HYDRAULIC GEOMETRY AND SEDIMENT DATA FOR THE SOUTH FORK SALMON RIVER, IDAHO, 1985-86

By Rhea P. Williams, Ivalou O'Dell, and Walter F. Megahan

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CONVERSION FACTORS

Inch-pound units in this report may be converted to metric units using conversion factors listed below. Constituent concentrations are given in mg/L (milligrams per liter), which is equal to parts per million. Specific conductance is reported in µS/cm (microsiemens per centimeter at 25 degrees Celsius). Weight measurements are reported in grams; to convert grams to ounces, multiply by 0.03527.

Multiply inch-pound unit	By	To obtain metric unit
cubic foot per second (ft^3/s)	0.02832	cubic meter per second
foot (ft)	0.3048	meter
mile (mi)	1.609	kilometer
square inch (in^2)	0.00065	square meter
square mile (mi^2)	2.590	square kilometer
ton per day (ton/d)	0.9072	megagram per day

Temperature in °C (degrees Celsius) can be converted to °F (degrees Fahrenheit) as follows:

$$°F = (1.8)(°C) + 32$$

Water temperatures are reported to the nearest 0.5 °C.

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ABSTRACT

Hydraulic geometry, suspended-sediment, and bedload samples were collected at three sites in the upper reach of the South Fork Salmon River drainage basin from April 1985 to June 1986. Sites selected were South Fork Salmon River near Krassel Ranger Station, Buckhorn Creek, and North Fork Lick Creek. Results of the data collection are presented in this report.

INTRODUCTION

The South Fork Salmon River is part of the Columbia River system in west-central Idaho and drains an area of about 1,290 mi^2 (fig. 1). Most of the area is underlain by granitic rocks of the Idaho batholith. Approximately one-third of the drainage basin is within the Boise National Forest; the remainder is in the Payette National Forest.

The South Fork Salmon River drainage basin has abundant natural resources, including economic mineral deposits, recreation, timber, water, wildlife, and fish. The fishing resource is particularly significant because the South Fork is an important spawning and rearing habitat for anadromous fish populations, including salmon and steelhead. Past soil-disturbing activities, especially timber harvest and road construction, have caused excessive sedimentation in the river and have raised many questions about future land-management activities within the basin (Seyedbagheri and others, 1987).

Information was needed about the sediment-transport capabilities of the river and representative tributaries to assist in future land-use planning efforts. In 1985, the Idaho Department of Fish and Game and the U.S. Geological Survey entered into a cooperative agreement to develop some of the needed information. The Survey, under the direction of the U.S. Forest Service, Intermountain Experiment Station, conducted a 2-year study to collect the data. Results of this study are summarized in this report.

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[1] U.S. Forest Service, Intermountain Experiment Station, Boise, Idaho

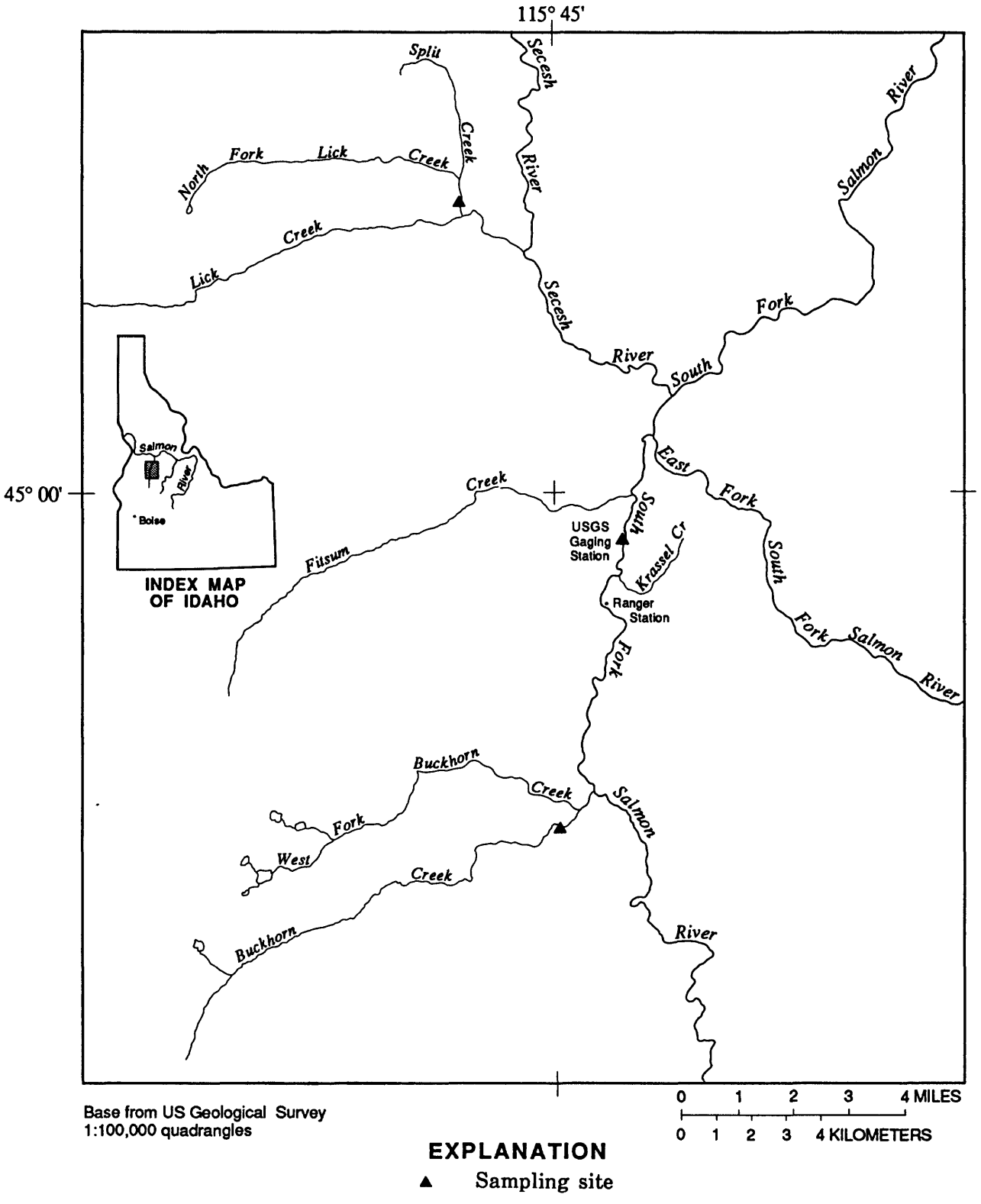

Figure 1.--Location of study area and sampling sites.

Data were collected at three sites within the upper reach of the South Fork Salmon River drainage basin. Sites selected were South Fork Salmon River near Krassel Ranger Station, drainage area 330 mi^2; Buckhorn Creek, drainage area 24.9 mi^2; and North Fork Lick Creek, drainage area 9.63 mi^2 (fig. 1).

EXPLANATION OF THE DATA

Data collected at the three sites include hydraulic geometry, suspended sediment, and bedload.

Hydraulic geometry data for the South Fork Salmon River, Buckhorn Creek, and North Fork Lick Creek are presented in tables 1, 2, and 3, respectively (all tables in back of report). Water-surface slopes were obtained by surveying elevations at the respective sites and at reference points up- and downstream from the initial point.

Suspended-sediment data are listed in tables 4, 5, and 6. Water samples for analyses of suspended sediment were collected using US DH-48 and US DH-59 suspended-sediment samplers (Guy and Norman, 1982) and the equal-width increment method. In addition to total sediment concentration, a sand-silt split was determined by wet-sieve analysis using a 0.062-millimeter sieve (Guy, 1969). Suspended-sediment discharge was computed as discharge (tons per day) = water discharge (cubic feet per second) x suspended-sediment concentration (milligrams per liter) x the constant 0.0027.

Bedload samples were collected using a Helley-Smith bedload sampler with a 3-in^2 orifice. Field tests of the sampler indicated near-perfect efficiency (Emmett, 1979). Samples were collected at 12-26 equally spaced cross-section locations. The sampling duration ranged from 30 seconds to 120 seconds but consistent time was used for each transect. The samples were air dried, and size distribution was determined by dry-sieve analysis using Tyler[2] and U.S. standard sieves with mesh-size openings that decrease by a factor of 1.414. Each sample (in the set of sieves) was shaken for 15-20 minutes on a Ro-tap shaker. Bedload particle-size distributions for the three sites are presented in tables 7, 8, and 9.

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

Bedload discharge (tables 10, 11, and 12) was computed using the equation:

$$QB = K \times Wt/T \times gt$$

where

QB = bedload discharge, in tons per day;
K = 0.3816, a factor to convert grams per second per foot into tons per day per foot;
Wt = total width of the stream;
T = total time in seconds that the bedload sampler was on the bed, calculated by multiplying the sample time by n (n = total number of vertical samples); and
gt = total grams of sample collected in the cross section.

Total-sediment discharge data (suspended and bedload) are presented in tables 10, 11, and 12.

REFERENCES CITED

Emmett, W.W., 1979, A field calibration of the sediment-trapping characteristics of the Helley-Smith bedload sampler: U.S. Geological Survey Open-File Report 79-411, 96 p.

Guy, H.P., 1969, Laboratory theory and methods for sediment analyses: U.S. Geological Survey Techniques of Water-Resources Investigations, Book 5, Chapter C1, 58 p.

Guy, H.P., and Norman, V.W., 1982, Field methods for measurement of fluvial sediment: U.S. Geological Survey Techniques of Water-Resources Investigations, Book 3, Chapter C2, 59 p.

Seyedbagheri, K.A., McHenry, M.L., and Platts, W.S., compilers, 1987, An annotated bibliography of the hydrology and fisheries studies of the South Fork Salmon River: Ogden, Utah, U.S. Forest Service, Intermountain Research Station, General Technical Report INT-235, 27 p.

GLOSSARY OF TERMS

Alpha--Velocity distribution coefficient.

Bedload--The sediment that is transported in a stream by rolling, sliding, or skipping along the bed and very close to it. In this report, bedload is considered to consist of particles in transit within 0.3 ft of the streambed.

Bedload discharge--The quantity of bedload passing a transect in a unit of time.

Discharge--The volume of water that passes a given point within a given period of time.

Depth-integrated sample--A discharge-weighted (velocity-weighted) sample of water-sediment mixture collected at one or more verticals in accordance with the technique of depth integration. The discharge of any property of the sample expressible as a concentration can be obtained as the product of the concentration and the water discharge represented by the sample.

Depth integration--A method of sampling at every point throughout the sampled depth whereby a water-sediment mixture is collected so that the contribution to the sample from each point is proportional to the stream velocity at the point.

Equal-width increment method--A procedure for obtaining the discharge-weighted suspended-sediment concentration of flow at a transect by: (1) performing depth integration at a series of verticals equally spaced across the transect, and (2) using the same vertical transit rate at all sampling verticals.

Manning n--A roughness or flow resistance coefficient.

Particle-size distribution--The frequency distribution of the relative amounts of particles in a sample that are within specified size ranges. Relative amounts usually are expressed as percentages by mass.

Sediment discharge--The mass or volume of sediment (usually mass) passing a stream transect in a unit of time. The term may be qualified, for example, as suspended-sediment discharge, bedload discharge, or total-sediment discharge.

Suspended sediment--The sediment that at any given time is maintained in suspension by the upward components of turbulent currents or that exists in suspension as a colloid.

Suspended-sediment concentration--The velocity-weighted concentration of a suspended sediment in the sampled zone (from the water surface to a point approximately 0.3 ft above the bed) expressed as milligrams of dry sediment per liter of water-sediment mixture (milligrams per liter).

Suspended-sediment discharge (tons per day)--The quantity of sediment, as measured by dry mass or volume, that passes a section in a given time.

Total-sediment discharge--The total quantity of sediment (bedload plus suspended sediment) passing a section in a unit of time.

Table 1.--*Hydraulic geometry data, South Fork Salmon River near Krassel Ranger Station*

Date	Width (ft)	Area (ft)	Velocity (ft/s)	Gage height (ft)	Water discharge (ft^3/s)	Water-surface slope (ft/ft)	Alpha	Depth (ft)	Manning n
4-18-85	107	457	2.77	4.66	1,270	0.00100	1.05	4.27	0.045
4-30-85	103	382	2.03	3.85	776	.00083	1.16	3.71	.051
5- 1-85	103	419	2.28	4.20	953	.00078	1.12	4.07	.046
5- 2-85	107	486	2.73	4.74	1,320	.00072	1.10	4.54	.040
5- 7-85	108	488	2.70	4.79	1,320	.00050	1.10	4.52	.034
5- 8-85	109	514	2.97	5.10	1,530	.00067	1.08	4.72	.036
5- 9-85	108	506	2.87	5.01	1,450	.00067	1.08	4.69	.037
5-15-85	105	435	2.45	4.32	1,070	.00050	1.11	4.14	.035
5-16-85	106	435	2.38	4.29	1,050	.00072	1.12	4.10	.043
5-17-85	106	464	2.60	4.46	1,210	.00072	1.09	4.38	.041
5-21-85	110	560	3.33	5.42	1,870	.00112	1.06	5.09	.044
5-22-85	112	589	3.47	5.67	2,040	.00056	1.06	5.26	.031
5-23-85	113	613	3.65	5.87	2,240	.00056	1.06	5.42	.030
5-29-85	109	544	3.35	5.38	1,820	.00056	1.05	4.99	.031
5-30-85	108	512	3.13	5.05	1,600	.00067	1.06	4.74	.035
5-31-85	108	485	2.92	4.81	1,420	.00078	1.08	4.49	.039
6- 5-85	108	480	2.83	4.70	1,360	.00072	1.06	4.44	.038
6- 6-85	110	523	3.08	5.04	1,610	.00078	1.05	4.75	.038
6- 7-85	110	525	3.12	5.11	1,610	.00083	1.06	4.77	.039
6-11-85	106	444	2.60	4.40	1,160	.00083	1.07	4.19	.043
6-12-85	106	453	2.58	4.44	1,170	.00072	1.06	4.27	.041
6-17-85	105	396	2.15	3.93	841	.00072	1.13	3.77	.045
6-18-85	105	396	2.21	3.90	877	.00061	1.13	3.77	.040
6-19-85	104	382	2.11	3.82	804	.00061	1.17	3.67	.041
6-25-85	101	317	1.62	3.13	514	.00067	1.26	3.14	.051
6-26-85	102	315	1.57	3.07	490	.00089	1.24	3.09	.060
7- 9-85	100	240	1.11	2.40	266	.00056	1.33	2.40	.057
7-10-85	100	235	1.10	2.38	258	.00061	1.33	2.35	.059
7-17-85	99	217	.91	2.19	214	.00050	1.44	2.19	.062
7-18-85	99	214	.99	2.17	211	.00056	1.44	2.16	.059

Table 1.--*Hydraulic geometry data, South Fork Salmon River near Krassel Ranger Station*--Continued

[-, no data available]

Date	Width (ft)	Area (ft)	Velocity (ft/s)	Gage height (ft)	Water discharge (ft^3/s)	Water-surface slope (ft/ft)	Alpha	Depth (ft)	Manning n
7-23-85	99	205	0.91	2.06	186	0.00060	1.48	2.07	0.065
7-30-85	98	199	.93	2.05	185	.00056	1.36	2.03	.060
8- 6-85	99	195	.81	1.85	154	.00056	1.48	1.97	.068
8-20-85	97	190	.75	1.89	137	.00050	1.72	1.96	.069
9- 4-85	97	174	.74	1.79	130	.00056	1.51	1.79	.070
10- 2-85	98	190	.85	1.95	168	.00044	1.42	1.94	.057
4- 9-86	107	434	2.56	4.32	1,110	.00106	1.09	4.06	.048
4-22-86	107	505	2.95	4.79	1,490	.00128	1.06	4.72	.051
4-23-86	111	577	3.34	5.45	1,930	.00075	1.05	5.20	.037
4-24-86	109	535	3.20	5.15	1,710	.00061	1.05	4.91	.033
4-25-86	108	526	3.06	5.01	1,610	.00067	1.07	4.87	.036
4-29-86	106	430	2.61	4.34	1,120	.00061	1.07	4.06	.036
5-20-86	110	542	3.30	5.27	1,790	.00069	1.06	4.93	.034
5-21-86	113	613	3.65	5.87	2,240	.00039	1.06	5.42	.025
5-22-86	112	579	3.32	5.63	1,920	.00072	1.06	5.17	.036
5-23-86	110	538	3.26	5.36	1,750	.00053	1.07	4.89	.030
5-25-86	110	-	-	5.25	1,720	.00050	-	-	-
5-26-86	113	608	3.81	5.85	2,310	.00044	1.05	5.38	.025
5-27-86	115	723	4.46	6.84	3,230	.00044	1.06	6.29	.024
5-28-86	118	-	-	7.06	3,480	-	-	-	-
5-29-86	123	853	5.10	7.80	4,300	.00081	1.06	6.93	.030
5-30-86	125	-	-	8.38	5,260	.00108	-	-	-
6- 2-86	121	-	-	7.76	4,360	.00086	-	-	-
6- 3-86	121	841	5.18	7.78	4,390	.00097	1.04	6.95	.033
6- 6-86	114	-	-	6.52	2,900	-	-	-	-
6- 7-86	113	646	4.24	6.28	2,740	.00058	1.06	5.72	.027
6- 8-86	115	-	-	6.82	3,220	.00058	-	-	-
6-10-86	111	590	3.78	5.79	2,230	.00058	1.05	5.32	.029
6-24-86	103	390	2.28	3.93	891	.00067	1.11	3.79	.041

Table 2.--*Hydraulic geometry data, Buckhorn Creek*

[-, no data available]

Date	Width (ft)	Area (ft)	Velocity (ft/s)	Gage height (ft)	Water discharge (ft^3/s)	Water-surface slope (ft/ft)	Alpha	Depth (ft)	Manning n
5- 7-85	35	42.2	3.57	6.50	152	0.00797	1.27	1.21	0.042
5-16-85	32	40.2	3.08	6.30	124	.00944	1.22	1.26	.055
5-21-85	32	52.0	4.15	6.75	216	.00630	1.21	1.63	.039
5-30-85	31	41.2	3.70	6.51	154	.00714	1.52	1.33	.041
6- 6-85	30	43.2	3.97	6.54	172	.00760	1.40	1.44	.042
6-11-85	30	43.0	3.53	6.49	152	.00960	1.44	1.43	.052
6-17-85	30	33.2	3.01	6.25	100	.00564	1.30	1.11	.040
6-25-85	30	33.7	1.82	-	61	.00559	1.30	1.12	.066
7- 9-85	30	29.8	1.07	-	32	.00660	1.75	.99	.112
7-17-85	29	27.1	.95	5.66	25	.00681	1.83	.93	.123
7-23-85	28	24.2	.93	5.56	22	.00574	1.59	.86	.110
7-30-85	28	24.1	.90	5.54	22	.00511	1.90	.86	.107
8- 5-85	28	21.7	.82	5.52	18	.00553	1.62	.78	.114
8-20-85	29	24.7	.81	5.46	20	.00553	1.72	.85	.123
4-23-86	34	54.8	4.33	6.66	238	.00850	1.17	1.61	.044
4-24-86	32	47.1	3.96	6.50	186	.00978	1.26	1.47	.048
4-29-86	34	50.1	2.18	6.27	110	.00591	1.75	1.47	.068
5-21-86	32	55.8	4.95	6.85	276	.00760	1.28	1.74	.038
5-22-86	32	49.6	4.02	6.76	200	.00710	1.33	1.55	.042
5-26-86	32	50.0	-	6.85	280	.00839	-	1.56	-
5-29-86	38	87.3	9.50	7.80	830	.02000	-	2.30	.039
6- 3-86	37	73.0	5.75	7.31	420	.00882	-	1.97	.038
6- 9-86	31	53.1	3.82	6.81	224	.00745	1.15	1.71	.048

Table 3.--*Hydraulic geometry data, North Fork Lick Creek*

[-, no data available]

Date	Width (ft)	Area (ft)	Velocity (ft/s)	Gage height (ft)	Water discharge (ft^3/s)	Water-surface slope (ft/ft)	Alpha	Depth (ft)	Manning n
5- 8-85	26	36.1	2.07	15.24	75	0.00500	1.79	1.39	0.063
5-15-85	25	28.8	1.84	15.04	52	.00890	1.71	1.15	.084
5-22-85	29	37.3	2.62	15.91	98	.00500	-	1.29	.047
5-29-85	28	34.3	2.47	15.39	85	.00833	2.05	1.23	.063
6- 6-85	28	35.7	2.64	15.46	92	.00810	1.92	1.28	.060
6-12-85	27	30.2	2.08	15.08	63	.00500	1.55	1.12	.054
6-18-85	24	25.5	1.77	14.95	45	.00578	1.48	1.06	.066
6-26-85	23	20.9	1.22	14.83	23	.00789	1.63	.91	.101
7-10-85	22	17.7	.85	14.56	15	.00731	1.46	.80	.129
7-18-85	21	15.9	.76	14.53	12	.00364	1.56	.76	.098
7-23-85	21	16.0	.78	14.47	13	.00714	1.42	.76	.134
7-30-85	20	13.6	.71	14.48	9.6	.00571	1.34	.68	.122
8- 7-85	20	13.1	.60	14.40	7.8	.00600	1.50	.66	.145
8-21-85	18	9.6	.39	14.36	3.7	.00209	2.11	.53	.115
4-23-86	28	36.6	2.96	15.35	108	.00552	-	1.31	.045
4-25-86	26	31.3	2.56	15.16	81	.00552	-	1.20	.049
4-28-86	25	30.4	1.71	14.97	52	.00793	1.68	1.22	.088
5-21-86	28	39.3	2.67	15.34	106	.00621	-	1.40	.055
5-22-86	27	35.9	2.55	15.22	92	.00500	-	1.33	.050
5-26-86	28	39.6	2.80	15.35	112	.00534	-	1.41	.049
5-30-86	30	52.3	3.33	15.79	206	.01760	-	1.74	.086
5-30-86	30	74.8	3.56	16.40	266	.00633	-	2.49	.061
6- 3-86	29	48.1	3.12	15.64	150	.01240	-	1.66	.074
6- 6-86	28	41.0	-	15.40	116	-	-	1.46	-
6- 9-86	27	36.5	2.93	15.24	108	.00586	-	1.35	.047

Table 4.--Suspended-sediment data, South Fork Salmon River near Krassel Ranger Station

Date	Water discharge (ft^3/s)	Specific conductance ($\mu S/cm$)	Water temperature (°C)	Suspended sediment (mg/L)	Percent sand	Suspended-sediment discharge (ton/d)
4-18-85	1,270	30	7.0	19	60	65
4-30-85	776	33	7.0	6	43	13
5- 1-85	953	32	5.5	13	49	33
5- 2-85	1,320	29	6.0	14	55	50
5- 7-85	1,320	29	7.0	12	55	43
5- 8-85	1,530	25	6.0	17	59	70
5- 9-85	1,450	25	5.5	13	61	51
5-15-85	1,070	28	5.5	8	65	23
5-16-85	1,050	29	5.5	6	49	17
5-17-85	1,210	28	6.0	9	47	29
5-21-85	1,870	23	8.0	28	62	141
5-22-85	2,040	23	6.0	43	70	237
5-23-85	2,240	22	7.0	51	81	308
5-29-85	1,820	23	7.0	17	68	84
5-30-85	1,600	23	5.0	13	62	56
5-31-85	1,420	24	5.0	12	60	46
6- 5-85	1,360	26	7.0	10	59	37
6- 6-85	1,610	23	8.0	12	66	52
6- 7-85	1,610	23	10.0	22	70	96
6-11-85	1,160	26	11.0	9	60	28
6-12-85	1,170	24	11.0	7	58	22
6-17-85	841	26	13.0	7	51	16
6-18-85	877	27	11.0	10	67	24
6-19-85	804	27	11.0	6	41	13
6-25-85	514	32	13.0	5	44	6.9
6-26-85	490	33	9.0	4	45	5.3
7- 9-85	266	43	22.0	3	39	2.2
7-10-85	258	42	18.0	4	34	2.8
7-17-85	214	47	22.0	1	46	.58
7-18-85	211	46	16.0	4	-	2.3

Table 4.--*Suspended-sediment data, South Fork Salmon River near Krassel Ranger Station*--Continued

Date	Water discharge (ft^3/s)	Specific conductance ($\mu S/cm$)	Water temperature (°C)	Suspended sediment (mg/L)	Percent sand	Suspended-sediment discharge (ton/d)
7-23-85	186	51	23.0	5	-	2.5
7-30-85	185	52	18.0	6	-	3.0
8- 6-85	154	53	16.0	3	-	1.2
8-20-85	137	55	18.0	3	-	1.1
9- 4-85	130	59	15.0	4	-	1.4
10- 2-85	168	55	9.0	2	-	.91
4-22-86	1,490	28	8.0	26	-	105
4-23-86	1,930	24	5.0	44	-	229
4-24-86	1,710	27	4.0	26	-	120
4-25-86	1,610	26	5.0	16	-	70
4-29-86	1,120	29	5.0	10	-	30
5-20-86	1,790	34	8.0	26	-	126
5-21-86	2,240	24	6.5	53	-	321
5-22-86	1,920	25	5.5	33	-	171
5-23-86	1,750	25	3.5	29	-	137
5-26-86	2,310	24	8.0	43	68	268
5-27-86	3,230	21	6.0	106	66	924
5-28-86	3,480	34	-	94	72	883
5-29-86	4,300	19	5.5	127	70	1,470
5-30-86	5,260	-	-	109	53	1,550
6- 2-86	4,360	18	8.0	69	71	812
6- 3-86	4,390	18	8.0	92	85	1,090
6- 6-86	2,900	19	8.5	51	86	399
6- 7-86	2,740	20	8.0	63	80	466
6- 8-86	3,220	20	-	70	90	608
6-10-86	2,230	23	7.0	52	81	313
6-24-86	891	33	14.0	6	-	14

Table 5.--*Suspended-sediment data, Buckhorn Creek*

[-, no data available]

Date	Water discharge (ft^3/s)	Specific conductance (µS/cm)	Water temperature (°C)	Suspended sediment (mg/L)	Percent sand	Suspended-sediment discharge (ton/d)
5- 7-85	152	26	-	6	66	2.5
5-16-85	124	26	-	2	50	.67
5-21-85	216	20	6.5	9	68	5.2
5-30-85	154	23	-	19	63	7.9
6- 6-85	172	18	-	4	64	1.9
6-11-85	152	25	6.0	3	70	1.2
6-17-85	100	21	10.0	5	57	1.4
6-25-85	61	24	8.0	2	62	.33
7- 9-85	32	36	14.5	1	62	.09
7-17-85	25	42	15.0	1	55	.07
7-23-85	22	42	15.0	2	-	.12
7-30-85	22	45	14.0	2	-	.12
8- 5-85	18	45	16.0	2	-	.10
8-20-85	20	49	13.0	2	-	.11
4-23-86	238	24	4.0	17	-	11
4-24-86	186	26	3.0	9	-	4.5
4-29-86	110	29	5.0	4	-	1.2
5-21-86	276	20	5.0	34	-	25
5-22-86	200	23	3.0	17	-	9.2
5-26-86	280	17	5.0	20	-	15
5-29-86	830	15	5.0	711	77	1,590
6- 3-86	420	-	8.0	44	81	50
8- 9-86	224	18	7.0	17	-	10

Table 6.--*Suspended-sediment data, North Fork Lick Creek*

[-, no data available]

Date	Water discharge (ft^3/s)	Specific conductance ($\mu S/cm$)	Water temperature (°C)	Suspended sediment (mg/L)	Percent sand	Suspended-sediment discharge (ton/d)
5- 8-85	75	21	5.0	4	58	0.81
5-15-85	52	24	-	4	55	.56
5-22-85	98	23	6.0	9	68	2.4
5-29-85	85	17	5.0	5	54	1.2
6- 6-85	92	16	5.5	8	64	2.0
6-12-85	63	17	10.0	3	50	.51
6-18-85	45	19	10.0	3	50	.36
6-26-85	23	22	9.5	4	54	.25
7-10-85	15	29	13.0	2	53	.08
7-18-85	12	32	10.5	1	52	.03
7-23-85	13	33	15.0	4	-	.14
7-30-85	9.6	36	13.0	4	-	.10
8- 7-85	7.8	34	10.0	2	-	.04
8-21-85	3.7	36	9.0	5	-	.05
4-23-86	108	20	3.0	12	-	3.5
4-25-86	81	21	3.0	10	-	2.2
4-28-86	52	24	5.0	2	-	.28
5-21-86	106	18	4.0	18	-	5.2
5-22-86	92	21	3.0	19	-	4.7
5-30-86	206	19	6.0	93	66	52
6- 3-86	150	17	7.5	24	76	9.7
6- 6-86	116	15	8.0	19	-	6.0
6- 9-86	108	17	7.5	10	-	2.9

Table 7.--*Bedload particle-size distribution, South Fork Salmon River near Krassel Ranger Station*

Date	Sample weight (grams)	Percentage by weight, particle size in millimeters											
		64	32	16	8	4	2	1	0.5	0.25	0.125	0.062	Pan
4-18-85	123.7	0.0	0.0	0.0	1.3	1.4	4.9	25.8	41.7	23.8	1.0	0.1	0.1
4-30-85	9.2	.0	.0	.0	.0	8.7	3.3	18.5	42.4	26.1	1.1	.0	.0
4-30-85	38.1	.0	.0	.0	.0	1.1	3.7	33.1	47.0	14.7	.5	.0	.0
5- 1-85	25.8	.0	.0	.0	.0	1.9	2.7	17.8	40.3	33.3	2.7	.8	.4
5- 2-85	173.5	.0	.0	.0	.4	3.1	14.9	31.2	30.8	18.2	1.1	.2	.1
5- 7-85	356.1	.0	.0	.0	.3	1.3	9.2	33.9	43.3	11.4	.4	.1	.1
5- 8-85	146.7	.0	.0	.0	.0	1.9	4.1	17.6	43.5	31.8	.9	.1	.1
5- 9-85	320.7	.0	.0	.0	.2	.4	3.5	24.5	54.5	16.4	.5	.1	.1
5-15-85	177.1	.0	.0	.0	.6	.4	3.6	29.2	50.7	15.0	.3	.1	.1
5-16-85	27.1	.0	.0	.0	1.1	1.8	2.6	15.5	39.5	37.6	1.9	.0	.0
5-17-85	158.0	.0	.0	.0	1.5	1.1	6.2	34.6	40.4	15.5	.6	.1	.1
5-21-85	1,447.3	.0	.0	.0	.3	3.3	12.0	28.7	42.3	13.1	.3	.1	.1
5-22-85	2,149.8	.0	.0	.0	.1	.4	3.3	29.4	48.3	17.7	.6	.1	.1
5-22-85	6,857.6	.0	.0	.0	.2	1.5	10.1	33.9	43.4	10.4	.3	.1	.1
5-23-85	645.2	.0	.0	.0	.3	.4	1.7	19.6	50.9	26.5	.5	.1	.1
5-23-85	4,025.4	.0	.0	.0	.2	1.3	9.6	39.9	35.0	13.3	.6	.1	.1
5-29-85	6,195.5	.0	.0	.0	.7	6.4	25.6	40.9	23.1	3.1	.1	.0	.0
5-29-85	5,967.1	.0	.0	.1	.5	6.6	29.9	44.6	16.4	1.7	.1	.0	.0
5-30-85	7,717.9	.0	.0	.0	.5	6.5	26.6	40.8	22.7	2.7	.1	.0	.0
5-31-85	7,800.3	.0	.0	.0	.3	6.5	32.2	40.5	18.7	1.7	.1	.0	.0
6- 5-85	1,993.0	.0	.0	.0	.8	5.7	26.8	42.3	21.1	3.3	.1	.0	.0
6- 6-85	5,400.0	.0	.0	.0	.6	5.7	24.0	45.4	21.1	3.1	.1	.0	.0
6- 7-85	1,385.8	.0	.0	.0	.3	2.6	13.5	36.0	36.2	11.1	.3	.0	.0
6-11-85	595.3	.0	.0	.0	.0	.2	6.5	29.1	49.7	14.0	.4	.0	.0
6-12-85	1,499.3	.0	.0	.0	.0	1.3	14.1	40.7	36.9	6.7	.3	.0	.0
6-17-85	236.4	.0	.0	.0	.0	.8	10.7	46.2	36.0	6.0	.2	.0	.0
6-18-85	548.1	.0	.0	.0	.0	1.4	12.4	36.4	43.3	6.3	.1	.0	.0
6-19-85	309.6	.0	.0	.0	.0	1.7	19.0	37.7	35.1	6.4	.1	.0	.0
6-25-85	135.9	.0	.0	.0	.0	1.6	16.6	32.9	40.3	8.3	.2	.1	.0

Table 7.--*Bedload particle-size distribution, South Fork Salmon River near Krassel Ranger Station*--Continued

Date	Sample weight (grams)	Percentage by weight, particle size in millimeters											
		64	32	16	8	4	2	1	0.5	0.25	0.125	0.062	Pan
6-26-85	276.9	0.0	0.0	0.0	0.0	1.9	19.6	32.4	34.7	11.1	0.2	0.0	0.0
7- 9-85	19.2	.0	.0	.0	.0	.0	21.9	66.7	9.4	2.1	.0	.0	.0
7-10-85	17.9	.0	.0	.0	.0	.6	7.8	43.1	33.5	13.4	.6	.0	.0
7-17-85	3.6	.0	.0	.0	.0	5.6	16.7	36.1	33.3	8.3	.0	.0	.0
7-18-85	.5	.0	.0	.0	.0	.0	.0	40.0	40.0	20.0	.0	.0	.0
7-23-85	.5	.0	.0	.0	.0	.0	.0	20.0	40.0	40.0	.0	.0	.0
7-30-85	3.6	.0	.0	.0	.0	.0	8.3	27.8	50.0	11.1	2.8	.0	.0
8-20-85	.9	.0	.0	.0	.0	.0	22.2	33.3	33.3	11.1	.0	.0	.0
4-22-86	1,395.9	.0	.0	.0	.3	1.2	8.3	37.9	41.7	10.1	.4	.0	.0
4-23-86	1,133.8	.0	.0	.0	1.9	14.3	34.2	25.4	12.8	11.1	.4	.0	.0
4-24-86	1,606.3	.0	1.4	.2	.8	1.8	4.0	24.8	47.2	19.3	.6	.1	.1
4-25-86	1,057.5	.0	.0	.0	.3	.7	9.3	36.0	40.0	13.2	.3	.0	.0
4-29-86	1,282.0	.0	.0	.0	.3	.4	8.8	41.0	40.4	8.8	.2	.1	.0
5-20-86	2,251.3	.0	.0	.7	.5	1.3	6.8	27.0	46.7	16.4	.5	.1	.0
5-21-86	5,969.4	.0	.0	.1	.3	2.2	10.0	26.5	41.2	18.9	.7	.1	.1
5-22-86	2,113.5	.0	.0	.5	.3	.8	4.9	24.9	48.1	19.9	.4	.1	.0
5-23-86	1,461.1	.0	.0	.1	.1	.8	3.7	29.6	46.8	14.4	.7	.0	.0
5-25-86	5,083.7	.0	.0	.0	.6	7.1	21.2	32.9	28.7	9.3	.2	.0	.0
5-26-86	5,163.7	.0	.0	.2	1.1	9.9	28.3	26.8	20.8	12.0	.7	.1	.0
5-27-86	7,819.2	.0	.0	.2	.6	4.3	20.2	31.6	28.7	13.6	.7	.1	.1
5-29-86	12,175.4	.0	.0	1.2	2.2	6.5	15.1	27.2	30.8	16.2	.6	.1	.1
5-30-86	16,172.5	.0	.6	.5	2.1	7.8	22.7	32.3	22.0	11.4	.4	.1	.1
6- 2-86	17,153.6	.0	.0	.1	2.3	10.9	28.9	29.2	21.7	6.8	.2	.0	.0
6- 3-86	15,851.1	.0	.0	.6	2.5	11.6	28.2	27.0	23.1	6.8	.3	.0	.0
6- 6-86	18,014.2	.0	.0	.0	1.8	10.5	31.7	34.4	18.2	3.2	.1	.0	.0
6- 7-86	15,293.9	.0	.0	.0	1.8	9.8	26.5	35.2	23.0	3.5	.1	.0	.0
6- 8-86	15,240.9	.0	.0	.2	2.2	12.6	28.4	37.1	16.4	2.8	.1	.0	.0
6-10-86	17,347.2	.0	.0	.1	1.2	9.2	27.4	35.6	23.6	2.9	.1	.0	.0
6-24-86	870.0	.0	.0	.0	.1	.7	10.2	41.5	43.3	4.1	.1	.0	.0

Table 8.--*Bedload particle-size distribution, Buckhorn Creek*

Date	Sample weight (grams)	Percentage by weight, particle size in millimeters											
		64	32	16	8	4	2	1	0.5	0.25	0.125	0.062	Pan
5- 7-85	15.1	0.0	0.0	0.0	0.0	0.7	13.2	27.2	35.1	22.5	0.7	0.3	0.3
5-16-85	7.0	.0	.0	.0	4.3	.0	8.6	24.3	35.7	24.3	1.4	.7	.7
5-21-85	192.7	.0	.0	1.3	6.1	9.4	22.6	29.9	21.3	9.1	.3	.1	.1
5-30-85	86.5	.0	.0	.0	6.7	20.5	15.8	19.8	22.3	14.3	.3	.1	.1
6- 6-85	136.5	.0	.0	.0	1.8	6.2	22.1	31.9	26.0	11.6	.2	.1	.1
6-11-85	26.8	.0	.0	.0	.0	3.9	12.5	29.2	33.5	20.4	.6	.0	.0
6-17-85	18.6	.0	.0	.0	2.2	2.2	7.0	24.2	36.0	28.0	.5	.0	.0
6-25-85	7.6	.0	.0	.0	.0	2.6	6.6	10.5	34.2	43.4	2.6	.0	.0
7- 9-85	1.3	.0	.0	.0	46.2	.0	7.7	7.7	15.4	15.4	7.7	.0	.0
7-23-85	.7	.0	.0	.0	.0	.0	23.6	14.3	28.6	28.6	.0	.0	.0
7-30-85	1.4	.0	.0	.0	14.3	.0	28.6	35.7	14.3	7.1	.0	.0	.0
4-23-86	132.8	.0	.0	.0	3.8	3.8	13.5	27.9	32.2	18.1	.5	.1	.1
4-24-86	92.4	.0	.0	.0	1.4	4.1	13.5	28.7	31.8	19.7	.5	.1	.1
4-29-86	23.7	.0	.0	.0	.0	.8	6.3	22.4	40.9	29.1	.4	.0	.0
5-21-86	350.8	.0	.0	.0	1.6	6.0	17.9	30.9	28.7	14.5	.3	.1	.1
5-22-86	184.1	.0	.0	.0	.8	7.3	20.0	31.6	27.4	12.7	.2	.1	.1
5-26-86	144.3	.0	.0	.0	1.2	3.9	15.0	29.9	31.3	18.4	.3	.1	.0
5-29-86	1,374.0	.0	9.2	2.4	5.5	9.8	15.9	18.9	20.1	16.9	.9	.2	.2
6- 3-86	852.9	.0	3.7	2.3	5.8	15.1	22.7	23.6	18.4	8.3	.2	.0	.1
6- 6-86	410.9	.0	.0	.0	2.9	8.4	17.6	27.7	27.2	15.7	.3	.1	.1
6- 9-86	217.6	.0	.0	.0	2.5	4.2	17.4	33.9	27.3	14.0	.4	.1	.2
6-25-86	63.4	.0	.0	.0	.6	14.4	26.2	27.1	18.5	12.8	.3	.1	.0

Table 9.--*Bedload particle-size distribution, North Fork Lick Creek*

Date	Sample weight (grams)	Percentage by weight, particle size in millimeters											
		64	32	16	8	4	2	1	0.5	0.25	0.125	0.062	Pan
5- 8-85	22.0	0.0	0.0	0.0	0.0	6.4	21.8	34.1	27.7	9.6	0.1	0.0	0.0
5- 8-85	18.3	.0	.0	.0	.0	.0	8.7	24.0	36.6	29.5	1.1	.0	.0
5-15-85	7.6	.0	.0	.0	.0	.0	17.1	35.5	27.6	18.4	1.3	.0	.0
5-22-85	56.6	.0	.0	.0	2.3	11.8	24.2	30.6	21.7	9.0	.2	.1	.1
5-22-85	77.5	.0	.0	18.2	10.6	8.0	16.1	24.3	15.7	6.7	.3	.1	.1
5-29-85	30.6	.0	.0	.0	.0	4.3	7.5	25.8	44.1	18.0	.3	.0	.0
6- 6-85	30.1	.0	.0	.0	2.7	2.2	23.1	28.9	26.6	15.9	.7	.0	.0
6-12-85	37.7	.0	.0	.0	.0	6.4	19.4	36.6	27.8	9.6	.3	.0	.0
6-18-85	10.5	.0	.0	.0	.0	4.8	10.5	33.3	37.1	13.3	1.0	.0	.0
6-26-85	.7	.0	.0	.0	.0	.0	14.3	14.3	28.6	28.6	14.3	.0	.0
8-21-85	.2	.0	.0	.0	.0	.0	.0	50.0	50.0	.0	.0	.0	.0
4-23-86	79.3	.0	.0	.0	10.0	1.6	14.4	27.0	26.7	14.9	5.2	.1	.1
4-25-86	18.1	.0	.0	.0	1.1	5.5	13.3	30.4	30.4	17.7	1.1	.6	.0
4-28-86	4.1	.0	.0	.0	.0	2.4	12.2	24.4	31.7	26.8	2.4	.0	.0
5-21-86	195.2	.0	.0	.0	1.2	6.0	28.9	40.3	18.1	5.2	.1	.1	.1
5-22-86	176.3	.0	.0	.0	.0	9.8	37.2	36.5	13.4	2.9	.1	.1	.0
5-26-86	88.0	.0	.0	.0	.6	3.2	24.7	41.1	22.7	7.4	.2	.1	.0
6- 3-86	105.8	.0	.0	.0	.9	9.3	26.9	30.9	21.4	10.3	.2	.1	.0
6- 6-86	131.7	.0	.0	.0	3.0	14.7	26.4	28.2	18.7	8.7	.2	.1	.1
6- 9-86	38.6	.0	.0	.0	.0	5.2	28.2	36.3	21.8	8.3	.3	.0	.0
6-25-86	4.3	.0	.0	.0	.0	16.3	30.2	37.2	11.6	4.7	.0	.0	.0

Table 10.--*Sediment discharge, South Fork Salmon River near Krassel Ranger Station*

Date	Water discharge (ft^3/s)	Suspended-sediment discharge (ton/d)	Bedload discharge (ton/d)	Total-sediment discharge (ton/d)	Percent suspended
4-18-85	1,270	65	8.4	73	89.0
4-30-85	776	13	.60	14	92.9
5- 1-85	953	33	.84	34	97.0
5- 2-85	1,320	50	7.9	58	86.2
5- 7-85	1,320	43	12	55	78.2
5- 8-85	1,530	70	5.1	75	93.3
5- 9-85	1,450	51	11	62	82.3
5-15-85	1,070	23	5.9	29	79.3
5-16-85	1,050	17	.91	18	94.4
5-17-85	1,210	29	5.3	34	85.3
5-21-85	1,870	141	51	192	73.4
5-22-85	2,040	237	77	314	75.5
5-23-85	2,240	308	23	331	93.1
5-29-85	1,820	84	215	299	28.1
5-30-85	1,600	56	140	196	28.6
5-31-85	1,420	46	134	180	25.6
6- 5-85	1,360	37	46	83	44.6
6- 6-85	1,610	52	94	146	35.6
6- 7-85	1,610	96	24	120	80.0
6-11-85	1,160	28	10	38	73.7
6-12-85	1,170	22	25	47	46.8
6-17-85	841	16	7.9	24	66.7
6-18-85	877	24	18	42	57.1
6-19-85	804	13	10	23	56.5
6-25-85	514	6.9	4.4	11	62.7
6-26-85	490	5.3	9	14	37.9
7- 9-85	266	2.2	1.2	3.4	64.7
7-10-85	258	2.8	.58	3.4	82.4
7-17-85	214	.58	.15	.73	79.5

Table 10.--*Sediment discharge, South Fork Salmon River near Krassel Ranger Station*--Continued

[-, no data available]

Date	Water discharge (ft^3/s)	Suspended-sediment discharge (ton/d)	Bedload discharge (ton/d)	Total-sediment discharge (ton/d)	Percent suspended
7-18-85	211	2.3	0.02	2.3	99.1
7-23-85	186	2.5	.02	2.5	99.2
7-30-85	185	3.0	.16	3.2	93.8
8- 6-85	154	1.2	.00	1.2	100.0
8-20-85	137	1.1	.06	1.2	91.6
9- 4-85	130	1.4	.00	1.4	100.0
10- 2-85	168	.91	.00	.91	100.0
4-22-86	1,490	105	24	129	81.4
4-23-86	1,930	229	40	269	85.1
4-24-86	1,710	120	28	148	81.1
4-25-86	1,610	70	36	106	66.0
4-29-86	1,120	30	22	52	57.7
5-20-86	1,790	126	41	167	75.4
5-21-86	2,240	321	107	428	75.0
5-22-86	1,920	171	75	246	69.5
5-23-86	1,750	137	49	186	73.7
5-25-86	1,720	-	89	-	-
5-26-86	2,310	268	169	437	61.3
5-27-86	3,230	924	286	1,210	76.4
5-28-86	3,480	883	-	-	-
5-29-86	4,300	1,470	454	1,920	76.6
5-30-86	5,260	1,550	584	2,130	72.6
6- 2-86	4,360	812	628	1,440	56.4
6- 3-86	4,390	1,090	554	1,640	66.3
6- 6-86	2,900	399	622	1,020	39.1
6- 7-86	2,740	466	500	966	48.2
6- 8-86	3,220	608	1,010	1,620	37.5
6-10-86	2,230	313	612	925	33.8
6-24-86	891	14	14	28	50.0

Table 11.--*Sediment discharge, Buckhorn Creek*

Date	Water discharge (ft^3/s)	Suspended-sediment discharge (ton/d)	Bedload discharge (ton/d)	Total-sediment discharge (ton/d)	Percent suspended
5- 7-85	152	2.5	0.34	2.8	88.0
5-16-85	124	.67	.10	.77	87.0
5-21-85	216	5.3	2.6	7.9	67.1
5-30-85	154	7.9	.57	8.5	93.2
6- 6-85	172	1.9	.87	2.8	68.6
6-11-85	152	1.2	.34	1.5	77.9
6-17-85	100	1.4	.13	1.5	91.5
6-25-85	61	.33	.10	.43	76.7
7- 9-85	32	.09	.02	.11	81.8
7-17-85	25	.07	.00	.07	100.0
7-23-85	22	.12	.01	.13	92.3
7-30-85	22	.12	.02	.14	85.7
8- 5-85	18	.10	.00	.10	100.0
8-20-85	20	.11	.00	.11	100.0
4-23-86	238	11	1.3	12	89.4
4-24-86	186	4.5	.67	5.2	87.0
4-29-86	110	1.2	.18	1.4	87.0
5-21-86	276	25	4.8	30	83.9
5-22-86	200	9.2	2.7	12	77.3
5-26-86	280	15	2.0	17	88.2
5-29-86	830	1,590	92	1,680	94.6
6- 3-86	420	50	24	74	67.6
6- 9-86	224	10	2.9	13	77.5

Table 12.--*Sediment discharge, North Fork Lick Creek*

[-, no data available]

Date	Water discharge (ft^3/s)	Suspended-sediment discharge (ton/d)	Bedload discharge (ton/d)	Total-sediment discharge (ton/d)	Percent suspended
5- 8-85	75	0.81	0.27	1.1	75.0
5-15-85	52	.56	.05	.61	91.8
5-22-85	98	2.4	.88	3.3	73.1
5-29-85	85	1.2	.39	1.6	75.5
6- 6-85	92	2.0	.38	2.4	84.0
6-12-85	63	.51	.25	.76	67.1
6-18-85	45	.36	.07	.43	83.7
6-26-85	23	.25	.01	.26	96.2
7-10-85	15	.08	.00	.08	100.0
7-18-85	12	.03	.00	.03	100.0
7-23-85	13	.14	.00	.14	100.0
7-30-85	9.6	.10	.00	.10	100.0
8- 7-85	7.8	.04	.00	.04	100.0
8-21-85	3.7	.05	.00	.05	100.0
4-23-86	108	3.5	.47	4.0	88.2
4-25-86	81	2.2	.19	2.4	92.1
4-28-86	52	.28	.05	.33	84.8
5-21-86	106	5.2	2.3	7.5	69.3
5-22-86	92	4.7	2.0	6.7	70.1
5-26-86	112	-	1.0	-	-
5-30-86	206	52	-	-	-
6- 3-86	150	9.7	3.3	13	74.6
6- 6-86	116	6.0	1.6	7.6	78.9
6- 9-86	108	2.9	.44	3.3	86.8