

Roughness Characteristics of Natural Channels

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*Color photographs and descriptive
data for 50 stream channels for
which roughness coefficients have
been determined*



$n = 0.030$

14-1057. Columbia River at The Dalles, Oreg.

Gage location.—Lat $45^{\circ}36'10''$, long $121^{\circ}10'40''$, in NW $\frac{1}{4}$ sec. 3, T. 1 N., R. 13 E., at upstream end of Port of The Dalles dock at The Dalles, 3.2 miles downstream from The Dalles Dam and at mile 189.3. Section 4 is at cableway 9 miles upstream from gage.

Drainage area.—237,000 sq mi, approximately.

Date of flood.—May 31, 1948.

Gage height.—154.56 ft at gage; 171.44 ft at section 1.

Peak discharge.—1,000,000 cfs.

Computed roughness coefficient.—Manning $n = 0.030$.

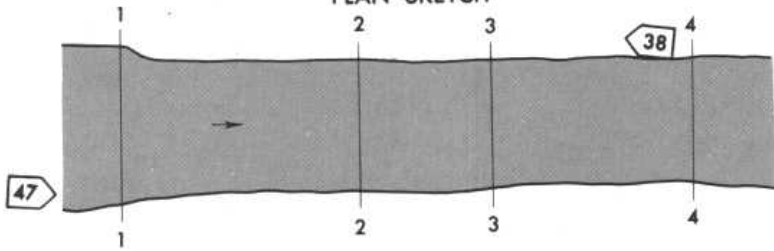
Description of channel.—Left bank consists of sand, gravel, and boulders, and has light cover of brush in some places. Right bank is formed by severely scalloped basalt cliffs. The bed material is fairly well graded from 18-inch boulders along the left bank down to sand at the base of the right bank.

Reach properties

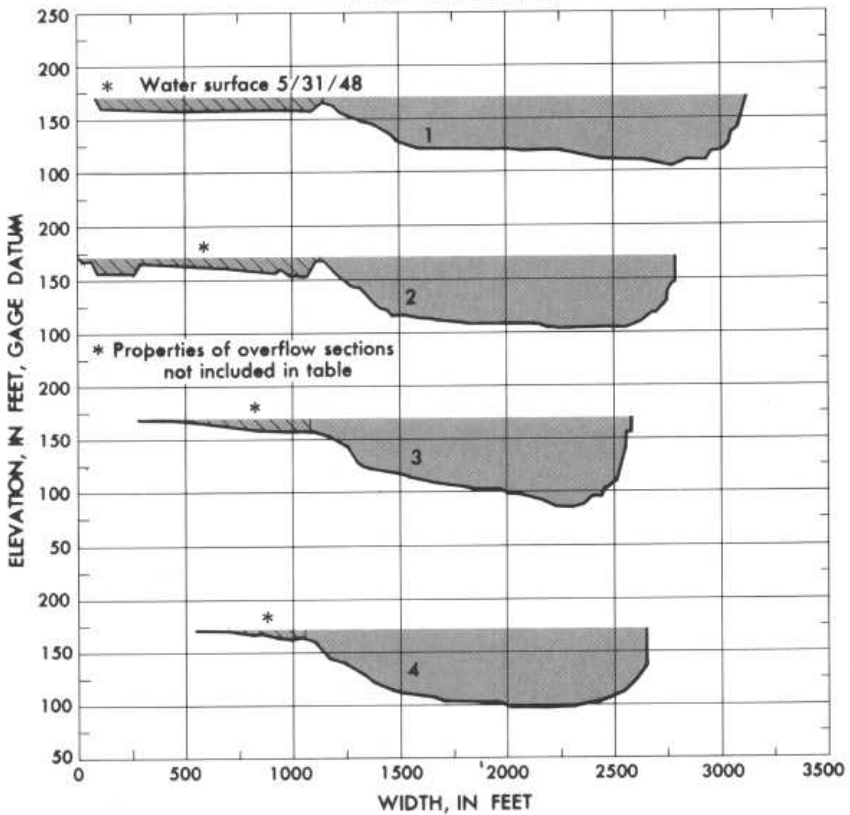
Section	Area (sq ft)	Top width (ft)	Mean depth (ft)	Hydraulic radius (ft)	Mean velocity (ft per sec)	Length (ft) between sections	Fall (ft) between sections
1.....	94,650	1,980	47.80	47.28	10.57	.....	.....
2.....	90,810	1,640	55.37	54.10	11.01	2,003	0.50
3.....	89,040	1,485	59.96	57.80	11.23	778	.20
4.....	91,890	1,600	57.43	55.81	10.88	1,394	.41

Notes.—

PLAN SKETCH



CROSS SECTIONS



Plan sketch and cross sections, Columbia River at
The Dalles, Oreg.

$n = 0.030$



No. 47 downstream along right bank from above section 1,
Columbia River at The Dalles, Oreg.



No. 38 upstream along left bank from section 4,
Columbia River at The Dalles, Oreg.

$n = 0.030$

1-3625. Esopus Creek at Coldbrook, N.Y.

Gage location.—Lat 42°00'45", long 76°16'10", on left bank at downstream side of highway bridge at Coldbrook, Ulster County, 1.5 miles upstream from Ashokan Reservoir and 2.5 miles south of Mount Tremper. Section 1 is about 400 ft upstream from Highway 28-A, which is about 6 miles southeast of gage.

Drainage area.—192 sq mi.

Date of flood.—Mar. 22, 1948.

Gage height.—12.39 ft at gage; 15.60 ft (different datum) at section 1.

Peak discharge.—13,900 cfs.

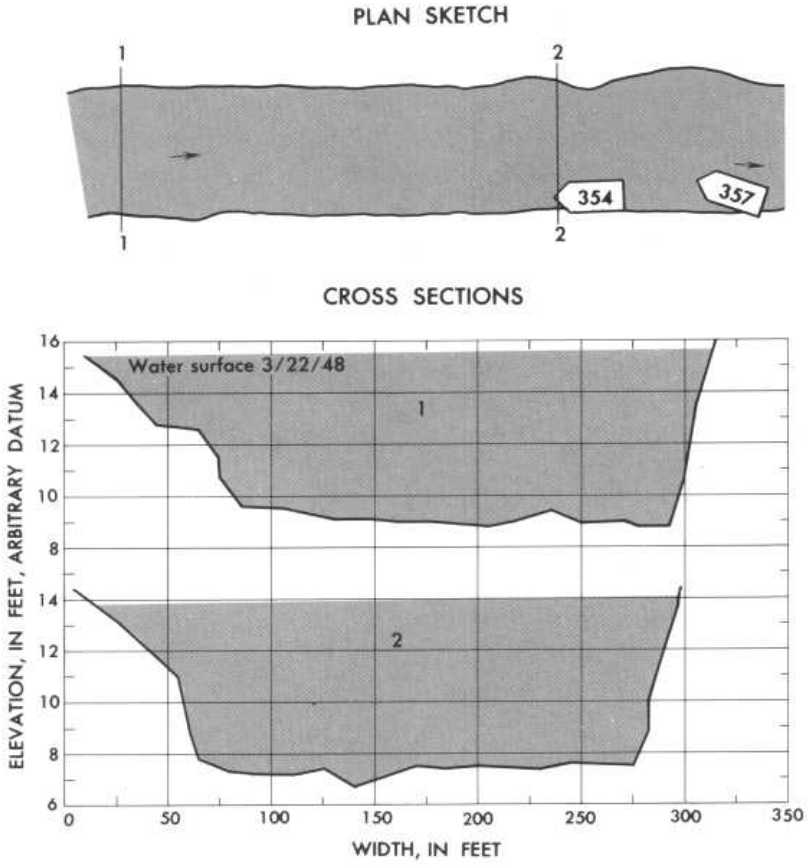
Computed roughness coefficient.—Manning $n = 0.030$.

Description of channel.—The bed is coarse gravel and both banks are lined with trees and brush.

Reach properties

Section	Area (sq ft)	Top width (ft)	Mean depth (ft)	Hydraulic radius (ft)	Mean velocity (ft per sec)	Length (ft) between sections	Fall (ft) between sections
1.	1,600	301	5.3	5.28	8.70	.....	.....
2.	1,589	284	5.6	5.54	8.77	471	1.60

Notes.—



Plan sketch and cross sections, Esopus Creek at Coldbrook, N.Y.



No. 354 upstream along left bank from section 2,
Esopus Creek at Coldbrook, N.Y.



No. 357 upstream from right end of bridge below reach,
Esopus Creek at Coldbrook, N.Y. (at Highway 28-A).

$n = 0.030$

6-8030. Salt Creek at Roca, Nebr.

Gage location.—Lat $40^{\circ}39'33''$, long $96^{\circ}39'39''$, in SW $\frac{1}{4}$ sec. 17, T. 8 N., R. 7 E., on left bank 15 ft downstream from highway bridge at west edge of Roca. Section 1 is 75 ft downstream from gage.

Drainage area.—174 sq mi.

Date of flood.—May 2, 1954.

Gage height.—16.02 ft at gage; 15.94 ft at section 1.

Peak discharge.—1,860 cfs.

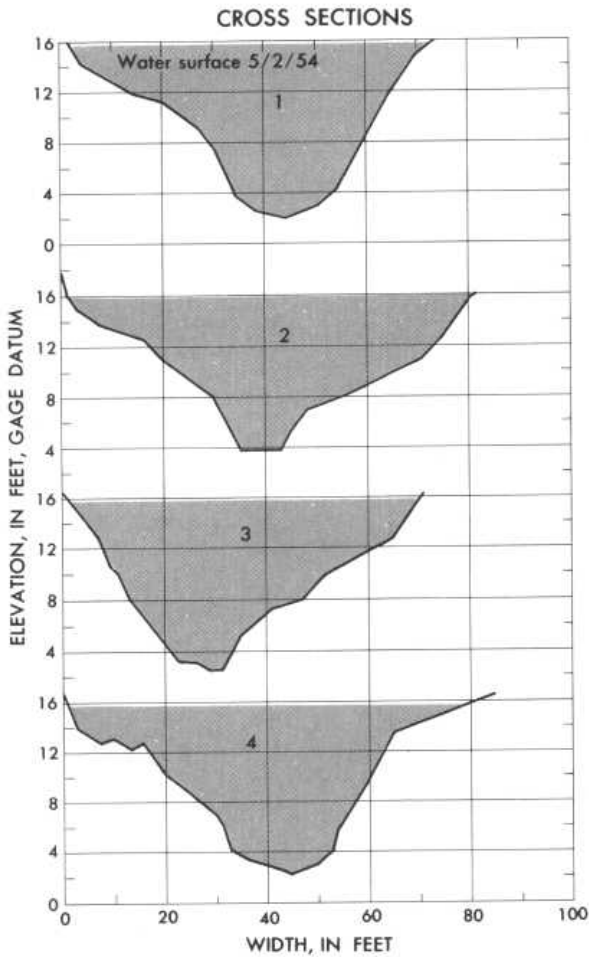
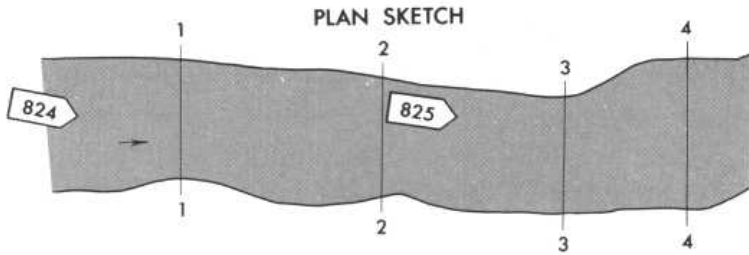
Computed roughness coefficient.—Manning $n = 0.030$.

Description of channel.—Bed consists of sand and clay. Banks are generally smooth and are free of vegetal growth during floods.

Reach properties

Section	Area (sq ft)	Top width (ft)	Mean depth (ft)	Hydraulic radius (ft)	Mean velocity (ft per sec)	Length (ft) between sections	Fall (ft) between sections
1.....	528	72	7.4	6.7	3.46	.....	.....
2.....	502	80	6.3	5.9	3.71	113	0.09
3.....	497	69	7.2	6.6	3.74	110	.06
4.....	497	78	6.4	5.9	3.74	134	.05

Notes.—



Plan sketch and cross sections, Salt Creek at Roca, Nebr.

$n = 0.030$



No. 824 downstream from above section 1,
Salt Creek at Roca, Nebr.



No. 825 downstream from below section 2,
Salt Creek at Roca, Nebr.

$n = 0.031$

12-3385. Blackfoot River near Ovando, Mont.

Gage location.—Lat $47^{\circ}01'10''$, long $113^{\circ}13'40''$, in SE $\frac{1}{4}$ NW $\frac{1}{4}$ sec. 34, T. 15 N., R. 13 W., on left bank 0.25 mile upstream from Monture Creek and 5 miles west of Ovando. Section 1 is about 0.25 mile upstream from gage.

Drainage area.—1,274 sq mi.

Date of flood.—May 22, 1948.

Gage height.—6.84 ft at gage; 16.34 ft at section 1.

Peak discharge.—8,200 cfs.

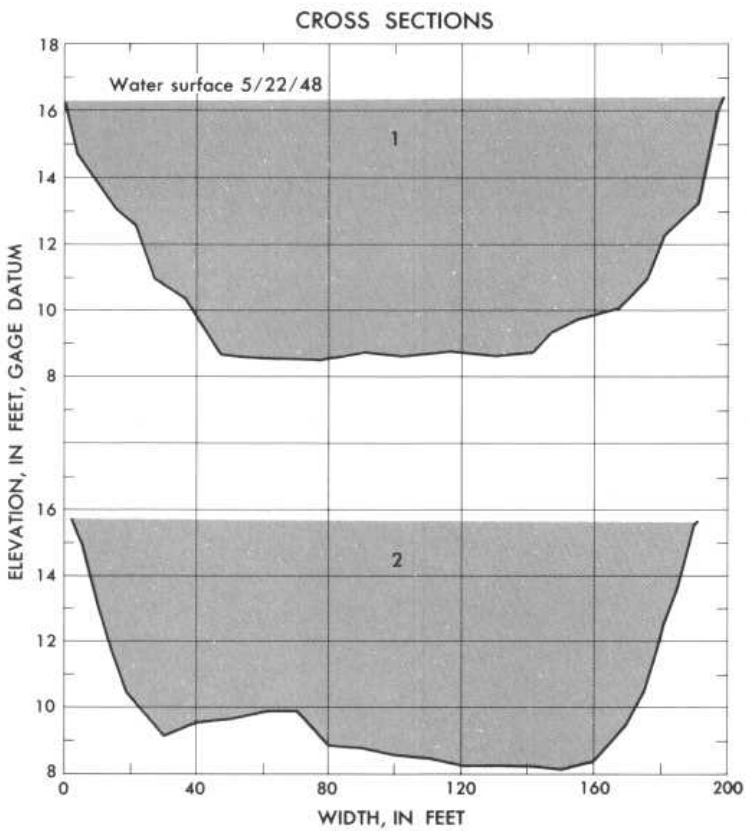
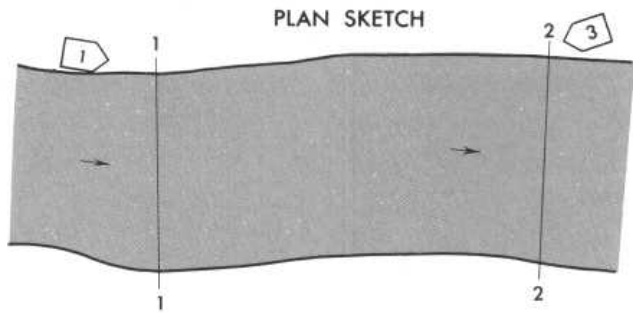
Computed roughness coefficient.—Manning $n = 0.031$.

Description of channel.—Bed is gravel and boulders; $d_{50} = 155$ mm, $d_{84} = 280$ mm. Banks consist of same material and are relatively free of vegetation.

Reach properties

Section	Area (sq ft)	Top width (ft)	Mean depth (ft)	Hydraulic radius (ft)	Mean velocity (ft per sec)	Length (ft) between sections	Fall (ft) between sections
1.....	1,230	199	6.18	6.12	6.67	.....	.....
2.....	1,140	189	6.03	5.97	7.19	292	0.68

Notes.—



Plan sketch and cross sections, Blackfoot River near Ovando, Mont.



No. 1 downstream from left bank above section 1,
Blackfoot River near Ovanda, Mont.



No. 3 upstream towards right bank from below section 2,
Blackfoot River near Ovanda, Mont.

$n = 0.032$

12-4120. Coeur d'Alene River near Prichard, Idaho

Gage location.—Lat $47^{\circ}38'05''$, long $115^{\circ}58'55''$, in lot 7, sec. 32, T. 50 N., R. 4 E., on right bank 0.2 mile downstream from Beaver Creek and 1.75 miles southwest of Prichard. Section 1 is 570 ft upstream from gage.

Drainage area.—583 sq mi.

Date of flood.—May 21, 1948.

Gage height.—9.24 ft at gage; 10.98 ft at section 1.

Peak discharge.—11,300 cfs.

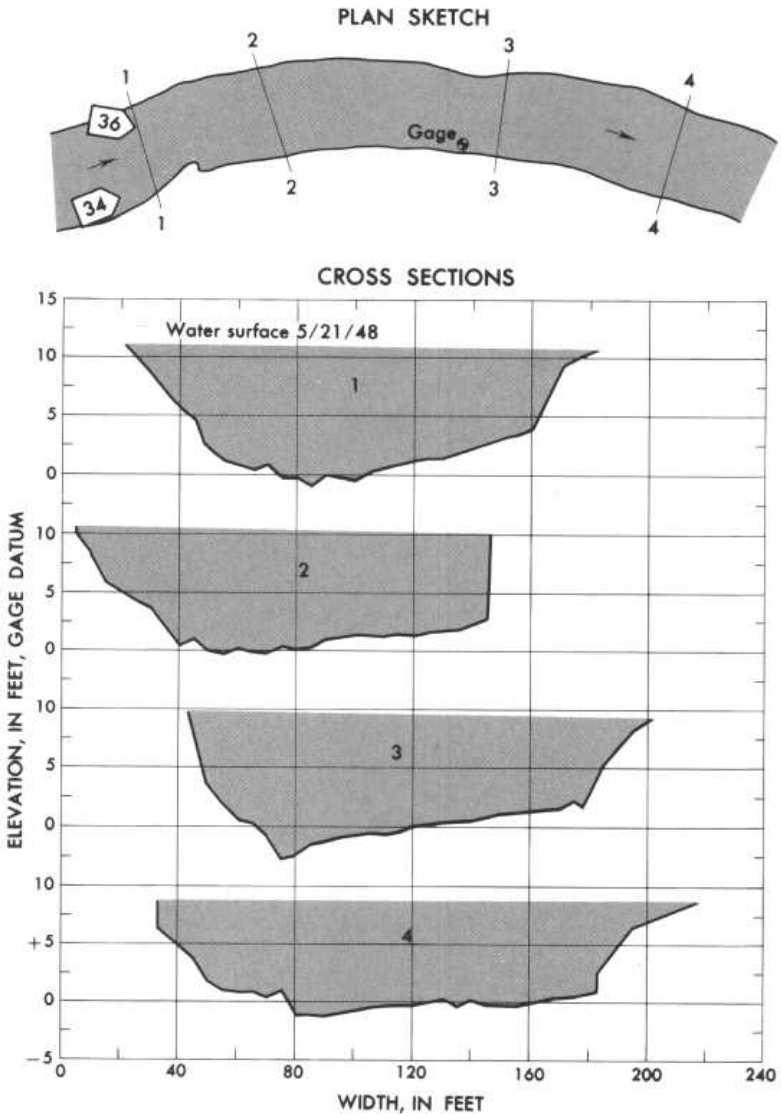
Computed roughness coefficient.—Manning $n = 0.032$.

Description of channel.—Bed is composed of rock along left edge, gravel and small boulders elsewhere; $d_{50} = 103$ mm, $d_{84} = 650$ mm. Left bank is irregular bedrock, steep and clean. Right bank consists of sand and gravel covered with heavy growth of brush and trees.

Reach properties

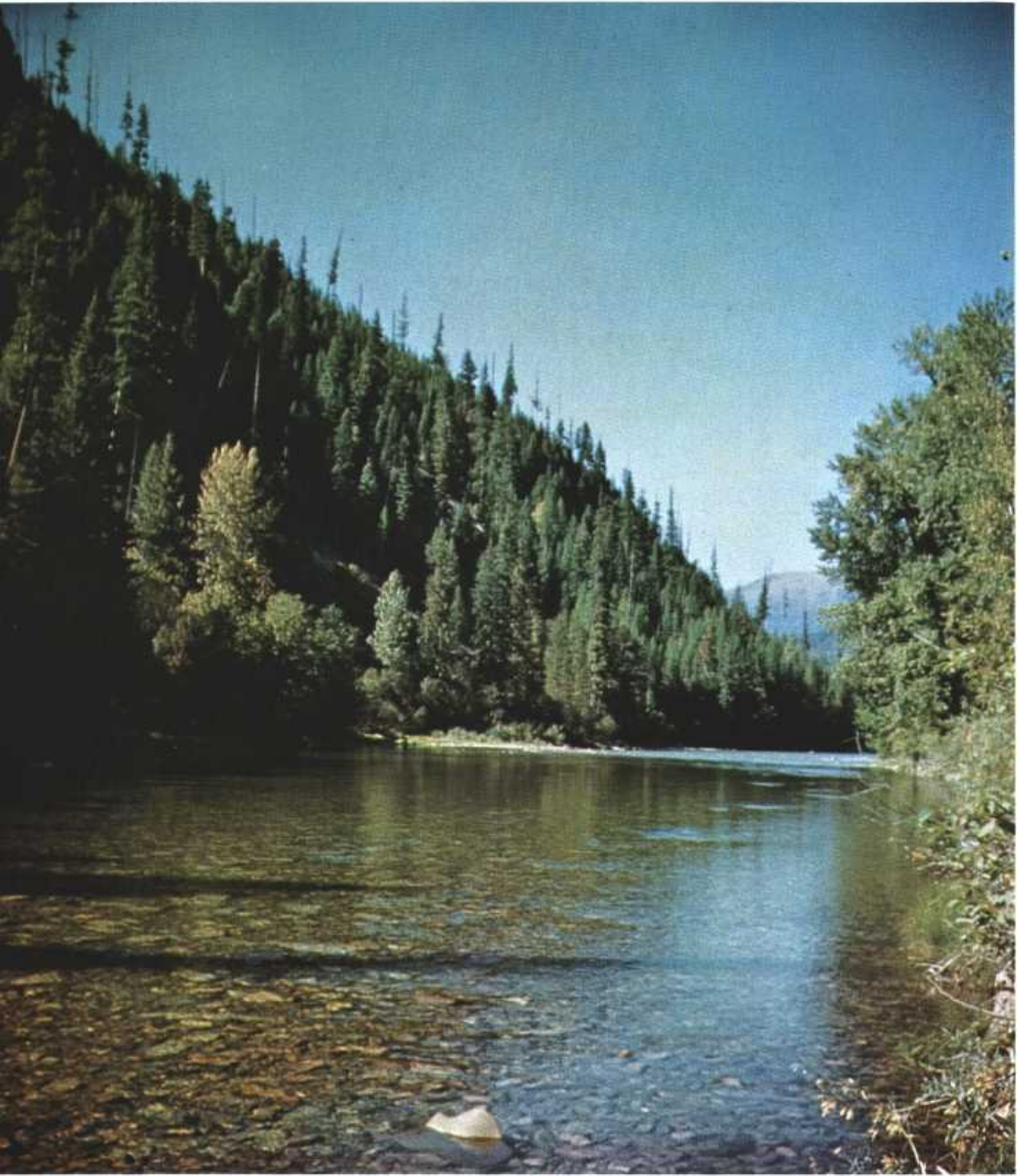
Section	Area (sq ft)	Top width (ft)	Mean depth (ft)	Hydraulic radius (ft)	Mean velocity (ft per sec)	Length (ft) between sections	Fall (ft) between sections
1.....	1,260	162	7.8	7.65	8.97	.....	.....
2.....	1,200	141	8.5	8.00	9.42	230	0.50
3.....	1,306	159	8.2	7.96	8.65	400	.88
4.....	1,312	185	7.1	6.87	8.61	302	.92

Notes.—



Plan sketch and cross sections, Coeur d'Alene River near Prichard, Idaho.

$n = 0.032$



No. 34 downstream through reach from right bank,
Coeur d'Alene River near Prichard, Idaho.



No. 36 downstream along right bank at section 1,
Coeur d'Alene River near Pritchard, Idaho.

$n = 0.032; 0.036$

8-2900. Rio Chama near Chamita, N. Mex.

Gage location.—Lat $36^{\circ}04'25''$, long $106^{\circ}06'39''$, in NE $\frac{1}{4}$ NE $\frac{1}{4}$ sec. 8, T. 21 N., R. 8 E., on left bank 200 ft downstream from bridge on U.S. Highway 285, 0.5 mile west of Chamita, 2.5 miles northwest of San Juan Pueblo, and 3 miles upstream from mouth. Section 1 is about 200 ft upstream from gage.

Drainage area.—3,140 sq mi.

Date of flood.—Mar. 24, 1950; Apr. 3, 1950.

Gage height.—3.41 ft, 2.95 ft at gage; 3.65 ft, 3.18 ft at section 1.

Peak discharge.—1,060 cfs; 684 cfs.

Computed roughness coefficient.—Manning $n = 0.032; 0.036$.

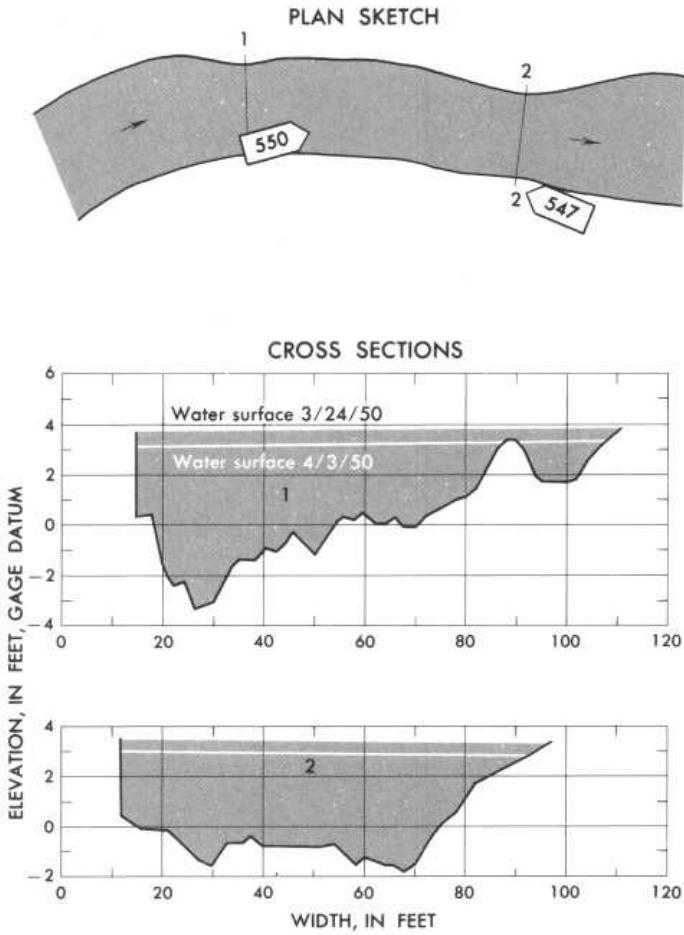
Description of channel.—The bed consists of sand and gravel.

The left bank is rock and the right bank is mostly gravel.

Reach properties

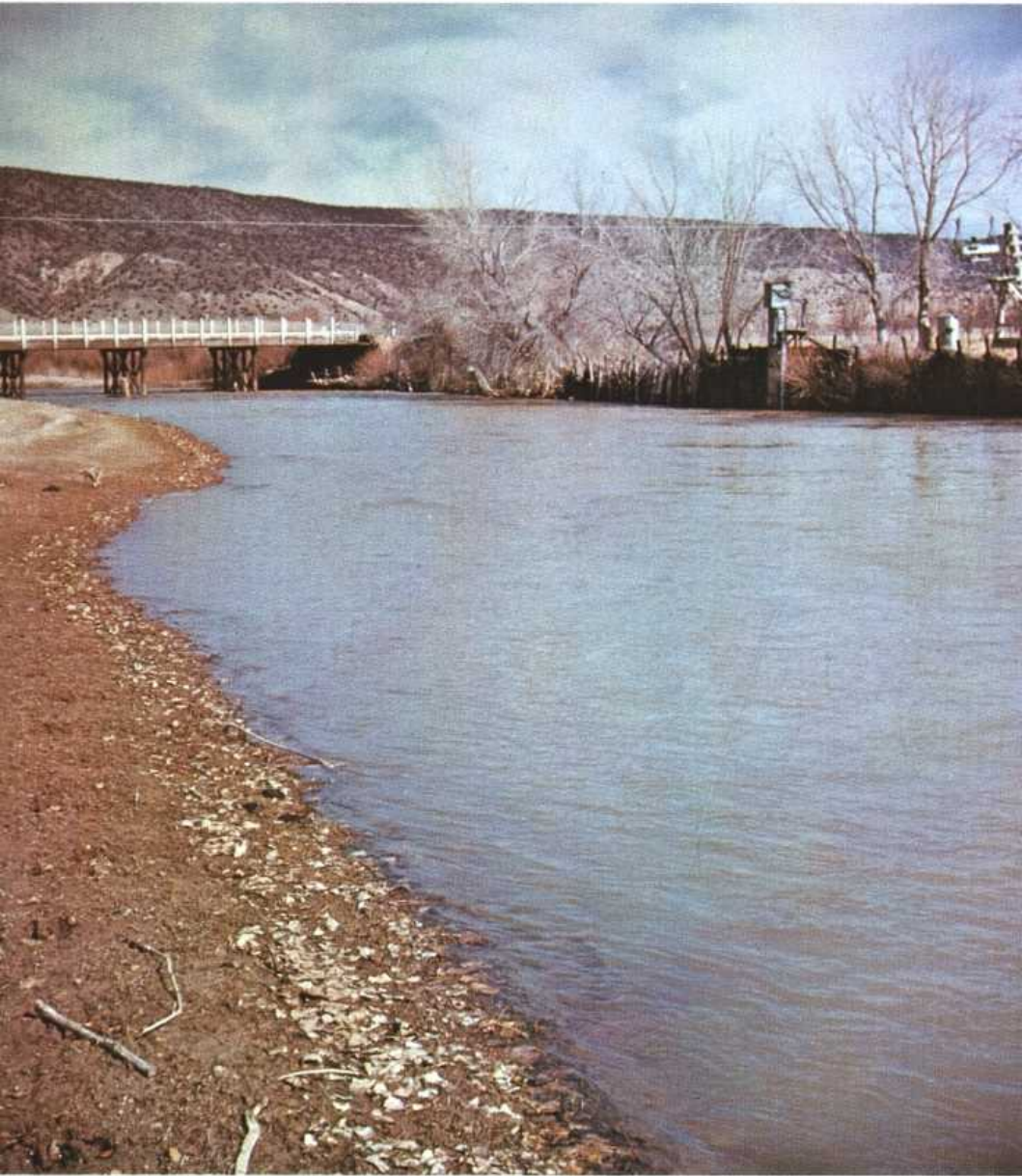
Section	Area (sq ft)	Top width (ft)	Mean depth (ft)	Hydraulic radius (ft)	Mean velocity (ft per sec)	Length (ft) between sections	Fall (ft) between sections
Mar. 24, 1950							
1	312	95	3.3	3.12	3.40	.....	.....
2	297	84	3.5	3.45	3.57	202	0.24
Apr. 3, 1950							
1	235	92	2.6	2.52	2.91	.....	.....
2	249	81	3.1	2.95	2.75	202	0.23

Notes.—

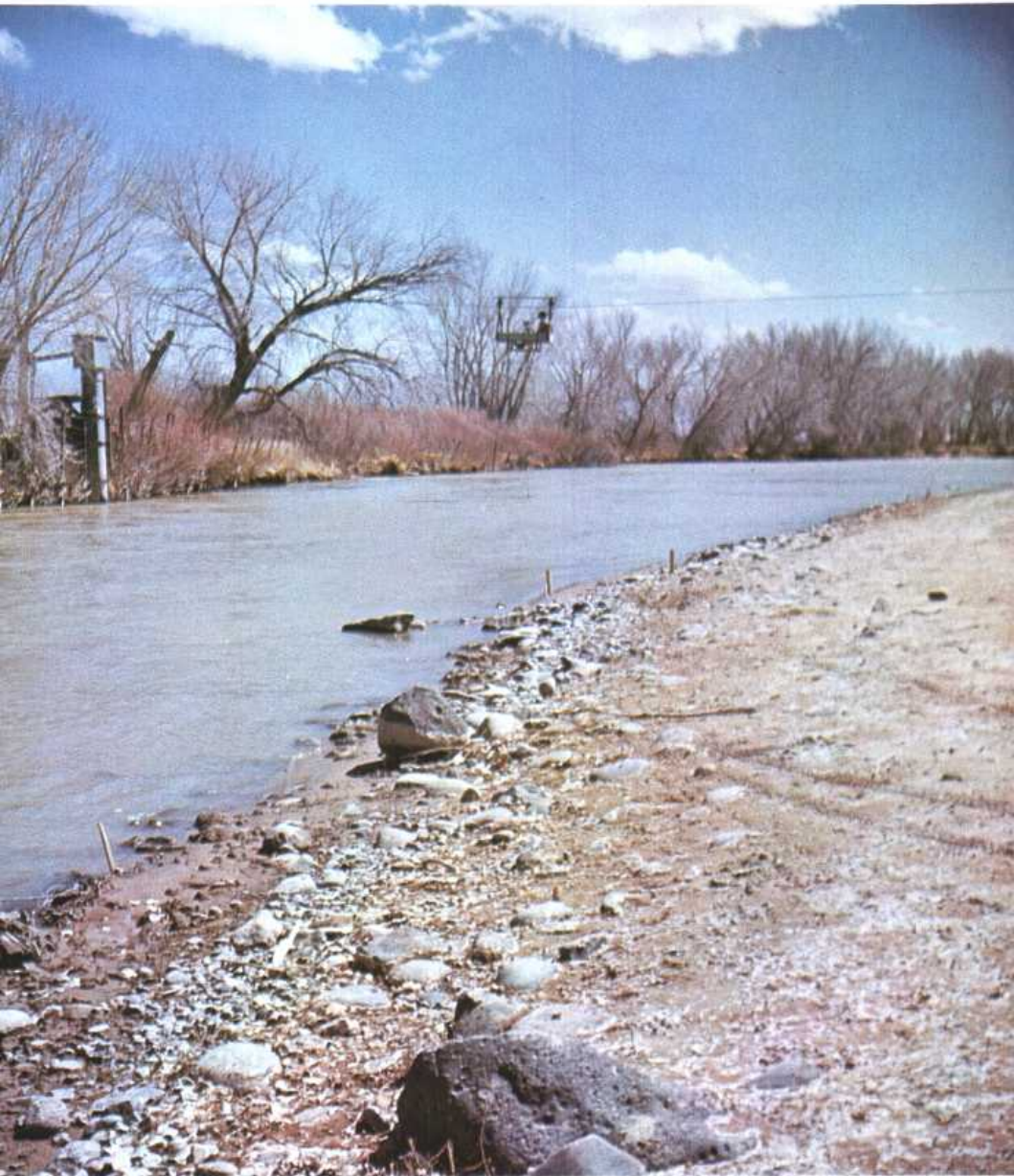


Plan sketch and cross sections, Rio Chama near Chamita, New Mex.

$n = 0.032; 0.036$



No. 547 upstream along right bank from below section 2,
Rio Chama near Chamita, N. Mex.



No. 550 downstream from right bank at section 1, Rio Chama
near Chamita, N. Mex.

$n = 0.032$

9-5020. Salt River below Stewart Mountain Dam,
Ariz.

Gage location.—Lat $33^{\circ}33'00''$, long $111^{\circ}34'31''$, in $N\frac{1}{2}NW\frac{1}{4}$ sec. 6, T. 2 N., R. 8 E. (unsurveyed), on left bank 3.5 miles downstream from Stewart Mountain Dam and 6 miles upstream from Verde River. Section 1 is about 2.25 miles downstream from gage.

Drainage area.—6,230 sq mi, of which 21 sq mi is below Stewart Mountain Dam.

Date of flood.—Mar. 24, 1950.

Gage height.—4.26 ft at gage; 99.26 ft (different datum) at section 1.

Peak discharge.—1,280 cfs.

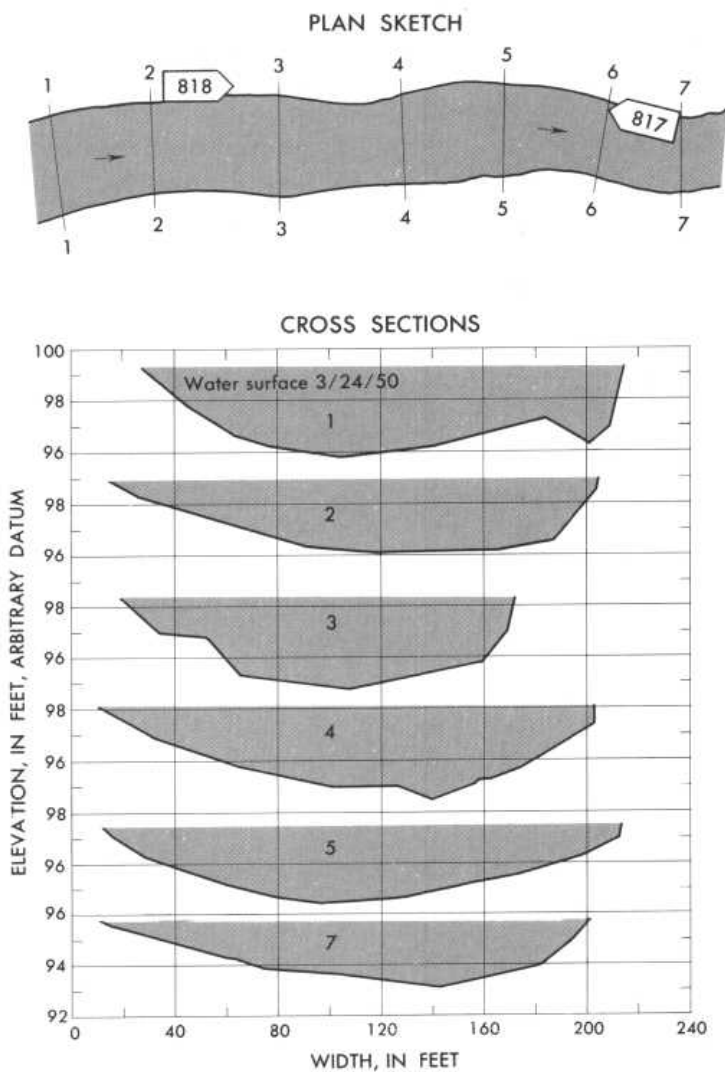
Computed roughness coefficient.—Manning $n = 0.032$.

Description of channel.—Bed and banks consist of smooth cobbles 4 to 10 inches in diameter, average diameter about 6 inches. A few boulders are as much as 18 inches in diameter.

Reach properties

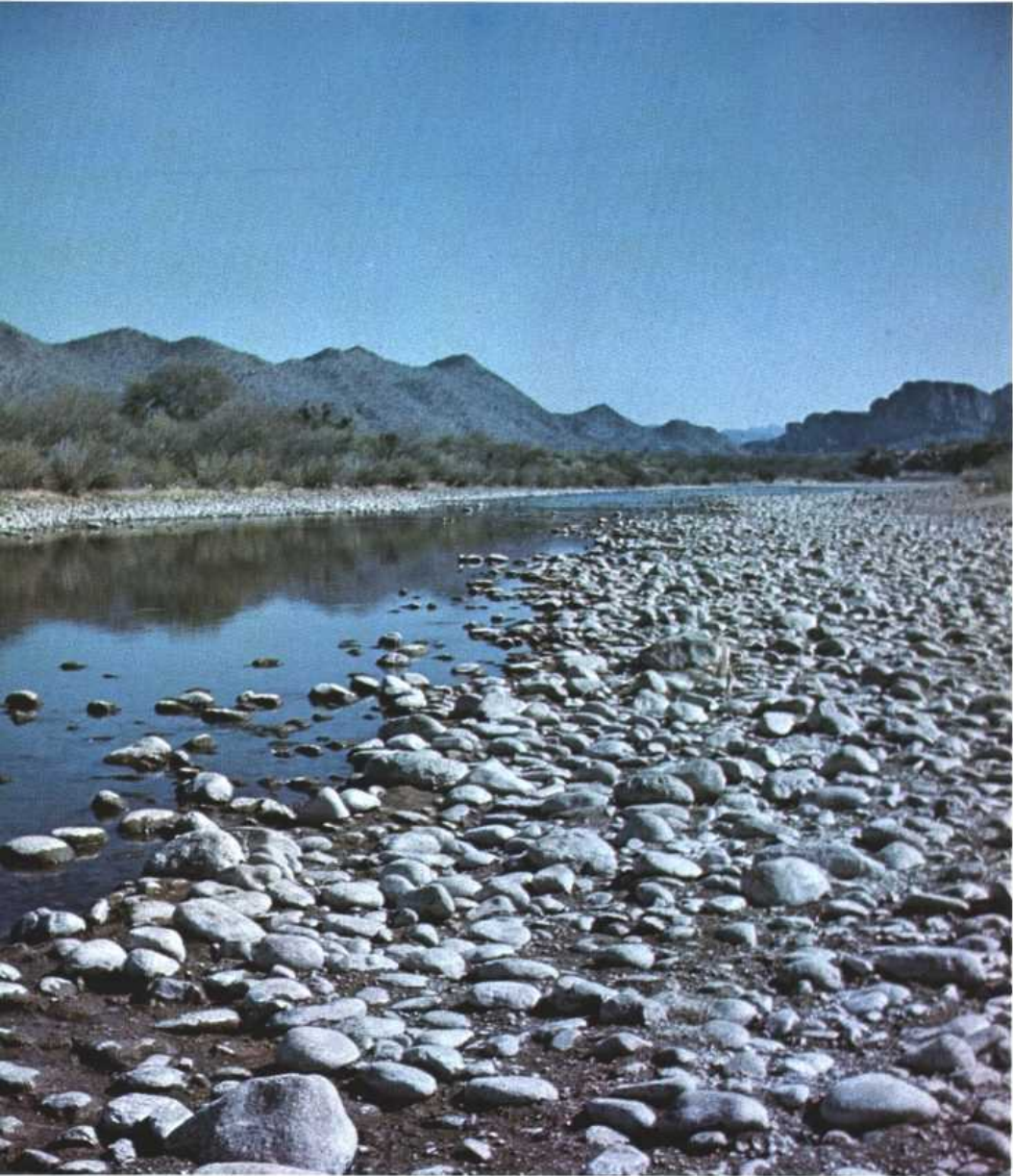
Section	Area (sq ft)	Top width (ft)	Mean depth (ft)	Hydraulic radius (ft)	Mean velocity (ft per sec)	Length (ft) between sections	Fall (ft) between sections
1	484	189	2.6	2.55	2.65	.....	.....
2	408	192	2.1	2.12	3.14	258	0.37
3	384	154	2.6	2.49	3.34	317	.50
4	449	194	2.3	2.30	2.86	294	.31
5	420	204	2.1	2.06	3.05	370	.63
6	381	207	1.8	1.84	3.36	333	.72
7	308	191	1.6	1.61	4.16	314	1.06

Notes.—



Plan sketch and cross sections, Salt River below Stewart Mountain Dam, Ariz.

$n = 0.032$



No. 817 upstream along left bank from below section 6
Salt River below Stewart Mountain Dam, Ariz.



No. 818 downstream along left bank from section 2, Salt River below Stewart Mountain Dam, Ariz.