

# Concentrations of Nutrients and Sediment from Two Sites in the Spring Creek Basin, Benton County, Washington, 1997-98

By Richard J. Wagner

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# CONTENTS

Abstract.....	1
Introduction .....	1
Purpose and scope .....	1
Description of the study area .....	1
Nutrients and sediment in surface water.....	3
Field procedures .....	3
Laboratory procedures .....	3
Results .....	3
Seasonal differences in surface water.....	9
Quality assurance and control.....	9
Summary.....	9
Selected References.....	13

## FIGURE

1. Locations of surface-water sites sampled for nutrients and suspended sediment in the Spring Creek Basin, Benton County, Washington ..... 2

## TABLES

1. Water discharge, values of temperature, specific conductance, dissolved oxygen, pH, and concentrations of nutrients and suspended sediment in samples collected April 1997 to September 1998 in the Spring Creek Basin, Benton, County, Washington..... 4
2. Statistical summary of selected water-quality data collected from April 1997 to September 1998 in the Spring Creek Basin, Benton County, Washington..... 8
3. Nutrient and sediment loads from two sites in the Spring Creek Basin, April 1997 to September 1998, Benton County, Washington ..... 10

## CONVERSION FACTORS AND VERTICAL DATUM

Multiply	By	To obtain
microgram ( $\mu\text{g}$ )	$3.53 \times 10^{-8}$	ounce
micrometer ( $\mu\text{m}$ )	$3.937 \times 10^{-5}$	inch
liter (L)	0.296	gallon
tons per day (t/day)	910.72	kilogram per day
square mile ( $\text{mi}^2$ )	2.590	square kilometer

**Temperature:** To convert temperature given in this report in degrees Fahrenheit ( $^{\circ}\text{F}$ ) to degrees Celsius ( $^{\circ}\text{C}$ ), use the following equation:  $^{\circ}\text{C} = 5/9(^{\circ}\text{F}-32)$ .

**Sea Level:** In this report "sea level" refers to the National Geodetic Vertical Datum of 1929 (NGVD of 1929)--a geodetic datum derived from a general adjustment of the first-order level nets of both the United States and Canada, formerly called Sea Level Datum of 1929.

# Concentrations of Nutrients and Sediment from Two Sites in the Spring Creek Basin, Benton County, Washington, 1997-98

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## ABSTRACT

From April 1997 to September 1998, the U.S. Geological Survey sampled streamflow from two sites in the Spring Creek Basin. Eighteen samples were collected from Spring Creek at Hanks Road and nineteen from Spring Creek at McCreddie Road and analyzed for concentrations of nitrogen, phosphorus, and sediment. Measurements of temperature, pH, specific conductance, alkalinity, and dissolved oxygen also were made at the time of collection of nutrient and sediment samples. This report presents physical properties and chemical data collected during the study period from Spring Creek at Hanks Road and Spring Creek at McCreddie Road.

## INTRODUCTION

The Benton Conservation District (BCD), under the Washington Department of Ecology Centennial Clean Water Program, has a long-term goal to reduce the amount of sediment entering the Yakima River through irrigation runoff to its major tributaries in Benton County. To help determine if efforts to reduce sediment yields are effective, the BCD entered into a cooperative agreement with the U.S. Geological Survey (USGS) to install a gage to measure streamflow in Spring Creek and collect surface-water samples for the analysis of nitrogen and phosphorus (nutrients) from two sites on Spring Creek, April 1997 through

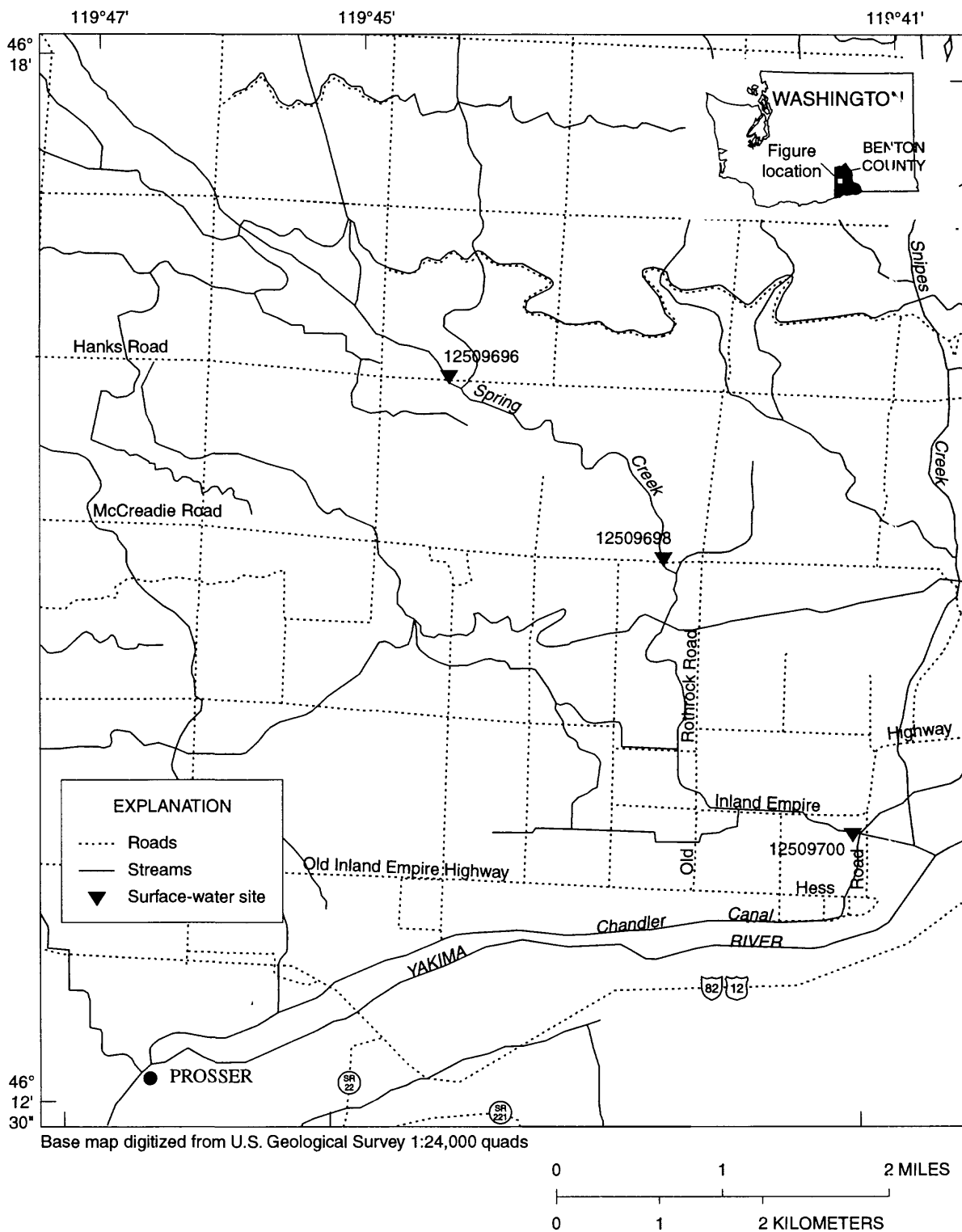
September 1998. These data will provide baseline information about nutrient concentrations in surface water in the Spring Creek watershed. Measurements of temperature, pH, specific conductance, alkalinity, and dissolved oxygen also were made at the time of collection of nutrient and sediment samples.

## Purpose and Scope

The purpose of this report is to present data for the concentrations and loads of nutrients and sediment in surface water from two sites on Spring Creek from April 1997 to September 1998. Streamflow data are published in Wiggins and others (1998, 1999).

## Description of the Study Area

Spring Creek is a major tributary of the lower reach of the Yakima River in Benton County (fig. 1) and has a drainage area of approximately 32 mi<sup>2</sup> (square miles) (Daly, 1998). The creek provides a source of irrigation water and receives irrigation runoff from fields and drains in the Spring Creek watershed. Irrigation in the Spring Creek Basin is primarily by sprinkler and rill methods, although there is a small amount of drip irrigation. Primary crops grown in the study area are apples, wine and table grapes, hops, and a smaller percentage of cherries and other fruits (Daly, 1998).



**Figure 1.** Locations of surface-water sites sampled for nutrients and suspended sediment in the Spring Creek Basin, Benton County, Washington.

## NUTRIENTS AND SEDIMENT IN SURFACE WATER

Two sites on Spring Creek, at Hanks Road and at McCreadie Road (fig. 1), were selected as being representative of land-use conditions for sampling the Spring Creek watershed upstream from the respective sites of collection. Eighteen samples were collected from the Hanks Road site and 19 samples from the McCreadie Road site from April 1997 through September 1998. Samples were analyzed for nitrogen and phosphorus species (nutrients), suspended sediment, and physical measurements were made at the sites to determine temperature, dissolved oxygen, pH, alkalinity, streamflow, and specific conductance.

### Field Procedures

Water samples representative of the stream were obtained by collecting depth-integrated subsamples at equally spaced verticals across the stream using a US DH-81 sampler, as described by Edwards and Glysson (1988). Subsamples were composited in a polyethylene churn and either split for raw-water samples (unfiltered) or filtered through a 0.45-micrometer ( $\mu\text{m}$ ) filter, as described by Horowitz and others (1994). Samples for the analysis of nutrients were stored at less than 4 degrees Celsius ( $^{\circ}\text{C}$ ) and submitted to the U.S. Geological Survey National Water Quality Laboratory (NWQL) in Arvada, Colo., for analysis. Samples for the analysis of suspended sediment were collected in conjunction with nutrient samples but were not composited in the churn splitter. Suspended sediment samples were submitted to the USGS Cascades Volcano Observatory Sediment Laboratory in Vancouver, Wash., for analysis as described by Guy (1969).

### Laboratory Procedures

Water samples for the analysis of nutrients were received at the NWQL and stored at less than  $4^{\circ}\text{C}$  prior to analysis, as described by Pritt and Raese (1995). Samples were analyzed for nitrite using a diazotization colorimetric method, ammonia using a salicylate-hypochlorite colorimetric method, nitrate-plus-nitrite using cadmium reduction-diazotization colorimetric method, and orthophosphate using a phosphomolybdate colorimetric method; all as described by Fishman (1993). Samples were analyzed for ammonia-

plus-organic nitrogen as well as phosphorus using microkjeldahl digestion and colorimetry, as described by Patton and Truitt (1992). Where applicable, dissolved concentrations were measured using samples filtered through a 0.45-micrometer filter and total concentrations (or whole-water samples) were measured using unfiltered samples.

### Results

All data collected are shown in table 1. The majority of nitrite concentrations at both sites was less than the detection limit of 0.01 milligrams per liter (mg/L) (table 1) and the maximum nitrite value observed was 0.02 mg/L (table 2). Because of these low values for nitrite, this report will hereafter refer to nitrate-plus-nitrite simply as nitrate. Observed concentrations of nitrate in samples from Spring Creek at Hanks Road ranged from 0.37 to 6.1 mg/L, with a median of 1.2 mg/L (table 2); whereas concentrations in samples from the McCreadie Road site ranged from 0.94 to 6.9 mg/L with a median of 2.0 mg/L. This compares with a median value of 1.4 mg/L for samples collected from Spring Creek at Hess Road (see fig. 1) during 1974-81 (Rinella and others, 1992). Concentrations of filtered phosphorus in samples from Spring Creek at Hanks Road ranged from 0.01 to 0.07 mg/L, with a median of 0.04 mg/L; and concentrations in samples from the McCreadie Road site ranged from 0.02 to 0.11 mg/L, with an identical median of 0.04 mg/L. Concentrations of total phosphorus in samples from Spring Creek at Hanks Road ranged from 0.05 to 0.26 mg/L with a median of 0.09 mg/L; and concentrations in samples from the McCreadie Road site ranged from 0.03 to 0.54, with a median of 0.11 mg/L. Concentrations of suspended sediment in samples from Spring Creek at Hanks Road ranged from 4 to 226 mg/L, with a median of 42 mg/L; compared to concentrations from the McCreadie Road site that ranged from 6 to 664 mg/L, with a median of 88 mg/L.

**Table 1.** Water discharge, values of temperature, specific conductance, dissolved oxygen, pH, and concentrations of nutrients and suspended sediment in samples collected April 1997 to September 1998 in the Spring Creek Basin, Benton County, Washington

[°C, degrees Celsius; µS/cm, microsiemens per centimeter; mg/L, milligrams per liter; N, nitrogen; ammonia + organic, ammonia plus organic; NO<sub>2</sub>+NO<sub>3</sub>, nitrite plus nitrate; P, phosphorus; t/day, tons per day; <, less than; --, not available]

12509696--Spring Creek at Hanks Road near Prosser, Washington									
Date	Time	Temperature water (°C)	Dis- charge, inst. (cubic feet per second)	Spe- cific con- duct- ance (µS/cm)	Oxygen, dis- solved (mg/L)	Oxygen, dis- solved (per- cent satur- ation)	pH water whole field (stand- ard units)	Nitro- gen, ammonia dis- solved (mg/L as N)	Nitro- gen, nitrite dis- solved (mg/L as N)
April 1997									
23...	1200	12.5	6.2	203	11.4	110	8.3	<0.015	<0.01
May									
23...	1300	16.0	4.5	228	9.3	97	7.8	0.03	0.01
June									
16...	1315	20.0	7.7	230	8.3	94	7.9	0.02	0.02
July									
16...	1200	18.5	9.3	185	8.0	88	7.8	<0.015	<0.01
August									
20...	1310	18.5	9.7	216	6.7	74	7.7	0.04	0.01
September									
24...	1400	17.0	7.2	269	7.7	82	7.8	<0.015	<0.01
October									
22...	1300	11.5	3.2	454	10.2	97	7.8	<0.015	0.01
November									
25...	1330	10.5	1.4	640	9.8	90	8.0	<0.02	<0.01
December									
18...	1300	7.5	0.80	660	10.8	92	7.8	<0.02	<0.01
January 1998									
27...	1245	9.0	0.39	670	11.2	100	8.0	<0.02	0.01
February									
25...	1245	8.0	0.40	670	12.0	105	8.3	<0.02	0.02
March									
18...	1230	11.0	0.15	650	13.2	123	8.4	0.02	0.01
April									
23...	1330	16.5	4.1	181	9.0	96	8.2	0.04	<0.01
May									
19...	1240	16.0	7.4	178	9.6	101	8.0	0.04	<0.01
June									
24...	1300	17.0	5.4	250	8.4	91	7.9	0.04	<0.01
July									
22...	1255	22.5	7.8	156	7.7	92	7.7	0.03	<0.01
August									
20...	1240	20.0	11	175	7.7	88	7.6	0.07	0.01
September									
08...	1200	19.5	11	204	7.5	85	7.8	0.04	<0.01

**Table 1.** Water discharge, values of temperature, specific conductance, dissolved oxygen, pH, and concentrations of nutrients and suspended sediment in samples collected April 1997 to September 1998 in the Spring Creek Basin, Benton County, Washington--Continued

12509696--Spring Creek at Hanks Road near Prosser, Washington									
Date	Nitro- gen, am- monia + organic dis. (mg/L as N)	Nitro- gen, am- monia + organic total (mg/L as N)	Nitro- gen, NO <sub>2</sub> +NO <sub>3</sub> dis- solved (mg/L as N)	Nitro- gen, total (mg/L as N)	Phos- phorus total (mg/L as P)	Phos- phorus dis- solved (mg/L as P)	Phos- phorus ortho, dis- solved (mg/L as P)	Sedi- ment, sus- pended (mg/L)	Sedi- ment, dis- charge, sus- pended (t/day)
April 1997									
23...	<0.2	0.5	1.3	1.8	0.11	0.02	0.02	102	1.7
May									
23...	0.2	0.6	1.5	2.1	0.23	0.04	0.04	226	2.7
June									
16...	<0.2	0.6	1.1	1.7	0.26	0.05	0.05	198	4.1
July									
16...	<0.2	0.2	0.82	1.1	0.10	0.01	0.03	38	0.96
August									
20...	<0.2	0.5	0.90	1.4	0.15	0.05	0.05	91	2.4
September									
24...	<0.2	<0.2	1.3	--	0.05	0.02	0.03	12	0.23
October									
22...	<0.2	<0.2	3.2	--	0.06	0.03	0.04	22	0.19
November									
25...	0.2	0.5	5.9	6.3	0.11	0.03	0.13	10	0.04
December									
18...	0.3	0.3	6.1	6.5	0.08	0.06	0.09	48	0.10
January 1998									
27...	0.2	0.3	6.1	6.4	0.05	0.04	0.07	4	0.00
February									
25...	0.3	0.3	5.6	6.0	0.07	0.07	0.07	135	0.15
March									
18...	0.1	0.3	5.3	5.6	0.06	0.05	0.05	14	0.01
April									
23...	0.3	0.6	0.75	1.3	0.07	0.03	0.03	72	0.80
May									
19...	0.2	0.3	0.61	0.92	0.09	0.03	0.03	112	2.2
June									
24...	0.2	0.4	0.90	1.3	0.09	0.04	0.04	46	0.67
July									
22...	0.2	0.3	0.37	0.65	0.12	0.04	0.03	28	0.59
August									
20...	0.2	0.2	0.43	0.66	0.05	0.03	0.05	11	0.32
September									
08...	0.2	0.3	0.56	0.86	0.10	0.05	0.06	28	0.85



**Table 1.** Water discharge, values of temperature, specific conductance, dissolved oxygen, pH, and concentrations of nutrients and suspended sediment in samples collected April 1997 to September 1998 in the Spring Creek Basin, Benton County, Washington--Continued

12509698--Spring Creek at McCreddie Road near Prosser, Washington									
Date	Time	Temperature water (°C)	Dis- charge, inst. (cubic feet per second)	Spe- cific con- duct- ance (µS/cm)	Oxygen, dis- solved (mg/L)	Oxygen, dis- solved (per- cent satur- ation)	pH water whole field (stand- ard units)	Nitro- gen, ammonia dis- solved (mg/L as N)	Nitro- gen, nitrite dis- solved (mg/L as N)
April 1997									
23...	1030	12.0	11	320	10.6	101	8.2	<0.015	<0.01
May									
23...	1020	14.0	12	316	10.0	98	8.0	<0.015	<0.01
June									
16...	1100	18.5	11	317	8.8	96	8.0	<0.015	0.01
July									
16...	0950	16.0	12	327	9.1	94	7.9	<0.015	<0.01
August									
20...	1000	17.5	14	315	8.6	93	7.9	<0.015	<0.01
September									
24...	1205	16.0	16	380	9.2	96	8.0	<0.015	<0.01
October									
22...	1100	10.5	7.6	567	10.5	96	8.1	<0.015	<0.01
November									
25...	1050	10.5	4.2	738	10.6	97	8.2	<0.02	<0.01
December									
18...	1150	9.0	3.3	750	11.4	100	8.2	<0.02	<0.01
January 1998									
27...	1030	10.5	2.8	743	11.0	101	8.2	<0.02	<0.01
February									
25...	1030	10.0	2.6	730	11.6	106	8.3	<0.02	<0.01
March									
18...	1020	11.0	2.2	730	11.4	105	8.4	0.03	<0.01
April									
23...	1030	15.0	9.7	293	10.5	108	8.2	0.03	<0.01
May									
19...	1015	14.5	16	251	10.0	101	8.1	0.03	<0.01
June									
01...	1200	18.5	17	236	9.6	106	8.0	0.08	0.02
24...	1100	17.5	13	302	8.6	93	8.1	0.03	<0.01
July									
22...	1040	20.5	15	260	8.3	95	7.9	0.03	<0.01
August									
20...	1020	18.0	16	268	9.2	100	8.1	0.07	<0.01
September									
08...	1050	18.5	19	278	9.0	99	8.0	0.03	<0.01

**Table 1.** Water discharge, values of temperature, specific conductance, dissolved oxygen, pH, and concentrations of nutrients and suspended sediment in samples collected April 1997 to September 1998 in the Spring Creek Basin, Benton County, Washington--Continued

12509698--Spring Creek at McCreadie Road near Prosser, Washington									
Date	Nitro- gen, am- monia + organic dis. (mg/L as N)	Nitro- gen, am- monia + organic total (mg/L as N)	Nitro- gen, NO <sub>2</sub> +NO <sub>3</sub> dis- solved (mg/L as N)	Nitro- gen, total (mg/L as N)	Phos- phorus total (mg/L as P)	Phos- phorus dis- solved (mg/L as P)	Phos- phorus ortho, dis- solved (mg/L as P)	Sedi- ment, sus- pended (mg/L)	Sedi- ment, dis- charge, sus- pended (t/day)
April 1997									
23...	<0.2	0.6	2.2	2.8	0.22	0.03	0.03	187	5.8
May									
23...	<0.2	0.6	2.2	2.7	0.23	0.04	0.04	328	10
June									
16...	<0.2	1.1	2.0	3.2	0.54	0.06	0.08	223	6.9
July									
16...	<0.2	0.3	2.0	2.3	0.10	0.02	0.03	88	2.9
August									
20...	<0.2	0.3	1.7	2.0	0.08	0.05	0.05	71	2.7
September									
24...	<0.2	0.3	2.2	2.5	0.11	0.11	0.04	88	3.9
October									
22...	<0.2	<0.2	4.2	--	0.07	0.04	0.05	32	0.66
November									
25...	0.2	0.3	6.9	7.1	0.04	0.04	0.11	8	0.09
December									
18...	0.2	0.3	6.8	7.0	0.08	0.06	0.12	6	0.05
January 1998									
27...	0.2	0.2	6.4	6.7	0.04	0.03	0.06	6	0.05
February									
25...	0.2	0.3	5.4	5.7	0.04	0.03	0.04	88	0.62
March									
18...	0.2	0.3	6.0	6.3	0.03	0.02	0.03	35	0.21
April									
23...	<0.1	0.5	1.5	2.0	0.10	0.04	0.03	71	1.9
May									
19...	0.1	0.3	1.2	1.6	0.11	0.03	0.05	172	7.3
June									
01...	0.2	0.5	0.94	1.4	0.20	0.03	0.05	156	7.2
24...	0.2	0.4	1.5	1.9	0.11	0.05	0.06	78	2.7
July									
22...	0.3	0.8	1.2	2.0	0.38	0.06	0.07	664	28
August									
20...	0.2	0.7	1.3	2.0	0.15	0.05	0.16	77	3.3
September									
08...	0.2	0.4	1.3	1.8	0.20	0.08	0.07	130	6.6

**Table 2.** Statistical summary of selected water-quality data collected from April 1997 to September 1998 in the Spring Creek Basin, Benton County, Washington

[% , percent; degrees C (°C), degrees Celsius; ft<sup>3</sup>/s, cubic feet per second; µS/cm, microsiemens per centimeter; mg/L, milligrams per liter; Amn+org, ammonia plus organic; NO<sub>2</sub>+NO<sub>3</sub>, nitrite plus nitrate; --, insufficient number of uncensored data for statistical calculation]

STATION NUMBER: 12509696 STATION NAME: SPRING CREEK AT HANKS ROAD NEAR PROSSER, WASHINGTON  
LATITUDE/LONGITUDE: 461622 1194417

Parameter code	Water-quality constituent	Units	Descriptive statistics				Percent of samples in which values were less than or equal to those shown				
			Sample size	Maximum	Minimum	Mean	95 %	75 %	(Median) 50 %	25 %	5 %
00010	Water temperature	(degrees C)	18	22.5	7.5	15.1	22.5	18.8	16.2	10.9	7.5
00061	Discharge, inst.	(ft <sup>3</sup> /s)	18	11.0	0.15	5.4	11.2	8.2	5.8	1.2	0.15
00095	Specific conductance	(µS/cm at 25°C)	18	670	156	345.5	670	642.5	229	184	156
00300	Oxygen, dissolved	(mg/L)	18	13.2	6.7	9.4	13.2	10.9	9.2	7.7	6.7
00400	pH, field	(standard unit)	18	8.4	7.6	7.9	8.4	8.0	7.8	7.8	7.6
00608	Nitrogen ammonia	(mg/L as N)	18	0.07	<0.015	0.03*	*0.07	*0.04	*0.02	*0.013	*0.008
00613	Nitrogen, nitrite	(mg/L as N)	18	0.02	<0.01	0.01*	*0.02	*0.01	*0.01	*0.008	*0.006
00623	Amn+org, filtered	(mg/L as N)	18	0.3	<0.1	0.2*	*0.3	*0.2	*0.2	*0.2	*0.1
00625	Amn+org, unfiltered	(mg/L as N)	18	0.6	<0.2	0.4*	*0.6	*0.5	*0.3	*0.3	*0.16
00631	NO <sub>2</sub> + NO <sub>3</sub> , filtered	(mg/L as N)	18	6.1	0.37	2.4	6.1	5.4	1.2	0.71	0.37
00665	Phosphorus, total	(mg/L as P)	18	0.26	0.05	0.10	0.26	0.12	0.09	0.06	0.05
00666	Phosphorus, filtered	(mg/L as P)	18	0.07	0.01	0.04	0.07	0.05	0.04	0.03	0.02
00671	Phosphorus, ortho	(mg/L as P)	18	0.13	0.02	0.05	0.13	0.06	0.04	0.03	0.02
80154	Suspended sediment	(mg/L)	18	226	4	66	226	104	42	14	4

STATION NUMBER: 12509698 STATION NAME: SPRING CREEK AT MCCREADIE ROAD NEAR PROSSER, WASHINGTON  
LATITUDE/LONGITUDE: 461527 1194237

Parameter code	Water-quality constituent	Units	Descriptive statistics				Percent of samples in which values were less than or equal to those shown				
			Sample size	Maximum	Minimum	Mean	95 %	75 %	(Median) 50 %	25 %	5 %
00010	Water temperature	(degrees C)	19	20.5	9.0	14.6	20.5	18.0	15.0	10.7	9.0
00061	Discharge, inst.	(ft <sup>3</sup> /s)	19	19.0	2.2	10.8	18.8	15.8	11.8	4.2	2.2
00095	Specific conductance	(µS/cm at 25°C)	19	750	236	427	750	730	317	278	236
00300	Oxygen, dissolved	(mg/L)	19	11.6	8.3	9.9	11.6	10.6	10.0	9.0	8.3
00400	pH, field	(standard unit)	19	8.4	7.9	8.1	8.4	8.2	8.1	8.0	7.9
00608	Nitrogen ammonia	(mg/L as N)	19	0.08	<0.015	0.02*	*0.08	*0.03	*0.02	*0.009	*0.005
00613	Nitrogen, nitrite	(mg/L as N)	19	0.02	<0.01	--	--	--	--	--	--
00623	Amn+org, filtered	(mg/L as N)	19	0.3	<0.1	0.2*	*0.3	*0.2	*0.2	*0.2	*0.1
00625	Amn+org, unfiltered	(mg/L as N)	19	1.1	<0.2	0.4*	*1.1	*0.6	*0.3	*0.3	*0.1
00631	NO <sub>2</sub> + NO <sub>3</sub> , filtered	(mg/L as N)	19	6.9	0.94	3.0	6.9	5.4	2.0	1.3	0.94
00665	Phosphorus, total	(mg/L as P)	19	0.54	0.03	0.15	0.54	0.20	0.11	0.07	0.03
00666	Phosphorus, filtered	(mg/L as P)	19	0.11	0.02	0.05	0.11	0.06	0.04	0.03	0.02
00671	Phosphorus, ortho	(mg/L as P)	19	0.16	0.03	0.06	0.16	0.07	0.05	0.04	0.03
80154	Suspended sediment	(mg/L)	19	664	6	132	664	172	88	35	6

\* - Value is estimated by using a log-probability regression to predict the values of data below the detection limit (Helsel and Cohn, 1988).

## SEASONAL DIFFERENCES IN SURFACE WATER

Concentrations of ammonia, ammonia-plus-organic nitrogen, total phosphorus, and suspended sediment generally were largest April through September, which is during the irrigation season; whereas the largest concentrations of dissolved nitrate and dissolved phosphorus generally occurred during the non-irrigation season. Although concentrations of dissolved nitrate are larger during the non-irrigation season, the instantaneous daily load of total nitrogen is generally larger during the irrigation season, because discharge is greater (table 3). Insufficient data do not permit a model of nutrient or sediment loads, but daily nutrient and sediment loads can be estimated from instantaneous concentrations and daily streamflow (table 3).

## QUALITY ASSURANCE AND CONTROL

Quality-assurance (QA) plans were developed and followed to ensure that sample collection and processing procedures did not contaminate samples. The field QA plan consisted of quality-control procedures including the calibration of field instruments with standard solutions of known and assured values, submittal of quality-control samples that were free of analytes (blanks), and participation by field personnel in the National Field Quality Assurance Plan, as described by Stanley (1998). The laboratory QA plan consisted of quality-control procedures including the calibration of instruments and analysis of standard and blank solutions, as described by Pritt and Raese (1995). Field blanks were used to assess the potential levels of sample contamination occurring during sample collection, processing, and shipping. Two field blanks were collected on the same day as regular sampling (in February 1998 and in July 1998) by passing inorganic blank water through all sampling equipment using identical collection, processing, preservation, transportation, and storage procedures as for regular samples.

Nitrate was detected at a concentration of 0.008 mg/L in the February 1998 field blank; ammonia was detected at a concentration of 0.007 mg/L, orthophosphate was detected at a concentration of 0.003 mg/L, and nitrite was detected at a concentration of 0.001 mg/L in the July 1998 field blank. The blanks were analyzed using a special low-level technique, but the normal laboratory reporting limits (LRL) for

nitrate, orthophosphate, nitrite, and ammonia are 0.05, 0.01, 0.01, and 0.015 mg/L, respectively. The normal LRL for nitrate is more than 5 times the value of the detection in the blank, the LRL for orthophosphate is 3 times the value of the detection in the blank, the LRL for nitrite is 10 times the value of the detection in the blank, and the LRL for ammonia is more than twice the value of detection in the blank; thus there is little chance that the values for these constituents are biased.

## SUMMARY

A gage was installed to measure streamflow in the Spring Creek Basin and samples were collected at two sites to measure concentrations of nutrients and sediment from April 1997 to September 1998. Concentrations of nitrate in samples from Spring Creek at Hanks Road ranged from 0.37 to 6.2 mg/L and concentrations of nitrate in samples from Spring Creek at McCreadie Road ranged from 0.94 to 6.9 mg/L. Concentrations of phosphorus species and suspended sediment, showing a pattern of larger median concentrations and wider ranges at McCreadie Road than at the Hanks Road site, ranged from 0.01 to 0.07 mg/L and 0.05 to 0.26 mg/L at the Hanks Road site and ranged from 0.02 to 0.11 mg/L and 0.03 to 0.54 mg/L at the McCreadie Road site for dissolved and total phosphorus, respectively. Concentrations of suspended sediment ranged from 4 to 226 mg/L at the Hanks Road site and 6 to 664 mg/L at the McCreadie Road site.

**Table 3.** Nutrient and sediment loads from two sites in the Spring Creek Basin, April 1997 to September 1998, Benton County, Washington  
[mg/L, milligrams per liter; N, nitrogen; P, phosphorus; t/day, tons per day; <, less than]

Date	Time	Dis-charge (cubic feet per day)	Nitro- gen (mg/L as N)	Phos- phorus (mg/L as P)	Nitro- gen (t/day as N)	Phos- phorus (t/day as P)	Sedi- ment, dis- charge, sus- pended (t/day)
<u>Spring Creek at Hanks Road near Prosser, Washington</u>							
April 1997							
23...	1200	535,680	1.8	0.11	0.03	0.002	1.7
May							
23...	1300	388,800	2.1	0.23	0.03	0.003	2.7
June							
16...	1315	665,280	1.7	0.26	0.04	0.005	4.1
July							
16...	1200	803,520	1.1	0.10	0.03	0.003	0.96
August							
20...	1310	838,080	1.4	0.15	0.04	0.004	2.4
September							
24...	1400	622,080	<sup>e</sup> 1.5	0.05	<sup>e</sup> 0.03	<sup>e</sup> 0.001	0.22
October							
22...	1300	276,480	<sup>e</sup> 3.4	0.06	<sup>e</sup> 0.03	<sup>e</sup> <0.001	0.19
November							
25...	1330	120,960	6.3	0.11	0.02	<0.001	0.04
December							
18...	1300	69,120	6.5	0.08	0.01	<0.001	0.10
January 1998							
27...	1245	33,696	6.4	0.05	0.01	<0.001	0.00
February							
25...	1245	34,560	6.0	0.07	0.006	<0.001	0.15
March							
18...	1230	12,960	5.6	0.06	0.002	<0.001	0.01
April							
23...	1330	35,420	1.3	0.07	0.01	<0.001	0.80
May							
19...	1240	639,360	0.92	0.09	0.02	0.002	2.2
June							
24...	1300	466,560	1.3	0.09	0.02	0.001	0.67

**Table 3.** Nutrient and sediment loads from two sites in the Spring Creek Basin, April 1997 to September 1998, Benton County, Washington--Continued

Date	Time	Dis-charge (cubic feet per day)	Nitro- gen (mg/L as N)	Phos- phorus (mg/L as P)	Nitro- gen (t/day as N)	Phos- phorus (t/day as P)	Sedi- ment, dis- charge, sus- pended (t/day)
July							
22...	1255	673,920	0.65	0.12	0.01	0.003	0.59
August							
20...	1240	950,400	0.66	0.05	0.02	0.001	0.32
September							
08...	1200	950,400	0.86	0.10	0.03	0.003	0.85
<u>Spring Creek at McCreadie Road near Prosser, Washington</u>							
April 1997							
23...	1030	950,400	2.8	0.22	0.08	0.007	5.8
May							
23...	1020	1,036,800	2.7	0.23	0.09	0.007	10
June							
16...	1100	950,400	3.2	0.54	0.10	0.016	6.9
July							
16...	0950	1,036,800	2.3	0.10	0.07	0.003	2.9
August							
20...	1000	1,209,600	2.0	0.08	0.08	0.003	2.7
September							
24...	1205	1,382,400	2.5	0.11	0.11	0.005	3.9
October							
22...	1100	656,400	<sup>e</sup> 4.4	0.07	<sup>e</sup> 0.09	0.001	0.66
November							
25...	1050	362,880	7.1	0.04	0.08	<0.001	0.05
December							
18...	1150	285,120	7.0	0.08	0.06	<0.001	0.05
January 1998							
27...	1030	241,920	6.7	0.04	0.05	<0.001	0.05
February							
25...	1030	224,640	5.7	0.04	0.04	<0.001	0.62
March							
18...	1020	190,080	6.3	0.03	0.04	<0.001	0.21

**Table 3.** Nutrient and sediment loads from two sites in the Spring Creek Basin, April 1997 to September 1998, Benton County, Washington--Continued

Date	Time	Dis-charge (cubic feet per day)	Nitro- gen (mg/L as N)	Phos- phorus (mg/L as P)	Nitro- gen (t/day as N)	Phos- phorus (t/day as P)	Sedi- ment, dis- charge, sus- pended (t/day)
April							
23...	1030	838,080	2.0	0.10	0.05	0.003	1.9
May							
19...	1015	1,382,400	1.6	0.11	0.07	0.005	7.3
June							
01...	1200	1,468,800	1.4	0.20	0.06	0.009	7.2
24...	1100	1,123,200	1.9	0.11	0.07	0.004	2.7
July							
22...	1040	1,296,000	2.0	0.38	0.08	0.015	28
August							
20...	1020	1,382,400	2.0	0.15	0.09	0.006	3.3
September							
08...	1050	1,641,600	1.8	0.20	0.09	0.010	6.6

<sup>e</sup> Total nitrogen (the sum of NO<sub>2</sub>+NO<sub>3</sub> and ammonia plus organic) is estimated using the laboratory reporting limit for the ammonia plus organic value for all samples with concentrations of ammonia plus organic nitrogen that are less than the laboratory reporting limit. The calculated loads are also reported as an estimate.

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