SUSPENDED SEDIMENT STUDIES
For The
SACRAMENTO RIVER DIVERSION
To The
PERIPHERAL CANAL

Prepared by

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Agreement No. B54028/A1

June 1983

For The
Interagency Ecological Study Program

For The
Sacramento-San Joaquin Estuary

UNIVERSITY OF CALIFORNIA, DAVIS

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DEPARTMENT OF LAND, AIR AND WATER RESOURCES

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March, 1983

Mr. Randy Brown
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California Department of Water Resources
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Dear Mr. Brown:

I am transmitting a report on our study of suspended sediment at the Peripheral Canal Intake at Hood. The investigation was conducted under my direction by the Department of Land, Air and Water Resources, at the University of California, Davis, as specified in Agreement No. B54028/A1.

Sincerely,

J. Amorocho
Professor of Civil Engineering
and Water Science

JA:ck
enclosure

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ACKNOWLEDGMENTS

This study was coordinated with the Department of Water Resources through Mr. Randy Brown, Program Manager of the Peripheral Canal Intake Study Program.

1. INTRODUCTION

1.1 Background Information

In 1960 the Burns-Porter Act was approved in the State of California. It called for the construction of a complex system of surface water storage reservoirs and water conveyance facilities for the transfer of large quantities of water from Northern California (where two thirds of the state water runoff originates) to Southern California (where 70% of the state total water demand is concentrated) as part of the State Water Project (SWP). The SWP along with the federally operated Central Valley Project (CVP) are the two major water projects in California.

The Burns-Porter Act also provided for the construction of Delta facilities for water conservation and supply within the Delta, transfer of water across the Delta, flood and salinity control, and other functions. The Delta is an area approximately 700,000 acres in size lying in the vicinity where the Sacramento and San Joaquin Rivers converge to discharge over 40% of the state's total runoff into the San Francisco Bay (Fig. 1.1). It is also the area where 60% of all the diversions take place into the SWP and CVP for transfering water to Central and Southern California.

The Delta is a vast maze of waterways and islands beset by several hydrologic and environmental problems; reduced outflows because of upstream use and low outflows in dry years result in sea water intrusion from the ocean, high water levels during the winter season, and high ocean tides resulting in periodic flooding and loss of runoff.

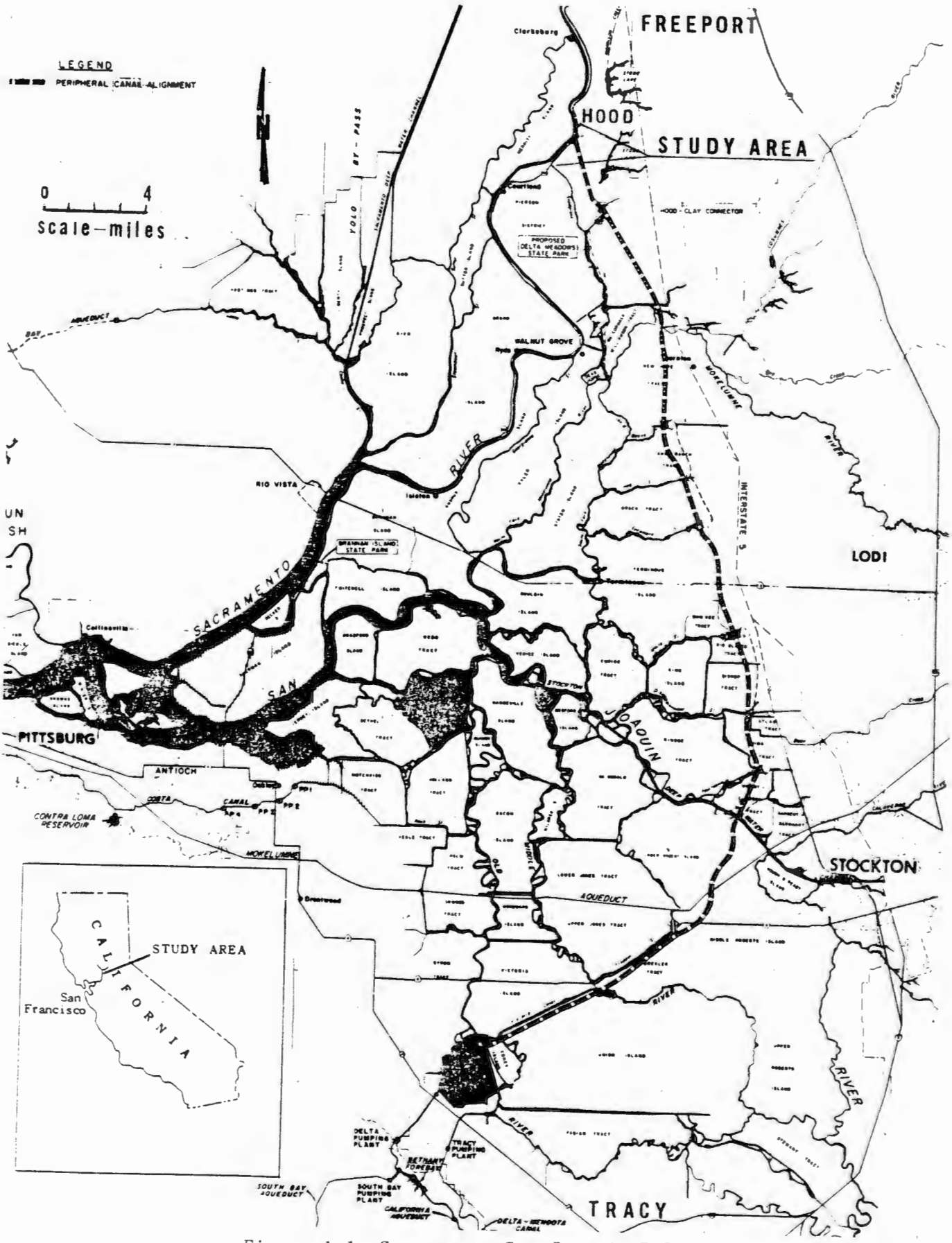

Figure 1.1 Sacramento-San Joaquin Delta

1.2 Peripheral Canal

In 1977 after seventeen years of intensive studies, in cooperation with the United States Bureau of Reclamation (USBR) and the U.S. Army Corps of Engineers (USCE), including reappraisals of the different alternatives to cope with the Delta problems, the California Department of Water Resources (DWR) reaffirmed that the Peripheral Canal (PC) would be the best alternative to the Delta problems. The forty-two-mile long canal would divert Sacramento River water near the town of Hood and transport it around the eastern edge of the Delta to the SWP and CVP pumping plants located on the southern edge (Fig. 1.1). It also would allow for the release of fresh water into the Delta at selective points along the canal for irrigation, fish and wildlife, recreation, and counteracting salt water intrusion.

1.3 Scope and Objectives

Of the many different problems associated with the design and operation of the Peripheral Canal to be studied carefully is sedimentation, in particular, the amount of sediments carried by the Sacramento River that would be directed into the Peripheral Canal. This is important because of the potential problems that it can cause; sedimentation in the canal itself resulting in reduced flows, downstream damage to agricultural lands, damage to pumps and turbines at the SWP and CVP intakes, to name but a few of the effects of the canal on the amount of sediments carried by the Sacramento River downstream from the canal intake.

Prior to carrying out any extensive analysis, it is of prime importance to examine the adequacy of the data base available for analysis. The United States Geological Survey (USGS) has been publishing annual

reports containing daily discharge and sediment load data for the Sacramento River at Sacramento (I-Street gaging station) since 1956. Beginning with water year 1979-1980, the USGS stopped publishing data for the Sacramento I-Street gaging station and replaced it with a gaging station about 11 miles downstream at Freeport. In addition, beginning in 1978 the USGS in cooperation with the DWR started collecting hydrologic and sediment-related data for the Sacramento River near the town of Hood (approximately 21.3 miles south of Sacramento), the proposed site for the intake to the Peripheral Canal. The data at this location were collected only at intermittent intervals, however.

The main objectives of this report are:

1. To describe the preparation of the data base for subsequent analysis.
2. To present the results of analyses of the data collected at Hood and correlations with data measured at Sacramento and Freeport.
3. To give an analysis of the expected amount of suspended sediment to be directed into the PC.

2. DATA BASE

2.1 Introduction

Discharge and total suspended sediment load are the Sacramento River characteristics of main concern to this report. Both refer to measured values at particular gaging stations; discharge is the amount of water crossing the stream-gaging station river cross-section during a given period of time, and total suspended sediment load refers to the total suspended sediments carried by the river across the same cross section during the same period of time. Daily values have been measured.

Since the lower reaches of the Sacramento River are affected by ocean tides over a period of approximately 25 hrs, discharge values vary accordingly. Consequently, a number of measurements of discharge must be taken during the tidal cycle and an arithmetic mean determined in order to express the mean daily discharge of the river. Daily values for the total suspended sediment load carried by the Sacramento River are obtained by multiplying the mean daily discharge of the river and the mean daily suspended sediment concentration (which is usually expressed in parts per million (ppm), or milligram-per-liter (mg/ℓ)), along with an appropriate conversion factor. For example, daily suspended sediment load (tons/day) = 0.0027 times mean daily discharge (cfs) times mean daily sediment concentration (mg/ℓ).

2.2 Sacramento-River Stream Gaging Stations

This report is concerned with the values of the mean daily discharge and daily suspended sediment load of the Sacramento River at two locations along the river.

2.2.1 Sacramento River at Sacramento

Mean daily discharge and sediment load values have been measured and reported by the USGS for the Sacramento I-Street gaging station located about 0.5 miles downstream from the confluence of the American River with the Sacramento River (Fig. 2.1) for the water years from 1956 to 1978. In 1979 the gaging station named Sacramento River at Sacramento was moved to Freeport about 11 miles south of Sacramento. The mean daily flows at the two locations are essentially the same. According to the USGS (Oltman, 1979) the extraction of water by small irrigation pumps and the presence of small drains that discharge water into the river has an insignificant net effect on the river discharge between the two stations. Also, the periodic operations of the navigation locks connecting the Sacramento River and the Port of Sacramento deepwater ship channel (located about 2.1 miles downstream from the Sacramento I-Street gage) do not affect the Sacramento gaging station significantly.

Consequently, for the purpose of this report, the data collected at Freeport is assumed to be an extension of the information for the Sacramento River at Sacramento, and as shown later in this report, there is an excellent correlation between the two sets of data.

2.2.1.1 Methods for measuring and calculating mean daily discharge and mean daily suspended sediment load

Prior to 1976, two techniques were used by the USGS to measure the mean daily discharge, depending upon its magnitude. For discharges greater than 40,000 cfs the conventional stage-discharge method was used. For discharges less than 40,000 cfs (which exist about 80 percent of the time) the flow is affected by

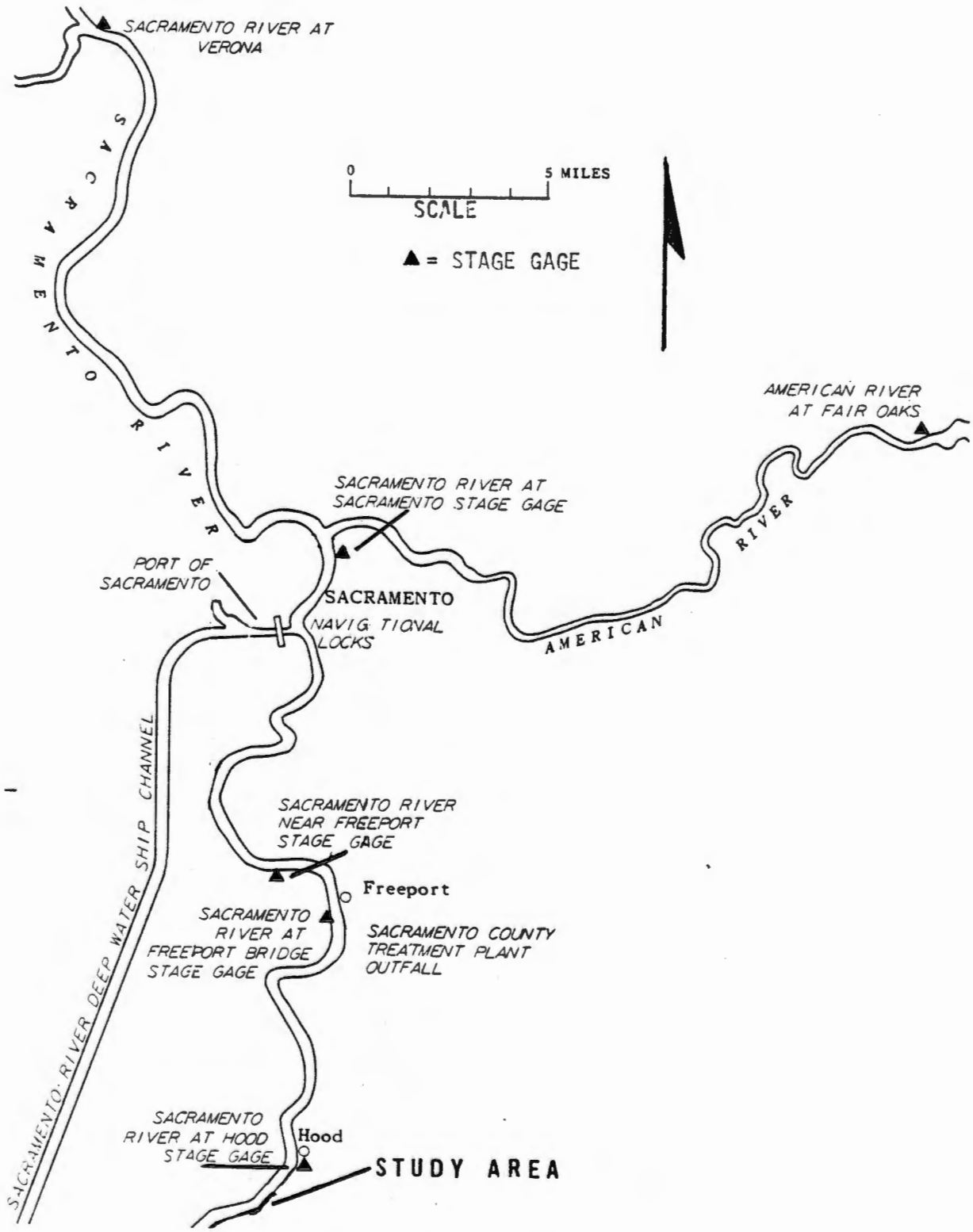

Figure 2.1 Location of Sacramento River Gaging Stations

the tides, and the stage-discharge curve is no longer single valued. Consequently, the stage-fall-discharge method was used (Oltmann, 1979). Stages for both the Sacramento River at Sacramento gaging station and an auxiliary gaging station located 10.8 miles south of Sacramento (Fig. 2.1) were used. The technique provides reliable mean daily discharge values, but it is not reliable for determining instantaneous discharge, particularly for flows smaller than 14,000 cfs (which exist 40% of the time). Furthermore, the technique requires about 20 conventional discharge measurements over the 24- to 26-hr tidal cycle. Consequently, the USGS, in cooperation with DWR, developed a transient-flow computer model for the Sacramento River and tested it on the 10.8-mile-long Sacramento to Freeport reach utilizing syncronized stage data at both ends (Oltman, 1979). The model was later extended an additional 10.5 miles to Hood (Oltman, 1980). The synchronized stage values at Sacramento and Hood were used as model boundary conditions (Fig. 2.1). Discharges at Sacramento and Freeport for both intervals were obtained using the model, and the mean daily discharge was taken as the arithmetic mean of the values throughout the day. All discharge data reported by the USGS since February 1976 were obtained through use of the model.

Daily suspended sediment concentrations in the Sacramento River were obtained using the Integrated Sample Technique. The sediment sampler is lowered close to the river bed and is then raised slowly at a uniform rate. The sediment sample is weighed to determine the amount of sediment per unit water volume. The result is expressed in units of mg/ℓ.

There is no uniform procedure for classification of the types of sediments. In general, however, there are two sources of sediments:

a. Sediments originating from the channel bed material referred to as bed-material load. These are the sediment particles originating from the bed and transported along in close proximity to the channel bottom (referred to as bed load), and the suspended particles originating from the bed material and carried in suspension.

b. Sediments originating from upstream sources such as bank erosion, normally composed of particles finer than the bulk of the bed material particles and referred to as wash load.

Total sediment load (as measured by the integrated sampler) thus accounts for both the wash load and most of the bed-material load. For practical reasons, when sediment measurements are being made it is difficult to lower the sampler all the way to the channel bed, and some of the bed load may not be measured. It is reasonable to assume that the amount not measured is only a small part of the total sediment load, and therefore the values published in the USGS annual reports refer to the "total sediment load". In this report, the terms daily suspended sediment load and total sediment load are used interchangeably, even though the values given are not precisely "total load" but something less.

As was pointed out in a DWR study (DWR, 1977), most of the sediment load is actually washload. The original source of these sediments were the hydraulic mining operations carried out in the Northern Sierra Nevada in the late 1800s.

2.2.1.2 Data sources

Values for mean daily discharge (cfs), daily sediment concentration (mg/ℓ), and daily suspended sediment load (tons/day) for the water years 1956-1957 through 1978-1979 on computer cards were obtained from the USGS in October, 1981. The discharge and sediment values were checked against values published in reports of the USGS and the DWR. Minor discrepancies were corrected and missing data were filled in. In addition, Freeport data for the water year 1979-1980 (the last year for which published data was available) were also included. Annual USGS reports have been published containing daily discharge and sediment data. The reports for water years 1956-57 through 1963-64 are available as individually numbered USGS Water Supply Papers. The reports for water years 1964-65 through 1979-80 are available yearly as Water Resources Data for California. A total of 8,766 daily discharge and sediment values for the 24-yr period were checked at the UC Davis Hydraulic Laboratory and stored on magnetic tape for subsequent analysis.

2.2.2 Sacramento River at Hood

The USGS and the DWR in a cooperative effort set up a program to periodically monitor the Sacramento River at Hood. Beginning in May 1978 the data collection procedure was initiated at four locations along the Sacramento River near the town of Hood (Fig. 2.2). Section 1 is located upstream from the proposed PC intake location, Section 2 at the proposed intake location, and Sections 3 and 4 downstream. The locations of the sections are shown in Fig. 2.2. A typical sample of the data collected is shown in Fig. 2.3. At any section, measurements of

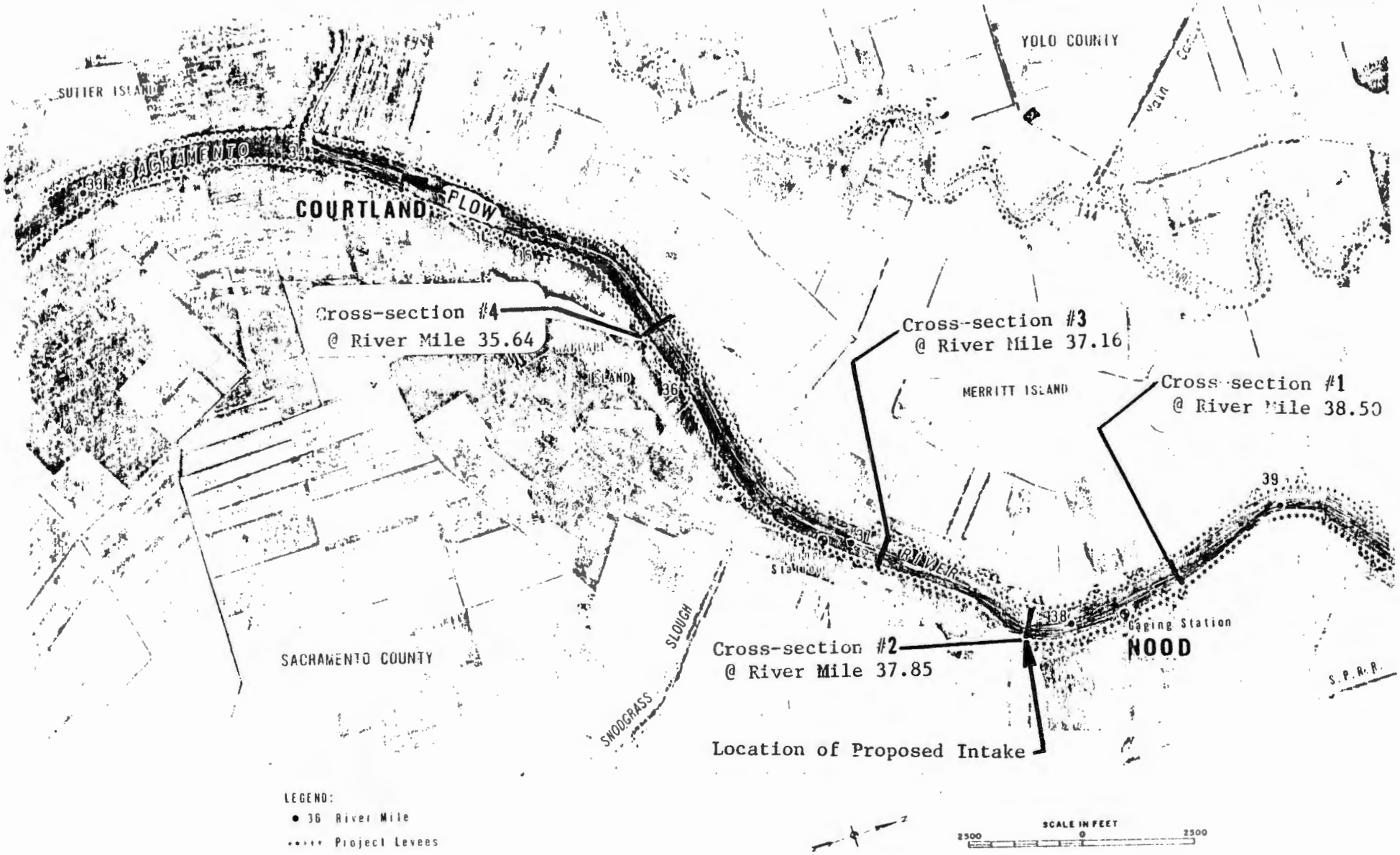

Figure 2.2 Locations of the Study Cross-Sections

UNITED STATES GEOLOGICAL SURVEY
WATER RESOURCES DIVISION

SACRAMENTO RIVER near HOOD, CA., at CROSS SECTION # 4

DATA GATHERED AT: DATE Sept. 16, 1981 TIME 0855-1115

	SECTION STATION (FEET)	TOTAL DEPTH (FEET)	AZIMUTH	SAMPLING DEPTH (FEET)	VELOCITY (FEET/SEC)	CONCEN TRATION MG/LITRE)	% >.062
1	133	21.0	235 55	2.0	1.51	14	3
2			245 65	5.2	1.47	16	2
3	"UNPUBLISHED RECORDS SUBJECT TO REVISION"		245 65	10.5	1.44	18	2
4			245 65	15.7	1.32	18	5
5			232 52	19.5	1.03	22	6
		Depth Integrated				18	8
1	200	21.8	23 52	2.0	1.67	15	5
2			23 52	5.4	1.67	19	5
3			52	10.9	1.51	23	4
4			232 52	16.3	1.35	26	6
5			50	20.3	1.11	25	5
		Depth Integrated				27	6
1	287	23.5	23 52	2.0	1.84	20	7
2			52	5.9	1.76	27	6
3			23 52	11.8	1.65	35	11
4			52	17.7	1.47	30	4
5			23 52	22.0	1.29	36	6
		Depth Integrated				25	15
1	426	25.0	23 53	2.0	1.80	30	5
2			23 53	6.2	1.76	35	6
3			23 52	12.5	1.70	39	6
4			52	18.7	1.62	51	4
5			52	23.5	1.33	69	6
		Depth Integrated				37	5
1	542	25.5	23 55	2.0	1.73	27	6
2			23 55	6.4	1.80	36	5
3			57	12.8	1.84	35	4
4			55	19.2	1.47	41	6
5			47	24.0	1.26	48	10
		Depth Integrated				32	9

Figure 2.3 Sample of Field Data

water velocity and sediment concentration were obtained at four to five locations across the river and at five to six depths. In addition, for data collected since 1980, sediment values using the Depth Integrated Sampler technique were also obtained. Bed samples were also obtained for subsequent particle size distribution analysis; an example is shown in Fig. 2.4.

Of the sixty measurements obtained between May 18, 1978 and September 17, 1981 (inclusive), ten were discarded due to a lack of sediment concentration measurements and/or unavailability of river stage data (due to possible stage recorder malfunction). The subsequent analysis is based on the revised set of data obtained from the USGS in March 1982. A summary of the dates in which the measurements took place, the section, and the hours of day during which the data were collected is shown in Table 2.1. An example of the grain size distribution is given for Section 3 in Fig. 2.5.

SACRAMENTO
EXP FORM
11/9/78

UNITED STATES GEOLOGICAL SURVEY
WATER RESOURCES DIVISION

BED MATERIAL SIZE DISTRIBUTION

SITE Sacramento River at Peripheral Canal Intake Site near Hood

STATION	PERCENT FINER THAN INDICATED SIZE (MM)									
	64.0	32.0	16.0	8.00	4.00	2.00	1.00	0.500	.250	.125
Feb. 28, 1980				Cross Section 2						
120		100	97	97	96	95	92	78	13	1
250							100	94	22	1
380						100	99	81	10	0
510					100	98	95	62	3	0
640						100	99	67	3	0
Feb. 28,1980				Cross Section 1						
180								100	65	2
260								100	32	1
350							100	84	3	0
410					100	99	98	67	2	1
500			100	98	96	93	75	8	1	0
Feb. 29, 1980				Cross Section 4						
66					100	99	97	50	2	0
176					100	99	96	41	1	0
296			100	97	96	94	93	71	5	1
416				100	99	98	94	70	9	0
526			100	96	94	93	92	88	24	1
Feb. 29, 1980				Cross Section 3						
70						100	99	86	13	0
180						100	98	57	3	0
300					100	99	97	69	5	0
420		100	99	98	97	97	92	45	3	0
530				100	99	99	99	95	24	0

Figure 2.4 Example of Bed Material Data

Table 2.1. Dates and Locations for Data Collected at Hood.

Date		Hours	Section
1978	May 18	1030-1330	2
	Nov 21	1200-1412	4
	Nov 22	1350-1600	2
		0950-1320	3
	Nov 27	1223-1509	1
1979	Jan 19	1205-1329	1
		1355-1527	2
	Feb 13	1245-1450	1
		1005-1215	2
	Feb 22	1015-1235	2
		1305-1455	3
	Mar 19	0940-1130	2
		1200-1330	4
	Apr 13	1010-1140	1
		1215-1325	2
	June 5	1015-1150	1
		1220-1355	2
	July 17	1110-1320	2
		1325-1505	2
	July 18	0930-1110	1
		1130-1315	1
	Aug 15	1030-1210	2
	Aug 16	0830-1000	2
		1000-1115	2
		1130-1310	2
	Sep 6	0910-1100	3
		1135-1255	3
		1300-1410	3
	Sep 11	1000-1140	4
		1200-1320	4
		1340-1500	4
	Sep 12	0930-1100	1
		1115-1225	1
		1240-1400	1
1980	Feb 28	1400-1540	1
		1055-1235	2
	Feb 29	1300-1420	3
		1000-1120	4
	Jun 24	1100-1455	4
	Jun 25	1020-1340	3
	Jun 26	0940-1325	2
	Jun 27	1045-1500	1
1981	Apr 28	1250-1420	1
	Apr 29	1030-1305	2
	Apr 30	1130-1420	3
	May 1	1005-1310	4
	Sep 15	1015-1215	1
	Sep 16	0855-1115	4
		1215-1355	3
	Sep 17	0840-1100	2

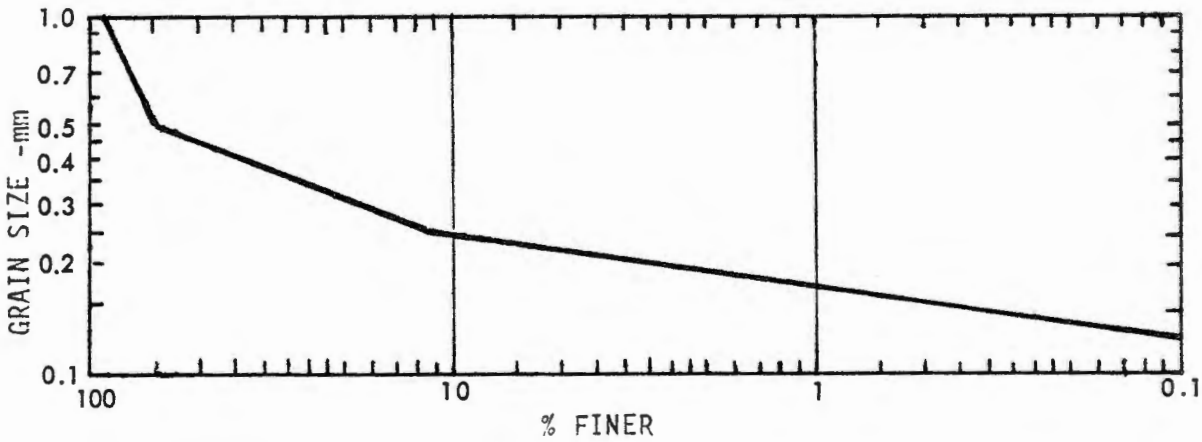

Figure 2.5 Grain Size Distribution for Section 3

3. ANALYSIS OF SACRAMENTO RIVER DATA COLLECTED AT HOOD

3.1 Introduction

A weighted-average-technique was used to determine the mean daily discharge (cfs) and mean daily suspended sediment load (tons/day) at Hood for each of the measurements listed in Table 2.1. A statistical analysis was carried out to determine the correlation between the calculated values and the corresponding historically-measured values at both the Sacramento and Freeport gaging stations. A comparison of the mean daily suspended sediment load as obtained from the point samples and the integrated sample was also carried out. Finally, sediment-discharge relationships were determined for later comparison purposes.

3.2 Supplemental Data

In addition to the velocity and sediment concentration values, the following data were also obtained for subsequent analysis:

a. Sacramento River section profiles

The cross-sectional profile of the Sacramento River at the four section locations have been surveyed periodically. The latest available data at the UCD Hydraulics Laboratory was used to define the four sections. Plots of the sections are shown in Fig. 3.1.

b. River stage values

The depths to the points at which velocity measurements were made and samples taken to determine suspended sediment concentration were measured relative to the water surface at each location. Because the elevation of the water surface (river stage) was not measured at the time of data collection it was necessary to rely on river stage data available at nearby locations.

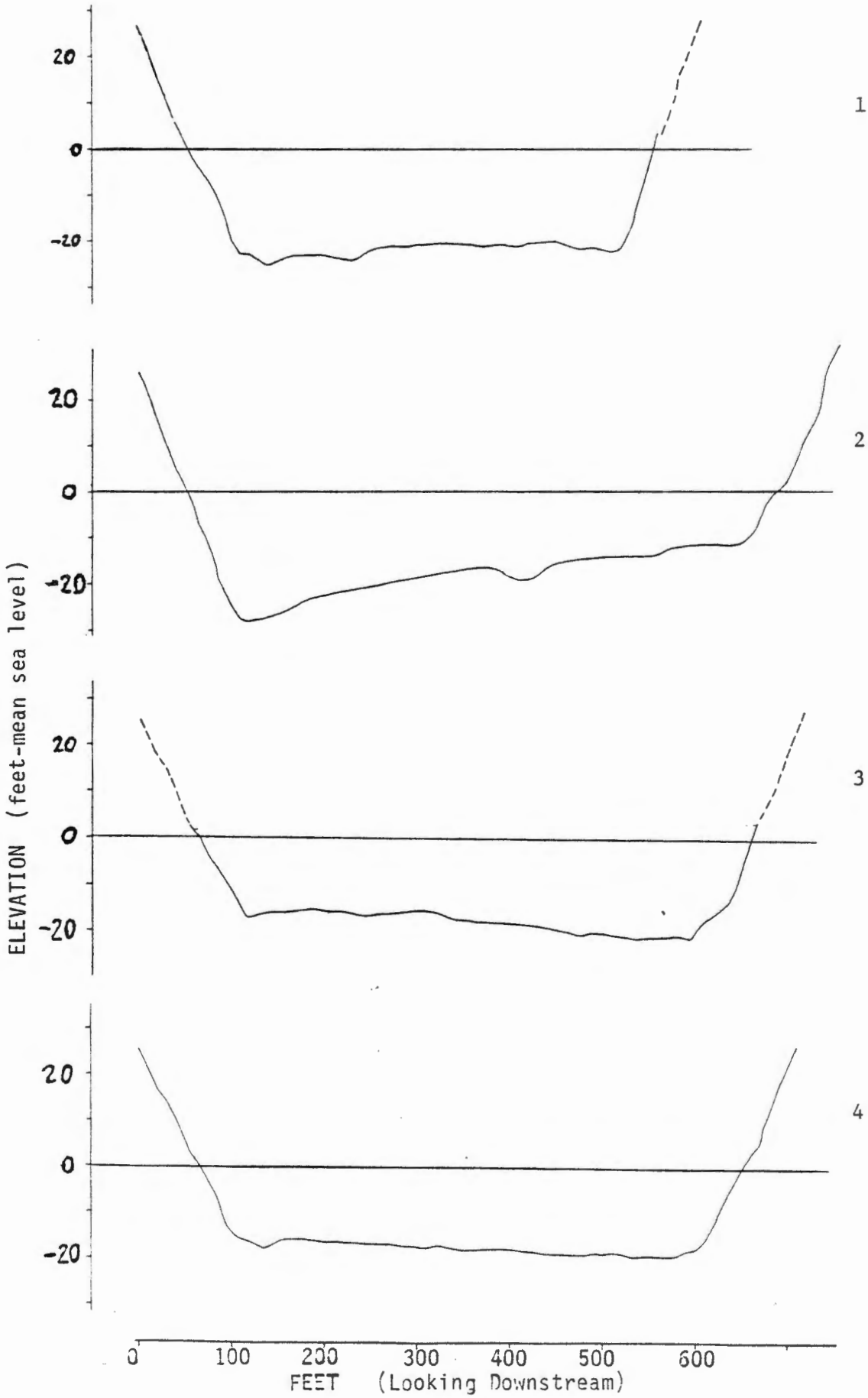

Figure 3.1 Cross-Sections of the Four Study Locations

There are two 15-min synchronized stage recorders located in the vicinity of the four sections near Hood; one is located at Hood near Section 2 and the other at Snodgrass Slough just downstream from Section 4. Long-term data for both recorders are available at the Central District Office of the DWR in Sacramento. For the purposes of this report, the stage data at Hood is asumed to apply to both Sections 1 and 2 while the stage data of Snodgrass Slough applies to Sections 3 and 4.

Due to tidal effects the river stage values can vary over the 2- to 3-hr period during which the data was collected. Consequently, a river stage average value consisting of the arithmetic mean of the 15-min stage values for each of the time periods shown in Table 2.2 was calculated. The results are listed in Table 3.1.

c. Left-river bank embankment elevations

For each of the four sections, the distance to the various locations along the cross section were measured from the top of the embankment of the left river bank (see Point 1, Fig. 3.2). A survey was carried out in March 1982 (USGS, 1982a), and the elevations measured are listed in Table 3.2.

d. River channel side slopes

From Fig. 3.1 the Sacramento River channel side slopes (horizontal-vertical) were estimated and the results summarized: (Left Bank – 2:1, 2:1, 2:1, 2:1. Right Bank – 2:1, 2:1, 2:1, 2.5:1)

e. Horizontal distance to river channel side slopes at zero (ft.) elevation

The horizontal distance to the intersection of the river channel side slope at zero elevation was approximated from Fig. 3.1

Table 3.1 Sacramento River Stage Values at Hood

Date	Hours	Section	Average River Stage (ft.)
May 18, 1978	10:30 - 13:30	2	2.89
Nov 21, 1978	12:00 - 14:12	4	6.05
Nov 22, 1978	09:50 - 13:20	3	6.15
	13:50 - 16:00	2	3.05
Nov 27, 1978	12:23 - 15:09	1	3.19
Jan 19, 1979	12:05 - 13:29	1	6.49
	13:55 - 15:27	2	6.15
Feb 13, 1979	10:05 - 12:15	2	2.40
	12:45 - 14:50	1	2.46
Feb 22, 1979	10:15 - 12:35	2	9.64
	13:05 - 14:45	3	11.81
Mar 19, 1979	09:40 - 11:30	2	5.07
	12:00 - 13:30	4	7.56
Apr 13, 1979	10:10 - 11:40	1	2.26
	12:15 - 13:25	2	1.75
June 5, 1979	10:15 - 11:50	1	1.73
	12:20 - 13:55	2	2.42
July 17, 1979	11:10 - 13:20	2	2.92
	13:25 - 15:05	2	2.65
July 18, 1979	09:30 - 11:10	1	1.97
	11:30 - 13:15	1	2.66
Aug 15, 1979	10:30 - 12:10	2	2.87
Aug 16, 1979	08:30 - 10:00	2	1.82
	10:00 - 11:15	2	2.12
	11:30 - 13:10	2	2.71
Sept 6, 1979	09:10 - 11:00	3	5.40
	10:00 - 12:55	3	4.81
	13:00 - 14:10	3	4.84
Sept 11, 1979	10:00 - 11:40	4	6.01
	12:00 - 13:20	4	5.59
	13:40 - 15:00	4	5.12

Table 3.1 Sacramento River Stage Values at Hood
(Continued)

Date	Hours	Section	Average River Stage (ft.)
Sept 12, 1979	09:30 - 11:00	1	2.87
	11:15 - 12:25	1	2.87
	12:40 - 14:00	1	2.58
Feb 28, 1980	10:55 - 12:35	2	14.51
	14:00 - 15:40	1	14.45
Feb 29, 1980	10:00 - 11:20	4	16.24
	13:00 - 14:20	3	16.24
June 24, 1980	11:00 - 14:55	4	5.99
June 25, 1980	10:20 - 13:40	3	5.63
June 26, 1980	09:40 - 13:25	2	2.71
June 27, 1980	10:45 - 15:00	1	2.39
Apr 28, 1981	12:50 - 14:20	1	1.97
Apr 29, 1981	10:30 - 13:05	2	2.68
Apr 30, 1981	11:30 - 14:20	3	5.88
May 1, 1981	10:05 - 13:10	4	5.14
Sept 15, 1981	10:15 - 12:15	1	2.17
Sept 16, 1981	08:55 - 11:15	4	5.84
	12:15 - 13:55	3	4.92
Sep 17, 1981	08:40 - 11:00	2	2.63

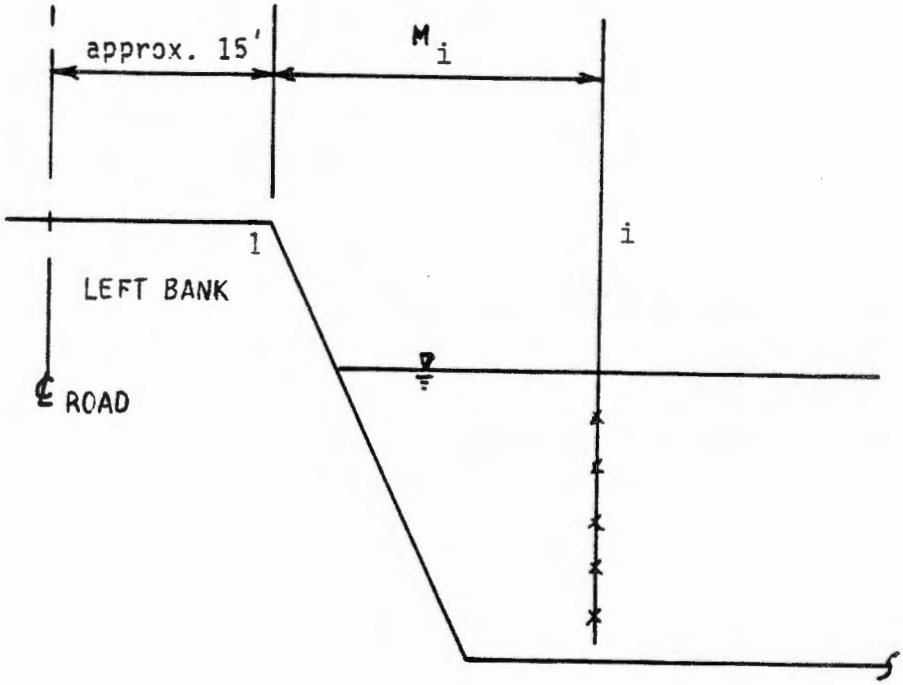

Figure 3.2 Sacramento River Left Bank

Table 3.2. Sacramento River Left Bank Embankment Elevations (ft.)

* Section	Elevation
1	26.9
2	26.0
3	25.7
4	25.8

* For each of the four sections the distance to the various locations along the cross-section were measured from the top of the embankment of the left river bank (see point 1, Figure 3.2). A survey was carried out in March, 1982 (USGS, 1982a) and the elevations measured are given in Table 3.2.

The values for each cross section are given in Table 3.3. The distances are relative to the respective right-hand-side vertical axis.

3.3 Weighted Average Technique to Obtain Mean Daily Discharge and Mean Daily Suspended Sediment Load

The velocity and sediment concentration data (a sample of which is shown in Fig. 2.3), along with the supplemental data discussed in Section 3.2, were used to calculate the mean daily discharge (cfs) and the mean daily sediment load (tons/day) for each of the measurement data listed in Table 2.1. A schematic diagram of a typical cross-section is shown in Fig. 3.3. The velocity and sediment concentration data were taken at n locations across the section (i=1,2,3,...,n) and m different depths (j=1,2,...,m).

Known variables are: (i=1,2,...,n and j=1,2,...m)

M_i = horizontal distance from left bank (see Point 1, Fig. 3.2) to the location i (ft)

Y_{ij} = depth from the water surface at location i to point j (ft)

V_{ij} = velocity at depth Y_{ij} (fps)

C_{ij} = sediment concentration at depth Y_{ij} (mg/ℓ)

D_i = total depth to river bottom at location i (ft)

x_1 = distance to left bank slope at zero elevation (ft)

x_2 = distance to right bank slope at zero elevation (ft)

s_1 = left bank slope (ft/ft)

s_2 = right bank slope (ft/ft)

STAGE = average river stage elevation (ft), Table 3.1

EL_1 = elevation of Point 1 Fig. 3.3 (ft), Table 3.2.

Table 3.3. Horizontal Distance to Side Slope at Zero Elevation (ft.)

Section	Left bank	Right bank
1	55.0	557.0
2	55.0	698.0
3	62.0	663.0
4	65.0	652.0

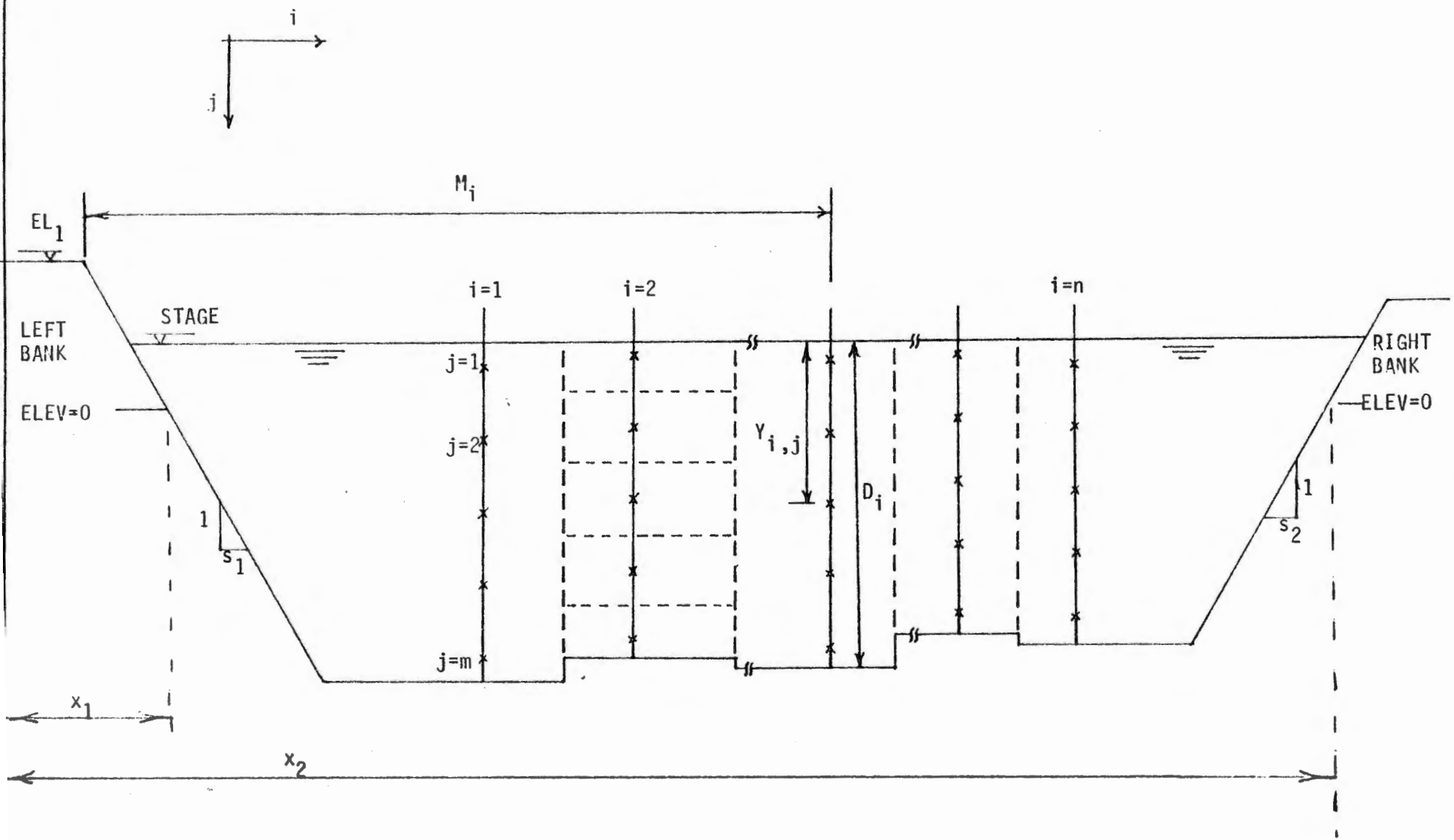

Figure 3.3 Schematic of a Typical Cross-Section

The total cross-sectional area is then subdivided as follows:

1. The distances between locations are averaged, thus delineating the cross area into n column areas. For example location 2 (see Fig. 3.4) delineates a vertical column area of constant width W_2, where

$$W_2 = \frac{M_2 + M_3}{2} - \frac{M_1 + M_2}{2} = \frac{M_3 - M_1}{2} \text{ (ft)}$$

2. Similarly each vertical column (area) is then subdivided into m subareas by averaging the depths to the various measuring points. For example, in Fig. 3.4, at location i=2, the depth j=2 delineates a rectangular area $a_{2,2}$ with base width $W_2 = \frac{1}{2}(M_3 - M_2)$ and height $h_{2,2} = \frac{1}{2}(Y_{2,3} - Y_{2,1})$.

It is obvious that all areas a_{ij} are rectangular with the exception of location 1 and location n (adjacent to the channel side slopes) in which the subdivided areas are trapezoidal in shape.

A basic assumption was made that the velocity and sediment concentration values at each coordinate i,j represents the average values of velocity and sediment concentration for the entire area $a_{i,j}$. The discharge (cfs) and sediment load (tons/day) can then be calculated as follows

$$q_{i,j} = v_{i,j}\, a_{i,j} \text{ (cfs)} \tag{3.1}$$

$$SS_{i,j} = 0.0027\, C_{i,j}\, q_{i,j} \text{ (tons/day)} \tag{3.2}$$

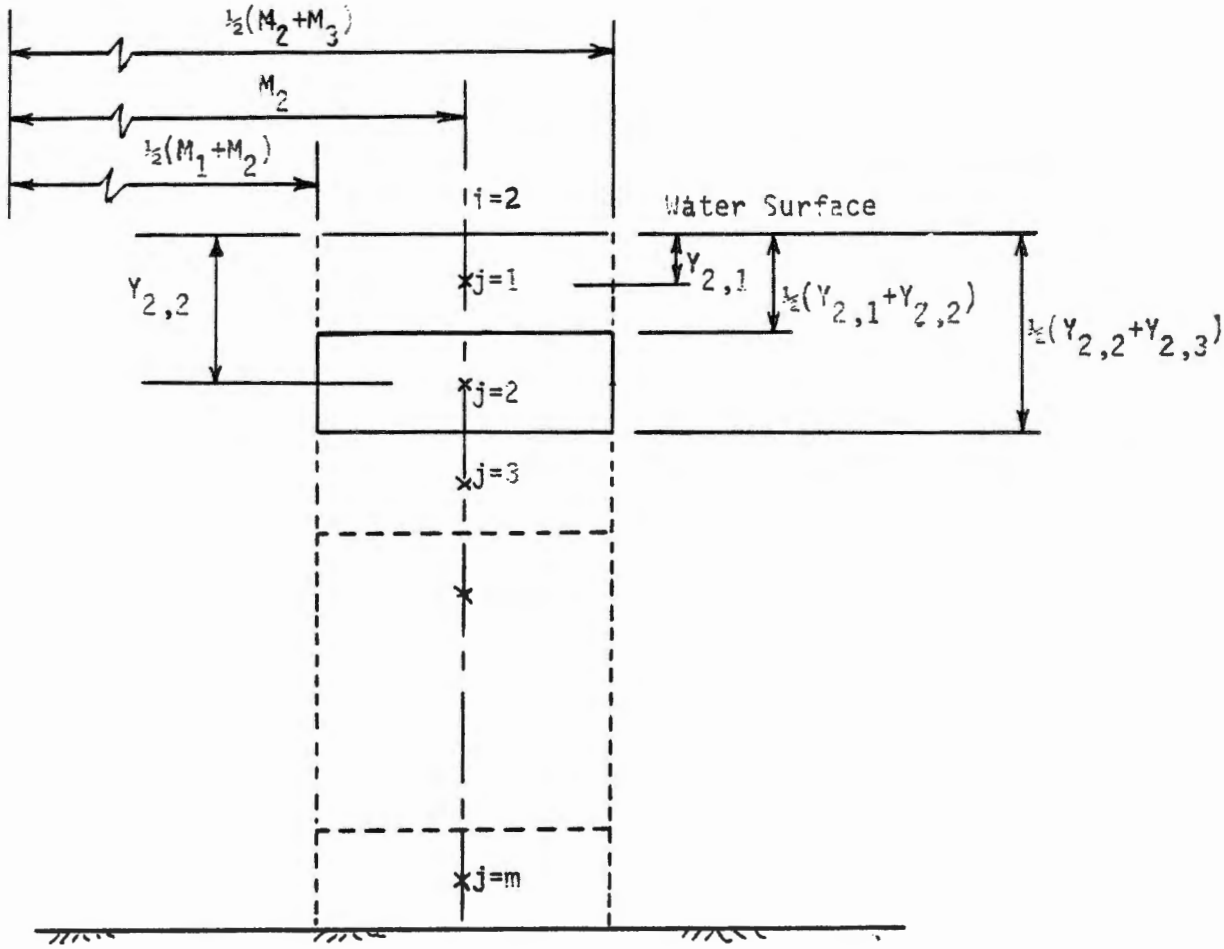

Figure 3.4 Subdividing Column Area at Location 2

The mean daily discharge (cfs) and the mean daily suspended sediment load for the section under consideration is the algebraic sum of the discharge and sediment load values for the individual subareas. The average velocity (fps) for the entire section is obtained by dividing the mean daily discharge (cfs) by the cross-sectional area (ft^2). The results are summarized in Table 3.4. A complete listing of the results is given in Appendix B.

In addition to calculating to mean daily sediment load (tons/day) using the point sample data, the integrated sample data were also used to calculate the sediment load. The following procedure was used: the integrated sample concentration value for each location i was multiplied by the corresponding total area for column i (obtained from Table 1, Appendix B), the values for all locations i were summed up and then multiplied by a conversion factor (0.0027), to obtain the mean daily sediment load (tons/day). The results are shown in column 6 of Table 3.5.

3.4 Statistical Correlation Between Results Calculated at Hood with Historical Values at Sacramento and Freeport

To test the accuracy and adequacy of the data collected at Hood, the mean daily discharge and daily suspended sediment load values (see Section 3.3) were statistically correlated with published USGS and DWR results. They are summarized in Table 3.5. Columns 1, 2, and 3 show the date, the hours during which the data were collected, and the section where the data were being collected. Columns 4, 5, and 6 are the results obtained from the previous section; Column 4 is the mean daily discharge (cfs); Column 5 is the suspended sediment load (tons/day) as

Table 3.4. Summary of Mean Daily Discharge and Velocities for the USGS Data.

DATE	SECTION	HOURS	DISCH (CFS)	SED LOAD (T/DAY)	AREA (SQ FT)	AV VEL (FPS)
1978 5 18	2	1030 1330	25985.	3549.	12697.	2.05
1978 11 21	4	1200 1412	16159.	558.	14105.	1.15
1978 11 22	2	1350 1600	18017.	1022.	13721.	1.31
1978 11 22	3	950 1320	11186.	473.	14807.	0.76
1978 11 27	1	1223 1509	7451.	281.	13006.	0.57
1979 1 19	1	1205 1329	43878.	22515.	14603.	3.00
1979 1 19	2	1355 1527	44783.	23690.	15872.	2.82
1979 2 13	1	1245 1450	14043.	587.	12605.	1.11
1979 2 13	2	1005 1215	19831.	928.	13697.	1.45
1979 2 22	2	1015 1235	61235.	39226.	18475.	3.31
1979 2 22	3	1305 1445	58990.	36862.	17641.	3.34
1979 3 19	2	940 1130	33190.	5006.	15118.	2.20
1979 3 19	4	1200 1330	35802.	5529.	14898.	2.40
1979 4 13	1	1010 1140	22586.	2101.	12586.	1.79
1979 4 13	2	1215 1325	23029.	2809.	12639.	1.82
1979 6 5	1	1015 1150	19210.	1043.	12110.	1.59
1979 6 5	2	1220 1355	11189.	436.	12928.	0.87
1979 7 17	2	1110 1320	14373.	601.	13776.	1.04
1979 7 17	2	1325 1505	16873.	536.	13707.	1.23
1979 7 18	1	930 1110	22055.	1691.	12485.	1.77
1979 7 18	1	1130 1315	15579.	882.	12797.	1.22
1979 8 15	2	1030 1210	15930.	874.	13401.	1.19
1979 8 16	2	830 1000	23530.	2318.	12935.	1.82
1979 8 16	2	1000 1115	22690.	2056.	12836.	1.77
1979 8 16	2	1130 1310	16119.	989.	13153.	1.23
1979 9 6	3	910 1100	24664.	2560.	14173.	1.74
1979 9 6	3	1135 1255	25085.	3335.	13813.	1.82
1979 9 6	3	1300 1410	25024.	3324.	13587.	1.84
1979 9 11	4	1000 1140	15466.	794.	13918.	1.11
1979 9 11	4	1200 1320	21114.	1566.	13548.	1.56
1979 9 11	4	1340 1500	24165.	2221.	13291.	1.82
1979 9 12	1	930 1100	13265.	806.	12665.	1.05
1979 9 12	1	1115 1225	14616.	715.	12778.	1.14
1979 9 12	1	1240 1400	18284.	1032.	12958.	1.41
1980 2 28	1	1400 1540	83648.	31879.	18188.	4.60
1980 2 28	2	1055 1235	83640.	36592.	19389.	4.31
1980 2 29	3	1300 1420	75909.	29465.	19606.	3.87
1980 2 29	4	1000 1120	84925.	33757.	19800.	4.29
1980 6 24	4	1100 1455	22859.	2409.	13958.	1.64
1980 6 25	3	1020 1340	25849.	3262.	13113.	1.97
1980 6 26	2	940 1325	26041.	3209.	14079.	1.85
1980 6 27	1	1045 1500	25535.	2966.	12899.	1.98
1981 4 28	1	1250 1420	13389.	477.	12806.	1.05
1981 4 29	2	1030 1305	6966.	275.	13041.	0.53
1981 4 30	3	1130 1420	7024.	316.	14135.	0.50
1981 5 1	4	1005 1310	14904.	717.	13430.	1.11
1981 9 15	1	1015 1215	22444.	2376.	12594.	1.78
1981 9 16	4	855 1115	22657.	1963.	14302.	1.58
1981 9 16	3	1215 1355	21200.	2109.	12973.	1.63
1981 9 17	2	840 1100	17082.	797.	13360.	1.28

Table 3.5. Mean Daily Discharge and Daily Suspended Sediment Load at Hood

	Date (1)	Time From (2)	Time To (2)	X-Sec (3)	Data @ Hood Analysis Q^H (cfs) (4)	Data @ Hood Analysis S^H (tons/day) (5)	Data @ Hood Analysis S^H (tons/day) (6)	* USGS Sacramento to Hood Transient Flow Model Q^H (cfs) (7)	USGS Sacramento to Hood Transient Flow Model Q^D (cfs) (8)	USGS Sacramento to Hood Transient Flow Model Q^H (cfs) (9)	USGS Sacramento to Hood Transient Flow Model Q^D (cfs) (10)	Water Resources Data for California Q^D (cfs) (11)	Water Resources Data for California S^D (tons/day) (12)	Water Resources Data for California Q^D (cfs) (13)	Water Resources Data for California S^D (tons/day) (14)
1	May 18, 1978	1030	1330	2	25985	3549		22450	21692	21444	21673	23200	3570		
2	Nov 21, 1978	1200	1412	4	16159	558		13482	13987	14495	13914	14100	1290		
3	Nov 22, 1978	1350	1600	2	18017	1022		15927	15579	16953	15623	15600	1770		
4	Nov 22, 1978	0950	1320	3	11186	473		11207	15579	9836	15623	15600	1770		
5	Nov 27, 1978	1223	1509	1	7451	281		8496	13732	5848	13804	13800	1230		
6	Jan 19, 1979	1205	1329	1	43878	22515		38702	39170	39753	39558	38300	16500		
7	Jan 19, 1979	1355	1527	2	44783	23690		38723	39170	39772	39558	38300	16500		
8	Feb 13, 1979	1245	1450	1	14043	587		14034	12221	11769	11971	12400	770		
9	Feb 13, 1979	1005	1215	2	19831	928		15110	12221	16674	11971	12400	770		
10	Feb 22, 1979	1015	1235	2	61235	39226		55767	56342	54238	55842	57000	27700		
11	Feb 22, 1979	1305	1455	3	58990	36862		56270	56342	55745	55842	57000	27700		
12	Mar 19, 1979	0940	1130	2	33190	5006		27949	28493	28694	28438	28600	4630		
13	Mar 19, 1979	1200	1330	4	35802	5529		29377	28493	30488	28438	28600	4630		
14	Apr 13, 1979	1010	1140	1	22586	2101		17914	14867	19870	14934	14700	2060		
15	Apr 13, 1979	1215	1325	2	23029	2809		17995	14867	19655	14934	14700	2060		
16	Jun 5, 1979	1015	1150	1	19210	1043		14180	12429	13017	12544	12200	725		
17	Jun 5, 1979	1220	1355	2	11189	436		10017	12429	8534	12544	12200	725		
18	Jul 17, 1979	1110	1320	2	14373	601		13315	15365	12982	15440	15200	1110		
19	Jul 17, 1979	1325	1505	2	16873	536		15351	15365	16521	15440	15200	1110		
20	Jul 18, 1979	0930	1110	1	22055	1691		17296	15151	16678	15225	15000	1050		
21	Jul 18, 1979	1130	1315	1	15579	882		13377	15151	11491	15225	15000	1050		
22	Aug 15, 1979	1030	1210	2	15930	874		14655	16495	13200	16474	16400	1150		
23	Aug 16, 1979	0830	1000	2	23530	2318		18927	16085	19550	16179	15900	1120		
24	Aug 16, 1979	1000	1115	2	22690	2056		17189	16085	15497	16179	15900	1120		
25	Aug 16, 1979	1130	1310	2	16119	989		14137	16085	12468	16179	15900	1120		
26	Sep 6, 1979	0910	1100	3	24664	2560						14800	1760		
27	Sep 6, 1979	1135	1255	3	25085	3335						14800	1760		
28	Sep 6, 1979	1300	1410	3	25024	3324						14800	1760		
29	Sep 11, 1979	1000	1140	4	15446	794						15500	1720		
30	Sep 11, 1979	1200	1320	4	21114	1566						15500	1720		
31	Sep 11, 1979	1340	1500	4	24165	2221						15500	1720		
32	Sep 12, 1979	0930	1100	1	13265	806						15500	1670		
33	Sep 12, 1979	1115	1225	1	14616	715						15500	1670		
34	Sep 12, 1979	1240	1400	1	18284	1032						15500	1670		
35	Feb 28, 1980	1400	1540	1	83648	31879	33097	74976	75862	75048	75853			75800	29300
36	Feb 28, 1980	1055	1235	2	83640	36592	33153	75941	75862	76057	75853			75800	29300
37	Feb 29, 1980	1300	1420	3	75909	29465	29757	72989	73106	72663	72985			72500	31500
38	Feb 29, 1980	1000	1120	4	84925	33757	26845	73223	73106	73110	72985			72500	31500
39	Jun 24, 1980	1100	1455	4	22859	2409	2456	21587	20727	20604	20749			20300	1810
40	Jun 25, 1980	1020	1340	3	25849	3262	3225	23457	21294	23849	21346			21000	1870
41	Jun 26, 1980	0940	1325	2	26041	3209	3093	23642	21120	24959	21314			21000	1810
42	Jun 27, 1980	1045	1500	1	25555	2966	2721	22814	20262	23590	20292			20100	1680
43	Apr 28, 1981	1250	1420	1	13389	477	479	10772	11896	11873	11939				
44	Apr 29, 1981	1030	1305	2	6966	275	281	8362	11460	6128	11486				
45	Apr 30, 1981	1130	1420	3	7024	316	340	7180	10161	4854	10110				
46	May 1, 1981	1005	1310	4	14904	717	763	11514	9174	9811	9218				
47	Sep 15, 1981	1015	1215	1	22444	2376	2425								
48	Sep 16, 1981	0855	1115	4	22657	1963	1792								
49	Sep 16, 1981	1215	1355	3	21200	2109	2044								
50	Sep 17, 1981	0840	1100	2	17082	797	1011								

* Columns 7 & 8 from USGS data at Freeport
Columns 9 & 10 from USGS data at Hood

calculated from the point sediment samples, and Column 6 is the suspended sediment load (tons/day) as calculated from the integrated sediment samples. The superscript "H" indicates that the values are a measure only for the time period that the data were collected, and thus provide only an estimate of the mean daily values (due to tidal effects). Columns 7 through 10 were obtained from the USGS Sacramento-to-Hood Transient Flow Model results (which calculate discharge values at 15-min intervals); Columns 7 and 9 are the arithmetic means of the 15-min discharge results for the time period in question, while Columns 8 and 10 are the arithmetic means of the 96 daily values. The superscript "D" is used to indicate that the values are arithmetic means over the 24-hr period of the date in question. Columns 11 through 14 were obtained from the USGS-DWR annual reports "Water Resources Data for California". Missing values in the table imply either that they were unavailable at the time the analysis was carried out, or that measurements (e.g., integrated sediment concentration samples) were not taken for those dates.

A straight-line relationship was used for the correlation of the various data in Table 3.5. The equation is of the form

$$Y = aX + b \tag{3.3}$$

where Y is the dependent variable X is the independent variable and a and b are regression coefficients.

The data from Table 3.5 were fitted to Eq. (3.3) and the constants a and b were obtained by linear regression. The BMDP Biomedical Computer Programs (P-series), part of the statistical package available at the UCD Computer Center, were used to carry out the linear regression analysis. The results are summarized in Table 3.6.

Table 3.6. Summary of Statistical Correlations for Data at Hood.

Dependent variable	Independent variable	Number of data points	Coefficients in equation (3.3) a	b	Correlation coefficient r
(4) Q^H_{HOOD}	(9) Q^H_{HOOD}	33	1.076	1741.5	0.9964
(4) Q^H_{HOOD}	(7) $Q^H_{FREEPORT}$	33	1.086	1299.4	0.9961
(9) Q^H_{HOOD}	(7) $Q^H_{FREEPORT}$	25	1.019	-657.5	0.9945
(11) $Q^D_{SACRAMENTO}$	(8) $Q^D_{FREEPORT}$	13	1.006	-42.8	0.9991
(10) Q^D_{HOOD}	(11) $Q^D_{SACRAMENTO}$	13	0.987	1962.2	0.9987
(5) S^H_{HOOD}	(6) S^H_{HOOD}	14	1.065	4.52	0.9920

Note: The numbers in parentheses in columns 1 and 2 indicate the column number of Table 3.5 from which the data points were taken. The data for the year 1981 were not included in the above analyses because they only became available after most of the analyses were made.

3.5 Discharge-Sediment Load Relationships

The data shown in Table 3.5 was also used to determine relationships between mean daily discharge (cfs) and daily sediment load (tons/day) using an equation of the form

$$S = a\ Q^b \tag{3.4}$$

where Q is the mean daily discharge (cfs), S is the daily sediment load (tons/day), and a and b are constants.

Equation (3.4) can be transformed to a log-linear form as

$$Ln(S) = Ln(a) + b\ Ln(Q) \tag{3.5}$$

where Ln is the logarithm to the base "e' (natural logarithm).

Data from Table 3.5 were used to fit Eq. (3.4), and the constants a and b were determined from a linear regression analysis using the UCD statistical package mentioned in the previous section. The results are summarized in Table 3.7.

Table 3.7. Summary of the Discharge-Sediment Load Relationship Results.

Dependent variable	Independent variable	Number of data points	Coefficients in equation (3.4) a	b	Correlation coefficient (Eq. 3.5)
(5) S^H_{HOOD}	(4) Q^H_{HOOD}	42	7.74216×10^{-8}	2.397	0.9734
(12) $S^D_{SACRAMENTO}$	(11) $Q^D_{SACRAMENTO}$	14	1.62814×10^{-7}	2.369	0.9746
(14) $S^D_{FREEPORT}$	(13) $Q^D_{FREEPORT}$	7	5.57×10^{-7}	2.205	0.9988

(See note at the bottom of Table 3.6.)

4. SACRAMENTO RIVER SEDIMENT ANALYSIS AT HOOD (PERIPHERAL CANAL INTAKE)

4.1 Introduction

The purpose of this chapter is to describe the use of the mean daily discharge (cfs) and daily sediment load (tons/day) values measured in the Sacramento River for the water years 1956-57 through 1979-80 (inclusive) as long-term data to estimate the amount of suspended sediments that would be diverted into the PC at the intake located at Hood, given the Canal's operational schedule for water diversion from the Sacramento River.

An implied assumption is that the long-term historical data for the Sacramento River mean daily flow and sediment load measured at Sacramento apply equally well in the vicinity of Hood (about 21 miles south of Sacramento). This assumption is reinforced by the fact that the net change in flow and sediment load within the Sacramento-Hood reach is negligible.

Sediment-discharge relationships are derived, and together with Kalinske's equation and Einstein's technique, the amount of suspended sediment load and bed load diverted into the PC are calculated. Also computed are the sediment volume remaining downstream from the intake, along with the expected bed load deposition downstream of the intake.

4.2 Supplemental Data

The primary data used in this study were the daily values of mean daily discharge (cfs) and daily suspended sediment load (tons/day) over the 24-yr period (a total of 8,766 pairs of values) and the results of particle size analysis of bed material samples (discussed in Section 2.2.1). The UCD Hydraulics Laboratory was also provided with data of projected Peripheral Canal diversions for the Sacramento River for

several alternatives (DWR, 1981a). Using historical Sacramento River discharge data at Sacramento (1921-22 through 1970-71, inclusive) and following the DWR criteria for diverting water into the PC, average monthly Sacramento River flows and diversions into the PC were calculated and grouped according to the following six different water-year classifications:

a. average

b. above normal (18%)

c. below normal (18%)

d. wet (32%)

e. dry (20%)

f. critical (12%).

The numbers in parenthesis indicate the relative amount of time (as a percent of the total) that a water-year classification occurred during the period. The monthly average daily Sacramento River flow and PC diversions based on the 1921-22 through 1970-71 data are summarized in Table 4.1.

4.3 Basic Statistics for the Sacramento River

Due to the large quantity of the Sacramento River historical records of mean daily flow and sediment load, individual values are not included in the report. Rather, the data are presented in the form of hydrograph plots (Fig. 4.1). As pointed out earlier in this report the 1979-80 Sacramento River data at Freeport were included as part of the Sacramento River data at Sacramento.

In addition, some of the basic statistics of the historical data were determined and the results summarized in Tables 4.2 through 4.10. Tables 4.2 through 4.6 are self explanatory. For each month of each

Table 4.1. Monthly Average Mean Daily Flow in Sacramento River and Diversion Into the Peripheral Canal.

	Sacramento River at Sacramento (cfs)						Diversion into the Peripheral Canal (cfs)					
Month	Average	Above normal	Below normal	Wet	Dry	Critical	Average	Above normal	Below normal	Wet	Dry	Critical
October	12725	12170	12567	14377	11626	11220	8636	8766	8903	9328	7630	8020
November	13759	12808	13614	16605	12284	10269	9536	9333	9549	11305	8244	7261
December	20458	16127	14281	34965	12887	10156	10680	9439	9168	14371	9196	7442
January	28841	21248	16583	53713	16825	12322	11723	13252	10978	11066	12734	10616
February	35558	31401	32295	56558	22067	13110	10686	11129	11516	9046	11871	11176
March	30013	36213	26668	41545	20227	11290	9568	9952	10589	7853	11411	8962
April	22887	23404	15627	36181	14823	10988	10307	11483	10272	10785	10134	7610
May	21680	18649	15957	36616	12698	9952	6672	5936	6946	6250	7677	6819
June	18400	18199	15883	26207	13387	10101	8502	9127	9336	7271	9935	7205
July	18382	19693	18171	21023	16334	13101	13094	13853	13770	13132	13339	10434
August	19480	20499	20168	20551	18859	15095	17041	17959	17732	17923	16612	12991
September	14540	14430	15211	16198	13029	11796	10584	10954	11652	10369	10532	9091

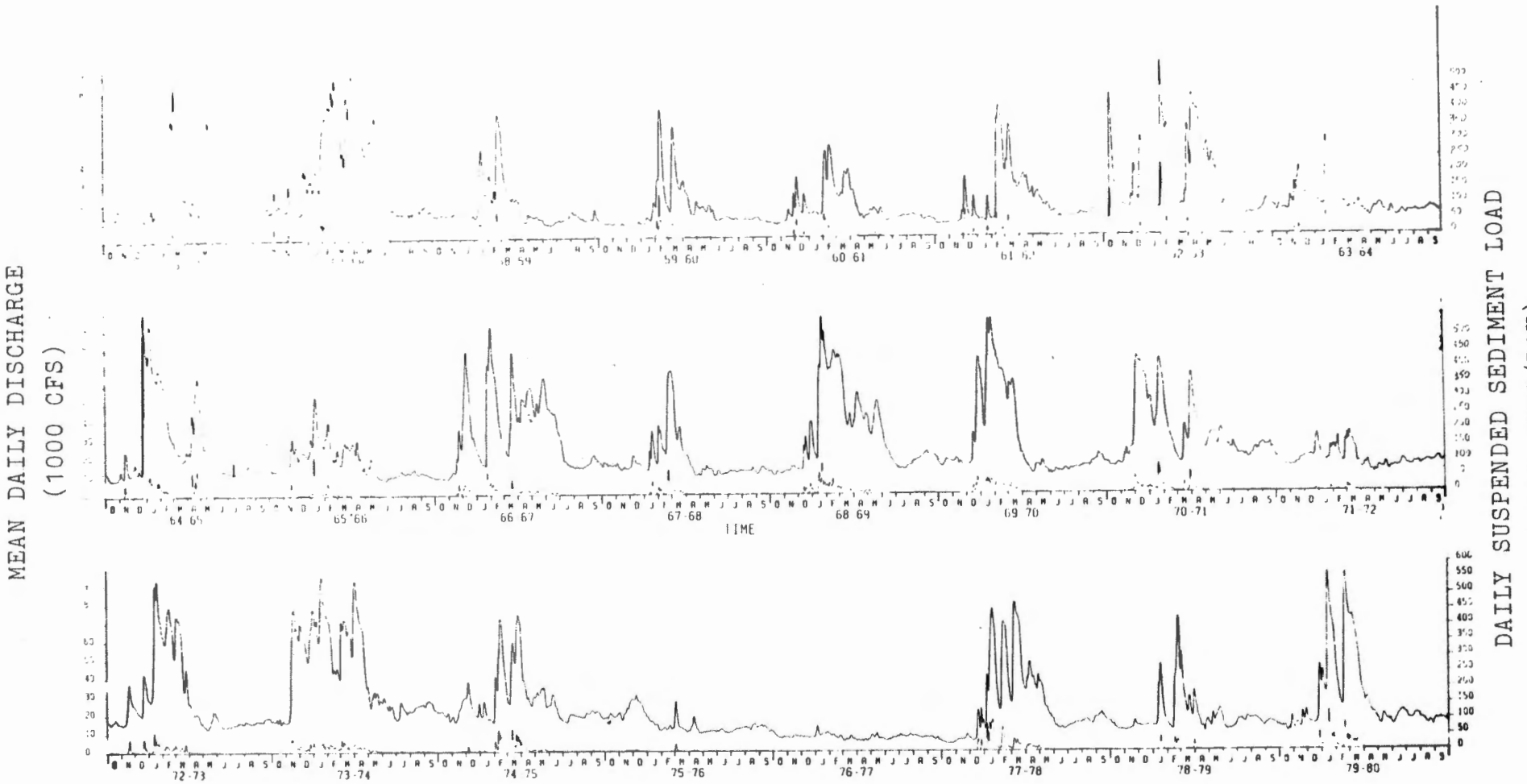

Figure 4.1 24 year Hydrograph of daily discharge and suspended sediment load

Table 4.2. Sacramento River Basic Statistics (Part a).

Year		Minimum Mean Daily Flow (cfs)	Maximum Mean Daily Flow (cfs)	Minimum Daily Sediment Load (tons)	Maximum Daily Sediment Load (tons)
1956	57	8730.0	83200.0	389.0	60000.0
1957	58	12200.0	88800.0	1210.0	58600.0
1958	59	7140.0	67300.0	580.0	88900.0
1959	60	6260.0	69100.0	200.0	147000.0
1960	61	6780.0	49500.0	290.0	75000.0
1961	62	6660.0	70100.0	300.0	85500.0
1962	63	8720.0	94400.0	505.0	229000.0
1963	64	9030.0	52200.0	501.0	68100.0
1964	65	8640.0	98800.0	500.0	525000.0
1965	66	8120.0	53600.0	555.0	132000.0
1966	67	8610.0	90700.0	491.0	77300.0
1967	68	9780.0	66600.0	480.0	83800.0
1968	69	10300.0	95200.0	467.0	100000.0
1969	70	10100.0	93800.0	469.0	54600.0
1970	71	14200.0	73200.0	811.0	95000.0
1971	72	9800.0	32200.0	579.0	22800.0
1972	73	12600.0	92700.0	541.0	68200.0
1973	74	15200.0	94200.0	609.0	44000.0
1974	75	15600.0	73800.0	1080.0	76400.0
1975	76	9840.0	30600.0	310.0	26700.0
1976	77	5200.0	13700.0	161.0	2860.0
1977	78	3970.0	79300.0	151.0	101000.0
1978	79	10100.0	71300.0	437.0	47300.0
1979	80	10100.0	94600.0	436.0	129000.0

Table 4.3. Sacramento River Basic Statistics (Part b).

Water Year		Calendar Year	Month	Day	Min. Mean Daily Flow (cfs)
1956	57	1957	7	13	8730.0
1957	58	1958	8	10	12200.0
1958	59	1959	6	17	7140.0
1959	60	1959	12	14	6260.0
1960	61	1960	10	23	6780.0
1961	62	1961	10	9	6660.0
1962	63	1962	10	9	8720.0
1963	64	1964	4	27	9030.0
1964	65	1964	10	14	8640.0
1965	66	1966	6	15	8120.0
1966	67	1966	10	29	8610.0
1967	68	1968	6	3	9780.0
1968	69	1968	10	9	10300.0
1969	70	1970	6	3	10100.0
1970	71	1970	10	19	14200.0
1971	72	1972	4	29	9800.0
1972	73	1973	5	11	12600.0
1973	74	1973	10	21	15200.0
1974	75	1975	7	11	15600.0
1975	76	1976	6	24	9840.0
1976	77	1977	4	15	5200.0
1977	78	1977	10	15	3970.0
1978	79	1979	4	22	10100.0
1979	80	1979	10	18	10100.0

Table 4.4. Sacramento River Basic Statistics (Part c).

Water Year		Calendar Year	Month	Day	Max. Mean Daily Flow (cfs)
1956	57	1957	3	6	83200.0
1957	58	1958	4	7	88800.0
1958	59	1959	2	20	67300.0
1959	60	1960	2	10	69100.0
1960	61	1961	2	14	49500.0
1961	62	1962	2	16	70100.0
1962	63	1963	2	2	94400.0
1963	64	1964	1	23	52200.0
1964	65	1964	12	24	98800.0
1965	66	1966	1	10	53600.0
1966	67	1967	1	31	90700.0
1967	68	1968	2	28	66600.0
1968	69	1969	1	22	95200.0
1969	70	1970	1	24	93800.0
1970	71	1970	12	5	73200.0
1971	72	1972	3	6	32200.0
1972	73	1973	1	19	92700.0
1973	74	1974	1	20	94200.0
1974	75	1975	3	26	73800.0
1975	76	1975	12	8	30600.0
1976	77	1977	1	5	13700.0
1977	78	1978	3	9	79300.0
1978	79	1979	2	24	71300.0
1979	80	1980	1	15	94600.0

Table 4.5. Sacramento River Basic Statistics (Part d).

Water Year		Calendar Year	Month	Day	Min. Daily Sed. Load (tons)
1956	57	1957	1	7	389.0
1957	58	1957	12	7	1210.0
1958	59	1959	4	21	580.0
1959	60	1959	12	14	200.0
1960	61	1960	10	23	290.0
1961	62	1961	11	21	300.0
1962	63	1963	8	2	505.0
1963	64	1964	4	28	501.0
1964	65	1964	10	20	500.0
1965	66	1966	6	23	555.0
1966	67	1966	11	3	491.0
1967	68	1968	1	1	480.0
1968	69	1968	10	12	467.0
1969	70	1969	11	28	469.0
1970	71	1970	10	17	811.0
1971	72	1971	11	8	579.0
1972	73	1973	6	29	541.0
1973	74	1973	11	5	609.0
1974	75	1974	12	26	1080.0
1975	76	1976	1	29	310.0
1976	77	1976	12	29	161.0
1977	78	1977	10	21	151.0
1978	79	1978	12	23	437.0
1979	80	1979	10	18	436.0

Table 4.6. Sacramento River Basic Statistics (Part e).

Water Year		Calendar Year	Month	Day	Max. Daily Sed. Load (tons)
1956	57	1957	2	25	60000.0
1957	58	1958	4	3	58600.0
1958	59	1959	2	18	88900.0
1959	60	1960	2	9	147000.0
1960	61	1961	2	2	75000.0
1961	62	1961	12	4	85500.0
1962	63	1963	2	2	229000.0
1963	64	1964	1	23	68100.0
1964	65	1964	12	24	525000.0
1965	66	1966	1	7	132000.0
1966	67	1967	1	23	77300.0
1967	68	1968	2	22	83800.0
1968	69	1969	1	22	100000.0
1969	70	1969	12	24	54600.0
1970	71	1971	1	19	95000.0
1971	72	1972	3	2	22800.0
1972	73	1973	1	13	68200.0
1973	74	1973	11	12	44000.0
1974	75	1975	3	12	76400.0
1975	76	1976	3	3	26700.0
1976	77	1977	1	6	2860.0
1977	78	1978	1	19	101000.0
1978	79	1979	1	17	47300.0
1979	80	1980	1	15	129000.0

Table 4.7. Sacramento River Basic Statistics (Part f)

Year		Month	Mean Daily Flow (cfs)	Daily Sed. Load (tons/day)	Total Volume (ac-ft)	Total Sediment (tons)
1956	57	10	12387.	1186.	761653.	36770.
		11	14597.	1378.	868562.	41341.
		12	12510.	565.	769190.	17521.
		1	12035.	1295.	740033.	40139.
		2	17861.	9847.	991974.	275720.
		3	49845.	22474.	3064860.	696700.
		4	19993.	3301.	1189686.	99040.
		5	30977.	9494.	1904727.	294300.
		6	16794.	2554.	999332.	76623.
		7	9329.	886.	573620.	27465.
		8	9745.	924.	599207.	28641.
		9	12213.	1799.	726744.	53958.
1957	58	10	18213.	6425.	1119868.	199170.
		11	18770.	4368.	1116893.	131030.
		12	23106.	9924.	1420760.	307630.
		1	35052.	19405.	2155240.	601570.
		2	72332.	42779.	4017124.	1197800.
		3	60413.	29026.	3714645.	899800.
		4	71363.	24487.	4246413.	734600.
		5	53619.	15639.	3296926.	484800.
		6	35077.	7783.	2087207.	233500.
		7	14390.	1794.	884826.	55600.
		8	14197.	1735.	872926.	53800.
		9	15937.	2700.	948298.	81000.
1958	59	10	12671.	1461.	779107.	45300.
		11	13083.	1317.	778512.	39500.
		12	12729.	1132.	782678.	35100.
		1	27355.	17445.	1681983.	540790.
		2	40486.	22935.	2248463.	642180.
		3	27084.	7409.	1665322.	229670.
		4	13928.	2170.	828754.	65085.
		5	11412.	1716.	701693.	53195.
		6	8016.	1028.	476965.	30845.
		7	10554.	1417.	648932.	43940.
		8	11954.	1473.	735015.	45650.
		9	10880.	2642.	647405.	79260.
1959	60	10	7921.	641.	487021.	19860.
		11	7342.	395.	436860.	11849.
		12	7208.	346.	443187.	10719.
		1	11087.	2119.	681739.	65697.
		2	35559.	31093.	2045355.	901700.
		3	33700.	14100.	2072132.	437100.
		4	19247.	3057.	1145256.	91696.
		5	16077.	3034.	988562.	94050.
		6	10866.	1145.	646552.	34362.
		7	10396.	932.	639253.	28906.
		8	9730.	966.	598255.	29934.
		9	9647.	1291.	574056.	38715.

Table 4.7. (continued)

	Year	Month	Mean Daily Flow (cfs)	Daily Sed. Load (tons/day)	Total Volume (ac-ft)	Total Sediment (tons)
1960	61	10	7690.	682.	472860.	21143.
		11	11701.	3022.	696258.	90663.
		12	18497.	8812.	1137322.	273178.
		1	12935.	1393.	795372.	43177.
		2	38729.	26297.	2150876.	736320.
		3	28465.	13021.	1750215.	403660.
		4	16931.	4594.	1007484.	137830.
		5	13110.	2542.	806083.	78800.
		6	10935.	1609.	650658.	48266.
		7	10545.	1067.	648397.	33075.
		8	11445.	1274.	703736.	39509.
		9	9685.	1252.	576298.	37556.
1961	62	10	7085.	584.	435630.	18093.
		11	8248.	842.	490810.	25265.
		12	15693.	12304.	964919.	381426.
		1	10534.	3133.	647702.	97114.
		2	43001.	23864.	2388179.	668192.
		3	37790.	14547.	2323636.	450970.
		4	28240.	4209.	1680397.	126260.
		5	19748.	2786.	1214281.	86380.
		6	13011.	1366.	774208.	40967.
		7	10246.	840.	629990.	26055.
		8	11542.	1050.	709686.	32559.
		9	12113.	1789.	720793.	53666.
1962	63	10	28688.	17544.	1763960.	543855.
		11	16703.	2015.	993917.	60445.
		12	31919.	11346.	1962645.	351730.
		1	19287.	7643.	1185917.	236926.
		2	56089.	44179.	3115041.	1237000.
		3	24426.	8323.	1501884.	258020.
		4	61633.	21737.	3667438.	652100.
		5	42784.	10174.	2630678.	315400.
		6	17603.	3184.	1047471.	95510.
		7	12142.	1099.	746579.	34077.
		8	11468.	994.	705124.	30815.
		9	16217.	4344.	964959.	130310.
1963	64	10	14168.	1936.	871140.	60021.
		11	22637.	7214.	1346975.	216430.
		12	20987.	2482.	1290446.	76940.
		1	24732.	11135.	1520727.	345170.
		2	20883.	3022.	1201190.	87650.
		3	14381.	1404.	884231.	43523.
		4	12514.	1266.	744655.	37965.
		5	13945.	1797.	857455.	55718.
		6	11104.	1087.	660754.	32620.
		7	11622.	806.	714585.	24973.
		8	12161.	934.	747769.	28965.
		9	13243.	1968.	788033.	59034.

Table 4.7. (continued)

	Year	Month	Mean Daily Flow (cfs)	Daily Sed. Load (tons/day)	Total Volume (ac-ft)	Total Sediment (tons)
1964	65	10	9721.	894.	597719.	27711.
		11	13992.	5131.	832562.	153935.
		12	36558.	71407.	2247868.	2213632.
		1	71781.	44384.	4413620.	1375900.
		2	45968.	17046.	2552926.	477300.
		3	23068.	3580.	1418380.	110970.
		4	42170.	29043.	2509289.	871300.
		5	30097.	7332.	1850579.	227280.
		6	16017.	2354.	953058.	70630.
		7	12365.	1342.	760264.	41610.
		8	14445.	1694.	888198.	52500.
		9	15487.	2046.	921521.	61380.
1965	66	10	13942.	1429.	857256.	44290.
		11	20177.	7778.	1200595.	233340.
		12	22610.	4573.	1390215.	141760.
		1	34535.	24516.	2123504.	760010.
		2	27007.	12088.	1499901.	338450.
		3	23677.	4958.	1455868.	153710.
		4	21717.	4970.	1292231.	149110.
		5	14205.	2498.	873421.	77443.
		6	9583.	1075.	570248.	32237.
		7	11584.	1367.	712264.	42383.
		8	12290.	1328.	755702.	41175.
		9	10949.	1693.	651491.	50782.
1966	67	10	9126.	852.	561144.	26400.
		11	18597.	6562.	1106579.	196856.
		12	46426.	16426.	2854612.	509200.
		1	36103.	16808.	2219901.	521050.
		2	51736.	18035.	2873256.	504980.
		3	41800.	12229.	2570182.	379100.
		4	50357.	12652.	2996430.	379560.
		5	51932.	12202.	3193190.	378260.
		6	43023.	7835.	2560066.	235060.
		7	19490.	2393.	1198413.	74170.
		8	15052.	1379.	925488.	42750.
		9	18573.	2146.	1105190.	64390.
1967	68	10	16155.	1907.	993322.	59110.
		11	14593.	1164.	868364.	34920.
		12	17177.	1453.	1056198.	45028.
		1	20477.	8308.	1259107.	257547.
		2	39779.	21374.	2288132.	619850.
		3	36016.	10474.	2214545.	324680.
		4	14437.	1691.	859041.	50735.
		5	13316.	2538.	818777.	78668.
		6	11353.	982.	675531.	29448.
		7	12594.	1014.	774347.	31427.
		8	13003.	1076.	799537.	33349.
		9	13120.	1244.	780694.	37326.

Table 4.7. (continued)

	Year	Month	Mean Daily Flow (cfs)	Daily Sed. Load (tons/day)	Total Volume (ac-ft)	Total Sediment (tons)
1968	69	10	11629.	793.	715041.	24590.
		11	13603.	988.	809455.	29654.
		12	22935.	9567.	1410248.	296585.
		1	55403.	30815.	3406612.	955250.
		2	71793.	26668.	3987174.	746700.
		3	49729.	13240.	3057719.	410440.
		4	45350.	10864.	2698512.	325930.
		5	40606.	9095.	2496793.	281940.
		6	23123.	4508.	1375934.	135250.
		7	14216.	1787.	874116.	55410.
		8	18345.	3152.	1128000.	97700.
		9	21017.	3152.	1250579.	94560.
1969	70	10	16694.	1335.	1026446.	41373.
		11	16940.	857.	1008000.	25705.
		12	35252.	14655.	2167537.	454315.
		1	70261.	29063.	4320198.	900960.
		2	66061.	23736.	3668826.	664600.
		3	44206.	13779.	2718149.	427140.
		4	14620.	1758.	869950.	52738.
		5	14265.	2131.	877091.	66062.
		6	11787.	1097.	701355.	32905.
		7	13174.	991.	810050.	30707.
		8	14977.	1149.	920926.	35624.
		9	18513.	1933.	1101620.	58000.
1970	71	10	15261.	1224.	938380.	37940.
		11	22520.	7026.	1340033.	210789.
		12	63971.	20816.	3933421.	645300.
		1	52323.	26298.	3217190.	815250.
		2	31196.	10089.	1732562.	282480.
		3	30481.	14321.	1874182.	443960.
		4	38270.	9941.	2277223.	298230.
		5	29190.	5701.	1794843.	176730.
		6	27550.	3195.	1639339.	95850.
		7	20981.	1956.	1290050.	60650.
		8	22465.	2501.	1381289.	77540.
		9	24393.	2308.	1451504.	69240.
1971	72	10	16071.	1103.	988165.	34183.
		11	15853.	922.	943339.	27650.
		12	21758.	2744.	1337851.	85075.
		1	20000.	2733.	1229752.	84726.
		2	22117.	2694.	1272198.	78120.
		3	23897.	7369.	1469355.	228430.
		4	13120.	1845.	780694.	55363.
		5	12848.	2028.	790017.	62879.
		6	13837.	1479.	823339.	44370.
		7	15000.	1404.	922314.	43525.
		8	15658.	1456.	962777.	45127.
		9	16817.	1667.	1000661.	50012.

Table 4.7. (continued)

Year		Month	Mean Daily Flow (cfs)	Daily Sed. Load (tons/day)	Total Volume (ac-ft)	Total Sediment (tons)
1972	73	10	16077.	1235.	988562.	38296.
		11	23203.	7409.	1380694.	222277.
		12	27423.	9249.	1686149.	286730.
		1	60132.	22914.	3697388.	710330.
		2	65257.	18250.	3624198.	511000.
		3	51642.	14965.	3175339.	463920.
		4	20670.	3445.	1229950.	103350.
		5	16416.	2039.	1009388.	63216.
		6	14937.	1339.	888793.	40166.
		7	15168.	1433.	932628.	44409.
		8	16123.	1946.	991339.	60320.
		9	17487.	1805.	1040529.	54140.
1973	74	10	16723.	1085.	1028231.	33650.
		11	48037.	16421.	2858380.	492634.
		12	61632.	15771.	3789620.	488890.
		1	74826.	20394.	4600860.	632200.
		2	52389.	17681.	2909554.	495060.
		3	64681.	19745.	3977058.	612100.
		4	66283.	16407.	3944132.	492200.
		5	29177.	6319.	1794050.	195900.
		6	24413.	3320.	1452694.	99600.
		7	21752.	2932.	1337455.	90900.
		8	23948.	2949.	1472529.	91420.
		9	25060.	3178.	1491174.	95330.
1974	75	10	20119.	1935.	1237091.	59980.
		11	22003.	2919.	1309289.	87560.
		12	25645.	4240.	1576860.	131440.
		1	19432.	1973.	1194843.	61150.
		2	47518.	27856.	2639008.	779970.
		3	50942.	28911.	3132298.	896230.
		4	33173.	9771.	1973950.	293140.
		5	30265.	6616.	1860893.	205100.
		6	23710.	3291.	1410843.	98720.
		7	18284.	2081.	1124231.	64500.
		8	19497.	2358.	1198810.	73100.
		9	20380.	2971.	1212694.	89130.
1975	76	10	19174.	1735.	1178975.	53770.
		11	22250.	3153.	1323967.	94580.
		12	25545.	3238.	1570711.	100370.
		1	15132.	845.	930446.	26192.
		2	12772.	789.	734678.	22884.
		3	14574.	3767.	896132.	116762.
		4	12724.	1747.	757150.	52419.
		5	10910.	1167.	670810.	36167.
		6	10935.	1248.	650658.	37454.
		7	12077.	1150.	742612.	35641.
		8	13348.	1599.	820760.	49570.
		9	12510.	1511.	744397.	45319.

Table 4.7. (continued)

Year		Month	Mean Daily Flow (cfs)	Daily Sed. Load (tons/day)	Total Volume (ac-ft)	Total Sediment (tons)
1976	77	10	8103.	483.	498228.	14969.
		11	7823.	329.	465521.	9868.
		12	7743.	256.	476093.	7951.
		1	9802.	822.	602678.	25485.
		2	8003.	551.	444456.	15438.
		3	6573.	499.	404152.	15467.
		4	5961.	504.	354704.	15132.
		5	7597.	900.	467107.	27909.
		6	6865.	532.	408516.	15955.
		7	8248.	830.	507174.	25744.
		8	7687.	822.	472641.	25468.
		9	6838.	760.	406889.	22789.
1977	78	10	4494.	261.	276337.	8084.
		11	6687.	482.	397924.	14448.
		12	11745.	8796.	722202.	272663.
		1	45490.	48514.	2797091.	1503930.
		2	44704.	26013.	2482711.	728370.
		3	55571.	18931.	3416926.	586850.
		4	38883.	12764.	2313719.	382920.
		5	25194.	4096.	1549091.	126970.
		6	12660.	1121.	753322.	33620.
		7	14300.	1583.	879273.	49070.
		8	15968.	1813.	981818.	56210.
		9	17933.	2135.	1067107.	64060.
1978	79	10	12487.	1066.	767802.	33038.
		11	12443.	966.	740430.	28987.
		12	13203.	660.	811835.	20471.
		1	23190.	7312.	1425917.	226679.
		2	32443.	13500.	1801785.	378003.
		3	29165.	7538.	1793256.	233680.
		4	16547.	2859.	984595.	85765.
		5	17984.	2001.	1105785.	62040.
		6	12207.	831.	726347.	24924.
		7	16413.	1379.	1009190.	42760.
		8	15677.	1268.	963967.	39300.
		9	14567.	1463.	866777.	43895.
1979	80	10	12577.	643.	773355.	19919.
		11	15200.	999.	904463.	29957.
		12	20319.	7065.	1249388.	219028.
		1	58635.	36571.	3605355.	1133710.
		2	52576.	25556.	3024198.	741110.
		3	55339.	21821.	3402645.	676440.
		4	22587.	2509.	1344000.	75270.
		5	15894.	1112.	977256.	34486.
		6	17813.	1366.	1059967.	40983.
		7	17726.	1317.	1089917.	40840.
		8	14916.	949.	917157.	29428.
		9	15887.	1026.	945322.	30767.

Table 4.8. Sacramento River Basic Statistics (Part g).

Year		Avg. annual daily flow (cfs)	Avg. annual sedim. load (tons)	Annual volume (ac. ft)	Annual sedim. (tons)	Accum. volume (ac. ft)	Accumulated sediments (tons)
56	57	18218.	4625.	13189587.	1688218.	13189587.	1688218.
57	58	35749.	13645.	25881124.	4980300.	39070711.	6668518.
58	59	16541.	5070.	11974830.	1850515.	51045540.	8519033.
59	60	14820.	4821.	10758228.	1764588.	61803769.	10283621.
60	61	15740.	5324.	11395557.	1943177.	73199326.	12226798.
61	62	17929.	5498.	12980231.	2006947.	86179557.	14233745.
62	63	28020.	10811.	20285613.	3946188.	106465170.	18179933.
63	64	16018.	2921.	11627960.	1069009.	118093131.	19248942.
64	65	27551.	15573.	19945983.	5684148.	138039114.	24933090.
65	66	18485.	5657.	13382698.	2064690.	151421812.	26997780.
66	67	33378.	9073.	24164450.	3311776.	175586261.	30309556.
67	68	18441.	4377.	13387597.	1602088.	188973858.	31911644.
68	69	32060.	9463.	23210182.	3454009.	212184040.	35365653.
69	70	27888.	7644.	20190149.	2790129.	232374188.	38155782.
70	71	31590.	8805.	22870017.	3213959.	255244205.	41369741.
71	72	17247.	2294.	12520463.	839460.	267764668.	42209201.
72	73	28516.	7118.	20644959.	2598154.	288409626.	44807355.
73	74	42344.	10465.	30655736.	3819884.	319065362.	48627239.
74	75	27447.	7781.	19870810.	2840020.	338936172.	51467259.
75	76	15182.	1834.	11021296.	671128.	349957468.	52138387.
76	77	7608.	609.	5508159.	222175.	355465626.	52360562.
77	78	24362.	10485.	17637521.	3827195.	373103147.	56187757.
78	79	17953.	3341.	12997686.	1219542.	386100833.	57407299.
79	80	26576.	8393.	19293025.	3071938.	405393858.	60479237.

Table 4.9. Sacramento River Basic Statistics (Part h).

Month	Annual Average Monthly Volume (ac-ft)	Annual Minimum Monthly Volume (ac-ft)	Annual Maximum Monthly Volume (ac-ft)
10	838221.	276337.	1763960.
11	1009099.	397924.	2858380.
12	1543831.	443187.	3933421.
1	2102216.	602678.	4600860.
2	2320574.	444456.	4017124.
3	2248046.	404152.	3977058.
4	1737319.	354704.	4246413.
5	1438729.	467107.	3296926.
6	999715.	408516.	2560066.
7	852103.	507174.	1337455.
8	885527.	472641.	1472529.
9	916031.	406889.	1491174.

Average = 1,407,618 acre-feet/month

Table 4.10. Sacramento River Basic Statistics (Part i).

Month	Annual Average Monthly Sediments (tons)	Annual Minimum Monthly Sediments (tons)	Annual Maximum Monthly Sediments (tons)
10	62563.	3084.	543855.
11	104570.	9868.	492634.
12	307195.	7951.	2213632.
1	498373.	25485.	1503930.
2	547120.	15438.	1237000.
3	395805.	15467.	899800.
4	234489.	15132.	871200.
5	148487.	27909.	484800.
6	69161.	15955.	235060.
7	43660.	24973.	90900.
8	47519.	25468.	97700.
9	61026.	22789.	130310.

Average = 209,997 tons/month

water year, columns 3 and 4 of Table 4.7 show the monthly average mean daily discharge (cfs) and monthly average daily sediment load (tons/day). These are determined using the following equations:

$$(Q_{ave})_{j,k} = \frac{1}{n_{j,k}} \sum_{i=1}^{n_{j,k}} (Q_{M.D.})_{i,j,k} \tag{4.1}$$

$$(S_{ave})_{j,k} = \frac{1}{n_{j,k}} \sum_{i=1}^{n_{j,k}} (S_{M.D.})_{i,j,k} \tag{4.2}$$

where the subscripts i = day; j = month; k = water year; and $(Q_{av})_{j,k}$ = monthly average mean daily discharge, (cfs); $(Q_{M.D.})_{i,j,k}$ = mean daily discharge (cfs); $n_{j,k}$ = number of days; $(S_{ave})_{j,k}$ = monthly average daily sediment load (tons/day); $(S_{M.D.})_{i,j,k}$ = daily sediment load (tons/day).

Columns 5 and 6 show the total amount of water (ac-ft) and the total amount of sediment (tons) passing the Sacramento River at Sacramento gaging station during the given month. In equation form:

$$V_{j,k} = 86400 \sum_{i=1}^{n_{j,k}} (Q_{M.D.})_{i,j,k} \tag{4.3}$$

$$W_{j,k} = \sum_{i=1}^{n_{j,k}} (S_{M.D.})_{i,j,k} \tag{4.4}$$

where $V_{j,k}$ = total volume of water crossing the Sacramento River at Sacramento gaging station during month j, (ac-ft); $W_{j,k}$ = total amount

of sediments crossing the Sacramento River at the Sacramento gaging station during month j, (tons). All other terms are as defined previously.

In Table 4.8 Columns 2 and 3 give the annual average mean daily flow (cfs) and the annual average daily sediment load (tons/day), as computed from the following equations :

$$(Q_{YR})_k = \frac{1}{m_k} \sum_{j=1}^{12} \sum_{i=1}^{n_{j,k}} (Q_{M.D.})_{i,j,k} \tag{4.5}$$

$$(S_{YR})_k = \frac{1}{m_k} \sum_{j=1}^{12} \sum_{i=1}^{n_{j,k}} (S_{M.D.})_{i,j,k} \tag{4.6}$$

where $(Q_{YR})_k$ = annual average mean daily flow (cfs); m_k = number of days in year k; $(S_{YR})_k$ = annual average daily sediment load (tons/day). Columns 4 and 5 of Table 4.8 give the total annual volume of water (ac-ft) and sediment load (tons) crossing the gaging station during the water year. These were computed from:

$$(V_{YR})_k = \sum_{j=1}^{12} V_{j,k} \tag{4.7}$$

$$(W_{YR})_k = \sum_{j=1}^{12} W_{j,k} \tag{4.8}$$

where $(V_{YR})_k$ = total annual volume of water crosing gaging station (ac-ft); $(W_{YR})_k$ = total annual sediment load crossing gaging station

(tons). Columns 6 and 7 give the accumulated annual volume of water (ac-ft) and sediment load (tons), respectively over the 24-yr period.

Tables 4.9 and 4.10 give the average monthly, minimum monthly, and maximum monthly water volumes (ac-ft) and sediment loads (tons), respectively, for each month over the 24-yr period.

The last two columns of Table 4.8 provide data for a plot of the double-mass relationship between the accumulated volume (runoff) and measured sediment load for the 24-yr period (Fig. 4.2). Also, the results of Tables 4.9 and 4.10 were used for a plot of the monthly average relationship between sediment load (tons) and flow volume (ac-ft) (Fig. 4.3).

4.4 Sediment Inflow into the Peripheral Canal

4.4.1 Sediment-discharge relationships

In order to estimate the amount of suspended sediment that would be diverted into the PC from the Sacramento River under various canal operational schedules, a basic assumption was made that the amount of suspended sediments diverted would be proportional to the amount of water diverted into the canal.

To determine the amount of diverted sediment into the canal for a given Sacramento River flow and canal diversion, it is first necessary to determine a general relationship between the Sacramento River flow and the corresponding sediment load just upstream from the intake. The commonly used relationship between the two is of the form

$$S = a\,Q^{b} \tag{4.9}$$

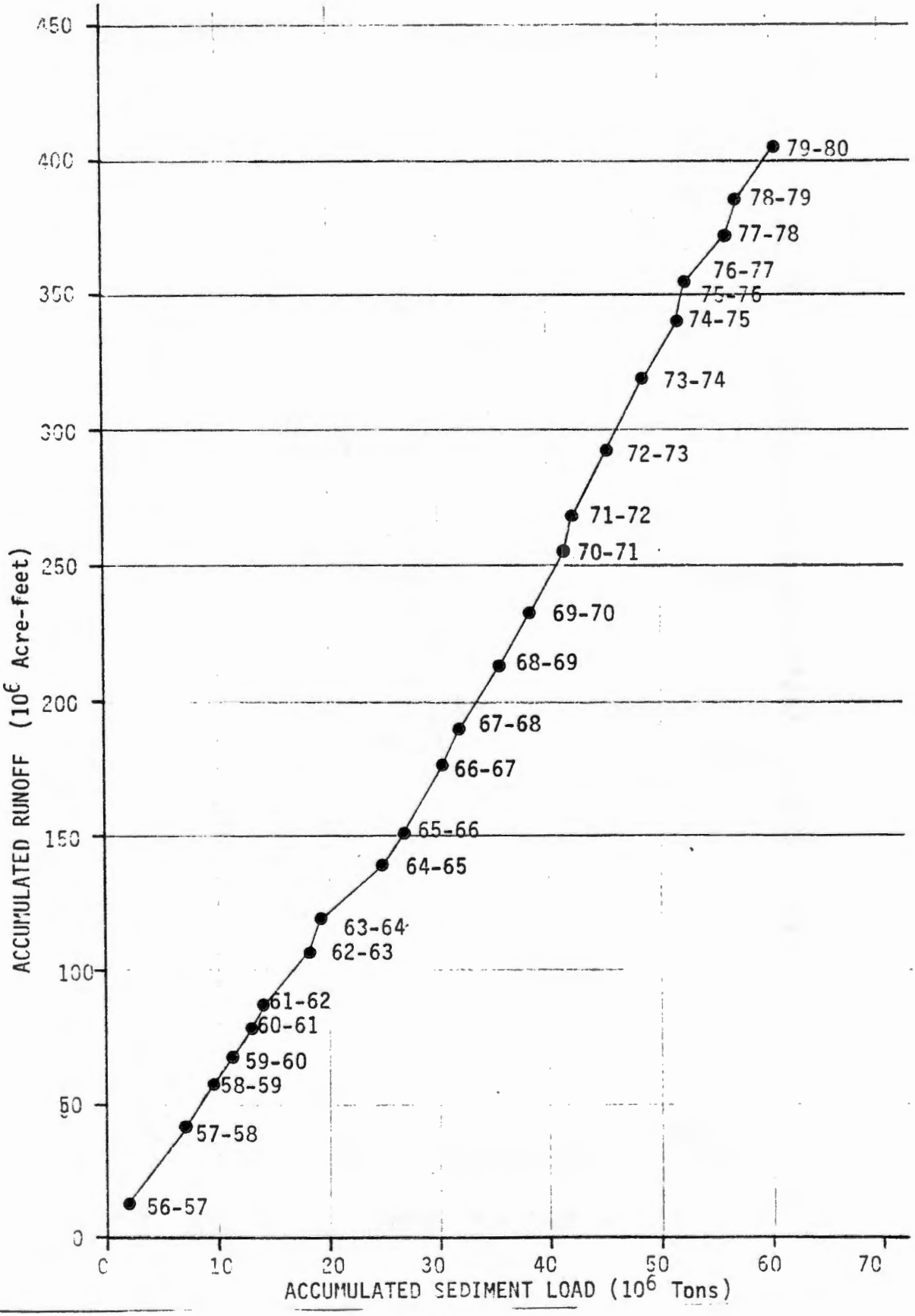

Figure 4.2. Double-Mass Relation Between Runoff and Measured Sediment Load

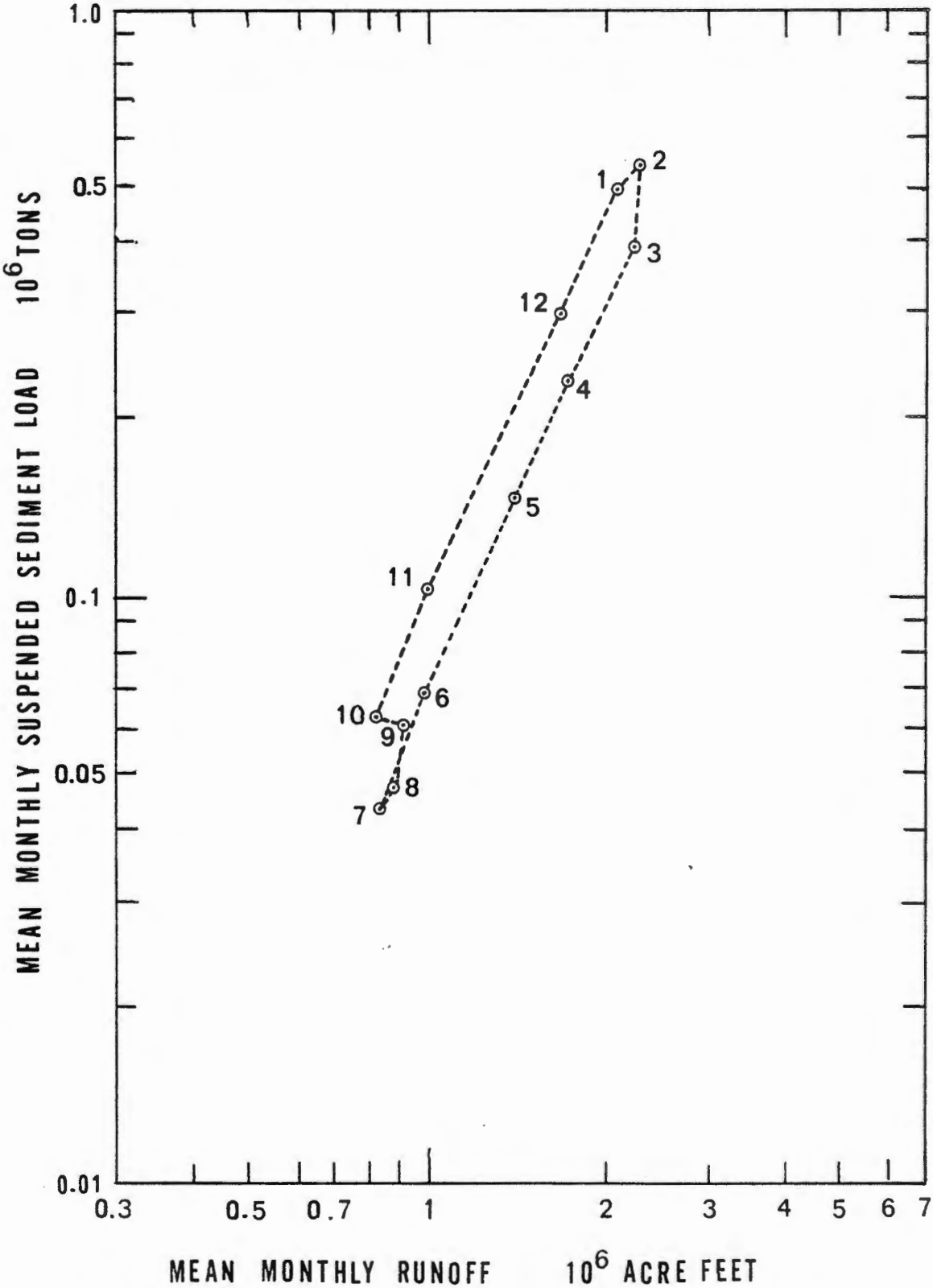

Figure 4.3 Monthly Relationship Between Suspended Sediments and Runoff

where S = daily sediment load (tons/day); Q = mean daily discharge (cfs); and a and b are constants.

Historical data were used to determine the constants a and b by linearizing Eq. (4.9) and performing a linear regression analysis (see Section 3.5). As the data shown in Fig. 4.1, Table 4.2, and Fig. 4.3 clearly indicate, there is a wide range of values for both the mean daily discharge and daily sediment load. The cyclic relationship of the data (Fig. 4.3) show no simple relationship between the two. Consequently, rather than using all 8766 data points, seasonal effects were incorporated into the study by developing a separate equation of the form of Eq. (4.9) for each of the 12 months of the year. Two approaches were used.

1. For each month the mean daily flow (cfs) and daily sediment load (tons/day) for the entire 24-yr period were used; for example, for the month of October there are 744 pairs of data points. Twelve equations were developed, one for each month.
2. For each month, the average mean daily flow (cfs) and daily sediment load (tons/day) were used (see Table 4.7). In this case there are 24 pairs of data points for each month. Twelve equations were developed, one for each month.

Equation (4.9) was linearized and the linear regression analysis was carried out for the above two approaches using the UCD Computer Center Statistical Package mentioned previously. The values of the constant coefficients a and b are listed in Table 4.11. The correlation coefficients (listed in Table 4.11) are an indication of the variability in the data which can be accounted for. The fact that the higher river flow values (and highest sediment loads) occur during the winter and

Table 4.11. Sediment-Discharge Relationship Linear Regression Results, Sacramento River.

Month	Approach I - Mean Daily Values				Approach II - Monthly Average Mean Daily Values			
	Number of data points	Correlation coefficient, r	a ($\times 10^6$)	b	Number of data points	Correlation coefficient, r	a ($\times 10^6$)	b
October	744	0.8464	360.21	1.58379	24	0.8362	114.75	1.71263
November	720	0.8774	3.14	2.08127	24	0.8401	4.94	2.05813
December	744	0.8930	1.31	2.16574	24	0.7945	10.42	1.99510
January	744	0.9205	2.89	2.09605	24	0.9026	80.46	1.80617
February	678	0.9306	8.62	1.99491	24	0.8945	40.80	1.86547
March	744	0.9363	107.51	1.74840	24	0.9433	308.19	1.66007
April	720	0.9491	267.19	1.64451	24	0.9587	438.20	1.60405
May	744	0.9345	1218.47	1.49325	24	0.9519	1793.76	1.45939
June	720	0.9115	1408.46	1.45609	24	0.9347	1847.52	1.43175
July	744	0.7723	15955.69	1.18948	24	0.8426	26402.94	1.13882
August	744	0.7551	8761.66	1.25501	24	0.8399	12603.26	1.21934
September	720	0.6676	75526.63	1.04980	24	0.6617	599223.88	0.83945

spring months led to the use of the coefficients a and b from the second approach for subsequent calculations.

4.4.2 Sediment load diverted into the Peripheral Canal

Using the sediment-discharge relationships derived in the previous section, the amount of suspended sediments carried by the Sacramento River just upstream from the canal intake (i.e., Freeport to Hood reach) was calculated for various mean daily flow values for each month under the six different flow alternatives (Columns 2 through 7, Table 4.1). The average monthly results expressed in 1,000 cfs-days* for flow and 1,000 tons for suspended sediments are summarized in Columns 2 and 3 of Table 4.12. The Peripheral Canal diversions from the Sacramento River (last six columns of Table 4.1) in 1,000 cfs-days are shown in Column 5 of Table 4.12. Using the assumption that the amount of suspended sediment diverted into the canal is proportional to the quantity of water diverted into the canal, the suspended sediments diverted into the canal were calculated and the results summarized in Column 6 of Table 4.12.

As discussed above in Section 2.2.1.1, the total sediment load values used in the calculations contain some of the bed load in addition to the sediment load. It is anticipated that proper design of the intake will minimize the amount of bed load diverted. Thus, the amount of sediment computed to be diverted into the Peripheral Canal can be considered to be conservative.

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* 1 cfs-day = 1.983 acre-feet

Table 4.12. Sediment Diversions into the Peripheral Canal.

Month	FREEPORT TO HOOD			CANAL DIVERSIONS		HOOD TO WALNUT GROVE		
		Sediment			Sediment		Bed Sediment	
	Flow 1,000 cfs-day	suspended 1,000 tons	bed 1,000 tons	Flow 1,000 cfs-day	suspended 1,000 tons	Flow 1,000 cfs-day	capacity 1,000 tons	deposition 1,000 tons
October								
A-N	377	35	6.1	271	25	106	0.0	6.1
B-N	390	37	6.6	276	26	114	0.0	6.6
WET	446	47	8.9	289	31	157	0.3	8.6
DRY	360	33	5.9	236	22	124	0.0	5.9
CRIT	348	31	5.1	249	22	99	0.0	5.1
AVE	394	38	7.0	267	26	127	0.1	6.9
November								
A-N	384	42	6.5	280	31	104	0.0	6.5
B-N	408	48	7.5	288	34	122	0.0	7.5
WET	498	72	11.2	339	49	159	0.4	10.8
DRY	369	39	6.3	248	26	121	0.0	6.3
CRIT	308	27	4.2	218	19	90	0.0	4.2
AVE	413	49	8.3	286	34	127	0.1	8.2
December								
A-N	500	80	11.4	293	47	207	1.2	10.2
B-N	443	63	8.8	284	40	159	0.3	8.5
WET	1,084	375	27.3	446	154	638	15.1	12.1
DRY	399	51	6.7	285	36	114	0.0	6.7
CRIT	315	32	5.1	231	24	84	0.0	5.1
AVE	634	129	14.5	331	67	303	3.9	10.6
January								
A-N	659	163	15.9	411	102	248	2.3	13.6
B-N	514	104	12.0	340	69	174	0.5	11.5
WET	1,665	872	41.7	343	180	1,322	35.1	6.6
DRY	522	107	11.7	395	81	127	0.0	11.7
CRIT	382	61	5.8	329	53	53	0.0	5.8
AVE	894	284	22.5	363	115	531	11.9	10.6

Table 4.12 Continued

Month	FREEPORT TO HOOD Flow 1,000 cfs-day	FREEPORT TO HOOD Sediment suspended 1,000 tons	FREEPORT TO HOOD Sediment bed 1,000 tons	CANAL DIVERSIONS Flow 1,000 cfs-day	CANAL DIVERSIONS Sediment suspended 1,000 tons	HOOD TO WALNUT GROVE Flow 1,000 cfs-day	HOOD TO WALNUT GROVE Bed Sediment capacity 1,000 tons	HOOD TO WALNUT GROVE Bed Sediment deposition 1,000 tons
February								
A-N	911	290	22.4	323	103	588	13.5	8.9
B-N	937	305	22.8	334	109	603	13.7	9.1
WET	1,640	868	41.5	262	139	1,378	37.4	4.1
DRY	640	150	15.3	344	81	296	4.0	11.3
CRIT	380	57	6.7	324	49	56	0.0	6.7
AVE	1,031	365	25.9	310	110	721	18.9	7.0
March								
A-N	1,123	353	29.6	309	97	814	21.0	8.6
B-N	827	213	20.6	329	85	498	10.5	10.1
WET	1,288	444	33.6	244	84	1,044	26.6	7.0
DRY	627	134	14.4	354	76	273	3.0	11.4
CRIT	350	51	5.1	278	41	72	0.0	5.1
AVE	930	259	23.1	296	82	634	14.5	8.6
April								
A-N	702	134	11.0	344	66	358	5.5	5.5
B-N	469	70	9.9	308	46	161	0.4	9.5
WET	1,085	770	28.6	323	80	762	19.8	8.8
DRY	445	64	8.8	304	44	141	0.1	8.7
CRIT	330	40	4.7	229	28	101	0.0	4.7
AVE	687	129	17.3	310	58	377	6.4	10.9
May								
A-N	578	95	12.6	184	30	394	6.7	5.9
B-N	495	76	10.4	216	33	279	3.2	7.2
WET	1,135	254	29.9	194	43	941	24.0	5.9
DRY	394	54	6.7	238	33	156	0.3	6.4
CRIT	309	38	4.1	212	26	97	0.0	4.1
AVE	672	118	16.2	207	36	465	9.6	6.6

Table 4.12 Continued

Month	FREEPORT TO HOOD Flow 1,000 cfs-day	Sediment suspended 1,000 tons	Sediment bed 1,000 tons	CANAL DIVERSIONS Flow 1,000 cfs-day	Sediment suspended 1,000 tons	HOOD TO WALNUT GROVE Flow 1,000 cfs-day	Bed Sediment capacity 1,000 tons	Bed Sediment deposition 1,000 tons
June								
A-N	546	70	12.4	274	35	272	3.3	9.1
B-N	476	57	10.0	280	34	196	1.1	8.9
WET	786	117	19.1	218	33	568	12.3	6.8
DRY	400	45	7.0	298	34	102	0.0	7.0
CRIT	303	30	4.1	216	21	87	0.0	4.1
AVE	552	71	11.1	255	33	297	3.9	7.2
July								
A-N	610	64	14.1	429	45	181	0.6	13.5
B-N	563	58	12.8	427	44	136	0.1	12.7
WET	652	69	14.8	407	43	245	2.2	12.6
DRY	506	51	11.5	413	42	93	0.0	11.5
CRIT	406	40	7.2	323	32	83	0.0	7.2
AVE	570	59	11.5	406	42	164	0.4	11.1
August								
A-N	635	71	15.0	556	62	79	0.0	15.0
B-N	625	69	14.8	549	61	76	0.0	14.8
WET	637	71	14.5	556	62	81	0.0	14.5
DRY	585	64	13.2	515	56	70	0.0	13.2
CRIT	468	49	7.2	403	42	65	0.0	9.2
AVE	604	66	13.0	528	58	76	0.0	13.0
September								
A-N	433	56	8.6	329	43	104	0.0	8.6
B-N	456	58	9.7	349	44	107	0.0	9.7
WET	486	61	10.6	311	39	175	0.7	9.9
DRY	391	51	6.9	316	41	75	0.0	6.9
CRIT	354	47	5.4	273	36	81	0.0	5.4
AVE	436	56	8.7	317	41	119	0.0	8.7

Table 4.12 Continued

	FREEPORT TO HOOD			CANAL DIVERSIONS		HOOD TO WALNUT GROVE		
		Sediment			Sediment		Bed Sediment	
	Flow 1,000 cfs-day	suspended 1,000 tons	bed 1,000 tons	Flow 1,000 cfs-day	suspended 1,000 tons	Flow 1,000 cfs-day	capacity 1,000 tons	deposition 1,000 tons
Total								
A-N	7,458	1,453	165.6	4,003	800	3,455	54.1	111.5
B-N	6,603	1,158	145.9	3,980	625	2,625	29.8	116.1
WET	11,402	3,520	281.7	3,932	937	7,470	173.9	107.8
DRY	5,638	843	114.4	3,946	572	1,692	7.4	107.0
CRIT	4,253	503	66.7	3,285	393	968	0.0	66.7
AVE	7,817	1,623	179.1	3,876	702	3,941	69.7	109.4

4.5 Sacramento River Bed Load Capacity and Bed Load Deposition Downstream from the Peripheral Canal Intake

Two methods were used to determine the Sacramento River bed load capacity upstream and downstream from the Peripheral Canal intake: Kalinske's procedure and Einstein's procedure (Graf, 1971). In order that the analyses of both techniques draw from similar data bases, and following consideration of the available data at Hood (Appendix A), the data for Section 3 (Fig. 2.2) were assumed to be representative of the Sacramento River at the Peripheral Canal Intake. Also, the particle size analysis of the bed material for February 29, 1980 (Fig. 2.4) was chosen as representative of the bed load particle size distribution for subsequent analysis.

4.5.1 Kalinske procedure

The results of the particle size analysis for Section 3 near Hood are plotted in Fig. 2.5. As can be seen from the plot, the diameter for which 50% of the sample (by weight) is finer is 0.285 mm (d_{50} = 0.285 mm).

In order to carry out Kalinske's procedure, it was necessary to develop the following relationships:

1. Discharge vs cross-sectional area

The Section 3 historical data for daily flow and cross-sectional area listed in Table 3.5 are summarized in Table 4.13 (values for one pair were questionable and thus were not included in the analysis). The data were fit to an equation of the form

$$A = aQ^b \tag{4.10}$$

Table 4.13. Summary of Q, A, Ave Depth, R Values for Section 3.

Date	Q(cfs)	A(ft^2)	Average Depth (ft)	R(ft)
Feb. 22, 1979	58,990	17,641	29.48	27.92
Sept. 6, 1979	24,664	14,173	22.56	23.59
	25,085	13,813	21.86	23.11
	25,024	13,587	21.36	22.82
Feb. 29, 1980	75,909	19,606	33.00	30.28
June 25, 1980	25,849	13,113	20.70	22.13
Sept 16, 1981	21,200	12,973	20.90	21.86

where

Q = mean daily flow (cfs)

A = cross-sectional area (ft^2)

a,b = regression coefficients.

The equation was transformed by taking logarithms of each side and linear regression was used to determine a and b. The regression coefficient are given in Table 4.14.

It should be noted that this equation is an approximation, and analysis by a more complete method will give somewhat different results. However, the approximation was assumed to be adequate in this context.

Table 4.14. A vs Q and R vs Q Relationships for Section 3.

Equation	a	b	Correlation coefficient
$A = aQ^b$	561.196	0.31510	0.9845
$R = aQ^b$	1.899	0.24561	0.9832

2. Discharge vs hydraulic radius

The hydraulic radius for flow conditions for each date in Table 4.13 were calculated using the formula:

$$R = \frac{A}{P} \tag{4.11}$$

where

R = Hydraulic radius (ft)

A = cross-sectional area (ft), Table 4.13

P = $b+2d\sqrt{5}$ wetted perimeter (ft), (trapezoidal section, side slopes 2:1)

b = average river bottom width (ft), ~500 ft (see Fig. 3.1)

d = average flow depth (ft), see Appendix A

The values of R and Q were then fitted to the equation

$$R = aQ^b \tag{4.12}$$

The results are shown in Table 4.14. In order to carry out Kalinske's procedure (and Einstein's procedure also) it is necessary to have an estimate of the average river bed slope because the bed slope is assumed to represent the slope of the energy grade line. An examination of the bed elevations of the various sections, however, show that in this region, the Sacramento River has an adverse (negative) bed slope; in other words the bed elevation increases in the downstream direction. Consequently, an alternative approach was followed:

1. Manning's roughness coefficient, n, was computed using an equation developed in an earlier UCD Hydraulic Laboratory study (Bamgboye et al., 1981). The equation is

$$n = \left(0.0164 + \frac{Q - 20{,}000}{5 \times 10^7}\right) R^{1/6} \qquad (4.13)$$

where

n = Manning's roughness coefficient

Q = mean daily flow (cfs)

R = Hydraulic radius (ft)

2. The friction slope, S_f is used in the place of the bed slope in these calculations. It can be determined from the Manning equation:

$$S_f = \left(\frac{nQ}{1.486\ R^{2/3}\ A}\right)^2 \qquad (4.14)$$

where

S_f = friction slope (ft/ft)

n = Manning's roughness coefficient

Q = mean daily flow (cfs)

R = hydraulic radius (ft)

Q = cross sectional area (ft)

The results of Kalinske's procedure are summarized in Tables 4.15-4.26. The following is a summary of data in the individual columns of the table which also provide information on how the values were calculated.

(1) Month

(2) Q, cfs (mean daily flow); from Table 4.1

(3) R, ft (hydraulic radius); from Eq. (4.12)

(4) A, ft^2 (cross-sectional area); from Eq. (4.10)

(5) n, dimensionless (Manning's coefficient); from Eq. (4.13)

(6) S_f, ft/ft (friction slope); from Eq. (4.14)

(7) τ_o, kg/m^2 (shear stres; $\tau_o = \gamma \frac{R}{3.28} S_f$, $\gamma = 1000\ kg/m^3$

(8) $(\tau_o)_{cr}$; kg/m^2 (critical shear stress); $(\tau_o)_{cr} = 0.02\ kg/m^2$ (Graf, 1971) for mean diameter $d_{50} = 0.285$ mm.$(\tau_o)cr/\tau_o$, dimensionless

(9) Factor, dimensionless; from Graf (1971)

(10) q_s; m^3/day-m (bed load rate); from q_s = (factor)$(u_*)(d_{50})$ where $u_* = \sqrt{\tau_o/\rho}$; d_{50}, m; $\rho = 1{,}000/9.8$ kg-sec^2/m^4

(11) g_s, kg/m-sec (bed load rate); from $g_s = q_s\gamma_s$; $\gamma_s = (2.65)(1{,}000)$ kg/m^3

(12) G_s, kg/sec (bed load rate); from $G_s = g_s$ B; B = bottom width = 500/3.28 m

(13) Q, 1,000 cfs-day (total monthly flow); from $(Q^{(2)})$(no. days in month)/1,000

(14) G_s, 1,000 tons/day (bed load rate); from $(G_s^{(12)})$ (2.2 x 86,400/2,000) (no. days/1,000)

Column 4 of Table 4.12 shows bed load capacity of the Sacramento River upstream of the canal intake. These values are summarized from Tables 4.15 through 4.20. Column 8 of Table 4.12 shows the bed load capacity of the Sacramento River downstream of the canal intake. These values are summarized from Tables 4.21 through 4.26. The design plans for the Peripheral Canal include construction of a 10 ft sill at the canal's intake to prevent bed load from being carried into the canal. Thus, assuming that the river is carrying its bed load at capacity, the amount of bed load

Table 4.15. Freeport to Hood Bed Load Calculations, Kalinske's Procedure (Above Normal Year).

Month	Q (cfs)	P (ft)	A_2 (ft^2)	n	S_f (ft/ft)	τ_o (kg/m^2)	$\frac{(\tau_o)cr.}{\tau_o}$	Factor	q_s (m^2/sec)	g_s (kg/sec)	G_s (kg/sec)	Q (1000 cfs/day)	G_s (1000 tons)
10	12170.	19.139	10874.0	0.0266	.782E-05	0.0456	0.438	0.85	.512E-05	0.01358	2.069	377.	6.1
11	12808.	19.380	11050.5	0.0266	.830E-05	0.0490	0.408	0.90	.562E-05	0.01490	2.271	384.	6.5
12	16127.	20.509	11882.7	0.0270	.108E-04	0.0678	0.295	1.30	.955E-05	0.02530	3.857	500.	11.4
1	21248.	21.946	12961.4	0.0275	.150E-04	0.1001	0.200	1.50	.134E-04	0.03548	5.409	659.	15.9
2	31401.	24.156	14658.9	0.0283	.238E-04	0.1752	0.114	1.70	.201E-04	0.05320	8.109	911.	22.4
3	36213.	25.017	15332.5	0.0286	.282E-04	0.2154	0.093	1.90	.249E-04	0.06593	10.051	1123.	29.6
4	23404.	22.473	13362.2	0.0277	.168E-04	0.1149	0.174	1.00	.956E-05	0.02534	3.863	702.	11.0
5	18649.	21.254	12439.4	0.0273	.128E-04	0.0832	0.240	1.30	.106E-04	0.02803	4.273	578.	12.6
6	18199.	21.127	12344.0	0.0272	.125E-04	0.0804	0.249	1.35	.108E-04	0.02861	4.362	546.	12.4
7	19693.	21.540	12654.7	0.0273	.137E-04	0.0899	0.223	1.40	.118E-04	0.03138	4.783	610.	14.1
8	20499.	21.754	12815.7	0.0274	.143E-04	0.0951	0.210	1.45	.126E-04	0.03344	5.097	635.	15.0
9	14430.	19.956	11473.6	0.0268	.952E-05	0.0579	0.345	1.10	.747E-05	0.01980	3.018	433.	8.6

Table 4.16. Freeport to Hood Bed Load Calculations, Kalinske's Procedure (Below Normal Year).

Month	Q (cfs)	P (ft)	A^2 (ft^2)	n	S_f (ft/ft)	τ_o (kg/m^2)	$(\tau_o)cr. / \tau_o$	Factor	q_s (m^2/sec)	g_s (kg/sec)	G_s (kg/sec)	Q (1000 cfs/day)	G_s (1000 tons)
10	12567.	19.290	10984.6	0.0266	.812E-05	0.0477	0.419	0.90	.555E-05	0.01470	2.241	390.	6.6
11	13614.	19.673	11265.1	0.0267	.890E-05	0.0534	0.375	1.00	.652E-05	0.01728	2.634	408.	7.5
12	14281.	19.906	11436.1	0.0268	.941E-05	0.0571	0.350	1.10	.742E-05	0.01965	2.996	443.	8.8
1	16583.	20.650	11987.5	0.0271	.112E-04	0.0705	0.284	1.35	.101E-04	0.02679	4.085	514.	12.0
2	32295.	24.323	14789.1	0.0283	.246E-04	0.1824	0.110	1.70	.205E-04	0.05429	8.276	937.	22.8
3	26668.	23.206	13923.4	0.0279	.196E-04	0.1385	0.144	1.65	.173E-04	0.04590	6.997	827.	20.6
4	15627.	20.351	11765.3	0.0270	.104E-04	0.0648	0.309	1.20	.862E-05	0.02284	3.482	469.	9.9
5	15957.	20.456	11843.1	0.0270	.107E-04	0.0668	0.300	1.20	.875E-05	0.02318	3.534	495.	10.4
6	15883.	20.432	11825.7	0.0270	.106E-04	0.0663	0.302	1.20	.872E-05	0.02310	3.522	476.	10.0
7	18171.	21.119	12338.0	0.0272	.125E-04	0.0802	0.249	1.35	.108E-04	0.02858	4.357	563.	12.8
8	20168.	21.667	12750.1	0.0274	.141E-04	0.0930	0.215	1.45	.125E-04	0.03305	5.038	625.	14.8
9	15211.	20.216	11665.7	0.0269	.101E-04	0.0624	0.321	1.20	.846E-05	0.02241	3.416	456.	9.7

Table 4.17. Freeport to Hood Bed Load Calculations, Kalinske's Procedure (Wet Year).

Month	Q (cfs)	P (ft)	A (ft^2)	n	S_f (ft/ft)	τ_o (kg/m^2)	$\frac{(\tau_o)cr.}{\tau_o}$	Factor	q_s (m^2/sec)	g_s (kg/sec)	G_s (kg/sec)	Q (1000 cfs/day)	G_s (1000 tons)
10	14377.	19.938	11460.3	0.0268	.948E-05	0.0576	0.347	1.10	.745E-05	0.01975	3.010	446.	8.9
11	16605.	20.657	11992.6	0.0271	.112E-04	0.0706	0.283	1.30	.975E-05	0.02583	3.937	498.	11.2
12	34965.	24.802	15164.0	0.0285	.271E-04	0.2047	0.098	1.80	.230E-04	0.06089	9.282	1084.	27.3
1	53713.	27.560	17360.5	0.0297	.459E-04	0.3853	0.052	2.00	.350E-04	0.09282	14.149	1665.	41.7
2	56558.	27.912	17645.2	0.0298	.489E-04	0.4163	0.048	2.05	.373E-04	0.09889	15.075	1640.	41.5
3	41545.	25.875	16010.7	0.0289	.334E-04	0.2633	0.076	1.95	.282E-04	0.07482	11.405	1288.	33.6
4	36181.	25.011	15328.2	0.0286	.282E-04	0.2151	0.093	1.90	.249E-04	0.06589	10.044	1085.	28.6
5	36616.	25.085	15386.1	0.0286	.286E-04	0.2189	0.091	1.90	.251E-04	0.06647	10.132	1135.	29.9
6	26207.	23.106	13847.1	0.0279	.192E-04	0.1350	0.148	1.60	.166E-04	0.04396	6.701	786.	19.1
7	21023.	21.889	12918.0	0.0275	.148E-04	0.0986	0.203	1.40	.124E-04	0.03287	5.010	652.	14.8
8	20551.	21.767	12825.9	0.0274	.144E-04	0.0955	0.209	1.40	.122E-04	0.03234	4.930	637.	14.5
9	16198.	20.531	11899.1	0.0270	.109E-04	0.0682	0.293	1.25	.921E-05	0.02440	3.720	486.	10.6

Table 4.18. Freeport to Hood Bed Load Calculations, Kalinske's Procedure (Dry Year).

Month	Q (cfs)	P (ft)	A (ft^2)	n	S_f (ft/ft)	τ_o (kg/m^2)	$\frac{(\tau_o)cr.}{\tau_o}$	Factor	q_s (m^2/sec)	g_s (kg/sec)	G_s (kg/sec)	Q (1000 cfs/day)	G_s (1000 tons)
10	11626.	18.925	10718.4	0.0265	.742E-05	0.0428	0.467	0.85	.496E-05	0.01315	2.004	360.	5.9
11	12284.	19.183	10906.0	0.0266	.790E-05	0.0462	0.433	0.90	.546E-05	0.01447	2.205	369.	6.3
12	12887.	19.410	11071.9	0.0267	.835E-05	0.0494	0.405	0.90	.565E-05	0.01496	2.281	399.	6.7
1	16825.	20.723	12042.4	0.0271	.114E-04	0.0719	0.278	1.30	.984E-05	0.02607	3.974	522.	11.7
2	22067.	22.151	13116.8	0.0276	.156E-04	0.1056	0.189	1.50	.138E-04	0.03645	5.556	640.	15.3
3	20227.	21.682	12761.8	0.0274	.141E-04	0.0933	0.214	1.40	.121E-04	0.03198	4.875	627.	14.4
4	14823.	20.089	11571.2	0.0269	.982E-05	0.0602	0.332	1.10	.761E-05	0.02017	3.075	445.	8.8
5	12698.	19.339	11020.5	0.0266	.821E-05	0.0484	0.413	0.90	.559E-05	0.01481	2.257	394.	6.7
6	13337.	19.574	11192.3	0.0267	.869E-05	0.0519	0.386	0.95	.610E-05	0.01618	2.466	400.	7.0
7	16334.	20.573	11930.5	0.0270	.110E-04	0.0690	0.290	1.30	.963E-05	0.02553	3.892	506.	11.5
8	18859.	21.313	12483.3	0.0273	.130E-04	0.0845	0.237	1.35	.111E-04	0.02934	4.473	585.	13.2
9	13029.	19.462	11110.2	0.0267	.846E-05	0.0502	0.398	0.95	.601E-05	0.01591	2.426	391.	6.9

Table 4.19. Freeport to Hood Bed Load Calculations, Kalinske's Procedure (Critical Year).

Month	Q (cfs)	P (ft)	A_2 (ft^2)	n	S_f (ft/ft)	τ_o (kg/m^2)	$\frac{(\tau_o)cr.}{\tau_o}$	Factor	q_s (m^2/sec)	g_s (kg/sec)	G_s (kg/sec)	Q (1000 cfs/day)	G_s (1000 tons)
10	11220.	18.760	10599.1	0.0264	.712E-05	0.0407	0.491	0.75	.427E-05	0.01132	1.725	348.	5.1
11	10269.	18.357	10307.4	0.0263	.643E-05	0.0360	0.556	0.68	.364E-05	0.00964	1.470	308.	4.2
12	10156.	18.307	10271.5	0.0263	.635E-05	0.0354	0.564	0.80	.425E-05	0.01126	1.716	315.	5.1
1	12322.	19.197	10916.6	0.0266	.793E-05	0.0464	0.431	0.80	.486E-05	0.01289	1.965	382.	5.8
2	13110.	19.492	11131.9	0.0267	.852E-05	0.0506	0.395	0.95	.603E-05	0.01598	2.437	380.	6.7
3	11290.	18.789	10619.9	0.0265	.717E-05	0.0411	0.487	0.75	.429E-05	0.01137	1.733	350.	5.1
4	10988.	18.664	10529.5	0.0264	.695E-05	0.0396	0.506	0.73	.410E-05	0.01085	1.655	330.	4.7
5	9952.	18.216	10206.0	0.0263	.620E-05	0.0344	0.581	0.65	.340E-05	0.00902	1.375	309.	4.1
6	10101.	18.283	10253.9	0.0263	.631E-05	0.0352	0.569	0.68	.360E-05	0.00953	1.453	303.	4.1
7	13101.	19.488	11129.5	0.0267	.852E-05	0.0506	0.395	0.95	.603E-05	0.01598	2.435	406.	7.2
8	15095.	20.178	11637.6	0.0269	.100E-04	0.0617	0.324	1.10	.771E-05	0.02043	3.115	468.	9.2
9	11796.	18.993	10767.6	0.0265	.754E-05	0.0437	0.458	0.80	.472E-05	0.01250	1.906	354.	5.4

Table 4.20. Freeport to Hood Bed Load Calculations, Kalinske's Procedure (Average Year).

Month	Q (cfs)	P (ft)	A_2 (ft^2)	n	S_f (ft/ft)	τ_o (kg/m^2)	$\frac{(\tau_o)cr.}{\tau_o}$	Factor	q_s (m^2/sec)	g_s (kg/sec)	G_s (kg/sec)	Q (1000 cfs/day)	G_s (1000 tons)
10	12725.	19.350	11027.9	0.0266	.823E-05	0.0486	0.412	0.95	.591E-05	0.01565	2.386	394.	7.0
11	13759.	19.724	11302.7	0.0268	.901E-05	0.0542	0.369	1.10	.722E-05	0.01915	2.919	413.	8.3
12	20458.	21.743	12807.6	0.0274	.143E-04	0.0949	0.211	1.40	.122E-04	0.03224	4.914	634.	14.5
1	28841.	23.656	14271.3	0.0281	.215E-04	0.1549	0.129	1.70	.189E-04	0.05003	7.627	894.	22.5
2	35558.	24.905	15244.6	0.0286	.276E-04	0.2098	0.095	1.80	.233E-04	0.06164	9.396	1031.	25.9
3	30013.	23.889	14451.6	0.0282	.225E-04	0.1641	0.122	1.70	.194E-04	0.05149	7.849	930.	23.1
4	22887.	22.350	13268.5	0.0276	.163E-04	0.1113	0.180	1.60	.151E-04	0.03990	6.083	687.	17.3
5	21680.	22.055	13043.9	0.0275	.153E-04	0.1030	0.194	1.50	.136E-04	0.03599	5.487	672.	16.2
6	18400.	21.184	12386.8	0.0272	.126E-04	0.0816	0.245	1.20	.967E-05	0.02563	3.907	552.	11.1
7	18382.	21.179	12383.0	0.0272	.126E-04	0.0815	0.245	1.20	.967E-05	0.02561	3.905	570.	11.5
8	19480.	21.483	12611.4	0.0273	.135E-04	0.0885	0.226	1.30	.109E-04	0.02891	4.407	604.	13.0
9	14540.	19.994	11501.1	0.0268	.961E-05	0.0586	0.342	1.10	.751E-05	0.01990	3.034	436.	8.7

Table 4.21. Hood to Walnut Grove Bed Load Calculations, Kalinske's Procedure (Above Normal Year).

Month	Q (cfs)	P (ft)	A (ft^2)	n	S_f (ft/ft)	τ_o (kg/m^2)	$\frac{(\tau_o)cr.}{\tau_o}$	Factor	q_s (m^2/sec)	g_s (kg/sec)	G_s (kg/sec)	Q (1000 cfs/day)	G_s (1000 tons)
10	3404.	13.996	7278.5	0.0249	.183E-05	0.0078	2.565	0.00	0.	0.00000	0.000	106.	0.0
11	3475.	14.068	7326.0	0.0250	.187E-05	0.0080	2.493	0.00	0.	0.00000	0.000	104.	0.0
12	6688.	16.522	9004.6	0.0257	.394E-05	0.0198	1.009	0.25	.993E-06	0.00263	0.401	207.	1.2
1	7996.	17.263	9526.0	0.0260	.483E-05	0.0254	0.787	0.43	.193E-05	0.00512	0.781	248.	2.3
2	20272.	21.694	12770.8	0.0274	.142E-04	0.0936	0.214	1.40	.121E-04	0.03203	4.882	588.	13.5
3	26261.	23.118	13856.1	0.0279	.192E-04	0.1354	0.148	1.70	.177E-04	0.04678	7.130	814.	21.0
4	11921.	19.042	10803.4	0.0265	.764E-05	0.0443	0.451	0.80	.475E-05	0.01259	1.920	358.	5.5
5	12713.	19.345	11024.6	0.0266	.822E-05	0.0485	0.412	0.90	.559E-05	0.01482	2.259	394.	6.7
6	9072.	17.806	9912.6	0.0261	.558E-05	0.0303	0.661	0.58	.285E-05	0.00755	1.150	272.	3.3
7	5840.	15.981	8628.0	0.0256	.337E-05	0.0164	1.217	0.15	.542E-06	0.00144	0.219	181.	0.6
8	2540.	13.025	6637.1	0.0246	.131E-05	0.0052	3.839	0.00	0.	0.00000	0.000	79.	0.0
9	3476.	14.069	7326.7	0.0250	.187E-05	0.0080	2.492	0.00	0.	0.00000	0.000	104.	0.0

Table 4.22. Hood to Walnut Grove Bed Load Calculations, Kalinske's Procedure (Below Normal Year).

Month	Q (cfs)	P (ft)	A^2 (ft^2)	n	S_f (ft/ft)	τ_o (kg/m^2)	$\frac{(\tau_o)cr.}{\tau_o}$	Factor	q_s (m^2/sec)	g_s (kg/sec)	G_s (kg/sec)	Q (1000 cfs/day)	G_s (1000 tons)
10	3664.	14.252	7449.3	0.0250	.199E-05	0.0086	2.318	0.00	0.	0.00000	0.000	114.	0.0
11	4065.	14.620	7697.1	0.0251	.223E-05	0.0100	2.008	0.01	.282E-07	0.00007	0.011	122.	0.0
12	5113.	15.467	8274.1	0.0254	.290E-05	0.0137	1.463	0.08	.264E-06	0.00070	0.107	159.	0.3
1	5605.	15.820	8517.1	0.0255	.322E-05	0.0155	1.288	0.13	.457E-06	0.00121	0.185	174.	0.5
2	20779.	21.826	12870.6	0.0274	.146E-04	0.0970	0.206	1.40	.123E-04	0.03260	4.969	603.	13.7
3	16079.	20.494	11871.5	0.0270	.108E-04	0.0675	0.296	1.20	.879E-05	0.02330	3.553	498.	10.5
4	5355.	15.644	8395.5	0.0255	.306E-05	0.0146	1.372	0.10	.341E-06	0.00090	0.138	161.	0.4
5	9011.	17.777	9891.5	0.0261	.553E-05	0.0300	0.667	0.55	.269E-05	0.00712	1.086	279.	3.2
6	6547.	16.436	8944.4	0.0257	.384E-05	0.0192	1.039	0.25	.979E-06	0.00259	0.395	196.	1.1
7	4401.	14.908	7892.2	0.0252	.244E-05	0.0111	1.800	0.03	.892E-07	0.00024	0.036	136.	0.1
8	2436.	12.892	6550.2	0.0246	.125E-05	0.0049	4.066	0.00	0.	0.00000	0.000	76.	0.0
9	3559.	14.150	7381.4	0.0250	.192E-05	0.0083	2.412	0.00	0.	0.00000	0.000	107.	0.0

Table 4.23. Hood to Walnut Grove Bed Load Calculations, Kalinske's Procedure (Wet Year).

Month	Q (cfs)	R (ft)	A (ft^2)	n	S_f (ft/ft)	τ_o (kg/m^2)	$\frac{(\tau_o)cr.}{\tau_o}$	Factor	q_s (m^2/sec)	g_s (kg/sec)	G_s (kg/sec)	Q (1000 cfs/day)	G_s (1000 tons)
10	5049.	15.419	8241.3	0.0254	.286E-05	0.0134	1.489	0.07	.229E-06	0.00061	0.092	157.	0.3
11	5300.	15.604	8368.2	0.0255	.302E-05	0.0144	1.392	0.10	.338E-06	0.00090	0.137	159.	0.4
12	20594.	21.778	12834.4	0.0274	.144E-04	0.0957	0.209	1.45	.127E-04	0.03355	5.114	638.	15.1
1	42647.	26.042	16143.3	0.0290	.345E-04	0.2737	0.073	2.00	.295E-04	0.07823	11.925	1322.	35.1
2	47512.	26.742	16702.3	0.0293	.394E-04	0.3210	0.062	2.10	.336E-04	0.08896	13.560	1378.	37.4
3	33692.	24.577	14987.8	0.0284	.259E-04	0.1940	0.103	1.80	.224E-04	0.05927	9.035	1044.	26.6
4	25396.	22.929	13710.6	0.0278	.185E-04	0.1291	0.155	1.70	.172E-04	0.04567	6.961	762.	19.8
5	30366.	23.958	14504.9	0.0282	.228E-04	0.1669	0.120	1.75	.202E-04	0.05345	8.148	941.	24.0
6	18936.	21.334	12499.4	0.0273	.131E-04	0.0850	0.235	1.30	.107E-04	0.02834	4.320	568.	12.3
7	7891.	17.207	9486.4	0.0260	.475E-05	0.0249	0.802	0.42	.187E-05	0.00496	0.756	245.	2.2
8	2628.	13.135	6708.7	0.0247	.136E-05	0.0055	3.663	0.00	0.	0.00000	0.000	81.	0.0
9	5829.	15.973	8622.9	0.0256	.337E-05	0.0164	1.220	0.16	.578E-06	0.00153	0.233	175.	0.7

Table 4.24. Hood to Walnut Grove Bed Load Calculations, Kalinske's Procedure (Dry Year).

Month	Q (cfs)	P (ft)	A (ft^2)	n	S_f (ft/ft)	τ_o (kg/m^2)	$\frac{(\tau_o)cr.}{\tau_o}$	Factor	q_s (m^2/sec)	g_s (kg/sec)	G_s (kg/sec)	Q (1000 cfs/day)	G_s (1000 tons)
10	3996.	14.559	7655.7	0.0251	.219E-05	0.0097	2.056	0.01	.278E-07	0.00007	0.011	124.	0.0
11	4040.	14.598	7682.2	0.0251	.222E-05	0.0099	2.026	0.01	.280E-07	0.00007	0.011	121.	0.0
12	3691.	14.277	7466.6	0.0250	.200E-05	0.0087	2.294	0.00	0.	0.00000	0.000	114.	0.0
1	4091.	14.643	7712.6	0.0252	.225E-05	0.0100	1.991	0.01	.283E-07	0.00007	0.011	127.	0.0
2	10196.	18.325	10284.2	0.0263	.638E-05	0.0356	0.561	0.68	.362E-05	0.00960	1.463	296.	4.0
3	8816.	17.682	9823.6	0.0261	.540E-05	0.0291	0.687	0.52	.250E-05	0.00663	1.011	273.	3.0
4	4689.	15.142	8051.4	0.0253	.263E-05	0.0121	1.649	0.04	.124E-06	0.00033	0.050	141.	0.1
5	5021.	15.398	8226.8	0.0254	.284E-05	0.0133	1.500	0.07	.228E-06	0.00060	0.092	156.	0.3
6	3402.	13.994	7277.2	0.0249	.183E-05	0.0078	2.567	0.00	0.	0.00000	0.000	102.	0.0
7	2995.	13.563	6990.8	0.0248	.158E-05	0.0065	3.060	0.00	0.	0.00000	0.000	93.	0.0
8	2247.	12.639	6385.6	0.0245	.114E-05	0.0044	4.544	0.00	0.	0.00000	0.000	70.	0.0
9	2497.	12.971	6601.5	0.0246	.129E-05	0.0051	3.930	0.00	0.	0.00000	0.000	75.	0.0

Table 4.25. Hood to Walnut Grove Bed Load Calculations, Kalinske's Procedure (Critical Year).

Month	Q (cfs)	P (ft)	A (ft^2)	n	S_f (ft/ft)	τ_o (kg/m^2)	$\frac{(\tau_o)cr.}{\tau_o}$	Factor	q_s (m^2/sec)	g_s (kg/sec)	G_s (kg/sec)	Q (1000 cfs/day)	G_s (1000 tons)
10	3200.	13.786	7139.2	0.0249	.170E-05	0.0072	2.793	0.00	0.	0.00000	0.000	99.	0.0
11	3008.	13.578	7000.4	0.0248	.159E-05	0.0066	3.042	0.00	0.	0.00000	0.000	90.	0.0
12	2714.	13.239	6777.1	0.0247	.141E-05	0.0057	3.505	0.00	0.	0.00000	0.000	84.	0.0
1	1706.	11.812	5854.8	0.0242	.837E-06	0.0030	6.636	0.00	0.	0.00000	0.000	53.	0.0
2	1934.	12.182	6090.8	0.0243	.964E-06	0.0036	5.585	0.00	0.	0.00000	0.000	56.	0.0
3	2328.	12.749	6457.3	0.0245	.119E-05	0.0046	4.328	0.00	0.	0.00000	0.000	72.	0.0
4	3378.	13.970	7261.0	0.0249	.181E-05	0.0077	2.592	0.00	0.	0.00000	0.000	101.	0.0
5	3133.	13.714	7090.7	0.0249	.166E-05	0.0070	2.876	0.00	0.	0.00000	0.000	97.	0.0
6	2896.	13.452	6917.2	0.0248	.152E-05	0.0062	3.205	0.00	0.	0.00000	0.000	87.	0.0
7	2667.	13.182	6739.9	0.0247	.139E-05	0.0056	3.590	0.00	0.	0.00000	0.000	83.	0.0
8	2104.	12.437	6254.7	0.0244	.106E-05	0.0040	4.974	0.00	0.	0.00000	0.000	65.	0.0
9	2705.	13.228	6770.0	0.0247	.141E-05	0.0057	3.521	0.00	0.	0.00000	0.000	81.	0.0

Table 4.26. Hood to Walnut Grove Bed Load Calculations, Kalinske's Procedure (Average Year).

Month	Q (cfs)	P (ft)	A_2 (ft^2)	n	S_f (ft/ft)	τ_o (kg/m^2)	$\frac{(\tau_o)cr.}{\tau_o}$	Factor	q_s (m^2/sec)	g_s (kg/sec)	G_s (kg/sec)	Q (1000 cfs/day)	G_s (1000 tons)
10	4089.	14.641	7711.4	0.0252	.225E-05	0.0100	1.992	0.02	.565E-07	0.00015	0.023	127.	0.1
11	4223.	14.758	7790.2	0.0252	.233E-05	0.0105	1.905	0.02	.578E-07	0.00015	0.023	127.	0.1
12	9778.	18.137	10149.4	0.0263	.608E-05	0.0336	0.595	0.63	.326E-05	0.00864	1.316	303.	3.9
1	17118.	20.811	12108.1	0.0271	.116E-04	0.0737	0.271	1.30	.996E-05	0.02639	4.022	531.	11.9
2	24872.	22.812	13620.8	0.0278	.180E-04	0.1253	0.160	1.70	.170E-04	0.04499	6.858	721.	18.9
3	20445.	21.739	12805.0	0.0274	.143E-04	0.0948	0.211	1.40	.122E-04	0.03222	4.912	634.	14.5
4	12580.	19.295	10988.1	0.0266	.812E-05	0.0478	0.418	0.90	.555E-05	0.01471	2.243	377.	6.4
5	15008.	20.130	11616.5	0.0269	.997E-05	0.0612	0.327	1.15	.803E-05	0.02128	3.243	465.	9.6
6	9898.	18.192	10188.5	0.0263	.616E-05	0.0342	0.585	0.65	.339E-05	0.00899	1.370	297.	3.9
7	5288.	15.596	8362.3	0.0255	.301E-05	0.0143	1.397	0.09	.304E-06	0.00081	0.123	164.	0.4
8	2439.	12.896	6552.8	0.0246	.125E-05	0.0049	4.060	0.00	0.	0.00000	0.000	76.	0.0
9	3956.	14.523	7631.5	0.0251	.217E-05	0.0096	2.085	0.01	.276E-07	0.00007	0.011	119.	0.0

deposition downstream from the canal intake (i.e., the Hood to Walnut Grove reach) is the difference between the values in Column 8 and 4. These are listed in Column 9 of Table 4.12.

4.5.2 Einstein's procedure

The particle size distribution curve (Fig. 2.5) delineates three distinct grain size regions which account for approximately 99% of the sample analyzed with the remaining 1% (finer by weight) lying beyond the regions d greater than 1.000 mm and d less than 0.125 mm. The region, the mean grain size for each, and the percentage of the sample (fines by weight) for each is summarized in Table 4.27.

Table 4.27. Sacramento River Bed Material Information for February 29, 1980.

Grain Size Distribution, mm	Average Grain Size mm	ft	%	Settling velocity fps
d>1.000	–	–	1	–
1.000>d>0.500	0.700	0.00230	4	0.250
0.500>d>0.250	0.310	0.00102	71	0.125
0.250>d>0.125	0.245	0.000804	24	0.100
0.125>d	–	–	0	–

$$\left.\begin{array}{l} d_{35} = 0.265 \text{ mm} = 0.000869 \text{ ft} \\ d_{65} = 0.325 \text{ mm} = 0.001066 \text{ ft} \end{array}\right\} \text{Fig. 2.5}$$

In order to carry out Einstein's procedure, an average slope of the river is required. As pointed out, the Sacramento River has a negative bed slope in the vicinity of Hood. In Kalinske's procedure the friction slope was used to represent the river slope, and a relationship was determined between friction slope and mean daily flow (Eq. 4.14) In Einstein's procedure, however, discharge values are a byproduct of the calculations whereas values for friction slope are required prior to reaching that stage of the calculations. As an approximation, a single value determined from the friction slope for the discharge for the section was used to represent the general river slope for all of the discharges. Thus:

Mean daily flow Q = 75,909 cfs (Table 3.4 for February 29, 1980)

Cross-sectional area A = 19,606 ft^2 (Table 3.4)

Average depth of flow, D = 33 ft (p.143, Appendix A)

Average bottom width, B = 500 ft (Fig. 3.1)

Average channel side slope, s:1 = 2:1

Average wetted parameter, $P = B+2\sqrt{1+s^2}D = 647.58$ ft

Average hydraulic radius, R = A/P = 30.28 ft

Manning's coefficient, $n = 0.0164+[(Q-20,000)/5 \times 10^7] \times R^{1/6} = 0.030931$ (Eq.4.13)

Friction slope, $S_f = [nQ/1.486R^{2/3}A)^2 = 0.000069$ ft/ft (Eq.4.14)

The calculations of Einstein's procedure are summarized in Tables 4.28 through 4.29 a,b,c. Table 4.28 is a summary of the hydraulic elements. The range of values for R'_h (Column 1) were chosen to cover the entire discharge range of the Sacramento River (i.e., Q less than 105,000 cfs, Column 17). The calculations are straightforward. Following each table is a description of how the various columns were calculated.

Table 4.28. Sacramento River Bed Material Load Calculations Einstein's Procedure (Part I).

R_h' (1)	u_*' (2)	δ (3)	k_s/δ (4)	x (5)	Δ (6)	$\bar{u}$ (7)	ψ' (8)	$\bar{u}/u''$ (9)	u_*'' (10)	R_h'' (11)
0.75	0.04082	0.00386	0.3	0.950	0.001122	0.919	27.707	5.8	0.1598	11.489
1.00	0.04714	0.00334	0.3	1.070	0.000996	1.109	20.780	6.4	0.1732	13.506
2.00	0.06666	0.00236	0.5	1.322	0.000806	1.718	10.390	8.3	0.2070	19.294
3.00	0.08164	0.00193	0.6	1.450	0.000735	2.206	6.927	10.0	0.2206	21.907
4.00	0.09427	0.00167	0.6	1.520	0.000701	2.626	5.195	11.5	0.2284	23.474
5.00	0.10540	0.00149	0.7	1.560	0.000683	3.002	4.156	12.8	0.2345	24.755
6.00	0.11546	0.00136	0.8	1.590	0.000670	3.346	3.463	14.1	0.2373	25.352
7.00	0.12471	0.00126	0.8	1.605	0.000664	3.665	2.969	15.5	0.2365	25.171
8.00	0.13332	0.00118	0.9	1.610	0.000662	3.964	2.598	16.7	0.2374	25.360
9.00	0.14141	0.00111	1.0	1.615	0.000660	4.247	2.309	18.0	0.2360	25.059
10.00	0.14906	0.00106	1.0	1.615	0.000660	4.516	2.078	19.5	0.2316	24.142

R_h (12)	u_* (13)	D (14)	A (15)	P (16)	Q (17)	X (18)	Y (19)	β_x (20)	$(\beta/\beta_x)^2$ (21)	P_E (22)
12.239	0.1649	12.985	6829.8	558.04	6274.3	0.00536	0.23	1.705	0.3617	12.773
14.506	0.1795	15.555	8261.6	569.53	9159.2	0.00465	0.25	1.694	0.3664	13.073
21.294	0.2175	23.558	12889.2	605.31	22149.5	0.00328	0.38	1.635	0.3931	13.700
24.907	0.2352	28.005	15571.2	625.18	34352.7	0.00268	0.50	1.587	0.4172	13.965
27.474	0.2471	31.243	17573.9	639.66	46154.2	0.00232	0.59	1.545	0.4402	14.122
29.755	0.2571	34.174	19422.4	652.76	58303.3	0.00208	0.66	1.508	0.4622	14.237
31.352	0.2639	36.257	20757.4	662.07	69463.1	0.00190	0.73	1.477	0.4820	14.316
32.171	0.2674	37.333	21453.9	666.88	78638.9	0.00176	0.78	1.447	0.5017	14.354
33.360	0.2722	38.908	22481.7	673.92	89118.6	0.00164	0.80	1.420	0.5215	14.399
34.059	0.2751	39.840	23094.7	678.09	98087.8	0.00155	0.82	1.396	0.5397	14.426
34.142	0.2754	39.951	23167.9	678.58	104630.0	0.00147	0.84	1.373	0.5579	14.428

Glossary for Table 4.28

(1) R_h', ft (hydraulic radius with respect to the grains); various values are assumed to cover the entire discharge range desired ($Q_{max} \cong 105{,}000$ cfs)

(2) $u_*' = \sqrt{32.2\ R_h'\ S_f}$, fps (shear velocity with respect to grain)

(3) $\delta 11.65\nu/u_*'$, ft (thickness of laminar layer); ν = kinematic viscosity = 1.358×10^{-5} ft^2/sec for T = 11.5°C

(4) $k_s = d_{65}$ (roughness diameter)

(5) x (correction in the logarithmic velocity formula, distinguishing the smooth transition and rough regimes; x = fct (k_s/δ): Refer to Graf (1971)or Einstein (1950).

(6) Δ, ft (apparent roughness diameter); $\Delta = k_s/x$

(7) $\bar{u}$, fps (average velocity); $\bar{u} = u_*'\ (5.75) \log (12.27\ R'_h/\Delta)$

(8) Ψ' (intensity of shear on representative particle);

$\psi' = ((\rho_s - \rho)d_{35})/((\rho(R_h'S))$

$\rho = 1.939$ slug/ft^3

$S \equiv S_f$

$\rho_s = 2.65\ \rho$

(9) $\bar{u}/u_*'' = $ fct (ψ'): Refer to Einstein (1950)

(10) u_*'' fps (shear velocity due to channel irregularities)

(11) R_h'', ft (hydraulic radius with respect to channel irregularities); from $u_*'' = \sqrt{gR_h''S}$; g = 32.2 fps

(12) R_h, ft (hydraulic radius) $R_h = R_h' + R_h''$, with no additional friction from the banks, vegetation etc.; R_h represents the total hydraulic radius

(13) u_*, fps (shear velocity); from $u_* = \sqrt{gR_hS}$

Glossary for Table 4.28 (Continued)

(14) D, ft (depth or stage); calculated from $R_h = A/P = D(B+sD)/B+2\sqrt{1 + s^2}D$; B = bottom width; s = side slope

(15) A, ft^2 (cross-sectional area); from $A = D(B+sD)$

(16) P, ft (wetted parameter); from $P = B+2\sqrt{1+s^2}D$

(17) Q, cfs (flow discharge); $Q = \bar{u}A$

(18) X, ft (characteristic distance); $X = 0.77\ \Delta$ for $\Delta/\delta > 1.80$ and $X = 1.39\delta$ for $\Delta/\delta < 1.80$

(19) Y (pressure correction term); Y = fct (k_s/δ): Refer to Einstein (1950)

(20) β_x (logarithm function); $\beta_x = \log\ (10.6\ X/\Delta)$

(21) $(\beta/\beta_x)^2$; with $\beta = \log 10.6$

(22) P_E (Einstein's transport parameter); $P_E = (1/0.434) \log\ (30.2D/\Delta)$

Table 4.29a. Sacramento River Bed Material Load Calculations, Einstein's Procedure (Part II)

d = 0.000804 ft.

d (1)	i_b (2)	R'_h (3)	Ψ (4)	d/X (5)	ξ (6)	Ψ_* (7)	Φ_* (8)	$i_s g_s$ (9)	$i_s G_s$ (10)	$\Sigma i_s G_s$ (11)
0.000804	0.24	0.75	25.635	0.150	65.0	138.62	0.00	0.00000	0.000	0.0
0.000804	0.24	1.00	19.226	0.173	47.0	82.77	0.00	0.00000	0.000	0.0
0.000804	0.24	2.00	9.613	0.245	21.5	30.87	0.00	0.00000	0.000	0.0
0.000804	0.24	3.00	6.409	0.300	13.5	18.05	0.01	0.00004	0.025	0.0
0.000804	0.24	4.00	4.807	0.347	9.7	12.11	0.05	0.00030	0.194	0.2
0.000804	0.24	5.00	3.845	0.387	7.4	8.68	0.14	0.00092	0.603	0.6
0.000804	0.24	6.00	3.204	0.423	6.0	6.76	0.32	0.00211	1.398	1.4
0.000804	0.24	7.00	2.747	0.457	4.5	4.84	0.68	0.00449	2.992	3.0
0.000804	0.24	8.00	2.403	0.490	3.9	3.91	1.10	0.00726	4.892	4.9
0.000804	0.24	9.00	2.136	0.519	3.5	3.31	1.50	0.00990	6.712	6.7
0.000804	0.24	10.00	1.923	0.547	2.9	2.61	2.10	0.01386	9.403	9.4

A_E (12)	Z (13)	I_1 (14)	I_2 (15)	$P_E I_1 + I_2 + 1$ (16)	$i_{st} g_{st}$ (17)	$i_{st} G_{st}$ (18)	$\Sigma i_{st} G_{st}$ (19)
0.00013138	6.124	0.0421	-0.3684	1.1158	0.00000	0.000	0.0
0.00011085	5.303	0.0502	-0.4454	1.2324	0.00000	0.000	0.0
0.00007551	3.750	0.0785	-0.7167	1.7983	0.00000	0.000	0.0
0.00006456	3.062	0.1047	-0.9596	2.3346	0.00009	0.058	0.1
0.00005853	2.652	0.1307	-1.1949	2.8737	0.00087	0.558	0.6
0.00005404	2.372	0.1574	-1.4319	3.4644	0.00320	2.089	2.1
0.00005129	2.165	0.1853	-1.6715	4.0256	0.00850	5.628	5.6
0.00004998	2.005	0.2148	-1.9145	4.4926	0.02016	13.443	13.4
0.00004920	1.875	0.2464	-2.1700	5.0794	0.03687	24.846	24.9
0.00004721	1.768	0.2805	-2.4337	5.5960	0.05539	37.558	37.6
0.00004710	1.677	0.3175	-2.7044	5.9600	0.08259	56.042	56.0

Table 4.29b. Sacramento River Bed Material Load Calculations, Einstein's Procedure (Part II)

d = 0.00102 ft.

d (1)	i_b (2)	R_h' (3)	Ψ (4)	d/X (5)	ξ (6)	Ψ_* (7)	Φ_* (8)	$i_s g_s$ (9)	$i_s G_s$ (10)	$\Sigma i_s G_s$ (11)
0.001020	0.71	0.75	32.522	0.190	38.5	104.16	0.00	0.00000	0.000	0.0
0.001020	0.71	1.00	24.391	0.219	28.0	62.56	0.00	0.00000	0.000	0.0
0.001020	0.71	2.00	12.196	0.311	12.5	22.77	0.00	0.00003	0.017	0.0
0.001020	0.71	3.00	8.130	0.381	7.7	13.06	0.03	0.00092	0.575	0.6
0.001020	0.71	4.00	6.098	0.440	5.2	8.24	0.17	0.00474	3.033	3.2
0.001020	0.71	5.00	4.878	0.490	4.0	5.95	0.42	0.01172	7.647	8.3
0.001020	0.71	6.00	4.065	0.537	3.1	4.43	0.85	0.02371	15.698	17.1
0.001020	0.71	7.00	3.484	0.580	2.5	3.48	1.35	0.03766	25.112	28.1
0.001020	0.71	8.00	3.049	0.622	2.2	2.80	1.90	0.05300	35.717	40.6
0.001020	0.71	9.00	2.710	0.658	1.8	2.22	2.90	0.08089	54.852	61.6
0.001020	0.71	10.00	2.439	0.694	1.7	1.94	3.40	0.09484	64.356	73.8

A_E (12)	Z (13)	I_1 (14)	I_2 (15)	$P_E I_1 + I_2 + 1$ (16)	$i_{st} g_{st}$ (17)	$i_{st} G_{st}$ (18)	$\Sigma i_{st} G_{st}$ (19)
0.00016668	7.656	0.0324	-0.2774	1.0954	0.00000	0.000	0.0
0.00014063	6.629	0.0384	-0.3334	1.1847	0.00000	0.000	0.0
0.00009580	4.688	0.0586	-0.5260	1.6039	0.00004	0.027	0.0
0.00008190	3.828	0.0764	-0.6917	1.9814	0.00182	1.140	1.2
0.00007425	3.315	0.0933	-0.8467	2.3432	0.01111	7.107	7.7
0.00006856	2.965	0.1099	-0.9978	2.7229	0.03190	20.823	22.9
0.00006507	2.707	0.1265	-1.1457	3.0623	0.07261	48.070	53.7
0.00006341	2.506	0.1434	-1.2909	3.3186	0.12497	83.338	96.7
0.00006115	2.344	0.1607	-1.4393	3.6349	0.19264	129.825	154.7
0.00005990	2.210	0.1784	-1.5877	3.8837	0.31416	213.029	250.6
0.00005975	2.096	0.1969	-1.7355	4.0169	0.38096	258.513	314.5

Table 4.29c. Sacramento River Bed Material Load Calculations, Einstein's Procedure (Part II)
d = 0.0023 ft.

d (1)	i_b (2)	R_h' (3)	Ψ (4)	d/X (5)	ξ (6)	Ψ_* (7)	Φ_* (8)	$i_s g_s$ (9)	$i_s G_s$ (10)	$\Sigma i_s G_s$ (11)
0.002300	0.04	0.75	73.333	0.429	5.7	34.77	0.00	0.00000	0.000	0.0
0.002300	0.04	1.00	55.000	0.495	3.7	18.64	0.01	0.00003	0.018	0.0
0.002300	0.04	2.00	27.500	0.701	1.6	6.57	0.33	0.00176	1.063	1.1
0.002300	0.04	3.00	18.333	0.858	1.3	4.97	0.65	0.00346	2.162	2.8
0.002300	0.04	4.00	13.750	0.991	1.1	3.93	1.00	0.00532	3.404	6.6
0.002300	0.04	5.00	11.000	1.106	1.1	3.69	1.20	0.00639	4.168	12.5
0.002300	0.04	6.00	9.167	1.211	1.0	3.23	1.40	0.00745	4.932	23.0
0.002300	0.04	7.00	7.857	1.307	1.0	3.07	1.70	0.00905	6.033	34.1
0.002300	0.04	8.00	6.875	1.402	1.0	2.87	1.80	0.00958	6.455	47.1
0.002300	0.04	9.00	6.111	1.484	1.0	2.70	2.10	0.01117	7.577	69.2
0.002300	0.04	10.00	5.500	1.565	0.0	0.00	2.30	0.01224	8.305	82.1

A_E (12)	Z (13)	I_1 (14)	I_2 (15)	$P_E I_1 + I_2 + 1$ (16)	$i_{st} g_{st}$ (17)	$i_{st} G_{st}$ (18)	$\Sigma i_{st} G_{st}$ (19)
0.00037585	15.311	0.0151	-0.1179	1.0554	0.00000	0.000	0.0
0.00031711	13.258	0.0176	-0.1405	0.0974	0.00004	0.020	0.0
0.00021602	9.376	0.0258	-0.2145	1.2829	0.00225	1.364	1.4
0.00018469	7.656	0.0324	-0.2741	1.4367	0.00497	3.107	4.3
0.00016743	6.630	0.0384	-0.3267	1.5737	0.00837	5.356	13.1
0.00015460	5.930	0.0438	-0.3755	1.7089	0.01091	7.123	30.0
0.00014672	5.413	0.0489	-0.4208	1.8197	0.01356	8.975	62.7
0.00014299	5.012	0.0538	-0.4631	1.8918	0.01711	11.413	108.1
0.00013789	4.688	0.0586	-0.5046	1.9803	0.01897	12.783	167.5
0.00013506	4.420	0.0631	-0.5442	2.0382	0.02278	15.444	266.0
0.00013473	4.193	0.0676	-0.5816	2.0512	0.02510	17.035	331.5

Glossary for Tables 4.29a through 4.29c

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(1) d, ft (grain size); the representative ones are taken from Table 4.27

(2) i_b (fraction of bed material); taken from Table 4.27

(3) R_h', ft (hydraulic radius with respect to grains); taken from Table 4.28

(4) Ψ (intensity of shear on particle: $\Psi = d(\rho_s - \rho)/(\rho\ (R_h' S))$: $\rho = 1.939$ slug/ft^3; $S \equiv S_f$; $\rho_s = 2.65\ \rho$

(5) d/X; for values of X see Table 4.28

(6) ξ (hiding factor); ξ = fct (d/X): Refer to Einstein (1950)

(7) Ψ_* (intensity of shear on individual grain size); $\Psi_* = \xi Y(\beta/\beta_x)^2\Psi$; values are given in Table 4.28

(8) Φ_* (intensity of transport for individual grain size); Φ_* = fct (Ψ_*): Refer to Einstein (1950)

(9) $i_s g_s$, lb/(sec)(ft) (bed load rate in weight per unit width and time for a size fraction); $i_s g_s = i_b\ \phi_*\ \rho_s\ g^{3/2}\ d^{3/2}\ \sqrt{\rho_s/\rho - 1}$

(10) $i_s G_s$, lb/sec (bed load rate in weight per unit time for a size fraction for entire cross sections); $i_s\ G_s = (i_s g_s)P$, P given in Table 4.28.

(11) $\Sigma i_s G_s$, lb/sec (bed load rate in weight per unit time for all size fractions for entire cross section)

(12) $A_E = 2d/R_h$ (ratio of bed layer to hydraulic radius)

(13) Z (exponent for suspension distribution); $Z = v_{ss}/0.4\ u_*'$; v_{ss} = settling velocity (Table 4.27) from Einstein; u_*' from Table 4.28

Glossary for Tables 4.29a through 4.29c (Continued)

(14) I_1, (integral) = $0.216\ A^{z-1}/(1-A)^z \int_A^1 (1-y/y)^z\ dy$; Can be determined; $I_1 = f(A_E, z)$. For this report evaluated numerically using SQUANK (Simpson's Quadrature Used Adaptively-Noise Killed)

(15) $I_2 = 0.216\ A^{z-1}/(1-A)^z \int_A^1 (1-y/y)^z \operatorname{Log}_e(y)\ dy$. Can be determined (refer to Einstein); $I_2 = f(A_E, z)$. For this report evaluated numerically using SQUANK (Simpson's Quadrature Used Adaptively Noise Killed)

(16) $(P_E I_1 + I_2 + 1)$

(17) $i_{st} g_{st}$, lb/(sec)(ft) (bed material load in weight per unit width and time for a size fraction); $i_{st} g_{st} = i_s g_s\ (P_E I_1 + I_2 + 1)$

(18) $i_{st} G_{st}$, lb/sec (bed material rate on weight per unit time for a size fraction for entire cross section); $i_{st} G_{st} = (i_{st} g_{st}) P$

(19) $\Sigma i_{st} G_{st}$, lb/sec (bed material rate in weight per unit time for all size fractions for entire cross section).

Thus, Column 11 of Tables 4.29 represents the bed load while Column 19 represents the bed material load for the various discharge values as represented indirectly by the R_h' of Column 3. It should be noted that Columns 11 and 22 represent accumulated values. The results (after appropriate conversion of units) were plotted and are shown in Fig. 4.4. These results do not agree very well with those obtained from Kalinske's procedure, which was adopted here as the more accurate of the two. This is discussed further in the next section.

5. DISCUSSION OF RESULTS

In calculating the discharge and sediment load values for the Sacramento River near Hood using the USGS measurements at Hood data, it was necessary to rely on river stage records at Hood and Snodgrass Slough. Due to tidal effects, the river stage varies appreciably during the several hour data collection period. Consequently, some inaccuracies may have been introduced into the calculations which could have been minimized if the river stage had been measured on site during the data collection period. It was also necessary to rely on river section profiles which were surveyed several years ago and which may now be different due to sediment deposition and scour. Nevertheless, the results of the Hood data analysis were considered to be good as exemplified by the high correlation of the data within itself and with historical measurements.

Kalinske's procedure for calculating the Sacramento River bed load capacities and downstream deposition appears to be more accurate than Einstein's procedure. The main problem encountered in the application

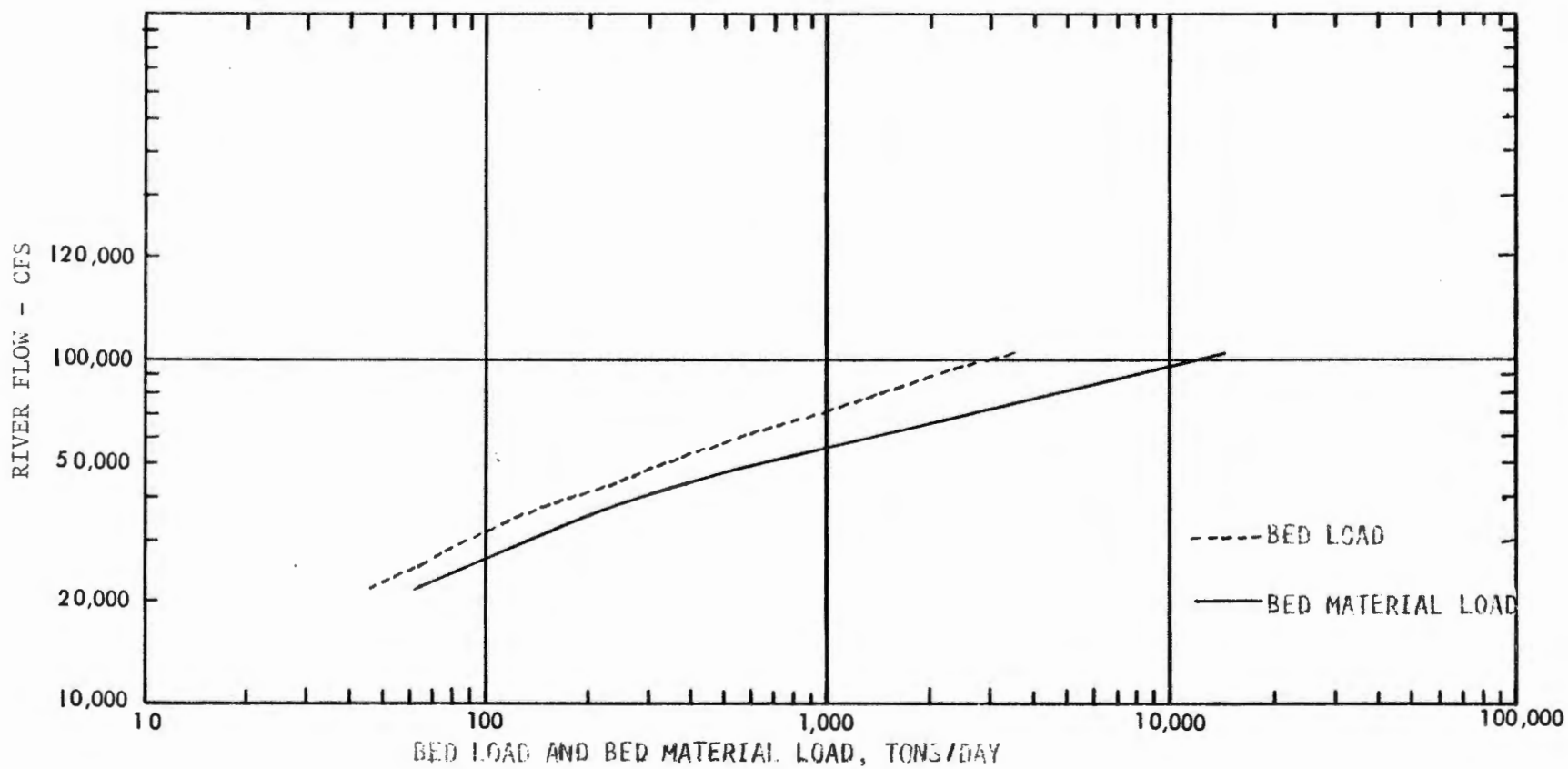

Figure 4.4 Water Discharge Versus Bed Load and Bed Material Load for Grains Coarser than d = 0.125 mm

of both techniques is the selection of an appropriate slope value. The river bed slope in the vicinity of Hood is negative. In Kalinske's procedure, an approximate relationship between discharge and friction slope was used in place of the bed slope. However, this could not be done in the application of Einstein's method because the bed slope (or friction slope) is used in the calculations independent of the discharge. The use of a constant friction slope did not appear to improve the results.

The Einstein procedure is based on the determination of bed load movement through the use of a "bed-load function." The total load is computed from the bed load. In the portion of the Sacramento River studied here, bed load ia a minor part of the total load. Errors in the estimation of the bed load can greatly affect the calculated amounts of total load. The sediment load values calculated by Einstein's procedure are much smaller than the observed values. The Kalinske method gave results that were in closer agreement with the measured values, and this latter method was the basis for the sediment loads presented in the results of this study.

The average annual flow of the Sacramento River is in the range 4,250,000 to 11,400,000 cfs-day (equivalent to mean daily flows of 11,600 to 31,200 cfs), and sediment loads are 503,000 to 3,520,000 tons (equivalent to mean daily values of 1,370 to 9,600 tons/day) (Table 4.12). Operating the Peripheral Canal in the average annual flow range of 3,300,000 to 4,000,000 cfs-day (equivalent to mean daily flows of 9,000 to 11,000 cfs) would result in a predicted annual suspended sediment load diversion of 400,000 to 900,000 tons (equivalent to mean daily sediment loads of 1,000 to 2,500 tons/day). The expected annual

downstream deposition is about 70,000 to 120,000 tons (equivalent to mean daily bed load deposition of 180 to 320 tons/day).

The data base used for the work described here is judged to be a sufficient basis for the calculations made to estimate the potential amount of sediment to be diverted into the Peripheral Canal. However, the present monitoring programming by the U.S. Geological Survey should be continued to extend the present data base. Continuing this data acquisition program will permit future changes in sediment transport conditions to be revealed.

6. SUMMARY

The studies discussed in this report have led to the following:

1. A data base for the Sacramento River for mean daily flow and mean daily suspended sediment load for the water years 1956-57 through 1979-80, inclusive, along with a review of the techniques used to measure both.
2. An analysis of data collected by the USGS for the Sacramento River near Hood (location of the inlet to the proposed Peripheral Canal) for calculating flow and sediment load values and correlating them with historically measured values.
3. A derivation of sediment load-discharge relationships for the Sacramento River nead Hood to permit the prediction of the amount of suspended sediment that would be diverted into the Peripheral Canal for a wide range of Sacramento River flows and corresponding Peripheral Canal diversion.
4. A calculation of the Sacramento River bed load capacities and the amounts of potential bed load deposition downstream from the Peripheral Canal intake.

5. The present sediment monitoring program by the U. S. Geological Survey should be continued.

7. BIBLIOGRAPHY

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APPENDIX A

15,600

2020 T/d

UNITED STATES GEOLOGICAL SURVEY
WATER RESOURCES DIVISION

SACRAMENTO RIVER near HOOD, CA., at CROSS SECTION # 1

DATA GATHERED AT: DATE June 22, 1978 TIME 1039-1433 hrs

REVERSE ORDER

SECTION STATION (FEET)		TOTAL DEPTH (FEET)	SAMPLING DEPTH (FEET)	VELOCITY (FEET/SEC)	CONCENTRATION MG/LITRE)	% >.062 MM
	459 RB					
1		24.5	1.0	2.06	18	14
2			6.1	2.03	20	16
3			12.2	1.86	20	12
4			18.4	1.69	62	13
5			23.5	1.08	80	12
	358					
1		23.5	1.0	2.19	16	10
2			5.9	2.36	26	7
3			11.8	2.11	32	5
4			17.6	1.94	27	27
5			22.5	1.77	52	8
	236					
1		27.0	1.0	2.19	24	18
2			6.8	2.11	26	17
3			13.5	2.03	31	11
4			20.2	1.52	53	10
5			26.0	.54	81	9
	187					
1		25.3	1.0	1.94	19	32
2			6.3	1.94	32	6
3			12.6	1.77	46	9
4			19.0	1.49	61	9
5			24.3	1.11	75	9
	123					
1		26.3	1.0	1.60	22	13
2			6.6	1.69	25	15
3			13.2	1.69	40	8
4			19.7	1.35	54	6
5			25.3	1.22	91	12

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5300 190' 10.0

UNITED STATES GEOLOGICAL SURVEY
WATER RESOURCES DIVISION

SACRAMENTO RIVER near HOOD, CA., at CROSS SECTION # 1

DATA GATHERED AT: DATE Nov. 27, 1978 TIME 1223-1509

	SECTION STATION (FEET)	TOTAL DEPTH (FEET)	SAMPLING DEPTH (FEET)	VELOCITY (FEET/SEC)	CONCEN TRATION MG/LITRE)	% >.062 MM
	135 ~~100~~					
1		29.3	1.0	.39	14	20
2			7.3	.55	11	[illegible]
3			14.6	.62	10	7
4			22.0	.54	16	3
5			28.3	.35	12	6
	196 ~~260~~					
1		27.8	1.0	.48	12	6
2			7.0	.56	13	2
3			13.9	.49	13	4
4			20.8	.54	15	5
5			26.8	.14		
	255 ~~350~~					
1		24.1	1.0	.49	11	4
2			6.0	.56	12	2
3			12.0	.56	15	2
4			18.0	.54	13	3
5			23.1	.43	16	4
	368 ~~410~~					
1		25.3	1.0	.60	17	2
2			6.3	.56	12	2
3			12.6	.60	14	3
4			18.9	.54	14	2
5			24.3	.34	16	3
	437 ~~500~~					
1		24.6	1.0	.72	13	1
2			6.2	.84	13	1
3			12.3	.75	18	1
4			18.4	.48	15	3
5			23.6	.62	17	5

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37,700
21,600

8.5

SACRAMENTO RIVER near HOOD, CA., at CROSS SECTION # 1

DATA GATHERED AT: DATE Jan. 19, 1979 TIME 1005-1315

	SECTION STATION (FEET)	TOTAL DEPTH (FEET)	SAMPLING DEPTH (FEET)	VELOCITY (FEET/SEC)	SEDIMENT CONCENTRATION (MG/LITRE)	% > .062 MM
	129 ~~200~~					
1		31.0	1.0	3.12	144	10.4
2			7.5	3.27	199	26.1
3			15.0	3.05	223	33.0
4			22.5	2.33	375	54.8
5			29.0	2.04	309	44.0
	209 ~~300~~					
1		29.7	1.0	3.63	178	15.2
2			7.4	3.35	196	24.9
3			14.8	2.98	209	26.2
4			22.3	2.60	217	24.0
5			29.7	2.14	325	45.1
	272 ~~390~~					
1		28.4	1.0	3.63	162	17.5
2			7.1	3.63	185	17.7
3			14.2	3.63	202	21.7
4			21.3	3.12	198	33.0
5			27.4	2.60	216	24.6
	386 ~~410~~					
1		28.4	1.0	3.56	161	15.9
2			7.1	3.87	175	18.6
3			14.2	3.42	163	23.8
4			21.3	2.85	188	19.8
5			27.4	1.41	192	35.7
	452 ~~590~~					
1		30.0	1.0	3.12	155	16.2
2			7.5	3.27	160	25.1
3			15.0	3.05	162	19.9
4			22.5	2.55	170	17.3
5			29.0	1.91	173	14.8

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13100

572

UNITED STATES GEOLOGICAL SURVEY
WATER RESOURCES DIVISION

SACRAMENTO RIVER near HOOD, CA., at CROSS SECTION # [illegible]

DATA GATHERED AT: DATE Feb. 23, 1979 TIME 1245-1450

	SECTION STATION (FEET)	TOTAL DEPTH (FEET)	SAMPLING DEPTH (FEET)	VELOCITY (FEET/SEC)	CONCEN TRATION MG/LITRE)	% >.063 MM
1	142	[illegible]	1.0	.56	13	26
2			[illegible]	[illegible]	19	5
3			14.0	.56	11	15
4			21.0	.54	19	24
5			27.0	.43	22	5
1	203	25.4	1.0	1.06	12	30
2			6.4	1.03	16	5
3			12.7	.95	15	29
4			19.1	.86	17	25
5			24.4	.82	20	9
1	269	24.2	1.0	1.44	13	15
2			6.0	1.41	17	8
3			21.1	1.41	14	22
4			18.1	1.29	19	12
5			23.2	1.03	19	36
1	379	23.8	1.0	1.62	17	15
2			6.0	1.58	15	40
3			11.9	1.26	16	25
4			17.9	1.51	18	15
5			22.8	.97	20	6
1	452	24.1	1.0	1.58	10	14
2			6.0	1.54	18	7
3			12.0	1.11	14	18
4			18.0	1.11	12	23
5			23.1	.75	17	21

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1990
1960

UNITED STATES GEOLOGICAL SURVEY
WATER RESOURCES DIVISION

155

SACRAMENTO RIVER near HOOD, CA., at CROSS SECTION # 1

DATA GATHERED AT: DATE April 13, 1979 TIME 1010-1140

	SECTION STATION (FEET)	TOTAL DEPTH (FEET)	SAMPLING DEPTH (FEET)	VELOCITY (FEET/SEC)	CONCENTRATION MG/LITRE)	% > .062 MM
1	139 ~~150~~	27.0	1.0	1.88	26	17
2			7.5	1.88	41	21
3			13.5	1.66	48	29
4			20.2	1.41	50	16
5			26.0	.82	48	8
1	190 ~~200~~	26.0	1.0	2.05	31	11
2			6.5	2.15	38	16
3			13.0	1.68	41	7
4			19.5	1.54	42	13
5			25.0	1.14	40	14
1	245 ~~250~~	25.3	1.0	2.10	32	7
2			6.1	1.96	38	17
3			12.2	2.10	33	17
4			18.2	1.96	38	10
5			24.3	1.08	48	16
1	330 ~~340~~	23.6	1.0	2.25	26	18
2			5.9	2.20	29	13
3			11.8	2.25	33	9
4			17.7	1.38	38	3
5			22.6	1.41	41	8
1	433 ~~500~~	24.1	1.0	2.15	33	15
2			6.0	2.00	21	23
3			12.0	1.84	35	38
4			18.0	1.62	39	3
5			23.1	1.32	25	11

"UNPUBLISHED RECORDS
SUBJECT TO REVISION"

1770
1150

UNITED STATES GEOLOGICAL SURVEY
WATER RESOURCES DIVISION

205

SACRAMENTO RIVER near HOOD, CA., at CROSS SECTION # 1

DATA GATHERED AT: DATE June 5, 1979 TIME 1015-1150

	SECTION STATION (FEET)	TOTAL DEPTH (FEET)	SAMPLING DEPTH (FEET)	VELOCITY (FEET/SEC)	CONCENTRATION MG/LITRE)	% >.062 MM
1	142 ~~200~~	24.5	1.0	1.80	22	5
2			6.1	1.65	22	11
3			12.2	1.65	25	15
4			18.4	1.65	30	15
5			23.5	1.35	45	23
1	219 ~~250~~	24.7	1.0	1.88	16	6
2			6.2	1.84	19	5
3			12.4	1.65	22	5
4			19.5	1.41	25	7
5			23.7	.89	32	8
1	262 ~~350~~	24.4	1.0	1.88	16	6
2			6.1	1.68	17	4
3			12.2	1.73	21	6
4			18.3	1.65	21	6
5			23.4	1.01	25	6
1	393 ~~510~~	22.8	1.0	1.84	15	6
2			5.7	1.80	17	6
3			11.4	1.65	18	5
4			17.1	1.58	22	7
5			21.8	1.26	25	7
1	452 ~~590~~	23.2	1.0	1.73	13	3
2			5.8	1.65	16	4
3			11.6	1.70	17	4
4			17.4	1.26	19	3
5			22.2	1.01	19	6

UNPUBLISHED RECORDS
SUBJECT TO REVISIONS

17300
1470

UNITED STATES GEOLOGICAL SURVEY
WATER RESOURCES DIVISION

225

UNPUBLISHED RECORDS
SUBJECT TO REVISION

SACRAMENTO RIVER near HOOD, CA., at CROSS SECTION # 1

DATA GATHERED AT: DATE July 18, 1979 TIME 0930-1110

	SECTION STATION (FEET)	TOTAL DEPTH (FEET)	SAMPLING DEPTH (FEET)	VELOCITY (FEET/SEC)	CONCEN TRATION MG/LITRE)	% >.062 MM
1	151	26.6	1.0	1.92	15	15
2			6.6	1.69	29	19
3			13.3	1.83	40	10
4			20.0	1.20	47	11
5			25.6	.95	64	14
1	196	25.2	1.0	2.05	17	20
2			6.3	2.00	30	12
3			12.6	1.92	31	9
4			18.9	1.84	39	19
5			24.2	1.65	67	8
1	249	24.0	1.0	2.05	20	14
2			6.0	1.96	31	8
3			12.0	1.84	35	9
4			18.0	1.92	42	7
5			23.0	1.44	44	14
1	404	24.2	1.0	2.15	19	11
2			6.0	2.20	17	26
3			12.1	2.10	23	18
4			18.1	1.84	31	16
5			23.2	1.29	34	8
1	448	24.0	1.0	2.05	18	13
2			6.0	2.05	20	18
3			12.0	1.68	22	15
4			18.0	1.23	27	17
5			23.0	1.08	26	18

UNPUBLISHED RECORDS
SUBJECT TO REVISION

11500

740

WATER RESOURCES DIVISION

UNPUBLISHED RECORDS SUBJECT TO REVISION

SACRAMENTO RIVER near HOOD, CA., at CROSS SECTION # 1

DATA GATHERED AT: DATE July 18, 1979 TIME 1130-1315

SECTION STATION (FEET)	TOTAL DEPTH (FEET)	SAMPLING DEPTH (FEET)	VELOCITY (FEET/SEC)	CONCENTRATION MG/LITRE)	% >.062 MM
151					
1	26.6	1.0	1.26	16	7
2		6.6	1.41	18	12
3		13.3	1.56	26	11
4		20.0	1.08	41	12
5		25.6	.80	50	9
196					
1	25.0	1.0	1.54	14	7
2		6.2	1.51	21	6
3		12.5	1.29	33	16
4		18.8	1.32	43	8
5		24.0	.97	70	4
249					
1	25.6	1.0	1.51	22	7
2		6.4	1.38	21	7
3		12.8	1.38	21	27
4		19.2	1.14	26	2
5		24.6	.70	26	13
404					
1	25.2	1.0	1.41	13	1
2		6.3	1.54	14	1
3		12.6	1.51	16	3
4		18.9	1.14	15	7
5		24.2	.86	21	11
448					
1	24.4	1.0	1.08	14	4
2		6.1	1.11	13	4
3		12.2	1.23	16	11
4		18.3	.86	16	5
5		23.4	.75	20	4

"UNPUBLISHED RECORDS SUBJECT TO REVISION"

UNPUBLISHED RECORDS SUBJECT TO REVISION

UNITED STATES GEOLOGICAL SURVEY
WATER RESOURCES DIVISION

UNPUBLISHED RECORDS SUBJECT TO REVISION

SACRAMENTO RIVER near HOOD, CA., at CROSS SECTION # 1

DATA GATHERED AT: DATE Sept. 12, 1979 TIME 0930-1100

	SECTION STATION (FEET)	TOTAL DEPTH (FEET)	SAMPLING DEPTH (FEET)	VELOCITY (FEET/SEC)	CONCEN TRATION MG/LITRE)	% >.062 MM
1	[redacted] 145	27.4	1.0	1.08	19	9
2	[redacted]		6.8	1.11	20	3
3			13.7	.99	24	3
4	"UNPUBLISHED RECORDS SUBJECT TO REVISION"		20.5	.84	25	4
5			26.4	.65	28	2
1	[redacted] 226	26.0	1.0	1.18	15	0
2	[redacted]		6.5	1.08	19	0
3			13.0	.99	19	5
4			18.5	.93	27	4
5			25.0	.84	36	2
1	[redacted] 269	25.4	1.0	1.29	22	5
2	[redacted]		6.4	1.23	22	6
3			12.7	1.08	22	0
4			19.0	.91	22	0
5			24.4	.69	40	0
1	[redacted] 324	24.0	1.0	1.32	19	2
2	[redacted]		6.0	1.20	-	-
3			12.0	1.11	24	12
4			18.0	1.14	24	5
5			23.0	.80	28	11
1	[redacted] 430	23.8	1.0	1.41	20	6
2	[redacted]		6.0	1.23	21	6
3			11.9	1.14	23	8
4			17.9	.86	25	9
5			22.8	.66	25	6

UNPUBLISHED RECORDS SUBJECT TO REVISION

UNITED STATES GEOLOGICAL SURVEY
WATER RESOURCES DIVISION

UNPUBLISHED RECORDS
SUBJECT TO REVISION

SACRAMENTO RIVER near HOOD, CA., at CROSS SECTION # 1

DATA GATHERED AT: DATE Sept. 12, 1979 TIME 1115-1225

	SECTION STATION (FEET)	TOTAL DEPTH (FEET)	SAMPLING DEPTH (FEET)	VELOCITY (FEET/SEC)	CONCENTRATION MG/LITRE)	>.062 MM
1	145	27.7	1.0	1.08	16	0
2			6.9	1.08	17	4
3			13.8	.97	21	3
4			20.7	.91	27	5
5			26.7	.70	29	2
1	226	26.6	1.0	1.18	65	7
2			6.6	1.14	27	0
3			13.3	.95	27	11
4			20.0	.89	17	0
5			25.6	.70	14	3
1	269	24.4	1.0	1.29	13	0
2			6.1	1.18	17	4
3			12.2	1.29	17	1
4			16.3	.97	17	1
5			23.4	.95	18	1
1	324	24.8	1.0	1.41	14	0
2			6.2	1.32	15	2
3			12.4	1.14	16	0
4			18.6	.95	21	12
5			23.8	.99	22	6
1	430	24.0	1.0	1.54	13	0
2			6.2	1.51	17	5
3			12.5	1.47	15	3
4			18.8	1.01	14	6
5			24.0	.84	13	2

UNPUBLISHED RECORDS
SUBJECT TO REVISION

UNITED STATES GEOLOGICAL SURVEY
WATER RESOURCES DIVISION

22.5

UNPUBLISHED RECORDS
SUBJECT TO REVISION

SACRAMENTO RIVER near HOOD, CA., at CROSS SECTION # 1

DATA GATHERED AT: DATE Sept. 12, 1979 TIME 1240-1400

SECTION STATION (FEET)		TOTAL DEPTH (FEET)	SAMPLING DEPTH (FEET)	VELOCITY (FEET/SEC)	CONCEN TRATION MG/LITRE)	% >.062 MM
1	145	27.4	1.0	1.68	20	5
2			6.8	1.50	25	6
3			13.7	1.41	30	9
4	"UNPUBLISHED RECORDS SUBJECT TO REVISION"		20.6	1.32	31	3
5			26.4	.95	32	4
1	226	26.4	1.0	1.58	15	12
2			6.6	1.51	24	5
3			13.2	1.51	20	0
4			19.8	1.03	35	0
5			25.4	.95	37	5
1	269	25.6	1.0	1.65	14	4
2			6.4	1.58	20	0
3			12.8	1.38	17	4
4			19.2	1.14	28	9
5			24.6	.93	21	6
1	324	25.0	1.0	1.58	15	5
2			6.2	1.62	18	10
3			12.5	1.38	18	0
4			18.7	1.33	19	15
5			24.0	.93	22	5
1	430	24.8	1.0	1.68	19	23
2			6.2	1.65	21	22
3			12.4	1.51	15	5
4			18.6	1.29	17	3
5			23.8	.91	15	0

UNPUBLISHED RECORDS
SUBJECT TO REVISION

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35600

UNITED STATES GEOLOGICAL SURVEY
WATER RESOURCES DIVISION

10.5

SACRAMENTO RIVER near HOOD, CA., at CROSS SECTION # 1

DATA GATHERED AT: DATE 3-28-80 TIME 1120 to 1540

LB	SECTION STATION (FEET)	TOTAL DEPTH (FEET)	SAMPLING DEPTH (FEET)	VELOCITY (FEET/SEC)	CONCENTRATION MG/LITRE)	% >.062 MM
81°00' 1	132 ~~200~~	39.[illegible]	1.0	5.20	88	[illegible]
2			[illegible]	[illegible]	[illegible]	[illegible]
3			19.6	4.16	149	50
4	"UNPUBLISHED RECORDS SUBJECT TO REVISION"		29.4	3.72	200	61
5			38.2	1.41		
		Depth Integrated			176	[illegible]
76°10' 1	226 ~~250~~	38.2	1.0	5.58	97	25
2			9.6	5.45	140	46
3			19.1	4.48	154	56
4			28.7	4.07	284	73
5			37.2	1.97	[illegible]	[illegible]
		Depth Integrated			159	52
72°40' 1	296 ~~350~~	38.0	1.0	5.45	94	23
2			9.5	5.20	107	35
3			19.0	4.75	140	46
4			28.5	4.75	174	55
5			37.0	2.92	340	81
		Depth Integrated			165	53
70°20' 1	344 ~~410~~	37.3	1.0	5.45	89	16
2			9.3	5.32	123	32
3			18.6	4.55	116	38
4			27.9	4.16	151	48
5			36.3	3.13	383	78
		Depth Integrated			118	37
67°40' 1	400 ~~500~~	36.8	1.0	5.45	91	20
2			9.2	5.45	104	29
3			18.4	5.20	119	35
4			27.6	4.55	119	34
5			35.8	3.50	148	47
		Depth Integrated			127	37

3 130

WATER RESOURCES DIVISION

SACRAMENTO RIVER near HOOD, CA., at CROSS SECTION # 1 Marsh McBirney Meter

DATA GATHERED AT: DATE June 27, 1980 TIME 1045-1500

	SECTION STATION (FEET)	TIME	TOTAL DEPTH (FEET)	AZIMUTH	SAMPLING DEPTH (FEET)	VELOCITY (FEET/SEC)	SONDEN TRATION MG/LITRE)	>.063 MM
1	142 ~~250~~	1045	25.0	323	2.0	2.08	36	12
2				323	6.2	2.01	43	19
3				323	12.5	1.74	58	9
4				323	18.7	1.62	71	12
5		1130		325	23.5	1.48	88	14
		Depth Integrated					60	
1	206 ~~350~~	1140	27.0	325	2.0	2.34	36	10
2				325	6.8	2.25	42	9
3				328	13.5	2.12	50	10
4				328	20.3	1.78	50	11
5		1230		328	25.5	1.36	64	17
		Depth Integrated					48	
1	272 ~~350~~	1235	26.0	323	2.0	2.39	43	10
2					6.5		43	10
3				325	13.0	2.23	47	10
4				325	19.5	1.61	55	11
5		1320		325	24.5	1.41	58	16
		Depth Integrated					48	
1	379 ~~10~~	1330	25.9	332	2.0	2.47	30	16
2				335	6.5	2.19	41	13
3				335	13.0	2.21	47	10
4				334	19.5	2.10	48	12
5		1413		328	24.4	1.30	55	13
		Depth Integrated					26	
1	448 ~~550~~	1420	25.4	328	2.0	2.30	18	10
2				328	6.4	2.30	30	7
3				328	12.7	1.96	34	14
4				328	19.1	1.67	42	14
5		1500		335	23.9	1.59	48	21
		Depth Integrated					28	

UNPUBLISHED RECORDS
SUBJECT TO REVISION

WATER RESOURCES DIVISION

SACRAMENTO RIVER near HOOD, CA., at CROSS SECTION # 1 Marsn McBirney Mater

DATA GATHERED AT: DATE April 29, 1981 TIME 1250-1420

	SECTION STATION (FEET)	TIME	TOTAL DEPTH (FEET)	AZIMUTH	SAMPLING DEPTH (FEET)	VELOCITY (FEET/SEC)	CONCEN TRATION MG/LITRE	% >.001 MM
	121 ~~100~~	1250	26.4	335	2.0	.91	13	7
2				347	6.6	.87	21	21
3				342	13.2	.79	17	5
4				345	19.8	1.01	24	8
5		1305		360	25.0	.32	27	4
					Depth Integrated		20	3
1	196 ~~280~~	1315	25.4	319	2.0	1.18	11	7
2				323	6.4	1.07	12	5
3				328	12.7	.97	15	18
4				335	19.0	.76	14	4
5		1325		343	24.0	.37	15	6
					Depth Integrated		12	3
1	275 ~~330~~	1335	25.4	329	2.0	1.38	12	8
2				328	6.4	1.23	13	6
3				328	12.7	.97	15	11
4				329	19.0	.79	16	8
5		1340		356	24.0	.37	15	5
					Depth Integrated		11	3
1	333 ~~410~~	1355	26.2	332	2.0	1.80	10	6
2				332	6.2	1.40	11	6
3				331	12.4	1.40	12	6
4				333	18.6	1.39	13	6
5		1405		339	24.8	1.55	14	4
					Depth Integrated		10	2
1	408 ~~590~~	1410	24.4	331	2.0	1.24	10	3
2				335	5.8	1.22	12	5
3				335	11.5	1.48	11	2
4				346	17.2	.73	11	0
5		1420		359	23.0	.64	12	2
					Depth Integrated		13	7

"UNPUBLISHED RECORDS SUBJECT TO REVISION"

UNITED STATES GEOLOGICAL SURVEY
WATER RESOURCES DIVISION

SACRAMENTO RIVER near HOOD, CA., at CROSS SECTION # 1

DATA GATHERED AT: DATE September 15, 1981 TIME 1015-1215

	SECTION STATION (FEET)	TOTAL DEPTH (FEET)	AZIMUTH	SAMPLING DEPTH (FEET)	VELOCITY (FEET/SEC)	CONCENTRATION MG/LITRE)	% >.062 MM
1	155	27.1	325	2.0	1.80	29	4
2			322	6.8	1.73	43	[illegible]
3			321	13.6	1.65	55	6
4			323	20.4	1.35	71	8
5			327	25.6	1.03	94	16
		Depth Integrated				56	12
1	226	25.6	317	2.0	1.92	28	4
2			317	6.4	1.84	36	4
3			317	12.8	1.70	41	3
4			317	19.2	1.38	54	4
5			315	24.1	1.21	63	5
		Depth Integrated				40	6
1	269	23.5	318	2.0	2.05	32	5
2			318	5.9	1.92	33	3
3			317	11.8	1.80	39	7
4			317	17.7	1.35	44	3
5			322	22.0	1.58	60	4
		Depth Integrated				41	5
1	365	25.5	318	2.0	2.15	27	5
2			318	6.4	2.05	31	4
3			318	12.8	1.96	37	2
4			318	19.2	1.54	40	6
5			317	24.0	1.35	49	5
		Depth Integrated				38	7
1	433	23.5	325	2.0	2.29	26	5
2			325	5.9	2.10	31	6
3			322	11.8	2.05	38	5
4			322	17.7	1.80	35	4
5			320	22.0	1.58	36	5
		Depth Integrated				32	6

UNPUBLISHED RECORDS
SUBJECT TO REVISION

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UNITED STATES GEOLOGICAL SURVEY
WATER RESOURCES DIVISION

Temp 17.5

SACRAMENTO RIVER near HOOD, CA., at CROSS SECTION # 2

DATA GATHERED AT: DATE May 18, 1978 TIME 1030-1330

	SECTION STATION (FEET)	TOTAL DEPTH (FEET)	SAMPLING DEPTH (FEET)	VELOCITY (FEET/SEC)	CONCEN TRATION MG/LITRE)	% >.062 MM
1	128	27.4	1.0	1.92	31	4
2			6.8	1.97	51	5
3			13.7	1.51	50	4
4			20.5	1.41	53	4
5			26.4	1.11	70	10
1	257	21.7	1.0	2.20	36	6
2			5.4	2.74	50	4
3			10.8	2.10	55	4
4			16.2	1.68	67	8
5			20.7	1.35	81	5
1	389	18.0	1.0	2.29	42	4
2			4.5	2.34	46	6
3			9.0	2.34	54	3
4			13.5	2.16	60	2
5			17.0	1.62	75	7
1	523	16.6	1.0	2.68	42	7
2			4.2	2.44	45	5
3			8.3	2.39	49	4
4			12.4	2.20	54	6
5			15.6	1.96	61	4
1	647	14.3	1.0	2.55	34	4
2			3.6	2.44	46	6
3			7.2	2.10	45	14
4			10.8	2.10	54	6
5			13.3	1.96	51	6

"UNPUBLISHED RECORDS
SUBJECT TO REVISION"

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10.5

UNITED STATES GEOLOGICAL SURVEY
WATER RESOURCES DIVISION

SACRAMENTO RIVER near HOOD, CA., at CROSS SECTION # 2

DATA GATHERED AT: DATE Nov. 22, 1978 TIME 1350 -1600

	SECTION STATION (FEET)	TOTAL DEPTH (FEET)	SAMPLING DEPTH (FEET)	VELOCITY (FEET/SEC)	CONCEN TRATION MG/LITRE)	% >.062 MM
1	189 ~~120~~	30.0	1.0	1.47	23	6
2			7.5	1.44	19	4
3			15.0	1.23	22	8
4			22.5	.99	16	9
5			29.0	.80	34	3
1	235 ~~250~~	23.6	1.0	1.73	14	8
2			5.9	1.65	23	3
3			11.8	1.50	24	6
4			17.7	1.65	27	5
5			22.6	.46	32	3
1	324 ~~300~~	21.6	1.0	1.50	17	2
2			5.4	1.54	19	6
3			10.8	1.44	22	5
4			16.2	1.33	24	2
5			20.6	.46	30	4
1	399 ~~410~~	18.8	1.0	1.65	20	3
2			4.7	1.50	22	4
3			9.4	1.65	22	4
4			14.1	1.41	21	3
5			17.3	.73	23	0
1	530 ~~540~~	16.6	1.0	1.61	18	4
2			4.2	1.54	19	3
3			8.3	1.41	20	4
4			12.4	1.21	22	5
5			15.6	.52	23	4

"UNPUBLISHED RECORDS SUBJECT TO REVISION"

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WATER RESOURCES DIVISION

9.0

SACRAMENTO RIVER near HOOD, CA., at CROSS SECTION # 2

DATA GATHERED AT: DATE Jan 19, 1979 TIME 1355-1527

Reverse Order

	SECTION STATION (FEET)	TOTAL DEPTH (FEET)	SAMPLING DEPTH (FEET)	VELOCITY (FEET/SEC)	CONCENTRATION MG/LITRE)	2>.080 MM
RB 1	640 ~~100~~	18.4	1.0	3.27	150	16.6
2			4.6	2.98	163	27.2
3			9.2	3.05	184	18.9
4			13.8	2.60	183	19.7
5			17.4	2.24	200	26.3
1	579 ~~250~~					
2		21.4	1.0	3.19	158	15.9
3			5.4	3.19	175	21.8
4			10.7	2.98	187	18.6
5			16.0	2.43	203	24.1
			20.4	1.69	222	32.8
1	576 ~~200~~					
2		23.2	1.0	3.19	158	17.5
3			5.8	3.19	175	22.7
4			11.6	2.85	179	34.2
5			17.4	2.24	205	26.5
			22.2	1.91	218	31.2
1	338 ~~510~~					
2		25.0	1.0	3.42	170	33.7
3			6.2	3.35	197	26.3
4			12.5	2.98	220	31.8
5			18.8	2.79	255	36.6
			24.0	1.57	279	44.8
LB 1	120 ~~640~~					
2		30.0	1.0	3.35	159	20.0
3			7.5	3.35	186	27.0
4			15.0	2.79	209	34.4
5			22.5	2.49	224	30.3
			29.0	1.69	194	35.2

"UNPUBLISHED RECORDS SUBJECT TO REVISION"

16 800
798

UNITED STATES GEOLOGICAL SURVEY
WATER RESOURCES DIVISION

11.0

SACRAMENTO RIVER near HOOD, CA., at CROSS SECTION # 2

DATA GATHERED AT: DATE Feb. 13, 1979 TIME 1005-1215

"UNPUBLISHED RECORDS SUBJECT TO REVISION"

	SECTION STATION (FEET)	TOTAL DEPTH (FEET)	SAMPLING DEPTH (FEET)	VELOCITY (FEET/SEC)	CONCEN TRATION MG/LITRE)	% >.062 MM
1	204 ~~[illegible]~~	28.0	1.0	1.41	19	22
2			7.0	1.47	21	19
3			14.0	1.23	20	20
4			21.0	1.16	26	25
5			27.0	1.16	27	23
1	302 ~~259~~	22.6	1.0	1.65	15	18
2			5.6	1.58	17	13
3			11.3	1.41	17	6
4			16.9	1.47	17	16
5			21.6	1.11	19	12
1	396 ~~339~~	19.2	1.0	1.84	14	7
2			4.8	1.65	16	17
3			9.6	1.68	13	22
4			14.4	1.68	18	20
5			18.2	.95	37	62
1	467 ~~410~~	18.0	1.0	1.65	11	20
2			4.5	1.65	13	18
3			9.0	1.65	12	19
4			13.5	1.47	17	16
5			17.0	1.00	21	5
1	558 ~~[illegible]~~	16.2	1.0	1.73	13	7
2			4.0	1.68	14	12
3			8.1	1.58	14	17
4			12.1	1.54	11	12
5			15.2	1.26	18	44

54300
36100

UNITED STATES GEOLOGICAL SURVEY
WATER RESOURCES DIVISION

9.0

SACRAMENTO RIVER near HOOD, CA., at CROSS SECTION # 2

DATA GATHERED AT: DATE Feb. 22. 1979 TIME 1015-1235

"UNPUBLISHED RECORDS SUBJECT TO REVISION"

	SECTION STATION (FEET)	TOTAL DEPTH (FEET)	SAMPLING DEPTH (FEET)	VELOCITY (FEET/SEC)	CONCEN TRATION MG/LITRE)	% >.062 MM
1	143 ~~120~~	37.0	1.0	2.74	171	24
2			9.2	3.34	211	32
3			18.5	3.21	219	28
4			27.7	3.28	238	33
5			36.0	1.80	237	37
1	367 ~~350~~	28.4	1.0	4.07	195	31
2			7.1	3.98	225	37
3			14.2	3.80	276	42
4			21.3	3.35	365	55
5			27.4	2.55	337	55
1	453 ~~430~~	26.4	1.0	3.98	200	27
2			6.6	3.80	192	20
3			13.2	3.65	251	33
4			19.8	3.13	311	46
5			25.4	1.51	410	55
1	537 ~~510~~	25.0	1.0	4.16	180	18
2			6.2	3.89	206	25
3			12.5	3.80	212	27
4			18.7	3.35	264	38
5			24.0	1.96	305	46
1	620 ~~590~~	22.2	1.0	3.57	169	17
2			5.6	3.89	212	25
3			11.1	3.57	270	19
4			16.7	3.35	232	28
5			21.2	2.39	265	40

28400
4390

UNITED STATES GEOLOGICAL SURVEY
WATER RESOURCES DIVISION

12.5

SACRAMENTO RIVER near HOOD, CA., at CROSS SECTION # 2

DATA GATHERED AT: DATE March 19, 1979 TIME 0940-1130

	SECTION STATION (FEET)	TOTAL DEPTH (FEET)	SAMPLING DEPTH (FEET)	VELOCITY (FEET/SEC)	CONCENTRATION MG/LITRE)	% >.062 MM
1	180	28.7	1.0	2.50	40	13
2			7.2	2.34	58	16
3			14.4	1.88	59	26
4			21.6	1.62	68	22
5			27.7	1.20	69	21
1	279	23.8	1.0	2.50	46	12
2			6.0	2.68	58	16
3			11.9	2.39	61	17
4			17.9	2.50	64	19
5			22.8	1.80	89	28
1	374	22.0	1.0	2.50	37	13
2			5.5	2.55	51	13
3			11.0	2.39	61	17
4			16.5	2.10	63	21
5			21.0	1.80	64	26
1	576	21.0	1.0	2.44	45	16
2			5.2	2.55	47	11
3			10.5	2.39	50	13
4			15.7	2.00	57	12
5			20.0	1.68	54	14
1	661	20.0	1.0	2.61	42	6
2			5.0	2.44	59	6
3			10.0	2.25	49	8
4			15.0	2.20	66	26
5			19.0	1.63	67	10

"UNPUBLISHED RECORDS SUBJECT TO REVISION"

19700

2440

UNITED STATES GEOLOGICAL SURVEY
WATER RESOURCES DIVISION

16.0

SACRAMENTO RIVER near HOOD, CA., at CROSS SECTION # 2

DATA GATHERED AT: DATE April 13, 1979 TIME 1215-1325

	SECTION STATION (FEET)	TOTAL DEPTH (FEET)	SAMPLING DEPTH (FEET)	VELOCITY (FEET/SEC)	CONCEN TRATION MG/LITRE)	% >.062 MM
1	189 ~~120~~	24.4	1.0	1.96	39	12
2			6.1	2.10	44	18
3			12.2	1.54	50	26
4			18.3	1.41	68	5
5			23.4	1.32	96	5
1	216 ~~250~~	21.5	1.0	2.05	35	9
2			5.4	2.05	41	7
3			10.8	1.84	41	12
4			16.1	1.80	50	6
5			20.5	1.51	53	12
1	332 ~~380~~	19.3	1.0	1.96	39	7
2			4.8	1.88	40	8
3			9.6	1.92	47	11
4			14.4	1.62	57	8
5			18.3	1.58	56	17
1	460 ~~510~~	16.7	1.0	2.25	35	9
2			4.2	2.15	38	6
3			8.4	2.25	45	8
4			12.5	1.96	45	12
5			15.7	1.44	48	13
1	586 ~~630~~	14.8	1.0	1.92	41	16
2			3.7	2.05	39	12
3			7.4	2.00	45	13
4			11.1	1.65	12	23
5			13.8	1.68	45	13

"UNPUBLISHED RECORDS
SUBJECT TO REVISION"

8100
311

UNITED STATES GEOLOGICAL SURVEY
WATER RESOURCES DIVISION

21.0

SACRAMENTO RIVER near HOOD, CA., at CROSS SECTION # 2

DATA GATHERED AT: DATE June 5, 1979 TIME 1220-1355

	SECTION STATION (FEET)	TOTAL DEPTH (FEET)	SAMPLING DEPTH (FEET)	VELOCITY (FEET/SEC)	CONCEN TRATION MG/LITRE)	% >.062 MM
1	197 ~~120~~	24.9	1.0	1.18	13	5
2			6.3	1.14	16	2
3			12.4	.80	18	3
4			18.7	.70	20	3
5			23.9	.70	27	9
1	302 ~~220~~	20.6	1.0	1.11	11	1
2			5.2	1.14	13	1
3			10.3	.95	14	4
4			15.4	.73	15	1
5			19.6	.56	17	2
1	352 ~~320~~	18.8	1.0	1.03	11	8
2			4.7	1.03	7	7
3			9.4	.99	18	8
4			14.1	.72	13	22
5			17.8	.72	16	12
1	475 ~~510~~	17.0	1.0	1.14	11	12
2			4.2	.99	13	8
3			8.5	.95	11	4
4			12.8	.75	15	5
5			16.0	.69	13	6
1	544 ~~640~~	16.3	1.0	.86	15	14
2			4.0	.86	12	11
3			8.2	.70	8	27
4			12.2	.72	14	17
5			15.3	.56	15	20

UNPUBLISHED RECORDS
SUBJECT TO REVISION

12600
514

UNITED STATES GEOLOGICAL SURVEY
WATER RESOURCES DIVISION

23.0

UNPUBLISHED RECORDS
SUBJECT TO REVISION

SACRAMENTO RIVER near HOOD, CA., at CROSS SECTION # 2

DATA GATHERED AT: DATE July 17, 1979 TIME 1110-1320

	SECTION STATION (FEET)	TOTAL DEPTH (FEET)	SAMPLING DEPTH (FEET)	VELOCITY (FEET/SEC)	CONCEN TRATION MG/LITRE)	% >.062 MM
1	[redacted] 174	26.6	1.0	1.18	14	15
2	[redacted]		6.7	1.16	18	10
3			13.3	1.08	19	6
4			20.0	.97	25	5
5			25.6	.75	36	38
1	[redacted] 307	22.1	1.0	1.20	12	2
2	[redacted]		6.5	1.18	17	16
3			11.0	1.08	13	12
4			17.5	.75	19	10
5			21.1	.38	17	21
1	[redacted] 396	20.2	1.0	1.20	10	11
2	[redacted]		5.0	1.23	3	3
3			10.1	1.23	15	10
4			15.1	1.08	14	5
5			19.2	.80	17	9
1	[redacted] 453	19.4	1.0	1.26	9	7
2	[redacted]		4.9	1.11	13	8
3			9.7	1.08	10	10
4			14.6	.95	14	5
5			18.4	.75	12	7
1	[redacted] 558	17.2	1.0	1.26	9	24
2	[redacted]		4.3	1.26	13	9
3			8.6	1.14	14	13
4			12.9	1.03	14	5
5			16.2	.41	15	7

UNPUBLISHED RECORDS
SUBJECT TO REVISION

UNPUBLISHED RECORDS

16300

544

UNITED STATES GEOLOGICAL SURVEY
WATER RESOURCES DIVISION

23.0

UNPUBLISHED RECORDS
SUBJECT TO REVISION

SACRAMENTO RIVER near HOOD, CA., at CROSS SECTION # 2

DATA GATHERED AT: DATE July 17, 1979 TIME 1325-1505

	SECTION STATION (FEET)	TOTAL DEPTH (FEET)	SAMPLING DEPTH (FEET)	VELOCITY (FEET/SEC)	CONCEN TRATION MG/LITRE)	% >.062 MM
1	[redacted] 174	26.9	1.0	1.23	14	8
2	([redacted])		6.8	1.18	9	3
3			13.5	1.11	10	8
4			20.3	.99	13	8
5			25.9	.73	16	5
1	[redacted] 309	23.0	1.0	1.35	8	6
2	([redacted])		5.8	1.29	14	17
3			11.5	1.29	10	0
4			17.3	1.18	12	0
5			22.0	.69	19	2
1	[redacted] 396	19.6	1.0	1.38	12	13
2	[redacted]		4.9	1.38	12	8
3			9.8	1.26	12	5
4			14.7	1.20	13	3
5			18.6	.93	11	11
1	[redacted] 453	18.4	1.0	1.54	10	12
2	([redacted])		4.6	1.47	12	9
3			9.2	1.38	11	5
4			13.8	1.32	16	13
5			17.4	1.08	12	16
1	[redacted] 558	16.8	1.0	1.65	7	10
2	([redacted])		4.2	1.62	12	5
3			8.4	1.47	11	16
4			12.6	1.23	14	13
5			15.8	.84	19	15

UNPUBLISHED RECORDS
SUBJECT TO REVISION

UNPUBLISHED RECORDS
SUBJECT TO REVISION

12900

809

UNITED STATES GEOLOGICAL SURVEY
WATER RESOURCES DIVISION

21.0

UNPUBLISHED RECORDS SUBJECT TO REVISION

SACRAMENTO RIVER near HOOD, CA., at CROSS SECTION # 2

DATA GATHERED AT: DATE Aug. 15, 1979 TIME 1030-1210

	SECTION STATION (FEET)	TOTAL DEPTH (FEET)	SAMPLING DEPTH (FEET)	VELOCITY (FEET/SEC)	CONCEN TRATION MG/LITRE)	% >.062 MM
1	197	27.2	1.0	1.41	24	17
2			6.8	1.51	27	20
3			13.6	1.11	19	6
4			20.4	1.01	16	24.
5			26.2	.80	42	19
1	250	24.0	1.0	1.41	13	0
2			6.0	1.41	26	33
3			12.0	1.29	28	12
4			18.0	1.08	36	5
5			23.0	.86	65	6
1	324	20.4	1.0	1.35	14	16
2			5.1	1.41	17	12
3			10.2	1.18	23	7
4			15.3	1.11	28	11
5			19.4	.76	46	11
1	439	19.0	1.0	1.38	12	23
2			4.2	1.32	13	9
3			9.5	1.35	21	14
4			13.8	1.14	13	39
5			18.0	.69	24	10
1	537	16.0	1.0	1.41	11	19
2			4.0	1.47	13	15
3			8.0	1.32	12	16
4			12.0	.75	12	26
5			15.0	.75	26	14

"UNPUBLISHED RECORDS SUBJECT TO REVISION"

UNPUBLISHED RECORDS

19900
2070

UNITED STATES GEOLOGICAL SURVEY
WATER RESOURCES DIVISION

21.0

UNPUBLISHED RECORDS
SUBJECT TO REVISION

SACRAMENTO RIVER near HOOD, CA., at CROSS SECTION # 2

DATA GATHERED AT: DATE Aug. 16, 1979 TIME 0830-1000

	SECTION STATION (FEET)	TOTAL DEPTH (FEET)	SAMPLING DEPTH (FEET)	VELOCITY (FEET/SEC)	CONCEN TRATION MG/LITRE)	% >.062 MM
1	[redacted] 189	29.0	1.0	1.80	17	19
2	[redacted]		7.2	1.65	38	11
3			14.5	1.54	46	18
4			21.8	1.62	61	28
5			28.0	1.18	48	16
1	[redacted] 257	22.4	1.0	2.05	20	16
2	[redacted]		5.6	2.05	31	25
3			11.2	1.92	40	20
4			16.8	1.65	52	15
5			21.4	1.11	60	6
1	[redacted] 345	20.4	1.0	2.10	32	18
2	[redacted]		5.1	2.10	36	14
3			10.2	1.80	42	27
4			15.3	1.65	51	21
5			19.4	1.29	69	15
1	[redacted] 432	17.8	1.0	2.25	27	20
2	[redacted]		4.2	2.25	26	29
3			8.4	1.92	31	23
4			12.6	1.65	34	22
5			16.8	1.41	47	17
1	[redacted] 537	14.0	1.0	2.20	23	13
2	[redacted]		3.5	2.44	26	10
3			7.0	2.15	33	18
4			10.5	1.80	30	18
5			13.0	1.80	42	10

"UNPUBLISHED RECORDS
SUBJECT TO REVISION"

UNPUBLISHED RECORDS
SUBJECT TO REVISION

15300

1470

UNITED STATES GEOLOGICAL SURVEY
WATER RESOURCES DIVISION

UNPUBLISHED RECORDS SUBJECT TO REVISION

210

SACRAMENTO RIVER near HOOD, CA., at CROSS SECTION # 2

DATA GATHERED AT: DATE Aug. 16, 1979 TIME 1000-1115

	SECTION STATION (FEET)	TOTAL DEPTH (FEET)	SAMPLING DEPTH (FEET)	VELOCITY (FEET/SEC)	CONCENTRATION MG/LITRE)	% >.062 MM
1	189	28.8	1.0	1.92	25	17
2			7.2	1.84	36	24
3			14.4	1.44	39	12
4			21.6	1.41	37	8
5			27.8	1.03	44	8
1	257	22.4	1.0	2.10	29	3
2			5.6	2.00	35	9
3			11.2	1.92	40	20
4			16.8	1.76	51	7
5			21.4	1.54	58	5
1	345	19.0	1.0	2.20	20	7
2			4.8	1.92	30	19
3			9.5	1.80	45	7
4			15.2	1.41	49	20
5			18.0	1.29	60	11
1	432	18.2	1.0	2.00	21	17
2			4.6	1.96	23	13
3			9.1	1.80	28	5
4			13.6	1.65	34	8
5			17.2	1.47	41	10
1	537	14.0	1.0	2.00	19	17
2			3.5	2.15	25	13
3			7.0	2.00	30	8
4			10.5	1.92	33	12
5			13.0	1.68	39	21

"UNPUBLISHED RECORDS SUBJECT TO REVISION"

UNPUBLISHED RECORDS

12300
E05

UNITED STATES GEOLOGICAL SURVEY
WATER RESOURCES DIVISION

UNPUBLISHED RECORDS
SUBJECT TO REVISION

21.0

42-382

SACRAMENTO RIVER near HOOD, CA., at CROSS SECTION # 2

DATA GATHERED AT: DATE Aug. 16, 1979 TIME 1130-1310

	SECTION STATION (FEET)	TOTAL DEPTH (FEET)	SAMPLING DEPTH (FEET)	VELOCITY (FEET/SEC)	CONCEN TRATION MG/LITRE)	% >.062 MM
1	[redacted] 139	29.0	1.0	1.62	20	12
2	[redacted]		7.2	1.38	25	36
3			14.5	1.11	30	17
4			21.8	1.26	30	9
5			28.0	.91	29	17
1	[redacted] 257	22.2	1.0	1.38	19	16
2	([redacted])		5.6	1.41	27	13
3			11.1	1.16	30	17
4			16.6	1.26	43	12
5			21.2	.70	57	19
1	[redacted] 345	20.0	1.0	1.38	13	15
2	([redacted])		5.0	1.38	17	9
3			10.0	1.32	25	25
4			15.0	.97	25	21
5			19.0	.91	35	14
1	[redacted] 432	18.4	1.0	1.14	17	13
2	[redacted]		4.6	1.26	17	15
3			9.2	1.11	22	17
4			13.8	.99	21	12
5			17.4	.97	24	10
1	[redacted] 537	14.8	1.0	1.35	11	6
2	([redacted])		3.7	1.35	13	7
3			7.4	1.32	15	10
4			11.1	1.08	20	11
5			13.8	1.14	21	9

"UNPUBLISHED RECORDS
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UNPUBLISHED RECORDS
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UNITED STATES GEOLOGICAL SURVEY
WATER RESOURCES DIVISION

39500

SACRAMENTO RIVER near HOOD, CA., at CROSS SECTION # 2

DATA GATHERED AT: DATE 2-28-80 TIME 1055 to 1235

LB	SECTION STATION (FEET)	TOTAL DEPTH (FEET)	SAMPLING DEPTH (FEET)	VELOCITY (FEET/SEC)	CONCEN TRATION MG/LITRE)	% >.062 MM
112°30'1	166 ~~120~~	37.1	1.0	4.55	101	26
2			9.3	4.45	122	32
3			18.6	4.48	155	53
4			27.9	3.89	212	62
5			36.1	3.13	406	83
		Depth Integrated			139	41
110°0'1	279 ~~250~~	34.2	1.0	4.75	90	18
2			8.5	4.75	109	30
3			17.1	4.46	173	56
4			25.6	3.72	274	72
5			33.2	3.13	501	84
		Depth Integrated			202	62
108°30'1	345 ~~380~~	30.8	1.0	5.45	103	27
2			7.7	4.75	138	50
3			15.4	4.37	128	57
4			23.1	4.16	206	64
5			29.8	3.21	365	81
		Depth Integrated			152	60
106°40'1	425 ~~510~~	28.3	1.0	5.45	98	25
2			7.1	4.96	107	32
3			14.2	4.75	137	45
4			21.3	3.35	174	56
5			27.3	3.43	483	84
		Depth Integrated			155	52
105°30'1	558 ~~640~~	24.6	1.0	5.08	92	22
2			6.2	4.96	101	28
3			12.3	4.16	121	40
4			18.4	3.98	157	52
5			23.6	3.72	245	71
		Depth Integrated			130	39

"UNPUBLISHED RECORDS SUBJECT TO REVISION"

UNITED STATES GEOLOGICAL SURVEY
WATER RESOURCES DIVISION

SACRAMENTO RIVER near HOOD, CA., at CROSS SECTION # 2 Marsh McBirney Meter

DATA GATHERED AT: DATE March 26, 1980 TIME 1050-1245

SECTION STATION (FEET)	TIME	TOTAL DEPTH (FEET)	AZIMUTH	SAMPLING DEPTH (FEET)	VELOCITY (FEET/SEC)	CONCENTRATION MG/LITRE	% >.062 MM
175	1050	31.0	195 15	29.6	1.57	No Sediment Samples	
			200 20	28.6	1.96		
			195 15	27.6	1.75		
			189 9	26.6	1.72		
			191 11	25.6	1.64		
			191 11	24.6	1.72		
			190 10	20.0	1.97		
			187 7	15.0	2.12		
			185 5	10.0	2.32		
			182 2	5.0	2.48		
	1130		180 0	1.0	2.54		
295	1155	24.9	188 8	23.4	1.83		
			188 8	23.0	1.79		
			188 8	22.0	1.92		
			186 6	21.0	1.93		
			187 7	20.0	2.19		
			186 6	19.0	2.07		
			186 6	17.0	2.24		
			186 6	15.0	2.26		
			184 4	10.0	2.51		
			181 1	5.0	2.67		
	1245			1.0	2.70		

"UNPUBLISHED RECORDS SUBJECT TO REVISION"

32600

UNITED STATES GEOLOGICAL SURVEY
WATER RESOURCES DIVISION

11.5

SACRAMENTO RIVER near HOOD, CA., at CROSS SECTION # 2 Marsh McBirney Meter

DATA GATHERED AT: DATE March 26, 1980 TIME 1250-1440

SECTION STATION (FEET)	TIME	TOTAL DEPTH (FEET)	AZIMUTH	SAMPLING DEPTH (FEET)	VELOCITY (FEET/SEC)	CONCENTRATION MG/LITRE	% >.062 MM
405	1250	22.4	188	21.0	1.74	No Sediment Samples	
			186	20.0	1.93		
			187	19.0	2.10		
			188	18.0	2.25		
			187	17.0	2.20		
			182	15.0	2.37		
			185	10.0	2.54		
			184	5.0	2.66		
	1325			1.0	2.72		
510	1335	20.0	188	18.6	1.77		
			187	18.0	1.99		
			187	17.0	2.02		
			185	16.0	2.22		
			186	15.0	2.22		
			184	14.0	2.40		
			184	10.0	2.57		
			183	5.0	2.72		
	1410		179 359	1.0	2.72		
595	1415	17.4	186	16.0	1.91		
			188	15.0	2.10		
			7	14.0	2.12		
			187	13.0	2.24		
			183	10.0	2.30		
			180	5.0	2.46		
	1440			1.0	2.59		

"UNPUBLISHED RECORDS SUBJECT TO REVISION"

25,200

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UNITED STATES GEOLOGICAL SURVEY
WATER RESOURCES DIVISION

SACRAMENTO RIVER near HOOD, CA., at CROSS SECTION # 2 Marsh McBirney Meter

DATA GATHERED AT: DATE June 26, 1980 TIME 0940-1325

	SECTION STATION (FEET)	TIME	TOTAL DEPTH (FEET)	AZIMUTH	SAMPLING DEPTH (FEET)	VELOCITY (FEET/SEC)	CONCENTRATION MG/LITRE)	% >.062 MM
1	174	0940	30.4	183 3	2.0	1.86	41	13
2				183 3	7.6	1.62	44	8
3				185 5	15.2	1.58	49	10
4				191 11	22.8	1.52	42	9
5		1030		193 13	28.9	1.16	42	9
		Depth Integrated					40	
1	279	1035	23.5		2.0	2.13	38	12
2				183 3	5.9	2.06	48	10
3				185 5	11.8	1.86	55	12
4				188 8	17.7	1.60	62	11
5		1125		190 10	22.0	1.30	66	21
		Depth Integrated					52	
1	367	1130	21.7	1	2.0	2.25	45	12
2				179 358	5.4	2.24	48	18
3				3	10.8	1.99	45	20
4				185 5	17.2	1.64	58	16
5		1215		188 8	20.2	1.28	48	39
		Depth Integrated					44	
1	453	1220	19.6		2.0	2.43	38	11
2				184 4	4.9	2.20	25	33
3				189 9	9.8	2.04	45	17
4				190 10	14.7	1.89	49	13
5		1255		191 11	18.1	1.23	58	16
		Depth Integrated					44	
1	578	1300	15.5	183 3	2.0	2.31	39	12
2				183 3	3.9	2.24	41	15
3				8	7.8	2.28	57	13
4				191 9	11.7	2.06	43	19
5		1325			14.0	1.69	40	25
							44	

"UNPUBLISHED RECORDS SUBJECT TO REVISION"

14.500 UNITED STATES GEOLOGICAL SURVEY 135
WATER RESOURCES DIVISION

SACRAMENTO RIVER near HOOD, CA., at CROSS SECTION # 2 Marsh McBirney Meter

DATA GATHERED AT: DATE Nov. 12, 1980 TIME 1340-1550

	SECTION STATION (FEET)	TIME	TOTAL DEPTH (FEET)	AZIMUTH	SAMPLING DEPTH (FEET)	VELOCITY (FEET/SEC)	CONCENTRATION MG/LITRE	% >.062 MM
1	157 ~~180~~	1340	27.5	171 351	1.0	1.18	No Sediment Samples	
2				172 352	6.8	.94		
3				171 351	13.7	.93		
4				171 351	21.4	.82		
5		1400		132 310	26.0	.64		
1	242 ~~180~~	1405	22.5	164 344	1.0	.87		
2				173 358	5.6	1.34		
3				173 358	11.2	1.16		
4				187 1	16.8	1.00		
5		1430		207 27	21.0	1.03		
1	302 ~~305~~	1440	20.0	175 355	1.0	1.22		
2				176 356	5.0	1.18		
3				175 355	10.0	1.10		
4				175 15	15.0	1.10		
5		1500		175 355	18.5	1.02		
1	345 ~~300~~	1510	17.4	173 353	1.0	1.00		
2				173 353	4.4	1.03		
3				173 353	8.7	.98		
4				175 355	12.0	.93		
5		1530		173 353	15.9	.81		
1	432 ~~430~~	1535	14.0	172 352	1.0	.92		
2				176 356	3.5	.85		
3				173 353	7.0	.85		
4				175 355	10.5	.79		
5		1550		175 355	12.5	.71		

"UNPUBLISHED RECORDS SUBJECT TO REVISION"

12000 12.5

UNITED STATES GEOLOGICAL SURVEY
WATER RESOURCES DIVISION

SACRAMENTO RIVER near HOOD, CA., at CROSS SECTION # 2 Marsh McBirney Meter

DATA GATHERED AT: DATE Nov. 13, 1980 TIME 0945-1220

"UNPUBLISHED RECORDS SUBJECT TO REVISION"

	SECTION STATION (FEET)	TIME	TOTAL DEPTH (FEET)	AZIMUTH	SAMPLING DEPTH (FEET)	VELOCITY (FEET/SEC)	CONCEN TRATION MG/LITRE	% >.062 MM
1	105 ~~55~~	0945	29.5	329 149	1.0	.74	No Sediment Samples	
2				330 150	7.3	.74		
3				358 172	14.7	.58		
4				323 143	22.0	.58		
5		1005		85 155	28.0	.18		
1	357 ~~350~~	1020	24.4	348 168	1.0	1.35		
2				355 175	6.1	1.09		
3				358 178	12.2	.94		
4				352 172	18.3	.85		
5		1040		358 178	22.9	.73		
1	396 ~~350~~	1050	20.8	354 174	1.0	1.83		
2				359 177	5.2	1.78		
3				359 179	10.4	1.61		
4				359 179	15.6	1.37		
5		1110		351 171	19.3	.95		
1	523 ~~550~~	1120	18.2	352 172	1.0	2.34		
2				358 178	4.6	2.22		
3				358 178	9.1	2.09		
4				356 176	13.6	1.95		
5		1140		355 175	16.7	1.55		
1	620 ~~550~~	1200	14.0	360 180	1.0	2.48		
2				360 180	3.5	2.42		
3				360 180	7.0	2.36		
4				360 180	10.5	2.09		
5		1220		360 180	12.5	1.90		

UNITED STATES GEOLOGICAL SURVEY
WATER RESOURCES DIVISION

SACRAMENTO RIVER near HOOD, CA., at CROSS SECTION # 2

DATA GATHERED AT: DATE Nov. 13, 1980 TIME 1305-1500

	SECTION STATION (FEET)	TIME	TOTAL DEPTH (FEET)	AZIMUTH	SAMPLING DEPTH (FEET)	VELOCITY (FEET/SEC)	CONCEN TRATION MG/LITRE	% >.062 MM
1	105 ~~55~~	1305	29.0	175 355	1.0	2.20	No sediment samples	
2				175 355	7.2	1.58		
3	"UNPUBLISHED RECORDS SUBJECT TO REVISION"			175 5	14.5	1.61		
4				175 15	21.7	1.42		
5		1325		181 1	27.5	1.06		
1	367 ~~320~~	1330	23.8	137 317	1.0	2.22		
2				137 317	6.0	2.18		
3				120 360	11.9	2.13		
4				232 42	17.8	1.69		
5		1350		215 35	22.3	1.42		
1	396 ~~350~~	1355	20.0	170 358	1.0	2.53		
2				360	5.1	2.44		
3				180 360	10.2	2.11		
4				8	15.3	1.84		
5		1415		6	18.5	1.64		
1	523 ~~470~~	1420	17.5	173 353	1.0	2.52		
2				179 359	4.4	2.27		
3				179 359	8.8	2.55		
4				201 21	13.1	2.19		
5		1440		10	16.0	1.47		
1	620 ~~550~~	1445	13.0	190 10	1.0	2.35		
2				190 10	3.2	2.42		
3				190 10	6.5	2.44		
4				193 13	9.8	2.24		
5		1500		182 8	11.5	2.07		

UNITED STATES GEOLOGICAL SURVEY
WATER RESOURCES DIVISION

SACRAMENTO RIVER near HOOD, CA., at CROSS SECTION # 2 Marsh McBirney Meter

DATA GATHERED AT: DATE Nov. 14, 1980 TIME 0900-1130

SECTION STATION (FEET)	TIME	TOTAL DEPTH (FEET)	AZIMUTH	SAMPLING DEPTH (FEET)	VELOCITY (FEET/SEC)	CONCEN TRATION MG/LITRE	% >.062 MM
1 143 ~~90~~	0900	30.0	315 135	1.0	.04	No sediment samples	
2			330 150	7.5	.10		
3 "UNPUBLISHED RECORDS SUBJECT TO REVISION"			318 135	15.0	.04		
4			356 176	22.5	.07		
5	0920		353 173	28.5	.08		
227							
1 ~~180~~	0955	25.2	351 171	1.0	.24		
2			355 175	6.3	.16		
3			360 180	12.6	.13		
4			360 180	18.9	.09		
5	1015		360 180	23.7	.08		
353 ~~310~~							
1	1025	20.0	319 139	1.0	.10		
2			327 147	5.0	.12		
3			326 146	10.0	.11		
4			327 147	15.0	.13		
5	1040		328 148	18.5	.09		
446 ~~390~~							
1	1050	18.2	325 145	1.0	.17		
2			343 173	4.5	.21		
3			342 172	9.1	.17		
4			345 175	13.6	.14		
5	1105		342	16.7	.12		
571 ~~510~~							
1	1115	14.0	325 145	1.0	.22		
2			339 159	3.5	.24		
3			326 146	7.0	.21		
4			338 158	10.5	.19		
5	1130		348 168	12.5	.15		

UNITED STATES GEOLOGICAL SURVEY
WATER RESOURCES DIVISION

SACRAMENTO RIVER near HOOD, CA., at CROSS SECTION # 2 Marsh McBirney Meter

DATA GATHERED AT: DATE Nov. 14, 1980 TIME 1145-1340

	SECTION STATION (FEET)	TIME	TOTAL DEPTH (FEET)	AZIMUTH	SAMPLING DEPTH (FEET)	VELOCITY (FEET/SEC)	CONCEN TRATION MG/LITRE	% >.062 MM
1	~~80~~ 143	1145	30.2	315 135	1.0	.44	No sediment samples	
2				0 130	7.5	.61		
3				0 130	15.1	.59		
4				6 130	22.6	.47		
5		1200		349 169	28.7	.38		
1	~~180~~ 227	1205	24.5	354 174	1.0	.82		
2				354 174	6.1	.74		
3				353 173	12.2	.61		
4				353 173	18.3	.56		
5		1225		356 176	23.0	.52		
1	~~310~~ 353	1230	21.0	351 171	1.0	1.16		
2				358 178	5.2	1.05		
3				358 178	10.5	.97		
4				357 177	15.7	.88		
5		1250		352 172	19.5	.63		
1	~~400~~ 446	1255	18.5	358 178	1.0	1.27		
2				359 179	4.6	1.20		
3				359 179	9.2	1.14		
4				0 130	13.8	1.02		
5		1315		353 173	17.0	.89		
1	~~510~~ 571	1320	14.0	0 130	1.0	1.31		
2				10 0	3.5	1.26		
3				10 0	7.0	1.21		
4				121 1	10.5	1.13		
5		1340		121 1	12.5	.95		

"UNPUBLISHED RECORDS SUBJECT TO REVISION"

UNITED STATES GEOLOGICAL SURVEY
WATER RESOURCES DIVISION

SACRAMENTO RIVER near HOOD, CA., at CROSS SECTION # 2 Marsh McBirney Meter

DATA GATHERED AT: DATE Nov. 14, 1980 TIME 1350-1550

	SECTION STATION (FEET)	TIME	TOTAL DEPTH (FEET)	AZIMUTH	SAMPLING DEPTH (FEET)	VELOCITY (FEET/SEC)	CONCEN TRATION MG/LITRE)	% >.062 MM
1	~~90~~ 143	1350	29.0	43 223	1.0	1.00	No sediment samples	
2				31 211	7.2	.92		
3				356 176	14.5	.97		
4				358 178	21.7	.91		
5		1410		359 179	27.5	.66		
	227							
1	~~180~~	1415	24.5	359 179	1.0	1.17		
2				3 183	6.1	1.20		
3				5 185	12.2	1.17		
4				7 187	18.5	1.02		
5		1435		358 178	23.0	.77		
	353							
1	~~310~~	1450	19.5	333 153	1.0	1.21		
2				354 174	4.8	1.35		
3				359 179	9.7	1.32		
4				0 180	14.5	1.17		
5		1505		5 185	17.0	1.03		
	446							
1	~~400~~	1510	17.5	358 178	1.0	1.25		
2				360 180	4.3	1.43		
3				359 179	8.7	1.34		
4				8 188	13.0	1.31		
5		1530		185	15.0	1.21		
	571							
1	~~510~~	1535	14.0	360	1.0	1.42		
2				360 180	3.5	1.35		
3				360 180	7.0	1.41		
4				360 180	10.5	1.25		
5		1550		330 150	12.5	1.20		

"UNPUBLISHED RECORDS SUBJECT TO REVISION"

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SACRAMENTO RIVER near HOOD, CA., at CROSS SECTION # 2 Marsh McBirney Meter

DATA GATHERED AT: DATE April 29, 1981 TIME 1030-1305

	SECTION STATION (FEET)	TIME	TOTAL DEPTH (FEET)	AZIMUTH	SAMPLING DEPTH (FEET)	VELOCITY (FEET/SEC)	CONCEN TRATION MG/LITRE	% >.062 MM
1	189 ~~190~~	1030	23.0	0	2.0	.60	16	4
2			190	0	5.8	.52	23	5
3			191	0	11.5	.40	25	3
4			190	0	16.3	.35	26	4
5		1040	190	0	21.6	.00	31	7
					Depth Integrated		23	6
1	297 ~~250~~	1105	21.4	191 11	2.0	.79	13	2
2			190	0	5.4	.82	15	5
3			199	18	10.7	.68	18	6
4			199	19	16.1	.38	19	3
5		1115	192	12	20.0	.50	21	2
					Depth Integrated		17	6
1	360 ~~300~~	1145	20.3	202 22	2.0	.81	10	1
2			199	19	5.1	.83	12	2
3			243	63	10.2	.85	14	7
4			262	82	15.3	.41	14	1
5		1155	267	87	18.9	.64	14	1
					Depth Integrated		13	4
1	491 ~~510~~	1220	18.5	250 70	2.0	.76	10	8
2			249	69	4.6	.65	11	3
3			249	69	9.3	.52	12	1
4			306	126	13.9	.70	13	5
5		1230	312	132	17.1	.55	13	4
					Depth Integrated		11	2
1	558 ~~540~~	1255	17.0	174 354	2.0	.59	8	7
2			190	10	4.2	.53	10	6
3			190	0	8.5	.42	11	3
4			292	102	12.7	.44	12	5
5		1305	213	33	15.6	.49	12	6
					Depth Integrated		11	5

"UNPUBLISHED RECORDS SUBJECT TO REVISION"

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UNITED STATES GEOLOGICAL SURVEY
WATER RESOURCES DIVISION

SACRAMENTO RIVER near HOOD, CA., at CROSS SECTION # 2 Marsh McBirney Meter

DATA GATHERED AT: DATE April 29, 1981 TIME 1345-1510

	SECTION STATION (FEET)	TIME	TOTAL DEPTH (FEET)	AZIMUTH	SAMPLING DEPTH (FEET)	VELOCITY (FEET/SEC)	CONCEN TRATION MG/LITRE	% >.062 MM
1	189 ~~150~~	1345	24.4	187 7	2.0	.65		No sediment samples
2				190 10	6.1	.58		
3				190 10	12.2	.55		
4				191 11	18.3	.40		
5		1400		215 35	23.0	.25		
	237							
1	~~250~~	1405	23.4	215 53	2.0	.74		
2				201 21	5.8	.64		
3				195 5	11.7	.62		
4				197 17	17.5	.34		
5		1415		223 43	22.0	.43		
	360							
1	~~380~~	1425	21.0	180 360	2.0	.94		
2				203 23	5.2	1.02		
3				199 8	10.5	.64		
4				199 8	15.7	.58		
5		1435		199 18	19.6	.33		
	481							
1	~~510~~	1440	19.0	197 7	2.0	1.32		
2				187 7	4.8	1.25		
3				190 0	9.5	1.04		
4				249 69	14.3	.86		
5		1450		211 31	17.6	.75		
	558							
1	~~640~~	1500	17.3	51 239	2.0	1.28		
2				60 240	4.3	.39		
3				101 281	8.6	1.21		
4				180 0	12.9	.31		
5		1510		187 9	15.9	.76		

"UNPUBLISHED RECORDS SUBJECT TO REVISION"

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UNITED STATES GEOLOGICAL SURVEY
WATER RESOURCES DIVISION

SACRAMENTO RIVER near HOOD, CA., at CROSS SECTION # 2

DATA GATHERED AT: DATE September 17, 1981 TIME 0840-1100

	SECTION STATION (FEET)	TOTAL DEPTH (FEET)	Azimuth	SAMPLING DEPTH (FEET)	VELOCITY (FEET/SEC)	CONCEN TRATION MG/LITRE)	% >.062 MM
1	143	30.3	175 355	2.0	.89	11	2
2			175 350	7.6	.93	14	11
3			84 4	15.2	.69	18	7
4			4	22.8	.62	34	57
5			5	28.8	.54	18	9
		Depth Integrated				22	4
1	235	24.2	3	2.0	1.35	11	4
2			5	6.0	1.32	8	6
3			187 7	12.1	1.23	16	5
4			182 2	18.1	1.11	19	22
5			190 10	22.7	.93	22	6
		Depth Integrated				16	6
1	324	20.3	2	2.0	1.58	12	2
2			2	5.1	1.62	16	4
3			2	10.2	1.51	6	0
4			7	15.3	1.32	16	3
5			5	18.8	.93	24	0
		Depth Integrated				14	0
1	410	18.7	2	2.0	1.76	14	1
2			2	4.7	1.70	16	0
3			182 2	9.4	1.58	17	1
4			7	14.1	1.35	19	4
5			7	17.2	1.07	23	4
		Depth Integrated				19	5
1	579	15.4	187 7	2.0	1.76	18	7
2			187 7	3.8	1.80	19	6
3			7	7.7	1.65	17	4
4			7	11.5	1.54	24	5
5			187 7	13.9	1.20	27	3
		Depth Integrated				30	11

"UNPUBLISHED RECORDS SUBJECT TO REVISION"

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WATER RESOURCES DIVISION

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SACRAMENTO RIVER near HOOD, CA., at CROSS SECTION # 3

DATA GATHERED AT: DATE Nov. 22, 1978 TIME 0950-1320

	SECTION STATION (FEET)	TOTAL DEPTH (FEET)	SAMPLING DEPTH (FEET)	VELOCITY (FEET/SEC)	CONCENTRATION MG/LITRE)	% >.062 MM
1	114 ~~40~~	20.8	1.0	1.11	14	3
2			5.2	1.13	14	4
3			10.4	1.08	17	4
4			15.6	.95	19	9
5			19.8	.76	20	8
1	245 ~~200~~	22.6	1.0	.95	14	2
2			5.6	.93	16	2
3			11.3	.89	12	6
4			16.9	.78	18	1
5			21.6	.38	20	3
1	372 ~~300~~	23.7	1.0	.75	13	3
2			5.9	.72	14	9
3			11.8	.73	16	4
4			17.7	.65	15	3
5			22.7	.48	15	5
1	403 ~~400~~	24.6	1.0	.82	13	4
2			6.2	.80	10	4
3			12.3	.73	18	4
4			18.5	.80	17	6
5			23.6	.65	17	7
1	501 ~~500~~	26.6	1.0	.76	15	4
2			6.7	.73	15	0
3			13.3	.57	18	1
4			20.0	.70	16	3
5			25.6	.40	19	3

"UNPUBLISHED RECORDS SUBJECT TO REVISION"

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UNITED STATES GEOLOGICAL SURVEY
WATER RESOURCES DIVISION

9.5

SACRAMENTO RIVER near HOOD, CA., at CROSS SECTION # 3

DATA GATHERED AT: DATE Feb. 22, 1979 TIME 1305-1445

	SECTION STATION (FEET)	TOTAL DEPTH (FEET)	SAMPLING DEPTH (FEET)	VELOCITY (FEET/SEC)	CONCEN TRATION MG/LITRE)	% >.062 MM
1	194 ~~79~~	27.0	1.0	3.57	179	16
2			6.8	3.65	211	25
3			13.5	3.50	210	28
4			20.3	3.13	232	32
5			26.0	2.68	294	43
1	311 ~~210~~	26.0	1.0	4.07	186	19
2			6.5	3.89	216	25
3			13.0	3.35	232	31
4			19.5	3.35	245	34
5			25.0	3.13	283	40
1	414 ~~309~~	29.0	1.0	4.16	157	11
2			7.2	4.16	213	29
3			14.5	4.16	253	33
4			21.7	3.72	284	47
5			28.0	3.20	178	19
1	479 ~~380~~	31.4	1.0	4.16	269	17
2			7.8	4.16	219	29
3			15.7	4.07	253	34
4			23.5	3.21	329	46
5			30.4	2.10	421	55
1	524 ~~420~~	34.0	1.0	3.35	194	22
2			8.5	3.35	213	25
3			17.0	2.92	244	35
4			25.5	2.74	294	38
5			33.0	1.65	350	[illegible]

"UNPUBLISHED RECORDS SUBJECT TO REVISION"

220

UNITED STATES GEOLOGICAL SURVEY
WATER RESOURCES DIVISION

UNPUBLISHED RECORDS
SUBJECT TO REVISION

SACRAMENTO RIVER near HOOD, CA., at CROSS SECTION # 3

DATA GATHERED AT: DATE Sept. 6, 1979 TIME 0910-1100

	SECTION STATION (FEET)	TOTAL DEPTH (FEET)	SAMPLING DEPTH (FEET)	VELOCITY (FEET/SEC)	CONCEN TRATION MG/LITRE)	% >.062 MM
1	83	20.4	1.0	1.76	22	6
2			5.1	1.68	27	6
3			10.2	1.51	34	7
4			15.3	1.41	35	7
5			19.4	1.38	43	6
1	204	20.4	1.0	1.96	27	6
2			5.1	1.92	31	5
3			10.2	1.96	30	4
4			15.3	1.54	35	7
5			19.4	1.14	41	8
1	341	23.0	1.0	2.25	28	2
2			5.7	2.20	31	4
3			11.5	1.80	37	5
4			17.3	1.63	39	4
5			22.0	1.14	48	7
1	424	24.0	1.0	2.10	28	6
2			6.0	2.10	40	12
3			12.0	1.68	42	5
4			18.0	1.68	50	4
5			23.0	1.41	63	5
1	490	25.0	1.0	2.00	31	8
2			6.2	1.92	36	5
3			12.5	1.65	47	10
4			18.8	1.76	54	10
5			24.0	1.20	62	8

"UNPUBLISHED RECORDS
SUBJECT TO REVISION"

UNPUBLISHED RECORDS
SUBJECT TO REVISION

UNITED STATES GEOLOGICAL SURVEY
WATER RESOURCES DIVISION

22.5

UNPUBLISHED RECORDS
SUBJECT TO REVISION

SACRAMENTO RIVER near HOOD, CA., at CROSS SECTION # 3

DATA GATHERED AT: DATE Sept. 6, 1979 TIME 1135-1255

SECTION STATION (FEET)		TOTAL DEPTH (FEET)	SAMPLING DEPTH (FEET)	VELOCITY (FEET/SEC)	CONCENTRATION MG/LITRE)	% >.062 MM
1	83	19.8	1.0	1.76	33	18
2			4.9	1.84	34	5
3			9.9	1.68	39	7
4			14.9	1.62	49	8
5			18.8	1.08	68	10
1	204	19.9	1.0	2.20	32	11
2			4.9	1.96	45	15
3			10.0	1.84	50	8
4			14.9	1.68	50	17
5			18.9	1.44	64	8
1	341	22.0	1.0	2.15	35	13
2			5.5	2.25	43	9
3			11.0	2.20	49	14
4			16.5	1.65	59	13
5			21.0	1.70	67	11
1	424	23.0	1.0	2.25	32	29
2			5.7	2.20	47	32
3			11.5	1.68	57	3
4			17.3	1.68	69	17
5			22.0	1.38	90	17
1	490	24.6	1.0	2.10	32	11
2			6.2	2.10	42	16
3			12.3	1.68	48	10
4			18.4	1.54	63	16
5			23.6	1.32	95	13

"UNPUBLISHED RECORDS
SUBJECT TO REVISION"

UNPUBLISHED RECORDS
SUBJECT TO REVISION

UNITED STATES GEOLOGICAL SURVEY
WATER RESOURCES DIVISION

22.5

UNPUBLISHED RECORDS SUBJECT TO REVISION

42 393

SACRAMENTO RIVER near HOOD, CA., at CROSS SECTION # 3

DATA GATHERED AT: DATE Sept. 6, 1979 TIME 1300-1410

	SECTION STATION (FEET)	TOTAL DEPTH (FEET)	SAMPLING DEPTH (FEET)	VELOCITY (FEET/SEC)	CONCENTRATION MG/LITRE)	% >.062 MM
1	[redacted] 83	19.0	1.0	2.10	14	20
2	[redacted]		4.7	1.92	22	10
3			9.5	1.84	36	28
4	"UNPUBLISHED RECORDS SUBJECT TO REVISION"		14.3	1.65	47	23
5			18.0	1.58	66	13
1	[redacted] 204	19.4	1.0	2.51	36	17
2	[redacted]		4.8	2.00	50	8
3			9.7	1.96	41	16
4			14.6	1.68	55	10
5			18.4	1.23	62	25
1	[redacted] 341	21.4	1.0	2.25	28	23
2	[redacted]		5.3	2.05	45	12
3			10.7	2.10	53	13
4			16.1	1.65	66	5
5			20.4	1.41	81	12
1	[redacted] 424	22.4	1.0	2.25	31	11
2	[redacted]		5.6	2.00	48	9
3			11.2	1.92	61	18
4			16.8	1.65	79	10
5			21.4	1.38	99	13
1	[redacted] 490	24.6	1.0	1.92	29	12
2	[redacted]		6.2	2.00	40	14
3			12.3	1.92	47	9
4			18.4	1.68	69	14
5			23.6	1.35	91	30

UNPUBLISHED RECORDS

72,600

35300

11.5

UNITED STATES GEOLOGICAL SURVEY
WATER RESOURCES DIVISION

SACRAMENTO RIVER near HOOD, CA., at CROSS SECTION # 3

DATA GATHERED AT: DATE 2-29-80 TIME 1300 to 1420

LB	SECTION STATION (FEET)	TOTAL DEPTH (FEET)	SAMPLING DEPTH (FEET)	VELOCITY (FEET/SEC)	CONCEN TRATION MG/LITRE)	% >.062 MM
1	185 ~~70~~	30.2	1.0	4.55	96	23
2			7.6	4.37	100	29
3			15.1	3.89	111	34
4			22.7	3.35	123	39
5			29.2	2.25	166	54
		Depth Integrated			98	32
1	297 ~~190~~	30.0	1.0	5.20	89	20
2			7.5	4.65	127	32
3			15.0	4.48	150	45
4			22.5	3.21	181	58
5			29.0	1.96	451	83
		Depth Integrated			150	49
1	372 ~~300~~	33.2	1.0	4.96	94	24
2			8.3	4.48	122	41
3			16.6	4.55	151	51
4			24.9	3.65	248	70
5			32.2	2.25	417	84
		Depth Integrated			159	53
1	428 ~~430~~	35.6	1.0	4.96	89	22
2			8.9	4.48	117	38
3			17.8	4.48	120	39
4			26.7	2.99	226	66
5			34.6	2.68	386	80
		Depth Integrated			189	60
1	479 ~~530~~	36.0	1.0	4.55	88	20
2			9.0	4.37	113	36
3			18.0	3.89	139	49
4			27.0	3.35	202	57
5			35.0	2.25	403	81

"UNPUBLISHED RECORDS SUBJECT TO REVISION"

24600
3060

UNITED STATES GEOLOGICAL SURVEY
WATER RESOURCES DIVISION

19.0

SACRAMENTO RIVER near HOOD, CA., at CROSS SECTION # 3 Marsh McBirney Meter

DATA GATHERED AT: DATE June 25, 1980 TIME 1020-1340

	SECTION STATION (FEET)	TIME	TOTAL DEPTH (FEET)	AZIMUTH	SAMPLING DEPTH (FEET)	VELOCITY (FEET/SEC)	CONCENTRATION MG/LITRE	% > .062 MM
1	~~70~~ 120	1020	15.5	14	1.5	1.99	29	6
2				14	3.9	1.99	35	9
3				14	7.8	1.96	38	9
4				14	11.7	2.01	42	17
5		1100		15	14.0	1.31	46	
		Depth Integrated					37	
1	~~130~~ 201	1105	19.0	16	1.5	2.44	36	36
2				16	4.8	2.14	37	10
3				15	9.5	2.23	43	8
4				16	14.3	2.06	46	8
5		1145		17	17.5	1.74	50	9
		Depth Integrated					39	
1	~~300~~ 344	1150	22.0	14	1.5	2.27	46	10
2				12	5.5	2.26	46	8
3				12	11.0	2.13	52	8
4				14	16.5	1.92	63	12
5		1220		16	19.5	1.91	62	15
		Depth Integrated					49	
1	~~420~~ 479	1225	23.5	16	2.0	2.26	33	13
2				16	5.9	2.14	38	10
3				16	11.8	2.07	45	10
4				12	17.7	1.96	53	10
5		1305		21	22.0	1.56	62	14
		Depth Integrated					49	
1	~~530~~ 509	1310	23.5	15	2.0	1.99	43	14
2				16	5.9	1.88	46	16
3				16	11.8	1.85	51	19
4				18	17.7	1.68	53	8
5		1340		16	22.0	1.43	60	13
		Depth Integrated					51	

"UNPUBLISHED RECORDS SUBJECT TO REVISION"

UNITED STATES GEOLOGICAL SURVEY
WATER RESOURCES DIVISION

SACRAMENTO RIVER near HOOD, CA., at CROSS SECTION # 3 Marsh McBirney Meter

DATA GATHERED AT: DATE April 30, 1981 TIME 1130-1420

	SECTION STATION (FEET)	TIME	TOTAL DEPTH (FEET)	ACCUM.	SAMPLING DEPTH (FEET)	VELOCITY (FEET/SEC)	CONCENTRATION MG/LITRE	% >.062 MM
1	102	1130	19.4	118	2.0	1.18	18	6
2				132	4.9	1.18	19	4
3				131	9.7	1.09	21	7
4				136	14.6	1.00	22	5
5		1210		140	18.0	.93	20	4
		Depth Integrated					22	11
1	236	1225	19.5	168	2.0	.83	14	9
2				167	4.9	.92	13	10
3				170	9.8	.31	14	5
4				166	14.7	.62	20	-
5		1250		191	18.1	.58	19	9
		Depth Integrated					17	12
1	307	1300	22.0	199	2.0	.69	14	9
2				200	5.2	.68	14	6
3				200	10.3	.49	15	13
4				235	15.5	.51	18	9
5		1325		231	20.6	.35	20	10
		Depth Integrated					18	10
1	410	1335	24.2	21	2.0	.29	12	12
2				185	6.2	.44	13	22
3				245	12.4	.37	16	9
4				95	18.6	.31	19	9
5		1400		150	22.3	.25	17	8
		Depth Integrated					15	8
1	532	1410	25.8	57	2.0	.33	11	12
2				198	6.5	.26	13	8
3				272	12.9	.15	16	21
4				36	19.4	.23	16	8
5		1420		65	24.4	.18	17	9

"UNPUBLISHED RECORDS SUBJECT TO REVISION"

UNITED STATES GEOLOGICAL SURVEY
WATER RESOURCES DIVISION

SACRAMENTO RIVER near HOOD, CA., at CROSS SECTION # 3 Marsh McBirney Meter

DATA GATHERED AT: DATE April 30, 1981 TIME 1450-1615

	SECTION STATION (FEET)	TIME	TOTAL DEPTH (FEET)	AZIMUTH	SAMPLING DEPTH (FEET)	VELOCITY (FEET/SEC)	CONCENTRATION MG/LITRE)	% > .062 MM
1	~~50~~ 102	1450	19.9	17	2.0	.44	No Sediment Samples	
2				79	5.0	.37		
3				219	10.0	.39		
4				202	15.0	.27		
5		1505		201	18.5	.37		
1	~~100~~ 236	1510	20.4	23	2.0	.57		
2				120	5.1	.62		
3				139	10.2	.51		
4				196	15.3	.50		
5		1520		178	19.0	.37		
1	~~300~~ 307	1525	23.0	135	2.0	.54		
2				163	5.8	.59		
3				132	11.5	.65		
4			255	75	17.3	.57		
5		1540	220	40	21.6	.40		
1	~~400~~ 410	1545	26.2	42	2.0	.77		
2				88	6.6	.85		
3				139	13.1	.71		
4				143	19.7	.68		
5		1555		22	24.5	.30		
1	~~500~~ 532	1605	25.6	139	2.0	.39		
2				80	6.4	.94		
3			274	94	12.8	.96		
4				98	19.2	.74		
5		1615		98	24.2	.64		

"UNPUBLISHED RECORDS SUBJECT TO REVISION"

17500

UNITED STATES GEOLOGICAL SURVEY
WATER RESOURCES DIVISION

22.5

SACRAMENTO RIVER near HOOD, CA., at CROSS SECTION # 3

DATA GATHERED AT: DATE Sept. 16, 1981 TIME 1215-1355

	SECTION STATION (FEET)	TOTAL DEPTH (FEET)	AZIMUTH	SAMPLING DEPTH (FEET)	VELOCITY (FEET/SEC)	CONCEN TRATION MG/LITRE)	% >.062 MM
1	220	19.2	22	2.0	1.70	21	1
2			22	4.8	1.58	27	3
3			22	9.6	1.62	29	7
4			22	14.4	1.38	34	6
5			22	17.7	1.18	42	5
		Depth Integrated				30	7
1	311	19.5	20	2.0	1.88	22	3
2			21	4.9	1.88	23	1
3			21	9.8	1.84	28	2
4			20	14.7	1.58	29	2
5			20	18.0	1.11	25	2
		Depth Integrated				29	4
1	414	20.0	20	2.0	2.05	26	7
2			21	5.0	1.92	36	5
3			20	10.0	1.88	35	4
4			21	15.0	1.54	44	1
5			22	18.5	1.23	42	4
		Depth Integrated				31	4
1	479	21.8	20	2.0	2.00	23	7
2			20	5.4	1.96	26	6
3			21	10.9	1.88	42	4
4			20	16.3	1.76	66	6
5			20	20.3	1.26	98	5
		Depth Integrated				35	7
1	548	24.0	22	2.0	1.76	28	7
2			18	6.0	1.84	31	5
3			15	12.0	1.65	44	5
4			15	18.0	1.54	63	6
5			15	22.5	1.21	94	22
		Depth Integrated				47	6

"UNPUBLISHED RECORDS SUBJECT TO REVISION"

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UNITED STATES GEOLOGICAL SURVEY
WATER RESOURCES DIVISION

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SACRAMENTO RIVER near HOOD, CA., at CROSS SECTION # 4

DATA GATHERED AT: DATE May 21, 1978 TIME 1200-1312

	SECTION STATION (FEET)	TOTAL DEPTH (FEET)	SAMPLING DEPTH (FEET)	VELOCITY (FEET/SEC)	CONCEN TRATION MG/LITRE)	% >.062 MM
1	126	20.9	1.0	1.65	10	3
2			5.4	1.57	11	3
3			10.5	1.38	14	5
4			15.9	1.23	13	7
5			19.9	.70	17	16
1	237	21.8	1.0	1.38	15	11
2			5.4	1.50	12	13
3			10.9	1.35	14	14
4			16.3	1.21	16	7
5			20.8	.93	16	8
1	426	24.3	1.0	1.23	17	5
2			6.2	1.23	12	12
3			12.4	1.28	14	11
4			18.7	.93	14	10
5			23.8	.75	15	8
1	557	26.0	1.0	1.13	8	7
2			6.2	1.06	12	3
3			12.5	.95	9	10
4			18.8	.78	12	9
5			25.0	.60	16	16
1						
2						
3						
4						
5						

"UNPUBLISHED RECORDS SUBJECT TO REVISION"

30400
4880

UNITED STATES GEOLOGICAL SURVEY
WATER RESOURCES DIVISION

13.0

SACRAMENTO RIVER near HOOD, CA., at CROSS SECTION # 4

DATA GATHERED AT: DATE March 19, 1979 TIME 1200-1330

	SECTION STATION (FEET)	TOTAL DEPTH (FEET)	SAMPLING DEPTH (FEET)	VELOCITY (FEET/SEC)	CONCEN TRATION MG/LITRE)	% >.062 MM
1	133	22.0	1.0	2.74	46	10
2			5.5	2.80	44	7
3			11.0	2.61	53	8
4			16.5	2.15	62	9
5			21.0	1.58	64	10
1	246	22.6	1.0	2.80	51	8
2			6.6	2.80	54	13
3			11.3	2.80	56	12
4			17.9	2.39	60	12
5			21.6	2.20	60	16
1	312	24.4	1.0	2.74	52	8
2			6.1	2.80	60	11
3			12.2	2.68	64	12
4			18.3	2.39	75	15
5			23.4	2.20	72	38
1	407	26.6	1.0	2.74	54	8
2			6.7	2.74	62	15
3			13.3	2.50	65	16
4			20.0	2.25	78	19
5			25.6	1.58	80	22
1	537	27.0	1.0	2.55	43	10
2			6.7	2.61	45	13
3			13.5	2.29	57	19
4			20.2	1.32	65	27
5			26.0	1.11	63	21

"UNPUBLISHED RECORDS SUBJECT TO REVISION"

22.0

UNITED STATES GEOLOGICAL SURVEY
WATER RESOURCES DIVISION

UNPUBLISHED RECORDS
SUBJECT TO REVISION

SACRAMENTO RIVER near HOOD, CA., at CROSS SECTION # 4

DATA GATHERED AT: DATE Sept. 11, 1979 TIME 1000-1140

	SECTION STATION (FEET)	TOTAL DEPTH (FEET)	SAMPLING DEPTH (FEET)	VELOCITY (FEET/SEC)	CONCEN TRATION MG/LITRE)	% >.062 MM
1	139	20.2	1.0	1.14	16	8
2			5.0	1.06	18	14
3			10.1	1.14	18	12
4	"UNPUBLISHED RECORDS SUBJECT TO REVISION"		15.2	1.01	20	15
5			19.2	.69	22	7
1	250	22.0	1.0	1.20	14	12
2			5.5	1.23	27	52
3			11.0	1.14	17	15
4			16.5	1.03	23	18
5			21.0	.84	27	14
1	325	23.0	1.0	1.38	12	0
2			5.7	1.26	15	0
3			11.5	1.11	15	2
4			17.3	1.01	18	3
5			22.0	.76	22	7
1	446	24.4	1.0	1.20	15	0
2			6.1	1.18	14	1
3			12.2	1.11	18	7
4			18.3	.99	19	2
5			23.4	.84	23	0
1	570	25.2	1.0	1.41	17	6
2			6.3	1.20	22	2
3			12.6	1.32	20	8
4			18.9	1.14	25	5
5			24.2	.76	26	29

UNPUBLISHED RECORDS

UNITED STATES GEOLOGICAL SURVEY
WATER RESOURCES DIVISION

UNPUBLISHED RECORDS SUBJECT TO REVISION

22.0

SACRAMENTO RIVER near HOOD, CA., at CROSS SECTION # 4

DATA GATHERED AT: DATE Sept. 11, 1979 TIME 1200-1320

	SECTION STATION (FEET)	TOTAL DEPTH (FEET)	SAMPLING DEPTH (FEET)	VELOCITY (FEET/SEC)	CONCENTRATION MG/LITRE)	% >.062 MM
1	[redacted] 139	20.0	1.0	1.58	14	0
2	[redacted]		5.0	1.54	17	1
3			10.0	1.38	22	1
4	"UNPUBLISHED RECORDS SUBJECT TO REVISION"		15.0	1.14	22	6
5			19.0	1.11	22	11
1	[redacted] 250	21.4	1.0	1.84	18	0
2	[redacted]		5.3	1.68	21	0
3			10.7	1.65	22	9
4			16.1	1.62	28	20
5			20.4	1.11	23	11
1	[redacted] 325	21.3	1.0	1.76	22	6
2	[redacted]		5.4	1.68	25	0
3			10.9	1.51	26	10
4			16.4	1.30	29	3
5			20.8	1.23	34	10
1	[redacted] 446	23.5	1.0	1.84	25	4
2	[redacted]		5.9	1.84	33	14
3			11.8	1.58	34	25
4			17.7	1.58	40	12
5			22.6	1.03	46	3
1	[redacted] 570	24.6	1.0	1.38	21	11
2	[redacted]		6.2	1.34	28	16
3			12.3	1.84	31	7
4			18.4	1.51	36	10
5			23.6	1.11	34	7

UNPUBLISHED RECORDS SUBJECT TO REVISION

UNITED STATES GEOLOGICAL SURVEY
WATER RESOURCES DIVISION

UNPUBLISHED RECORDS SUBJECT TO REVISION 22.5

SACRAMENTO RIVER near HOOD, CA., at CROSS SECTION # 4

DATA GATHERED AT: DATE Sept. 11, 1979 TIME 1340-1500

	SECTION STATION (FEET)	TOTAL DEPTH (FEET)	SAMPLING DEPTH (FEET)	VELOCITY (FEET/SEC)	CONCENTRATION MG/LITRE)	% >.062 MM
1	[redacted] 139	19.8	1.0	1.96	19	23
2	[redacted]		5.0	1.92	22	7
3			9.9	1.76	27	11
4	UNPUBLISHED RECORDS SUBJECT TO REVISION		14.9	1.65	32	17
5			18.8	1.32	31	11
1	[redacted] 250	20.6	1.0	2.05	21	10
2	[redacted]		5.2	2.05	28	26
3			10.3	1.92	29	11
4			15.4	1.80	28	9
5			19.6	1.41	39	14
1	[redacted] 325	21.2	1.0	1.88	26	10
2	[redacted]		5.3	1.92	33	19
3			10.6	1.92	34	6
4			15.9	1.80	33	21
5			20.2	1.54	51	22
1	[redacted] 446	23.2	1.0	2.05	27	5
2	[redacted]		5.8	1.92	31	3
3			11.6	1.84	45	10
4			17.4	1.65	48	9
5			22.2	1.29	61	16
1	[redacted] 570	24.2	1.0	2.10	22	9
2	[redacted]		6.0	2.10	31	4
3			12.1	1.88	43	10
4			18.2	1.88	49	11
5			23.2	1.06	57	20

73100

34800

11.0

UNITED STATES GEOLOGICAL SURVEY
WATER RESOURCES DIVISION

SACRAMENTO RIVER near HOOD, CA., at CROSS SECTION # 4

DATA GATHERED AT: DATE 2-29-80 TIME 1000 to 1120

LB		SECTION STATION (FEET)	TOTAL DEPTH (FEET)	SAMPLING DEPTH (FEET)	VELOCITY (FEET/SEC)	CONCENTRATION MG/LITRE)	% >.062 MM
33°30'	1	157	31.1	1.0	4.85	81	34
	2			7.8	4.37	100	27
	3			15.5	4.26	106	28
	4			23.3	4.26	157	55
	5			30.1	2.50	107	35
				Depth Integrated		95	35
31°00'	1	250	32.6	1.0	4.65	82	13
	2			7.9	4.75	104	28
	3			15.8	4.55	117	34
	4			23.7	3.80	142	46
	5			31.6	2.99	678	39
				Depth Integrated		111	34
73°30'	1	331	32.4	1.0	4.96	91	23
	2			8.1	5.20	118	33
	3			16.2	4.46	166	53
	4			24.3	3.72	157	57
	5			31.4	3.72	390	81
				Depth Integrated		147	52
75°30'	1	407	35.2	1.0	5.20	109	15
	2			8.8	5.20	126	35
	3			17.6	4.07	159	48
	4			26.4	3.65	336	76
	5			34.3	2.15		
				Depth Integrated		195	64
75°30'	1	465	37.0	1.0	4.96	84	35
	2			9.2	4.96	115	30
	3			18.5	4.26	129	44
	4			27.7	4.07	130	40
	5			36.0	3.21	412	82

UNPUBLISHED RECORDS
SUBJECT TO REVISION

20600
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UNITED STATES GEOLOGICAL SURVEY
WATER RESOURCES DIVISION

19.5

SACRAMENTO RIVER near HOOD, CA., at CROSS SECTION # 4 Marsh McBirney Meter

DATE GATHERED AT: DATE June 24, 1980 TIME 1100-1455

	SECTION STATION (FEET)	TIME	TOTAL DEPTH (FEET)	ADMINUTE	SAMPLING DEPTH (FEET)	VELOCITY (FEET/SEC)	CONCENTRATION MG/LITRE)	% >.062 MM
1	139	1100	21.0	227 47	2.0	2.34	33	8
2				231 51	4.7	2.26	32	20
3				234 54	10.5	1.99	42	12
4				233 53	15.2	1.87	46	12
5		1140		230 50	19.5	1.44	52	22
		Depth Integrated					40	
1	225	1200	21.5	230 50	2.0	2.18	26	10
2				231 51	5.4	2.14	26	
3				232 52	10.8	1.93	26	13
4				230 50	16.2	1.86	58	9
5		1235		230 50	20.0	1.63	58	13
		Depth Integrated					37	
1	350	1240	21.9	228 48	2.0	2.08	41	8
2				228 48	5.5	1.88	51	14
3				228 48	11.0	1.82	54	11
4				228 48	16.5	1.53	64	12
5		1315		228 48	20.4	1.54	69	11
		Depth Integrated					50	
1	439	1320	24.7	229 49	2.0	1.64	29	
2				227 47	6.2	1.72	35	8
3				229 49	12.4	1.56	48	9
4				231 51	18.6	1.40	56	10
5		1405		[illegible] 45	23.2	1.15	36	12
		Depth Integrated					45	
1	530	1410	25.7	229 49	2.0	1.57	16	18
2				233 53	6.4	1.47	19	14
3				233 53	12.8	1.14	28	11
4				235 55	19.2	1.03	33	9
5		1455		236 56	24.2	1.11	45	8

"UNPUBLISHED RECORDS SUBJECT TO REVISION"

UNITED STATES GEOLOGICAL SURVEY
WATER RESOURCES DIVISION

SACRAMENTO RIVER near HOOD, CA., at CROSS SECTION # 4 Marsh McBirney Meter

DATA GATHERED AT: DATE May 1, 1981 TIME 1005-1310

SECTION STATION (FEET)	TIME	TOTAL DEPTH (FEET)	AZIMUTH	SAMPLING DEPTH (FEET)	VELOCITY (FEET/SEC)	OXYGEN CONCENTRATION MG/LITRE	% >.062 MM
126 ~~65~~	1105	19.9	12 280	2.0	1.83	17	13
			12 280	5.0	1.77	15	11
			103 288	10.0	1.58	18	11
			126 306	15.0	1.38	22	12
	1135		13 309	18.5	1.27	24	8
	Depth Integrated					21	9
275 ~~175~~	1145	20.9	97 267	2.0	1.43	17	8
			96 276	5.2	1.59	15	13
			90 270	10.4	1.23	18	8
			122 302	15.6	1.40	22	4
	1200		75 253	19.5	1.44	24	8
	Depth Integrated					20	8
375 ~~275~~	1205	21.4	117 299	2.0	1.25	16	8
			121 301	5.4	1.19	18	10
			11 290	10.8	1.05	20	9
			131 309	16.2	1.35	20	13
	1225		91 271	20.0	1.28	23	9
	Depth Integrated					19	9
465 ~~15~~	1230	23.9	79 279	2.0	.85	13	12
			73 273	6.0	.91	17	12
			97 277	12.0	.76	18	8
			92 272	18.0	.39	19	18
	1250		1[illegible] 238	22.5	.45	21	16
	Depth Integrated					19	10
584 ~~335~~	1255	25.2	74 274	2.0	.63	12	10
			92 278	6.3	.63	13	11
			7[illegible] 278	12.6	.68	15	6
			[illegible] 281	19.3	.75	14	11
	1310		123 303	23.8	.77	17	[illegible]

"UNPUBLISHED RECORDS SUBJECT TO REVISION"

UNITED STATES GEOLOGICAL SURVEY
WATER RESOURCES DIVISION

SACRAMENTO RIVER near HOOD, CA., at CROSS SECTION # 4

DATA GATHERED AT: DATE Sept. 16, 1981 TIME 0855-1115

"UNPUBLISHED RECORDS SUBJECT TO REVISION"

	SECTION STATION (FEET)	TOTAL DEPTH (FEET)	AZIMUTH	SAMPLING DEPTH (FEET)	VELOCITY (FEET/SEC)	CONCENTRATION MG/LITRE)	% >.062 MM
1	X 133	21.0	235 55	2.0	1.51	14	3
2			245 65	5.2	1.47	16	2
3			245 65	10.5	1.44	18	2
4			65	15.7	1.32	18	5
5			232 52	19.5	1.03	22	6
		Depth Integrated				18	8
1	X 200	21.8	52	2.0	1.67	15	5
2			52	5.4	1.67	19	5
3			52	10.9	1.51	23	4
4			52	16.3	1.35	26	6
5			50	20.3	1.11	25	5
		Depth Integrated				27	6
1	X 287	23.5	52	2.0	1.34	20	7
2			52	5.9	1.76	27	6
3			52	11.8	1.65	35	11
4			52	17.7	1.47	30	4
5			52	22.0	1.29	36	6
		Depth Integrated				25	15
1	X 426	25.0	53	2.0	1.80	30	5
2			53	6.2	1.76	35	6
3			52	12.5	1.70	39	6
4			52	18.7	1.62	51	4
5			52	23.5	1.33	69	6
		Depth Integrated				37	5
1	X 542	25.5	55	2.0	1.73	27	6
2			55	6.4	1.80	36	5
3			57	12.8	1.84	35	4
4			55	19.2	1.47	41	6
5			47	24.0	1.26	48	10
		Depth Integrated				32	8

APPENDIX B

Table B.1. Cross-Sectional Area for all Locations.

DATE	SECTION	HOURS	AREA (SQ FT), J					TOTAL
			1	2	3	4	5	
1978 5 18	2	1030 1330	3257.	2832.	2394.	2141.	2072.	12697.
1978 11 21	4	1200 1412	3053.	3270.	3348.	4434.		14105.
1978 11 22	2	1350 1600	4083.	1593.	1663.	1936.	4445.	13721.
1978 11 22	3	950 1320	2488.	2915.	1872.	1587.	5945.	14807.
1978 11 27	1	1223 1509	2601.	1668.	2073.	2302.	4362.	13006.
1979 1 19	1	1205 1329	2945.	2124.	2513.	2556.	4465.	14603.
1979 1 19	2	1355 1527	4779.	4950.	2796.	1327.	2020.	15872.
1979 2 13	1	1245 1450	2677.	1613.	2130.	2178.	4007.	12605.
1979 2 13	2	1005 1215	4978.	2170.	1584.	1458.	3507.	13697.
1979 2 22	2	1015 1235	6855.	4402.	2244.	2088.	2886.	18475.
1979 2 22	3	1305 1445	5338.	2860.	2436.	1727.	5280.	17641.
1979 3 19	2	940 1130	4562.	2309.	2607.	3014.	2627.	15118.
1979 3 19	4	1200 1330	2882.	2023.	1964.	2992.	5036.	14898.
1979 4 13	1	1010 1140	2382.	1378.	1771.	2218.	4836.	12586.
1979 4 13	2	1215 1325	4382.	2075.	1390.	1703.	3089.	12639.
1979 6 5	1	1015 1150	2589.	1482.	2123.	2166.	3750.	12110.
1979 6 5	2	1220 1355	4418.	1906.	1814.	1377.	3413.	12928.
1979 7 17	2	1110 1320	4488.	2453.	1454.	1571.	3809.	13776.
1979 7 17	2	1325 1505	4517.	2553.	1411.	1490.	3736.	13707.
1979 7 18	1	930 1110	2581.	1235.	2496.	2408.	3765.	12485.
1979 7 18	1	1130 1315	2618.	1225.	2662.	2507.	3784.	12797.
1979 8 15	2	1030 1210	4081.	1524.	1928.	2024.	3844.	13401.
1979 8 16	2	830 1000	4224.	1747.	1785.	1709.	3470.	12935.
1979 8 16	2	1000 1115	4217.	1747.	1663.	1747.	3462.	12836.
1979 8 16	2	1130 1310	4275.	1732.	1750.	1766.	3630.	13153.
1979 9 6	3	910 1100	1683.	2632.	2530.	1788.	5540.	14173.
1979 9 6	3	1135 1255	1622.	2567.	2420.	1714.	5490.	13813.
1979 9 6	3	1300 1410	1573.	2503.	2354.	1669.	5489.	13587.
1979 9 11	4	1000 1140	2721.	2046.	2254.	2989.	3908.	13918.
1979 9 11	4	1200 1320	2682.	1990.	2136.	2891.	3849.	13548.
1979 9 11	4	1340 1500	2640.	1916.	2078.	2842.	3816.	13291.
1979 9 12	1	930 1100	3015.	1612.	1245.	1932.	4861.	12665.
1979 9 12	1	1115 1225	3040.	1649.	1196.	1996.	4897.	12778.
1979 9 12	1	1240 1400	2999.	1637.	1254.	2013.	5055.	12958.
1980 2 28	1	1400 1540	4504.	3132.	2242.	1940.	6370.	18188.
1980 2 28	2	1055 1235	6026.	3061.	2248.	3014.	5040.	19389.
1980 2 29	3	1300 1420	5795.	2805.	2175.	1905.	6927.	19606.
1980 2 29	4	1000 1120	4767.	2836.	2543.	2365.	7289.	19800.
1980 6 24	4	1100 1455	2549.	2268.	2343.	2223.	4574.	13958.
1980 6 25	3	1020 1340	1625.	2128.	3058.	1939.	4363.	13113.
1980 6 26	2	940 1325	4545.	2268.	1888.	2068.	3310.	14079.
1980 6 27	1	1045 1500	2500.	1755.	2249.	2279.	4116.	12899.
1981 4 28	1	1250 1420	2831.	1321.	1740.	1742.	5172.	12806.
1981 4 29	2	1030 1305	3872.	1830.	1969.	1832.	3538.	13041.
1981 4 30	3	1130 1420	2133.	1999.	1914.	2779.	5311.	14135.
1981 5 1	4	1005 1310	2772.	2602.	2033.	2498.	3525.	13430.
1981 9 15	1	1015 1215	3088.	1459.	1633.	2091.	4323.	12594.
1981 9 16	4	855 1115	2217.	1679.	2656.	3188.	4564.	14302.
1981 9 16	3	1215 1355	3931.	1892.	1680.	1461.	4009.	12973.
1981 9 17	2	840 1100	3392.	2190.	1776.	2384.	3617.	13360.

Table B.2. Mean Daily Discharge for all Locations.

DATE	SECTION	HOURS	DISCHARGE (CFS), J 1	2	3	4	5	TOTAL
1978 5 18	2	1030 1330	5314.	5808.	5225.	5005.	4632.	25985.
1978 11 21	4	1200 1412	4141.	4232.	3699.	4088.		16159.
1978 11 22	2	1350 1600	5003.	2310.	2165.	2771.	5768.	18017.
1978 11 22	3	950 1320	2562.	2353.	1264.	1166.	3840.	11186.
1978 11 27	1	1223 1509	1322.	777.	1090.	1241.	3021.	7451.
1979 1 19	1	1205 1329	8314.	6265.	8457.	7989.	12854.	43878.
1979 1 19	2	1355 1527	13527.	14265.	7549.	3637.	5805.	44783.
1979 2 13	1	1245 1450	1595.	1524.	2882.	3052.	4990.	14043.
1979 2 13	2	1005 1215	6449.	3152.	2514.	2203.	5512.	19831.
1979 2 22	2	1015 1235	20705.	15836.	7414.	7307.	9973.	61235.
1979 2 22	3	1305 1445	17964.	10144.	9201.	6257.	15424.	58990.
1979 3 19	2	940 1130	8954.	5569.	5969.	6747.	5952.	33190.
1979 3 19	4	1200 1330	7068.	5322.	5067.	7185.	11160.	35802.
1979 4 13	1	1010 1140	3870.	2386.	3316.	4252.	8762.	22586.
1979 4 13	2	1215 1325	7401.	3861.	2498.	3472.	5797.	23029.
1979 6 5	1	1015 1150	4249.	2314.	3433.	3550.	5664.	19210.
1979 6 5	2	1220 1355	4026.	1731.	1640.	1245.	2548.	11189.
1979 7 17	2	1110 1320	4722.	2352.	1639.	1627.	4033.	14373.
1979 7 17	2	1325 1505	4857.	3029.	1753.	2035.	5199.	16873.
1979 7 18	1	930 1110	4121.	2346.	4638.	4700.	6251.	22055.
1979 7 18	1	1130 1315	3385.	1638.	3315.	2318.	3923.	15579.
1979 8 15	2	1030 1210	4904.	1866.	2272.	2414.	4474.	15930.
1979 8 16	2	830 1000	6697.	3124.	3217.	3220.	7272.	23530.
1979 8 16	2	1000 1115	6608.	3271.	2886.	3114.	6810.	22690.
1979 8 16	2	1130 1310	5435.	2085.	2104.	1943.	4553.	16119.
1979 9 6	3	910 1100	2630.	4562.	4638.	3215.	9618.	24664.
1979 9 6	3	1135 1255	2679.	4683.	4852.	3149.	9721.	25085.
1979 9 6	3	1300 1410	2890.	4740.	4490.	3080.	9824.	25024.
1979 9 11	4	1000 1140	2817.	2251.	2501.	3205.	4692.	15466.
1979 9 11	4	1200 1320	3665.	3181.	3149.	4617.	6502.	21114.
1979 9 11	4	1340 1500	4626.	3573.	3803.	5016.	7147.	24165.
1979 9 12	1	930 1100	2917.	1612.	1306.	2169.	5261.	13265.
1979 9 12	1	1115 1225	2832.	1612.	1365.	2306.	6501.	14616.
1979 9 12	1	1240 1400	4323.	2175.	1687.	2791.	7308.	18284.
1980 2 28	1	1400 1540	18711.	13846.	10538.	8855.	31697.	83648.
1980 2 28	2	1055 1235	25423.	12895.	9889.	13227.	22206.	83640.
1980 2 29	3	1300 1420	22027.	11131.	8823.	7513.	26414.	75909.
1980 2 29	4	1000 1120	19929.	11885.	11258.	9754.	32100.	84925.
1980 6 24	4	1100 1455	5117.	4431.	4149.	3354.	5808.	22859.
1980 6 25	3	1020 1340	3184.	4533.	6421.	3904.	7808.	25849.
1980 6 26	2	940 1325	7168.	4090.	3608.	4087.	7088.	26041.
1980 6 27	1	1045 1500	4537.	3497.	4520.	4753.	8248.	25555.
1981 4 28	1	1250 1420	2320.	1212.	1671.	2589.	5597.	13389.
1981 4 29	2	1030 1305	1515.	1160.	1401.	1156.	1733.	6966.
1981 4 30	3	1130 1420	2321.	1516.	1030.	945.	1212.	7024.
1981 5 1	4	1005 1310	4398.	3662.	2467.	1967.	2410.	14904.
1981 9 15	1	1015 1215	4831.	2363.	2834.	3816.	8601.	22444.
1981 9 16	4	855 1115	3064.	2469.	4275.	5271.	7577.	22657.
1981 9 16	3	1215 1355	5944.	3182.	2923.	2616.	6535.	21200.
1981 9 17	2	840 1100	2568.	2618.	2507.	3588.	5802.	17082.

Table B.3. Mean Daily Sediment Load for all Locations.

DATE	SECTION	HOURS	SEDIMENT LOAD (TONS/DAY), J					TOTAL
			1	2	3	4	5	
1978 5 18	2	1030 1330	695.	864.	757.	666.	567.	3549.
1978 11 21	4	1200 1412	137.	162.	140.	119.		558.
1978 11 22	2	1350 1600	285.	144.	124.	160.	309.	1022.
1978 11 22	3	950 1320	112.	97.	50.	47.	168.	473.
1978 11 27	1	1223 1509	43.	28.	39.	47.	123.	281.
1979 1 19	1	1205 1329	5196.	3602.	4374.	3724.	5619.	22515.
1979 1 19	2	1355 1527	7061.	8355.	3721.	1812.	2740.	23690.
1979 2 13	1	1245 1450	70.	65.	123.	138.	191.	587.
1979 2 13	2	1005 1215	382.	143.	117.	83.	203.	928.
1979 2 22	2	1015 1235	11992.	11725.	4987.	4404.	6118.	39226.
1979 2 22	3	1305 1445	10525.	6267.	5659.	4375.	10036.	36862.
1979 3 19	2	940 1130	1373.	924.	889.	933.	886.	5006.
1979 3 19	4	1200 1330	983.	800.	879.	1288.	1580.	5529.
1979 4 13	1	1010 1140	433.	247.	327.	371.	724.	2101.
1979 4 13	2	1215 1325	1074.	451.	318.	392.	574.	2809.
1979 6 5	1	1015 1150	295.	134.	181.	181.	251.	1043.
1979 6 5	2	1220 1355	190.	63.	57.	42.	85.	436.
1979 7 17	2	1110 1320	260.	96.	55.	51.	139.	601.
1979 7 17	2	1325 1505	151.	97.	57.	67.	164.	536.
1979 7 18	1	930 1110	380.	220.	428.	298.	365.	1691.
1979 7 18	1	1130 1315	238.	145.	202.	136.	161.	882.
1979 8 15	2	1030 1210	314.	152.	141.	105.	161.	874.
1979 8 16	2	830 1000	753.	325.	376.	275.	589.	2318.
1979 8 16	2	1000 1115	627.	365.	300.	238.	526.	2056.
1979 8 16	2	1130 1310	386.	184.	125.	105.	190.	989.
1979 9 6	3	910 1100	218.	391.	439.	374.	1139.	2560.
1979 9 6	3	1135 1255	293.	595.	647.	474.	1326.	3335.
1979 9 6	3	1300 1410	256.	598.	632.	499.	1338.	3324.
1979 9 11	4	1000 1140	139.	130.	106.	149.	269.	794.
1979 9 11	4	1200 1320	188.	193.	225.	431.	529.	1566.
1979 9 11	4	1340 1500	318.	272.	352.	551.	728.	2221.
1979 9 12	1	930 1100	175.	97.	83.	135.	316.	806.
1979 9 12	1	1115 1225	158.	131.	60.	106.	261.	715.
1979 9 12	1	1240 1400	312.	144.	90.	136.	350.	1032.
1980 2 28	1	1400 1540	6844.	7762.	4232.	3491.	9549.	31879.
1980 2 28	2	1055 1235	11501.	6866.	4465.	5939.	7821.	36592.
1980 2 29	3	1300 1420	6587.	4770.	4151.	3191.	10767.	29465.
1980 2 29	4	1000 1120	5932.	5583.	5195.	4997.	12050.	33757.
1980 6 24	4	1100 1455	543.	438.	610.	418.	400.	2409.
1980 6 25	3	1020 1340	321.	511.	918.	470.	1041.	3262.
1980 6 26	2	940 1325	849.	578.	470.	453.	860.	3209.
1980 6 27	1	1045 1500	680.	441.	582.	554.	710.	2966.
1981 4 28	1	1250 1420	120.	43.	63.	84.	167.	477.
1981 4 29	2	1030 1305	90.	52.	48.	37.	49.	275.
1981 4 30	3	1130 1420	124.	63.	44.	39.	46.	316.
1981 5 1	4	1005 1310	218.	187.	129.	92.	91.	717.
1981 9 15	1	1015 1215	674.	269.	305.	365.	764.	2376.
1981 9 16	4	855 1115	141.	142.	338.	608.	734.	1963.
1981 9 16	3	1215 1355	469.	219.	282.	326.	813.	2109.
1981 9 17	2	840 1100	123.	103.	90.	166.	315.	797.