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Physical and Geomorphological Measurements for Selected River Segments in the Carson and Truckee River Basins, Nevada and California, 1993-96

By Stephen J. Lawrence and Nyle Pennington

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CONTENTS

FIGURES

TABLES

CONVERSION FACTORS AND VERTICAL DATUM

Multiply	By	To obtain
foot (ft)	0.3048	meter
foot per mile (ft/mi)	0.1894	meter per kilometer
foot-pound per square foot	14.596	joules per square meter
foot per square mile (ft/mi^2)	0.11768	meter per square kilometer
inch (in.)	25.4	millimeter
mile (mi)	1.609	kilometer
square miles (mi^2)	2.590	square kilometer

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

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ABSTRACT

This report, which is a product of the National Water-Quality Assessment Program, describes physical and geomorphological measurements made between 1993 and 1996 at 19 reaches in the Carson and Truckee River Basins, Nevada and California. Measurements such as streambank height, width, angle, and stability were made for the left and right banks at two to six permanent measurement stations called transects within a discrete reach of the river. Cross-section measurements of the stream channel were made at a subset of transects by surveying the stream bottom starting at National Geodetic Survey benchmarks with a known altitude above sea level.

INTRODUCTION

Background

In 1991, the U.S. Geological Survey (USGS) began a nationwide study of water quality. This program, named the National Water-Quality Assessment Program (NAWQA), is designed to assess the status of, and trends in, the Nation's water quality, and to develop an understanding of the major factors that affect water quality (Hirsch and others, 1988; Leahy and others, 1990). To accomplish these goals, NAWQA is integrating physical, chemical, and biological data from sites within large areas affected by natural and human-created processes or phenomena.

Measurements of stream-channel morphology and in-stream aquatic habitat are important components of NAWQA studies. These measurements document the presence, absence, and quality of instream cover, spawning areas and substrates, and other physical conditions that determine, in part, the health of fish and aquatic invertebrate populations (Platts and others, 1983; Simonson and others, 1993). The structure of aquatic communities and population dynamics of aquatic organisms may be limited by changes in channel morphology or streambed substrate that change aquatic habitat (Meador and others, 1993). Such habitat changes may mask water-quality changes that can affect aquatic organisms.

Furthermore, documenting changes in stream geomorphology, particularly on an annual or bi-annual interval, helps engineers and planners design stable roads, bridges, culverts, and other structures within river canyons, channels, and flood plains. Research shows that channel formation is primarily a random process; statistical chance alone is capable of creating the variety of river basins and channels observed in nature (Leopold, 1994). The stability and, thus, permanence of an engineered structure may depend on identifying a river's most probable state, a statistical term that describes the river's tendency toward minimum variance. Leopold (1994, p. 57) defines a river's most probable state as the compromise between a river's attempt (governed by the laws of physics) to satisfy two conditions: minimum work and uniform distribution of work. Both cannot be satisfied simultaneously, thus the river form (straight, meander, braided) observed in nature is a compromise between these two extremes. Therefore, the most probable state is a river's attempt to minimize the differences between these two extremes. The meander is the river form that approximates a river's most probable state (Leopold, 1994, p. 57). Multiple measurements of stream channel morphology on an annual or bi-annual interval may document a river's tendency to move towards its most probable state and lead to better placement and engineering of public works structures.

Purpose and Scope

The objective of this report is to summarize and describe the physical and geomorphological measurements made during 1993-96 at 19 reaches in the Carson and Truckee River Basins, Nevada and California. Three different categories of measurements were made: basin-level, segment-level, and reach-level. These measurements were part of the tasks undertaken by the Nevada Basin and Range study unit to fulfill part of the NAWQA goals. The physical and geomorphological measurements included in this report establish a baseline to which future measurements can be compared.

Study Area

The study area consists of the Carson and Truckee River Basins and the Upper Truckee River Basin above South Lake Tahoe, Calif. (fig. 1). With the exception of the Upper Truckee River Basin, the study area does not include Lake Tahoe or its watershed. The environmental setting of the study area is described in detail by Covay and others (1996).

DATA COLLECTION AND CALCULATION

The physical and geomorphological measurements made within the study area were grouped into three hierarchical levels of scale: basin, segment, and reach. This hierarchical approach is suggested by Meador and others (1993) and is a modification of earlier work by Frissel and others (1986). Microhabitat data also were collected in association with algae and benthic-invertebrate data. However, presentation of those data is beyond the scope of this report.

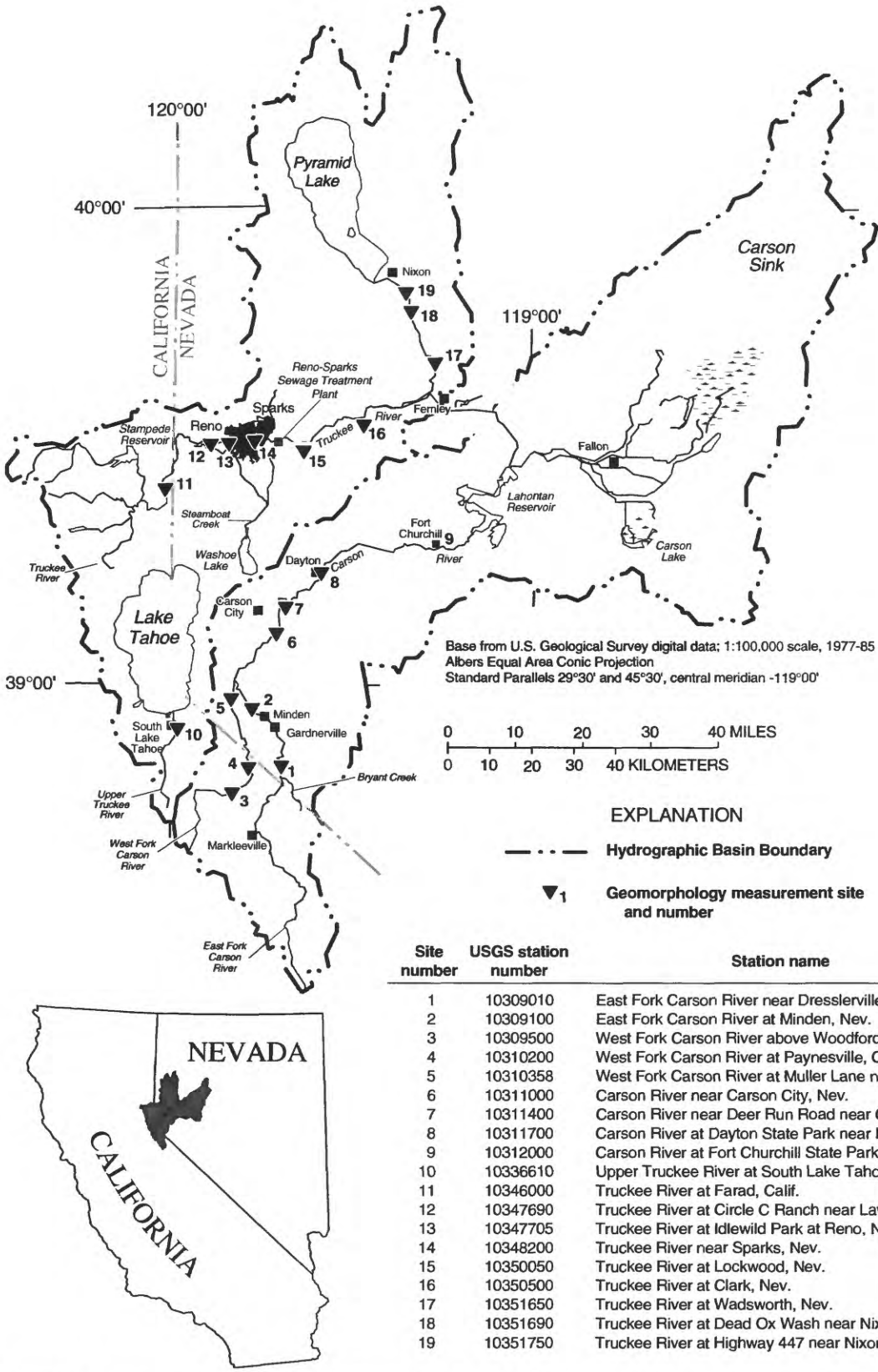
Stream Basin and Segment Measurements

Measurements of basin features were made from USGS topographic maps and orthophotoquads (1:24,000 and 1:100,000 scale). Basin features measured in the Carson and Truckee River Basins are listed in tables 2 and 4, respectively. These measurements describe the size of the basin (drainage area), the total length of stream channel within a drainage area (drainage density), and basin shape above a geomorphological measurement site. As the shape of the basin becomes more elliptical, the value for basin shape becomes larger. The stream length is the number of river miles from the river's origin to the measurement site. The basin relief measures the altitude difference between the highest point in the basin upstream from the measurement site and the site itself.

Stream-segment measurements also were made from USGS topographic maps (1:24,000 scale) and are given for the Carson River Basin in table 3 and for the Truckee River Basin in table 5. Four segments, one in the upper and one in the lower part of each river, were divided into three distinct reaches. The features listed include a description of the upper and lower segment boundaries, segment length, altitude at the downstream boundary, steepness of the valley side slopes in each segment, downstream link number at the downstream boundary, and channel gradient within each segment.

Stream-Reach Measurements

Stream-reach measurements were made at each site using protocols described by Meador and others (1993). The length of a reach was approximately 20 times the river width (Meador and others, 1993; Harrelson and others, 1994). Each reach was divided into four to six transects and measurements of angle, height, width, stability, substrate, and erosion were made for the left and right banks. Each transect was an imaginary line that extended from one bank to the other bank perpendicular to the stream channel and was bounded by a monument. Monuments were either cemented into the ground, attached to bedrock or boulders with epoxy, or driven into the ground (fig. 2). Surveyed cross sections were made at a minimum of three transects using a Nikon A5LG Total Station system and a Zeiss surveying level with surveying rod. Altitudes, in feet above sea level, were measured



Site number	USGS station number	Station name
1	10309010	East Fork Carson River near Dresslerville, Nev.
2	10309100	East Fork Carson River at Minden, Nev.
3	10309500	West Fork Carson River above Woodfords, Calif.
4	10310200	West Fork Carson River at Paynesville, Calif.
5	10310358	West Fork Carson River at Muller Lane near Minden, Nev.
6	10311000	Carson River near Carson City, Nev.
7	10311400	Carson River near Deer Run Road near Carson City, Nev.
8	10311700	Carson River at Dayton State Park near Dayton, Nev.
9	10312000	Carson River at Fort Churchill State Park, Nev.
10	10336610	Upper Truckee River at South Lake Tahoe, Calif.
11	10346000	Truckee River at Farad, Calif.
12	10347690	Truckee River at Circle C Ranch near Lawton, Nev.
13	10347705	Truckee River at Idlewild Park at Reno, Nev.
14	10348200	Truckee River near Sparks, Nev.
15	10350050	Truckee River at Lockwood, Nev.
16	10350500	Truckee River at Clark, Nev.
17	10351650	Truckee River at Wadsworth, Nev.
18	10351690	Truckee River at Dead Ox Wash near Nixon, Nev.
19	10351750	Truckee River at Highway 447 near Nixon, Nev.

Figure 1. Carson and Truckee River Basins, Nevada and California, with geomorphology measurement sites identified.

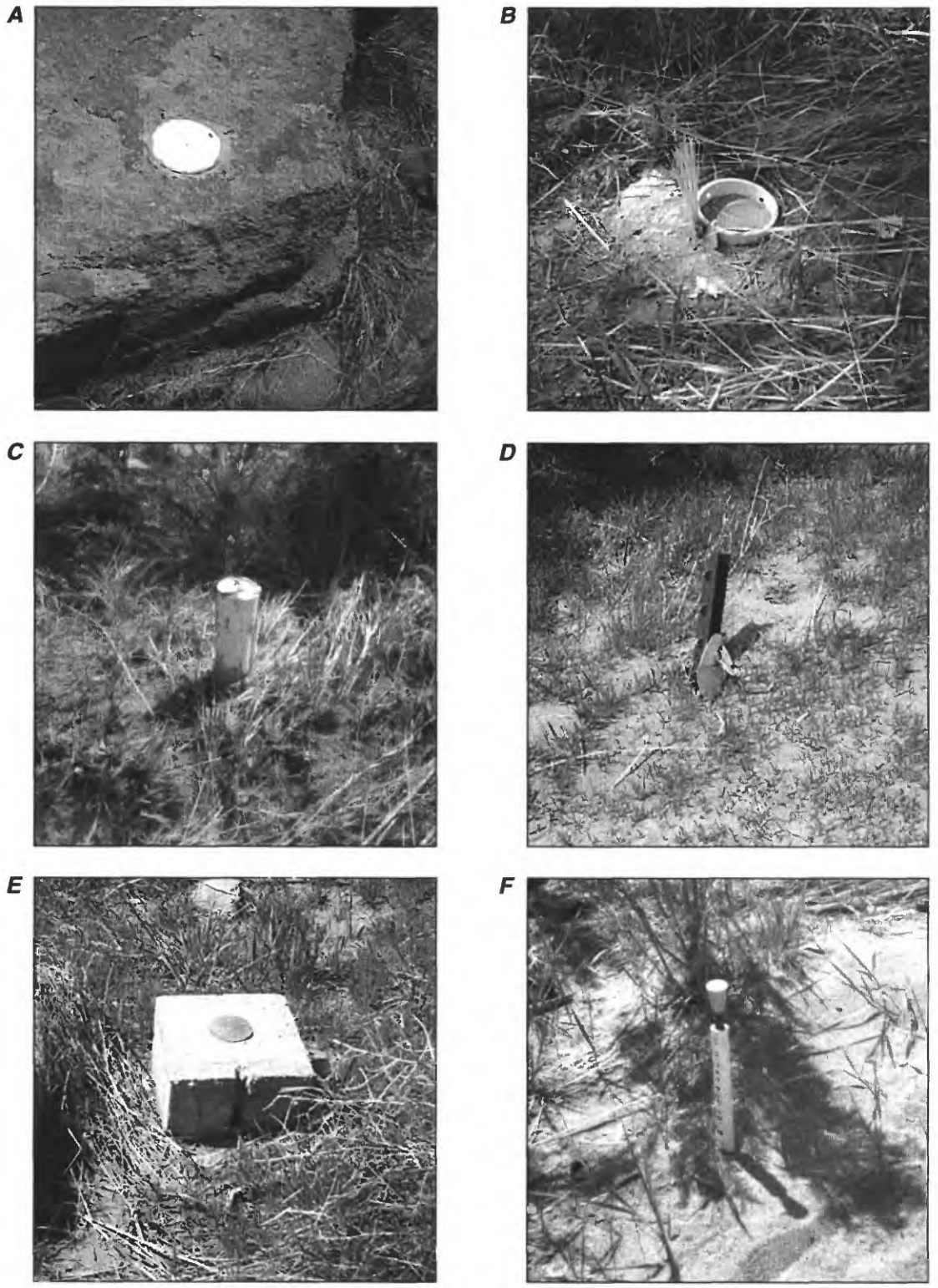


Figure 2. Examples of monuments used to mark transects in reaches of Carson and Truckee Rivers. *A.* 4-inch white disk attached to boulder, tree, or railroad tie. *B.* 4-inch polyvinyl-chloride (PVC) pipe topped with brass plate. *C.* 2-inch PVC pipe topped with hardware washer and bolt. *D.* Steel fence post driven into ground and cut to within 12 inches of land surface. *E.* 8-inch by 8-inch concrete block with brass plate. *F.* 1/2-inch yellow-capped rebar driven into ground.

using altitude benchmarks from the National Geodetic Survey or the Federal Emergency Management Agency (FEMA). Longitudinal channel profiles were made using altitude measurements of the channel thalweg. Distances along a cross section were determined using stadia measurements (Harrelson and others, 1994).

Three different methods were used to estimate the amount of sunlight arriving at the water surface in a reach: solar insolation, canopy density, and canopy angle. The amount of incident solar insolation was measured at one or two places in a reach using an instrument designed to provide solar site analysis (fig. 3). This device provided measurements of total annual and total monthly solar insolation. A spherical densiometer was used to determine the canopy density in percent within 1 ft of both streambanks and in the center of the channel. Canopy angle provides an estimate of potential channel shading by streamside vegetation or tall side slopes where no vegetation was present. Canopy angle was determined by measuring the angle between the stream plane at mid-channel and the top of the tallest streamside vegetation on both banks and subtracting these two measurements from 180°.

An estimate of coarse bed-substrate particle size was made using Wolman pebble counts (Wolman, 1954; Harrelson and others, 1994). The Wolman pebble-count method involves the selection and measurement of sand and larger particles on the streambed at intervals along a transect. The method used in this study was a random step-toe procedure in which a particle was blindly selected from the tip of the hydrographer's boot and measurements of the longest, intermediate, and shortest axis length were made in millimeters. A minimum of 50 measurements were made along a transect and tallied according to the Wentworth particle-size scale (table 1). These measurements provide a quantification of coarse streambed substrate.

Table 1. Wentworth particle-size classes used to quantify coarse streambed substrate composition in Wolman Pebble Count procedure (Wolman, 1954)

Particle classes	Size range (millimeters)
Sand	Less than 2
Very small gravel	2 to less than 4
Small gravel	4 to less than 8
Medium gravel	8 to less than 16
Large gravel	16 to less than 32
Very large gravel	32 to less than 64
Small cobble	64 to less than 90
Medium cobble	90 to less than 128
Large cobble	128 to less than 180
Very large cobble	180 to less than 256
Small boulder	256 to less than 512
Medium boulder	512 to less than 1,024
Large boulder	1,024 to less than 2,048
Very large boulder	Greater than 2,048

Carson River Basin

General topographic features of the Carson River Basin are given in table 2. Topographic features were measured at nine stream segments in the Carson River. These segments include the East Fork Carson River near Dresslerville, Nev.; East Fork Carson River at Minden, Nev.; West Fork Carson River above Woodfords, Calif.; West Fork Carson River at Paynesville, Calif.; West Fork Carson River at Muller Lane near Minden, Nev.; Carson River near Carson City, Nev.; Carson River at Deer Run Road near Carson City, Nev.; Carson River at Dayton (State Park), Nev., and Carson River at Fort Churchill (State Park), Nev. The general topographic features of the nine stream segments are given in table 3.

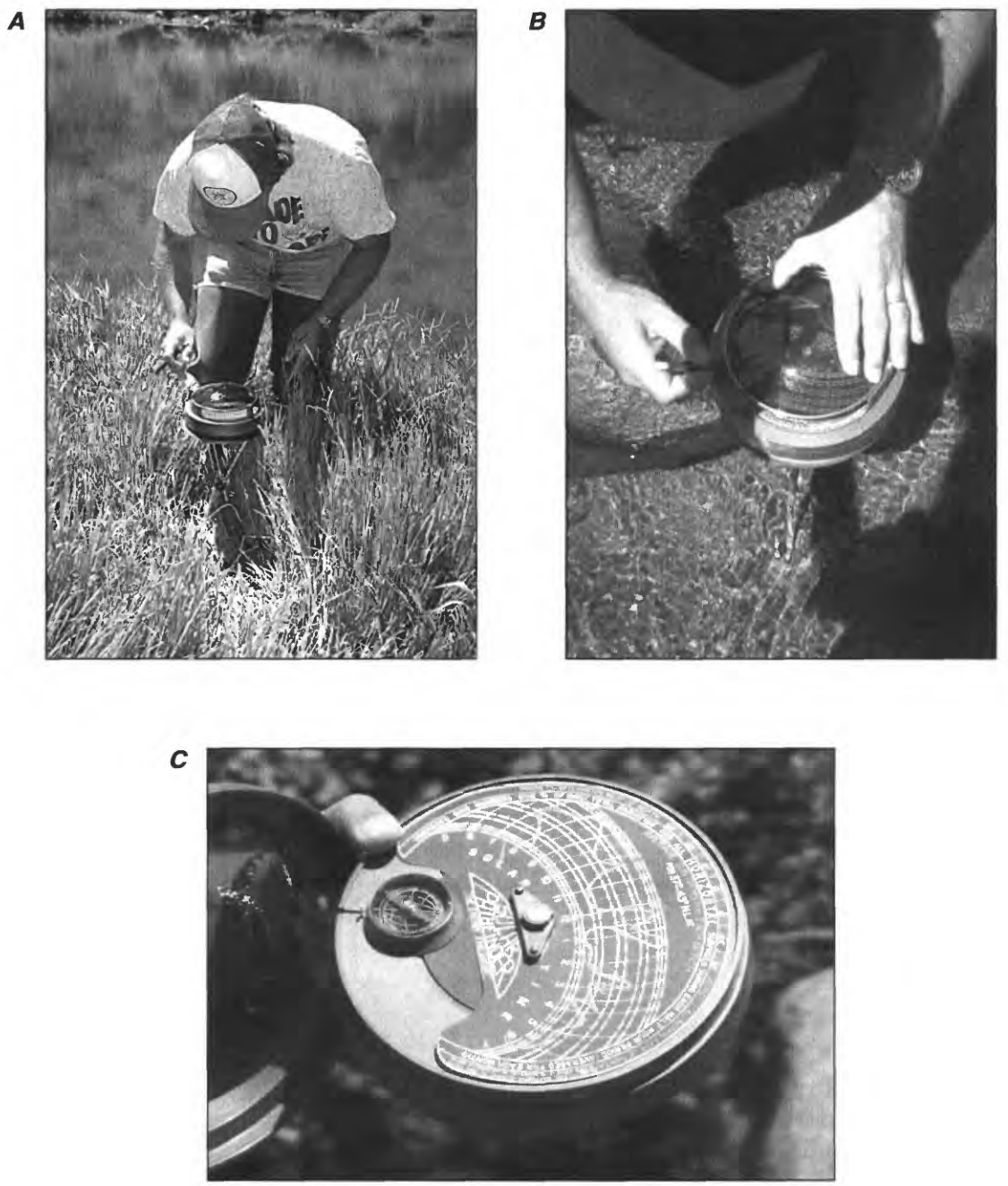


Figure 3. Measuring solar isolation at a site by tracing river shading over an annual solar cycle. *A*. Hydrographer measuring solar shading in middle of stream channel. *B*. Tracing shade features from their reflections on clear dome. *C*. Traced pattern on chart of annual solar cycle. Photographs by Ronald P. Collins, U.S. Geological Survey.

Table 2. Basin features upstream from selected stream-gaging stations in Carson River Basin

[Abbreviation and symbol: E, estimated; --, not recorded]

Station name and number	Drainage area (square miles)	Drainage density (feet per square mile)	Basin shape	Stream length (river miles from origin)	Basin relief (feet)
East Fork Carson River near Dresslerville, Nev. (10309010)	375	1.31	1.90	54.5	5,996
East Fork Carson River at Minden, Nev. (10309100)	392	--	--	63.1	6,210
West Fork Carson River above Woodfords, Calif. (10309500)	53	--	--	14.3	4,061
West Fork Carson River at Paynesville, Calif. (10310200)	80 E	--	--	23.1	5,846
West Fork Carson River at Muller Lane near Minden, Nev. (10310358)	--	--	--	37.8	6,251
Carson River near Carson City, Nev. (10311000)	886	--	--	81.4	6,306
Carson River at Deer Run Road at Carson City, Nev. (10311400)	959	1.17	3.58	88.5	6,331
Carson River at Dayton (State Park), Nev. (10311700)	1,090	--	--	99.6	6,581
Carson River near Fort Churchill (State Park), Nev. (10312000)	1,234	1.15	5.12	124.7	6,731

Table 3. Description and characteristics of selected stream segments in Carson River Basin

Station name and number	Segment boundary description [1]		Segment length (river miles)[1]	Downstream altitude[1] (feet above sea level)	Side slope gradient (foot per mile)[2]	Downstream link[2]	Sinuosity[3]	Gradient (foot per mile)[3]
	Upstream	Downstream						
East Fork Carson River near Dresslerville, Nev. (10309010)	USGS gage above Gardnerville (10308200)	Old Ruhenstroth diversion dam	3.3	4,920	2,150	122	1.7	87
East Fork Carson River near Minden, Nev. (10309100)	Diversion dam near contour 4720 on USGS topographic map (Minden)	U.S. Highway 88	1.3	4,700	10	124	1.1	17
West Fork Carson River above Woodfords, Calif. (10309500)	Altitude contour 6920 on USGS topographic map (Freel Peak quadrangle)	U.S. Highway 88	.7	6,855	2,080	14	1.1	102
West Fork Carson River at Paynesville, Calif. (10310200)	Road bridge from Carson River Road	Fredricksburg diversion dam	.7	5,075	478	25	1.2	123
West Fork Carson River at Muller Lane near Minden, Nev. (10310358)	Diversion dam upstream of Muller Lane	Diversion dam downstream of Muller Lane	.7	4,675	10	66	1.4	9.3
Carson River near Carson City, Nev. (10311000)	Site of old McTarnahan Bridge	Mexican Dam diversion	1.2	4,615	1,960	198	1.3	6
Carson River at Deer Run Road, near Carson City, Nev.(10311400)	Deer Run Road Bridge	Brunswick Canyon Bridge	.9	4,590	1,960	212	1.6	8.9
Carson River at Dayton (State Park), Nev. (10311700)	Dayton Bridge	Rock Point Mill site	.65	4,340	38	237	1.1	16
Carson River at Fort Churchill (State Park), Nev. (10312000)	USGS gage near Fort Churchill (10312000)	Weeks Bridge (Nevada State Highway 95)	5.0	4,190	22	241	2.1	10

[1] Brown and others (1986).

[2] Measurements taken from USGS 1:100,000 scale topographic map.

[3] Measurements taken from USGS 1:24,000 scale topographic map.

Physical and geomorphological measurements were made at select reaches within each of the nine stream segments. Figures and tables showing and listing the physical and geomorphological data for stream reaches are indexed in the following tabulation:

Measurements	Carson River site numbers [1] (fig. 1)								
	1	2	3	4	5	6	7	8	9
Landscape features	F4	--	--	--	--	--	F13	--	F17
Streambank features	T6,8,10	T21	T21	T21	T21	T21	T12	T21	T14,16,18
Longitudinal streambed and water-surface profile	F5	--	--	--	--	--	F14	--	F18
Channel cross-section	F6,8,10; T7,9,11	--	--	--	--	--	F15; T13	--	F19-21; T15,17,19
Distribution of coarse streambed particles	F7,9,11	--	F23	F24	F25	F25	F16	--	--
Monthly solar insolation	F12	--	F26	F26	F26	F26	F26	F26	F22

[1] 1, East Fork Carson River near Dresslerville, Nev.; 2, East Fork Carson River at Minden, Nev.; 3, West Fork Carson River above Woodfords, Calif.; 4, West Fork Carson River at Paynesville, Calif.; 5, West Fork Carson River at Muller Lane near Minden, Nev.; 6, Carson River near Carson City, Nev.; 7, Carson River at Deer Run Road near Carson City, Nev.; 8, Carson River at Dayton (State Park) near Dayton, Nev.; 9, Carson River at Fort Churchill (State Park), Nev.; F, figure; T, table.

Truckee River Basin

General basin features of the Truckee River Basin are given in table 4. Topographic features were measured at 8 stream segments in the Truckee River. These segments include the Upper Truckee River at South Lake Tahoe, Calif.; Truckee River at Farad, Calif.; Truckee River at Circle C Ranch near Lawton, Nev.; Truckee River at Idlewild Park at Reno, Nev.; Truckee River near Sparks, Nev.; Truckee River at Lockwood, Nev.; Truckee River at Clark, Nev.; and Truckee River at Dead Ox Wash near Nixon, Nev. The general features of these stream segments are given in table 5.

Table 4. Basin features upstream from selected stream-gaging stations in Truckee River Basin

[Explanation: --, not determined]

Station name and number	Drainage area (square miles)	Drainage density (feet per square mile)	Basin shape	Stream length [1] (river miles from origin)	Basin relief (feet)
Truckee River at Farad, Calif. (10346000)	933	0.89	3.37	34.4	3,979
Truckee River at Circle C Ranch near Lawton, Nev. (10347690)	975	--	--	50.4	4,474
Truckee River at Idlewild Park at Reno, Nev. (10347705)	1,000	--	--	54.5	4,639
Truckee River near Sparks, Nev. (10348200)	1,067	.95	5.45	60.2	4,757
Truckee River at Lockwood, Nev. (10350050)	1,433	--	--	66.2	4,799
Truckee River at Clark, Nev. (10350500)	1,592	1.00	5.06	77.7	4,915
Truckee River at Dead Ox Wash near Nixon, Nev. (10351690)	1,916	1.03	7.02	103.1	5,184

[1] Brown and others (1986)

Table 5. Description and characteristics of selected stream segments in Truckee River Basin

Station name and number	Segment boundary description [1]		Segment length[1] (river miles)	Downstream altitude[1] (feet above sea level)	Side slope gradient (foot per mile)	Down-stream link	Sinuosity	Gradient (foot per mile)
	Upstream	Downstream						
Upper Truckee River at South Lake Tahoe, Calif. (10336610)	Low-head dam near South Lake Tahoe Airport	U.S. Highway 50 bridge at South Lake Tahoe	0.5	6,137	10	24	1.5	9.1
Truckee River at Farad, Calif. (10346000)	Floristan Diversion Dam	Confluence with Mystic Creek	3.0	5,147	1,900	146	1.1	40.7
Truckee River at Circle C Ranch near Lawton, Nev. (10347690)	Circle D Ranch Bridge	Mayberry Drive Bridge	1.1	4,611	1,630	166	1.7	34.4
Truckee River at Idlewild Park, at Reno, Nev. (10347705)	Altitude contour 4920 on USGS topo-graphic map (Reno quadrangle)	Booth Street Bridge, Reno, Nev.	.8	4,501	80	170	1.2	28.7
Truckee River near Sparks, Nev. (10348200)	Truckee River at Reno gage (10348000)	McCarran Avenue Bridge, Sparks, Nev.	3.0	4,387	10	170	1.4	20.5
Truckee River at Lockwood, Nev. (10350050)	Largomarsino-Murphy Diversion	Largomarsino Bridge	1.1	4,345	1,570	198	1.1	20.4
Truckee River at Clark, Nev. (10350500)	Truckee River at Tracy gage (10350400)	Clark Station Bridge to Eagle-Picher Co.	2.0	4,229	680	243	1.1	7.8
Truckee River at Dead Ox Wash near Nixon, Nev. (10351690)	Confluence with Dead Ox Wash	Truckee River near Nixon gage (10351700)	3.7	3,935	470	312	1.3	8.9

[1] Brown and others (1986).

Physical and geomorphological measurements were made at selected reaches within each of the 10 Truckee River stream segments. Figures and tables showing and listing the physical and geomorphological data for stream reaches are indexed in the following tabulation:

Measurements	Truckee River site numbers [1] (fig. 1)									
	10	11	12	13	14	15	16	17	18	19
Landscape features	F27	F31	--	--	F39	--	F43	--	F52	--
Streambank features	T22	T24,26,28	T41	T41	T30	T41	T32,34,36	T41	T38	T41
Longitudinal streambed and water-surface profile	--	F32	--	--	F40	--	F44	--	F53	--
Channel cross-section	F28; T23	F33,35,37; T25,27,29	--	--	F41; T31	--	F45,47,49; T33,35,37	--	F54; T39	--
Distribution of coarse streambed particles	F29	F34,36	F55	F55	--	F55	F46,48,50	--	--	--
Monthly solar insolation	F30	F38	F56	F56	F42	F56	F51	F56	--	F56

[1] **10**, Upper Truckee River at South Lake Tahoe, Calif; **11**, Truckee River at Farad, Calif.; **12**, Truckee River at Circle C Ranch near Lawton, Nev.; **13**, Truckee River at Idlewild Park, at Reno, Nev.; **14**, Truckee River near Sparks, Nev.; **15**, Truckee River at Lockwood, Nev.; **16**, Truckee River at Clark, Nev.; **17**, Truckee River at Wadsworth, Nev.; **18**, Truckee River at Dead Ox Wash near Nixon, Nev.; **19**, Truckee River at Highway 447 near Nixon, Nev.; F, figure; T, table.

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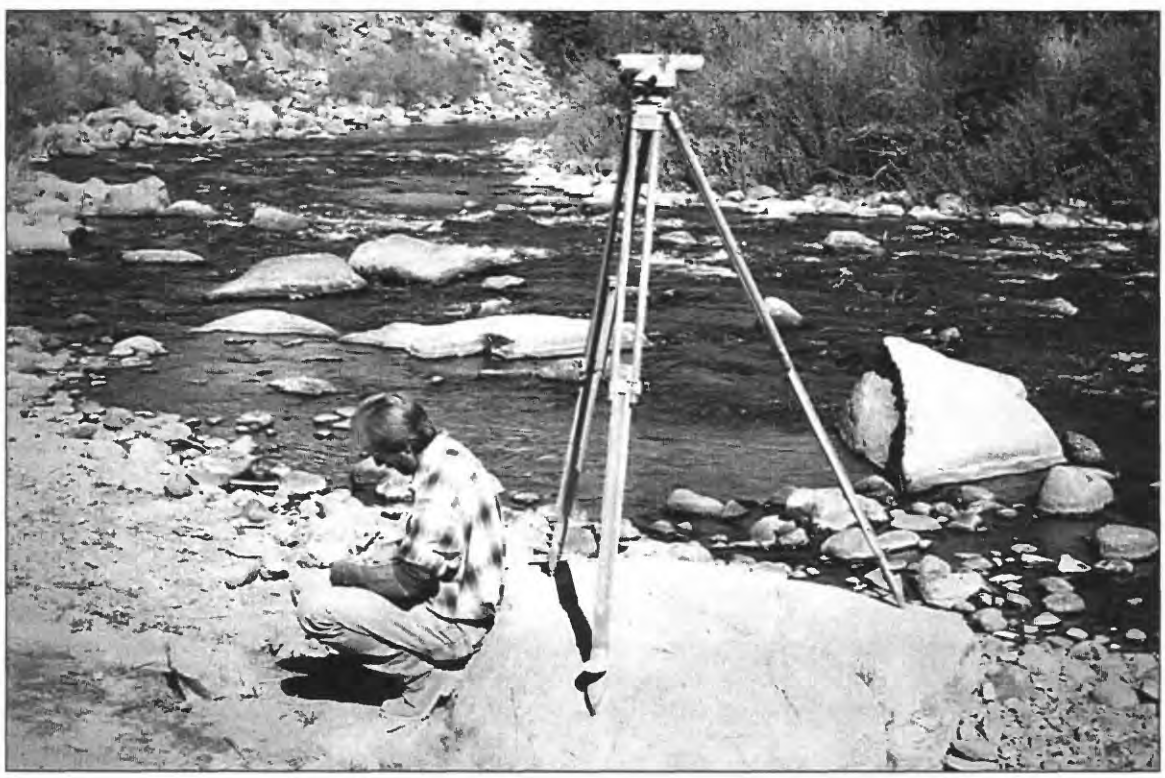
PHYSICAL AND GEOMORPHOLOGICAL DATA

Physical and geomorphological data are given for 9 sites in the Carson River and 10 sites in the Truckee River. The data shown in the following figures and tables include reach illustrations, cross sectional and longitudinal measurements of streambed and water-surface altitudes, particle-size distributions of coarse streambed substrate, solar insolation, basin characteristics such as drainage area, drainage density, and river segment characteristics such as length, gradient, and sinuosity.



Hydrographer Nyle Pennington recording altitude measurements at transect 6, reach A, during cross sectional survey of Truckee River at Farad, Calif. The Truckee River flows away from camera. Photograph by Ronald P. Collins, U.S. Geological Survey, August 1993.

East Fork Carson River near Dresslerville, Nev. (U.S. Geological Survey Station 10309010)

Upstream view of East Fork Carson River from transect 1, reach C, East Fork Carson River near Dresslerville, Nev. Photograph by Stephen J. Lawrence, U.S. Geological Survey, March 1997.

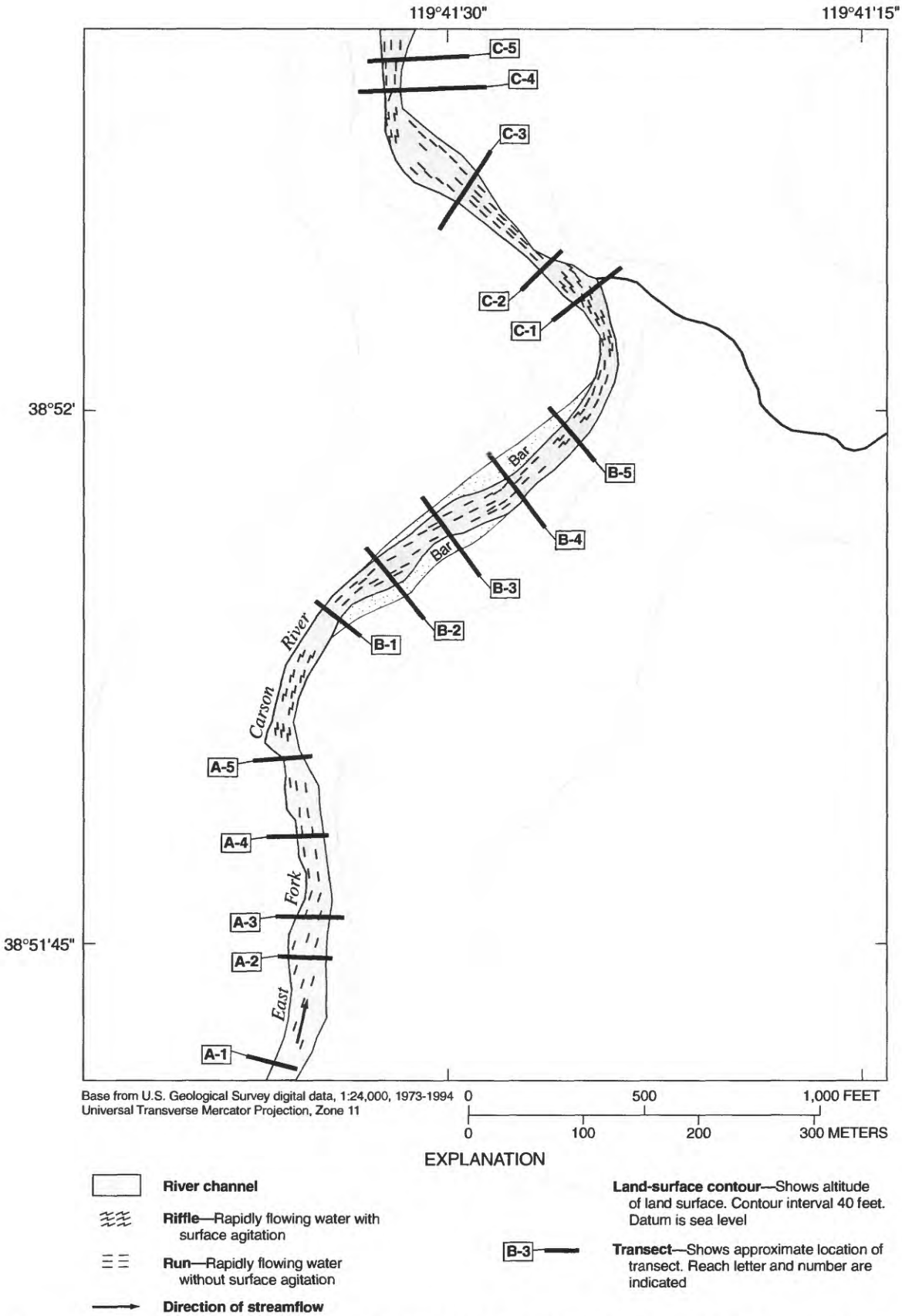


Figure 4. Location of transects in reaches A-C, East Fork Carson River near Dresslerville, Nev., with some landscape features approximately located, October 1994.

Table 6. Streambank features for selected transects in reach A, East Fork Carson River near Dresslerville, Nev., October 1994

[**Shape**: CC, concave up; LN, linear.
Substrate: BR, bedrock; CO, cobble; SA, sand; SI, silt, BO, boulder.
Habitat features: BO, boulder; MS, submergent macrophyte; UB, undercut bank]

Stream-bank	Angle (degrees)	Height (feet)	Width (feet)	Surface cover (percent)	Shape	Erosion	Substrate		Habitat features
							Dominant	Subdominant	
				Transect 1					
Left	4.1	6.3	44	greater than 80	LN	None	BR	--	5 percent BO
Right	17.7	8.3	15	greater than 80	LN	None	SI	BO	5 percent MS
				Transect 2					
Left	35.2	6.0	3.0	25 to 49	CC	Slab	BR	--	5 percent UB
Right	3.5	6.0	3.0	greater than 80	LN	None	SA	BR	10 percent BO
				Transect 3					
Left	6.8	14.1	78	greater than 80	CC	None	CO	SA	10 percent BO
Right	24.4	5.9	7	greater than 80	LN	None	BR	BO	None
				Transect 4					
Left	9.4	15	40	greater than 80	LN	None	SA	SI	None
Right	13.2	9	8	greater than 80	LN	None	SA	SI	None
				Transect 5					
Left	15.3	23.2	50	greater than 80	CC	None	BO	SA	5 percent BO
Right	4.1	5.4	44	greater than 80	LN	None	SA	CO	None

Table 7. Cross-section measurements and description of stream channel along selected transects in reach A, East Fork Carson River near Dresslerville, Nev., October 1994

[Latitude and longitude were measured using a Global Positioning Satellite system. Altitudes were measured using a surveyors level and rod from Federal Emergency Management Agency benchmark. Cross-section measurements are plotted in figure 6.
Abbreviation: PVC, polyvinyl-chloride]

Distance from left bank monument (feet)	Altitude (feet above sea level)	Description
		Transect 1
0	4,947.65	The left-bank monument is a 2.5-inch hardware washer epoxied vertically to a large rock outcrop. This monument was set in 1993. Latitude and longitude not recorded
3	4,942.88	Stream channel
9	4,943.12	Channel bar
25	4,944.12	Channel bar
44	4,943.42	Left edge of water
69	4,941.53	Stream channel
87	4,941.40	Thalweg
93	4,941.73	Stream channel
98	4,943.36	Right edge of water
100	4,944.98	Top of right bank
109	4,947.15	Land surface at base of boulder
113	4,949.97	The right-bank monument is a 3-inch metal disk epoxied to the top of a large oval boulder (8 feet by 3 feet) on a narrow terrace. This monument was reset in 1994 because original monument established in 1993 was destroyed by vandals. Latitude: 38° 51' 41.49"; Longitude: 119° 41' 35.47".

Table 7. Cross-section measurements and description of stream channel along selected transects in reach A, East Fork Carson River near Dresslerville, Nev., October 1994—Continued

Distance from left bank monument (feet)	Altitude (feet above sea level)	Description
		Transect 3
0	4,964.80	The left-bank monument is a 2.5-inch hardware washer epoxied vertically to a large rock outcrop. This monument was set in 1993. Latitude: 38° 51' 48.01"; Longitude: 119° 41' 36.57".
27	4,952.67	Left bank
51	4,947.50	Left bank
67	4,943.98	Left bank
79	4,942.34	Channel bar
105	4,941.12	Left edge of water
146	4,938.54	Thalweg
152	4,941.12	Right edge of water
159	4,944.47	Right bank
168	4,952.54	The right-bank monument is a 2.5-inch hardware washer epoxied to a boulder in a rock outcrop. Latitude and longitude not recorded.
		Transect 5
0	4,976.10	The left-bank monument is a 2.5-inch hardware washer epoxied vertically to a large rock outcrop. This monument was set in 1993. Latitude: 38° 51' 50.91"; Longitude: 119° 41' 36.96".
28	4,963.33	Left bank
32	4,952.31	Left bank
46	4,939.72	Left bank
65	4,941.03	Channel bar
78	4,940.85	Left edge of water
113	4,940.10	Thalweg
145	4,940.89	Right edge of water
165	4,943.89	Right bank
189	4,945.52	Right bank
222	4,955.31	The right-bank monument is a 2.5-inch PVC pipe cemented into terrace. This monument was reset in 1994 because original monument established in 1993 was destroyed by cattle. Latitude and longitude not recorded.

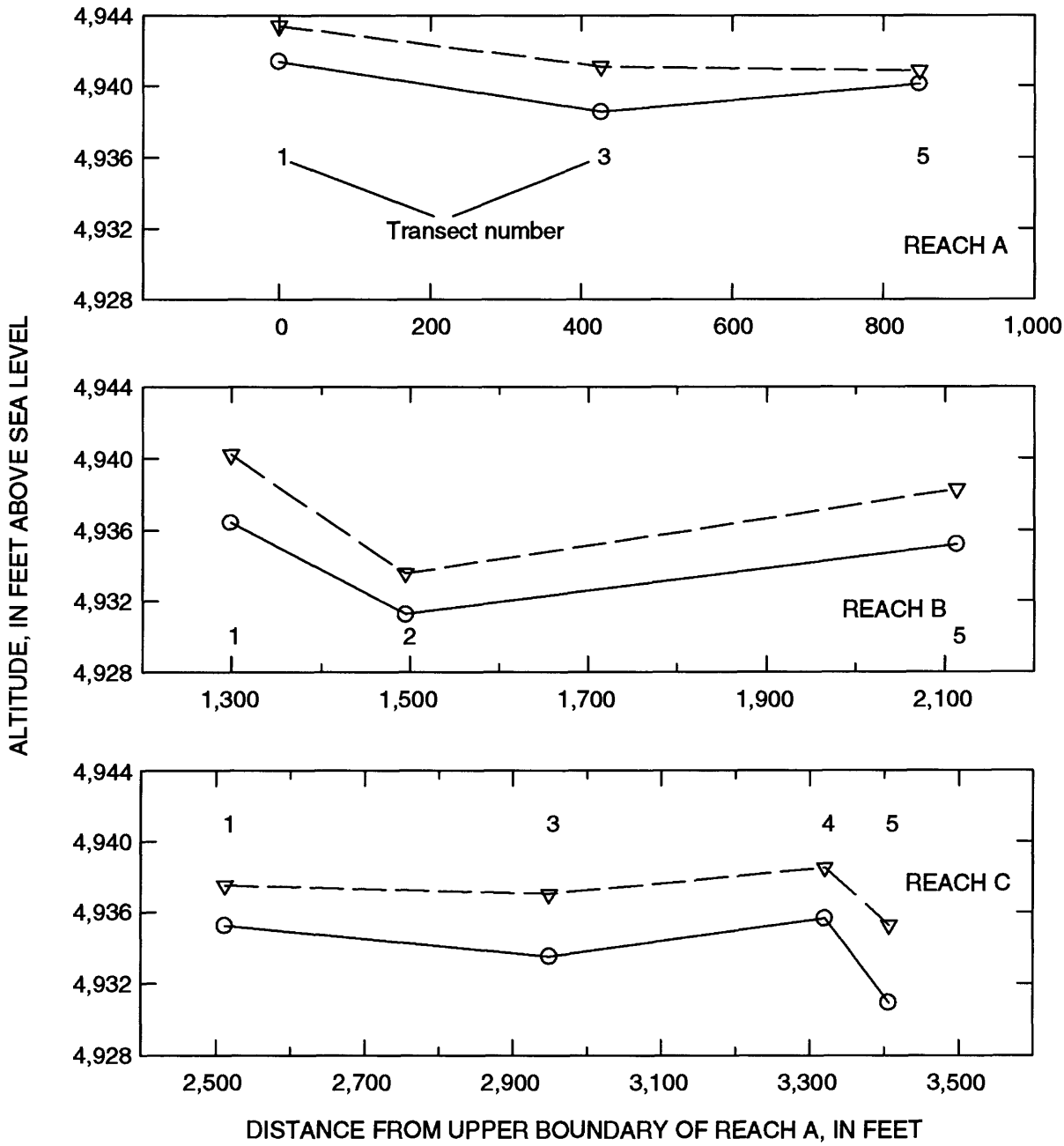


Figure 5. Longitudinal profiles of streambed (○) and water-surface (▽) altitudes measured along the thalweg in reaches A-C, East Fork Carson River near Dresslerville, Nev., October 1994.

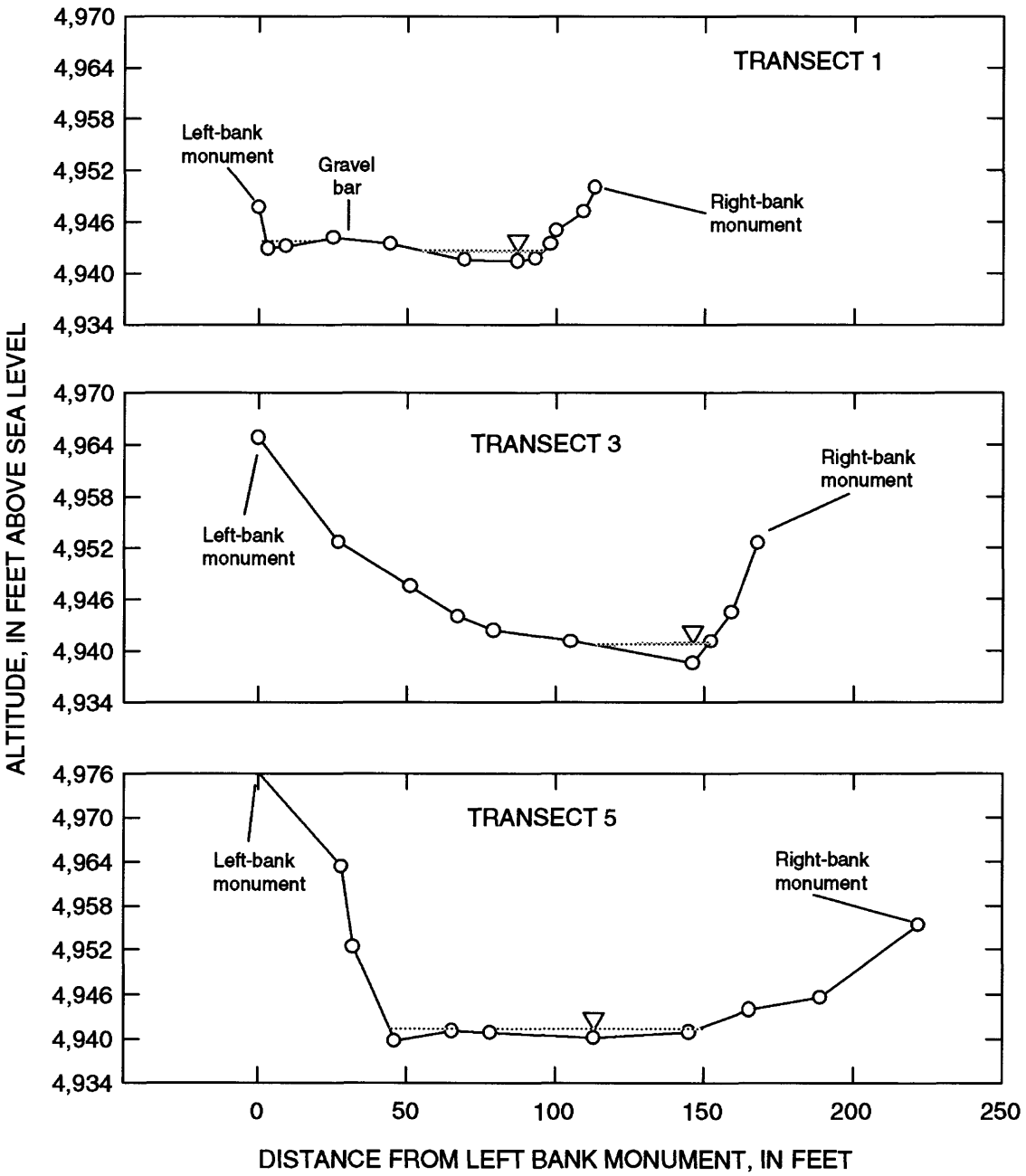


Figure 6. Cross sections showing land-surface (○) and water-surface (▽) altitudes for selected transects in reach A, East Fork Carson River near Dresslerville, Nev., October 1994.

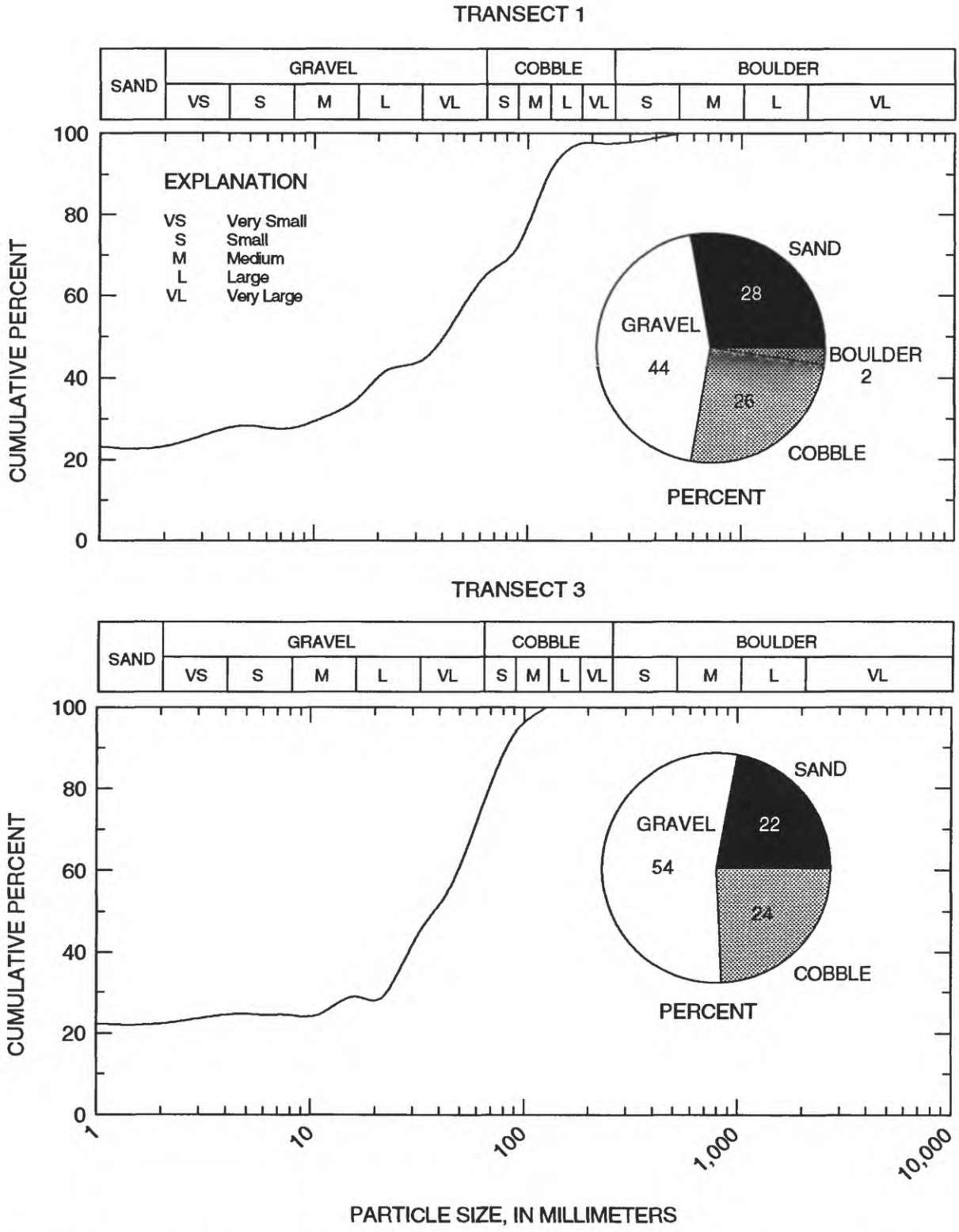


Figure 7. Particle-size distribution of coarse streambed substrate for selected transects in reach A, East Fork Carson River near Dresslerville, Nev., October 1994.

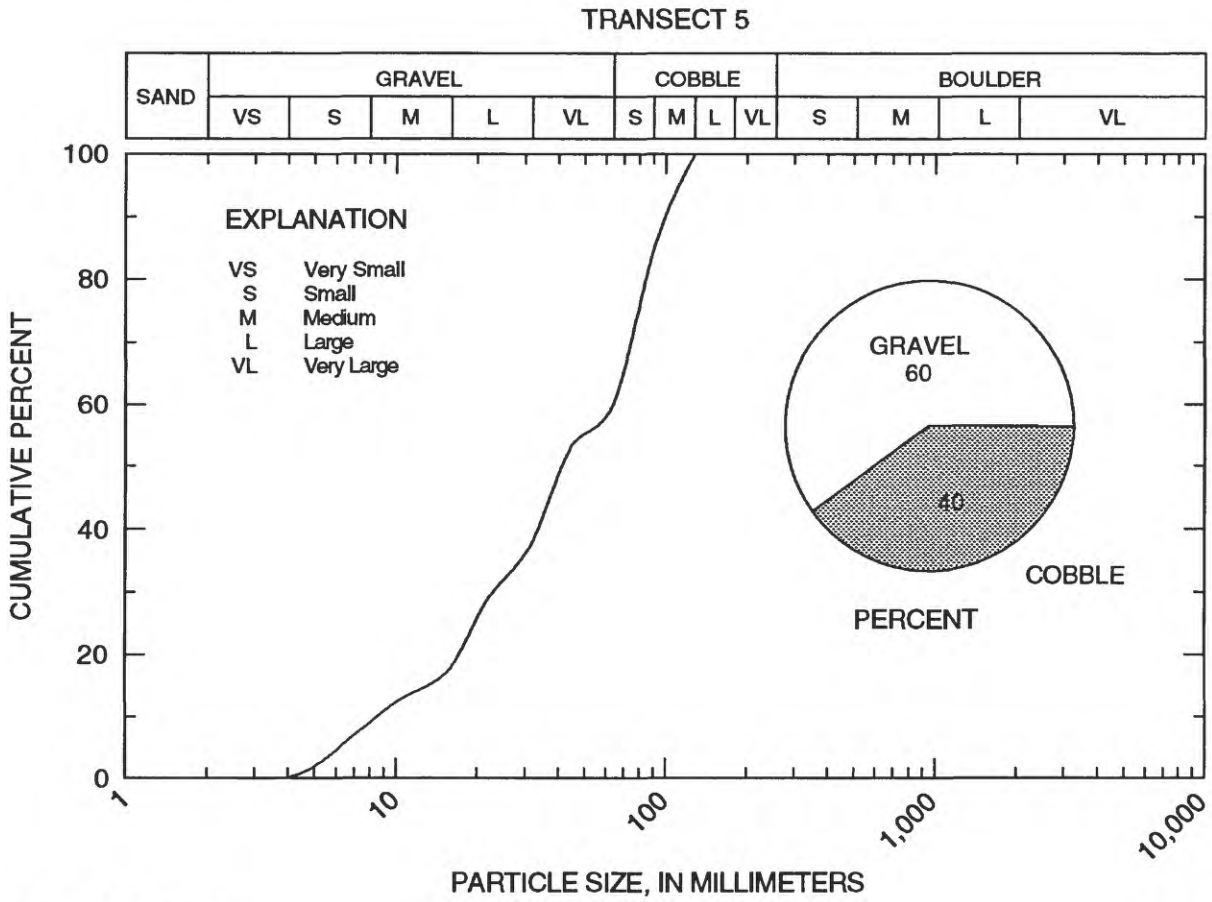


Figure 7. Continued.

Table 8. Streambank features for selected transects in reach B, East Fork Carson River near Dresslerville, Nev., October 1994

[**Shape**: CC, concave up; LN, linear.
Substrate: BO, boulder; BR, bedrock; CO, cobble; SA, sand; SI, silt.
Habitat features: BO, boulder; UB, undercut bank; WD, woody debris]

Stream-bank	Angle (degrees)	Height (feet)	Width (feet)	Surface cover (percent)	Shape	Erosion	Substrate		Habitat features
							Dominant	Subdominant	
				Transect 1					
Left	17.7	11.5	8	greater than 80	CC	None	CO	BO	10 percent BO
Right	3.6	5.9	54	greater than 80	LN	None	BO	SA	None
				Transect 2					
Left	13.2	8	10	greater than 80	LN	None	BO	SA	5 percent UB
Right	4.1	12	117	greater than 80	CC	None	CO	SA	None
				Transect 3					
Left	6.8	3	10	greater than 80	CC	None	CO	SA	None
Right	4.2	12	107	greater than 80	LN	None	SA	SI	None
				Transect 4					
Left	4.8	14.4	114	greater than 80	CC	None	BR	BO	None
Right	19.8	9	10	50 to 70	LN	None	CO	SA	5 percent UB
				Transect 5					
Left	7.6	15.7	79	greater than 80	LN	None	BR	--	5 percent WD
Right	22.2	15.1	24	greater than 80	LN	None	SA	SI	None

Table 9. Cross-section measurements and description of stream channel along selected transects in reach B, East Fork Carson River near Dresslerville, Nev., October 1994

[Latitude and longitude were measured using a Global Positioning Satellite system. Altitudes were measured using a surveyors level and rod from Federal Emergency Management Agency benchmark. Cross-section measurements are plotted in figure 8.
Abbreviation: PVC, polyvinyl-chloride]

Distance from left bank monument, (feet)	Altitude (feet above sea level)	Description
		Transect 1
0	4,953.20	The left-bank monument is a 2.5-inch hardware washer epoxied vertically to a large boulder. This monument was set in 1993. Latitude: 38°51' 54.64"; Longitude: 119°41' 34.78".
12	4,947.91	Top of left bank
20	4,940.18	Left edge of water
48	4,936.42	Thalweg
66	4,938.73	Stream channel
89	4,940.24	Right edge of water
102	4,942.13	Channel bar
124	4,943.54	Right bank
143	4,942.31	Bottom of terrace
152	4,945.75	Upper edge of terrace
162	4,948.63	Terrace
178	4,947.20	Terrace
193	4,951.03	Terrace
207	4,952.92	The right-bank monument is a 2.5-inch PVC pipe cemented into terrace. Latitude and longitude not recorded.

Table 9. Cross-section measurements and description of stream channel along selected transects in reach B, East Fork Carson River near Dresslerville, Nev., October 1994—Continued

Distance from left bank monument, (feet)	Altitude (feet above sea level)	Description
		Transect 4
0	4,949.98	The left-bank monument is yellow-capped rebar driven into the left bank about 227 feet downstream from transect 1, reach B. This monument was set in 1993, but not recovered in 1996. Latitude and longitude not recorded.
32	4,945.70	Edge of left bank
38	4,941.59	Left bank
64	4,932.48	Bottom of left bank
74	4,935.94	Channel bar
118	4,935.82	Channel bar
146	4,933.46	Left edge of water
202	4,931.26	Thalweg
217	4,933.66	Right edge of water
227	4,940.23	Upper edge of right bank
243	4,943.31	The right-bank monument is yellow-capped rebar driven into the ground on a narrow terrace. This monument was set in 1993, but not recovered in 1996. Latitude and longitude not recorded.
		Transect 5
0	4,950.94	The left-bank monument is a 2.5-inch hardware washer epoxied vertically to a large rock outcrop. This monument was set in 1993. Latitude: 38°52' 00.11"; Longitude: 119°41' 26.31".
5	4,934.95	Wetted channel
12	4,938.02	Wetted channel
52	4,940.28	Channel bar
79	4,938.30	Left edge of water
96	4,936.72	Stream channel
117	4,935.20	Thalweg
130	4,938.22	Right edge of water
135	4,944.40	Channel bar
145	4,947.46	Channel bar
154	4,950.28	Upper edge of right bank
163	4,955.90	The right-bank monument is a 2.5-inch hardware washer epoxied vertically and near the bottom of a large rock outcrop. Latitude and longitude not recorded.

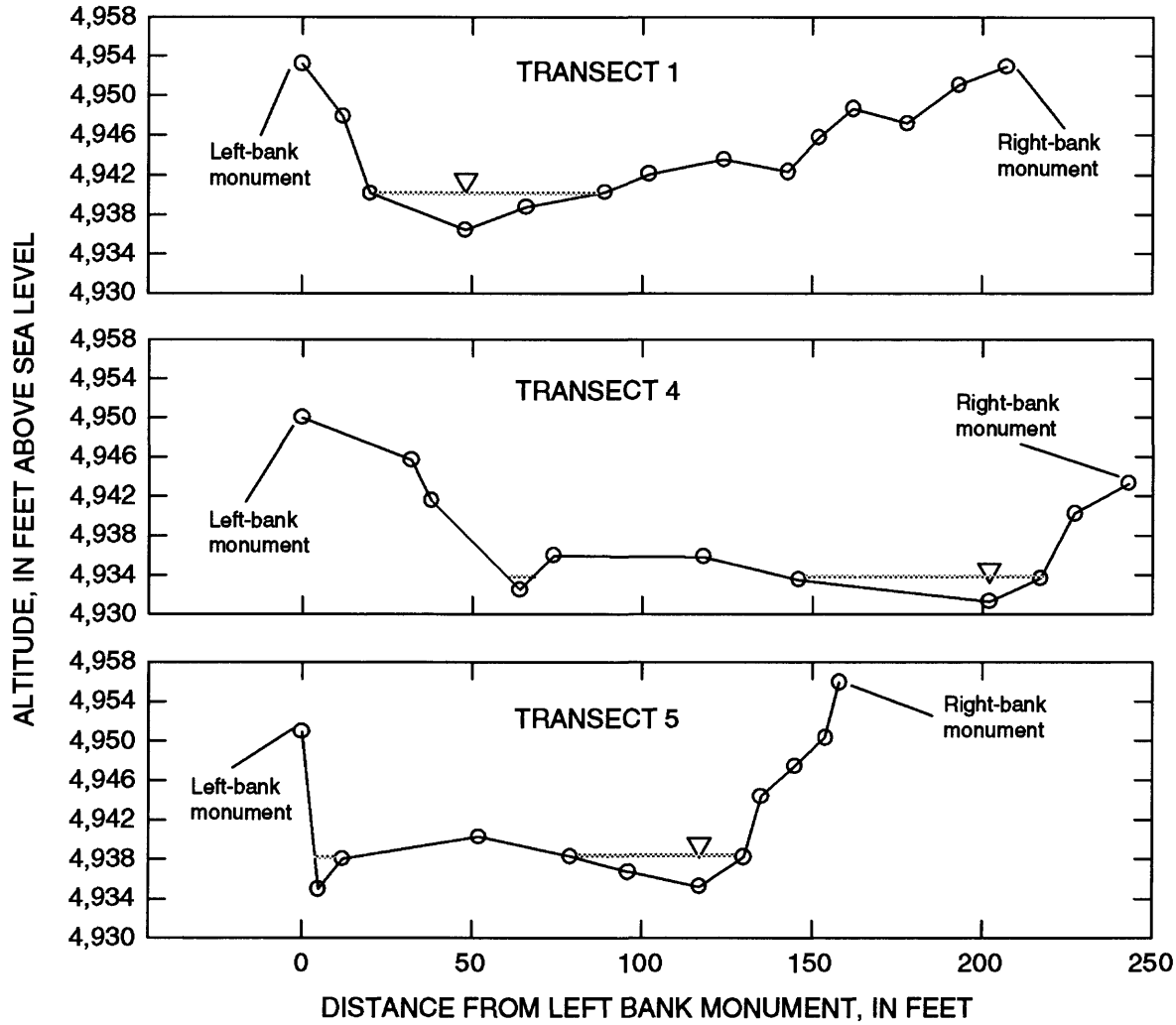


Figure 8. Cross sections showing land-surface (○) and water-surface (▽) altitudes for selected transects in reach B, East Fork Carson River near Dresslerville, Nev., October 1994.

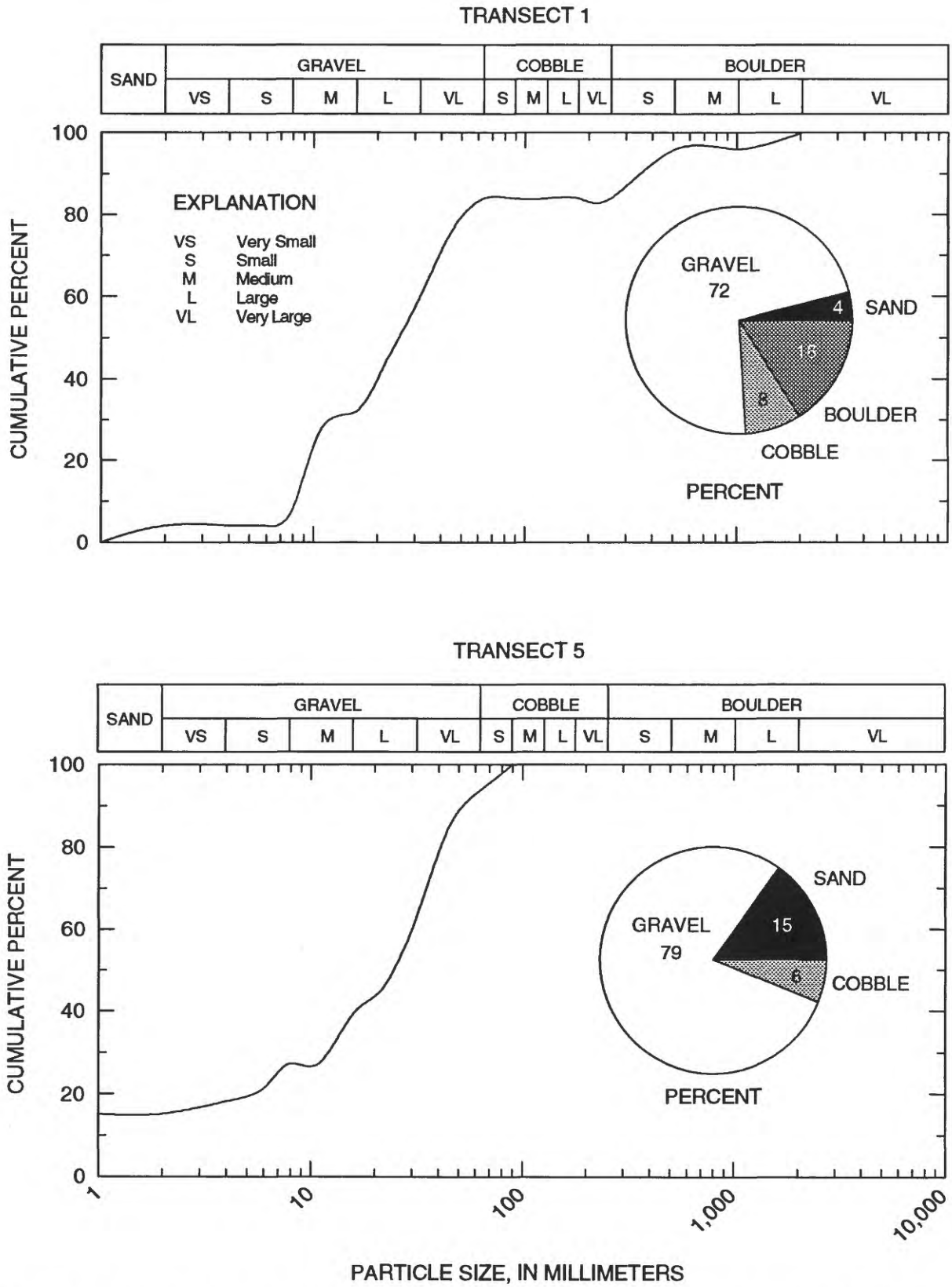


Figure 9. Particle-size distribution of coarse streambed substrate for selected transects in reach B, East Fork Carson River near Dresslerville, Nev., October 1994.

Table 10. Streambank features for selected transects in reach C, East Fork Carson River near Dresslerville, Nev., October 1994

[**Shape**: CC, concave up; LN, linear.
Erosion: CB, cut-bank scallop; SL, slab failure.
Substrate: BO, boulder; BR, bedrock; CO, cobble; SA, sand; SI, silt.
Habitat features: BO, boulder; UB, undercut bank.]

Stream-bank	Angle (degrees)	Height (feet)	Width (feet)	Surface cover (percent)	Shape	Erosion	Substrate		Habitat features
							Dominant	Subdominant	
				Transect 1					
Left	11.7	10.8	35	25 to 49	CC	SL	SA	SI	5 percent UB
Right	4.8	6.0	6	greater than 80	LN	None	BR	--	5 percent BO
				Transect 2					
Left	11.7	15	15	greater than 80	LN	None	SA	SI	5 percent UB
Right	5.9	6	25	greater than 80	CC	None	CO	SA	None
				Transect 3					
Left	15.4	7.7	4	50 to 79	CC	CB	SA	SI	5 percent UB
Right	6.7	15	78	greater than 80	LN	None	SA	SI	None
				Transect 4					
Left	29.2	13.4	12	greater than 80	LN	None	BO	SA	5 percent BO
Right	4.7	11.4	90	greater than 80	CC	None	CO	SI	None
				Transect 5					
Left	20	13.1	18	greater than 80	LN	None	BO	SA	20 percent BO
Right	4.7	14.4	155	greater than 80	CC	None	SA	SI	None

Table 11. Cross-section measurements and description of stream channel along selected transects in reach C, East Fork Carson River near Dresslerville, Nev., October 1994

[Latitude and longitude were measured using a Global Positioning Satellite system. Altitudes were measured using a surveyors level and rod from Federal Emergency Management Agency benchmark. Cross-section measurements in bold are plotted in figure 10. Abbreviation: PVC, polyvinyl-chloride]

Distance from left bank monument (feet)	Altitudo (feet above sea level)	Description
		Transect 1
0	4,956.88	The left-bank monument is a 2.5-inch hardware washer epoxied vertically to a rock outcrop. This monument was set in 1993. Latitude: 38° 52' 02.55"; Longitude: 119° 41' 26.18".
55	4,946.00	Upper edge of left bank
65	4,939.17	Bottom of left bank
68	4,937.22	Channel bar
77	4,935.50	Channel bar
87	4,937.13	Channel bar
90	4,937.58	Left edge of water
107	4,935.16	Thalweg
111	4,937.40	Right edge of channel bar
158	4,937.25	Left edge of channel bar
171	4,933.74	Small slough
172	4,937.43	Right edge of water
178	4,941.12	Upper edge of right bank
187	4,950.79	The right-bank monument is a 2.5-inch hardware washer epoxied vertically to a large rock outcrop. This monument was set in 1993. Latitude and longitude not recorded.

Table 11. Cross-section measurements and description of stream channel along selected transects in reach C, East Fork Carson River near Dresslerville, Nev., October 1994—Continued

Distance from left bank monument (feet)	Altitude (feet above sea level)	Description
		Transect 3
0	4,946.49	The left-bank monument is a 2.5-inch PVC pipe cemented into small terrace and topped with a hardware washer. This monument was set in 1993. Latitude and longitude not recorded.
24	4,941.21	Upper edge of left bank
28	4,937.00	Left edge of water
52	4,933.54	Thalweg
68	4,934.54	Stream channel
90	4,935.10	Stream channel
101	4,937.02	Right edge of water
129	4,937.07	Bottom of right bank
142	4,938.55	Right bank
166	4,944.96	Right bank
179	4,948.51	Former right-bank monument (yellow-capped rebar on right bank)
213	4,953.70	The right-bank monument is a metal fence post driven into the right bank about 45 feet upstream from parking area. This monument was reset in 1996 because original monument established in 1993 was not recovered. Latitude: 38° 52' 07.32"; Longitude: 119° 41' 28.44".
		Transect 4
0	4,949.05	The left-bank monument is a 2.5-inch PVC pipe cemented into the ground and topped with a hardware washer. This monument was set in 1993 and reset in 1994 because of vandalism. Latitude and longitude not recorded.
12	4,938.51	Left edge of water
24	4,935.61	Thalweg
74	4,938.97	Right edge of water
115	4,941.47	Channel bar
143	4,942.52	Right bank
154	4,943.93	Right bank
164	4,946.99	Former Right bank monument (rebar, est. 1993)
346	4,971.09	Right-bank monument is a metal fence post driven into the ground, 25 feet south of dirt road entrance to parking area. This monument was reset in 1996 because original monument established in 1993 was not recovered. Latitude: 38° 52' 09.11"; Longitude: 119° 41' 28.50".

Table 11. Cross-section measurements and description of stream channel along selected transects in reach C, East Fork Carson River near Dresslerville, Nev., October 1994—Continued

Distance from left bank monument (feet)	Altitude (feet above sea level)	Description
		Transect 5
	4,948.33	An additional monument was established in 1996 about 10 feet downstream. This second monument is a 4-inch white disk epoxied to a small flat boulder about 6 feet above the top of the left bank. This disk is inscribed with BOUNDARY MARKER USGS NAWQA XSEC. Latitude and longitude not recorded
0	4,947.32	Left-bank monument is a 8-inch. by 8-inch concrete block cemented into lower slope about 6 feet above the left bank. This monument has a 2-inch brass tablet and was set in 1993. Latitude and longitude not recorded.
6	4,944.03	Upper edge of left bank
17	4,937.46	Left bank
24	4,935.26	Left edge of water
42	4,930.91	Thalweg
63	4,935.21	Right edge of water
98	4,936.54	Channel bar
111	4,940.83	Channel bar
123	4,942.84	Right bank
171	4,943.77	Right bank
218	4,945.34	Right bank
229	4,948.29	Former right-bank monument (est. 1993)
292	4,962.18	Right-bank monument is a 4-inch white disk epoxied to a large flat boulder in a small rock outcrop about 130 feet downstream from parking area and 30 feet streamward from the dirt road entering the parking area. This disk is inscribed with BOUNDARY MARKER USGS NAWQA XSEC. This monument was reset in 1996 because original monument established in 1993 was destroyed by a bulldozer. Latitude: 38°52' 09.98"; Longitude: 119°41' 29.23".

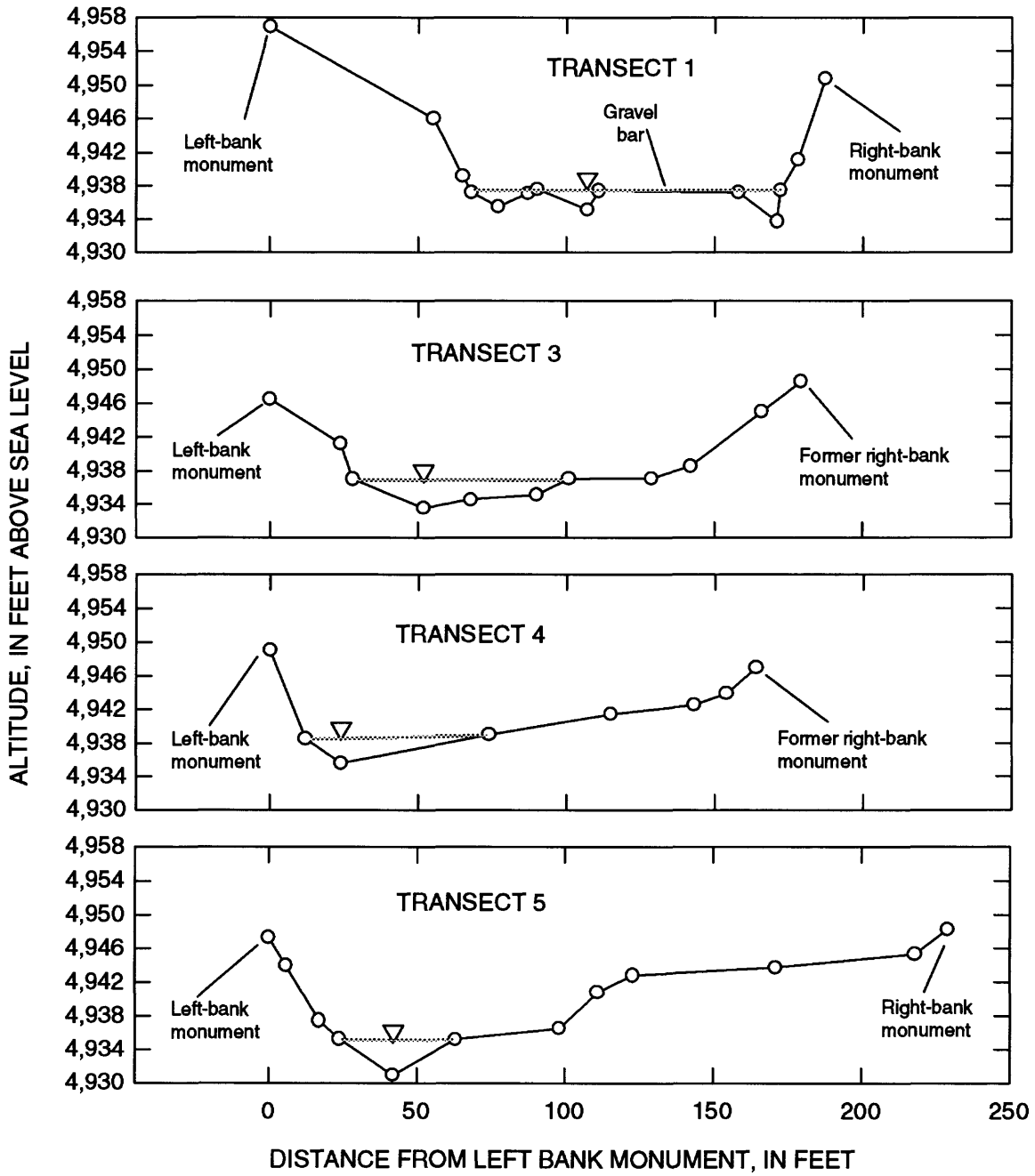


Figure 10. Cross sections showing land-surface (○) and water-surface (▽) altitudes for selected transects in reach C, East Fork Carson River near Dresslerville, Nev., October 1994.

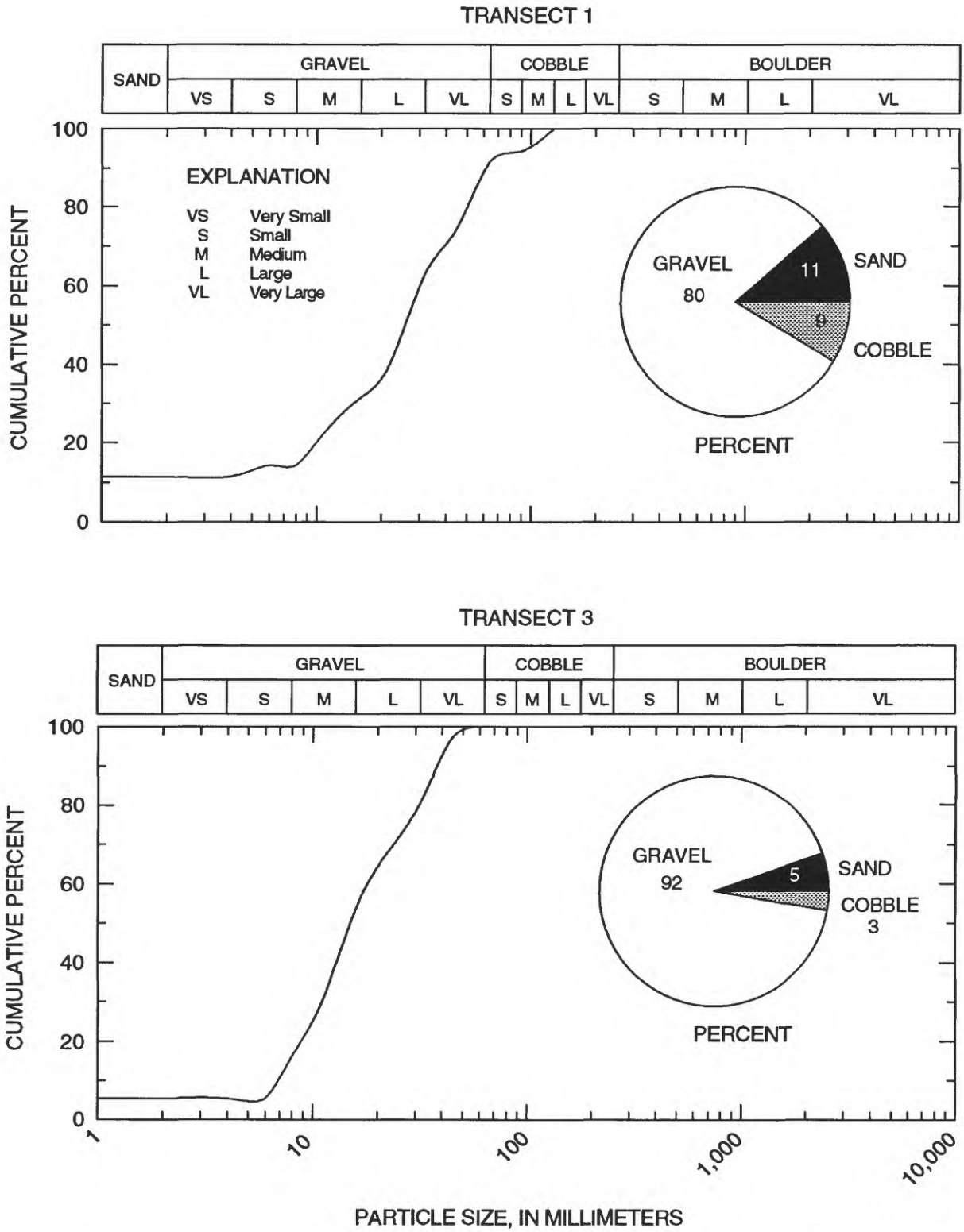


Figure 11. Particle-size distribution of coarse streambed substrate for selected transects in reach C, East Fork Carson River near Dresslerville, Nev., October 1994.

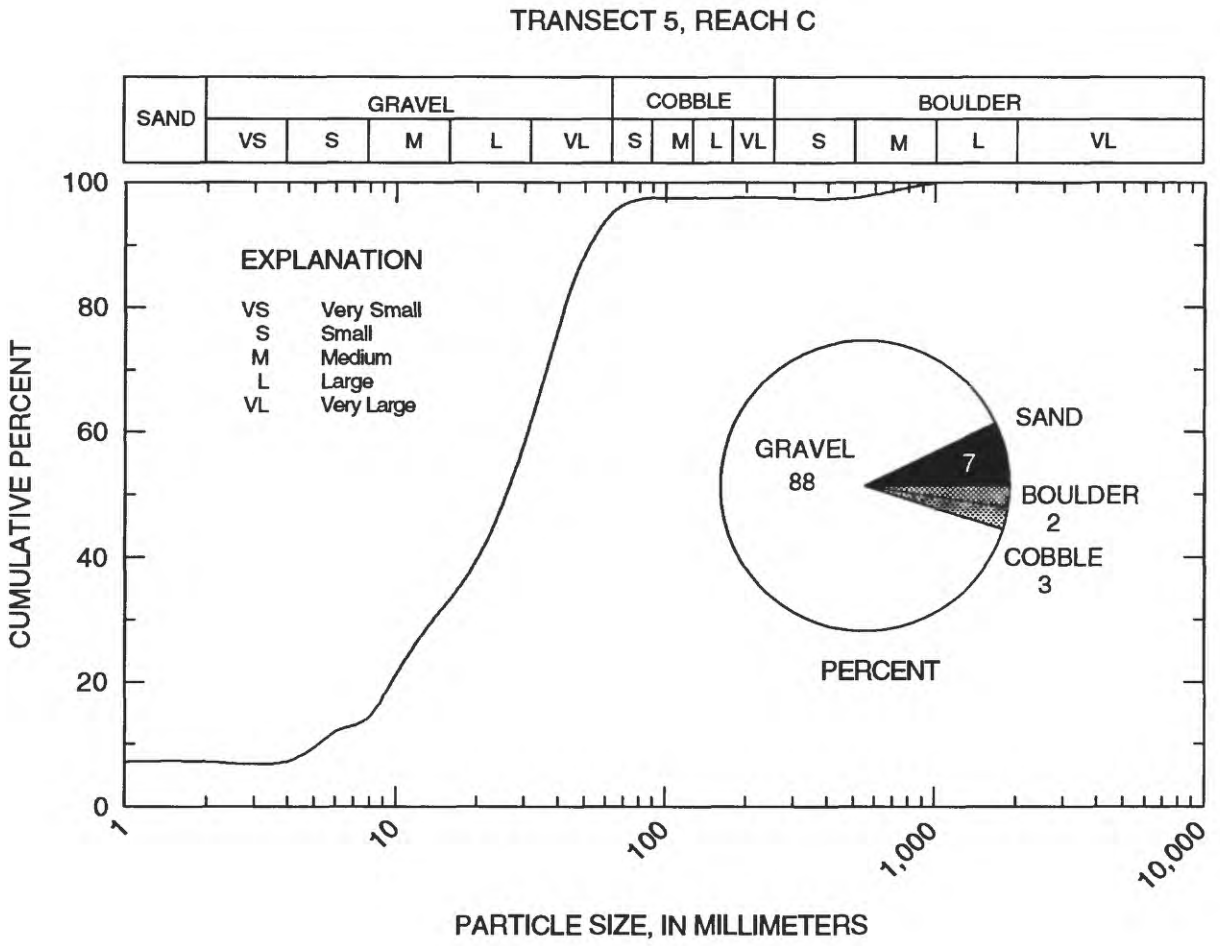


Figure 11. Continued.

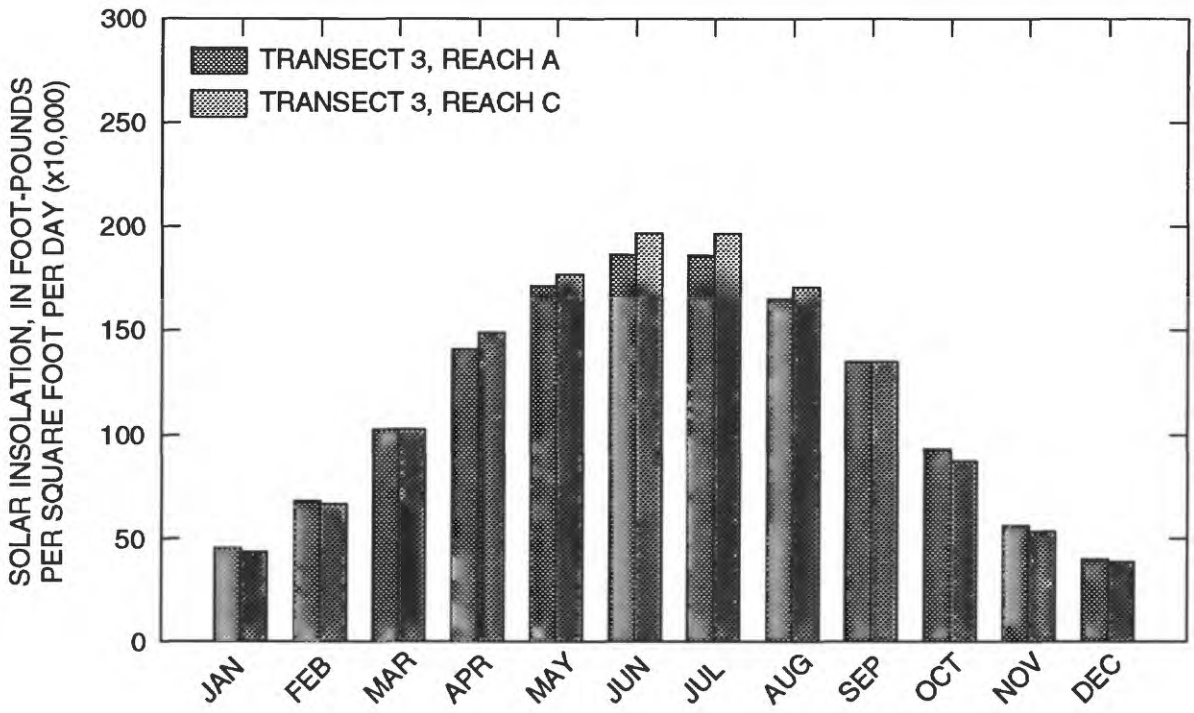
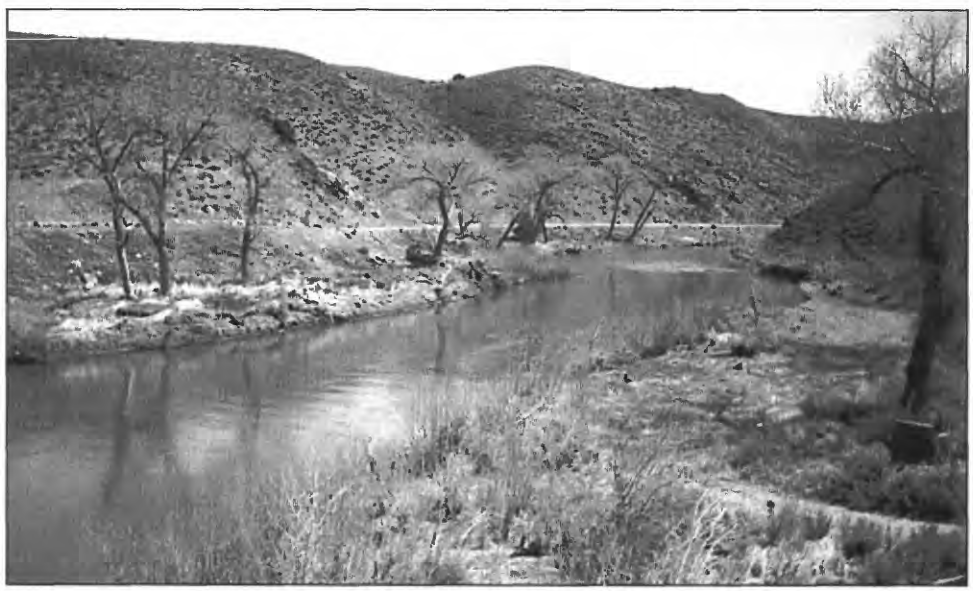


Figure 12. Monthly solar insolation midstream at transect 3 in reaches A and C, East Fork Carson River near Dresslerville, Nev.

Carson River at Deer Run Road near Carson City, Nev. (U.S. Geological Survey Station 10311400)



Downstream view of Carson River from Deer Run Road bridge 400 feet upstream from transect 1, reach A, Carson River at Deer Run Road near Carson City, Nev. Photograph by Stephen J. Lawrence, U.S. Geological Survey, March 1997.

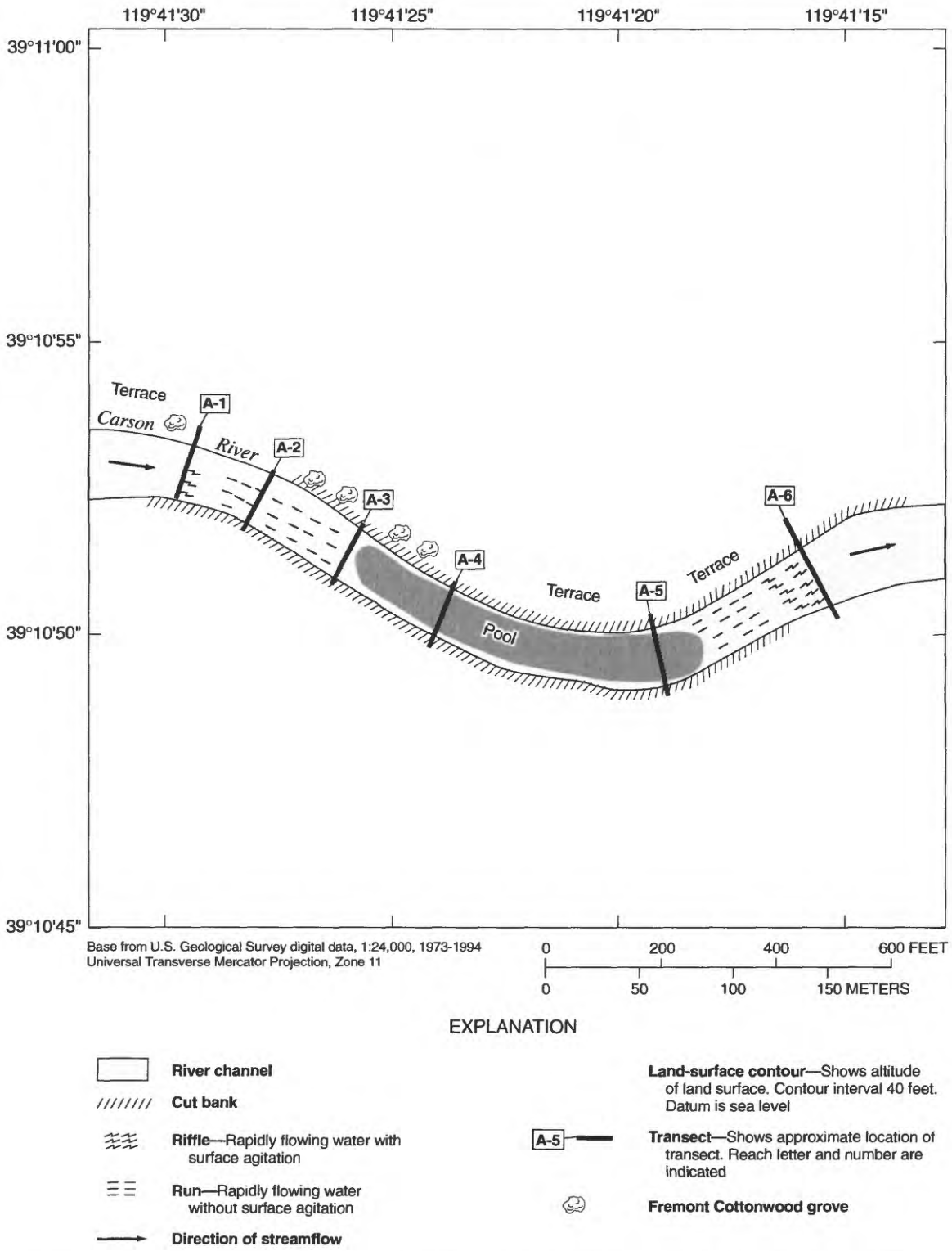


Figure 13. Location of transects in reach A, Carson River at Deer Run Road near Carson City, Nev., with some landscape features approximately located, July 1994.

Table 12. Streambank features for selected transects in reach A, Carson River at Deer Run Road near Carson City, Nev., July 1994

[**Shape**: CC, concave up; CV, convex up; LN, Linear.
Erosion: CB, cut-bank scallop.
Substrate: BO, boulder; SA, sand; SI, silt.
Habitat features: BO, boulder; ME, emergent macrophyte; MS, submergent macrophyte.]

Stream-bank	Angle (degrees)	Height (feet)	Width (feet)	Surface cover (percent)	Shape	Erosion	Substrate		Habitat features
							Dominant	Subdominant	
				Transect 1					
Left	10.9	12.9	62	50 to 79	LN	None	SI	SA	5 percent MS
Right	10.9	11.8	41	greater than 80	LN	CB	SI	SA	None
				Transect 2					
Left	5.2	3.7	13	greater than 80	CV	CB	SI	BO	30 percent ME
Right	9.6	7.0	15	greater than 80	CC	CB	SI	BO	15 percent ME
				Transect 3					
Left	18.8	8.5	13	greater than 80	CC	CB	SA	BO	25 percent ME
Right	6.2	9.5	34	greater than 80	LN	CB	SA	BO	25 percent ME
				Transect 4					
Left	6.6	5.5	12.8	greater than 80	CC	CB	SA	BO	10 percent ME
Right	9.6	9.0	18.0	greater than 80	CV	None	SA	BO	None
				Transect 5					
Left	14.0	8.5	17	greater than 80	LN	CB	SA	SI	15 percent BO
Right	8.6	6.0	15	greater than 80	LN	None	SA	BO	5 percent BO
				Transect 6					
Left	10.7	13.4	55	greater than 80	CC	CB	SI	BO	None
Right	9.7	9.1	36	greater than 80	CC	None	SI	BO	None

Table 13. Cross-section measurements and description of stream channel along selected transects in reach A, Carson River at Deer Run Road, near Carson City, Nev., July 1994

[Latitude and longitude were measured using a Global Positioning Satellite system. Altitudes were measured using a surveyors level and rod from USGS brass tablet RM-4 on the Deer Run Road bridge crossing the Carson River. Cross-section measurements are plotted in figure 15. Abbreviation: PVC, polyvinyl-chloride]

Distance from left bank monument (feet)	Altitude (feet above sea level)	Description
		Transect 1
0	4,585.93	The left-bank monument is a 4-inch PVC pipe topped with Department of the Interior brass tablet. This monument is cemented into a narrow terrace on the left bank. Latitude: 39° 10' 53.55"; Longitude: 119° 41' 29.22".
12	4,582.11	Bottom of left bank terrace
21	4,576.83	Channel Bar
37	4,575.72	Channel Bar
44	4,574.76	Channel Bar
49	4,574.29	Channel Bar
58	4,574.67	Channel Bar
62	4,574.33	Left edge of water
67	4,573.06	Thalweg
77	4,573.57	Stream channel
87	4,574.38	Right edge of water
97	4,574.43	Channel Bar
111	4,574.91	Bottom of right bank
117	4,576.20	Right bank
127	4,580.25	Right bank
128	4,584.86	Right bank
134	4,585.15	Right bank
138	4,585.87	The right-bank monument is a yellow-capped rebar driven into the ground. Latitude: 39° 10' 52.32"; Longitude: 119° 41' 29.76".

Table 13. Cross-section measurements and description of stream channel along selected transects in reach A, Carson River at Deer Run Road, near Carson City, Nev., July 1994—Continued

Distance from left bank monument (feet)	Altitude (feet above sea level)	Description
		Transect 3
0	4,586.20	The left-bank monument is a 2.5-inch PVC pipe topped with a hardware washer. This monument is cemented into a narrow terrace on the left bank. Latitude: 39° 10' 51.91"; Longitude: 119° 41' 25.63".
0	4,585.17	Land surface at monument
8	4,583.85	Top edge of left bank
10	4,581.80	Bottom of left bank
11	4,579.05	Channel bar
15	4,577.11	Channel bar
21	4,576.40	Left edge of water
23	4,575.67	Stream channel
33	4,575.37	Thalweg
38	4,574.13	Stream channel
43	4,574.39	Stream channel
50	4,573.59	Stream channel
59	4,575.38	Stream channel
62	4,575.03	Stream channel
64	4,574.07	Stream channel
70	4,574.10	Stream channel
72	4,573.87	Stream channel
80	4,574.03	Stream channel
86	4,576.02	Right edge of water
90	4,577.05	Edge of channel bar
94	4,576.20	Channel bar
97	4,576.11	Channel bar
104	4,576.09	Channel bar
108	4,578.15	Channel bar
115	4,579.49	Channel bar
117	4,580.82	Bottom of right bank
118	4,583.74	Right bank
120	4,584.90	Upper edge of bank
124	4,586.31	The right-bank monument is yellow-capped rebar, in 0.5-inch PVC pipe, driven into the ground. Latitude: 39° 10' 50.88"; Longitude: 119° 41' 26.34".

Table 13. Cross-section measurements and description of stream channel along selected transects in reach A, Carson River at Deer Run Road, near Carson City, Nev., July 1994—Continued

Distance from left bank monument (feet)	Altitude (feet above sea level)	Description
		Transect 6
0	4,586.40	The left-bank monument is a 8-inch by 8-inch concrete block topped with a 2-inch brass tablet. This monument is cemented into a narrow terrace on the left bank. Latitude: 39° 10' 51.99"; Longitude: 119° 41'16.33".
0	4,585.93	Land surface at monument
9	4,584.60	Terrace
18	4,585.07	Top edge of left bank
23	4,577.56	Left bank
28	4,575.70	Bottom of left bank
41	4,573.78	Channel bar
66	4,574.59	Channel bar
73	4,573.25	Left edge of water
75	4,572.62	Stream channel
81	4,572.55	Stream channel
89	4,571.63	Thalweg
93	4,571.97	Middle of stream channel
99	4,571.96	Stream channel
106	4,572.51	Right edge of water
108	4,573.73	Channel bar
117	4,574.69	Channel bar
124	4,576.36	Channel bar
130	4,579.38	Right bank
134	4,580.35	Right bank
142	4,580.75	Right bank
150	4,582.49	Talus slope
152	4,584.19	The right-bank monument is yellow-capped rebar, in 0.5-inch PVC pipe, driven into the ground. Latitude: 39° 10' 50.88"; Longitude: 119° 41' 16.02".

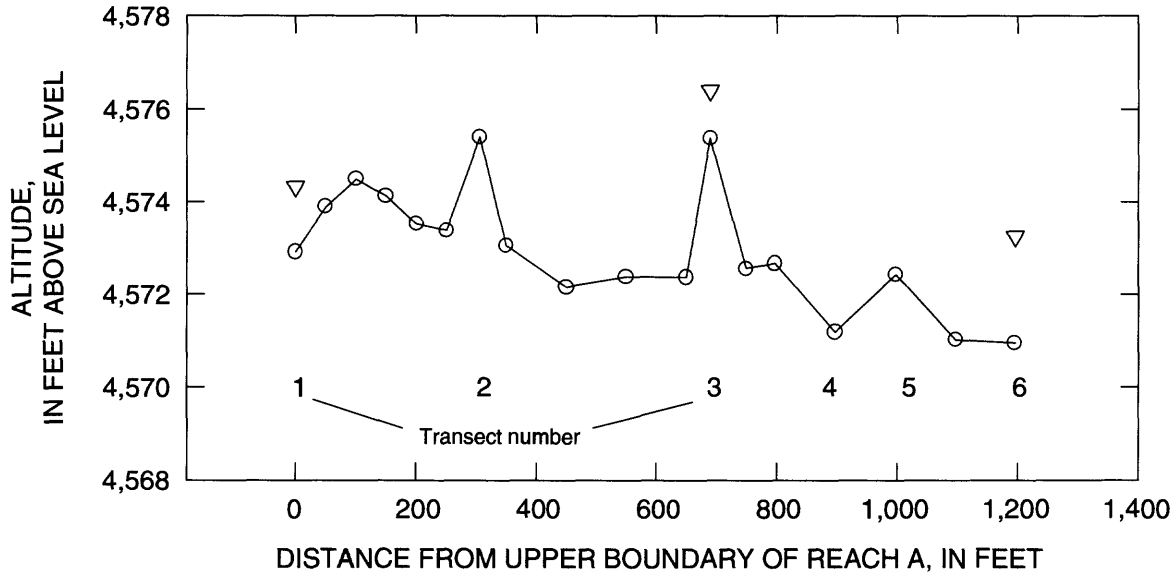


Figure 14. Longitudinal profiles of streambed (○) and water-surface (▽) altitudes measured along the thalweg in reach A, Carson River at Deer Run Road near Carson City, Nev., July 1994.

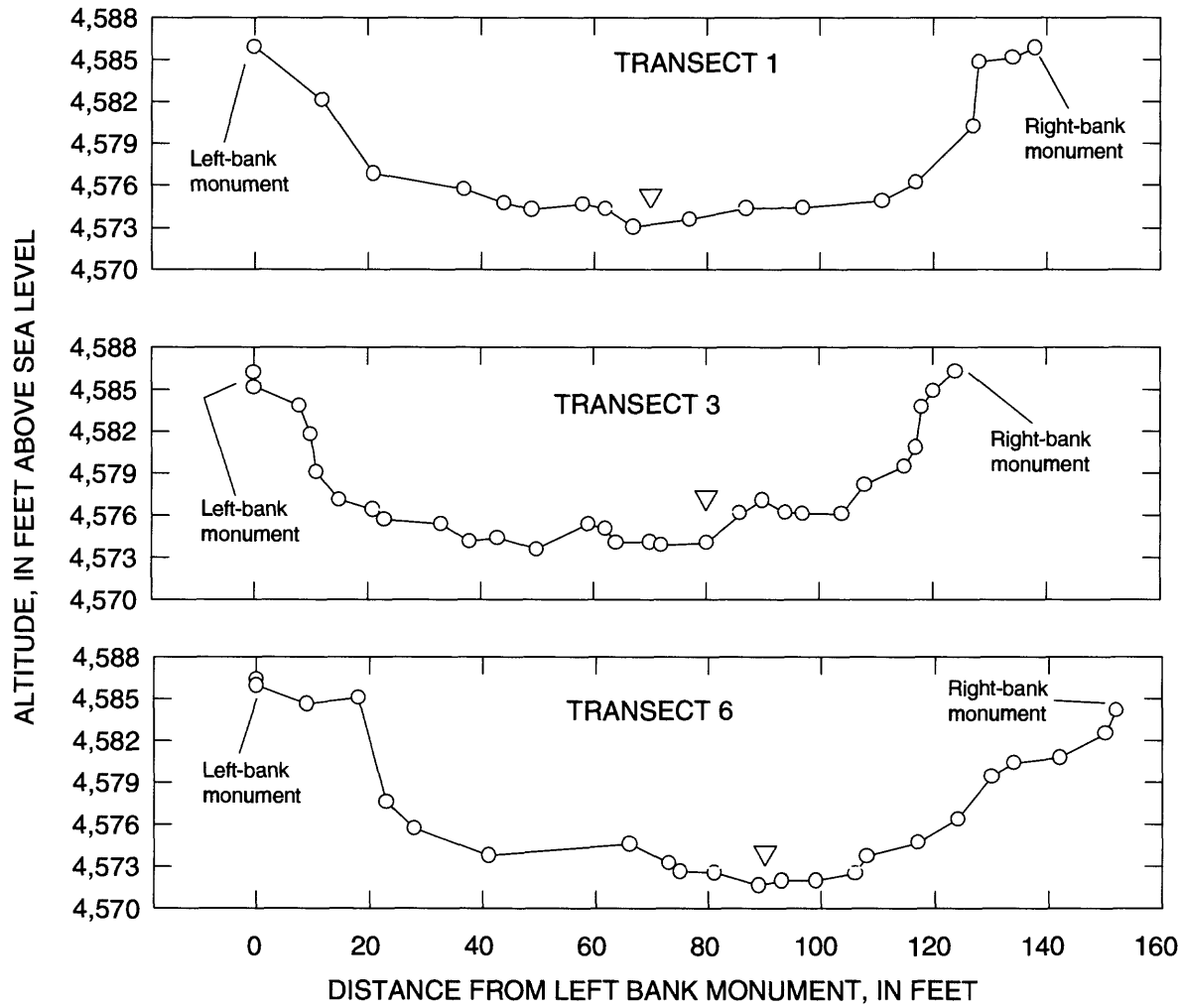


Figure 15. Cross sections showing land-surface (○) and water-surface (▽) altitudes for selected transects in reach A, Carson River at Deer Run Road near Carson City, Nev., July 1994.

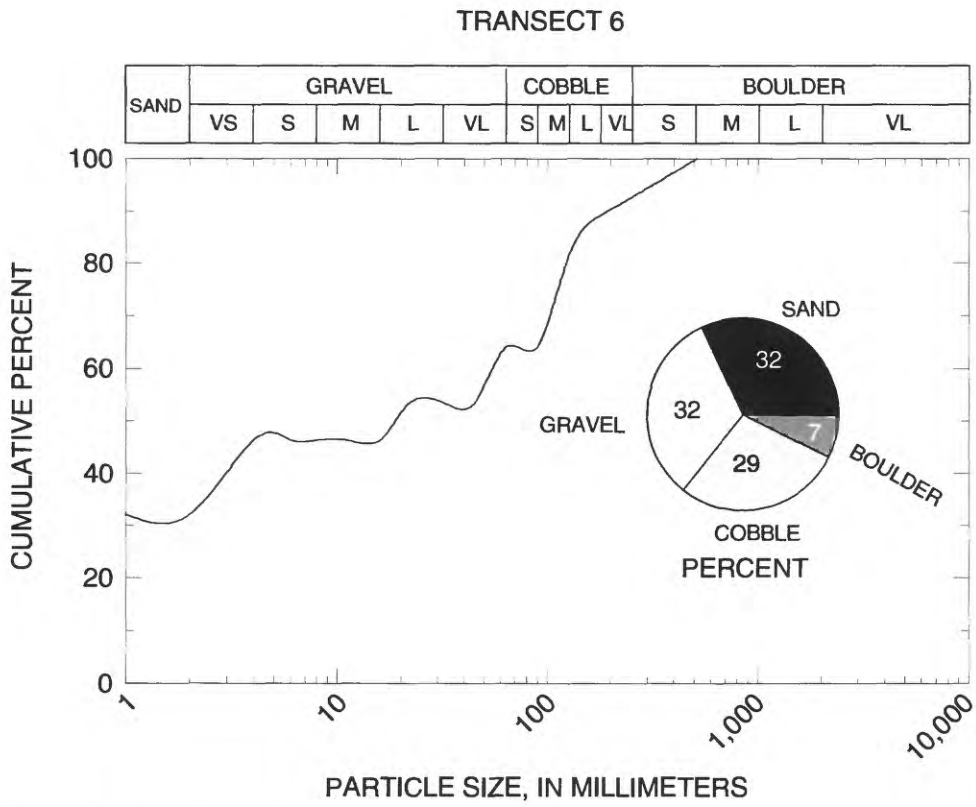


Figure 16. Particle-size distribution of coarse streambed substrate for transect 6 in reach A, Carson River at Deer Run Road near Carson City, Nev., August 1994.

Carson River at Fort Churchill (State Park), Nev. (U.S. Geological Survey Station 10312000)

Downstream view of Carson River from transect 1, reach B, Carson River at Fort Churchill (State Park), Nev. Photograph by Sonya Vasquez, U.S. Geological Survey, September 1995.

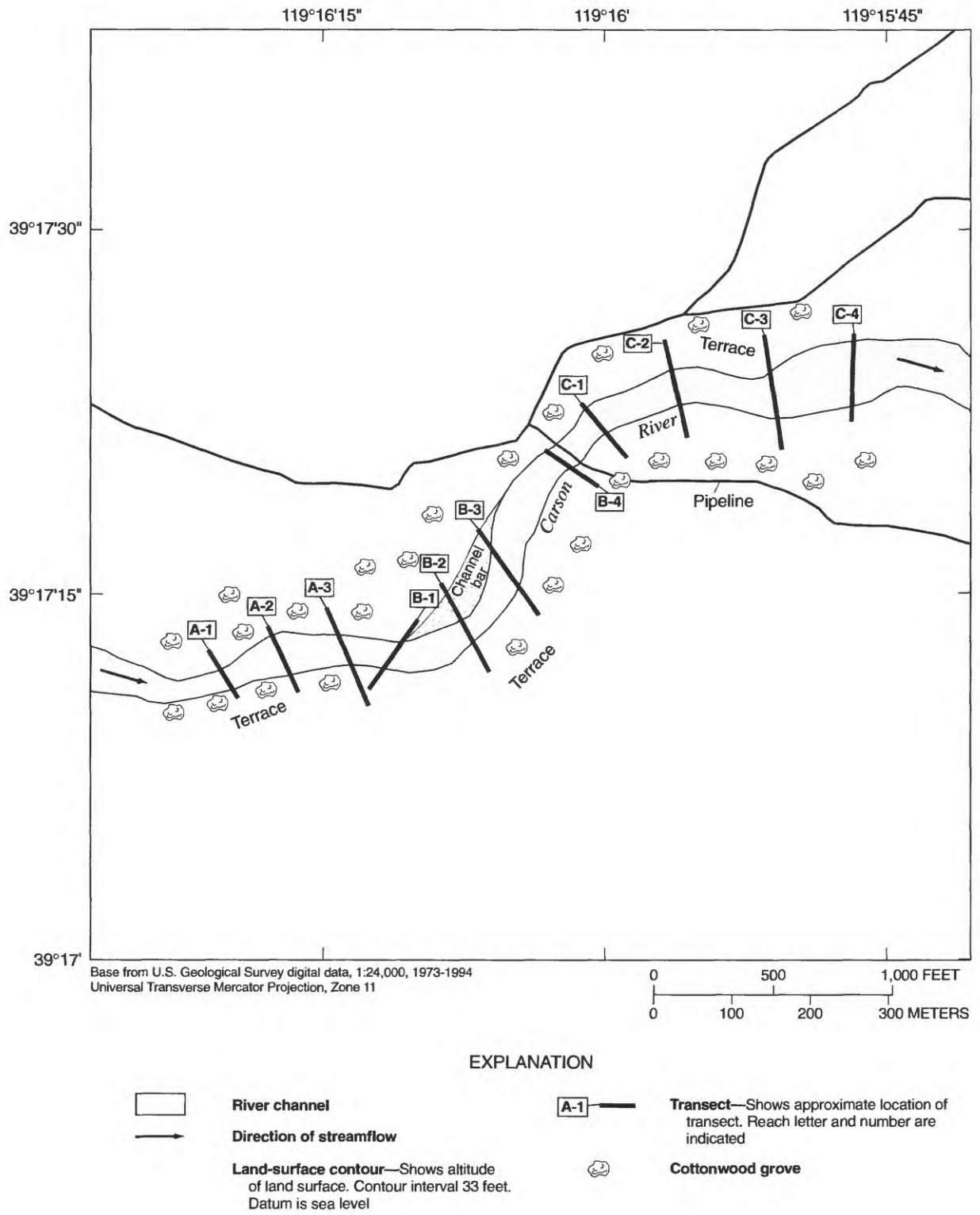


Figure 17. Location of transects in reaches A-C, Carson River at Fort Churchill (State Park), Nev., with some landscape features approximately located, October 1993.

Table 14. Streambank features for selected transects in reach A, Carson River at Fort Churchill (State Park), Nev., October 1993

[**Shape**; CC, concave up; CV, convex up.
Erosion: CB, cut-bank scallop; SL, slab failure.
Substrate: SA, sand; SI, silt.
Habitat features: UB, undercut bank.]

Stream-bank	Angle (degrees)	Height (feet)	Width (feet)	Surface cover (percent)	Shape	Erosion	Substrate		Habitat features
							Dominant	Subdominant	
				Transect 1					
Left	1.1	3.5	144	Less than 25	CC	SL	SA	SI	10 percent UB
Right	23.0	12.8	10	50 to 79	CV	CB	SA	SI	None
				Transect 2					
Left	7.2	12.5	58	Less than 25	CC	CB	SA	SI	None
Right	6.0	14.6	96	50 to 79	CV	None	SA	SI	None
				Transect 3					
Left	35.8	14.4	7	Less than 25	CC	None	SA	SI	None
Right	2.9	13.1	226	Less than 25	CC	SL,CB	SA	SI	None

Table 15. Cross-section measurements and description of stream channel along selected transects in reach A, Carson River at Fort Churchill (State Park), Nev., October 1993

[Latitude and longitude were measured using a Global Positioning Satellite system. Altitudes were measured using a surveyors level and rod from National Geodetic Survey benchmark A361. Cross-section measurements are plotted in figure 19]

Distance from left bank monument (feet)	Altitude (feet above sea level)	Description
		Transect 1
0	4,206.97	The left-bank monument is 4-inch PVC pipe cemented into ground and topped with Department of the Interior brass tablet. The monument is about 226 feet downstream from a railroad bridge that crosses the Carson River. Latitude: 39° 17' 12.69"; Longitude: 119° 16' 21.09".
23	4,205.77	Upper edge of left bank
38	4,201.65	Bottom of left bank
59	4,202.95	Channel bar
88	4,203.43	Channel bar
101	4,199.96	Channel bar
113	4,198.73	Channel bar
118	4,196.45	Channel bar
130	4,196.28	Channel bar
138	4,197.12	Channel bar
166	4,196.39	Channel bar
167	4,195.00	Left edge of water
171	4,193.56	Stream channel
207	4,192.92	Thalweg
225	4,194.18	Stream channel
227	4195.04	Right edge of water
232	4197.62	Bottom of right bank
237	4205.71	Upper edge of right bank
250	4207.07	The right-bank monument is 2.5-inch PVC pipe cemented into the ground and topped with a 2.5-inch hardware washer. Latitude: 39° 17' 10.74"; Longitude: 119° 16' 19.50".

Table 15. Cross-section measurements and description of stream channel along selected transects in reach A, Carson River at Fort Churchill (State Park), Nev., October 1993—Continued

Distance from left bank monument (feet)	Altitude (feet above sea level)	Description
		Transect 2
0	4,209.82	The left-bank monument is a 2.5 hardware washer driven into a 3-foot diameter tree stump. The monument is about 485 feet downstream from a railroad bridge that crosses the Carson River. Latitude: 39° 17' 13.68"; Longitude: 119° 16' 17.93".
45	4,206.11	Upper edge of left bank
70	4,203.95	Bottom of left bank
103	4,195.26	Left edge of water
144	4,193.65	Thalweg
188	4,195.27	Right edge of water
274	4,198.18	Bottom of right bank
284	4,208.27	Upper edge of right bank
294	4,207.90	The right-bank monument is yellow-capped rebar driven into the ground. Latitude: 39° 17' 10.99"; Longitude: 119° 16' 16.31".
		Transect 3
0	4,209.66	The left-bank monument is a metal fence post driven into the ground. The monument is about 885 feet downstream from a railroad bridge that crosses the Carson River. This monument was established in 1996 after severe erosion destroyed the initial monument. Latitude and longitude not recorded.
0	4,207.35	Land surface at monument
118	4,207.44	Upper edge of left bank
125	4,193.79	Left edge of water
138	4,193.04	Thalweg
174	4,193.93	Right edge of water
176	4,195.25	Channel bar
211	4,199.00	Channel bar
244	4,198.45	Channel bar
279	4,198.12	Channel bar
304	4,204.09	Right Bank
396	4,204.60	Right bank
400	4,206.18	Upper edge of right bank
418	4,208.19	The right-bank monument is yellow-capped rebar driven into the ground. Latitude: 39° 17' 10.45"; Longitude: 119° 16' 12.56".

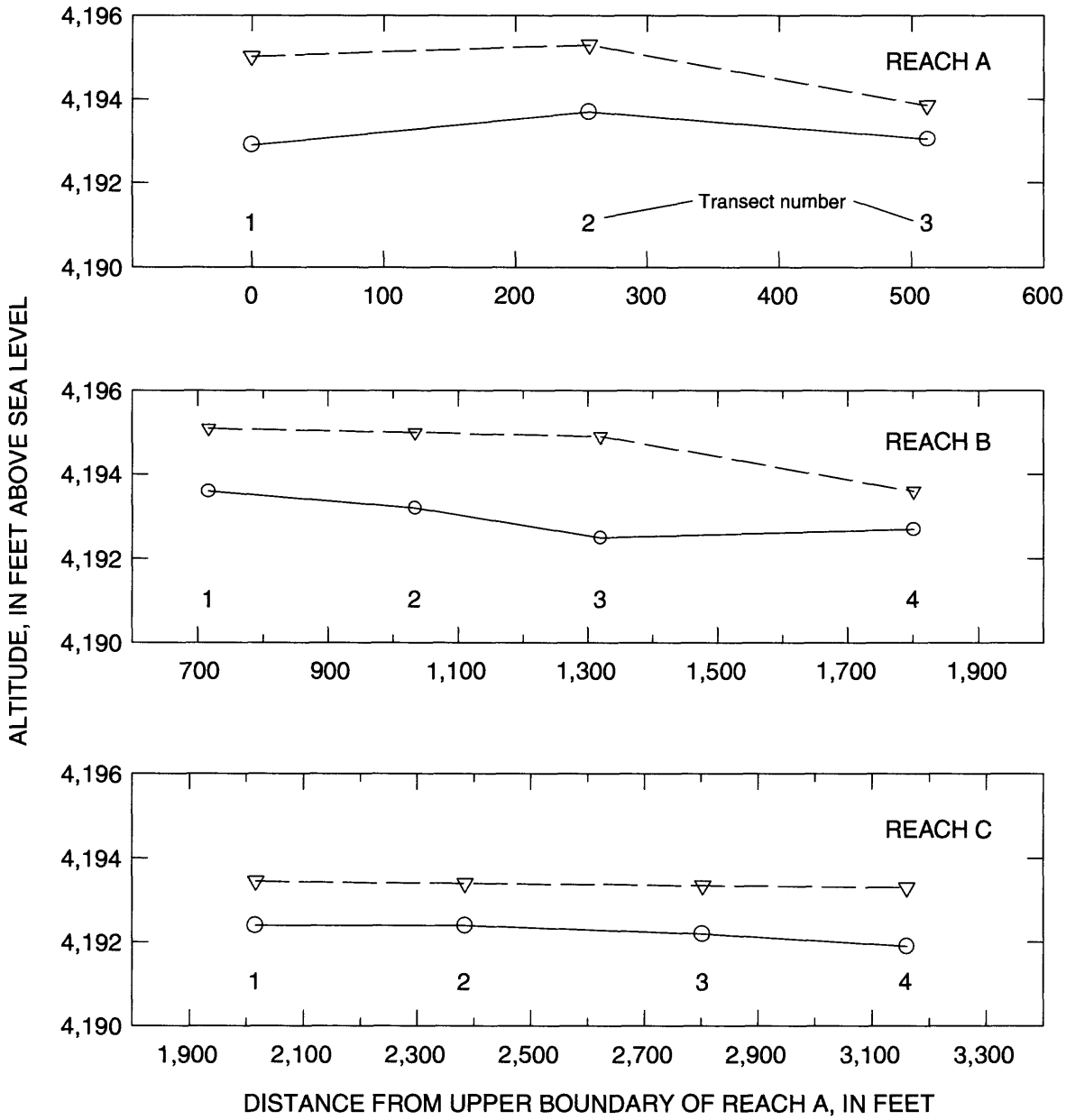


Figure 18. Longitudinal profiles of streambed (○) and water-surface (▽) altitudes measured along the thalweg in reaches A-C, Carson River at Fort Churchill (State Park), Nev., October 1993.

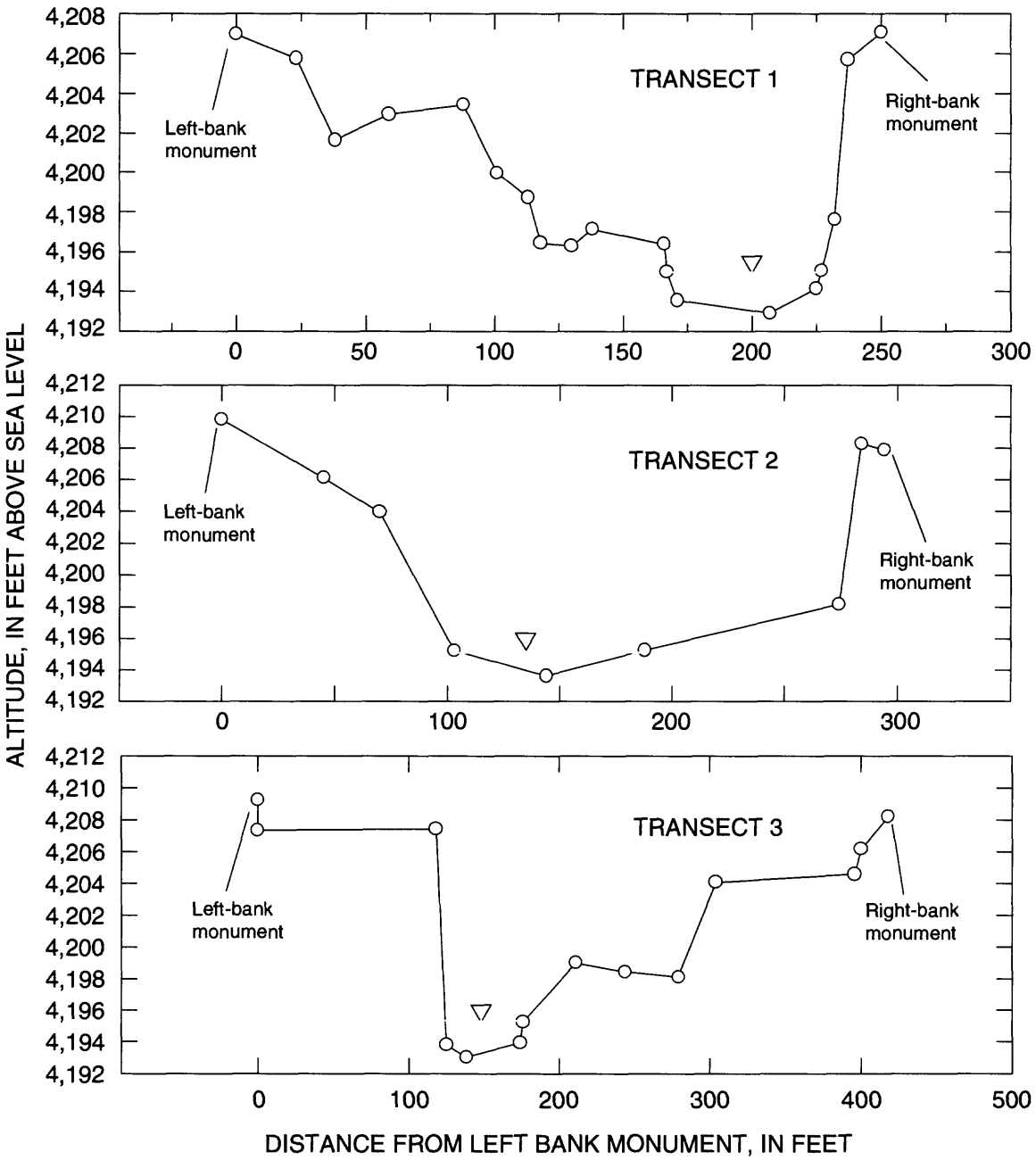


Figure 19. Cross sections showing land-surface (○) and water-surface (▽) altitudes for selected transects in reach A, Carson River at Fort Churchill (State Park), Nev., October 1993.

Table 16. Streambank features of selected transects in reach B, Carson River at Fort Churchill (State Park), Nev., October 1993

[**Shape**; CC, concave up; CV, convex up.
Erosion: CB, cut-bank scallop; SL, slab failure.
Substrate: SA, sand; SI, silt.
Habitat features: UB, undercut bank; WD, woody debris.]

Stream-bank	Angle (degrees)	Height (feet)	Width (feet)	Surface cover (percent)	Shape	Erosion	Substrate		Habitat features
							Dominant	Subdominant	
				Transect 1					
Left	9.5	12.7	19	25 to 49	CC	SL	SA	SI	None
Right	4.4	11.3	133	25 to 49	CC	None	SA	SI	1 percent WD
				Transect 2					
Left	4	6.7	230	Less than 25	CV	None	SA	SI	None
Right	12	15.1	65	50 to 79	CC	SL,CB	SA	SI	10 percent UB
				Transect 3					
Left	2.1	12.0	331	Less than 25	CV	None	SA	SI	None
Right	13	14.7	1	Less than 25	CC	SL,CB	SA	SI	25 percent WD
				Transect 4					
Left	5.1	13.6	40	Less than 25	CC	SL	SA	SI	None
Right	8.0	13.9	84	Less than 25	CV	None	SA	SI	None

Table 17. Cross-section measurements and description of stream channel along selected transects in reach B, Carson River at Fort Churchill (State Park), Nev., October 1993

[Latitude and longitude were measured using a Global Positioning Satellite system. Altitudes were measured using a surveyors level and rod from National Geodetic Survey benchmark A361. Cross-section measurements are plotted in figure 20. Abbreviation: PVC, polyvinyl-chloride]

Distance from left bank monument (feet)	Altitude (feet above sea level)	Description
		Transect 1
0	4207.20	The left-bank monument is a 2.5-inch PVC pipe topped with a hardware washer and cemented into the ground. The monument is about 1,117 feet downstream from a railroad bridge that crosses the Carson River. Latitude: 39° 17' 13.95"; Longitude: 119° 16' 09.95".
26	4206.27	Left bank
38	4195.54	Left bank
45	4194.98	Left edge of water
47	4193.71	Channel
56	4194.05	Channel
105	4193.57	Thalweg
119	4195.17	Right edge of water
126	4199.08	Channel bar
150	4199.79	Channel bar
176	4198.67	Channel bar
187	4196.77	Channel bar
226	4197.05	Channel bar
247	4197.79	Bottom of right bank
252	4204.82	Top right bank
276	4208.12	The right-bank monument is a 2.5-inch PVC pipe topped with a hardware washer and cemented into the ground. Latitude: 39° 17' 11.121"; Longitude: 119° 16' 09.76".

Table 17. Cross-section measurements and description of stream channel along selected transects in reach B, Carson River at Fort Churchill (State Park), Nev., October 1993—Continued

Distance from left bank monument (feet)	Altitude (feet above sea level)	Description
		Transect 3
0	4,204.55	The left-bank monument is a 2.5-inch PVC pipe topped with a hardware washer and cemented into the ground. The monument is near a picnic area about 1,724 feet downstream from a railroad bridge that crosses the Carson River. Latitude: 39° 17' 17.71"; Longitude: 119° 16' 06.75".
127	4,204.70	Left bank
216	4,202.05	Channel bar
331	4,194.94	Left edge water
377	4,192.52	Thalweg
440	4,192.55	Bottom right bank
440	4,207.25	The right-bank monument is a yellow-capped rebar driven into the ground. Latitude: 39° 17' 14.14"; Longitude: 119° 16' 03.49".
		Transect 4
0	4,213.75	The left-bank monument is a 2.5-inch PVC pipe cemented into the ground and topped with a hardware washer. The monument is on a small bluff, 30 feet upstream from a large pipe crossing and about 2,159 feet downstream from a railroad bridge that crosses the Carson River. Latitude: 39° 17' 20.94"; Longitude: 119° 16' 03.18".
31	4,206.25	Left bank
42	4,203.61	Left bank
46	4,195.80	Left bank
71	4,193.89	Left edge of water
93	4,193.57	Stream channel
105	4,195.65	Stream channel
117	4,193.71	Stream channel
132	4,193.79	Stream channel
141	4,194.54	Stream channel
155	4,193.43	Stream channel
183	4,192.66	Thalweg
198	4,193.59	Right edge of water
217	4,196.69	Right bank
241	4,198.80	Right bank
259	4,204.37	Right bank
282	4,206.59	The right-bank monument is a 2.5-inch PVC pipe cemented into the ground and topped with a hardware washer. Latitude: 39° 17' 19.45"; Longitude: 119° 16' 00.32".

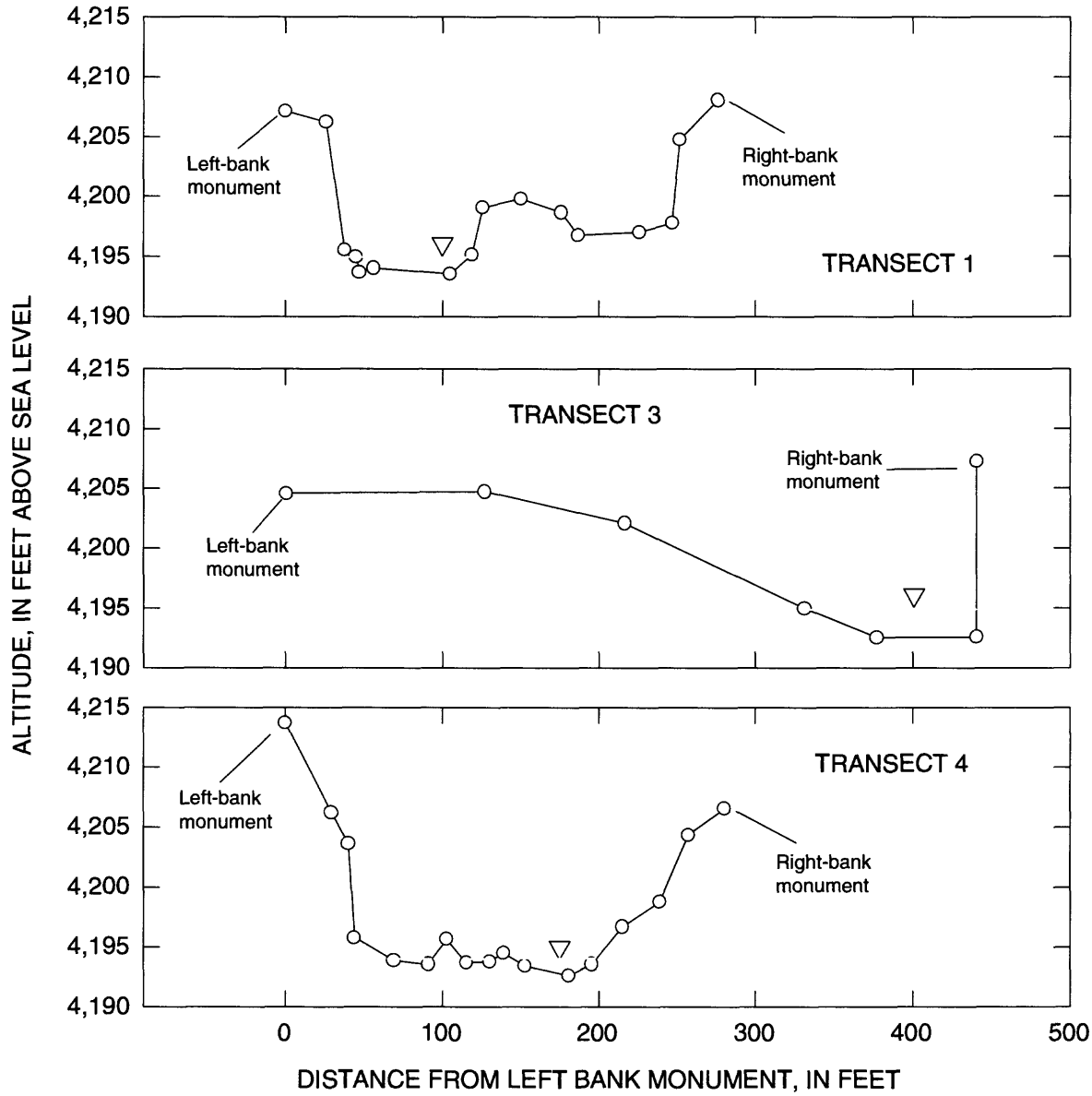


Figure 20. Cross sections showing land-surface (○) and water-surface (▽) altitudes for selected transects in reach B, Carson River at Fort Churchill (State Park), Nev., October 1993.

Table 18. Streambank features for selected transects in reach C, Carson River at Fort Churchill (State Park), Nev., October 1993

[**Shape**: CC, concave up; CV, convex up; LN, linear.
Erosion: SL, slab failure.
Substrate: GV, Gravel; SA, sand; SI, silt.
Habitat features: MS, submergent macrophyte; UB, undercut bank.
--, not measured]

Stream-bank	Angle (degrees)	Height (feet)	Width (feet)	Surface cover (percent)	Shape	Erosion	Substrate		Habitat features
							Dominant	Subdominant	
				Transect 1					
Left	47	14.6	90	Less than 25	CC	SL	SA	SI	10 percent UB
Right	30	14.7	200	Less than 25	LN	None	SA	SI	10 percent UB
				Transect 2					
Left	27	14.0	21	50 to 79	CC	SL	SA	SI	None
Right	3	13.9	150	25 to 49	LN	None	SA	SI	None
				Transect 3					
Left	--	12	20	50 to 79	CC	SL	SA	SI	None
Right	--	6	150	Less than 25	LN	None	GV	SA	None
				Transect 4					
Left	29	13.9	143	50 to 79	CV	None	SA	SI	2 percent MS
Right	47	13.6	124	50 to 79	CC	None	SA	SI	None

Table 19. Cross-section measurements and description of stream channel along selected transects in reach C, Carson River at Fort Churchill (State Park), Nev., October 1993

[Latitude and longitude were measured using a Global Positioning Satellite system. Altitudes were measured using a surveyors level and rod from National Geodetic Survey benchmark A361. Cross-section measurements are plotted in figure 21. Abbreviation: PVC, polyvinyl-chloride]

Distance from left bank monument (feet)	Altitude (feet above sea level)	Description
		Transect 1
0	4,207.04	The left-bank monument is a 2.5-inch PVC pipe topped with a hardware washer and cemented into the ground. The monument is about 60 feet downstream from a pipe that crosses the Carson River. Latitude: 39° 17' 22.87"; Longitude: 119° 16' 01.25".
52	4,204.77	Left bank
58	4,201.88	Left bank
69	4,199.30	Left bank
76	4,194.36	Left bank
90	4,193.40	Left edge of water
94	4,193.05	Stream channel
99	4,193.50	Channel bar
104	4,194.14	Channel bar
131	4,193.38	Right edge of channel bar
143	4,192.41	Thalweg
154	4,192.50	Stream channel
162	4,193.03	Stream channel
178	4,192.91	Stream channel
194	4,193.54	Right edge of water
213	4,197.24	Channel bar
223	4,197.46	Flood plain
232	4,197.30	Flood plain
237	4,196.26	Flood plain
262	4,197.07	Flood plain
297	4,200.00	Right bank
336	4,205.70	Right bank
394	4,207.11	Right-bank monument is a 2.5-inch PVC pipe topped with a hardware washer and cemented into the ground. Latitude: 39° 17' 20.64"; Longitude: 119° 15' 58.81".

Table 19. Cross-section measurements and description of stream channel along selected transects in reach C, Carson River at Fort Churchill (State Park), Nev., October 1993—Continued

Distance from left bank monument (feet)	Altitude (feet above sea level)	Description
		Transect 4
0	4,205.84	The left-bank monument is a 8-inch by 8-inch concrete block topped with a brass tablet. The monument is cemented into the ground. Latitude: 39° 17' 25.73"; Longitude: 119° 15' 46.75".
26	4,200.97	Left bank terrace
43	4,200.43	Left bank terrace
72	4,202.26	Left bank terrace
91	4,198.92	Channel bar
128	4,196.06	Channel bar
133	4,194.94	Channel bar
143	4,193.17	Left edge of water
168	4,192.77	Stream channel
170	4,192.46	Stream channel
195	4,192.10	Thalweg
209	4,192.56	Stream channel
217	4,192.91	Stream channel
224	4,192.72	Stream channel
232	4,191.90	Stream channel
238	4,193.42	Right edge of water
254	4,194.24	Channel bar
258	4,195.64	Channel bar
262	4,195.91	Channel bar
275	4,195.81	Channel bar
289	4,193.02	Thalweg, secondary channel
300	4,197.23	Right bank
334	4,200.20	Right bank
350	4,205.49	Right bank
362	4,206.72	The right-bank monument is a 2.5-inch PVC pipe topped with a hardware washer and cemented into the ground. Latitude: 39° 17' 22.11"; Longitude: 119° 15' 46.881".

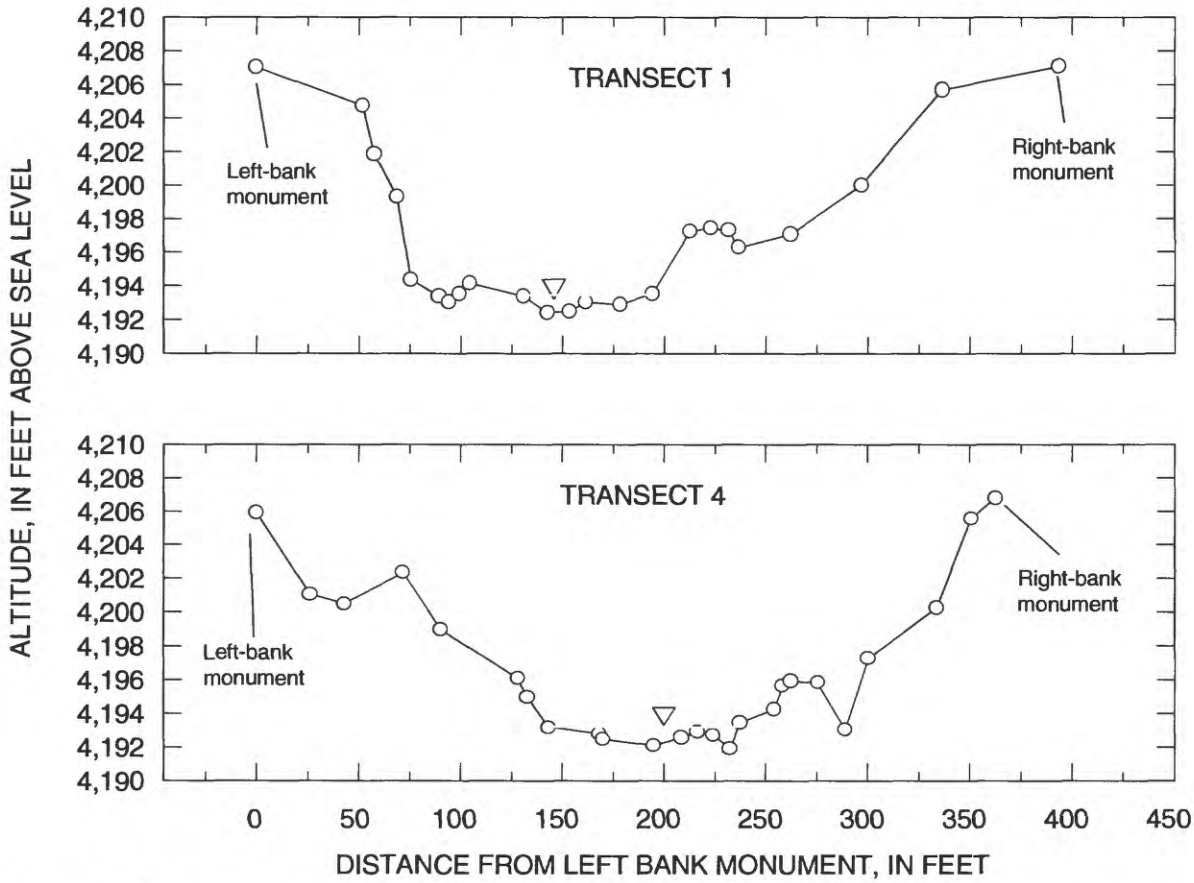


Figure 21. Cross sections showing land-surface (○) and water-surface (▽) altitudes for selected transects in reach C, Carson River at Fort Churchill (State Park), Nev., October 1993.

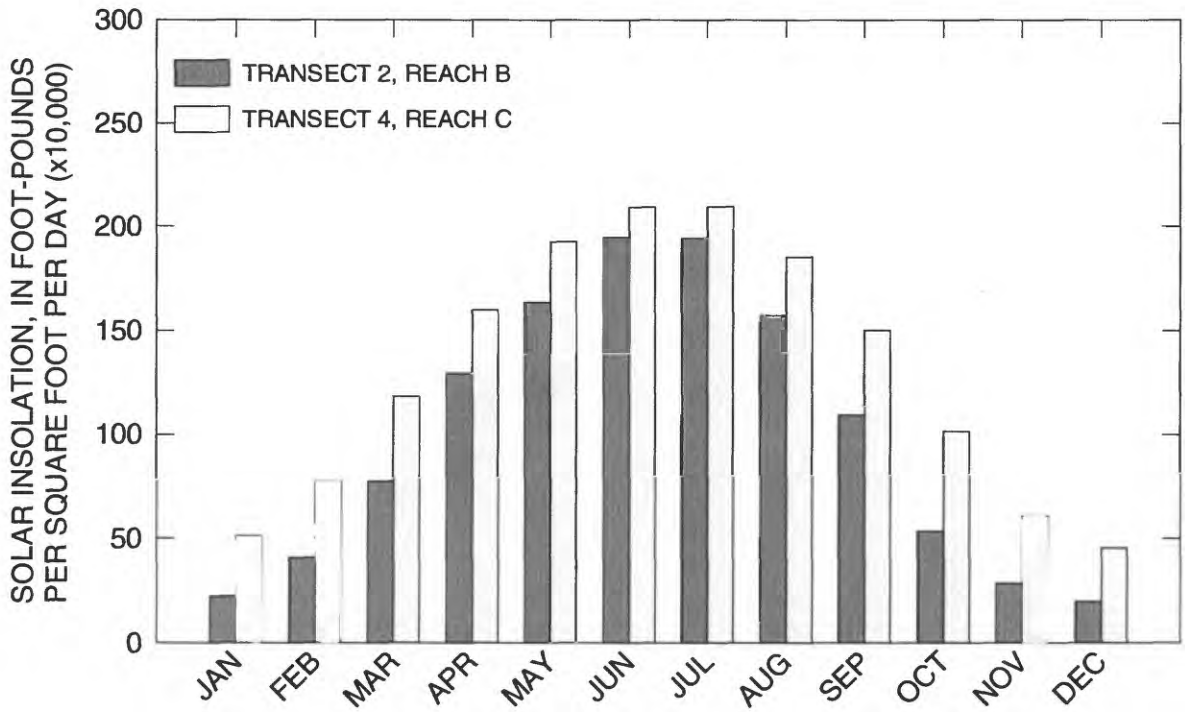


Figure 22. Monthly solar insolation midstream at selected transects in reaches B and C, Carson River at Fort Churchill (State Park), Nev.

Table 20. Locations and altitudes of monuments for transects not included in Carson River Basin cross-sectional surveys

[Latitude and longitude were measured using a Global Positioning Satellite system. Altitudes are in feet above sea level and were measured using a surveyors level and rod from Federal Emergency Management Agency or National Geodetic Survey benchmarks. Cross-section measurements were not made at these transects. Abbreviation: PVC, polyvinyl-chloride]

Transect	Left bank			Right bank			Description
	Latitude	Longitude	Altitude	Latitude	Longitude	Altitude	
East Fork Carson River near Dresslerville, Nev.							
Reach A							
2	not recorded		--	not recorded		4,952.0	Left and right bank markers are 2-inch hardware washers epoxied to rock outcrops. Unable to locate markers to measure latitude and longitude.
4	not recorded		--	not recorded		4,963.2	Left bank marker is yellow-capped rebar driven into ground. Right bank marker is 2-inch hardware washer epoxied to rock outcrop. Unable to locate markers to measure latitude and longitude.
Reach B							
2	not recorded		4,950.0	not recorded		4,243.3	Left bank markers are yellow-capped rebar.
3	not recorded		4,951.8	not recorded		--	Right bank markers are 2-inch PVC pipe cemented into ground. Latitude and longitude measurements not made because markers were not recovered.
Reach C							
2	38°52'03.4"	119°41'27.3"	4,954.5	not recorded		--	Left and right bank markers are 2-inch hardware washer epoxied to rock outcrop.
5	not recorded		4,947.3	38°52'10"	119°41'29.2"	4,962.18	Right bank marker is 4-inch white disk epoxied to large, flat boulder. Left bank marker is brass disk cemented in concrete block about 5 feet above trail. A secondary marker (4-inch white disk) is epoxied to a rock about 8 feet upstream from concrete block.
Carson River at Deer Run Road near Carson City, Nev.							
Reach A							
2	39°10'52.8"	119°41'27.6"	4,585.2	not recorded		4,598.4	Left bank monuments are 2-inch PVC pipe cemented into ground. Right bank monuments are yellow-capped rebar driven into the ground.
4	39°10'51.9"	119°41'25.6"	4,586.4	not recorded		4,606.6	
5	39°10'50.4"	119°41'19.3"	4,586.3	not recorded		4,607.2	
Carson River at Fort Churchill, Nev.							
Reach B							
2	39°17'15.5"	119°16'8.7"	4,206.3	39°17'11.8"	119°16'6.2"	--	Left bank monument is 2-inch PVC pipe cemented into ground. Right bank is yellow-capped rebar driven into ground.
Reach C							
2	not recorded		4,207.7	not recorded		4,208.8	Left bank monument is a metal fence post driven into the ground. Right bank monument is yellow-capped rebar driven into the ground.
3	39°17'25.7"	119°15'51.5"	4,205.1	39°17'21"	119°15'50.5"	4,209.0	Left bank monument is 2-inch PVC pipe cemented into the ground. Right bank monument is yellow-capped rebar driven into the ground.

Miscellaneous Carson River Sites

East Fork Carson River at Minden, Nev. (10309100), August 1994

West Fork Carson River above Woodfords, Calif. (10309500), August 1994

West Fork Carson River at Paynesville, Calif. (10310200), August 1994

West Fork Carson River at Muller Lane near Minden, Nev. (10310358), August 1994

Carson River near Carson City, Nev. (10311000), August 1994

Carson River at Dayton (State Park), Nev. (10311700), August 1994

Table 21. Streambank features for miscellaneous sites in Carson River Basin, August 1994

[**Shape**: CC, concave up; CV, convex up; LN, linear.
Erosion: CB, cut-bank scallop; SL, slab failure.
Substrate: BO, boulder; CO, cobble; SA, sand; SI, silt.
Habitat features: BO, boulder.]

Stream-bank	Angle (degrees)	Height (feet)	Width (feet)	Surface cover (percent)	Shape	Erosion	Substrate		Habitat features
							Dominant	Subdominant	
10309500 West Fork Carson River above Woodfords, Calif.									
Left	6.5	3	9	50 to 79	CC	None	BO	SA	10 percent BO
Right	21.0	20	38	50 to 79	CC	None	BO	SA	10 percent BO
10310200 West Fork Carson River at Paynesville, Calif.									
Left	10.3	6	95	greater than 80	CV	None	BO	CO	None
Right	8.2	4	12	greater than 80	CC	SL	BO	CO	5 percent BO
10310358 West Fork Carson River at Muller Lane near Minden, Nev.									
Left	14.6	5	13.5	greater than 80	CC	None	BO	SA	None
Right	15.7	6	14	greater than 80	CC	None	BO	SA	None
10309100 East Fork Carson River near Minden, Nev.									
Left	13.5	6	12	Less than 25	LN	CB	SA	CO	None
Right	2.4	6	15	Less than 25	LN	None	CO	SA	None
10311000 Carson River near Carson City, Nev.									
Left	6.2	6.5	21	50 to 79	CC	None	SA	SI	None
Right	6.0	5.5	28	50 to 79	LN	None	SA	BO	10 percent BO
10311700 Carson River at Dayton (State Park), Nev.									
Left	14.3	4	15	25 to 49	LN	CB	SA	SI	None
Right	3.4	3	10	50 to 79	CV	CB	SA	CO	None

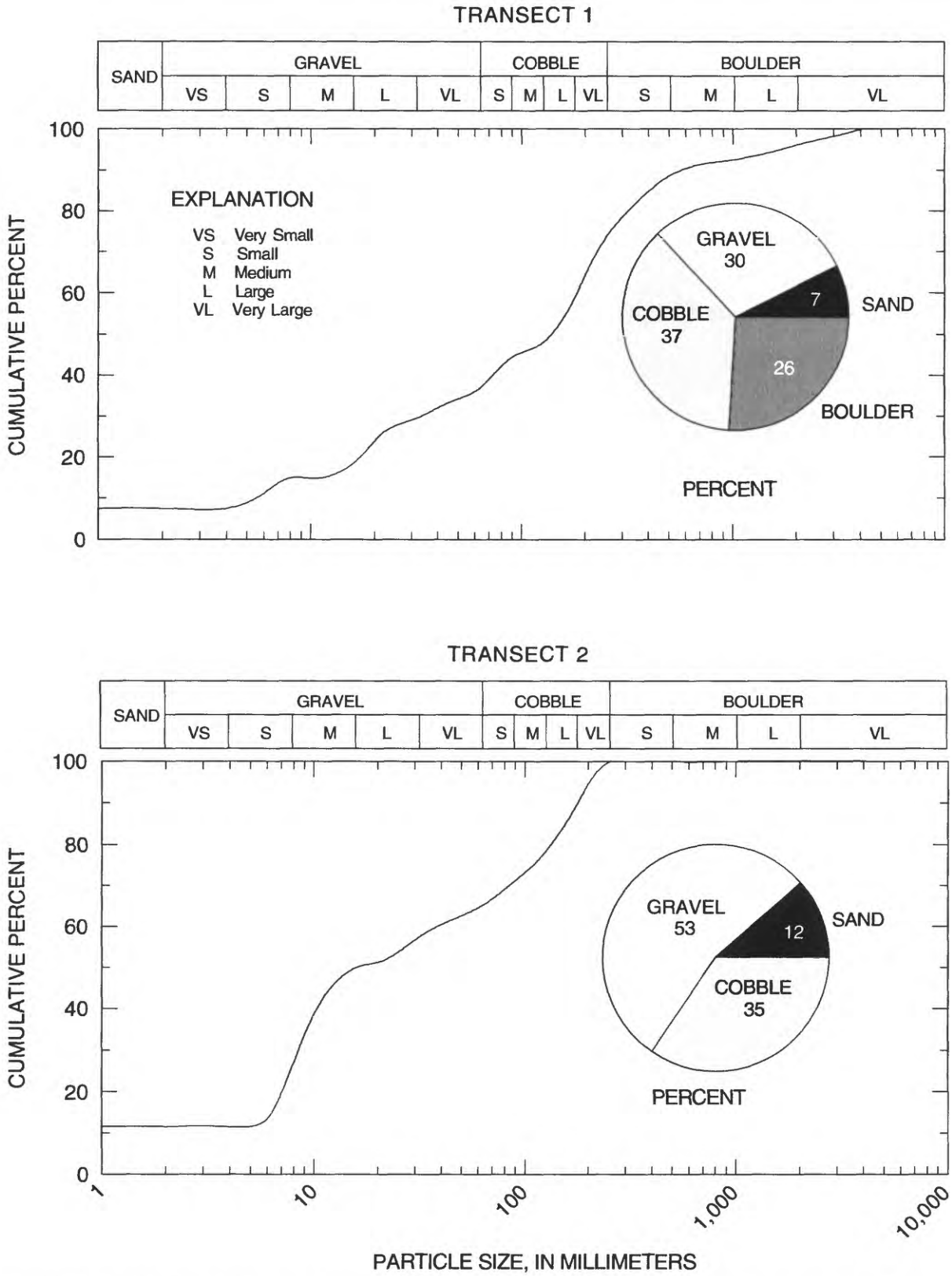


Figure 23. Particle-size distribution of coarse streambed substrate at selected transects in reach A, West Fork Carson River above Woodfords, Calif., August 1994.

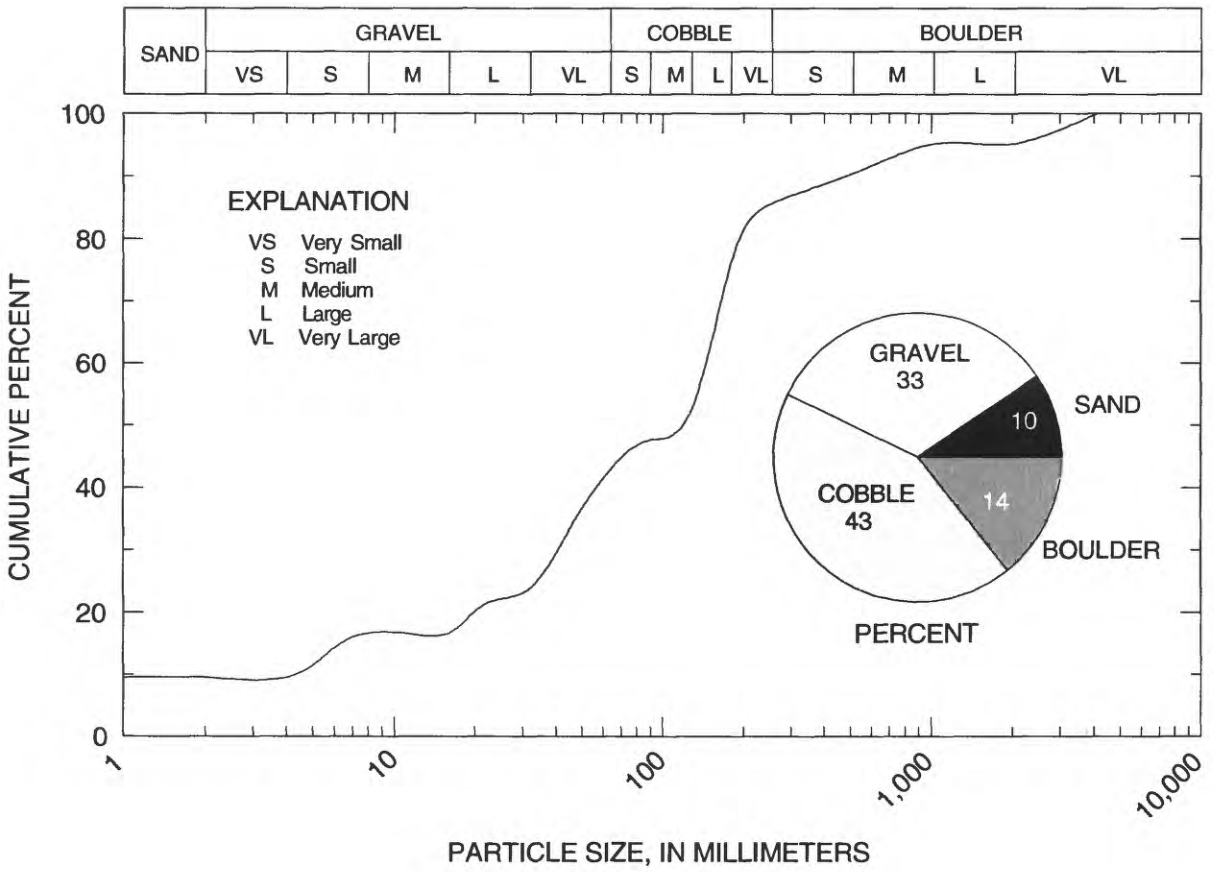


Figure 24. Particle-size distribution of coarse streambed substrate in reach A, West Fork Carson River at Paynesville, Calif., August 1994.

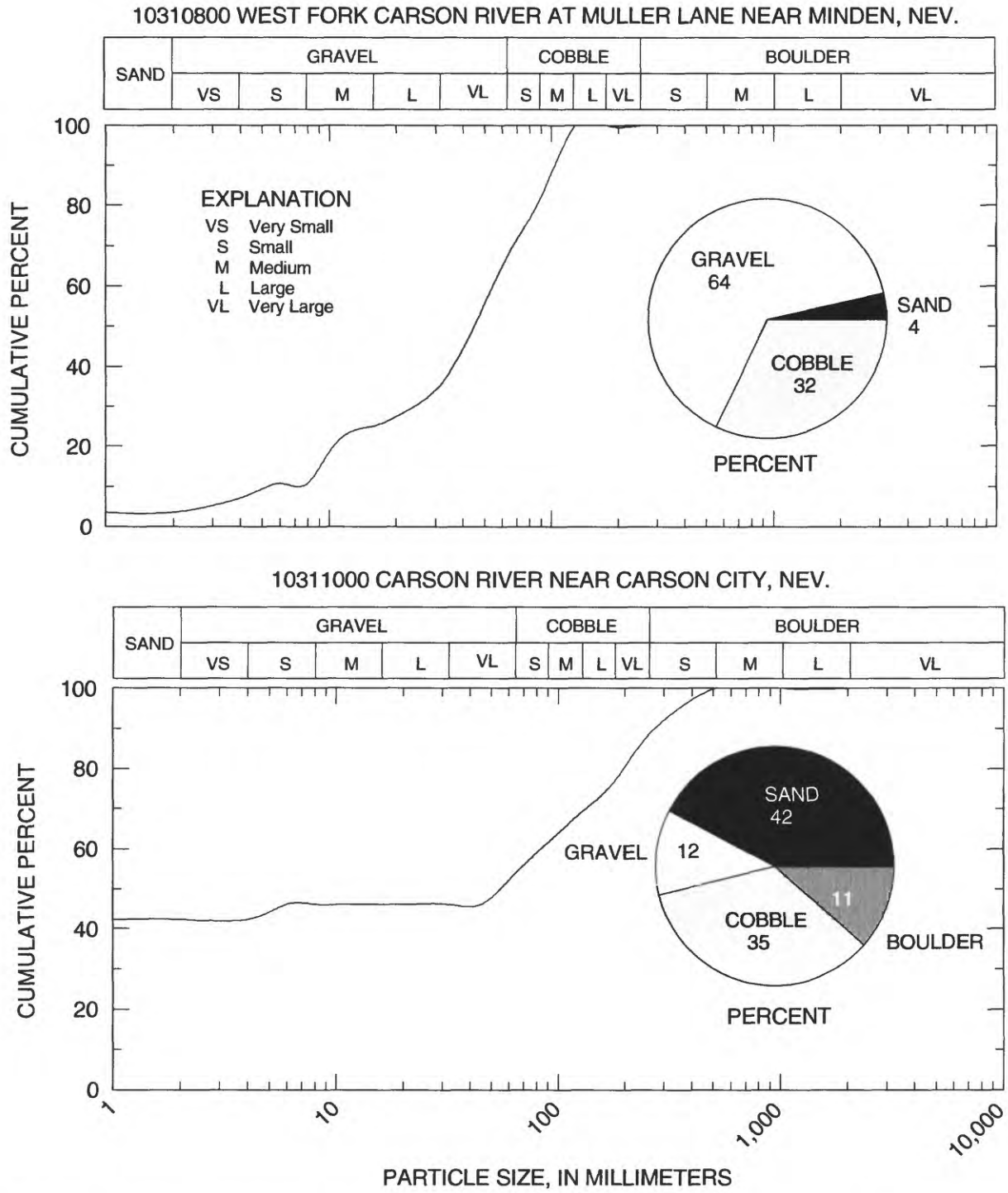


Figure 25. Particle-size distribution of coarse streambed substrate in reach A, West Fork Carson River at Muller Lane near Minden, Nev., and Carson River near Carson City, Nev., August 1994.

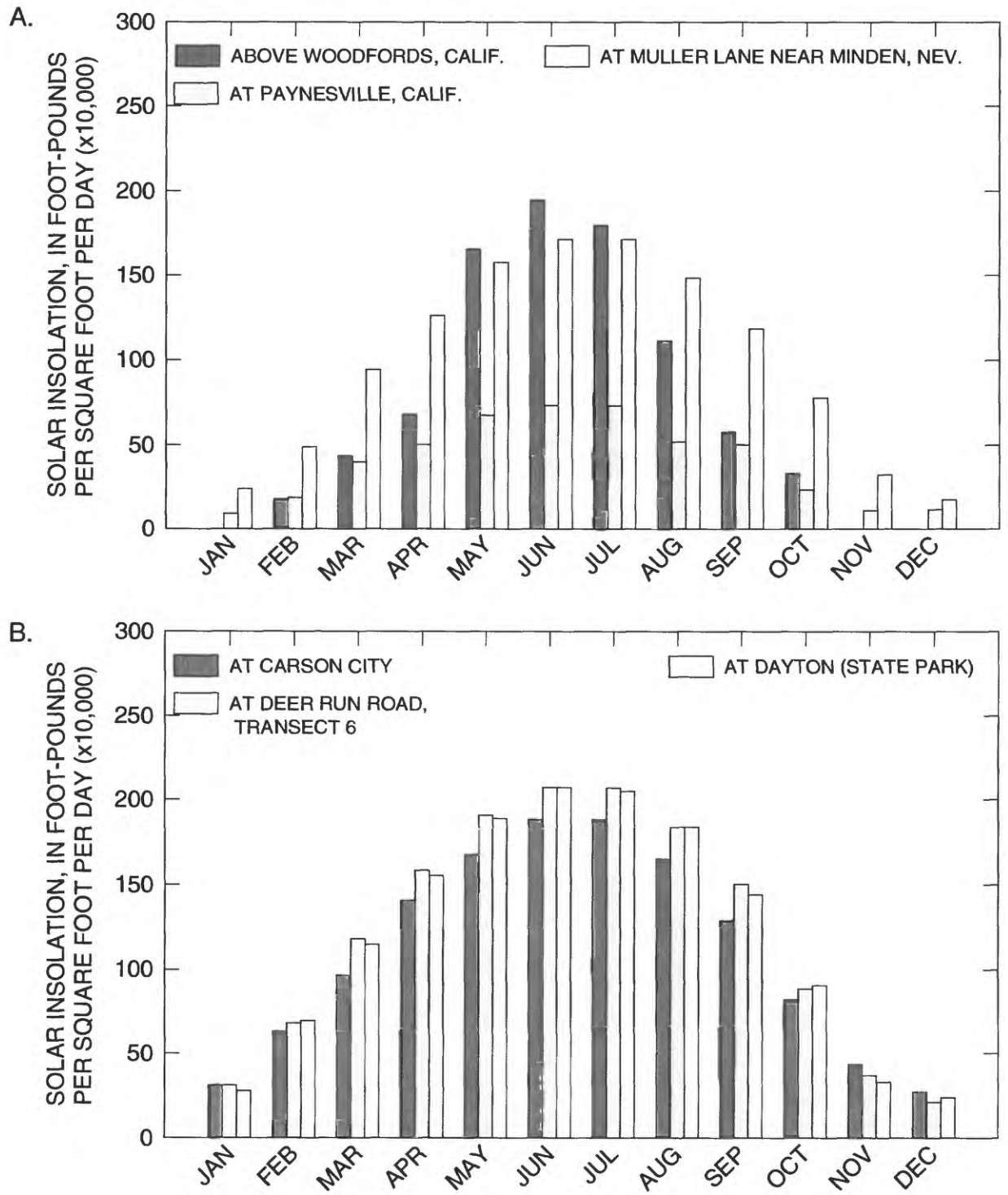


Figure 26. Monthly solar insolation midstream, *A.* West Fork Carson River above Woodfords, Calif; at Paynesville, Calif.; and at Muller Lane near Minden; and *B.* Carson River near Carson City, Nev.; at Deer Run Road near Carson City, Nev.; and at Dayton (State Park), Nev.

Upper Truckee River at South Lake Tahoe, Calif. (U.S. Geological Survey Station 10336610)

Downstream view of the Upper Truckee River from transect 1, reach A, Upper Truckee River at South Lake Tahoe, Calif. Photograph by Ronald P. Collins, U.S. Geological Survey, November 1993.

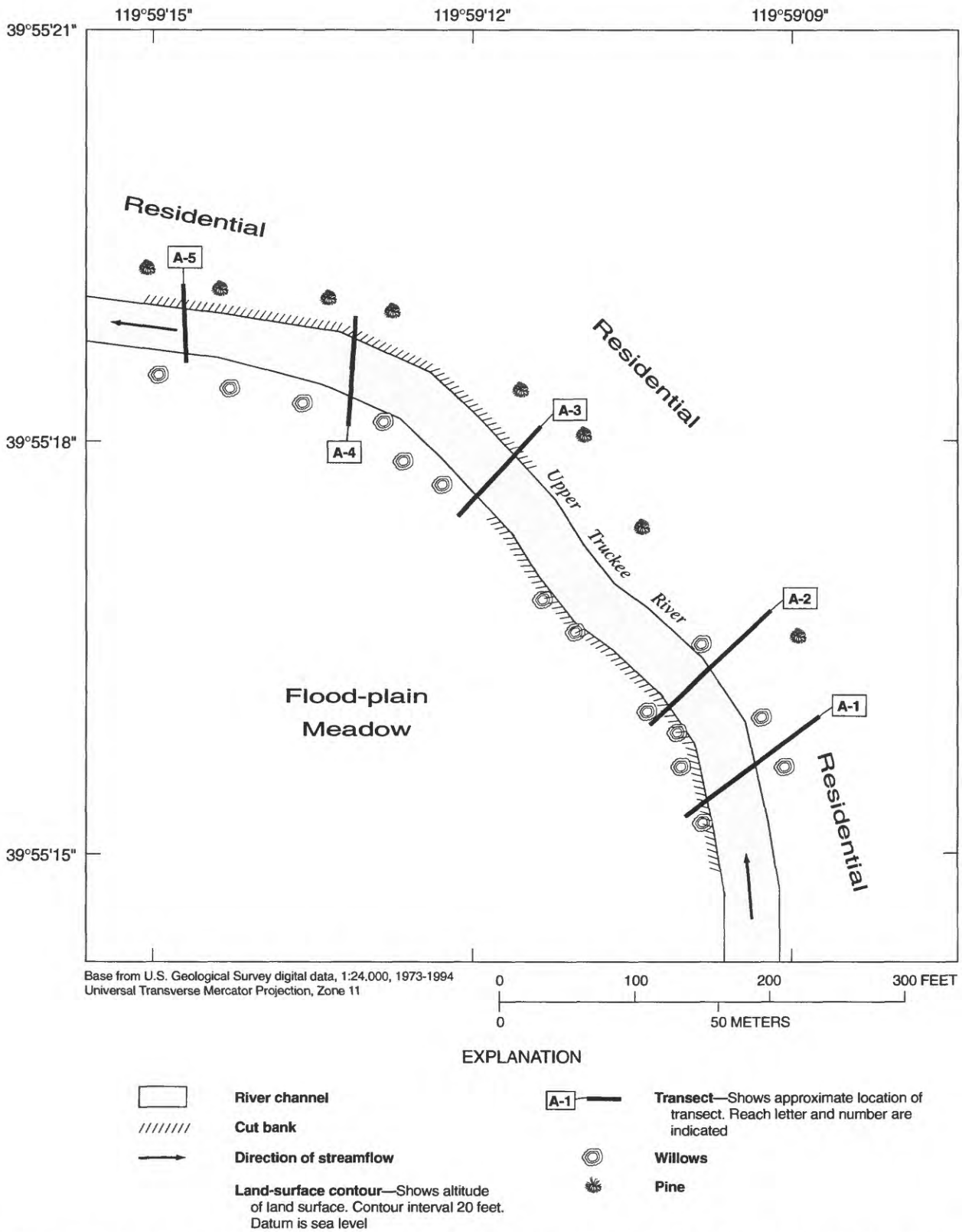


Figure 27. Location of transects in reach A, Upper Truckee River at South Lake Tahoe, Calif., with some landscape features approximately located, November 1993.

Table 22. Streambank features for selected transects in reach A, Upper Truckee River at South Lake Tahoe, Calif., November 1993

[**Shape**: CC, concave up; CV, convex up; LN, linear.
Erosion: CB, cut-bank scallop; SL, slab failure.
Substrate: SA, sand; SI, silt.
Habitat features: MS, submergent macrophyte; WD, woody debris]

Stream-bank	Angle (degrees)	Height (feet)	Width (feet)	Surface cover (percent)	Shape	Erosion	Substrate		Habitat features
							Dominant	Subdominant	
				Transect 1					
Left	24.5	5.0	6	50 to 79	CC	CB	SA	SI	20 percent WD
Right	8.0	4.9	21	50 to 79	CC	None	SA	SI	None
				Transect 2					
Left	9.7	5.0	17	50 to 79	CC	None	SA	SI	None
Right	42.3	6.0	3	50 to 79	CC	CB	SA	SI	None
				Transect 3					
Left	14.8	6.5	3	25 to 49	CC	SL	SA	SI	10 percent WD
Right	5.7	5.0	36	50 to 79	CC	None	SA	SI	None
				Transect 4					
Left	6.0	6.0	24	50 to 79	CC	None	SA	SI	None
Right	19.4	5.0	4	50 to 79	CC	SL	SA	SI	None
				Transect 5					
Left	20.5	4.5	4	25 to 49	LN	SL, CB	SA	SI	None
Right	12.7	5.2	8	greater than 80	CV	None	SA	SI	25 percent WD, MS

Table 23. Cross-section measurements and description of stream channel along selected transects in reach A, Upper Truckee River at South Lake Tahoe, Calif., November 1993

[Latitude and longitude were measured using a Global Positioning Satellite system. Altitudes were measured using a surveyors level and rod from National Geodetic Survey benchmark G837 on bridge 25-10. Cross-section measurements are plotted in figure 28.
Abbreviation: PVC, polyvinyl-chloride]

Distance from left bank monument (feet)	Altitude (feet above sea level)	Description
		Transect 1
0	6,237.50	The left-bank monument is a 2.5-inch PVC pipe cemented into flood-plain meadow and topped with a hardware washer. Latitude: 38° 55' 15.50"; Longitude: 119° 59' 09.60".
9	6,236.45	Top of left bank
11	6,235.03	Bottom of left bank
15	6,232.64	Left edge of water
20	6,231.41	Thalweg
34	6,232.60	Right edge of water
51	6,234.89	Channel edge
55	6,236.30	Upper edge of right bank
58	6,236.40	Small terrace
67	6,239.05	The right-bank monument is a 2.5-inch PVC pipe cemented into the bank and topped with a bronze disk. This monument is 1,150 feet upstream from the Highway 50 bridge (25-10) at South Lake Tahoe, Calif., and was established in 1993. Latitude: 38° 55' 16.00"; Longitude: 119° 59' 08.74".
		Transect 5
0	6,238.15	The left-bank monument is a 2.5-inch PVC pipe cemented into a flood-plain meadow and topped with a hardware washer. Latitude: 38° 55' 18.65"; Longitude: 119° 59' 14.69".
14	6,236.18	Top of left bank
18	6,232.86	Left edge of water
23	6,232.34	Channel
26	6,232.16	Channel
37	6,231.72	Thalweg
41	6,232.74	Right edge of water
48	6,234.49	Right bank
49	6,237.03	Top of right bank
61	6,238.92	The right-bank monument is a 2.5-inch PVC pipe cemented into the bank and topped with a bronze disk. This monument is 615 feet upstream from the Highway 50 bridge (25-10) at South Lake Tahoe, Calif., and was established in 1993. Latitude: 38° 55' 19.15"; Longitude: 119° 59' 14.72".

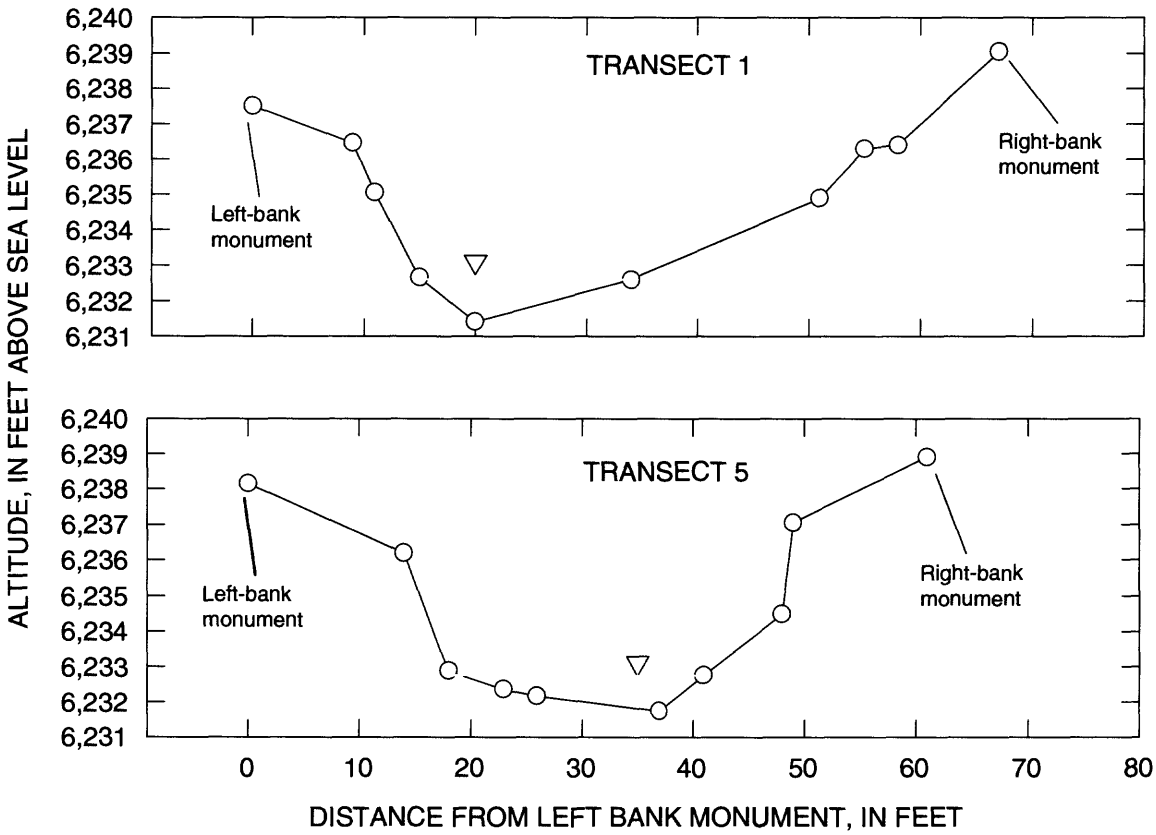


Figure 28. Cross section showing land-surface (○) and water-surface (▽) altitudes for selected transects in reach A, Upper Truckee River at South Lake Tahoe, Calif., November 1993.

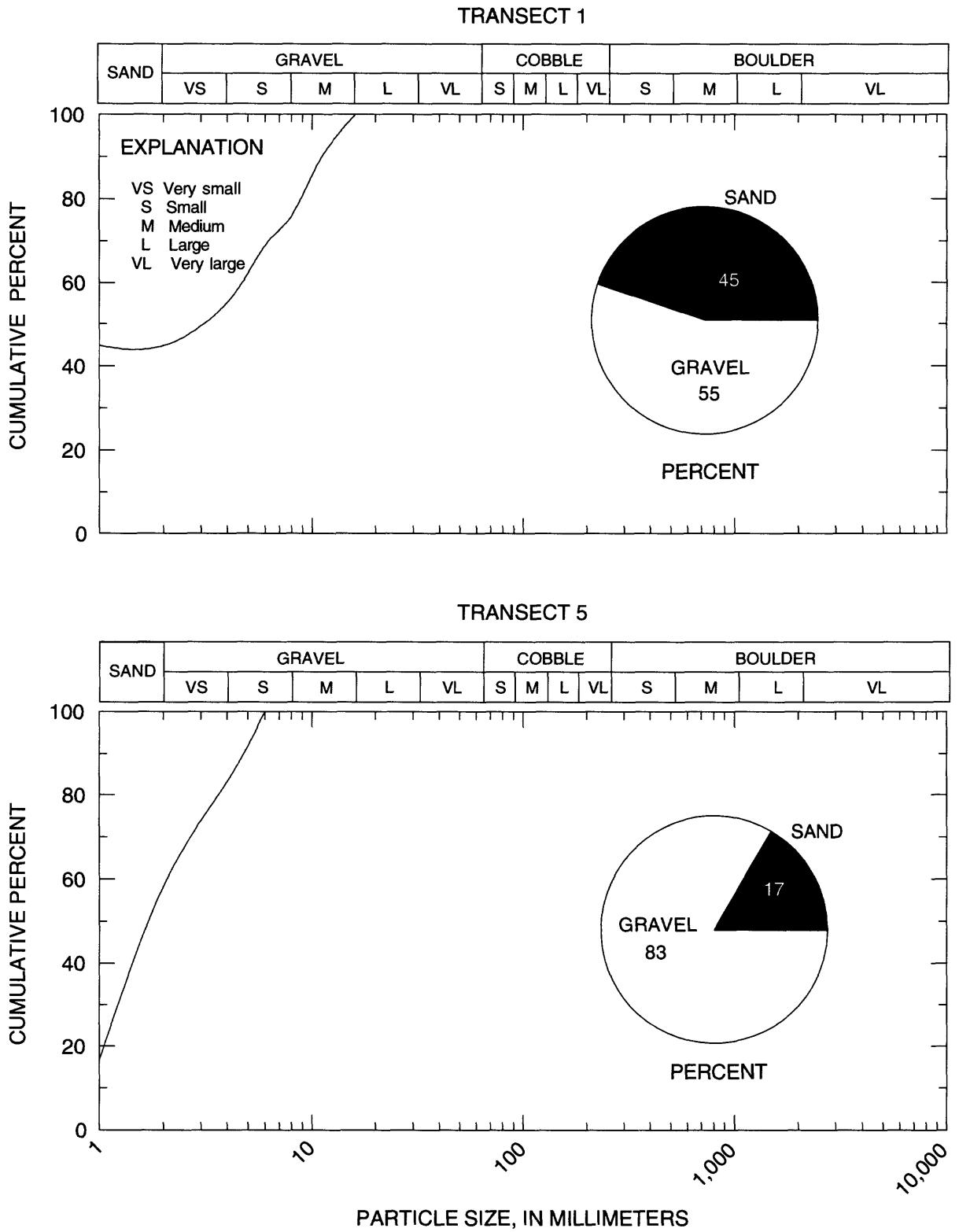


Figure 29. Particle-size distribution of coarse streambed substrate at selected transects in reach A, Upper Truckee River at South Lake Tahoe, Calif., August 1994.

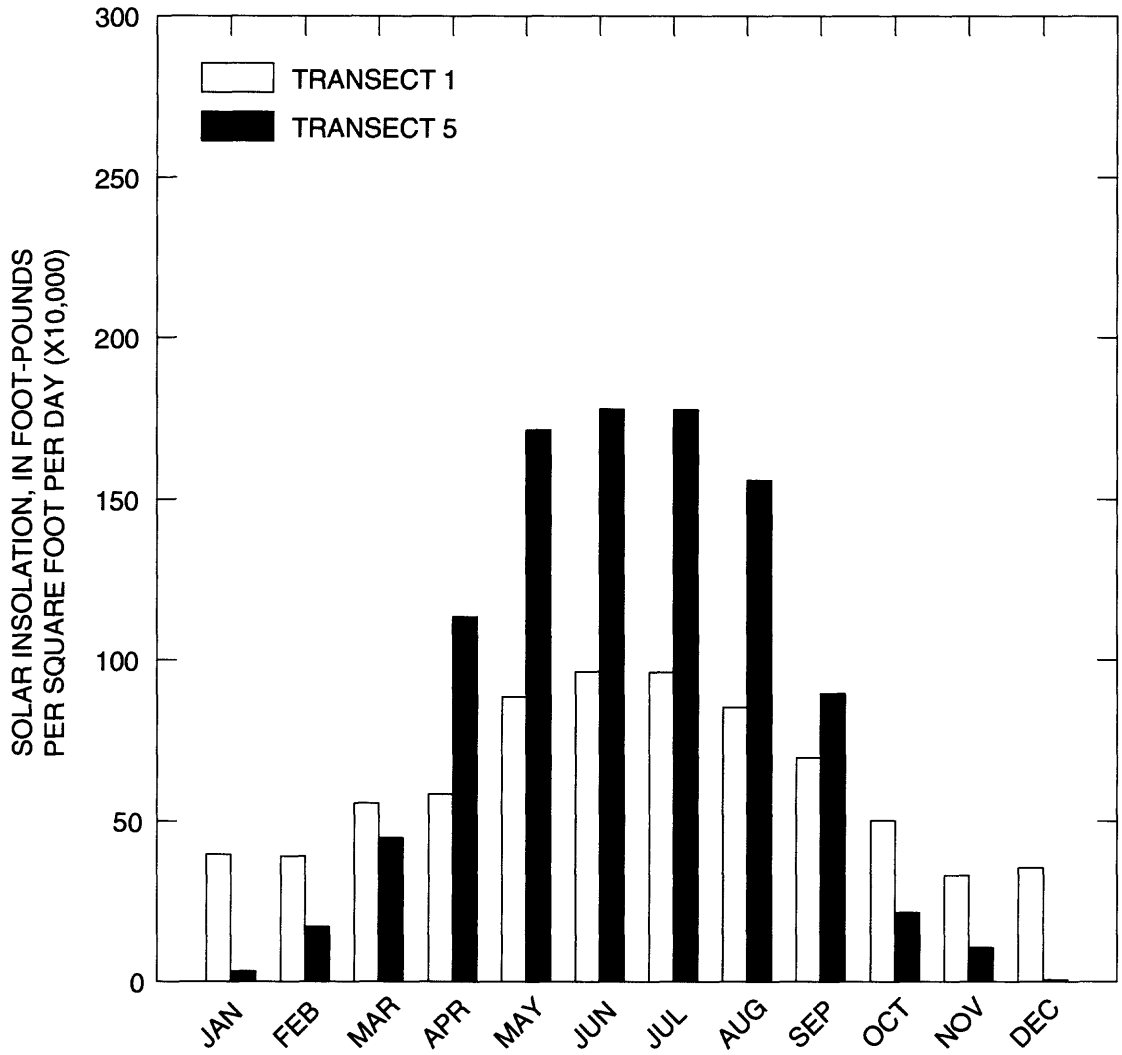
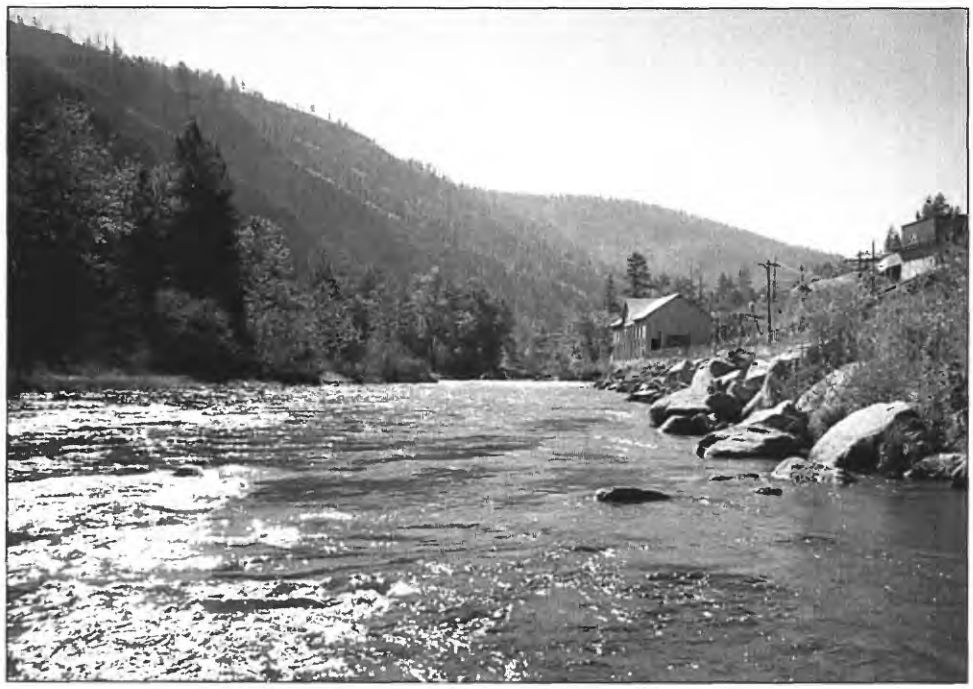


Figure 30. Monthly solar insolation midstream at selected transects in reach A, Upper Truckee River at South Lake Tahoe, Calif.

Truckee River at Farad, Calif.
(U.S. Geological Survey Station 10346000)



Upstream view of Truckee River from transect 2, reach A, Truckee River at Farad, Calif. Building at right center of photograph is hydroelectric power plant operated by Sierra Pacific Power Company. Photograph by Sonya Vasquez, U.S. Geological Survey, September 1995.

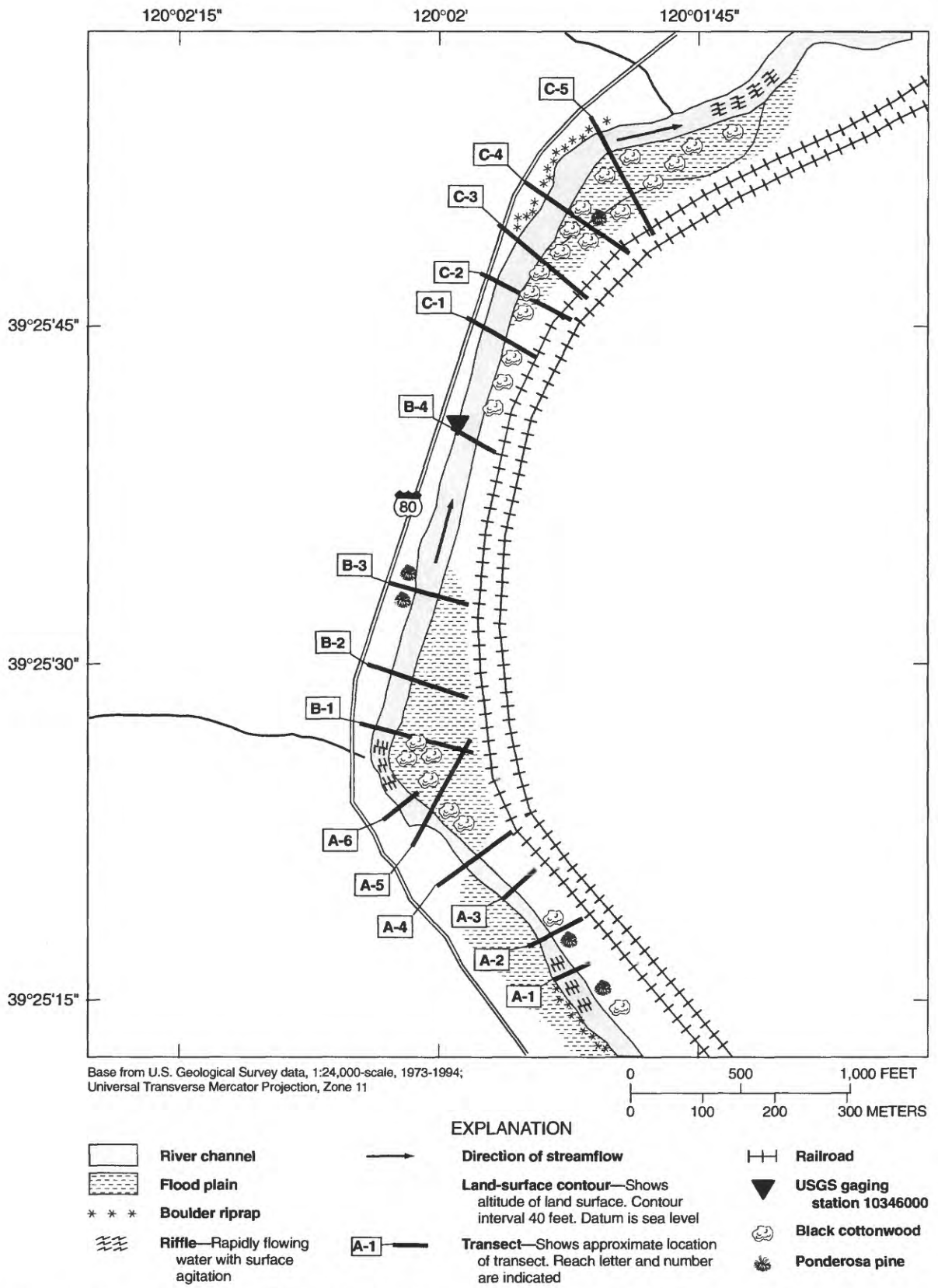


Figure 31. Location of transects in reaches A-C, Truckee River at Farad, Calif., with some landscape features approximately located, October 1993.

Table 24. Streambank features for selected transects in reach A, Truckee River at Farad, Calif., October 1993

[**Shape**: CC, concave up; CV, convex up; LN, linear.
Substrate: BO, boulder; CO, cobble; SA, sand; SI, silt.
Habitat features: BO, boulder]

Stream-bank	Angle (degrees)	Height (feet)	Width (feet)	Surface cover (percent)	Shape	Erosion	Substrate		Habitat features
							Dominant	Subdominant	
				Transect 1					
Left	16.5	9.5	13	greater than 80	LN	None	BO	SI	10 percent BO
Right	5.1	13.0	77	greater than 80	CV	None	CO	SA	None
				Transect 2					
Left	7.5	8.6	23	greater than 80	CC	None	SA	BO	10 percent BO
Right	5.6	8.1	47	greater than 80	CV	None	SA	BO	10 percent BO
				Transect 3					
Left	6.4	12.4	37	greater than 80	CC	None	BO	SI	10 percent BO
Right	33.2	17.7	18	greater than 80	CV	None	CO	SA	10 percent BO
				Transect 4					
Left	6.8	8.3	85	greater than 80	LN	None	CO	BO	None
Right	7.2	21.9	198	greater than 80	CV	None	CO	SA	None
				Transect 5					
Left	4.7	7.4	42	greater than 80	CC	None	CO	BO	10 percent BO
Right	4.7	7.8	70	greater than 80	CC	None	CO	BO	10 percent BO
				Transect 6					
Left	16.3	12.9	5	greater than 80	LN	None	BO	SI	10 percent BO
Right	5.8	9.7	72	greater than 80	CV	None	CO	BO	10 percent BO

Table 25. Cross-section measurements and description of stream channel along selected transects in reach A, Truckee River at Farad, Calif., October 1993

[Latitude and longitude were measured using a Global Positioning Satellite system. Altitudes were measured using a surveyors level and rod from National Geodetic Survey benchmark R1202. Cross-section measurements in bold were made in October 1993 and plotted in figure 33; measurements not in bold were made in July 1996 to extend the cross section from the old monument to the new. Abbreviation: PVC, polyvinyl-chloride]

Distance from left bank monument (feet)	Altitude (feet above sea level)	Description
		Transect 1
0	5,182.13	The left-bank monument is a 2.5-inch hardware washer epoxied to the top of a large boulder, streamward from a maintained service road. This monument is 394 feet downstream from an iron pipe that emerges from the left bank at the start of a concrete walkway, downstream from the Sierra Pacific Power hydroelectric power plant. Latitude: 39°25' 15.97"; Longitude: 120°01' 53.42".
13	5,175.30	Left edge of water
32	5,172.65	Thalweg
102	5,175.37	Right edge of water
139	5,177.14	Bottom of right bank
150	5,178.11	Right bank
170	5,180.25	Right bank
179	5,184.35	Top of right bank
184	5,185.68	The right-bank monument is a 2.5-inch brass tablet on top of a 2.5-inch PVC pipe that is cemented into the top of the right bank. The monument is about 8-10 inches above ground level and about 20 to 30 feet downstream from a 4-inch white boundary marker nailed to a large Ponderosa pine. Access to this monument is a dirt road that intersects the east-bound lane of Interstate 80 about one-half mile east of Floristan, Calif. This road parallels the railroad tracks along the south side of the Truckee River. Latitude: 39°25' 16.75"; Longitude: 120°01' 51.28".
		Transect 2
0	5,180.67	The left-bank monument is a 2.5-inch hardware washer epoxied to the top of a medium size boulder at the top of the bank. This monument is about 173 feet downstream from the transect one monument. This monument was set in 1993. Latitude: 39°25' 17.49"; Longitude: 120° 01' 54.87".
23	5,173.78	Left edge of water
65	5,172.12	Thalweg
101	5,173.89	Right edge of water
135	5,173.30	Bottom of right bank
148	5,183.41	Top of right bank
149	5,180.25	Former right-bank monument
196	5,178.00	Middle of small terrace
214	5,178.08	Bottom of railroad grade
249	5,193.74	Upper edge of railroad grade
270	5,196.39	The right-bank monument is a 4-inch white disk inscribed with BOUNDARY MARKER USGS NAWQA XSEC, set on top of a railroad tie, on the streamward edge of the Southern Pacific rail. This monument was set in 1996. The monument set in 1993 was destroyed during grading of the railroad bed. Latitude: 39° 25' 18.75"; Longitude 120° 01' 51.7".

Table 25. Cross-section measurements and description of stream channel along selected transects in reach A, Truckee River at Farad, Calif., October 1993—Continued

Distance from left bank monument (feet)	Altitude (feet above sea level)	Description
		Transect 3
0	5,181.94	The left-bank monument is a 2.5-inch hardware washer epoxied to the top of a medium size boulder at the top of the bank. This monument is about 242 feet downstream from the transect one monument. This monument was set in 1993. Latitude: 39°25' 19.59"; Longitude: 120°01' 56.38".
22	5,173.33	Bottom of left bank
37	5,171.87	Left edge of water
111	5,169.50	Thalweg
120	5,171.11	Right edge of water
128	5,180.54	Right bank
138	5,187.17	Top of right bank
141	5,187.80	Top of former right-bank monument (est. 1993)
201	5,193.62	The right-bank monument is a 4-inch white disk inscribed with BOUNDARY MARKER USGS NAWQA XSEC, set on top of a railroad tie, on the streamward edge of the Southern Pacific rail. This monument was set in 1996. The monument set in 1993 was destroyed during grading of railroad bed. Latitude: 39°25' 20.92"; Longitude: 120°01' 54.46".
		Transect 4
0	5,185.81	The left-bank monument is a metal fence post in a swale on the highway side of a paved service road. This monument is about 31 feet upstream from the metal gate preventing access to the Sierra Pacific Power hydroelectric plant. This monument was set in 1996 after the original monument was washed away. Latitude: 39°25' 20.18"; Longitude: 120°02' 00.16".
14	5,187.69	4 inch white boundary marker at north edge of paved service road
36	5,187.80	South edge of paved service road
60	5,176.18	Top of left bank
110	5,175.79	Former left-bank monument (rebar)
145	5,171.24	Left edge of water
169	5,167.89	Thalweg
187	5,171.19	Right edge of water
343	5,189.76	Top edge of right bank
345	5,189.92	Former right-bank monument
393	5,192.00	The right-bank monument is a 4-inch white disk inscribed with BOUNDARY MARKER USGS NAWQA XSEC, set on top of a railroad tie, on the streamward edge of the Southern Pacific rail. This monument was set in 1996. Latitude: 39° 25' 22.58"; Longitude: 120° 01' 55.83".

Table 25. Cross-section measurements and description of stream channel along selected transects in reach A, Truckee River at Farad, Calif., October 1993—Continued

Distance from left bank monument (feet)	Altitude (feet above sea level)	Description
		Transect 5
0	5,203.64	The left-bank monument is a white 4-inch disk inscribed with BOUNDARY MARKER USGS NAWQA XSEC. This monument is on the top of a wood post holding a metal guard rail at the junction of the Interstate 80 eastbound on-ramp and the service road to the Sierra Pacific hydroelectric plant. This monument was set in 1996. Latitude: 39°25' 21.95"; Longitude: 120°02' 01.61".
51	5,175.13	Top of left bank
73	5,174.73	Former left-bank monument (hardware washer on boulder)
93	5,169.36	Left edge of water
141	5,167.68	Thalweg
166	5,169.43	Right edge of water
236	5,174.69	Former right-bank monument (PVC pipe, destroyed prior to 1996)
465	5,175.49	Flood plain near beginning of railroad grade
522	5,185.10	Upper edge of railroad grade
566	5,187.32	The right bank monument is a white 4-inch disk inscribed with BOUNDARY MARKER USGS NAWQA XSEC, set on top of a railroad tie, on the streamward edge of the Southern Pacific rail. This monument was set in 1996. Latitude: 39° 25' 26.74"; Longitude: 120° 01' 58.21".
		Transect 6
0	5,210.14	The left-bank monument is a white 4-inch disk inscribed with BOUNDARY MARKER USGS NAWQA XSEC. This monument is on the southside of a wood post holding a metal guard rail along the southside of the eastbound lanes of Interstate 80. This monument was set in 1996. Latitude: 39° 25' 23.10"; Longitude: 120° 02' 03.29".
64	5,176.65	Former left-bank monument (hardware washer on boulder)
69	5,165.53	Left edge of water
108	5,163.74	Thalweg
131	5,165.95	Right edge of water
149	5,169.54	Right bank
203	5,173.48	The right bank monument is a 2.5-inch PVC capped with a 2.5-inch hardware washer and set about 6 inch above land surface in a large flood plain. This monument is identified by a white 4-inch disk inscribed with BOUNDARY MARKER USGS NAWQA XSEC, set about 8 feet high on a black cottonwood tree. Latitude: 39° 25' 24.34"; Longitude: 120° 02' 01.25".

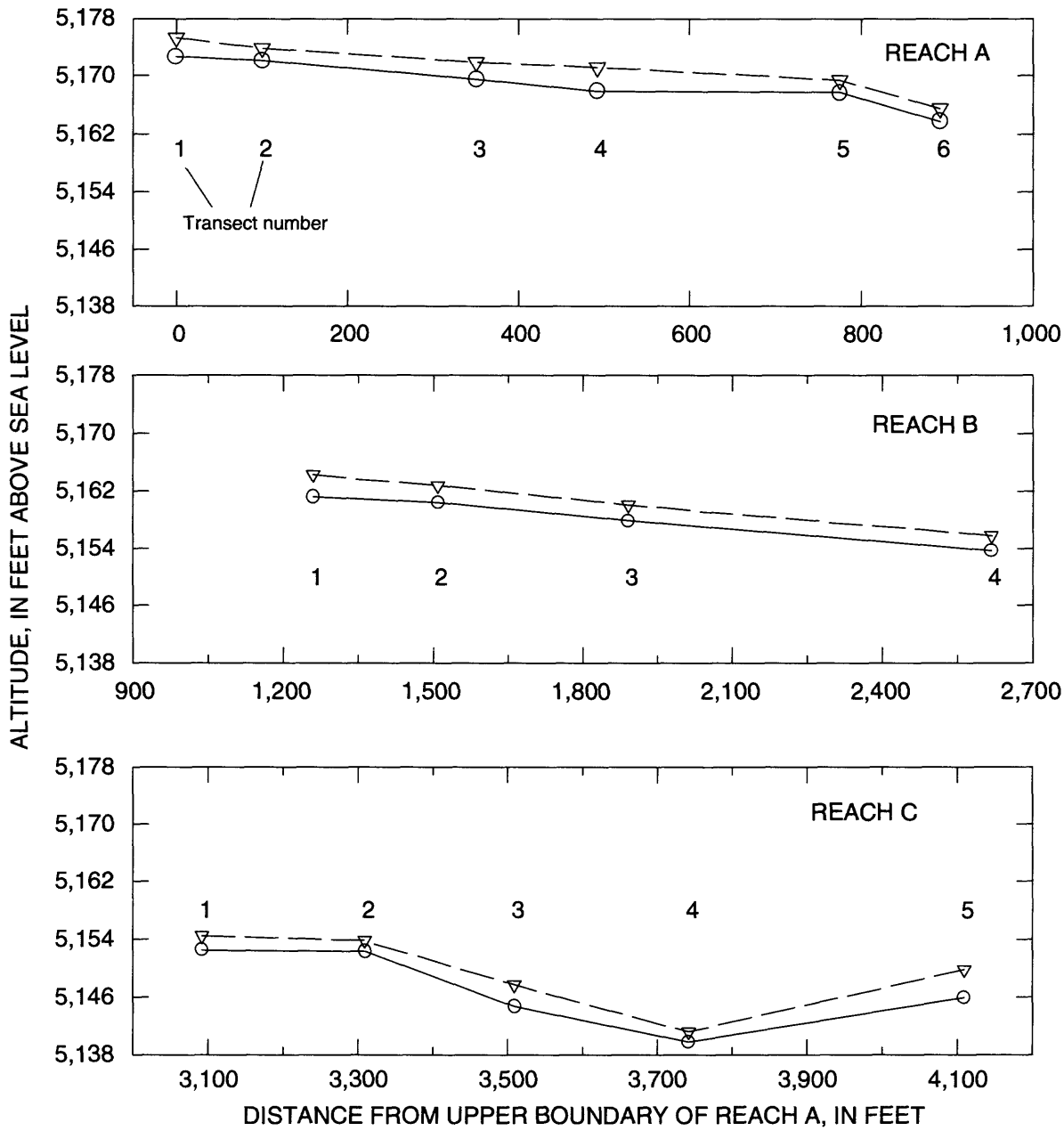


Figure 32. Longitudinal profiles of streambed (○) and water-surface (▽) altitudes measured along the thalweg in reaches A-C, Truckee River at Farad, Calif., October 1993.

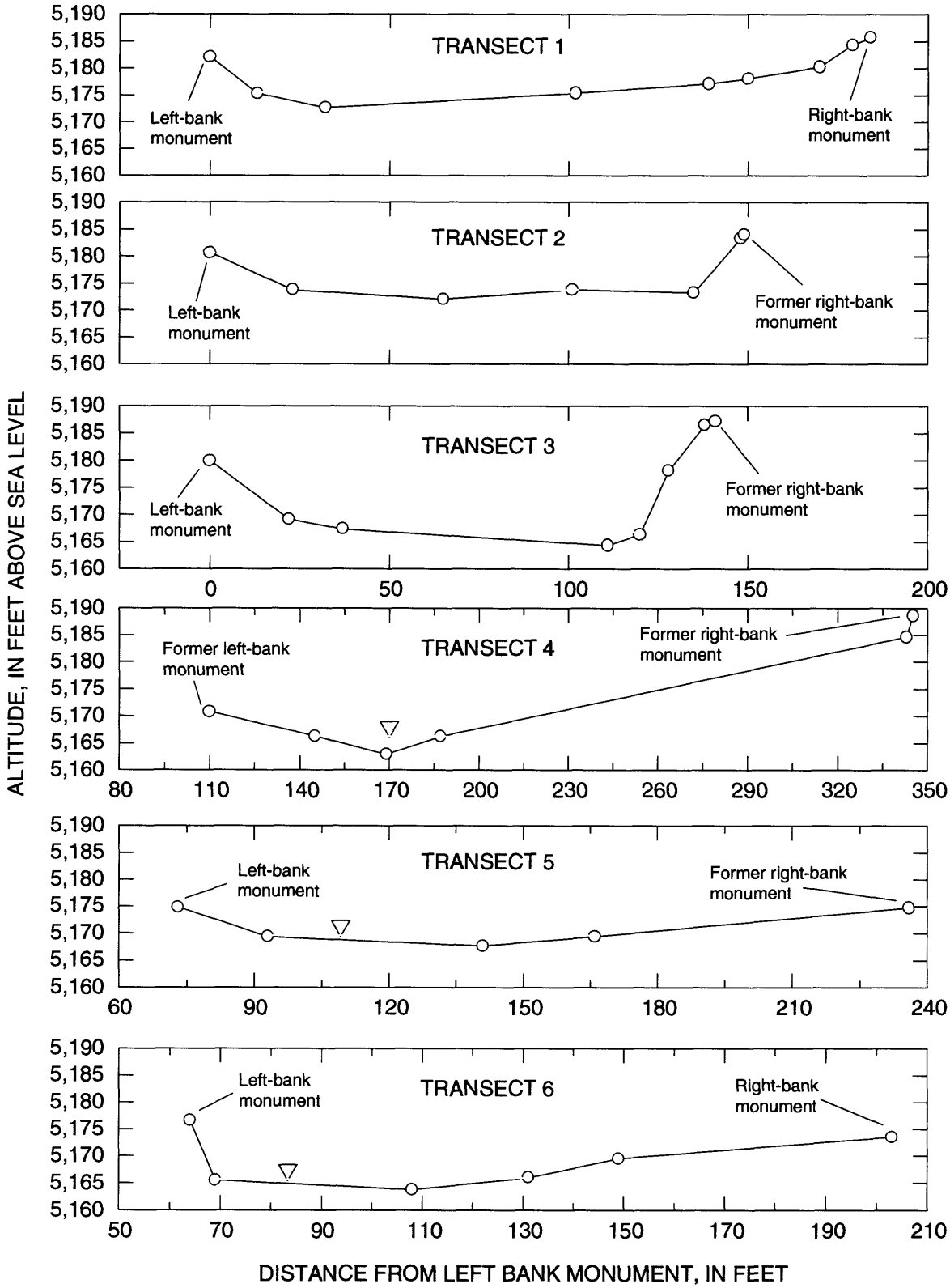


Figure 33. Cross sections showing land-surface (○) and water-surface (▽) altitudes for selected transects in reach A, Truckee River at Farad, Calif., October 1993.

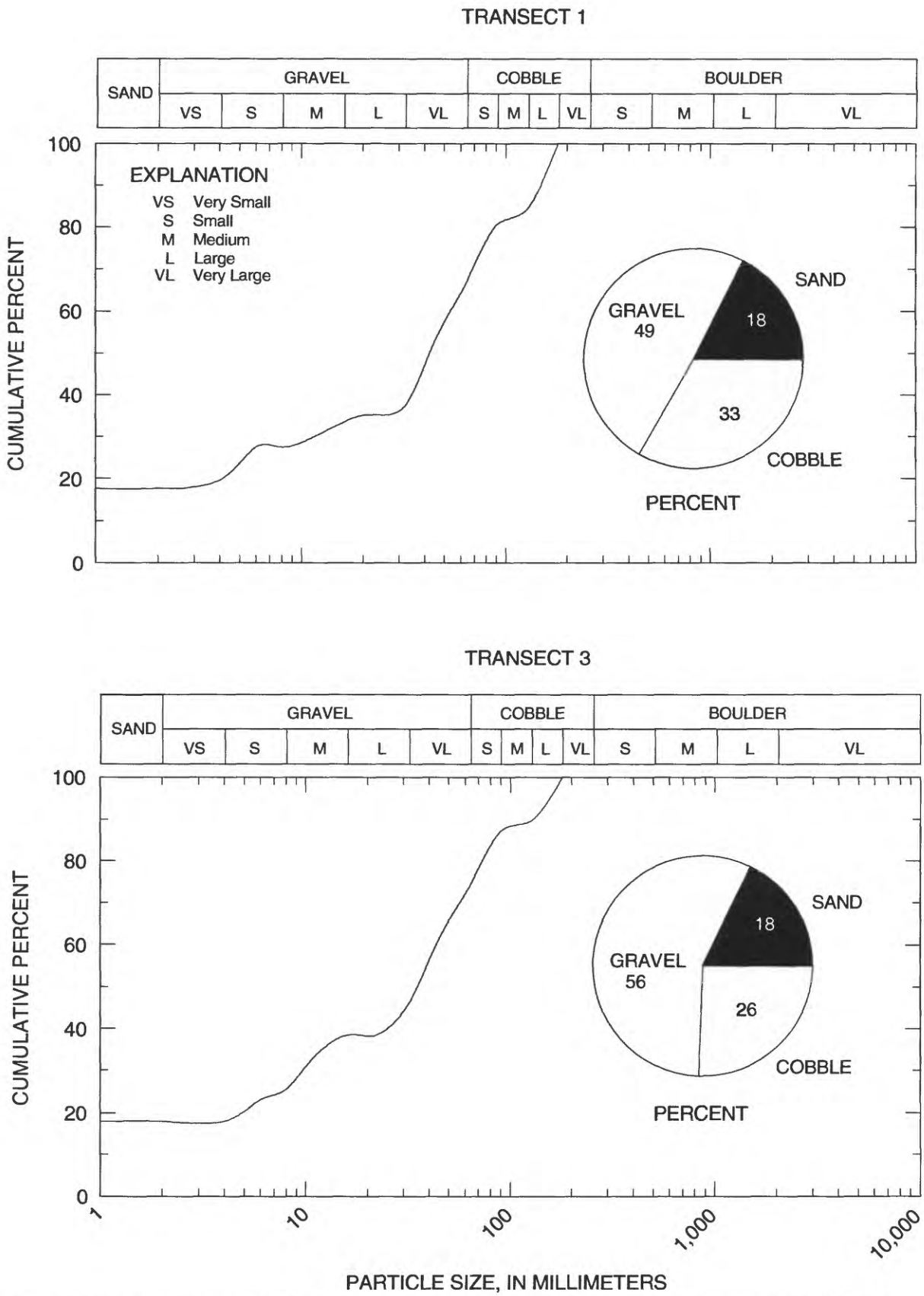


Figure 34. Particle-size distribution of coarse streambed substrate for selected transects in reach A, Truckee River at Farad, Calif., September 1994.

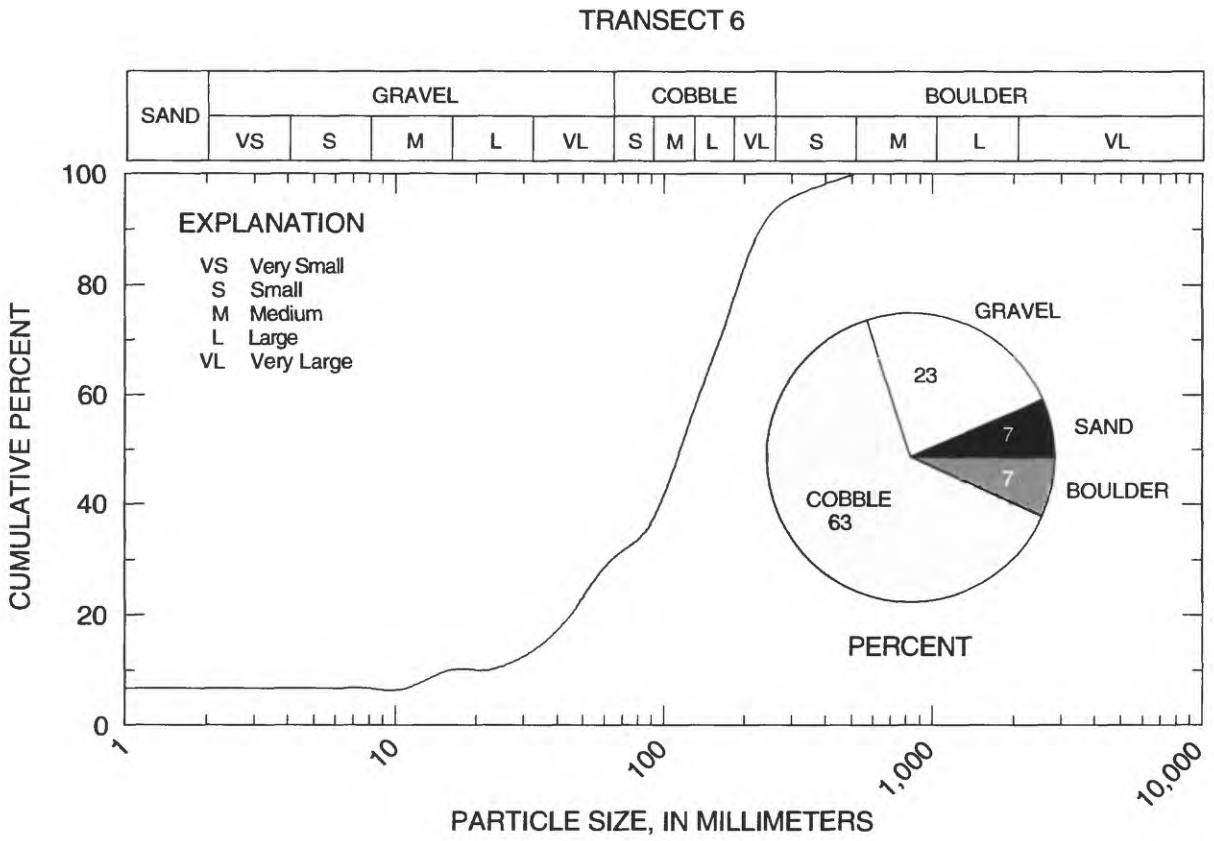


Figure 34. Continued.

Table 26. Streambank features for selected transects in reach B, Truckee River at Farad, Calif., October 1993

[**Shape**: CC, concave up; CV, convex up; LN, linear.
Substrate: BO, boulder; CO, cobble; SA, sand.
Habitat features: BO, boulder]

Stream-bank	Angle (degrees)	Height (feet)	Width (feet)	Surface cover (percent)	Shape	Erosion	Substrate		Habitat features
							Dominant	Subdominant	
				Transect 1					
Left	24.2	18.4	22	greater than 80	LN	None	BO	CO	15 percent BO
Right	6.5	11.3	41	greater than 80	CV	None	CO	BO	5 percent BO
				Transect 2					
Left	13.9	14.4	9.0	greater than 80	CC	None	SA	BO	20 percent BO
Right	7.5	8.8	12.0	greater than 80	CV	None	SA	BO	5 percent BO
				Transect 3					
Left	9.2	17.1	52	greater than 80	CC	None	SA	BO	None
Right	11.4	9.5	100	greater than 80	CV	None	SA	CO	None
				Transect 4					
Left	18.9	13.0	21	greater than 80	CC	None	SA	BO	10 percent BO
Right	3.2	8.1	57	greater than 80	CV	None	SA	CO	None

Table 27. Cross-section measurements and description of stream channel along selected transects in reach B, Truckee River at Farad, Calif., October 1993 and July 1996

[Latitude and longitude were measured using a Global Positioning Satellite system. Altitudes were measured using a surveyors level and rod from National Geodetic Survey benchmark R1202. Cross-section measurements in **bold** were made in October 1993 and are plotted in figure 35; measurements in plain type were made in July 1996 to extend the cross section from the old monuments to the new. Abbreviation: PVC, polyvinyl-chloride]

Distance from left bank monument (feet)	Altitude (feet above sea level)	Description
		Transect 1
0	5,216.35	The left-bank monument is a white 4-inch disk inscribed with BOUNDARY MARKER USGS NAWQA XSEC. This monument is on the southside of a wood post holding a metal guard rail along the southside of the eastbound lanes of Interstate 80. This monument was set in 1996. Latitude: 39° 25' 27.43"; Longitude: 120° 02' 04.63".
27	5,200.07	Top of left bank
84	5,179.58	Former left-bank monument (hardware washer on rock outcrop)
106	5,164.32	Left edge of water
125	5,161.22	Thalweg
183	5,164.37	Right edge of water
218	5,169.05	Right bank
224	5,172.48	Top of right bank
227	5,172.66	Former right-bank monument (PVC pipe)
530	5,188.10	The right-bank monument is a 4-inch white disk inscribed with BOUNDARY MARKER USGS NAWQA XSEC, set on a railroad tie, streamward from the Southern Pacific rail. This monument was set in 1996. Latitude: 39° 25' 26.11"; Longitude: 120° 01' 58.07".
		Transect 2
0	5,213.36	The left bank monument is a white 4-inch disk inscribed with BOUNDARY MARKER USGS NAWQA XSEC. This monument is on the southside of a wood post holding a metal guard rail along the southside of the eastbound lanes of Interstate 80, 286 feet east of transect B-1. This monument was set in 1996. Latitude: 39° 25' 30.08"; Longitude: 120° 02' 04.21".
14	5,165.89	2 inch hardware washer epoxied to a large boulder near river channel
23	5,162.88	Left edge of water
72	5,160.54	Thalweg
127	5,162.36	Right edge of water
139	5,169.38	Top of right bank
160	5,172.73	Former monument (rebar)
428	5,173.32	Bottom of railroad grade
449	5,183.46	Upper edge of railroad grade
467	5,185.48	The right bank monument is a 4-inch white disk inscribed with BOUNDARY MARKER USGS NAWQA XSEC, set on a railroad tie, streamward from the Southern Pacific rail. This monument was set in 1996. Latitude: 39° 25' 28.59"; Longitude: 120° 01' 58.40".

Table 27. Cross-section measurements and description of stream channel along selected transects in reach B, Truckee River at Farad, Calif., October 1993 and July 1996—Continued

Distance from left bank monument (feet)	Altitude (feet above sea level)	Description
		Transect 3
0	5,211.39	The left-bank monument is a white 4-inch disk inscribed with BOUNDARY MARKER USGS NAWQA XSEC. This monument is on the southside of a wood post holding a metal guard rail along the southside of the eastbound lanes of Interstate 80, 382 feet east of transect B-2. This monument was set in 1996. Latitude: 39° 25' 33.67"; Longitude: 120° 02' 02.91".
85	5,165.08	Former left-bank monument (hardware washer on boulder)
87	5,162.44	Top of left bank
111	5,159.89	Left bank
137	5,159.99	Left edge of water
190	5,157.79	Thalweg
223	5,160.09	Right edge of water
237	5,167.27	Top of right bank
253	5,167.54	Former right-bank monument
370	5,183.26	The right-bank monument is a 4-inch white disk inscribed with BOUNDARY MARKER USGS NAWQA XSEC, set on a railroad tie, streamward from the Southern Pacific rail. This monument was set in 1996. Latitude: 39° 25' 32.72"; Longitude: 120° 01' 58.34".
		Transect 4
0	5,174.46	The left-bank monument is a 2.5-inch hardware washer epoxied to the upper part of the south face of a large boulder. This monument is about 50 feet upstream from the USGS gaging station (10346000) and midway between the river channel and the eastbound lanes of Interstate 80. This monument was set in 1993. Latitude: 39° 25' 40.65"; Longitude: 120° 01' 59.34".
25	5,166.68	Top of left bank
45	5,157.51	Left bank
46	5,155.73	Left edge of water
63	5,153.72	Thalweg
94	5,155.50	Stream channel
152	5,155.95	Right edge of water
164	5,160.34	Bottom of right bank
180	5,161.78	Small flood plain
209	5,179.31	Top of right bank
235	5,182.20	The right-bank monument is a 2.5-inch PVC pipe cemented into the ground and topped by 2.5-inch and 1-inch hardware washers. This monument is 238 feet east of the large rock outcrop where National Geodetic Survey benchmark R1202 is located. This monument was set in 1993. Latitude: 39° 25' 39.54"; Longitude: 120° 01' 56.78".

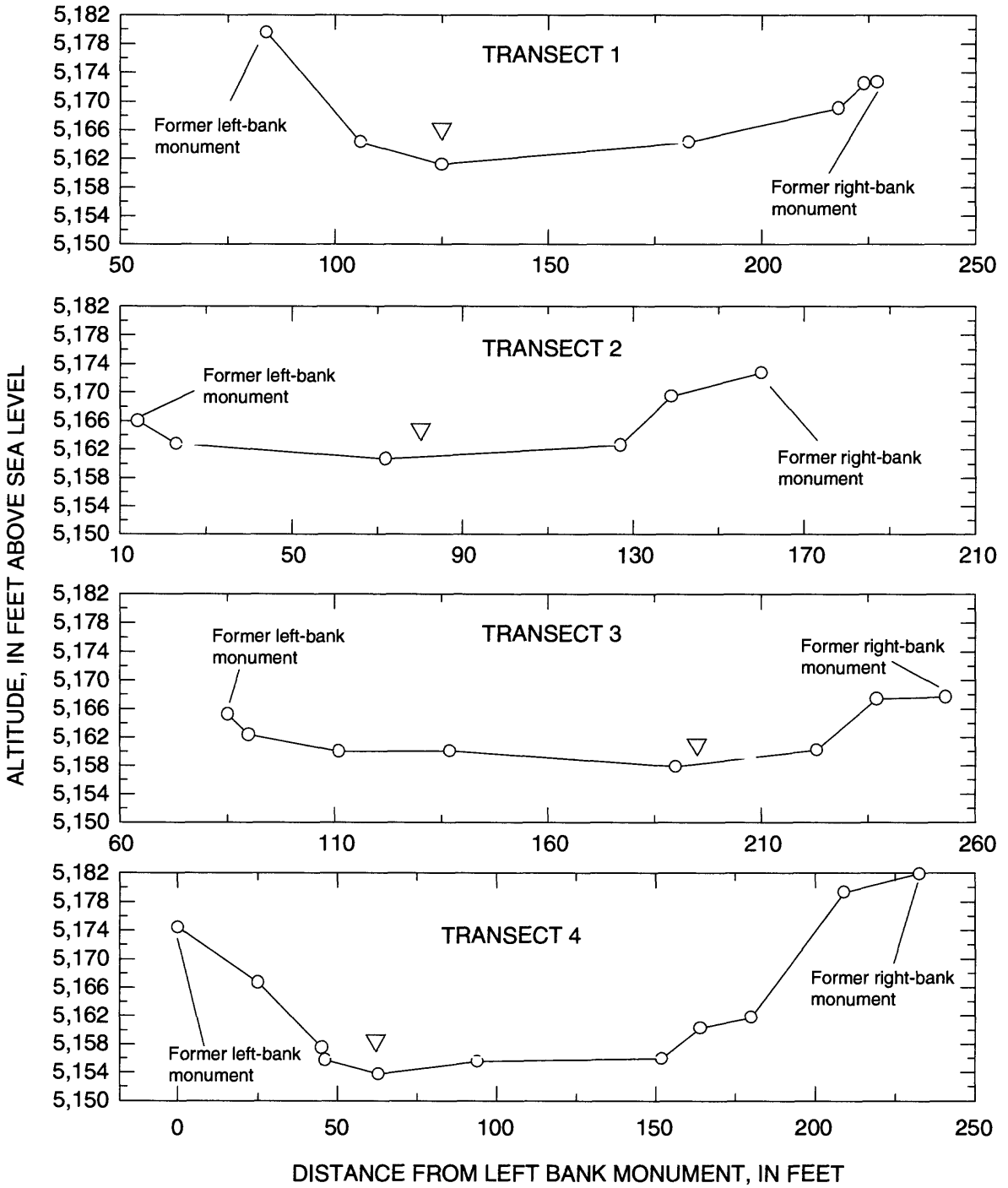


Figure 35. Cross sections showing land-surface (○) and water-surface (▽) altitudes for selected transects in reach B, Truckee River at Farad, Calif., October 1993.

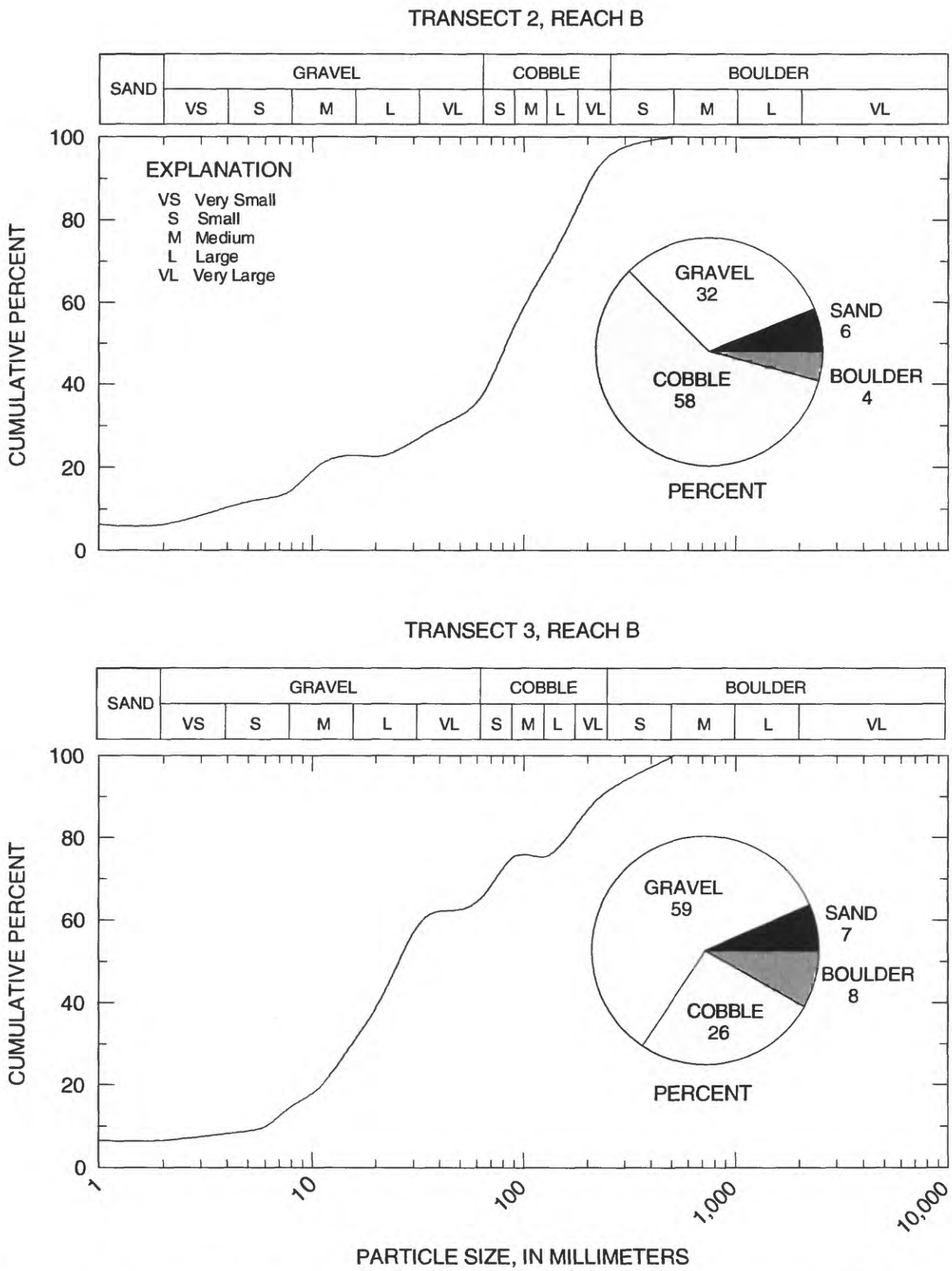


Figure 36. Particle-size distribution of coarse streambed substrate for selected transects in reach B, Truckee River at Farad, Calif., September 1994.

Table 28. Streambank features for selected transects in reach C, Truckee River at Farad, Calif., October 1993

[**Shape**: CC, concave up; CV, convex up; LN, linear.
Substrate: BO, boulder; CO, cobble; SA, sand.
Habitat features: BO, boulder.]

Stream-bank	Angle (degrees)	Height (feet)	Width (feet)	Surface cover (percent)	Shape	Erosion	Substrate		Habitat features
							Dominant	Subdominant	
Transect 1									
Left	4.6	7.8	78	greater than 80	CC	None	BO	CO	None
Right	5.2	8.4	36	greater than 80	CV	None	CO	SA	None
Transect 2									
Left	4.7	9.3	70	greater than 80	CC	None	SA	BO	10 percent BO
Right	7.3	7.0	13	greater than 80	CV	None	SA	CO	None
Transect 3									
Left	23.3	8.6	4	greater than 80	LN	None	SA	CO	None
Right	7.3	8.3	15	greater than 80	CV	None	SA	CO	None
Transect 4									
Left	8.3	12.3	30	greater than 80	LN	None	BO	CO	10 percent BO
Right	9.5	8.0	14	greater than 80	CV	None	CO	SA	10 percent BO
Transect 5									
Left	17.4	9.7	12	greater than 80	LN	None	CO	BO	10 percent BO
Right	8.5	11.5	16	greater than 80	CC	None	CO	BO	10 percent BO

Table 29. Cross-section measurements and description of stream channel along selected transects in reach C, Truckee River at Farad, Calif., October 1993 and July 1996

[Latitude and longitude were measured using a Global Positioning Satellite system. Altitudes were measured using a surveyors level and rod from National Geodetic Survey benchmark R1202. Cross-section measurements in **bold** were made in October 1993 and are plotted in figure 37; measurements in plain type were made in July 1996 to extend the cross section from the old monuments to the new. Abbreviation: PVC, polyvinyl-chloride; --, not measured; e, estimated]

Distance from left bank monument (feet)	Altitude (feet above sea level)	Description
		Transect 1
0	5,193.90	The left-bank monument is a white 4-inch disk inscribed with BOUNDARY MARKER USGS NAWQA XSEC. This monument is on the southside of a wood post holding a metal guard rail along the southside of the eastbound lanes of Interstate 80, 382 feet east of transect B-2. This monument was set in 1996. Latitude: 39° 25' 45.52"; Longitude: 120° 01' 58.46".
52	--	Top of left bank
121	5,160.30	Former left-bank monument (2.5-inch PVC pipe)
130	5,154.58	Left edge of water
150	5,152.54	Thalweg
207	5,154.50	Right edge of water
243	5,155.11	Channel bar
258	5,160.92	Flood plain
290	5,160.32	Flood plain
313	5,159.67	Bottom of right bank
334	5,174.96	Right bank
345	5,183.35	Former right-bank monument (2.5-inch PVC pipe)
404	5,178.30	The right-bank monument is a 4-inch white disk inscribed with BOUNDARY MARKER USGS NAWQA XSEC, set on a railroad tie, streamward from the Southern Pacific rail. The 4-inch white disk was established in 1996. Latitude: 39° 25' 43.78"; Longitude: 120° 01' 54.47".
		Transect 2
0	5,190.10	The left-bank monument is a white 4-inch disk inscribed with BOUNDARY MARKER USGS NAWQA XSEC. This monument is on the southside of a wood post holding a metal guard rail along the southside of the eastbound lanes of Interstate 80. This monument was set in 1996. Latitude: 39° 25' 47.51"; Longitude: 120° 01' 57.64".
117	5,161.42	Former left-bank monument (2.5-inch PVC pipe)
125	5,159.82	Left bank
134	5,153.84	Left bank
143	5,155.47	Bottom of left bank
175	5,153.69	Left edge of water
217	5,152.17	Thalweg
259	5,153.60	Right edge of water
272	5,159.17	Right bank
280	5,160.48	Former right-bank monument (rebar, not located in 1996)
373	5,176.36	Top edge of railroad grade
421	5,177.26	The right-bank monument is a 4-inch white disk inscribed with BOUNDARY MARKER USGS NAWQA XSEC, set on a railroad tie, streamward from the Southern Pacific rail. The 4-inch white disk was established in 1996. Latitude: 39° 25' 45.40"; Longitude: 120° 01' 52.36".

Table 29. Cross-section measurements and description of stream channel along selected transects in reach C, Truckee River at Farad, Calif., October 1993 and July 1996—Continued

Distance from left bank monument (feet)	Altitude (feet above sea level)	Description
		Transect 3
0	5,186.18	The left bank monument is a white 4-inch disk inscribed with BOUNDARY MARKER USGS NAWQA XSEC. This monument is on the southside of a wood post holding a metal guard rail along the southside of the eastbound lanes of Interstate 80. This monument was set in 1996. Latitude: 39° 25' 49.72"; Longitude: 120° 01' 56.59".
148	5,157.72	Former left-bank monument
154	5,155.96	Left bank terrace
158	5,150.27	Left edge of water
174	5,147.32	Thalweg
224	5,150.29	Right edge of water
239	5,153.30	Terrace
254	5,154.27	Terrace
263	5,158.58	Right bank
266	5,158.86	Former right-bank monument (2.5-inch PVC not found in 1996)
398	5,175.05	Top edge of railroad grade
420	5,176.84	The right-bank monument is a 4-inch white disk inscribed with BOUNDARY MARKER USGS NAWQA XSEC, set on a railroad tie, streamward from the Southern Pacific rail. The 4-inch white disk was established in 1996. Latitude: 39° 25' 46.37"; Longitude: 120° 01' 51.43".
		Transect 4
0	5,182.45	The left-bank monument is a white 4-inch disk inscribed with BOUNDARY MARKER USGS NAWQA XSEC. This monument is on the southside of a wood post holding a metal guard rail along the southside of the eastbound lanes of Interstate 80. This monument was set in 1996. Latitude: 39°25' 51.63"; Longitude: 120°01' 55.10".
130	5,152.02	Former left-bank monument (est. 1993)
150	5,141.77	Bottom of left bank terrace
160	5,141.12	Left edge of water
196	5,139.92	Stream channel
214	5,139.88	Thalweg
223	5,139.97	Stream channel
248	5,141.63	Right edge of water
262	5,146.43	Right channel margin
333	5,147.88	Former right-bank monument (est. 1993)
e473	5,173.11	Top edge of railroad grade
e490	5,174.85	The right-bank monument is a 4-inch white disk inscribed with BOUNDARY MARKER USGS NAWQA XSEC, set on a railroad tie, streamward from the Southern Pacific rail. The 4-inch white disk was established in 1996. Latitude: 39°25' 48.41"; Longitude: 120°01' 49.01".

Table 29. Cross-section measurements and description of stream channel along selected transects in reach C, Truckee River at Farad, Calif., October 1993 and July 1996—Continued

Distance from left bank monument (feet)	Altitude (feet above sea level)	Description
		Transect 5
0	5,182.050	The left-bank monument is a white 4-inch disk inscribed with BOUNDARY MARKER USGS NAWQA XSEC. This monument is on the southside of a wood post holding a metal guard rail along the southside of the eastbound lanes of Interstate 80. This monument was set in 1996. Latitude: 39° 25' 54.51"; Longitude: 120°01' 51.24".
43	5,158.31	Former left-bank monument (hardware washer on boulder)
43.5	5,155.54	Top of left bank
55	5,149.66	Left edge of water
74	5,145.83	Thalweg
114	5,147.79	Stream channel
135	5,149.71	Right edge of water
143	5,153.76	Right channel margin
151	5,156.17	Top of right bank
191	5157.32	Flood plain
262	5156.28	Former right-bank monument (concrete block with brass disk)
307	5,171.24	Top edge of railroad grade
325	5,173.63	The right-bank monument is a 4-inch white disk inscribed with BOUNDARY MARKER USGS NAWQA XSEC, set on a railroad tie, streamward from the Southern Pacific rail. The 4-inch white disk was established in 1996. Latitude: 39° 25' 49.26"; Longitude: 120° 01' 47.58".

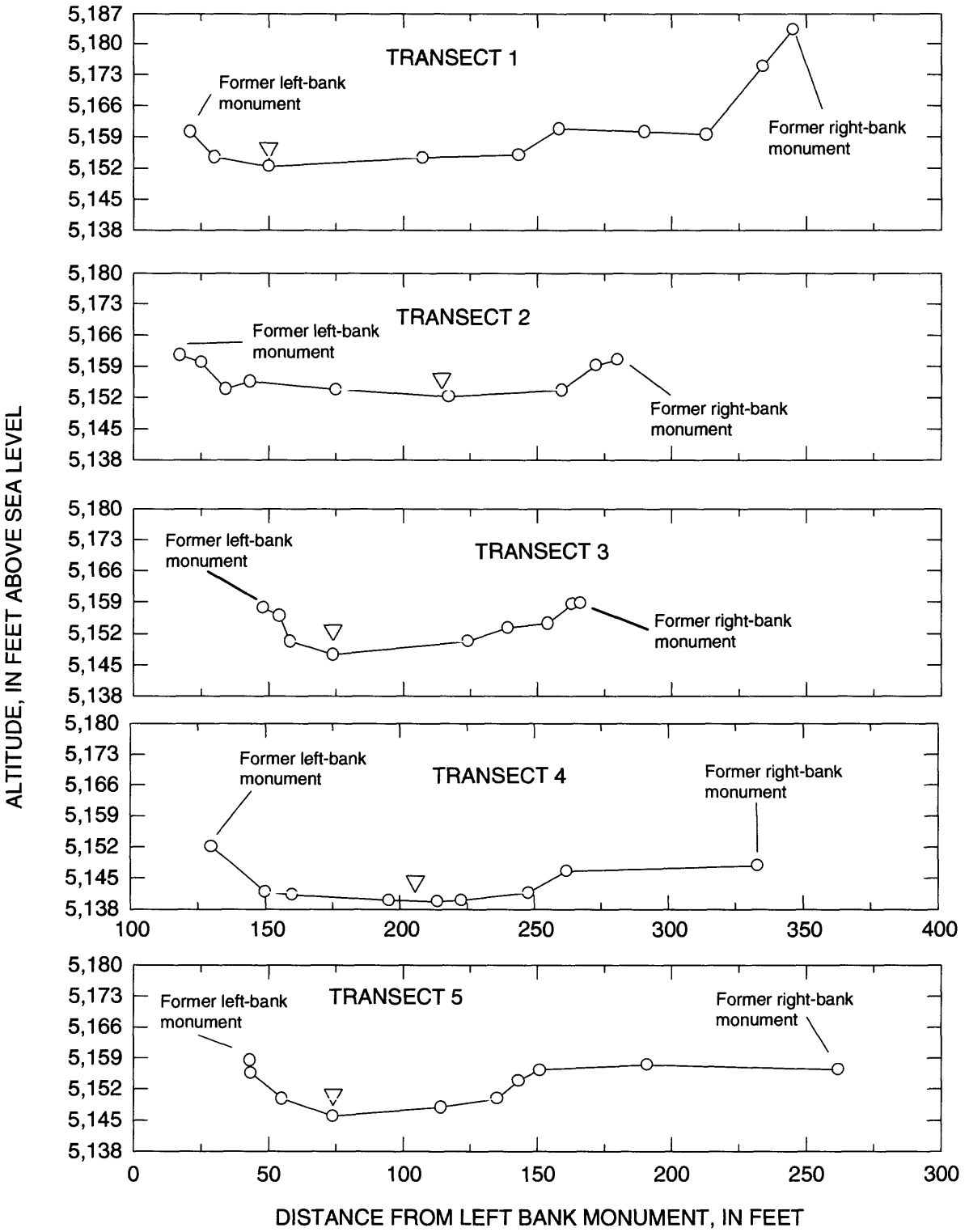


Figure 37. Cross sections showing land-surface (○) and water-surface (▽) altitudes for selected transects in reach C, Truckee River at Farad, Calif., October 1993.

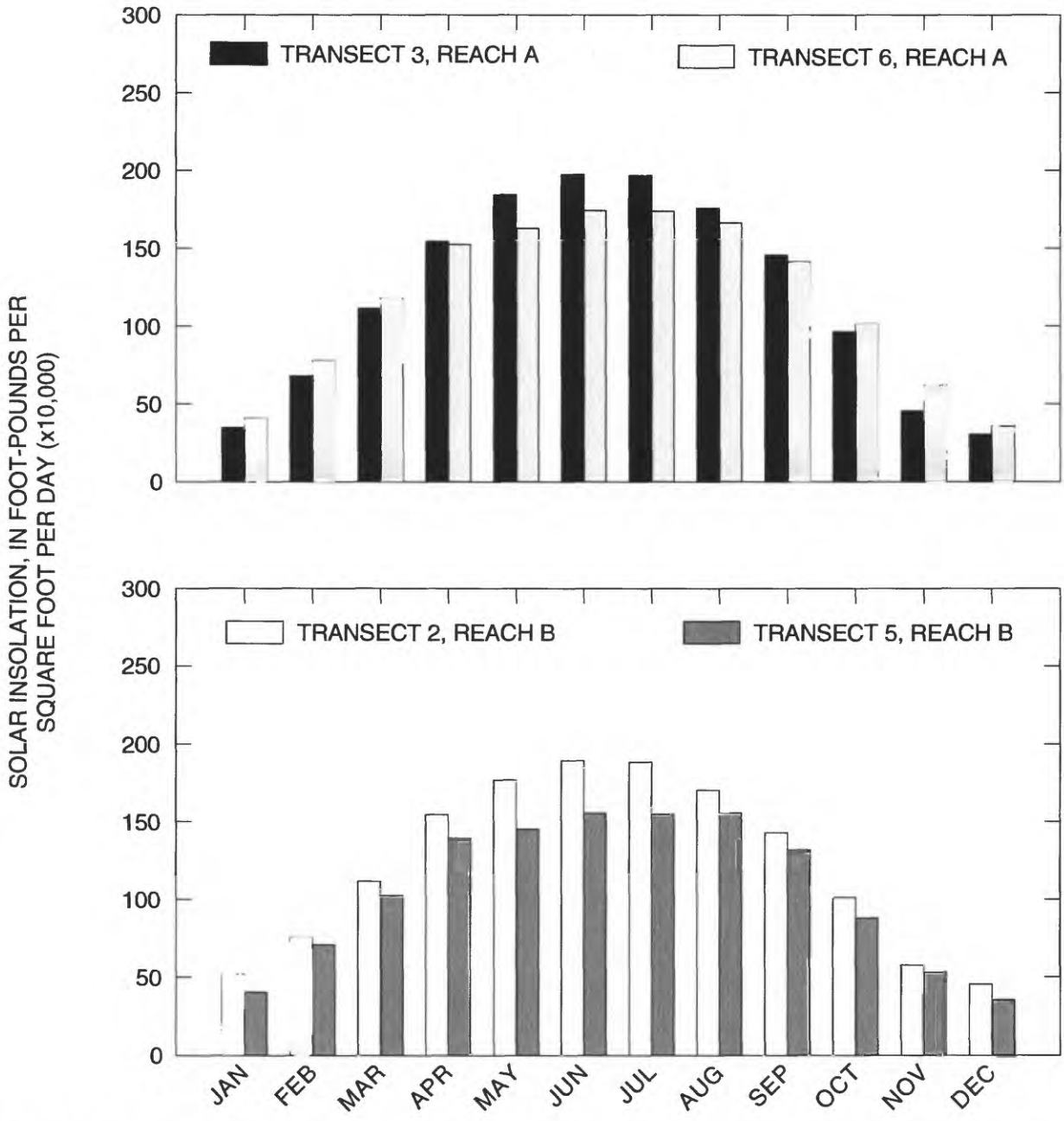


Figure 38. Monthly solar insolation midstream at selected transects in reaches A and B, Truckee River at Farad, Calif.

Truckee River near Sparks, Nev.
(U.S. Geological Survey Station 10348200)

Downstream view of Truckee River from transect 5, reach A, Truckee River near Sparks, Nev. Photograph by Ronald P. Collins, U.S. Geological Survey, September 1993.

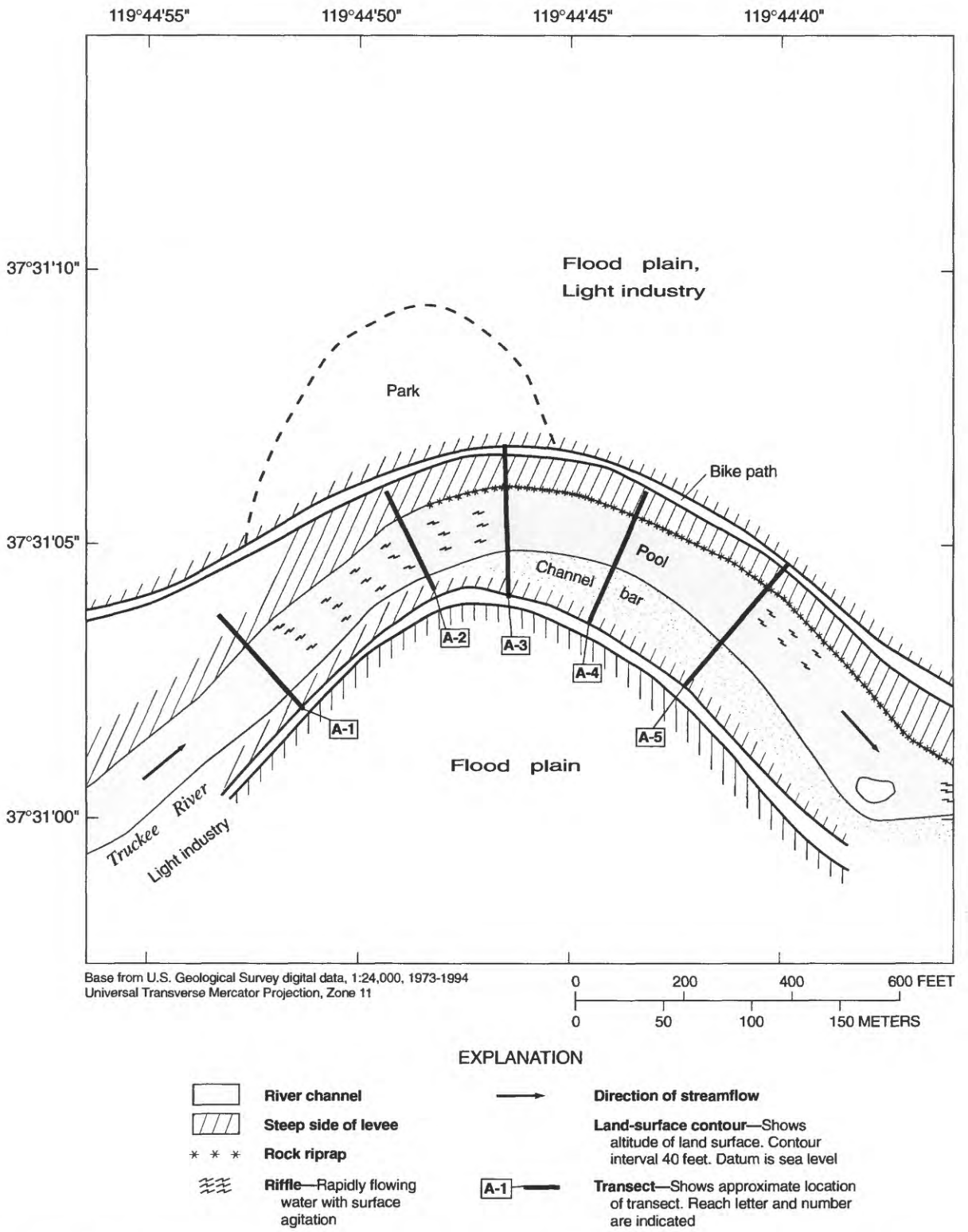


Figure 39. Location of transects in reach A, Truckee River near Sparks, Nev., with some landscape features approximately located, October 1994.

Table 30. Streambank features for selected transects in reach A, Truckee River near Sparks, Nev., October 1994

[**Shape**: CC, concave up; LN, linear.
Substrate: BO, boulder; CO, cobble; SA, sand; SI, silt.
Habitat features: BO, boulder]

Stream-bank	Angle (degrees)	Height (feet)	Width (feet)	Surface cover (percent)	Shape	Erosion	Substrate		Habitat features
							Dominant	Subdominant	
				Transect 1					
Left	5.8	11.7	33	greater than 80	CC	none	BO	SI	none
Right	6.0	5.5	19	greater than 80	LN	none	BO	SA	none
				Transect 2					
Left	11.2	12.7	32	greater than 80	LN	none	BO	SA	none
Right	5.4	13.4	126	greater than 80	CC	none	CO	SA	none
				Transect 3					
Left	25.2	12.7	34	greater than 80	LN	none	BO	SI	15 percent BO
Right	6.1	19.4	154	greater than 80	LN	none	CO	SA	none
				Transect 4					
Left	24.4	17.2	21	greater than 80	LN	none	BO	CO	15 percent BO
Right	7.3	17.9	114	greater than 80	CC	none	CO	SA	none
				Transect 5					
Left	22.1	15.4	23	greater than 80	LN	none	BO	SI	10 percent BO
Right	5.2	14.6	148	greater than 80	CC	none	CO	SA	none

Table 31. Cross-section measurements and description of stream channel along selected transects in reach A, Truckee River near Sparks, Nev., October 1994

[Latitude and longitude were measured using a Global Positioning Satellite system. Altitudes were measured using a surveyors level and rod from Federal Emergency Management Agency benchmark TRS17. Cross-section measurements are plotted in figure 41. Abbreviation: PVC, polyvinyl-chloride]

Distance from left bank monument (feet)	Altitude (feet above sea level)	Description
		Transect 1
0	4,403.28	The left-bank monument is a 4-inch PVC pipe cemented into ground and capped with Bureau of Reclamation brass tablet. This monument is between bicycle path and river, southwest of Glendale Park and about 4-inch above land surface. This monument was set in 1994. Latitude: 39°31' 03.70"; Longitude: 119°44' 53.32".
9	4,403.04	Top of left bank
36	4,392.10	Bottom of left bank
42	4,391.04	Left edge of water
58	4,391.30	Channel
89	4,391.09	Channel
111	4,391.59	Gravel bar
119	4,391.73	Gravel bar
124	4,390.63	Gravel bar
149	4,391.16	Channel
157	4,390.68	Channel
162	4,391.71	Right edge of water
166	4,394.04	Right bank
170	4,394.82	Right bank
176	4,396.51	Midpoint of right bank
189	4,403.12	The right-bank monument is a 2.5-inch PVC pipe cemented into the top of a levee. This monument was set in 1994. Latitude and longitude not recorded.
		Transect 2
0	4,401.83	The left-bank monument is a 2.5-inch hardware washer epoxied to north corner of concrete pad of westmost concrete picnic table of Glendale Park, Coney Island Drive, Sparks, Nev. This monument was set in 1994. Latitude: 39° 31' 05.96"; Longitude: 119° 44' 49.37".
14	4,401.03	Top of left bank
25	4,395.89	Midpoint of left bank
32	4,391.33	Bottom of left bank
38	4,388.61	Left edge of water
47	4,387.99	Thalweg
52	4,388.36	Left edge of gravel bar
60	4,388.63	Right edge of gravel bar
64	4,388.32	Channel
81	4,388.23	Channel
90	4,388.85	Right edge of water
112	4,390.21	Channel bar
148	4,392.09	Channel bar
159	4,392.56	Bottom of right bank
177	4,400.04	Midpoint right bank
188	4,401.85	Top edge of right bank
207	4,401.68	The right-bank monument is yellow-capped rebar driven into the top of a levee. This monument was set in 1994. Latitude and longitude not recorded.

Table 31. Cross-section measurements and description of stream channel along selected transects in reach A, Truckee River near Sparks, Nev., October 1994—Continued

Distance from left bank monument (feet)	Altitude (feet above sea level)	Description
		Transect 3
0	4,401.39	The left-bank monument is a yellow-capped rebar at land surface, 1 foot north of paved bicycle path and 56 feet east of eastern edge of Glendale Park. This monument was set in 1994. This monument was washed away during 1997 flooding. Latitude: 39°31' 06.82"; Longitude: 119°44' 46.57".
15	4,401.04	Top of bank
34	4,387.56	Left edge of water
42	4,384.22	Thalweg
70	4,387.48	Right edge of water
114	4,391.51	Channel bar
160	4,395.97	Channel bar
171	4,395.96	Channel bar
177	4,394.09	Channel bar
186	4,393.18	Channel bar
193	4,393.47	Channel bar
202	4,395.26	Bottom of right bank
224	4,403.63	Upper edge of right bank
241	4,404.40	The right-bank monument is yellow-capped rebar driven into top of levee. This monument was set in 1994. Latitude and longitude not recorded.
		Transect 4
0	4,402.11	The left-bank monument is a yellow, flat hardware washer epoxied to a small boulder embedded in the upper bank, 15 feet from paved bicycle path. This monument was set in 1994. This monument was washed away during 1997 flooding. Latitude: 39°31' 05.97"; Longitude: 119°44' 43.19"
21	4,387.56	Left edge of water
38	4,384.90	Thalweg
64	4,387.57	Right edge of water
93	4,389.33	Channel bar
101	4,391.97	Channel bar
128	4,394.20	Channel bar
146	4,393.70	Bottom of levee
162	4,401.98	Top edge of levee
178	4,402.82	The right-bank monument is yellow-capped rebar driven into the top of a levee. This monument was set in 1994. Latitude and longitude not recorded.

Table 31. Cross-section measurements and description of stream channel along selected transects in reach A, Truckee River near Sparks, Nev., October 1994—Continued

Distance from left bank monument (feet)	Altitude (feet above sea level)	Description
		Transect 5
0	4,401.69	The leftbank monument is a 4-inch PVC pipe cemented into ground and topped with Bureau of Reclamation brass tablet. This monument is 6 feet north of paved bicycle path, 1,186 feet from monument one, and 798 feet from monument two. This monument was set in 1994. Latitude: 39°31' 04.68"; Longitude: 119° 44' 39.82".
17	4,401.32	Left edge of grade
40	4,386.85	Left edge of water
55	4,385.89	Thalweg
66	4,386.88	Right edge of water
93	4,388.29	Channel bar
101	4,388.91	Channel bar
105	4,389.79	Channel bar
119	4,390.55	Channel bar
155	4,390.92	Channel bar
199	4,393.66	Bottom of levee, edge of channel bar
214	4,400.49	Top of levee
226	4,401.09	The right-bank monument is a 4-inch PVC pipe topped with Bureau of Reclamation brass tablet. This monument was cemented into ground at top of levee in 1994. Latitude and longitude not recorded.

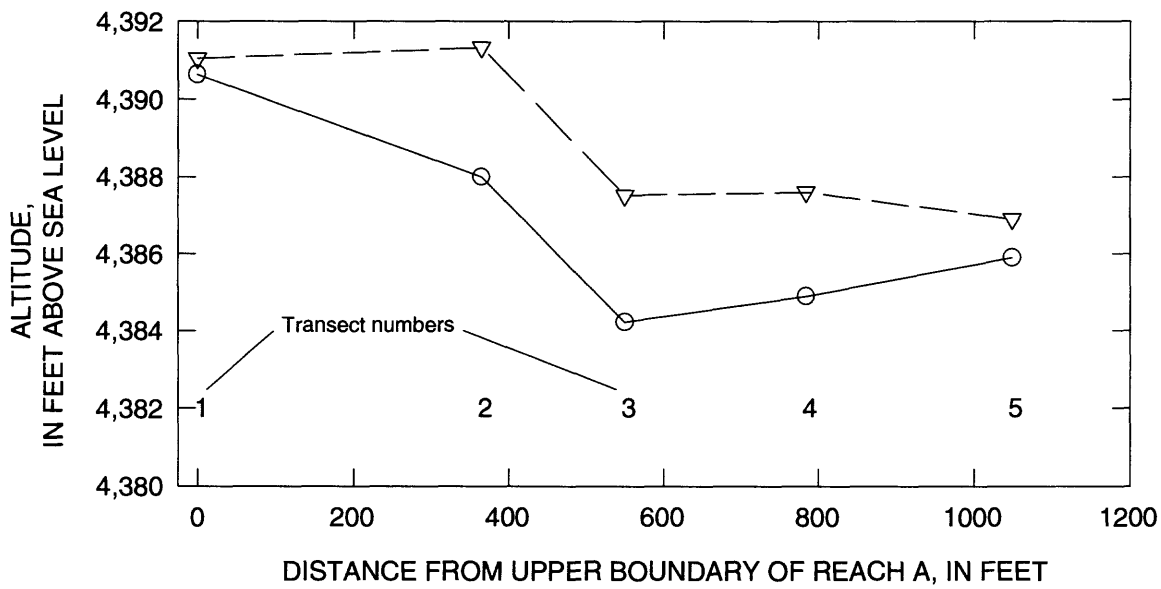


Figure 40. Longitudinal profiles of streambed (○) and water-surface (▽) altitudes measured along the thalweg in reach A, Truckee River near Sparks, Nev., October 1994.

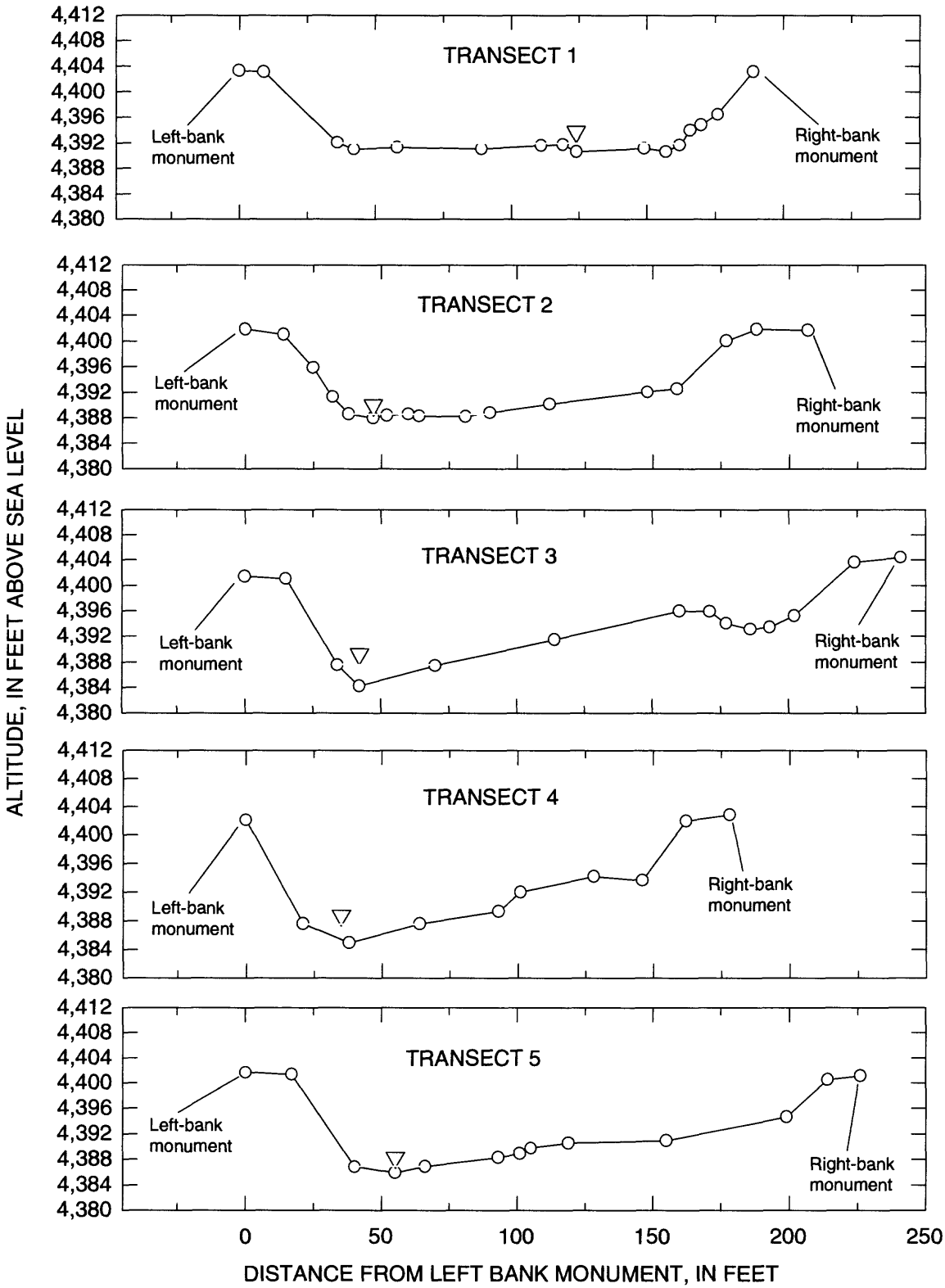


Figure 41. Cross sections showing land-surface (○) and water-surface (▽) altitudes for selected transects in reach A, Truckee River near Sparks, Nev., October 1994.

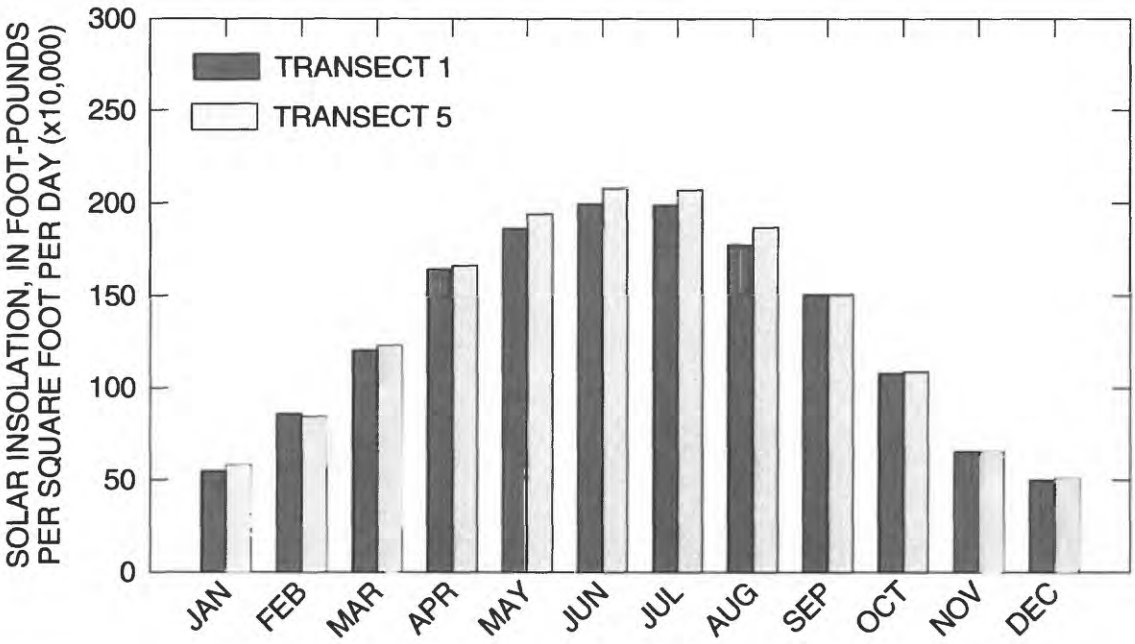


Figure 42. Monthly solar insolation midstream at selected transects in reach A, Truckee River near Sparks, Nev.

Truckee River at Clark, Nev.
(U.S. Geological Survey Station 10350500)

Upstream view of Truckee River from transect 5, reach C, Truckee River at Clark, Nev. Photograph by Sonya Vasquez, U.S. Geological Survey, September 1995.

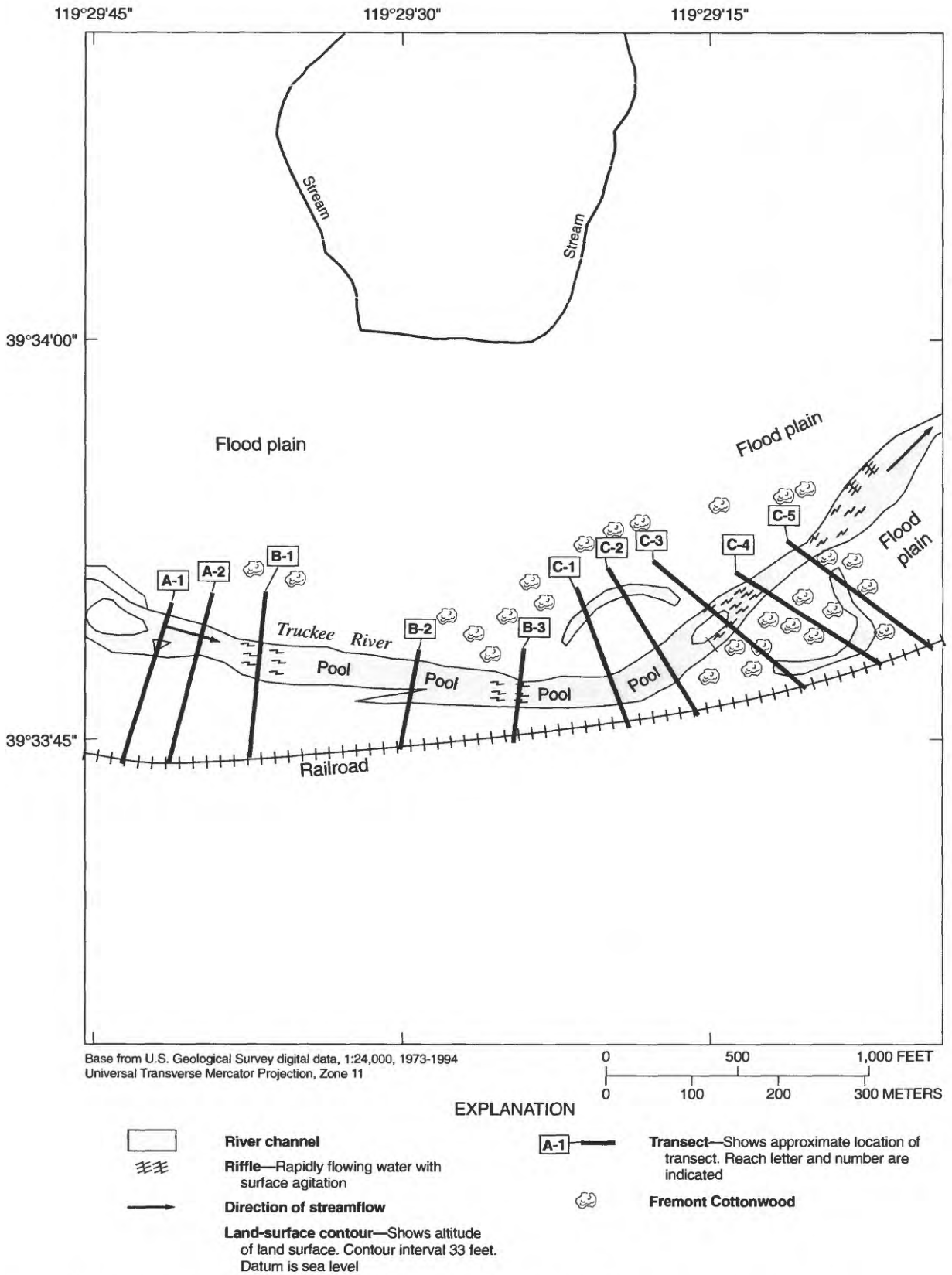


Figure 43. Location of transects in reaches A-C, Truckee River at Clark, Nev., with some landscape features approximately located, October 1993.

Table 32. Streambank features for selected transects in reach A, Truckee River at Clark, Nev., October 1993

[**Shape**: CC, concave up; CV, convex up; LN, linear.
Erosion: CB, cut-bank scallop; SL, slab failure.
Substrate: CO, cobble; SA, sand.]

Stream-bank	Angle (degrees)	Height (feet)	Width (feet)	Surface cover (percent)	Shape	Erosion	Substrate		Habitat features
							Dominant	Subdominant	
Transect 1									
Left	13.6	9.2	15	greater than 80	CV	SL	SA	CO	None
Right	1.8	5.7	131	greater than 80	LN	None	CO	SA	None
Transect 2									
Left	12.0	12.7	30	50 to 79	CC	SL	SA	CO	None
Right	5.0	16.7	154	50 to 79	CV	CB	CO	SA	None

Table 33. Cross-section measurements and description of stream channel along selected transects in reach A, Truckee River at Clark, Nev., October 1993 and August 1996

[Latitude and longitude were measured using a Global Positioning Satellite system. Altitudes were measured using a surveyors level and rod from National Geodetic Survey benchmark N339. Cross-section measurements in **bold** were made in October 1993 and are plotted in figure 45; measurements in plain type were made in August 1996 to extend the cross section from the old monument to the new. Abbreviations: e, estimated; PVC, polyvinyl-chloride.]

Distance from left bank monument (feet)	Altitude (feet above sea level	Description
		Transect 1
0	4,240.20	The left-bank monument is a brass tablet on 4-inch by 4-inch concrete block cemented into the ground. This monument was set in 1993. Latitude and longitude not recorded.
7	4,239.60	Top of left bank
22	4,231.20	Left edge of water
45	4,230.40	Thalweg
64	4,230.90	Stream channel
92	4,232.50	Right edge of water
124	4,234.40	Right bank
166	4,235.90	Right bank
223	4,236.30	Former right-bank monument is 2-inch PVC pipe cemented into the ground and topped with a hardware washer.
e630	4,260.20	Right-bank monument is a white disk attached to railroad tie on north railroad track. Latitude: 39°33'44.12"; Longitude: 119°29'43.63".
		Transect 2
0	4,242.50	The left-bank monument is a 2-inch PVC pipe cemented into ground. This monument was set in 1993. Latitude and longitude not recorded.
5	4,241.10	Top of left bank
15	4,234.90	Left bank
25	4,236.10	Left bank
35	4,232.20	Left edge of water
65	4,228.40	Thalweg
102	4,232.10	Right edge of water
115	4,233.80	Channel bar
162	4,235.30	Channel bar
242	4,233.50	Channel bar, bottom of right bank
256	4,245.10	Top of right bank
257	4,245.30	Former right-bank monument (2-inch PVC pipe cemented into ground, est. 1993)
e615	4,259.60	Right-bank monument is a white disk attached to railroad tie on north railroad track. Latitude: 39°33'44.11"; Longitude: 119°29'41.36".

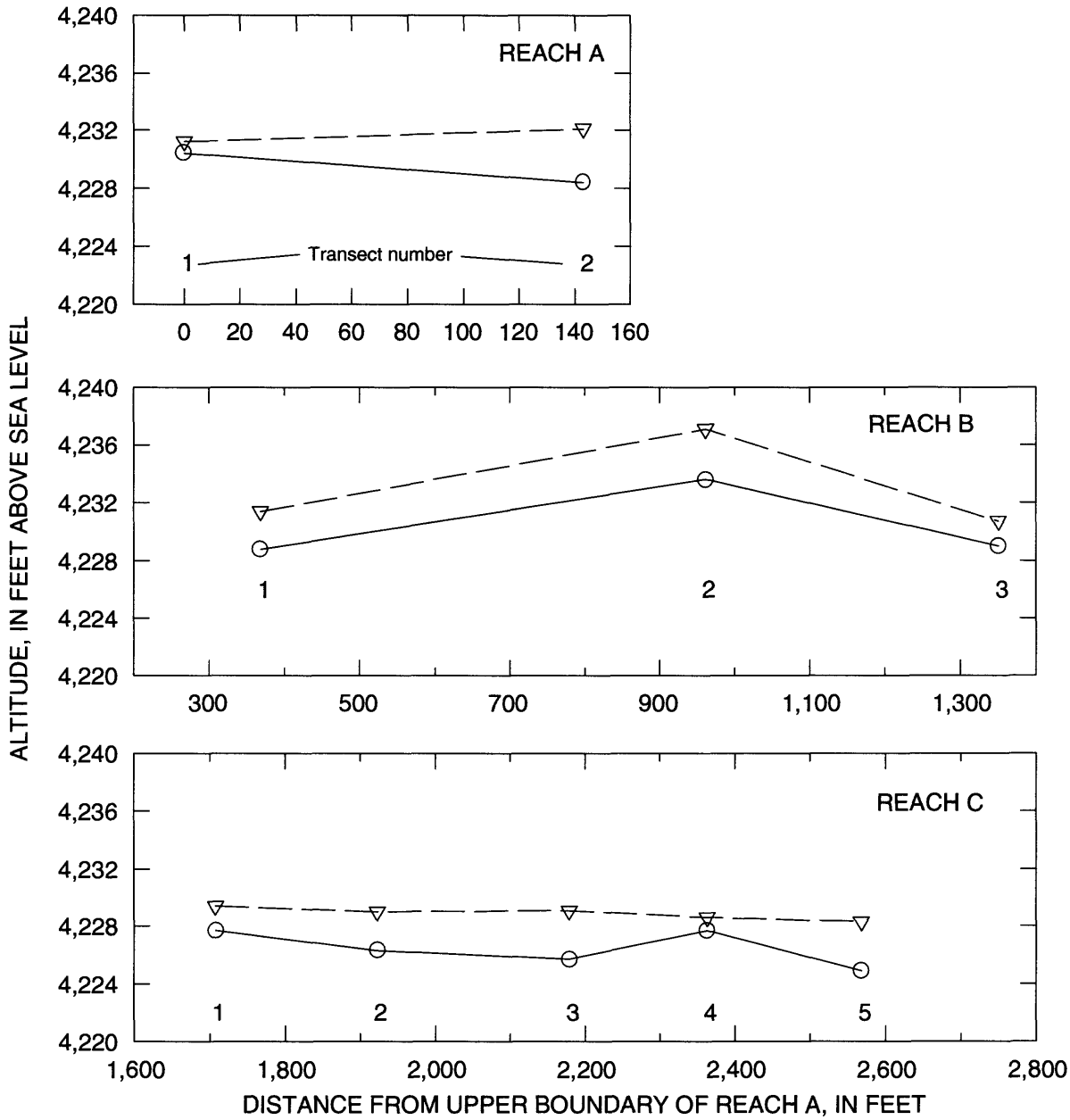


Figure 44. Longitudinal profiles of streambed (○) and water-surface (▽) altitudes measured along the thalweg in reaches A-C, Truckee River at Clark, Nev., October 1993.

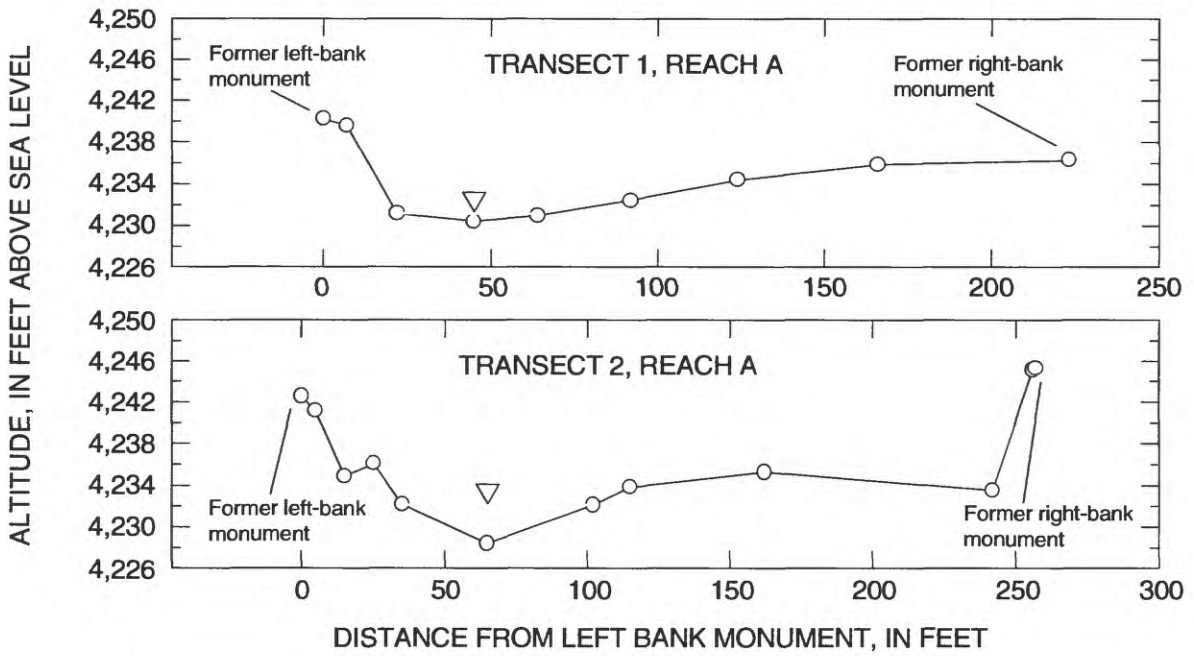


Figure 45. Cross sections showing land-surface (○) and water-surface (▽) altitudes for selected transects in reach A, Truckee River at Clark, Nev., October 1993.

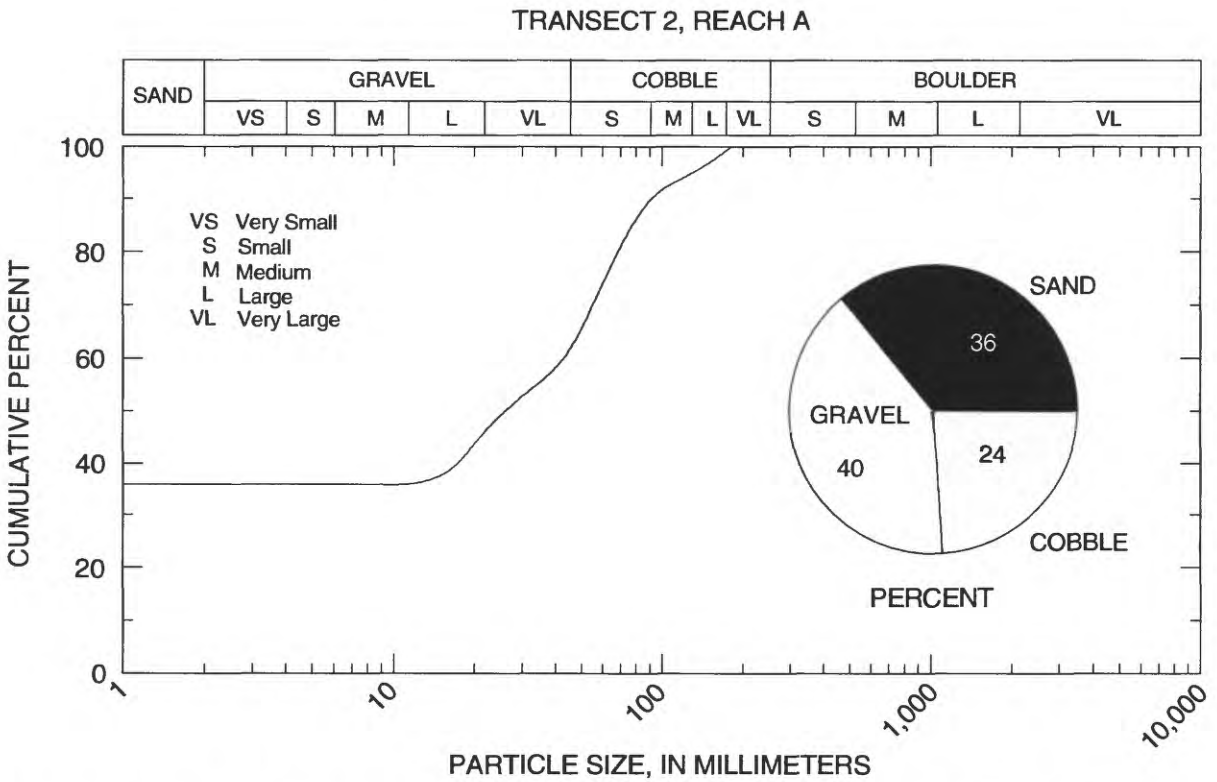


Figure 46. Particle-size distribution for coarse streambed substrate at selected transects in reach A, Truckee River at Clark, Nev., September 1994

Table 34. Streambank features for selected transects in reach B, Truckee River at Clark, Nev., October 1993

[**Shape**: CC, concave up; CV, convex up; LN, linear.
Erosion: CB, cut-bank scallop.
Substrate: CO, cobble; SA, sand; SI, silt.
Habitat features: WD, woody debris]

Stream-bank	Angle (degrees)	Height (feet)	Width (feet)	Surface cover (percent)	Shape	Erosion	Substrate		Habitat features
							Dominant	Subdominant	
				Transect 1					
Left	5.5	9.3	68	25 to 49	LN	CB	SA	CO	5 percent WD
Right	11.3	18.8	60	25 to 49	LN	CB	SA	CO	1 percent WD
				Transect 2					
Left	11.6	11.1	17	25 to 49	CC	CB	SA	CO	1 percent WD
Right	6.4	10.7	9	Less than 25	LN	CB	SA	CO	1 percent WD
				Transect 3					
Left	25	7	3	25 to 49	LN	CB	SA	SI	None
Right	3.6	13.1	168	greater than 80	CV	None	SA	SI	None

Table 35. Cross-section measurements and description of stream channel along selected transects in reach B, Truckee River at Clark, Nev., October 1993 and August 1996

[Latitude and longitude were measured using a Global Positioning Satellite system. Altitudes were measured using a surveyors level and rod from National Geodetic Survey benchmark N339. Cross-section measurements in **bold** were made in October 1993 and are plotted in figure 47; measurements in plain type were measured in August 1996 to extend the cross section from the old monuments to the new. Abbreviation: PVC, Polyvinyl-chloride]

Distance from left bank monument (feet)	Altitude (feet above sea level)	Description
		Transect 1
0	4,239.50	The left-bank monument is a 2-inch PVC pipe cemented into ground. Latitude and longitude not recorded.
17	4,238.10	Top of left bank
27	4,231.50	Bottom of left bank
35	4,230.30	Channel bar
41	4,231.40	Channel bar
58	4,232.40	Channel bar
85	4,231.30	Left edge of water
113	4,228.80	Thalweg
147	4,231.40	Right edge of water
155	4,240.90	Right bank
207	4,247.60	Top of right bank
246	4,248.30	Former right-bank monument (2-inch PVC pipe cemented into the ground)
322	4,258.20	Right-bank monument is a white disk attached to railroad tie on north railroad track. Latitude: 39°33'44.33"; Longitude: 119°29'37.45".

Table 35. Cross-section measurements and description of stream channel along selected transects in reach B, Truckee River at Clark, Nev., October 1993 and August 1996—Continued

Distance from left bank monument (feet)	Altitude (feet above sea level)	Description
		Transect 2
0	4,246.20	The left-bank monument is a 2-inch PVC pipe cemented into ground. Latitude and longitude not recorded.
16	4,244.70	Top of left bank
33	4,237.10	Left edge of water
70	4,233.60	Thalweg
157	4,237.00	Right edge of water
166	4,244.30	Top of right bank
219	4,245.30	Former right-bank monument (rebar with yellow cap, est. 1993)
e371	4,256.10	The right-bank monument is a white disk attached to railroad tie on north railroad track. Latitude: 39°33'44.64"; Longitude: 119°29'30.14".
		Transect 3
0	4,237.50	The left-bank monument is a 2-inch PVC pipe cemented into ground. Latitude and longitude not recorded.
31	4,236.00	Top of left bank
34	4,230.70	Left edge of water
46	4,229.00	Thalweg
87	4,230.60	Right edge of water
147	4,232.90	Channel bar
210	4,230.30	Channel bar
234	4,228.50	Channel bar
239	4,230.30	Right bank
255	4,242.10	Top of right bank
275	4,245.30	Former right-bank monument (PVC pipe cemented into ground)
295	4,255.00	Right-bank monument is a white disk attached to railroad tie on north railroad track. Latitude: 39°33'44.89"; Longitude: 119°29'24.62".

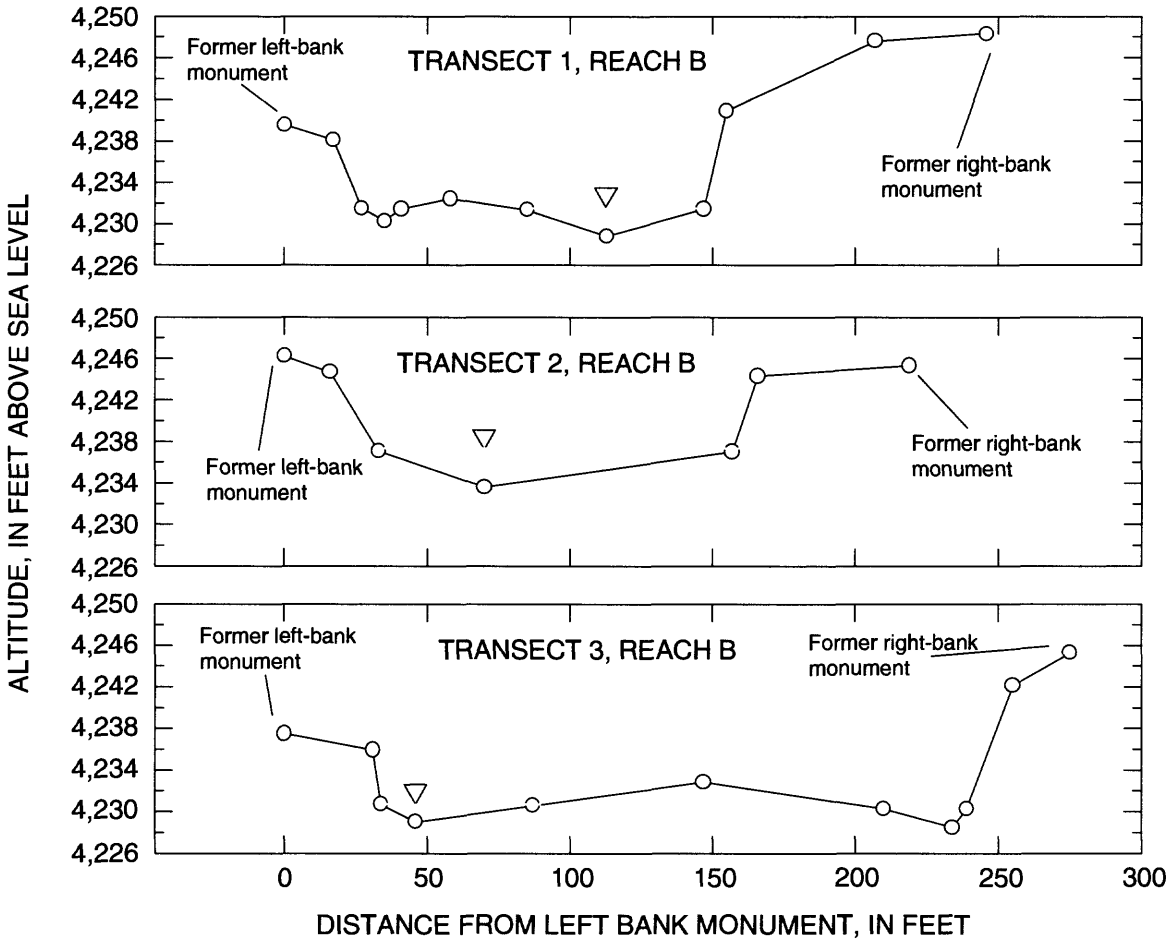


Figure 47. Cross sections showing land-surface (○) and water-surface (▽) altitudes for selected transects in reach B, Truckee River at Clark, Nev., October 1993.

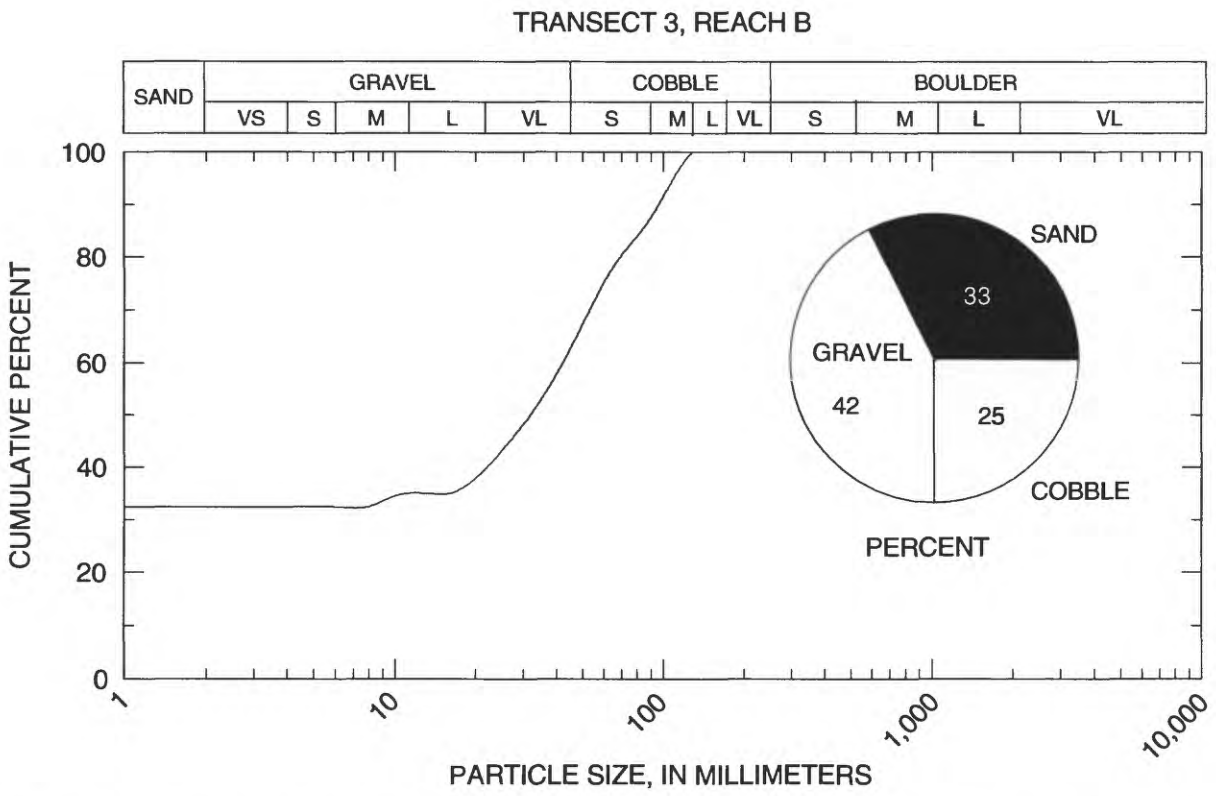


Figure 48. Particle-size distribution for coarse streambed substrate at transect 3 in reach B, Truckee River at Clark, Nev., September 1994

Table 36. Streambank features for selected transects in reach C, Truckee River at Clark, Nev., October 1993

[**Shape**: CC, concave up; LN, linear.
Erosion: CB, cut-bank scallop; SL, slab failure.
Substrate: CO, cobble; SA, sand; SI, silt.
Habitat features: MS, submergent macrophyte; WD, woody debris]

Stream-bank	Angle (degrees)	Height (feet)	Width (feet)	Surface cover (percent)	Shape	Erosion	Substrate		Habitat features
							Dominant	Subdominant	
				Transect 1					
Left	5.5	10.3	15 4	greater than 80	CC	None	CO	SI	None
Right	6.1	10.1	33	50 to 79	CC	CB	SA	SI	None
				Transect 2					
Left	3.3	9.7	119	greater than 80	CC	None	CO	SI	None
Right	18.9	12.7	13	25 to 49	CC	SL,CB	SI	SA	5 percent MS
				Transect 3					
Left	5.4	5.5	10	greater than 80	LN	None	SA	CO	15 percent WD
Right	10.8	8.5	5	25 to 49	CC	CB,SL	SI	SA	10 percent MS
				Transect 4					
Left	1.5	4.7	112	50 to 79	LN	None	SI	SA	50 percent MS
Right	11.0	10.5	6	greater than 80	LN	SL,CB	CO	SA	None
				Transect 5					
Left	12.4	8.6	8	25 to 49	CC	SL,CB	SA	SI	None
Right	5.7	5.3	12	greater than 80	LN	None	SA	SI	None

Table 37. Cross-section measurements and description of stream channel along selected transects in reach C, Truckee River at Clark, Nev., October 1993 and August 1996

[Latitude and longitude were measured using a Global Positioning Satellite system. Altitudes were measured using a surveyors level and rod from National Geodetic Survey benchmark N339. Cross-section measurements in **bold** were made in October 1993 and are plotted in figure 49; measurements in plain type were made in August 1996 to extend the cross section from the old monument to the new. Abbreviations: e, estimated; PVC, polyvinyl-chloride.]

Distance from left bank monument (feet)	Altitude (feet above sea level)	Description
		Transect 1
0	4,238.00	The left-bank monument is a 2-inch PVC pipe topped with washer and cemented into ground. Latitude and longitude not recorded.
33	4,235.70	Left bank
70	4,236.10	Left bank
114	4,230.80	Bottom of left bank
154	4,229.40	Left edge of water
177	4,227.70	Thalweg
202	4,229.10	Point bar
219	4,227.90	Stream channel
239	4,229.40	Right edge of water
245	4,231.00	Bottom of right bank
268	4,232.60	Right bank
272	4,237.80	Top of right bank
285	4,238.60	Former right-bank monument (PVC pipe cemented into ground)
e360	4,254.75	Right-bank monument is a white disk attached to railroad tie on north railroad track. Latitude: 39°33'45.47"; Longitude: 119°29'18.96".

Table 37. Cross-section measurements and description of stream channel along selected transects in reach C, Truckee River at Clark, Nev., October 1993 and August 1996—Continued

Distance from left bank monument (feet)	Altitude (feet above sea level)	Description
		Transect 2
0	4,236.30	The left-bank monument is a 2-inch PVC pipe topped with a washer and cemented into the ground. Latitude and longitude not recorded.
13	4,232.60	Left bank
45	4,233.40	Channel bar
92	4,231.30	Channel bar
119	4,229.00	Left edge of water
131	4,227.40	Stream channel
149	4,226.60	Center channel
169	4,226.30	Thalweg
193	4,229.10	Right edge of water
197	4,238.00	Right bank
206	4,239.70	Former right-bank monument (PVC pipe cemented into ground)
323	4,254.73	Right-bank monument is a white disk attached to railroad tie on north side of railroad track. Latitude: 39°33'45.94"; Longitude: 119°29'15.59".
		Transect 3
0	4,231.20	The left-bank monument is a 2-inch PVC pipe topped with washer and cemented into ground. Latitude and longitude not recorded.
10	4,229.10	Left edge of water
33	4,226.50	Stream channel
58	4,225.70	Thalweg
98	4,229.10	Right edge of water
103	4,234.20	Top of right bank
113	4,235.60	Former right-bank monument (PVC pipe cemented into the ground, est. 1993]
e445	4,254.42	Right-bank monument is a white disk attached to railroad tie on north side of railroad track. Latitude: 39°33'46.96"; Longitude: 119°29'10.39".

Table 37. Cross-section measurements and description of stream channel along selected transects in reach C, Truckee River at Clark, Nev., October 1993 and August 1996—Continued

Distance from left bank monument (feet)	Altitude (feet above sea level)	Description
		Transect 4
0	4,232.51	The left-bank monument is a 2-inch PVC pipe topped with a washer and cemented into the ground. Latitude: 39°33'51.31"; Longitude: 119°29'13.80".
78	4,231.08	Left bank
112	4,228.59	Left edge of water
127	4,227.65	Thalweg
152	4,228.65	Stream channel (riffle)
185	4,227.81	Stream channel
220	4,228.83	Right edge of water
226	4,238.28	Top of right bank
239	4,241.84	Former right-bank monument
e732	4,254.46	Right-bank monument is a white disk attached to railroad tie on north side of railroad track. Latitude: 39°33'47.84"; Longitude: 119°29'06.07".
		Transect 5
0	4,234.80	The left-bank monument is a 3-inch brass tablet in a concrete block cemented into the ground. Located on flood plain about 150 feet upstream from bridge. Latitude: 39°33'51.31"; Longitude: 119°29'13.80".
12	4,233.50	Top of left bank
20	4,228.30	Left edge of water
41	4,225.00	Stream channel
51	4,224.90	Thalweg
79	4,226.30	Stream channel
92	4,228.30	Right edge of water
104	4,230.20	Top of right bank
175	4,232.40	Former right-bank monument (PVC pipe cemented into ground)
e735	4,254.57	Right-bank monument is a white disk attached to railroad tie on north side of railroad track. Latitude: 39°33'48.46"; Longitude: 119°29'04.27".

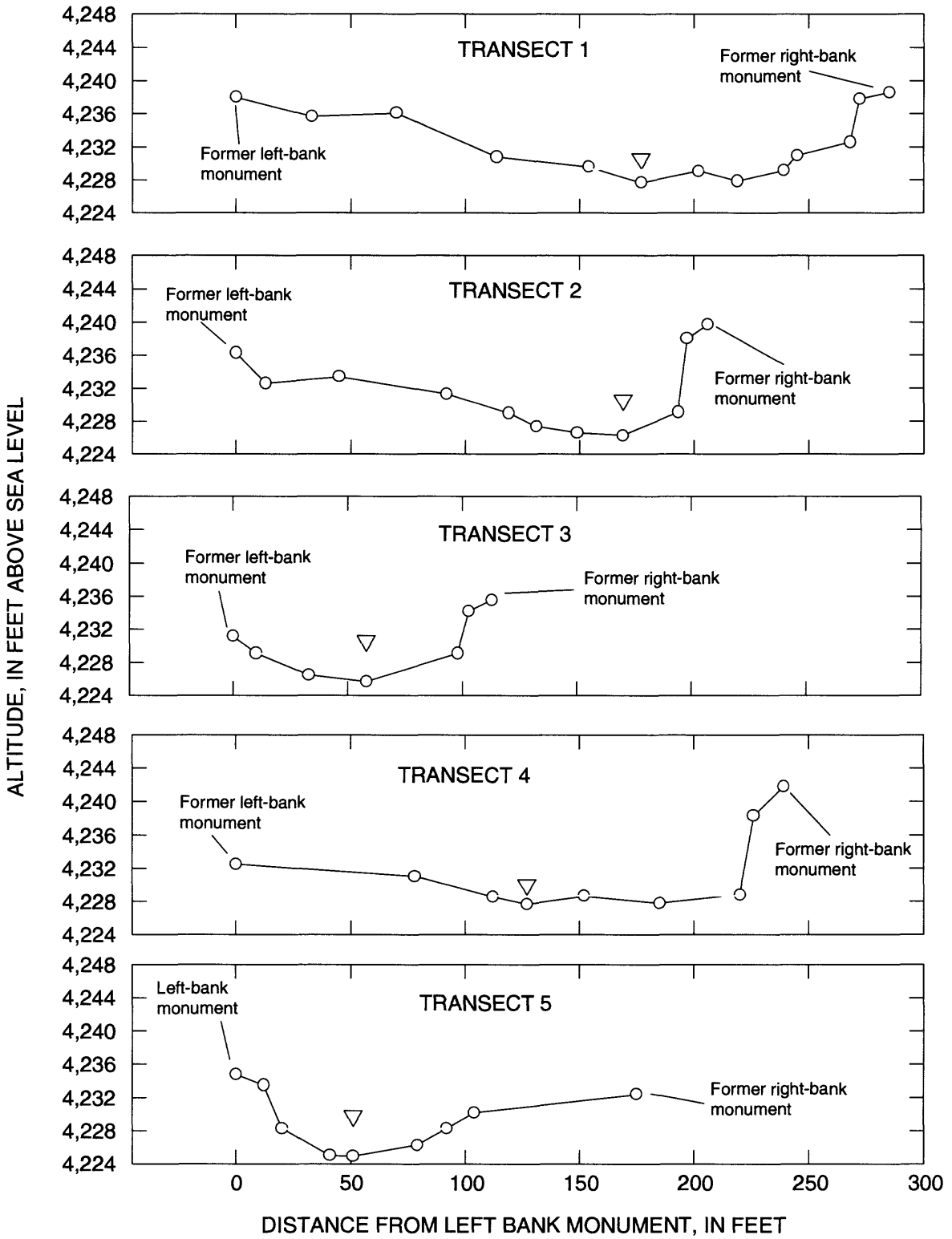


Figure 49. Cross sections showing land-surface (○) and water-surface (▽) altitudes for selected transects in reach C, Truckee River at Clark, Nev., October 1993.

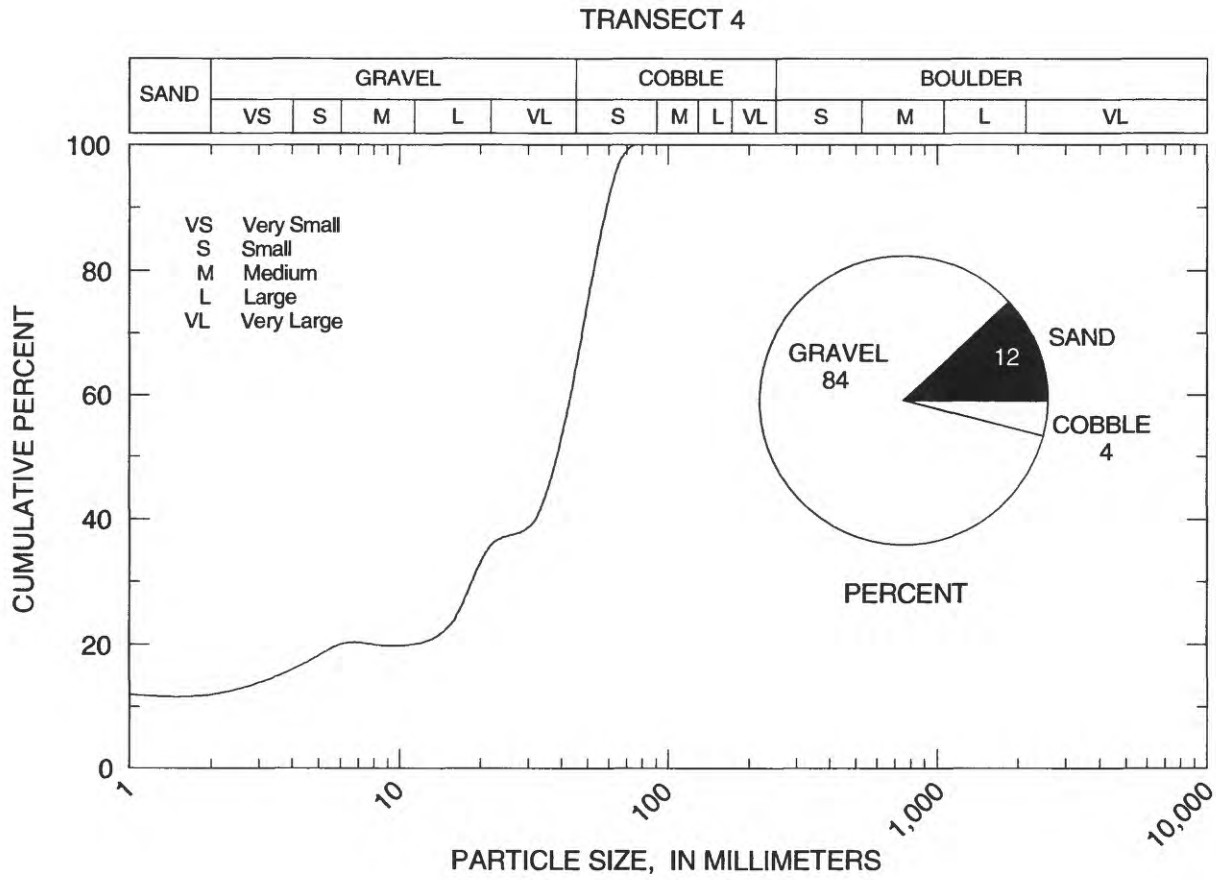


Figure 50. Particle-size distribution for coarse streambed substrate at transect 4 in reach C, Truckee River at Clark, Nev., September 1994

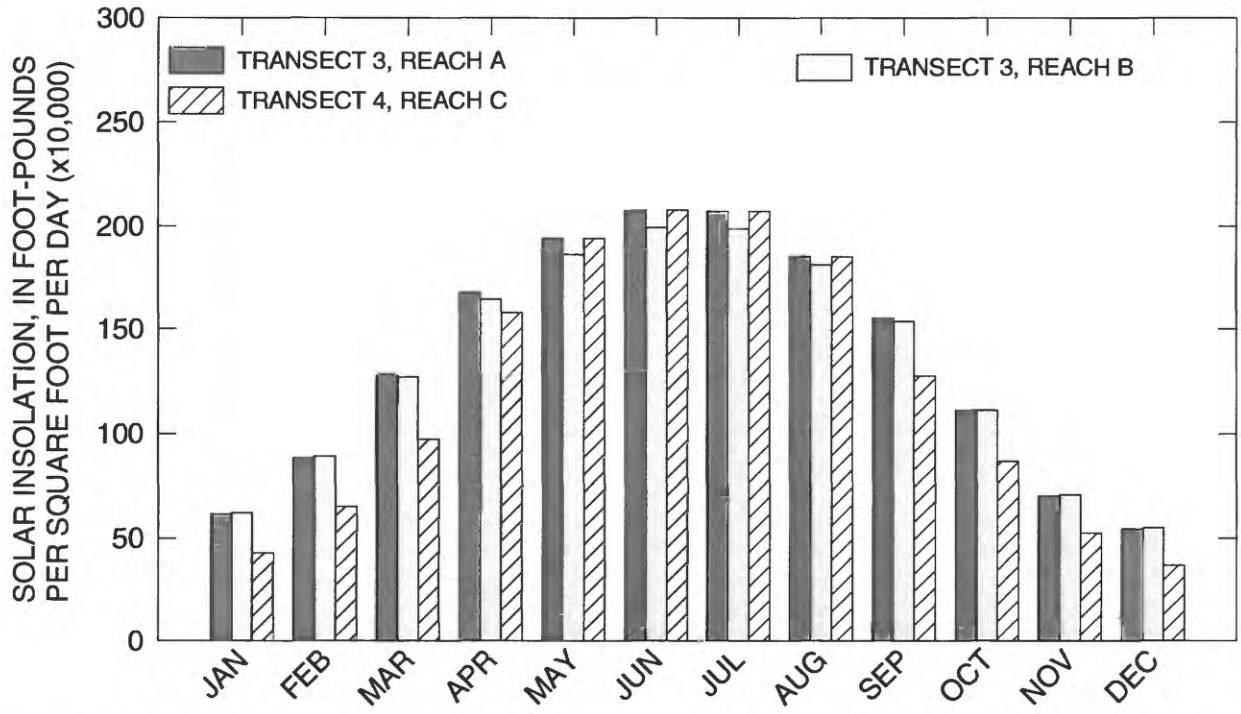
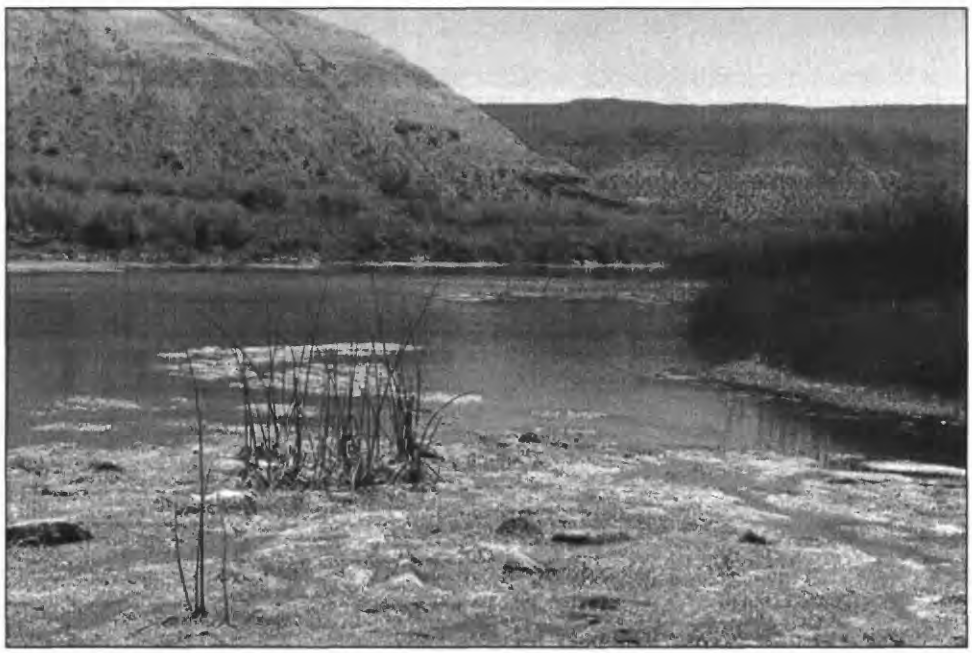


Figure 51. Monthly solar insolation midstream at selected transects in reaches A-C, Truckee River at Clark, Nev.

Truckee River at Dead Ox Wash near Nixon, Nev. (U.S. Geological Survey Station 10351690)



Upstream view of Truckee River from transect 1, reach A, Truckee River at Dead Ox Wash near Nixon, Nev. Photograph by Sonya Vasquez, U.S. Geological Survey, September 1995.

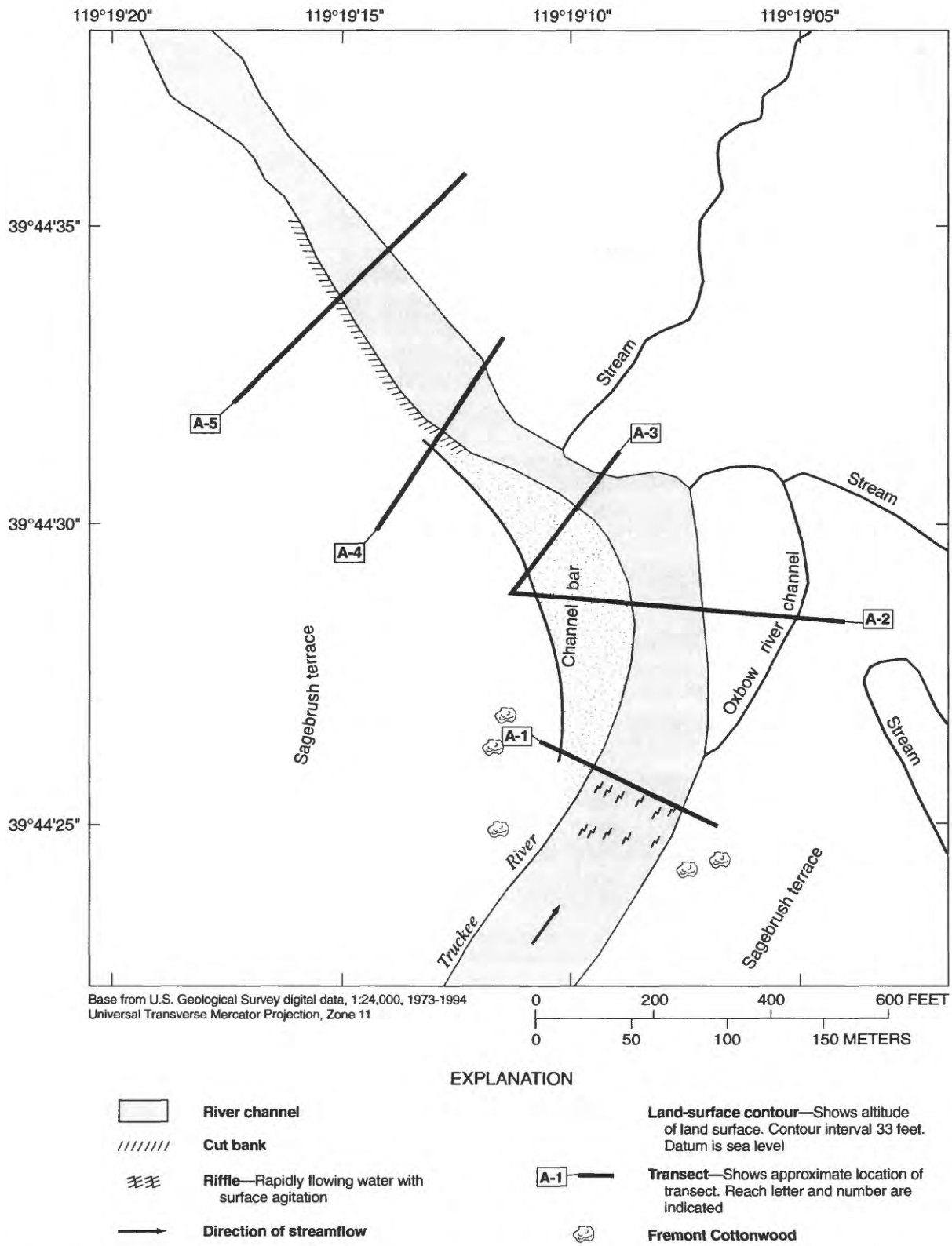


Figure 52. Location of transects in reach A, Truckee River at Dead Ox Wash near Nixon, Nev., with some landscape features approximately located, October 1994.

Table 38. Streambank features for selected transects in reach A, Truckee River at Dead Ox Wash, Nev., October 1994

[**Shape**: CC, concave up; CV, convex up; LN, linear.
Erosion: CB, cut-bank scallop; SL, slab failure.
Substrate: CO, cobble; GV, gravel; SA, sand; SI, silt.]

Stream-bank	Angle (degrees)	Height (feet)	Width (feet)	Surface cover (percent)	Shape	Erosion	Substrate		Habitat features
							Dominant	Subdominant	
				Transect 1					
Left	2.5	7	121	greater than 80	LN	None	CO	GV	None
Right	3.7	11	87	greater than 80	CV	CB	SI	SA	None
				Transect 2					
Left	3.4	8	95	greater than 80	CV	None	CO	GV	None
Right	15.8	11	16	25 to 49	CC	SL,CB	SI	CO	None
				Transect 3					
Left	6.1	6.2	26	greater than 80	CV	None	GV	CO	None
Right	8.7	13.0	7	50 to 79	CC	CB,SL	SI	GV	None
				Transect 4					
Left	6.1	11.6	64	Less than 24	LN	None	SA	CO	None
Right	5.8	11.6	81	50 to 79	CV	SL,CB	SI	CO	None
				Transect 5					
Left	8.5	11.8	10	25 to 49	LN	SL,CB	SA	SI	None
Right	4.7	6.6	16	greater than 80	CV	None	SA	CO	None

Table 39. Cross-section measurements and description of stream channel along selected transects in reach A, Truckee River at Dead Ox Wash above Nixon, Nev., October 1994

[Latitude and longitude were measured using a Global Positioning Satellite system. Altitudes were measured using a surveyors level and rod from National Geodetic Survey Benchmark V21. Cross-section measurements are plotted in figure 54. Abbreviation: PVC, polyvinyl-chloride]

Distance from left bank monument (feet)	Altitude (feet above sea level)	Description
		Transect 1
0	3,926.50	Left-bank monument is a 2-inch PVC pipe topped with a brass cap and cemented into ground. This monument was set in 1994. Latitude: 39°44' 26.38"; Longitude: 119°19' 10.69".
35	3,921.97	Left bank terrace
69	3,924.57	Left bank terrace
95	3,923.46	Left bank
126	3,920.15	Left bank
156	3,919.17	Left bank
169	3,918.35	Left bank
176	3,918.05	Left bank
198	3,917.65	Left edge of water
213	3,917.89	Channel Bar
227	3,917.72	Channel Bar
242	3,917.68	Right edge of water
259	3,918.12	Right bank
262	3,919.28	Right bank
264	3,919.61	Right bank
270	3,923.21	Right bank
279	3,925.66	Right bank
296	3,927.70	Top edge of right bank
322	3,928.57	Right-bank monument is a 4-inch PVC pipe topped with a brass plate and cemented into ground. Monument established in 1994. Latitude and longitude not recorded.

Table 39. Cross-section measurements and description of stream channel along selected transects in reach A, Truckee River at Dead Ox Wash above Nixon, Nev., October 1994—Continued

Distance from left bank monument (feet)	Altitude (feet above sea level)	Description
		Transect 2
0	3,931.84	Left-bank monument is a metal fence post driven into ground. This monument was set in 1994. Latitude: 39°44' 28.87"; Longitude: 119°19' 11.31". Altitude is top of fence post.
0	3,926.97	Ground surface at left-bank monument
50	3,926.91	Terrace
110	3,926.34	Terrace
139	3,920.60	Terrace
196	3,923.15	Small flood plain
257	3,919.41	Small flood plain
277	3,919.32	Left bank
283	3,918.11	Left bank channel bar
292	3,917.23	Left edge of water
307	3,916.43	Stream channel
321	3,915.45	Stream Channel
333	3,915.12	Thalweg
346	3,915.87	Stream channel
355	3,917.18	Right edge of water
359	3,919.00	Right bank
369	3,921.14	Right bank
372	3,926.13	Right-bank terrace
389	3,926.52	Right-bank monument was set in 1994 and is a metal fence post driven into the ground. Latitude and longitude not recorded.

Table 39. Cross-section measurements and description of stream channel along selected transects in reach A, Truckee River at Dead Ox Wash above Nixon, Nev., October 1994—Continued

Distance from left bank monument (feet)	Altitude (feet above sea level)	Description
		Transect 3
0	3,931.84	Left-bank monument was established in 1994 and is a metal fence post driven into the ground. Latitude: 39°44'28.87"; Longitude: 119°19'11.31". This monument is the same as the left-bank monument for transect 2. This measurement is the top of fence post.
0	3,926.97	Ground surface at left-bank monument
16	3,925.68	Dry oxbow channel
34	3,913.04	Dry oxbow channel
50	3,925.79	Dry oxbow channel
59	3,913.94	Dry oxbow channel
60	3,922.00	Dry oxbow channel
62	3,924.35	Dry oxbow channel
69	3,915.40	Dry oxbow channel
78	3,913.19	Dry oxbow channel
78	3,917.06	Dry oxbow channel
88	3,920.45	Dry oxbow channel
101	3,923.14	Left-bank terrace
111	3,922.17	Flood plain
181	3,919.10	Flood plain
203	3,919.72	Flood plain
240	3,919.41	Left bank
268	3,915.39	Stream channel (Left edge of water was not recorded)
291	3,913.54	Thalweg
309	3,914.38	Stream channel
325	3,915.69	Stream channel
346	3,915.77	Right edge of water
375	3,916.97	Right bank
382	3,919.29	Right bank
390	3,922.78	Right bank
391	3,926.55	Right bank
407	3,927.88	Right-bank monument was established in 1994 and is a metal fence post driven into ground. Latitude and longitude not recorded.

Table 39. Cross-section measurements and description of stream channel along selected transects in reach A, Truckee River at Dead Ox Wash above Nixon, Nev., October 1994—Continued

Distance from left bank monument (feet)	Altitude (feet above sea level)	Description
		Transect 4
0	3,935.12	Left-bank monument was established in 1994 and is a metal fence post driven into ground. Latitude: 39°44'29.91"; Longitude: 119°19'14.26".
0	3,930.54	Ground surface at left-bank monument
66	3,922.77	Dry oxbow channel
116	3,925.44	Flood plain
176	3,924.63	Top of left bank
192	3,920.03	Left bank
201	3,917.01	Left edge of water
211	3,915.44	Stream channel
235	3,916.02	Stream channel
244	3,914.55	Stream channel
250	3,913.81	Thalweg
259	3,914.15	Stream channel
270	3,914.49	Stream channel
280	3,915.25	Stream channel
288	3,917.00	Right edge of water
293	3,918.15	Right bank
301	3,919.24	Top of right bank, start of small flood plain
336	3,918.50	Small flood plain
350	3,921.87	Hill slope
376	3,925.45	Hill slope
406	3,931.51	Hill slope
439	3,933.82	Right-bank monument was established in 1994 and is a metal fence post driven into the ground. Latitude and longitude not recorded.

Table 39. Cross-section measurements and description of stream channel along selected transects in reach A, Truckee River at Dead Ox Wash above Nixon, Nev., October 1994—Continued

Distance from left bank monument (feet)	Altitude (feet above sea level)	Description
		Transect 5
0	3,932.63	Left-bank monument was established in 1994 and is a 2-inch PVC pipe topped with a hardware washer and cemented into the ground. Latitude: 39°44'32.05"; longitude: 119°19'17.37".
109	3,927.67	Hill slope
155	3,922.88	Flood plain
179	3,923.87	Upper edge of left bank
187	3,926.72	Stream channel (left edge of water was not recorded)
194	3,916.26	Stream channel
200	3,916.02	Stream channel
209	3,916.51	Stream channel
219	3,916.31	Stream channel
232	3,916.64	Stream channel
242	3,916.08	Stream channel
248	3,915.52	Thalweg
255	3,914.94	Stream channel
263	3,915.68	Right edge of water
274	3,916.91	Right bank
304	3,921.54	Upper edge of right bank
333	3,921.64	Flood plain
360	3,923.18	Flood plain
383	3,921.58	Flood plain
395	3,923.86	Hill slope
424	3,927.07	Hill slope
454	3,929.25	Hill slope
478	3,940.89	Hill slope
485	3,945.07	Right-bank monument was established in 1994 and is a 4-inch PVC pipe topped with a brass plate driven partway into the ground and held by a cairn. Latitude and longitude not recorded.

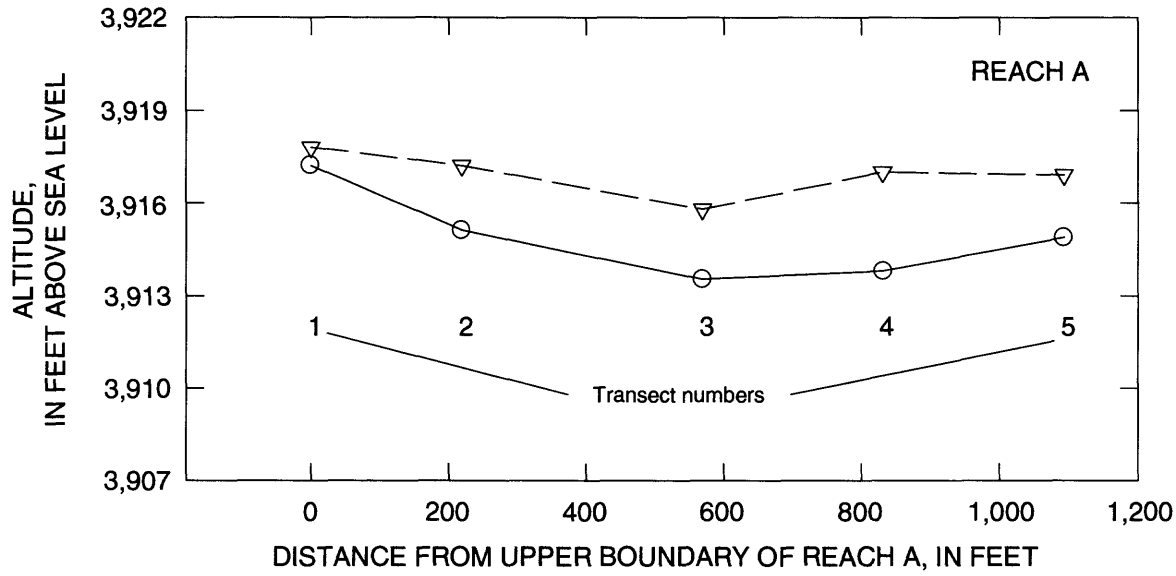


Figure 53. Longitudinal profiles of streambed (○) and water-surface (▽) altitudes measured along the thalweg in reach A, Truckee River at Dead Ox Wash near Nixon, Nev., October 1994.

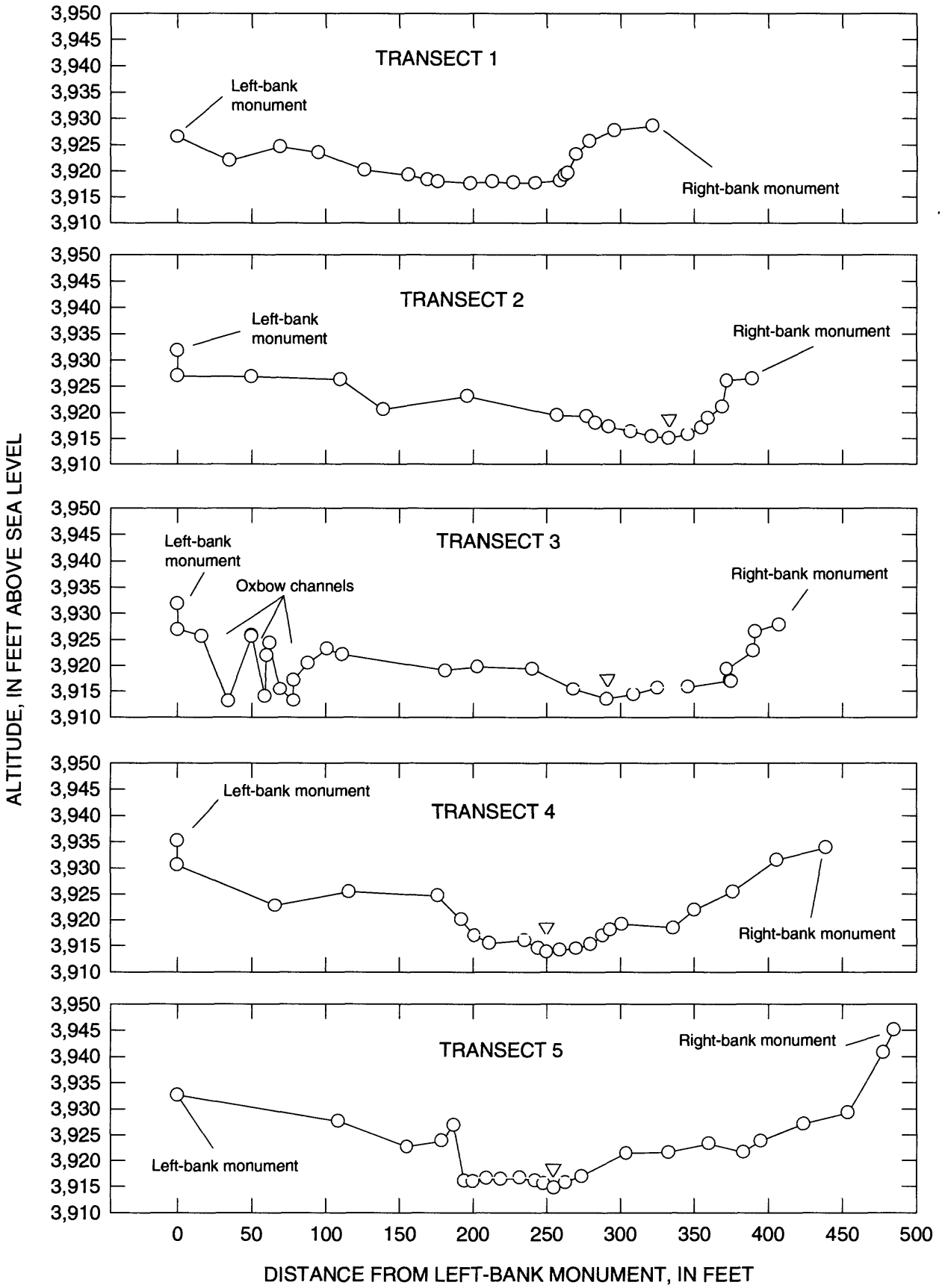


Figure 54. Cross sections showing land-surface (○) and water-surface (▽) altitudes for selected transects in reach A, Truckee River at Dead Ox Wash near Nixon, Nev., October 1994.

Table 40. Locations and altitudes of monuments for transects not included in Truckee River Basin cross-sectional surveys

[Latitude and longitude were measured using a Global Positioning Satellite system. Altitudes are in feet above sea level and were measured using a surveyors level and rod from National Geodetic Survey benchmark G837 on bridge 25-10. Cross-section measurements were not made at these transects. Abbreviation: PVC, polyvinyl-chloride]

Transect	Left bank			Right bank			Description
	Latitude	Longitude	Altitude	Latitude	Longitude	Altitude	
				Upper Truckee River at South Lake Tahoe, Calif.			
Reach A							
2	38°55'16.07"	119°59'10.15"	6,236.65	38°55'16.77"	119°59'09.20"	6,238.68	Left bank monuments are 4-inch PVC pipe cemented into ground of flood plain meadow and topped with a 4-inch white disk inscribed with BOUNDARY MARKER USGS NAWQA XSEC. Right bank monuments are 2.5-inch PVC pipe cemented into ground and topped with 2.5-inch hardware washer.
3	38°55'17.46"	119°59'12.14"	6,236.81	38°55'18.11"	119°59'11.36"	6,237.08	
4	38°55'18.11"	119°59'13.17"	6,236.68	38°55'18.49"	119°59'13.14"	6,238.08	

Miscellaneous Truckee River Sites

Truckee River at Circle C Ranch near Lawton, Nev. (10347690), August 1994

Truckee River at Idlewild Park at Reno, Nev. (10347705), August 1994

Truckee River at Lockwood, Nev. (10350050), August 1994

Truckee River at Wadsworth, Nev. (10351650), October 1995

Truckee River at Highway 447 near Nixon, Nev. (10351750), October 1995

Table 41. Streambank features for miscellaneous sites on Truckee River, August 1994

[**Shape**; CC, concave up; CV, convex up; LN, linear.
Erosion: CB, cut-bank scallop.
Substrate: BO, boulder; CO, cobble; SA, sand; SI, silt.]

Stream-bank	Angle (degrees)	Height (feet)	Width (feet)	Surface cover (percent)	Shape	Erosion	Substrate		Habitat features
							Dominant	Subdominant	
10347690 Truckee River at Mayberry Drive below Lawton, Nev.									
Left	2.0	6	20	greater than 80	CV	CB	SA	SI	None
Right	3.5	7	15	50 to 79	CV	CB	SA	SI	None
10347705 Truckee River at Idlewild Park, at Reno, Nev.									
Left	5.4	7.5	25	greater than 80	CC	CB	SA	BO	None
Right	2.0	3	10	25 to 50	CV	CB	SA	BO	None
10350050 Truckee River at Lockwood, Nev.									
Left	6.8	11	10	50 to 79	CC	None	SA	CO	None
Right	7.1	10	18	greater than 80	LN	None	SA	CO	None

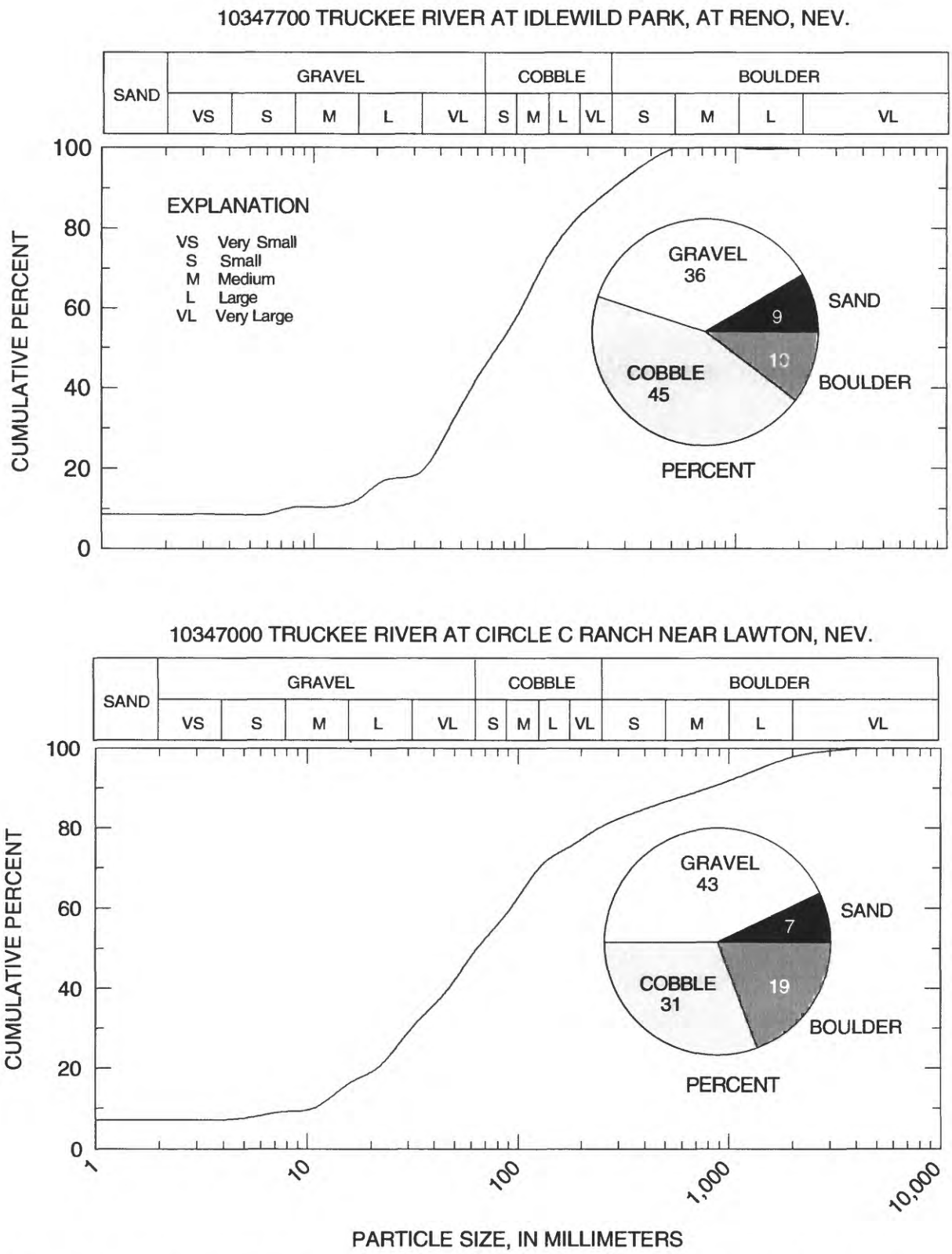


Figure 55. Particle-size distribution of coarse streambed substrate, Truckee River at Circle C Ranch near Lawton, Nev.; at Idlewild Park at Reno, Nev.; and at Lockwood, Nev., August 1994.

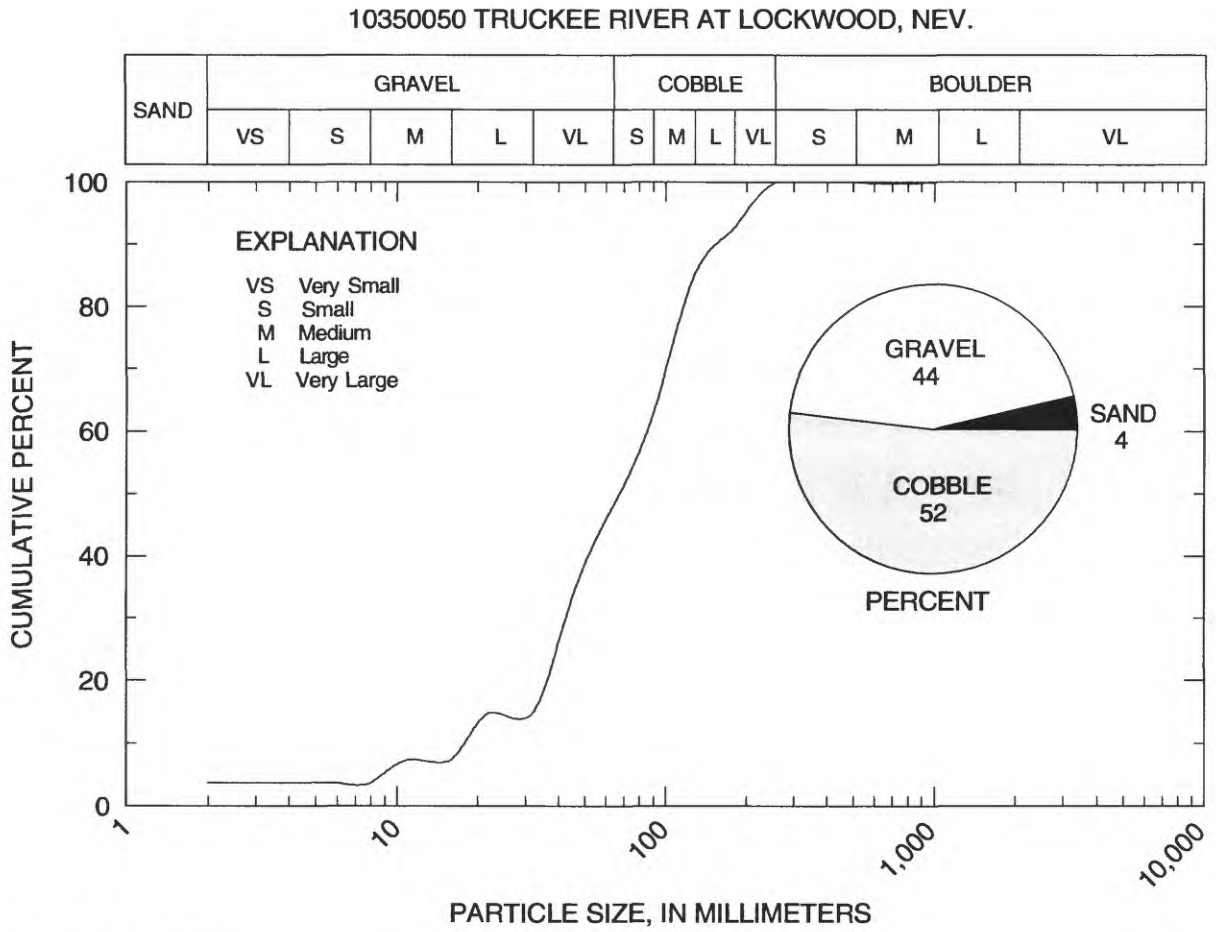


Figure 55. Continued.

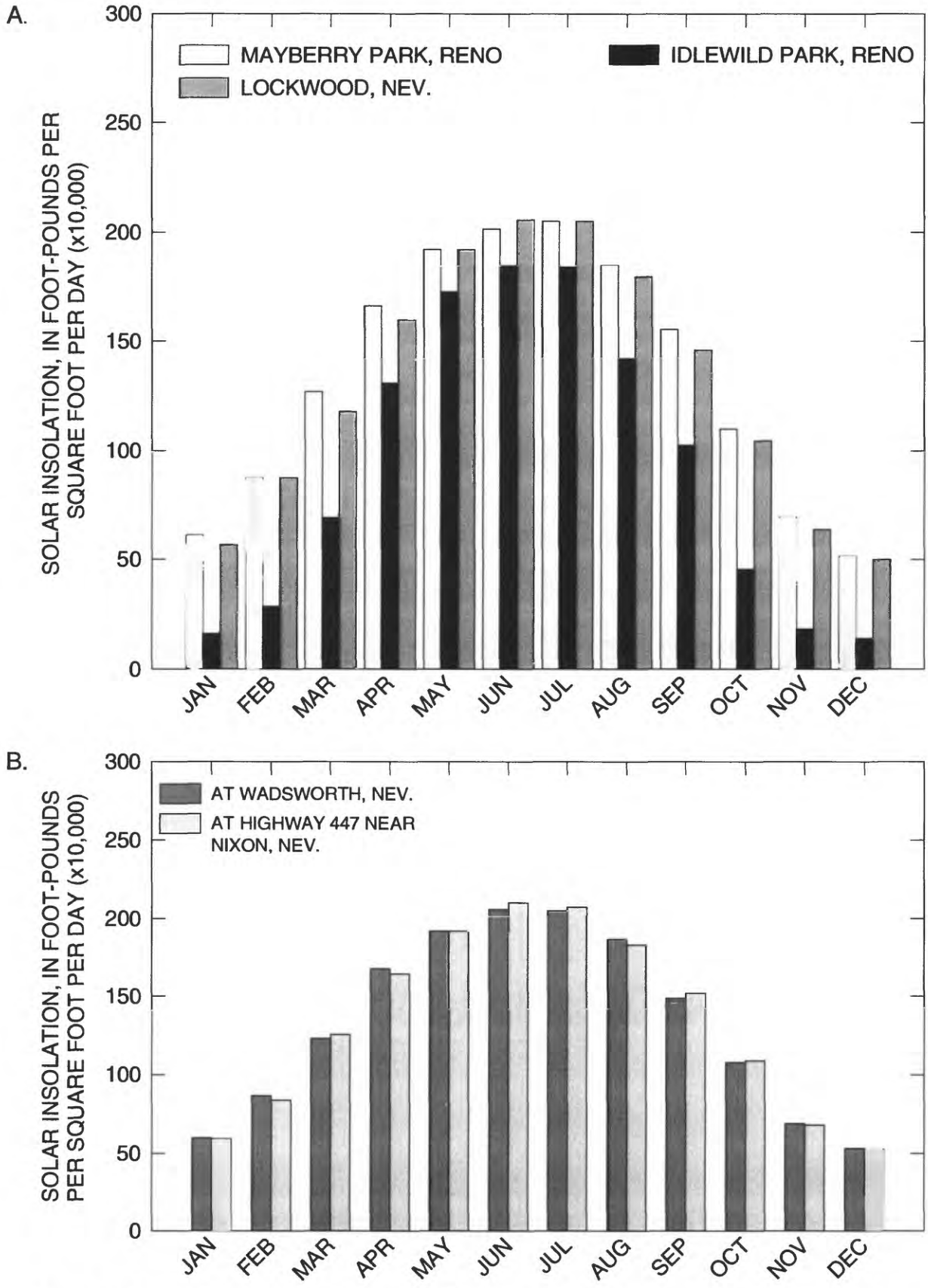


Figure 56. Monthly solar insolation midstream *(A)* Truckee River at Circle C Ranch near Lawton, Nev., at Idlewild Park at Reno, Nev., and at Lockwood, Nev.; and *(B)* Truckee River at Wadsworth, Nev., and Highway 447 near Nixon, Nev.

GLOSSARY

[all definitions from Meador and others (1993) except where noted]

Basin Relief. The difference between the highest altitude, in feet above sea level, in a basin and the lowest altitude in the basin. In this report, the lowest altitude is the altitude at a station.

Basin Shape. Calculated by measuring the length of the basin, in miles, squaring it, and dividing by the basin (drainage) area, in square miles.

Canopy Angle. The angle between the tallest structures on the left and right banks when measured from mid-channel to the visible horizon. Calculated by adding the angles to the tallest structure (tree, mountain) on the left and right banks, then subtracting that sum from 180°. Angles are measured with a clinometer at midchannel.

Canopy Density. Amount per unit area of stream overstory vegetation (leaf, branch, trunk)

Cross Section. A graphic representation of a section formed by a plane cutting through a stream channel, perpendicular to the channel axis (Soukhanov and Ellis, 1984).

Downstream Altitude. Altitude, in feet above sea level, at the downstream boundary of a river segment. Altitudes were taken from Brown and others (1986).

Downstream Link. A method of stream ordering proposed by Shreve (1967). It represents the cumulative number of tributaries upstream from a specific site in a river.

Drainage Area. The land area, in square miles, bounded by topographic divides where all surface water drains to a common outlet (Dunne and Leopold, 1978). In this report the common outlet is the river at a specified station. The drainage area provides a definitive and measurable unit for describing the environmental setting that influences a specific river site.

Drainage Density. Cumulative length, in miles, of all perennial streams and canals divided by the drainage area, in square miles.

Geomorphic Channel Units. River features such as pools, riffles, glides, and runs.

Habitat Features. Any material that provides shelter for aquatic organisms to hide, feed, or rest. These features include aquatic macrophyte beds, boulders, woody debris, snags, or undercut banks.

Monument. A permanent or semi-permanent structure marking the ends of a stream-measurement transect.

Pool. A part of a river or stream with deeper water than surrounding parts of the river and reduced water velocity.

Riffle. A part of a river or stream where water flows rapidly over submerged or partially submerged obstructions producing surface agitation or "whitewater".

River Segment. A definitive unit for describing homogeneous lengths of river. A segment is bounded by tributary junctions or physical discontinuities such as waterfalls, dams, and surface-water drains.

River Reach. A length of river within a segment where geomorphic channel units are representative of the segment. The principal area where physical and geomorphic measurements were made.

Run. A part of a river or stream where water flows rapidly without surface agitation or "whitewater." A run is deeper with slower current than a riffle, but shallower with faster current than a pool.

Segment Gradient. A measure of the steepness of a river segment. Calculated as the difference in altitude between the upper segment boundary and the lower segment boundary, divided by the linear distance between the two boundaries.

Side-Slope Gradient. Steepness of the valley sides in the segment; the difference in altitude of the river channel and the highest altitude within 1,000 feet of the channel divided by the horizontal distance between the two points. Calculated as the average of three measurements at right angles to the stream channel.

Sinuosity. A measure of the amount of river meandering within a defined length of river. Calculated as the ratio of linear distance to river distance between the upper and lower segment boundaries.

Solar Insolation. The rate of solar radiation delivered to a horizontal surface of unit area (Soukhanov and Ellis, 1984).

Streambank. The part of the stream channel from the edge of water or channel bar to the beginning of a flood plain or the upper edge of riparian vegetation (see fig. 57).

Streambank Angle. The angle of inclination between the thalweg and the top of the streambank, in degrees from horizontal. Measured using a clinometer.

Streambank Height. The height of the bank as measured from the channel bottom at the thalweg to the top of the streambank.

Streambank Erosion. A subjective measure of the type of bank erosion. Types: cut-bank scalloping, slab failure, debris avalanche, or rotational failure (see fig. 58).

Streambank Shape. A subjective measure of the geometric shape of the streambank, either concave up, convex, or linear.

Streambank Substrate. The dominant and subdominant material in the streambank. Types include: boulder, cobble, gravel, sand, silt.

Streambank Surface Cover. Vegetation, boulders, or other material in or on a streambank that provides resistance to erosion. Estimated as a percent of total bank area.

Thalweg. The path along which the centroid of flow travels within a stream channel. Generally the deepest area in the channel.

Transect. An imaginary line dividing a stream channel perpendicular to the channel axis, bounded by monuments (Soukhanov and Ellis, 1984). Marks the area where physical and geomorphic measurements were made within a reach.

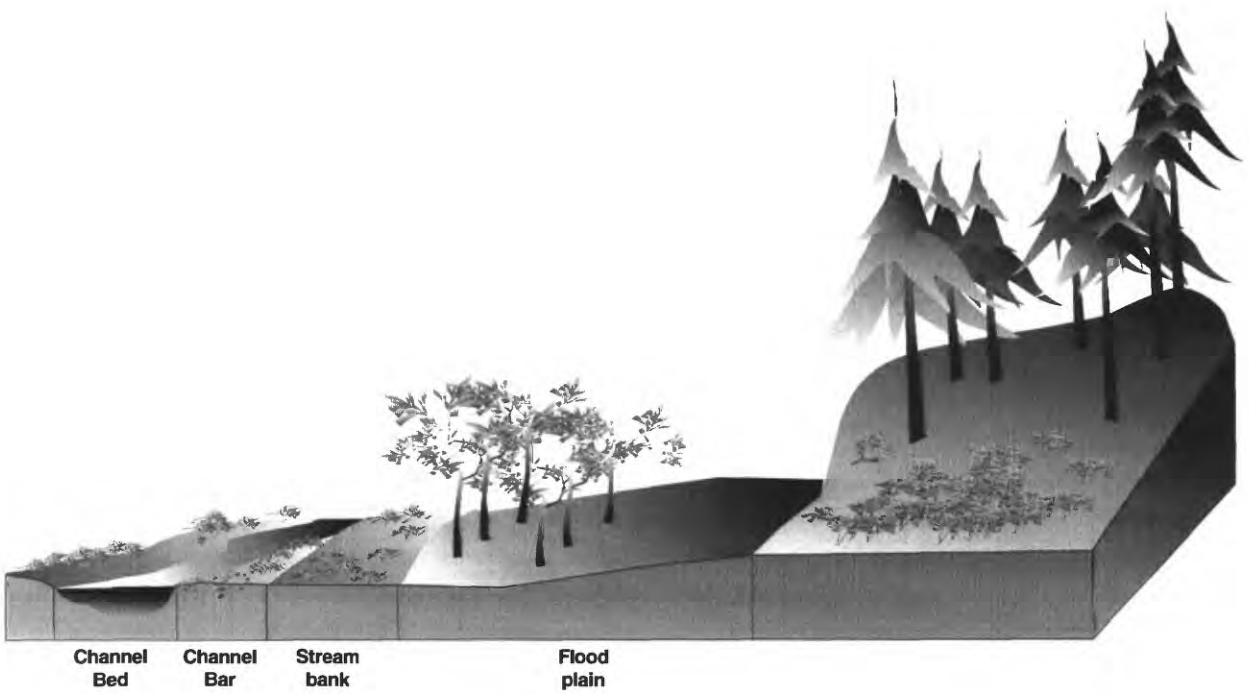


Figure 57. Idealized river cross sections showing the parts of a river or stream channel (modified from Hupp, 1986).

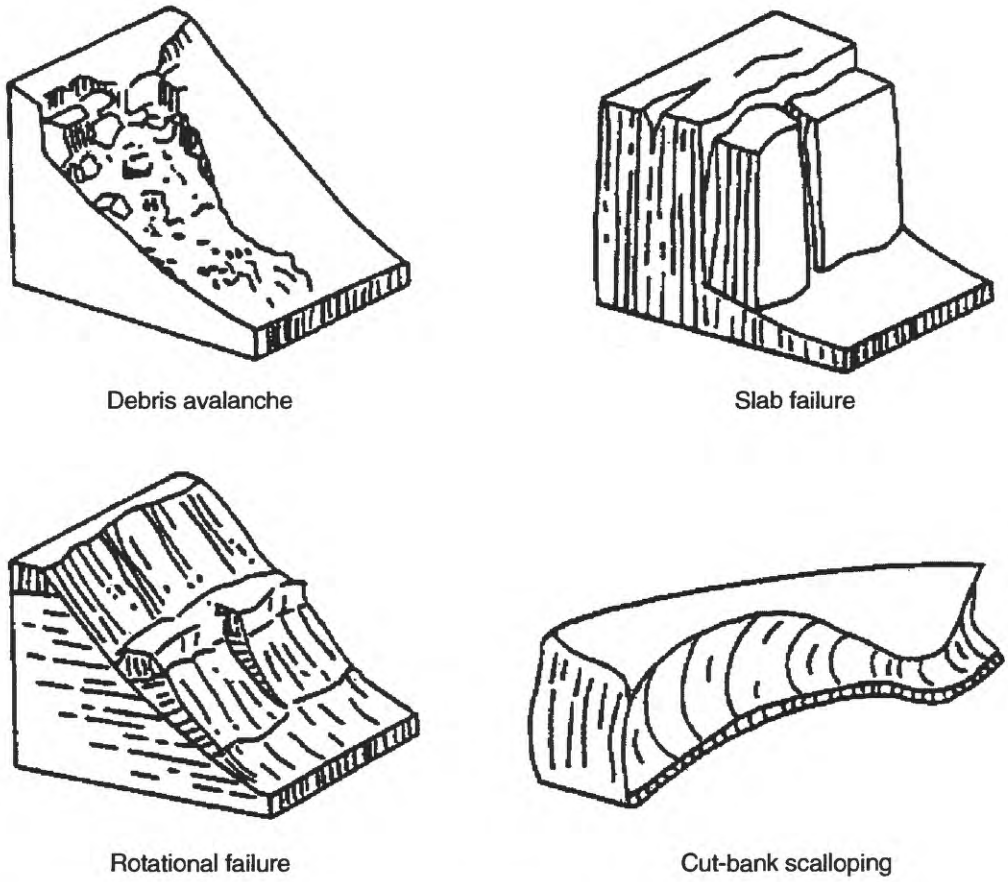


Figure 58. Examples of streambank erosion identified in the Carson and Truckee River Basins (from Leopold and others, 1964).