UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

SEDIMENT-DISCHARGE DATA FOR THE LOWER REACH OF CAMPBELL CREEK, ANCHORAGE, ALASKA: MAY TO OCTOBER 1986

by Stephen W. Lipscomb

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CONVERSION TABLE

For readers who may prefer to use International System of Units (SI) rather than inch-pound units, the conversion factors for the terms used in this report are listed below:

Multiply inch-pound units	by	To obtain SI units
foot (ft)	0.3048	meter (m)
mile (mi)	1.609	kilometer (km)
square mile (mi^2)	2.590	square kilometer (km^2)
cubic foot per second (ft^3/s)	0.02832	cubic meter per second (m^3/s)
ton per day (ton/d)	0.0972	megagram per day (Mg/d)
degree Fahrenheit	°C = 5/9 x (°F-32)	degree Celsius (°C)

Other abbreviation in this report is:

mg/L, milligrams per liter

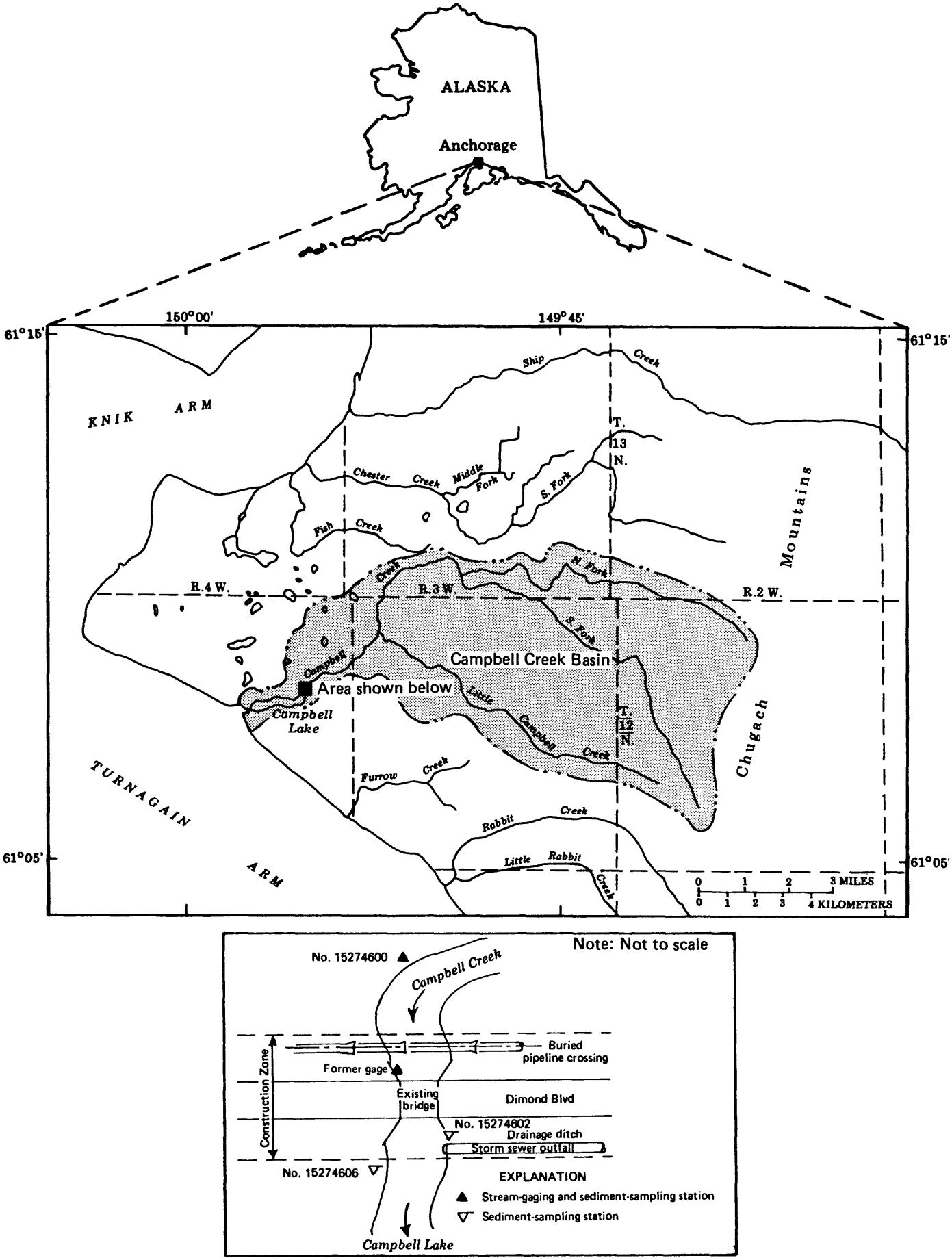

Figure 1.--Locations of the Campbell Creek basin, the study reach, and the stream-gaging and sediment-sampling sites.

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INTRODUCTION

In May 1986, the U.S. Geological Survey, in cooperation with the Alaska Department of Transportation and Public Facilities (ADOT&PF), began a study of suspended-sediment transport and streamflow characteristics in the lower reach of Campbell Creek near Anchorage, Alaska (fig. 1). The ADOT&PF plans to construct a new bridge across the creek within the reach. Sediment and streamflow data were collected from the creek in the vicinity of the proposed bridge construction site. This report is a summary of the data collected between May and October 1986.

DESCRIPTION OF STUDY REACH

The Campbell Creek drainage basin, which encompasses an area of 74 mi^2, has its headwaters in the Chugach Mountains east of Anchorage (fig. 1). The creek empties into Turnagain Arm south of the city. The lower part of the basin includes Campbell Lake, a shallow, man-made impoundment. The property adjacent to Campbell Lake is almost fully developed and the lake itself is used extensively for recreation and as a float-plane base. The study reach is located just upstream from the inlet to Campbell Lake and includes the proposed new bridge site at Dimond Boulevard.

DATA COLLECTION METHODS

Streamflow

The Geological Survey has operated a continuous recording stream-gaging station on Campbell Creek at Dimond Boulevard since 1966 (U.S. Geological Survey, 1967-86). Prior to the spring of 1986 the gage consisted of a stilling well and a digital recorder attached to the wingwall on the upstream right-bank side of the bridge. In anticipation of the new bridge construction, the gage was relocated to a site about 500 ft upstream of the existing bridge, where a mercury manometer was installed. Gage height is now recorded on both a continuous analog chart as well as digitally using a Campbell Scientific CR-21 micrologger.[1] Frequent discharge measurements have been made over a wide range in stage to develop a stage-discharge relation at the new site.

[1] Use of the brand name Campbell Scientific CR-21 micrologger in this report is for identification purposes only and does not constitute endorsement by the U.S. Geological Survey.

Suspended Sediment

Beginning in May 1986, suspended-sediment samples were collected on a regular basis using automatic pumping samplers (designated PS-69). Two samplers were installed: one upstream of the bridge at the site designated Campbell Creek near Spenard (station No. 15274600), and the other just downstream of the bridge, Campbell Creek below sewer outfall, (station No. 15274606) (fig. 1). The lower site was at a point far enough upstream of the lake entrance so that it would not be affected by backwater from the lake. Samples were taken occasionally at a third site, designated Campbell Creek above sewer outfall (station No. 15274602), located about 50 ft upstream of, and on the opposite bank from, station No. 15274606. These samples were taken to determine the effects of a storm sewer outfall which enters Campbell Creek about 30 ft downstream of the bridge.

The pumping samplers were controlled by the CR-21 microloggers, which activated the samplers on 6-hour intervals. The upstream micrologger was also programmed to activate that sampler at a greater frequency during storm events.

The intakes for the pumping samplers were secured within the channel at points determined to produce samples most closely representing the average suspended-sediment concentration of the entire cross section. Even so, the pumped samples generally had lower concentrations of suspended sediment than did simultaneous cross-section samples. To compensate for this difference, the concentrations of suspended sediment in the cross-section samples were used to make adjustments to the pumped sample values.

Cross-section samples were collected using a standard DH-75 depth integrating suspended-sediment sampler. The samples were obtained by the equal-width increment (EWI) method as described by Guy and Norman (1970).

Bedload

One bedload sample was collected during the summer to provide a basis for determining whether the amount of bedload transport in the study reach contributed significantly to the sedimentation of the lake. The sample was taken using a hand-held Helley-Smith bedload sampler (Helley and Smith, 1971) which is designed to sample coarse material (0.062 - 76.2 mm) within 0.3 ft of the streambed. The sampler was held on the bed for 60-second intervals at 15 equally spaced points across the channel. Two complete passes were made and the results averaged to reduce errors resulting from temporal variations of transport rates.

SEDIMENT DISCHARGE DATA

Table 1 shows the results of the laboratory analyses of suspended sediment in cross-section (EWI) samples collected at the three stations on Campbell Creek near Dimond Boulevard from May to October 1986.

The mean daily water discharge and suspended-sediment load values during the open-water period are given for station No. 15274600 (table 2), and for station No. 15274606 (table 3). These data are illustrated graphically in figure 2.

Table 1.--Suspended-sediment and streamflow data for the three Campbell Creek stations near Dimond Boulevard, May to October 1986

[Data include the percent sand and silt-clay fractions of each suspended-sediment sample. Sand-size particles range in size from 0.062 mm to 2.0 mm; silt-clay size particles range in size from 0.5 microns to 0.062 mm (U.S. Geological Survey, 1977).]

Station number (fig. 1)	Date	Time	Sediment conc. (mg/L)	Percent sand	Percent silt	Gage height (ft)	Water discharge (ft^3/s)	Water temp. (°C)
15274600	5/ 7	1410	86	39	61	17.66	38.3	---
	5/12	1110	24	--	--	17.65	37.6	---
	5/12	1115	27	--	--	17.65	37.6	---
	5/23	1045	42	15	85	18.00	62.4	5.2
	5/29	900	36	19	81	18.25	82.4	5.6
	5/30	845	97	41	59	18.42	96.9	6.2
	6/ 4	1800	26	14	86	18.08	68.6	6.8
	6/16	840	118	37	63	18.71	123.0	9.7
	7/10	1100	5	28	72	17.99	61.7	9.8
	7/11	1245	6	22	78	17.99	61.7	12.2
	7/12	1200	20	18	82	18.08	68.6	---
	7/16	745	15	23	77	18.15	74.2	9.5
	7/20	1630	297	33	67	18.60	113.0	---
	7/23	1055	495	47	53	19.42	196.0	---
	8/30	1045	9	36	64	18.47	101.0	8.0
	9/ 2	1055	32	15	85	18.54	108.0	---
	9/18	1050	6	29	71	18.31	87.4	---
	10/ 3	1915	322	22	78	19.64	221.0	6.7
15274602	7/16	855	16	33	67	----	76.6	9.5
	10/10	845	485	35	65	----	260.0	---
15274606	5/23	1130	41	14	86	----	62.4	5.6
	5/29	940	33	24	76	----	81.5	5.7
	5/30	955	80	39	61	----	96.0	6.2
	6/ 4	1900	18	17	83	----	68.6	6.8
	6/16	910	123	38	62	----	123.0	9.8
	7/10	1310	6	16	84	----	61.7	11.1
	7/11	1315	5	17	83	----	61.7	12.6
	7/12	1230	24	16	84	----	68.6	---
	7/16	830	22	21	79	----	75.8	9.5
	7/20	1715	341	32	68	----	124.0	---
	7/23	1135	546	60	40	----	199.0	---
	8/30	1125	9	42	58	----	101.0	---
	9/ 2	1135	20	24	76	----	108.0	---
	9/18	1250	7	27	73	----	87.4	7.5
	9/20	2250	291	50	50	----	264.0	---
	10/10	915	533	34	66	----	272.0	7.0

Table 2.--Water discharge and suspended-sediment loads for station No. 15274600, Campbell Creek near Spenard, May to October 1986

	May		June		July		August		September		October	
Day	Water discharge (ft^3/s)	Sediment load (ton/d)	Water discharge (ft^3/s)	Sediment load (ton/d)	Water discharge (ft^3/s)	Sediment load (ton/d)	Water discharge (ft^3/s)	Sediment load (ton/d)	Water discharge (ft^3/s)	Sediment load (ton/d)	Water discharge (ft^3/s)	Sediment load (ton/d)
1	60.0	6.0	80.0	5.4	82.0	2.8	75.0	0.7	110.0	12.0	119.0	2.9
2	55.0	5.0	74.0	4.0	86.0	3.3	70.0	0.7	110.0	17.0	121.0	4.1
3	45.0	4.0	65.0	2.5	87.0	3.4	67.0	1.0	93.0	4.1	157.0	114.0
4	40.0	3.0	65.0	2.5	80.0	2.3	68.0	1.0	87.0	2.5	170.0	69.0
5	40.0	2.5	62.0	1.8	78.0	1.9	69.0	1.3	82.0	2.0	138.0	20.0
6	38.0	2.5	68.0	3.0	77.0	1.9	70.0	2.0	80.0	1.6	123.0	8.4
7	38.0	2.5	82.0	4.8	76.0	2.6	64.0	1.0	100.0	11.0	125.0	12.0
8	34.0	2.0	100.0	9.7	68.0	5.3	65.0	1.9	109.0	8.6	121.0	5.9
9	32.0	1.9	81.0	2.4	65.0	1.6	59.0	1.4	99.0	6.7	114.0	3.3
10	32.0	1.9	76.0	2.2	61.0	1.5	73.0	2.8	86.0	2.5	198.0	118.0
11	34.0	1.8	74.0	2.2	60.0	1.4	73.0	2.1	82.0	2.0	352.0	328.0
12	39.0	2.3	73.0	2.8	65.0	2.5	101.0	18.0	77.0	1.9	302.0	108.0
13	45.0	2.6	76.0	3.3	82.0	5.6	189.0	130.0	76.0	1.5	253.0	49.0
14	39.0	1.9	87.0	5.9	75.0	2.9	132.0	19.0	73.0	1.4	245.0	40.0
15	35.0	1.9	98.0	9.0	65.0	1.6	123.0	23.0	72.0	1.0	206.0	19.0
16	42.0	2.4	119.0	32.0	71.0	2.1	113.0	12.0	92.0	6.3	192.0	14.0
17	39.0	1.9	129.0	41.0	64.0	1.6	99.0	5.8	99.0	5.8	172.0	10.0
18	37.0	1.8	129.0	24.0	58.0	1.1	96.0	7.5	87.0	3.0	164.0	7.2
19	39.0	1.9	115.0	9.5	57.0	1.1	96.0	4.2	84.0	2.8	165.0	8.8
20	41.0	2.4	109.0	7.9	75.0	24.0	85.0	2.5	181.0	103.0	172.0	9.2
21	44.0	3.2	101.0	4.9	106.0	19.0	81.0	0.8	248.0	68.0	156.0	5.3
22	49.0	3.8	92.0	3.1	82.0	5.2	82.0	1.6	208.0	34.0	145.0	4.9
23	58.0	5.9	86.0	3.3	168.0	151.0	84.0	0.4	207.0	72.0	138.0	4.0
24	59.0	5.7	81.0	2.8	151.0	38.0	127.0	9.2	151.0	15.0	131.0	3.2
25	69.0	10.0	76.0	1.8	113.0	13.0	161.0	13.0	134.0	11.0	120.0	2.3
26	81.0	19.0	70.0	1.4	162.0	29.0	145.0	12.0	123.0	15.0	115.0	2.2
27	69.0	5.0	71.0	1.4	139.0	6.8	124.0	7.4	121.0	6.5	120.0	1.2
28	67.0	4.6	77.0	1.5	108.0	3.5	118.0	5.7	118.0	4.6	119.0	1.2
29	77.0	8.2	79.0	1.9	91.0	2.6	109.0	4.7	113.0	2.2	112.0	1.1
30	91.0	17.0	79.0	2.3	82.0	1.6	100.0	2.9	120.0	5.8	105.0	1.0
31	92.0	15.0	--	--	77.0	1.1	101.0	2.9	--	--	102.0	1.0
Total	1560	150	2574	200	2711	341	3019	298	3414	431	4972	978

Table 3.--Water discharge and suspended-sediment loads for station No. 15274606, Campbell Creek below sewer outfall, May to October 1986.

	May		June		July		August		September		October	
Day	Water discharge (ft^3/s)	Sediment load (ton/d)	Water discharge (ft^3/s)	Sediment load (ton/d)	Water discharge (ft^3/s)	Sediment load (ton/d)	Water discharge (ft^3/s)	Sediment load (ton/d)	Water discharge (ft^3/s)	Sediment load (ton/d)	Water discharge (ft^3/s)	Sediment load (ton/d)
1	60.0	6.0	80.0	5.9	82.0	3.4	75.0	1.4	110.0	9.5	119.0	---
2	55.0	5.0	74.0	4.4	86.0	3.6	70.0	1.3	110.0	17.0	121.0	---
3	45.0	4.0	65.0	2.7	87.0	3.2	67.0	0.6	93.0	3.8	157.0	---
4	40.0	3.0	65.0	3.0	80.0	2.6	68.0	0.6	87.0	2.8	170.0	---
5	40.0	2.5	62.0	1.7	78.0	2.1	69.0	1.6	82.0	1.9	138.0	---
6	38.0	2.5	68.0	3.4	77.0	2.1	70.0	2.2	80.0	1.8	123.0	---
7	38.0	2.5	82.0	4.9	76.0	2.4	64.0	1.8	100.0	11.0	125.0	---
8	34.0	2.0	100.0	10.0	68.0	1.6	65.0	2.4	109.0	8.8	121.0	---
9	32.0	1.8	81.0	3.0	65.0	1.2	59.0	1.9	99.0	7.3	114.0	---
10	32.0	1.8	76.0	2.4	61.0	1.4	73.0	4.4	86.0	2.4	198.0	---
11	34.0	1.7	74.0	2.7	60.0	1.1	73.0	2.4	82.0	1.5	352.0	---
12	39.0	2.0	73.0	3.4	65.0	2.7	101.0	23.0	77.0	1.4	302.0	---
13	45.0	2.5	76.0	2.4	82.0	6.8	189.0	139.0	76.0	1.4	253.0	---
14	39.0	1.8	87.0	4.0	75.0	2.4	132.0	17.0	73.0	1.3	245.0	---
15	35.0	1.6	98.0	5.4	65.0	1.5	123.0	23.0	72.0	1.3	206.0	---
16	42.0	2.3	119.0	28.0	71.0	2.0	113.0	10.0	92.0	7.6	192.0	---
17	39.0	1.8	129.0	29.0	64.0	1.2	99.0	4.5	99.0	4.5	172.0	---
18	37.0	1.7	129.0	18.0	58.0	1.1	96.0	6.2	87.0	2.8	164.0	---
19	39.0	1.8	115.0	10.0	57.0	1.0	96.0	3.5	84.0	2.7	165.0	---
20	41.0	2.3	109.0	8.5	75.0	27.0	85.0	2.0	181.0	126.0	172.0	---
21	44.0	2.8	101.0	7.2	106.0	18.0	81.0	1.9	248.0	111.0	156.0	---
22	49.0	3.6	92.0	3.4	82.0	5.3	82.0	1.9	208.0	52.0	145.0	---
23	58.0	6.4	86.0	2.4	168.0	150.0	84.0	1.5	207.0	78.0	138.0	---
24	59.0	5.4	81.0	2.2	151.0	43.0	127.0	9.8	151.0	24.0	131.0	---
25	69.0	9.8	76.0	1.4	113.0	15.0	161.0	11.0	134.0	14.0	120.0	---
26	81.0	18.0	70.0	1.3	162.0	43.0	145.0	9.4	123.0	12.0	115.0	---
27	69.0	5.4	71.0	1.6	139.0	14.0	124.0	6.0	121.0	6.5	120.0	---
28	67.0	5.2	77.0	2.1	108.0	6.8	118.0	3.4	118.0	4.9	119.0	---
29	77.0	8.8	79.0	1.8	91.0	4.2	109.0	2.6	113.0	2.1	112.0	---
30	91.0	17.0	79.0	2.2	82.0	3.0	100.0	1.8	120.0	5.5	105.0	---
31	92.0	14.0	--	--	77.0	2.5	101.0	2.3	--	--	102.0	---
Total	1560	147	2574	178	2711	375	3019	300	3414	527	4972	---

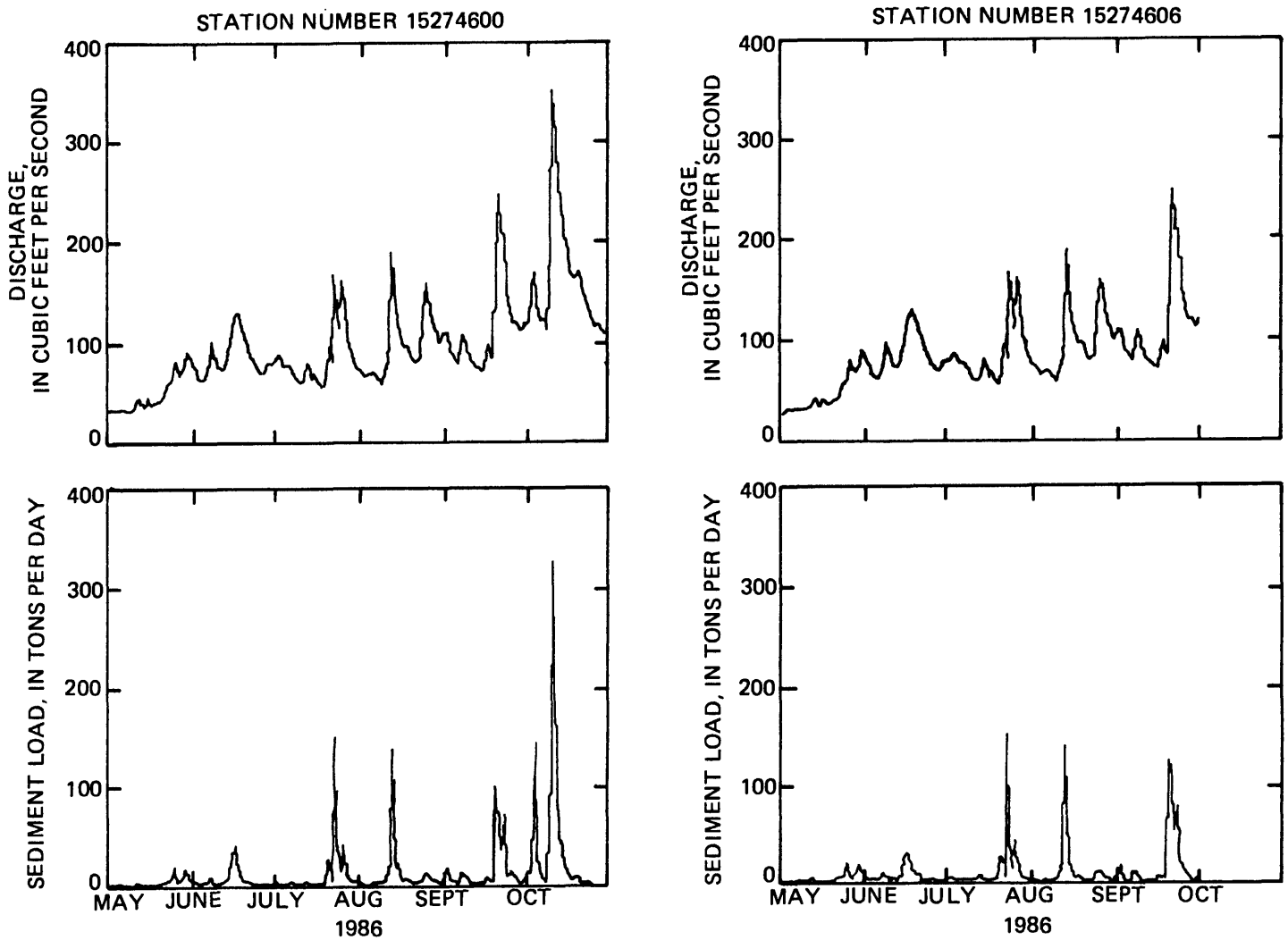

Figure 2.--Mean daily discharge and daily sediment load, May to October 1986, at Campbell Creek stations above (No. 15274600) and below (No. 15274606) Dimond Boulevard.

Computation of daily suspended-sediment loads was based on the mean daily discharge and mean daily suspended-sediment concentration as described by Porterfield (1972).

Freezing temperatures during the latter part of September necessitated deactivation of the pumping samplers. In early October, however, an unusually large, warm storm system approaching southcentral Alaska prompted the activation of one of the samplers (No. 15274600) in order to provide data for what proved to be a record runoff event at the Dimond Boulevard site. The peak flow from the event was 471 ft^3/s, which occurred on October 11. Based on flood frequency analysis, the recurrence interval was determined to be approximately 10 years (S.H. Jones, U.S. Geological Survey, oral commun., 1987). The mean daily sediment load for October 11 was 328 tons/d, which was nearly 34 percent of the total monthly suspended load (fig. 3). The total suspended-sediment load for the 3-day period of the storm (October 10-12) was 554 tons/d, which was 57 percent of the total monthly suspended load.

A summary of the analysis of the single bedload sample obtained during the summer is given below. This includes the bedload discharge and particle-size analysis of the sample.

Station number.....15274600
Date.....Sept. 18, 1986
Time.....1130
Water discharge.....87 ft^3/s
Bedload discharge.....9.2 ton/d

Particle-size distribution
Percentage, by weight, finer than size (mm) indicated

0.062	0.125	0.25	0.5	1.0	2.0	4.0	8.0	16.0	32.0
0	0	1	29	62	78	83	91	95	100

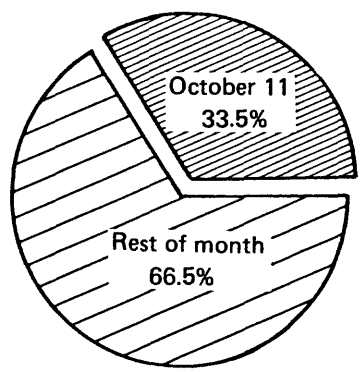

Figure 3.--Suspended-sediment load in Campbell Creek, October 1986.

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