.0	170	100.0	1360	84.0	6250	380	110	310	130	270	223
19	150	170	100.0	490	84.0	11300	380	130	15000	130	180	1410
20	130	160	140	360	88.0	9210	370	100.0	1520	130	180	11100
21	110	200	110	300	110	3110	350	91.0	580	120	480	12700
22	8340	430	99.0	220	150	850	360	77.0	400	120	190	2240
23	4170	280	210	180	150	280	240	77.0	320	120	150	1850
24	1020	210	170	170	110	220	240	77.0	280	110	150	504
25	440	180	110	160	83.0	1020	210	73.0	250	120	160	397
26	300	170	110	160	88.0	1820	200	69.0	210	130	370	350
27	260	170	100.0	140	84.0	1260	190	69.0	200	110	770	309
28	230	160	99.0	130	84.0	730	170	73.0	350	100.0	360	281
29	180	150	95.0	120	84.0	810	170	86.0	220	130	250	276
30	160	140	92.0	120	---	850	170	1240	200	110	3860	255
31	210	---	88.0	120	---	530	---	320	---	110	1250	---
TOTAL	17409.0	6536.0	3793.0	23850.0	2771.0	48623.0	27920.0	4636.0	48906.0	4392.0	18259.0	42727.0

WTR YR 1980 TOTAL 249822.0

Table 14. Total nitrite plus nitrate nitrogen discharge, in pounds per day, for Elk Creek near Independence, 1980 water year.

NITROGEN, NITRITE PLUS NITRATE, POUNDS PER DAY, WATER YEAR OCTOBER 1979 TO SEPTEMBER 1980
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	707	949	649	559	394	358	596	484	570	454	386	444
2	750	714	649	559	394	358	547	473	560	446	378	444
3	597	643	649	559	387	380	547	460	490	431	378	485
4	567	614	642	559	380	380	1110	448	470	424	386	693
5	559	806	649	559	380	415	1420	435	1330	506	378	506
6	544	1320	649	559	380	372	904	429	2130	439	371	436
7	544	838	707	559	372	372	941	416	1430	431	1290	436
8	544	785	664	559	372	365	1240	416	781	416	945	426
9	544	743	634	559	365	365	1050	410	728	416	439	464
10	544	714	627	559	365	358	746	416	671	401	441	436
11	552	700	642	624	365	358	722	479	607	426	450	488
12	552	700	612	524	365	358	840	441	571	401	397	1690
13	544	693	605	467	358	350	746	441	549	394	382	785
14	536	678	605	452	358	350	626	440	535	394	372	638
15	552	670	605	438	358	350	608	422	506	401	352	616
16	552	693	605	3770	358	329	584	410	498	498	347	682
17	536	707	590	2500	358	132	584	403	491	424	431	573
18	528	700	590	826	358	161	614	429	535	409	436	640
19	671	700	590	694	358	311	614	448	2300	409	382	743
20	634	693	664	617	365	272	608	416	900	401	382	2830
21	605	743	605	574	394	110	596	403	657	394	516	3420
22	2070	968	582	510	445	58.0	602	384	586	394	392	1640
23	2780	833	757	481	445	40.0	535	384	542	394	367	1350
24	1300	757	700	467	394	37.0	535	384	520	386	362	1280
25	975	721	612	452	358	816	516	378	498	394	372	1130
26	854	707	597	452	365	967	504	371	476	401	479	945
27	813	700	590	438	358	869	498	371	469	386	596	792
28	778	685	582	423	358	740	485	378	557	378	474	684
29	721	678	574	409	358	763	485	397	483	401	426	638
30	693	664	567	409	---	775	485	635	469	386	1030	624
31	757	---	559	409	---	674	---	17.0	---	386	616	---
TOTAL	23903.0	22516.0	19352.0	21526.0	10865.0	12543.0	20888.0	12818.0	21909.0	12821.0	14953.0	26958.0

WTR YR 1980 TOTAL 221052.0

Table 15. Total ammonia nitrogen discharge, in pounds per day, for Elk Creek near Independence, 1980 water year.

NITROGEN, AMMONIA, TOTAL, POUNDS PER DAY, WATER YEAR OCTOBER 1979 TO SEPTEMBER 1980
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	23.0	27.0	19.0	14.0	32.0	24.0	74.0	8.0	11.0	16.0	12.0	13.0
2	26.0	21.0	19.0	14.0	32.0	24.0	74.0	9.0	11.0	16.0	12.0	10.0
3	16.0	19.0	19.0	14.0	30.0	28.0	74.0	8.0	8.0	15.0	12.0	8.0
4	15.0	19.0	19.0	14.0	28.0	28.0	223	7.0	7.0	14.0	12.0	26.0
5	14.0	25.0	19.0	14.0	28.0	26.0	1040	6.0	143	20.0	12.0	14.0
6	14.0	42.0	19.0	14.0	28.0	27.0	526	6.0	244	15.0	11.0	9.0
7	14.0	27.0	23.0	14.0	27.0	27.0	424	5.0	128	15.0	105	9.0
8	14.0	28.0	20.0	14.0	27.0	25.0	880	5.0	50.0	14.0	154	8.0
9	14.0	25.0	19.0	14.0	25.0	25.0	405	5.0	39.0	14.0	38.0	11.0
10	14.0	23.0	18.0	14.0	25.0	24.0	78.0	5.0	33.0	13.0	9.0	9.0
11	14.0	22.0	19.0	124	25.0	24.0	67.0	9.0	28.0	13.0	10.0	8.0
12	14.0	22.0	17.0	74.0	25.0	24.0	137	6.0	25.0	13.0	6.0	305
13	14.0	22.0	17.0	52.0	24.0	22.0	78.0	6.0	23.0	12.0	6.0	42.0
14	13.0	21.0	17.0	48.0	24.0	22.0	34.0	7.0	22.0	12.0	5.0	24.0
15	14.0	24.0	17.0	43.0	24.0	22.0	29.0	5.0	20.0	13.0	4.0	18.0
16	14.0	22.0	17.0	4130	24.0	1170	24.0	5.0	19.0	19.0	4.0	20.0
17	13.0	23.0	16.0	4100	24.0	2690	24.0	4.0	19.0	14.0	8.0	11.0
18	13.0	22.0	16.0	874	24.0	2780	31.0	6.0	22.0	13.0	9.0	21.0
19	21.0	22.0	16.0	171	24.0	5800	31.0	7.0	380	13.0	6.0	26.0
20	19.0	22.0	20.0	120	25.0	5000	29.0	5.0	58.0	13.0	6.0	245
21	17.0	25.0	16.0	97.0	32.0	640	27.0	4.0	32.0	12.0	15.0	513
22	278	42.0	16.0	68.0	45.0	163	28.0	3.0	26.0	12.0	6.0	123
23	271	32.0	26.0	57.0	45.0	78.0	16.0	3.0	22.0	12.0	5.0	100.0
24	53.0	26.0	22.0	52.0	32.0	66.0	16.0	3.0	21.0	12.0	5.0	77.0
25	43.0	24.0	17.0	48.0	24.0	183	13.0	3.0	19.0	12.0	5.0	59.0
26	33.0	23.0	16.0	48.0	25.0	271	12.0	3.0	18.0	13.0	12.0	44.0
27	30.0	22.0	16.0	43.0	24.0	212	11.0	3.0	17.0	12.0	25.0	33.0
28	28.0	22.0	16.0	39.0	24.0	146	10.0	3.0	24.0	12.0	11.0	26.0
29	24.0	21.0	15.0	35.0	24.0	158	10.0	4.0	18.0	13.0	8.0	21.0
30	22.0	20.0	15.0	35.0	---	163	10.0	112	17.0	12.0	147	17.0
31	26.0	---	14.0	35.0	---	119	---	17.0	---	12.0	23.0	---
TOTAL	1138.0	735.0	555.0	10433.0	800.0	20011.0	4435.0	282.0	1504.0	421.0	703.0	1850.0

WTR YR 1980 TOTAL 42867.0

Table 16. Total phosphorus discharge, in pounds per day, for Elk Creek near Independence, 1980 water year.

PHOSPHORUS, TOTAL, POUNDS PER DAY, WATER YEAR OCTOBER 1979 TO SEPTEMBER 1980
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	123	1300	98.0	66.0	84.0	69.0	174	106	171	149	98.0	258
2	144	385	98.0	66.0	84.0	69.0	174	131	164	142	93.0	207
3	78.0	216	98.0	66.0	80.0	77.0	174	122	112	130	93.0	181
4	68.0	129	95.0	66.0	77.0	70.0	1770	113	92.0	125	98.0	859
5	66.0	354	98.0	66.0	77.0	79.0	2330	105	4060	197	103	341
6	61.0	892	98.0	66.0	77.0	76.0	720	101	5900	136	88.0	182
7	61.0	333	123	66.0	74.0	76.0	542	94.0	3270	130	1610	182
8	61.0	162	104	66.0	74.0	74.0	1600	94.0	474	119	2790	170
9	61.0	140	92.0	66.0	72.0	74.0	1050	90.0	506	119	561	220
10	61.0	126	89.0	66.0	72.0	71.0	427	94.0	411	108	231	182
11	63.0	119	95.0	208	72.0	71.0	392	135	316	120	246	193
12	63.0	119	83.0	147	72.0	71.0	581	109	270	108	171	2940
13	61.0	116	81.0	117	69.0	69.0	427	109	244	103	153	662
14	59.0	110	81.0	110	69.0	69.0	271	114	228	103	142	287
15	61.0	108	81.0	103	69.0	69.0	251	98.0	197	108	121	246
16	61.0	116	81.0	4740	69.0	2470	226	90.0	189	189	116	244
17	59.0	123	76.0	4230	69.0	3110	226	87.0	182	125	217	185
18	56.0	119	76.0	590	69.0	1950	258	101	228	113	224	187
19	107	119	76.0	275	69.0	4090	258	113	9000	113	153	756
20	92.0	116	104	203	72.0	3850	251	94.0	879	108	153	7160
21	81.0	140	81.0	177	84.0	897	238	87.0	388	103	364	7740
22	4550	284	73.0	139	106	319	245	76.0	288	103	165	1460
23	2510	190	147	124	106	181	180	76.0	236	103	136	605
24	542	147	119	117	84.0	161	180	76.0	212	98.0	131	382
25	275	129	83.0	110	69.0	348	164	73.0	189	103	142	343
26	203	123	78.0	110	72.0	467	154	70.0	168	108	293	273
27	178	119	76.0	103	69.0	388	149	70.0	162	98.0	554	214
28	158	113	73.0	96.0	69.0	294	140	73.0	253	93.0	285	179
29	129	110	70.0	90.0	69.0	310	140	83.0	175	108	210	173
30	116	104	68.0	90.0	---	319	140	679	162	98.0	2200	153
31	318	---	66.0	90.0	---	250	---	293	---	98.0	645	---
TOTAL	10526.0	6661.0	2761.0	12629.0	2198.0	20488.0	13832.0	3756.0	29126.0	3658.0	12586.0	27164.0

WTR YR 1980 TOTAL 145385.0

Table 17. Total organic nitrogen discharge, in pounds per day, for Bruce Valley Creek near Pleasantville, 1980 water year.

NITROGEN, ORGANIC, TOTAL, POUNDS PER DAY, WATER YEAR OCTOBER 1979 TO SEPTEMBER 1980
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	11.0	28.0	10.0	7.0	7.0	7.0	26.0	16.0	21.0	12.0	5.0	37.0
2	14.0	13.0	9.0	7.0	7.0	6.0	26.0	12.0	20.0	11.0	5.0	28.0
3	8.0	10.0	10.0	6.0	6.0	6.0	21.0	12.0	16.0	11.0	6.0	25.0
4	6.0	9.0	11.0	6.0	6.0	6.0	243	11.0	14.0	11.0	5.0	199
5	6.0	62.0	13.0	6.0	6.0	7.0	205	11.0	464	17.0	6.0	30.0
6	6.0	53.0	13.0	6.0	6.0	6.0	62.0	11.0	566	10.0	5.0	22.0
7	5.0	13.0	21.0	6.0	6.0	6.0	138	10.0	221	10.0	276	25.0
8	5.0	13.0	13.0	6.0	6.0	6.0	187	10.0	29.0	9.0	684	23.0
9	5.0	10.0	12.0	6.0	6.0	6.0	52.0	11.0	22.0	9.0	48.0	47.0
10	6.0	9.0	13.0	6.0	6.0	7.0	29.0	11.0	17.0	10.0	22.0	22.0
11	6.0	9.0	13.0	16.0	6.0	6.0	43.0	19.0	15.0	8.0	21.0	64.0
12	6.0	10.0	9.0	8.0	6.0	6.0	52.0	12.0	13.0	8.0	18.0	503
13	5.0	9.0	8.0	6.0	6.0	7.0	32.0	15.0	13.0	6.0	17.0	45.0
14	5.0	8.0	8.0	6.0	6.0	6.0	22.0	13.0	12.0	7.0	17.0	27.0
15	5.0	9.0	8.0	5.0	6.0	8.0	24.0	11.0	10.0	8.0	14.0	23.0
16	5.0	11.0	8.0	1520	6.0	2550	22.0	10.0	9.0	31.0	14.0	27.0
17	5.0	12.0	7.0	223	6.0	1120	28.0	11.0	9.0	7.0	32.0	22.0
18	5.0	11.0	7.0	46.0	6.0	2500	30.0	19.0	606	7.0	28.0	23.0
19	19.0	13.0	8.0	15.0	6.0	2460	30.0	16.0	2570	6.0	17.0	1250
20	8.0	12.0	8.0	12.0	6.0	409	30.0	12.0	42.0	6.0	17.0	2050
21	10.0	18.0	8.0	11.0	9.0	72.0	30.0	12.0	27.0	6.0	31.0	2320
22	1360	37.0	8.0	10.0	19.0	20.0	30.0	12.0	20.0	5.0	16.0	78.0
23	295	30.0	37.0	9.0	13.0	12.0	26.0	11.0	18.0	5.0	15.0	45.0
24	45.0	21.0	15.0	8.0	8.0	24.0	21.0	10.0	16.0	5.0	15.0	40.0
25	15.0	17.0	9.0	8.0	6.0	96.0	19.0	9.0	15.0	6.0	17.0	39.0
26	12.0	16.0	8.0	8.0	6.0	96.0	19.0	8.0	15.0	6.0	47.0	34.0
27	13.0	14.0	8.0	7.0	6.0	62.0	18.0	8.0	14.0	5.0	78.0	29.0
28	12.0	13.0	8.0	7.0	6.0	52.0	17.0	8.0	47.0	5.0	30.0	25.0
29	10.0	12.0	7.0	7.0	6.0	72.0	17.0	12.0	14.0	5.0	22.0	26.0
30	10.0	11.0	7.0	7.0	---	52.0	18.0	136	13.0	5.0	476	23.0
31	45.0	---	7.0	7.0	---	37.0	---	46.0	---	5.0	58.0	---
TOTAL	1968.0	513.0	331.0	2008.0	201.0	9730.0	1517.0	525.0	4888.0	262.0	2062.0	7151.0

WTR YR 1980 TOTAL 31156.0

Table 18. Total nitrite plus nitrate nitrogen discharge, in pounds per day, for Bruce Valley Creek near Pleasantville, 1980 water year.

NITROGEN, NITRITE PLUS NITRATE, POUNDS PER DAY, WATER YEAR OCTOBER 1979 TO SEPTEMBER 1980
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	46.0	64.0	45.0	38.0	32.0	30.0	35.0	28.0	30.0	22.0	14.0	35.0
2	50.0	49.0	43.0	38.0	32.0	30.0	35.0	25.0	29.0	20.0	14.0	30.0
3	40.0	44.0	44.0	37.0	31.0	31.0	32.0	25.0	25.0	20.0	14.0	28.0
4	37.0	43.0	45.0	37.0	31.0	33.0	84.0	25.0	24.0	20.0	14.0	60.0
5	36.0	86.0	49.0	37.0	31.0	32.0	78.0	24.0	163	27.0	15.0	30.0
6	36.0	82.0	48.0	37.0	31.0	31.0	49.0	24.0	220	20.0	13.0	26.0
7	35.0	49.0	58.0	37.0	31.0	31.0	67.0	23.0	103	20.0	64.0	27.0
8	35.0	48.0	48.0	36.0	30.0	31.0	75.0	24.0	47.0	18.0	99.0	26.0
9	35.0	44.0	47.0	36.0	30.0	31.0	46.0	24.0	31.0	18.0	27.0	37.0
10	36.0	43.0	48.0	37.0	31.0	32.0	36.0	25.0	27.0	28.0	22.0	26.0
11	37.0	42.0	48.0	52.0	31.0	31.0	42.0	31.0	25.0	17.0	21.0	34.0
12	36.0	43.0	42.0	41.0	31.0	31.0	46.0	26.0	23.0	17.0	20.0	149
13	35.0	42.0	40.0	37.0	31.0	32.0	38.0	28.0	23.0	15.0	19.0	45.0
14	34.0	40.0	40.0	37.0	31.0	31.0	33.0	26.0	22.0	16.0	19.0	38.0
15	34.0	42.0	40.0	39.0	31.0	34.0	33.0	25.0	20.0	17.0	18.0	35.0
16	34.0	47.0	40.0	335	31.0	25.0	32.0	24.0	19.0	37.0	18.0	38.0
17	34.0	47.0	39.0	100.0	31.0	15.0	36.0	24.0	19.0	17.0	26.0	34.0
18	34.0	46.0	39.0	52.0	31.0	44.0	37.0	31.0	197	16.0	24.0	34.0
19	56.0	48.0	40.0	44.0	31.0	62.0	37.0	29.0	442	15.0	19.0	129
20	41.0	47.0	40.0	40.0	31.0	85.0	37.0	26.0	44.0	15.0	19.0	274
21	44.0	59.0	40.0	39.0	37.0	52.0	37.0	26.0	34.0	15.0	25.0	368
22	278	72.0	40.0	37.0	49.0	31.0	37.0	25.0	30.0	14.0	19.0	90.0
23	167	66.0	72.0	36.0	42.0	25.0	34.0	25.0	27.0	13.0	19.0	66.0
24	77.0	58.0	51.0	35.0	34.0	33.0	32.0	23.0	26.0	13.0	19.0	64.0
25	51.0	54.0	42.0	34.0	31.0	58.0	31.0	23.0	25.0	14.0	19.0	67.0
26	47.0	53.0	41.0	34.0	31.0	58.0	31.0	22.0	25.0	15.0	30.0	62.0
27	49.0	50.0	40.0	33.0	30.0	49.0	30.0	21.0	24.0	13.0	37.0	57.0
28	47.0	49.0	40.0	33.0	30.0	46.0	29.0	22.0	47.0	14.0	24.0	54.0
29	45.0	47.0	38.0	32.0	30.0	52.0	29.0	25.0	24.0	14.0	22.0	59.0
30	43.0	46.0	38.0	32.0	---	46.0	30.0	68.0	23.0	13.0	110	57.0
31	77.0	---	38.0	32.0	---	40.0	---	47.0	---	14.0	28.0	---
TOTAL	1686.0	1550.0	1363.0	1524.0	934.0	1192.0	1228.0	844.0	1818.0	547.0	851.0	2079.0

WTR YR 1980 TOTAL 15616.0

Table 19. Total ammonia nitrogen discharge, in pounds per day, for Bruce Valley Creek near Pleasantville, 1980 water year.

NITROGEN, AMMONIA, TOTAL, POUNDS PER DAY, WATER YEAR OCTOBER 1979 TO SEPTEMBER 1980
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	3.0	5.0	3.0	2.0	3.0	3.0	10.0	2.0	2.0	1.00	2.0	3.0
2	3.0	3.0	2.0	2.0	3.0	3.0	10.0	2.0	2.0	1.00	2.0	2.0
3	2.0	3.0	3.0	2.0	3.0	3.0	8.0	2.0	2.0	1.00	2.0	3.0
4	2.0	2.0	3.0	2.0	3.0	3.0	82.0	2.0	1.0	1.00	2.0	11.0
5	2.0	7.0	3.0	2.0	3.0	3.0	70.0	2.0	24.0	2.00	2.0	3.0
6	2.0	7.0	3.0	2.0	3.0	3.0	23.0	2.0	56.0	1.00	1.0	2.0
7	2.0	3.0	4.0	2.0	3.0	3.0	48.0	2.0	23.0	1.00	18.0	3.0
8	2.0	3.0	3.0	2.0	3.0	3.0	64.0	2.0	6.0	.90	38.0	2.0
9	2.0	3.0	3.0	2.0	3.0	3.0	20.0	2.0	2.0	.90	4.0	4.0
10	2.0	2.0	3.0	2.0	3.0	3.0	11.0	2.0	2.0	2.00	2.0	2.0
11	2.0	2.0	3.0	3.0	3.0	3.0	16.0	3.0	2.0	2.00	2.0	8.0
12	2.0	3.0	2.0	2.0	3.0	3.0	20.0	2.0	1.0	2.00	2.0	46.0
13	2.0	2.0	2.0	2.0	3.0	3.0	12.0	2.0	1.0	2.00	2.0	6.0
14	2.0	2.0	2.0	2.0	3.0	3.0	9.0	2.0	1.0	2.00	2.0	5.0
15	2.0	2.0	2.0	4.0	3.0	4.0	9.0	2.0	1.0	2.00	2.0	4.0
16	2.0	3.0	2.0	529	3.0	588	4.0	2.0	1.0	4.00	2.0	5.0
17	2.0	3.0	2.0	81.0	3.0	214	5.0	2.0	1.0	2.00	3.0	4.0
18	2.0	3.0	2.0	11.0	3.0	642	5.0	3.0	50.0	2.00	3.0	3.0
19	4.0	3.0	2.0	6.0	3.0	910	5.0	3.0	193	2.00	2.0	31.0
20	2.0	3.0	2.0	5.0	3.0	204	5.0	2.0	4.0	2.00	2.0	80.0
21	8.0	4.0	2.0	5.0	4.0	27.0	5.0	2.0	3.0	2.00	3.0	120
22	56.0	6.0	2.0	4.0	8.0	8.0	5.0	2.0	2.0	2.00	2.0	12.0
23	13.0	5.0	6.0	4.0	6.0	5.0	4.0	2.0	2.0	1.00	2.0	9.0
24	6.0	4.0	3.0	4.0	3.0	9.0	4.0	2.0	2.0	1.00	2.0	8.0
25	3.0	4.0	2.0	4.0	3.0	35.0	3.0	1.0	2.0	2.00	2.0	8.0
26	3.0	3.0	2.0	3.0	3.0	35.0	3.0	1.0	2.0	2.00	4.0	4.0
27	3.0	3.0	2.0	3.0	3.0	23.0	3.0	1.0	1.0	1.00	6.0	7.0
28	3.0	3.0	2.0	3.0	3.0	20.0	3.0	1.0	4.0	2.00	3.0	6.0
29	3.0	3.0	2.0	3.0	3.0	27.0	3.0	2.0	1.0	2.00	2.0	7.0
30	3.0	3.0	2.0	3.0	---	20.0	3.0	11.0	1.0	1.00	37.0	6.0
31	6.0	---	2.0	3.0	---	14.0	---	4.0	---	2.00	5.0	---
TOTAL	151.0	102.0	78.0	704.0	96.0	2827.0	472.0	72.0	395.0	51.80	163.0	414.0

WTR YR 1980 TOTAL 5525.80

Table 20. Total phosphorus discharge, in pounds per day, for Bruce Valley Creek near Pleasantville, 1980 water year.

PHOSPHORUS, TOTAL, POUNDS PER DAY, WATER YEAR OCTOBER 1979 TO SEPTEMBER 1980
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	13.00	26.00	12.00	8.00	6.00	5.00	19.0	9.00	10.00	6.00	2.00	10.00
2	15.00	15.00	11.00	8.00	6.00	5.00	19.0	9.00	10.00	5.00	2.00	7.00
3	9.00	12.00	12.00	8.00	5.00	5.00	15.0	9.00	8.00	5.00	3.00	6.00
4	8.00	11.00	12.00	8.00	5.00	5.00	127	9.00	8.00	5.00	2.00	103
5	8.00	51.00	15.00	8.00	5.00	6.00	110	8.00	283	8.00	3.00	8.00
6	7.00	45.00	14.00	8.00	5.00	5.00	39.0	8.00	298	5.00	2.00	6.00
7	7.00	15.00	21.00	8.00	5.00	5.00	78.0	7.00	114	5.00	161	7.00
8	7.00	14.00	14.00	8.00	5.00	5.00	101	8.00	18.00	4.00	412	6.00
9	7.00	12.00	13.00	8.00	5.00	5.00	33.0	8.00	12.00	4.00	30.00	13.00
10	7.00	11.00	14.00	8.00	5.00	6.00	20.0	9.00	8.00	4.00	5.00	6.00
11	8.00	11.00	14.00	17.00	5.00	5.00	28.0	16.00	7.00	4.00	5.00	11.00
12	7.00	11.00	10.00	10.00	5.00	5.00	33.0	10.00	6.00	4.00	4.00	273
13	7.00	10.00	10.00	8.00	5.00	6.00	22.0	12.00	6.00	3.00	4.00	26.00
14	7.00	9.00	10.00	8.00	5.00	5.00	16.0	10.00	6.00	3.00	4.00	14.00
15	7.00	11.00	9.00	8.00	5.00	7.00	17.0	8.00	5.00	4.00	3.00	12.00
16	6.00	8.00	9.00	674	5.00	802	16.0	8.00	5.00	15.00	3.00	14.00
17	6.00	14.00	9.00	118	5.00	347	19.0	8.00	5.00	4.00	8.00	11.00
18	7.00	13.00	9.00	22.00	5.00	913	21.0	16.00	335	3.00	7.00	9.00
19	19.00	14.00	10.00	12.00	5.00	1060	21.0	13.00	1490	3.00	4.00	672
20	10.00	13.00	10.00	9.00	5.00	219	21.0	10.00	21.00	3.00	4.00	1180
21	11.00	19.00	10.00	9.00	8.00	69.00	21.0	10.00	13.00	3.00	8.00	1430
22	649	33.00	10.00	8.00	14.00	15.00	21.0	9.00	10.00	2.00	3.00	39.00
23	147	28.00	33.00	8.00	11.00	9.00	18.0	8.00	9.00	2.00	3.00	24.00
24	12.00	21.00	16.00	7.00	6.00	17.00	15.0	7.00	8.00	2.00	3.00	22.00
25	16.00	18.00	11.00	7.00	5.00	57.00	14.0	7.00	7.00	3.00	4.00	21.00
26	14.00	17.00	10.00	6.00	5.00	57.00	14.0	6.00	7.00	3.00	14.00	17.00
27	14.00	15.00	10.00	6.00	5.00	39.00	14.0	6.00	7.00	2.00	28.00	16.00
28	13.00	15.00	9.00	6.00	5.00	33.00	13.0	6.00	24.00	2.00	7.00	14.00
29	12.00	13.00	9.00	6.00	5.00	45.00	13.0	9.00	7.00	2.00	5.00	15.00
30	11.00	13.00	9.00	6.00	---	33.00	13.0	54.00	6.00	2.00	256	14.00
31	39.00	---	8.00	6.00	---	25.00	---	23.00	---	2.00	17.00	---
TOTAL	1110.00	518.00	373.00	1041.00	166.00	3820.00	931.0	340.00	2753.00	122.00	1016.00	4006.00

WTR YR 1980 TOTAL 16196.00

Table 21. Water temperatures for Elk Creek near Independence, 1980 water year.

TEMPERATURE, WATER (DEG. C), WATER YEAR OCTOBER 1979 TO SEPTEMBER 1980

DAY	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN
		OCTOBER			NOVEMBER			DECEMBER			JANUARY	
1				---	---	---	1.0	.5	.5	---	---	---
2				---	---	---	.5	.5	.5	---	---	---
3				---	---	---	2.0	.5	1.0	---	---	---
4				---	---	---	4.0	1.0	3.0	---	---	---
5				---	---	---	5.5	3.5	4.5	---	---	---
6				---	---	---	4.5	1.5	3.5	---	---	---
7				---	---	---	4.5	1.0	3.5	---	---	---
8				---	---	---	1.0	.5	1.0	---	---	---
9				---	---	---	4.5	.5	2.5	---	---	---
10				---	---	---	6.0	2.0	4.0	---	---	---
11				---	---	---	5.0	.5	3.5	---	---	---
12				---	---	---	.5	.5	.5	---	---	---
13				---	---	---	.5	.5	.5	---	---	---
14				---	---	---	1.0	.5	.5	---	---	---
15				6.0	5.5	5.5	4.0	.5	2.0	---	---	---
16				6.5	5.0	5.5	.5	.5	.5	1.0	.5	.5
17				8.0	4.0	5.5	---	---	---	1.0	.5	.5
18				8.5	4.0	6.0	---	---	---	2.0	.5	1.0
19				10.5	7.0	8.5	---	---	---	3.5	1.0	1.5
20				8.0	6.5	7.0	---	---	---	2.5	.5	1.0
21				7.0	5.0	6.0	---	---	---	2.0	.5	1.0
22				6.0	5.0	5.0	---	---	---	2.0	.5	1.0
23				5.5	4.5	5.5	---	---	---	.5	.5	.5
24				6.0	4.0	4.5	---	---	---	.5	.5	.5
25				5.5	3.0	4.5	---	---	---	.5	.5	.5
26				6.0	4.0	5.0	---	---	---	.5	.5	.5
27				5.5	3.0	4.0	---	---	---	---	---	---
28				3.5	1.5	2.5	---	---	---	---	---	---
29				3.0	.5	1.5	---	---	---	---	---	---
30				2.5	.5	1.5	---	---	---	---	---	---
31				---	---	---	---	---	---	---	---	---
MONTH				10.5	.5	5.0	6.0	.5	2.0	3.5	.5	1.0

TEMPERATURE, WATER (DEG. C), WATER YEAR OCTOBER 1979 TO SEPTEMBER 1980

DAY	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN
		FEBRUARY			MARCH			APRIL			MAY	
1				---	---	---	7.5	3.5	5.5	20.0	10.0	14.5
2				---	---	---	12.0	3.5	7.0	20.5	12.0	16.5
3				---	---	---	8.0	2.5	4.5	21.0	10.5	15.5
4				2.5	.0	1.0	10.0	1.5	5.0	20.5	11.0	15.5
5				2.5	.0	.5	8.0	.5	4.0	19.5	11.5	15.5
6				.0	.0	.0	9.0	4.5	6.5	17.0	9.5	13.0
7				.0	.0	.0	8.5	6.0	7.0	10.0	7.0	9.0
8				1.5	.0	.0	7.0	3.5	5.5	13.0	6.5	9.5
9				3.0	.0	.5	3.5	.5	2.0	17.5	7.5	12.0
10				3.5	.0	1.0	7.0	2.0	4.0	12.0	10.0	11.0
11				1.0	.0	.0	9.0	2.5	5.5	16.0	8.0	11.5
12				3.5	.0	1.0	8.0	3.5	5.5	17.0	8.5	12.5
13				4.5	.0	1.5	5.5	3.5	4.5	13.0	9.5	10.5
14				6.5	.0	2.5	7.0	3.0	4.5	13.5	8.5	11.0
15				7.5	.0	3.5	10.5	4.0	6.5	19.0	8.0	13.0
16				4.0	.0	1.5	12.5	4.5	8.0	15.5	9.0	12.5
17				1.5	.0	.5	15.0	7.5	11.0	12.5	11.0	11.5
18				2.5	.0	1.0	16.0	7.5	11.5	13.0	10.5	11.5
19				2.5	.5	1.0	17.0	9.0	12.5	20.0	10.5	15.0
20				4.0	.5	1.5	17.0	8.5	12.5	22.0	11.5	16.5
21				4.0	.0	1.5	19.0	10.0	13.5	23.0	12.0	17.0
22				2.0	.0	1.0	19.5	11.5	15.0	23.5	13.0	18.0
23				5.0	1.0	3.0	17.0	9.5	13.0	23.5	13.0	18.0
24				7.0	2.0	4.0	13.5	6.0	10.0	24.0	14.0	18.5
25				7.0	1.0	3.5	13.5	8.0	10.0	24.5	14.5	19.0
26				7.0	1.0	4.0	11.5	6.5	9.0	22.5	14.5	18.0
27				5.0	2.5	3.5	17.0	8.0	11.0	24.0	14.0	18.5
28				5.5	3.0	4.0	16.0	7.5	11.5	26.0	15.5	20.5
29				9.0	.0	5.0	13.5	9.5	11.0	22.0	17.0	19.0
30				9.0	.0	5.5	17.0	9.5	12.0	20.0	16.5	18.0
31				10.0	3.5	6.5	---	---	---	22.0	15.5	18.5
MONTH				10.0	.0	2.0	19.5	.5	8.5	26.0	6.5	15.0

Table 21. Water temperatures for Elk Creek near Independence, 1980 water year - - Continued.

	TEMPERATURE, WATER (DEG. C), WATER YEAR OCTOBER 1979 TO SEPTEMBER 1980											
DAY	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN
		JUNE			JULY			AUGUST			SEPTEMBER	
1	19.5	15.0	17.0	24.0	15.0	19.0	24.5	16.5	20.5	19.0	15.5	16.5
2	18.0	14.0	16.0	24.0	14.0	18.5	23.0	17.0	19.5	19.0	13.5	16.0
3	23.5	13.0	17.5	23.5	14.0	18.5	24.5	15.0	19.0	22.0	14.0	17.5
4	22.0	14.0	17.5	24.0	16.0	19.5	19.0	16.5	18.0	20.0	17.0	18.5
5	17.0	15.0	16.0	24.0	17.0	20.0	24.0	14.5	18.5	20.0	14.0	17.0
6	20.0	16.0	18.0	24.0	15.0	19.5	24.0	15.0	19.5	19.0	13.0	16.0
7	19.0	16.0	18.0	25.0	18.0	21.5	20.5	18.0	19.5	21.0	15.0	17.5
8	18.0	13.0	15.5	24.5	16.5	20.5	21.5	19.0	20.0	21.5	15.0	18.0
9	17.5	12.5	15.0	25.5	17.0	21.0	20.5	17.5	19.5	19.5	15.5	17.5
10	19.5	11.5	15.0	26.5	17.0	21.5	19.5	16.0	17.5	18.5	12.0	15.0
11	20.5	11.0	15.5	24.5	18.0	21.5	22.0	16.5	18.5	14.0	11.5	12.5
12	18.0	12.5	15.5	26.5	19.5	22.0	22.0	15.0	18.0	15.0	12.5	14.0
13	20.5	14.5	17.5	23.5	16.5	20.0	19.5	16.0	17.5	17.0	15.0	16.0
14	24.5	15.5	19.5	25.0	19.0	21.0	22.0	15.0	18.0	15.5	13.0	14.0
15	19.5	15.0	17.0	26.5	18.0	22.0	22.0	14.0	17.5	14.5	12.5	13.5
16	21.5	11.5	16.0	25.5	18.0	21.0	16.5	13.5	14.5	13.5	11.5	13.0
17	22.0	12.0	17.0	25.5	16.5	21.0	16.0	13.0	14.5	13.5	9.0	11.0
18	22.0	14.5	17.5	23.5	18.0	20.5	22.5	13.0	17.5	13.0	11.0	12.0
19	17.5	14.0	16.0	25.5	16.5	20.5	24.5	16.5	20.0	17.5	9.5	13.0
20	19.5	15.0	17.0	21.5	18.0	19.5	22.5	18.0	19.5	17.0	15.5	16.5
21	22.5	14.5	18.0	24.0	16.0	19.5	23.0	17.5	19.5	16.5	15.0	15.5
22	22.5	16.0	19.0	23.5	16.0	19.0	23.0	14.5	18.5	15.0	12.5	14.0
23	24.0	15.5	19.5	24.0	13.5	18.5	19.5	14.5	17.5	13.5	10.5	12.0
24	22.5	16.0	19.5	25.0	14.5	19.5	19.5	15.5	17.5	14.5	11.0	12.5
25	24.5	16.0	20.0	20.5	18.0	19.0	22.0	16.0	18.5	12.5	11.0	11.5
26	26.0	18.0	21.5	22.0	15.5	18.0	19.0	17.5	18.0	12.0	9.0	10.5
27	19.5	16.0	17.0	24.0	13.5	18.5	17.5	16.0	17.0	14.5	9.5	11.5
28	23.5	14.0	18.0	23.0	15.0	18.5	17.5	15.5	16.5	11.5	9.5	10.5
29	17.5	14.5	16.0	25.0	15.5	20.0	22.5	15.5	18.5	15.0	9.5	12.5
30	20.5	12.0	16.5	23.0	16.5	19.5	19.0	17.0	18.0	16.5	12.5	14.0
31	---	---	---	25.5	16.5	20.5	18.0	16.0	17.0	---	---	---
MONTH	26.0	11.0	17.5	26.5	13.5	20.0	24.5	13.0	18.0	22.0	9.0	14.5
YEAR	26.5	.0	12.0									

NOTE: NUMBER OF MISSING DAYS OF RECORD EXCEEDED 20% OF YEAR

Table 22. Water temperatures for Bruce Valley Creek near Pleasantville, 1980 water year.

	TEMPERATURE, WATER (DEG. C), WATER YEAR OCTOBER 1979 TO SEPTEMBER 1980											
DAY	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN
		OCTOBER			NOVEMBER			DECEMBER			JANUARY	
1	---	---	---	10.0	6.5	8.5	2.5	1.0	1.5	---	---	---
2	---	---	---	7.5	5.5	6.5	2.5	1.0	1.5	---	---	---
3	---	---	---	8.0	6.0	7.0	4.0	1.5	2.5	---	---	---
4	---	---	---	8.0	5.5	7.0	4.5	2.0	3.0	---	---	---
5	---	---	---	8.0	5.0	7.0	5.0	3.5	4.5	---	---	---
6	---	---	---	5.5	4.5	5.0	4.5	2.5	3.5	---	---	---
7	---	---	---	5.0	3.0	4.5	5.0	2.0	3.5	---	---	---
8	---	---	---	5.0	3.0	4.0	2.0	.5	1.5	---	---	---
9	---	---	---	4.5	3.0	3.5	4.0	2.0	3.0	---	---	---
10	---	---	---	---	---	---	5.0	2.5	3.5	---	---	---
11	10.0	9.0	9.5	---	---	---	4.5	.5	3.5	---	---	---
12	9.5	7.5	8.0	---	---	---	2.0	.0	1.0	---	---	---
13	9.5	6.5	8.0	---	---	---	2.5	1.0	2.0	---	---	---
14	10.0	6.0	8.0	---	---	---	3.0	1.0	2.0	---	---	---
15	10.5	7.0	8.5	6.0	5.5	5.5	4.0	.5	3.0	4.5	2.5	3.5
16	12.0	8.0	10.0	6.5	5.5	6.0	1.0	.0	.5	2.5	1.0	1.5
17	10.5	8.5	9.5	7.0	4.0	5.5	1.5	.5	1.0	1.5	1.0	1.5
18	12.0	9.5	11.0	7.5	4.5	6.5	2.5	1.0	2.0	3.5	1.5	2.5
19	13.5	11.5	12.5	9.5	7.5	8.5	4.0	2.0	1.5	4.0	1.5	2.5
20	15.5	12.5	14.0	8.0	7.0	7.5	4.5	2.0	3.0	3.5	1.5	2.0
21	14.5	11.0	13.0	7.5	5.0	6.5	4.5	2.5	3.5	2.5	1.5	2.0
22	11.0	6.0	9.0	6.0	4.5	5.0	4.5	2.5	3.5	2.5	1.0	2.0
23	7.0	5.0	6.0	6.0	5.0	5.5	4.5	2.0	3.0	1.5	1.0	1.0
24	8.5	5.5	7.0	5.5	4.0	5.0	4.5	2.5	3.5	2.0	1.0	1.5
25	8.0	6.0	7.0	5.5	3.5	4.5	4.5	2.0	3.0	2.5	1.0	1.5
26	7.5	5.5	6.5	6.0	5.0	5.5	---	---	---	1.5	1.0	1.0
27	9.0	7.0	8.0	5.5	3.5	4.5	---	---	---	1.5	1.0	1.0
28	10.0	7.0	8.5	4.0	2.5	3.0	---	---	---	1.5	1.0	1.0
29	10.0	7.0	8.5	3.0	2.0	2.5	---	---	---	1.5	1.0	1.0
30	10.0	8.0	9.0	3.0	2.0	2.5	---	---	---	1.5	1.0	1.0
31	12.5	9.5	10.5	---	---	---	---	---	---	2.0	.5	1.0
MONTH	15.5	5.0	9.0	10.0	2.0	5.5	5.0	.0	2.5	4.5	.5	1.5

Table 22. Water temperatures for Bruce Valley Creek near Pleasantville, 1980 water year - - Continued.

TEMPERATURE, WATER (DEG. C), WATER YEAR OCTOBER 1979 TO SEPTEMBER 1980

DAY	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN
		FEBRUARY			MARCH			APRIL			MAY	
1	1.5	.5	1.0	1.5	.0	.5	7.0	2.5	5.0	19.0	14.5	16.5
2	2.0	.5	1.0	1.5	.0	.5	10.0	3.5	7.0	18.0	11.0	14.5
3	2.0	.5	1.0	3.5	.5	1.5	7.0	2.5	4.0	13.5	11.5	12.5
4	2.0	.5	1.0	3.0	.5	1.5	8.5	1.5	4.0	---	---	---
5	3.0	1.0	2.0	3.0	.0	1.0	10.0	1.0	5.0	---	---	---
6	3.5	.5	1.5	1.5	.0	.5	7.5	4.0	5.5	---	---	---
7	2.0	.5	1.0	3.5	.0	1.5	8.0	5.5	6.5	---	---	---
8	2.5	.5	1.0	4.0	.0	1.5	6.0	1.5	4.5	---	---	---
9	3.0	.5	1.5	3.5	.0	1.5	3.5	1.0	2.0	---	---	---
10	4.0	1.0	2.0	4.0	.0	1.5	6.5	2.0	4.5	---	---	---
11	3.5	1.0	2.0	3.5	.5	1.0	8.0	2.5	5.5	---	---	---
12	3.0	.5	1.5	4.0	.5	2.0	7.5	3.0	5.0	---	---	---
13	4.0	1.5	2.5	4.5	.5	2.0	---	---	---	---	---	---
14	4.0	.5	2.0	6.0	.5	2.5	---	---	---	---	---	---
15	4.0	.5	2.0	6.5	1.0	3.5	---	---	---	---	---	---
16	2.0	.5	1.0	1.5	.5	1.0	---	---	---	---	---	---
17	1.5	.5	1.0	2.0	.5	1.0	---	---	---	---	---	---
18	3.0	.5	1.5	3.0	.5	1.0	---	---	---	---	---	---
19	4.0	2.0	3.0	3.0	.5	1.5	---	---	---	---	---	---
20	5.0	3.5	4.0	4.0	1.0	2.0	---	---	---	---	---	---
21	4.0	1.5	3.5	4.5	1.0	2.0	---	---	---	---	---	---
22	3.0	1.5	2.0	2.5	1.0	2.0	---	---	---	---	---	---
23	4.0	1.5	2.0	5.0	2.0	3.5	---	---	---	---	---	---
24	4.5	1.0	2.5	6.5	1.5	3.5	---	---	---	---	---	---
25	3.0	.0	1.0	5.5	1.0	2.5	---	---	---	---	---	---
26	1.0	.0	.5	6.5	1.5	3.5	---	---	---	---	---	---
27	3.0	.0	1.0	4.5	2.0	3.0	---	---	---	---	---	---
28	3.0	.0	1.0	5.0	2.5	3.5	---	---	---	---	---	---
29	1.0	.0	.5	8.0	2.5	4.5	---	---	---	---	---	---
30	---	---	---	7.5	1.5	4.5	---	---	---	21.0	17.0	18.0
31	---	---	---	8.0	2.5	5.0	---	---	---	19.5	14.0	17.0
MONTH	5.0	.0	1.5	8.0	.0	2.0	10.0	1.0	5.0	21.0	11.0	15.5

DAY	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN
		JUNE			JULY			AUGUST			SEPTEMBER	
1	17.5	14.5	16.0	21.5	14.5	17.5	20.0	14.5	17.5	17.5	14.5	15.5
2	17.5	13.5	15.0	20.5	13.5	17.0	19.5	15.0	17.0	17.0	13.5	15.0
3	21.0	12.5	16.5	20.5	13.5	17.0	20.0	14.0	16.5	19.5	14.0	16.5
4	20.0	13.5	16.5	21.5	15.0	18.0	17.0	14.5	16.0	20.5	16.5	18.5
5	18.0	14.5	16.5	21.5	16.5	18.5	20.0	13.5	16.5	18.0	13.0	15.5
6	21.0	16.5	18.5	21.0	14.5	17.5	20.5	13.5	17.0	16.5	12.5	14.5
7	20.0	16.5	18.5	22.0	17.0	19.5	21.0	17.5	19.5	19.0	14.5	16.0
8	17.5	12.5	15.0	22.0	16.0	18.5	22.0	19.0	20.0	19.5	14.5	16.5
9	17.0	13.0	15.0	23.0	16.0	19.0	18.5	15.5	17.0	18.5	14.5	17.0
10	18.5	12.0	15.0	23.5	16.0	19.0	17.5	14.5	16.0	16.0	11.5	13.5
11	19.0	12.0	15.5	21.5	16.5	19.0	19.0	15.0	16.5	13.0	11.5	12.0
12	17.0	13.0	15.0	23.5	18.0	20.0	18.5	14.0	16.0	15.0	13.0	14.0
13	20.0	14.5	17.0	20.0	15.5	18.0	17.5	14.5	16.0	16.5	14.0	15.0
14	23.0	15.5	18.5	21.5	16.5	18.5	19.0	14.0	16.0	15.0	12.5	13.5
15	18.5	14.5	16.5	23.0	16.5	19.5	18.5	13.5	15.5	13.5	12.5	13.0
16	19.5	11.5	15.0	23.5	18.5	20.0	15.0	13.0	13.5	13.0	11.5	12.5
17	19.5	12.0	15.5	22.5	15.5	19.0	14.5	12.5	13.5	12.0	9.5	11.0
18	19.0	14.0	16.5	21.5	17.0	18.5	19.0	13.0	16.0	12.0	10.5	11.5
19	19.0	13.5	16.0	22.0	15.0	18.0	20.0	16.0	18.0	18.0	10.0	12.5
20	18.0	13.0	16.0	19.0	16.5	18.0	20.0	16.5	18.0	17.0	14.5	16.0
21	21.0	14.0	17.0	21.0	15.0	17.5	20.5	16.0	18.0	16.5	14.5	15.0
22	20.5	15.5	17.5	19.5	14.5	17.0	19.5	13.5	16.5	14.0	12.5	13.5
23	22.0	15.0	18.5	20.0	13.0	16.0	18.0	13.5	15.5	12.5	9.5	11.5
24	21.0	16.0	18.5	21.0	13.5	17.0	17.5	14.5	16.0	13.5	11.0	12.0
25	23.0	16.0	19.0	18.0	16.0	17.0	20.0	15.5	17.0	12.5	11.0	11.5
26	23.5	17.0	20.0	19.0	14.5	16.5	18.5	17.0	18.0	11.5	9.0	10.5
27	19.5	15.0	17.0	20.0	13.0	16.0	17.5	16.0	16.5	13.0	9.5	11.5
28	21.5	15.0	17.5	19.0	13.5	16.0	16.0	15.0	15.5	11.0	9.5	10.5
29	17.5	14.5	15.5	21.0	14.0	17.0	20.0	15.0	17.0	13.5	10.0	12.0
30	18.0	12.0	15.0	19.0	14.5	16.5	19.5	17.0	18.0	15.0	12.5	13.5
31	---	---	---	21.5	15.0	17.5	17.5	14.5	15.5	---	---	---
MONTH	23.5	11.5	16.5	23.5	13.0	18.0	22.0	12.5	16.5	20.5	9.0	13.5
YEAR	23.5	.0	9.0									

NOTE: NUMBER OF MISSING DAYS OF RECORD EXCEEDED 20% OF YEAR

Table 23. Specific conductance for Elk Creek near Independence, 1980 water year.

SPECIFIC CONDUCTANCE (MICROMHOS/CM AT 25 DEG. C), WATER YEAR OCTOBER 1979 TO SEPTEMBER 1980

DAY	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN
	OCTOBER			NOVEMBER			DECEMBER			JANUARY		
1				---	---	---	234	225	229	---	---	---
2				---	---	---	254	218	236	---	---	---
3				---	---	---	240	214	229	---	---	---
4				---	---	---	233	229	231	---	---	---
5				---	---	---	237	225	231	---	---	---
6				---	---	---	227	223	225	---	---	---
7				---	---	---	225	212	217	---	---	---
8				---	---	---	229	216	223	---	---	---
9				---	---	---	230	228	229	---	---	---
10				---	---	---	232	228	231	---	---	---
11				---	---	---	231	218	224	---	---	---
12				---	---	---	256	221	236	---	---	---
13				---	---	---	242	217	232	---	---	---
14				---	---	---	238	216	229	---	---	---
15				237	224	236	232	220	230	---	---	---
16				236	230	233	231	225	229	264	140	202
17				231	226	227	---	---	---	138	117	125
18				228	224	226	---	---	---	166	140	154
19				226	221	224	---	---	---	175	166	172
20				223	221	222	---	---	---	179	172	176
21				229	211	218	---	---	---	180	175	177
22				212	199	205	---	---	---	179	174	177
23				212	207	209	---	---	---	198	178	186
24				217	214	216	---	---	---	181	168	174
25				224	219	222	---	---	---	176	169	170
26				225	220	223	---	---	---	185	178	182
27				225	221	223	---	---	---	---	---	---
28				231	217	224	---	---	---	---	---	---
29				224	221	222	---	---	---	---	---	---
30				229	223	225	---	---	---	---	---	---
31				---	---	---	---	---	---	---	---	---
MONTH				237	199	222	256	212	229	264	117	172

SPECIFIC CONDUCTANCE (MICROMHOS/CM AT 25 DEG. C), WATER YEAR OCTOBER 1979 TO SEPTEMBER 1980

DAY	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN
	FEBRUARY			MARCH			APRIL			MAY		
1				---	---	---	203	184	193	234	229	231
2				---	---	---	232	175	199	252	209	233
3				---	---	---	198	176	185	236	230	233
4				232	207	227	219	169	198	241	232	236
5				254	226	233	170	145	157	241	236	238
6				256	233	242	187	134	163	241	235	238
7				269	202	238	189	175	181	236	233	235
8				234	191	210	201	177	188	234	231	232
9				214	200	207	193	181	187	237	229	233
10				212	207	209	210	194	203	234	228	232
11				249	195	216	215	207	211	234	225	229
12				228	202	214	207	184	194	235	227	231
13				215	209	214	200	180	190	233	223	228
14				227	217	220	210	202	206	228	221	225
15				231	221	224	211	206	209	234	225	229
16				296	198	239	210	203	207	232	228	230
17				260	169	212	211	207	209	230	228	229
18				272	177	224	211	201	207	228	221	225
19				214	161	185	210	203	207	230	219	224
20				197	164	181	212	204	208	234	224	229
21				199	169	188	215	208	212	235	221	230
22				222	194	207	218	212	215	224	219	222
23				238	222	232	219	213	216	225	220	223
24				245	218	239	219	214	216	229	223	224
25				224	192	210	221	218	220	230	223	226
26				209	178	191	223	219	221	227	222	225
27				202	173	187	227	223	224	229	221	224
28				206	192	198	227	223	225	230	221	225
29				206	183	194	228	227	227	226	213	220
30				199	171	185	230	228	229	217	186	198
31				201	177	188	---	---	---	194	183	191
MONTH				296	161	211	232	134	204	252	183	227

Table 23. Specific conductance for Elk Creek near Independence, 1980 water year - - Continued.

SPECIFIC CONDUCTANCE (MICROMHOS/CM AT 25 DEG. C), WATER YEAR OCTOBER 1979 TO SEPTEMBER 1980

DAY	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN
		JUNE			JULY			AUGUST			SEPTEMBER	
1	215	126	198	249	242	245	233	229	231	246	218	237
2	212	193	205	251	242	247	237	230	233	252	245	249
3	237	227	231	252	245	248	237	232	235	285	235	253
4	250	217	235	253	244	249	238	230	234	299	210	232
5	230	141	185	250	232	241	238	230	236	313	204	237
6	185	136	161	256	247	252	244	220	240	297	213	227
7	207	176	191	258	253	256	224	162	193	325	194	278
8	228	196	218	260	254	257	176	127	150	312	235	282
9	232	225	230	261	256	258	209	152	181	257	225	244
10	235	229	232	264	257	260	222	200	216	246	232	242
11	235	230	233	262	259	260	223	184	216	245	231	241
12	233	230	231	254	248	252	230	223	227	232	103	181
13	233	227	230	243	238	240	228	226	227	---	---	---
14	231	225	228	232	229	231	234	227	231	309	223	236
15	229	224	227	226	217	222	233	197	219	339	222	275
16	231	224	227	228	206	216	234	192	214	291	226	246
17	230	223	227	231	221	227	233	188	210	246	234	240
18	230	194	223	232	227	229	228	216	223	251	216	232
19	160	129	142	234	228	231	231	226	228	239	130	222
20	216	156	191	233	228	231	235	224	231	149	113	131
21	235	219	229	235	231	233	232	212	222	137	98	112
22	243	237	240	238	233	235	239	229	234	210	138	180
23	246	242	243	242	225	231	247	220	236	231	213	224
24	245	242	244	236	229	232	240	233	238	236	233	235
25	247	243	245	232	224	228	239	230	235	237	229	233
26	248	242	245	228	223	226	252	228	241	239	232	236
27	245	226	241	230	224	228	252	234	241	242	239	241
28	237	217	229	229	224	227	242	237	240	241	237	239
29	243	236	240	230	218	225	248	241	244	238	233	235
30	245	240	242	230	227	228	246	174	206	238	236	237
31	---	---	---	234	226	229	327	181	220	---	---	---
MONTH	250	126	221	264	206	238	327	127	224	339	98	230
YEAR	339	98	220									

NOTE: NUMBER OF MISSING DAYS OF RECORD EXCEEDED 20% OF YEAR

Table 24. Specific conductance for Bruce Valley Creek near Pleasantville, 1980 water year.

SPECIFIC CONDUCTANCE (MICROMHOS/CM AT 25 DEG. C), WATER YEAR OCTOBER 1979 TO SEPTEMBER 1980

DAY	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN
		OCTOBER			NOVEMBER			DECEMBER			JANUARY	
1	---	---	---	190	171	182	202	194	197	---	---	---
2	---	---	---	189	185	188	203	197	201	195	192	194
3	---	---	---	190	186	188	202	197	201	---	---	---
4	---	---	---	193	186	191	199	197	198	---	---	---
5	---	---	---	212	190	200	197	191	194	---	---	---
6	---	---	---	365	183	193	354	191	200	199	195	199
7	---	---	---	192	185	189	206	189	194	199	196	198
8	---	---	---	192	187	190	195	193	194	198	193	195
9	---	---	---	193	190	192	196	194	195	197	195	197
10	---	---	---	---	---	---	196	192	194	196	195	196
11	195	185	194	---	---	---	192	189	190	---	---	---
12	196	194	194	---	---	---	201	193	197	---	---	---
13	198	194	196	---	---	---	200	198	199	---	---	---
14	199	196	197	---	---	---	200	200	198	---	---	---
15	199	196	198	207	179	206	198	198	196	200	177	198
16	202	197	199	197	192	194	203	203	198	252	114	185
17	201	198	199	195	190	193	206	184	190	175	114	147
18	203	200	201	195	192	193	202	200	201	195	179	188
19	283	200	231	193	188	191	201	197	199	200	196	198
20	216	209	211	191	188	189	201	196	198	205	198	201
21	223	202	213	226	190	199	203	196	198	204	199	201
22	274	87	168	238	186	196	199	193	196	205	197	200
23	168	144	158	203	188	192	229	209	209	210	203	205
24	178	166	171	189	186	187	224	207	217	205	196	201
25	179	174	177	189	186	188	200	194	197	200	196	198
26	182	179	180	188	186	187	196	193	194	204	198	201
27	184	180	182	187	184	185	---	---	---	205	198	201
28	185	180	183	194	185	190	---	---	---	205	198	202
29	187	183	185	352	192	199	---	---	---	205	200	203
30	193	186	190	198	194	195	---	---	---	205	199	201
31	206	169	187	---	---	---	---	---	---	211	198	205
MONTH	283	87	191	365	171	192	354	184	198	252	114	196

Table 24. Specific conductance for Bruce Valley Creek near Pleasantville, 1980 water year - - Continued.

SPECIFIC CONDUCTANCE (MICROMHOS/CM AT 25 DEG. C), WATER YEAR OCTOBER 1979 TO SEPTEMBER 1980

DAY	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN
		FEBRUARY			MARCH			APRIL			MAY	
1	212	208	210	228	220	225	184	168	176	194	181	182
2	213	207	210	228	218	223	197	169	179	190	181	186
3	212	208	210	223	218	220	194	164	183	215	187	196
4	214	209	211	222	209	215	263	172	202	---	---	---
5	210	206	208	212	208	210	197	95	164	---	---	---
6	209	205	207	215	207	211	231	155	195	---	---	---
7	211	205	207	215	209	211	293	183	213	---	---	---
8	210	206	208	216	210	212	294	199	221	---	---	---
9	211	206	208	216	210	212	199	188	194	---	---	---
10	210	207	209	218	208	212	254	199	214	---	---	---
11	210	206	208	219	209	213	245	179	215	---	---	---
12	209	205	207	215	211	213	191	173	181	---	---	---
13	209	205	207	215	210	211	---	---	---	---	---	---
14	209	205	207	215	211	213	---	---	---	---	---	---
15	209	205	207	247	211	220	---	---	---	---	---	---
16	210	205	207	264	171	214	---	---	---	---	---	---
17	210	206	208	250	137	190	---	---	---	---	---	---
18	211	206	208	240	121	192	---	---	---	---	---	---
19	211	207	209	206	120	151	---	---	---	---	---	---
20	232	207	211	206	128	156	---	---	---	---	---	---
21	306	227	247	166	139	153	---	---	---	---	---	---
22	383	304	339	178	159	169	---	---	---	---	---	---
23	384	303	340	183	179	182	---	---	---	---	---	---
24	301	252	271	188	167	182	---	---	---	---	---	---
25	249	225	235	188	161	173	---	---	---	---	---	---
26	828	218	303	179	151	165	---	---	---	---	---	---
27	335	235	263	176	151	164	---	---	---	---	---	---
28	241	225	230	183	171	177	---	---	---	---	---	---
29	231	222	227	184	157	173	---	---	---	---	---	---
30	---	---	---	176	158	166	---	---	---	265	162	213
31	---	---	---	180	161	170	---	---	---	234	203	208
MONTH	828	205	228	264	120	193	294	95	195	265	162	197
DAY	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN
		JUNE			JULY			AUGUST			SEPTEMBER	
1	208	200	205	205	201	203	211	201	207	216	213	214
2	210	205	206	206	202	204	212	202	206	215	212	213
3	213	203	208	203	201	202	207	203	205	217	211	213
4	213	207	210	203	194	201	208	202	206	235	191	202
5	268	95	189	237	191	200	205	196	200	219	199	212
6	217	158	187	200	196	197	207	181	202	218	214	216
7	289	158	198	202	196	199	239	144	169	215	210	214
8	184	172	180	202	197	200	173	70	126	216	210	213
9	184	183	183	203	198	200	209	168	196	236	207	214
10	186	182	183	205	198	201	213	208	210	215	210	213
11	189	185	187	207	202	204	215	210	213	259	205	215
12	191	188	190	206	200	203	214	210	211	220	145	168
13	198	188	193	209	201	204	213	210	212	209	188	204
14	191	182	185	205	199	202	213	210	211	209	207	208
15	186	183	185	209	198	203	214	210	212	208	205	208
16	186	182	185	299	185	201	214	206	210	211	204	208
17	187	183	185	205	195	200	241	205	220	207	203	205
18	185	135	179	204	196	201	206	194	201	208	204	206
19	175	126	144	205	197	200	214	206	210	208	119	194
20	199	178	191	203	199	201	220	210	213	193	102	147
21	204	197	200	204	198	201	252	197	211	169	98	124
22	207	204	205	205	200	202	215	206	211	191	172	185
23	210	204	207	208	201	203	215	210	213	194	190	192
24	209	205	208	212	201	204	216	209	212	195	191	193
25	211	205	208	205	197	201	218	211	214	202	191	196
26	214	206	209	200	196	198	286	209	235	193	190	192
27	214	198	208	204	199	201	275	206	229	193	190	191
28	273	170	195	205	200	203	217	209	214	191	188	190
29	202	195	199	206	201	203	221	217	218	187	184	186
30	204	198	201	210	201	205	218	161	186	186	183	185
31	---	---	---	208	201	204	213	182	204	---	---	---
MONTH	289	95	194	299	185	202	286	70	206	259	98	197
YEAR	828	70	200									

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