

Roughness Characteristics of Natural Channels

By HARRY H. BARNES, JR.

U.S. GEOLOGICAL SURVEY WATER-SUPPLY PAPER 1849

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



$n = 0.043$

13-3200. Catherine Creek near Union, Oreg.

Gage location.—Lat $45^{\circ}09'20''$, long $117^{\circ}46'40''$, in SE $\frac{1}{4}$ sec. 2, T. 5 S., R. 40 E., on right bank 3 miles downstream from Little Catherine Creek and 6 miles southeast of Union.

Section 1 is about 0.75 mile downstream from gage.

Drainage area.—105 sq mi.

Date of flood.—May 27, 1948.

Gage height.—4.57 ft at gage; 21.21 ft (different datum) at section 1.

Peak discharge.—1,740 cfs.

Computed roughness coefficient.—Manning $n = 0.043$.

Description of channel.—Bed consists of cobbles and small boulders. Banks are lined with small trees and brush, and limbs overhang along left bank.

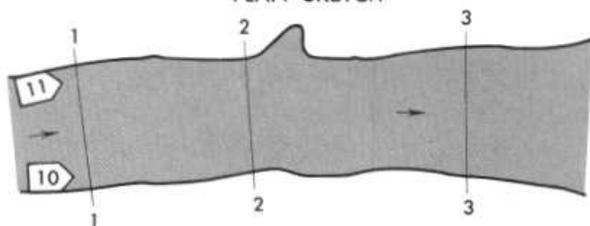
Reach properties

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	220	52	4.23	4.00	7.91	.....	.....
2	236	54	4.37	4.15	7.37	102	0.73
3	256	64	4.00	3.76	6.80	116	.72

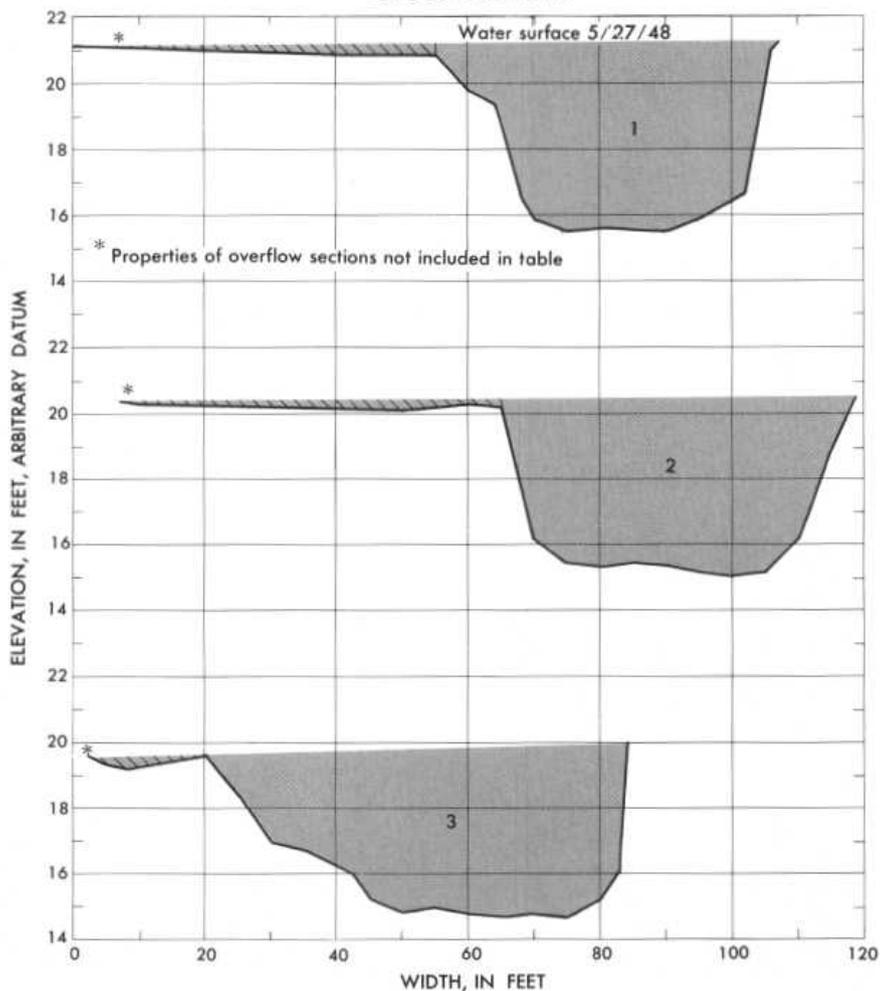
Notes.—

$n = 0.043$

PLAN SKETCH



CROSS SECTIONS



Plan sketch and cross sections, Catherine Creek near Union, Oreg.

$n = 0.043$



No. 10 downstream along right bank from above reach,
Catherine Creek near Union, Oreg.



No. 11 downstream along left bank from above reach,
Catherine Creek near Union, Oreg.

$n = 0.043$

12-4565. Chiwawa River near Plain, Wash.

Gage location.—Lat $47^{\circ}50'30''$, long $120^{\circ}39'40''$, in SE $\frac{1}{4}$ sec. 13, T. 27 N., R. 12 E., on right bank 0.5 mile upstream from Goose Creek, 6 miles north of Plain, 7 miles upstream from mouth, and 11 miles northeast of Chiwaukum. Section 1 is 90 ft downstream from gage.

Drainage area.—170 sq mi.

Date of flood.—May 29, 1948.

Gage height.—9.17 ft at gage; 9.62 ft at section 1.

Peak discharge.—5,880 cfs.

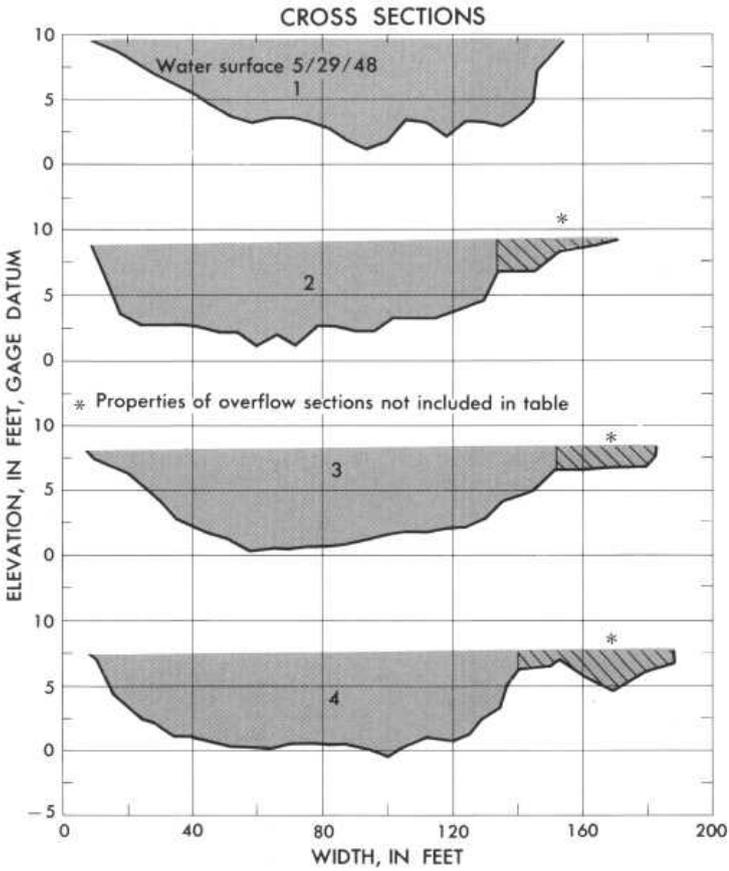
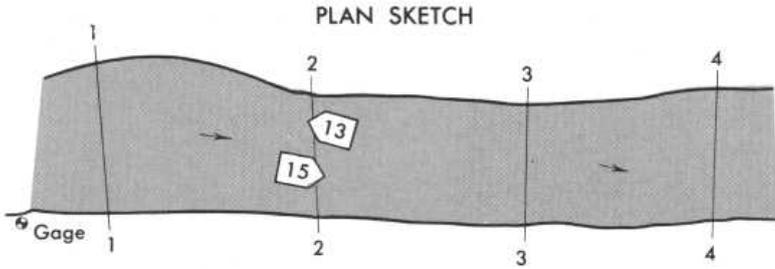
Computed roughness coefficient.—Manning $n = 0.043$.

Description of channel.—Bed generally extends to bedrock throughout reach with cover of boulders as much as $1\frac{1}{2}$ ft in diameter in some places. Banks are mildly sloped and have trees along the tops.

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.....	744	145	5.13	5.03	7.90	.....	.....
2.....	747	125	5.97	5.74	7.87	165	0.55
3.....	803	145	5.54	5.42	7.32	163	.80
4.....	770	131	5.89	5.75	7.64	145	.99

Notes.—



Plan sketch and cross sections, Chiwawa River near Plain, Wash.

$n = 0.043$



No. 13 upstream along left bank from section 2, Chiwawa River near Plain, Wash.



No. 15 downstream along right bank from section 2, Chiwawa River near Plain, Wash.

$n = 0.043$

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 400 ft upstream from gage.

Drainage area.—192 sq mi.

Date of flood.—Mar. 22, 1948.

Gage height.—12.39 ft at gage; 14.0 ft at section 1.

Peak discharge.—13,900 cfs.

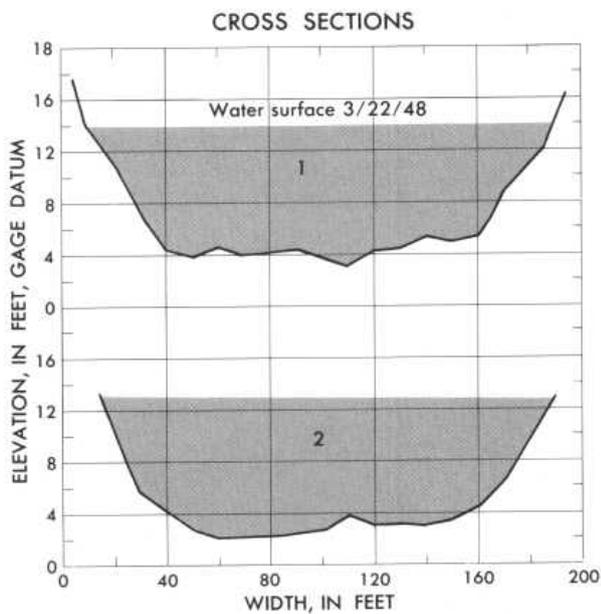
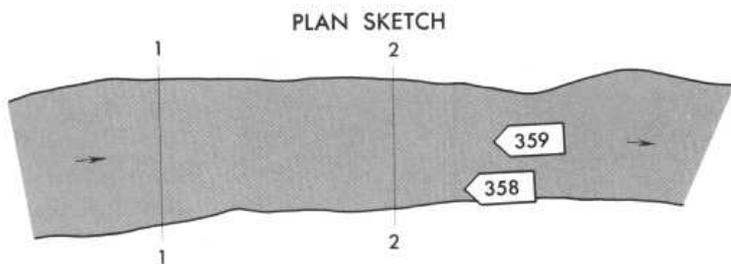
Computed roughness coefficient.—Manning $n = 0.043$.

Description of channel.—Bed material ranges from coarse gravel to a few large boulders. Banks are lined with boulders and scattered 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.....	1,460	181	8.1	7.97	9.48	.....	.....
2.....	1,470	175	8.4	8.28	9.45	258	1.15

Notes.—



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

$n = 0.043$



No. 358 upstream along right bank from below reach,
Esopus Creek at Coldbrook, N.Y.



No. 359 upstream along left bank from below reach,
Esopus Creek at Coldbrook, N.Y.

$n = 0.043$

13-3190. Grande Ronde River at La Grande, Oreg.

Gage location.—Lat $45^{\circ}21'$, long $118^{\circ}08'$, near center of sec. 36, T. 2 N., R. 37 E., on left bank 2 miles northwest of La Grande and 5 miles downstream from Fivepoint Creek. Section 1 is 0.65 mile downstream from gage.

Drainage area.—678 sq mi.

Date of flood.—May 22, 1948.

Gage height.—7.04 ft at gage; 12.95 ft (different datum) at section 1.

Peak discharge.—4,620 cfs.

Computed roughness coefficient.—Manning $n = 0.043$.

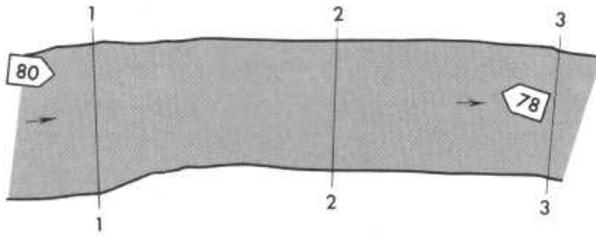
Description of channel.—Bed consists of boulders; $d_{50} = 93$ mm, $d_{84} = 157$ mm. Right bank is fairly steep and has dense overhanging bushes.

Reach properties

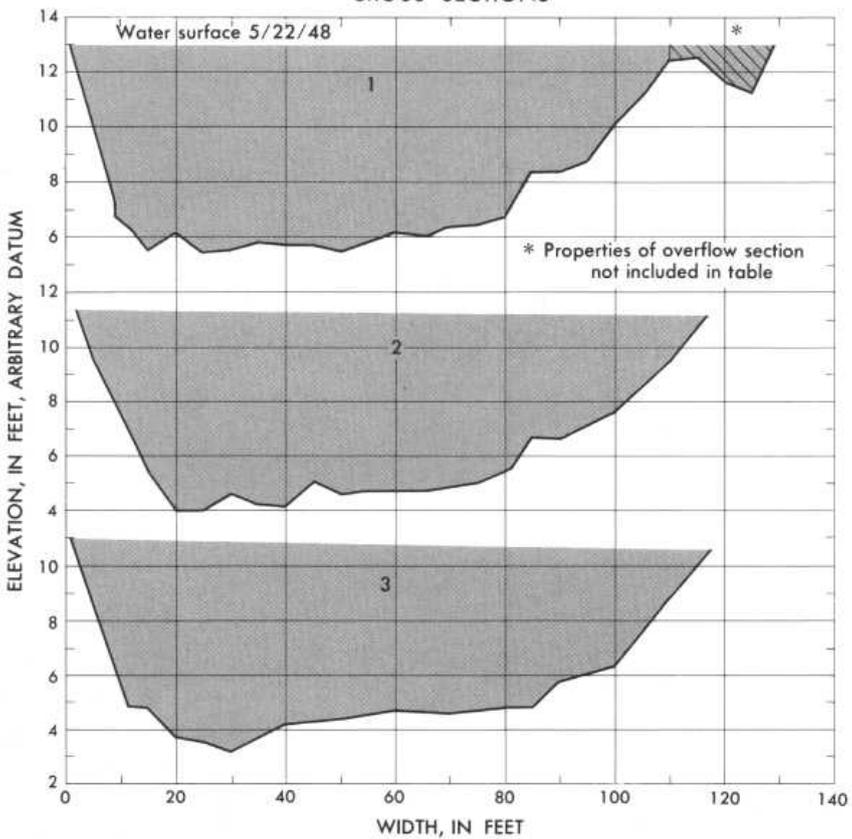
Section	Area (sq ft)	Top width (ft)	Mean depth (ft)	Hydraulic radius (ft)	Mean velocity (ft per sec)	Length (ft) between sections	Fall (ft) between sections
1.....	637	110	5.79	5.64	7.25	.....	.....
2.....	599	115	5.21	5.12	7.71	212	1.68
3.....	624	117	5.33	5.24	7.40	199	.48

Notes.—

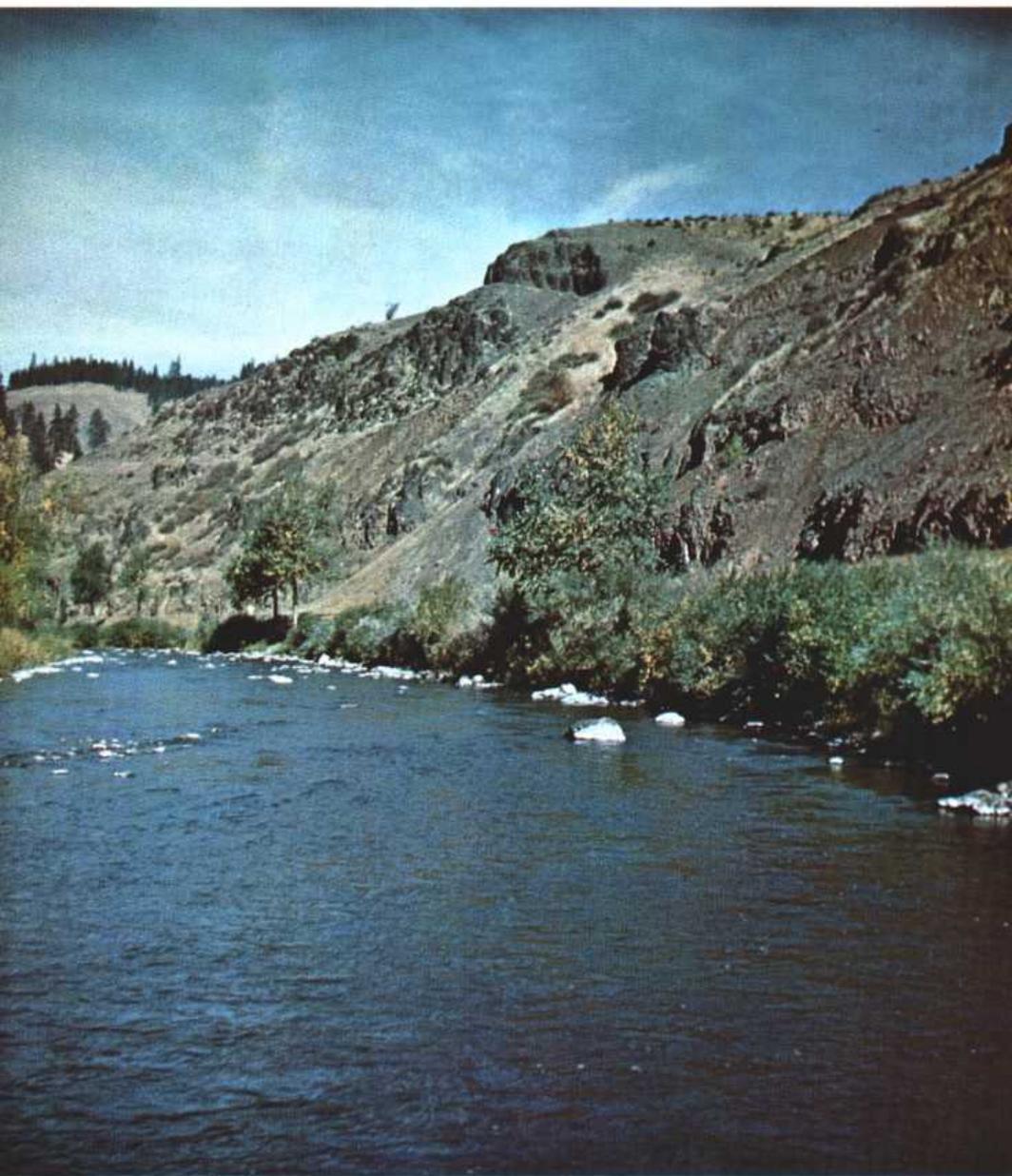
PLAN SKETCH



CROSS SECTIONS



Plan sketch and cross sections, Grande Ronde River at La Grande, Oreg.



No. 78 upstream along left bank from channel below section 3,
Grande Ronde River at La Grande, Oreg.



No. 80 downstream from left bank above section 1,
Grande Ronde River at La Grande, Oreg.

$n = 0.045$

2-2210. Murder Creek near Monticello, Ga.

Gage location.—Lat $33^{\circ}25'$, long $83^{\circ}40'$, on left bank 350 ft upstream from bridge on State Highway 229, 0.75 mile upstream from Pittman Creek, 1.75 miles downstream from confluence of Robinson and Sheppard Creeks, and 8 miles north of Monticello, Jasper County. Section 2 is about 630 ft upstream from gage.

Drainage area.—24 sq mi, approximately.

Date of flood.—Feb. 7, 1958.

Gage height.—4.68 ft at gage; 6.32 ft at section 2.

Peak discharge.—840 cfs.

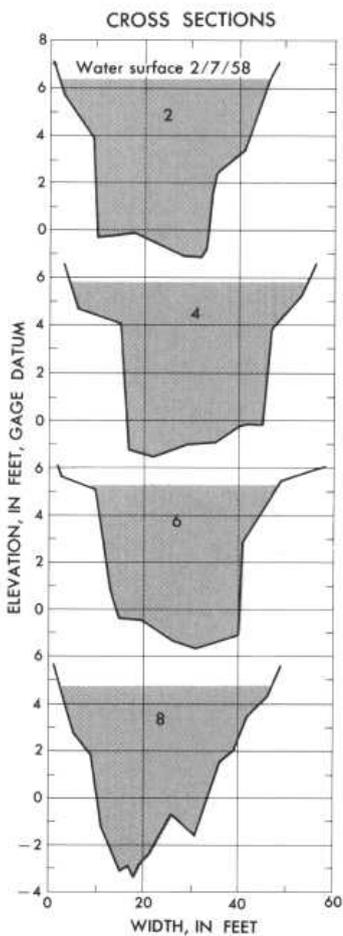
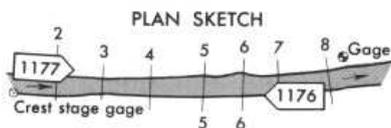
Computed roughness coefficient.—Manning $n=0.045$.

Description of channel.—Bed consists of sand and gravel. Both banks are lined with trees above low waterline.

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
2.....	215	45	4.8	4.21	3.93	.....	.....
3.....	212	42	5.0	4.20	3.99	78	0.21
4.....	227	50	4.5	4.02	3.73	124	.35
5.....	202	43	4.7	4.02	4.19	92	.21
6.....	187	41	4.6	3.74	4.52	71	.35
7.....	200	48	4.2	3.64	4.23	88	.11
8.....	198	45	4.4	3.94	4.27	149	.38

Notes.—



Plan sketch and cross sections, Murder Creek near Monticello, Ga.



No. 1176 upstream from right bank at section 7,
Murder Creek near Monticello, Ga.



No. 1177 downstream from left bank at section 2,
Murder Creek near Monticello, Ga.

$n = 0.045; 0.073$

10-1550. Provo River near Hailstone, Utah

Gage location.—Lat $40^{\circ}36'$, long $111^{\circ} 22'$, in SE $\frac{1}{4}$ sec. 34, T. 2 S., R. 5 E., on right bank 3 miles upstream from Ross Creek and Hailstone. Section 1 is about 120 ft upstream from gage.

Drainage area.—233 sq mi.

Date of flood.—June 13, Oct. 7, 1952.

Gage height.—4.66 ft, 1.58 at gage; 5.66 ft, 2.14 ft at section 1.

Peak discharge.—1,200 cfs, 64.8 cfs.

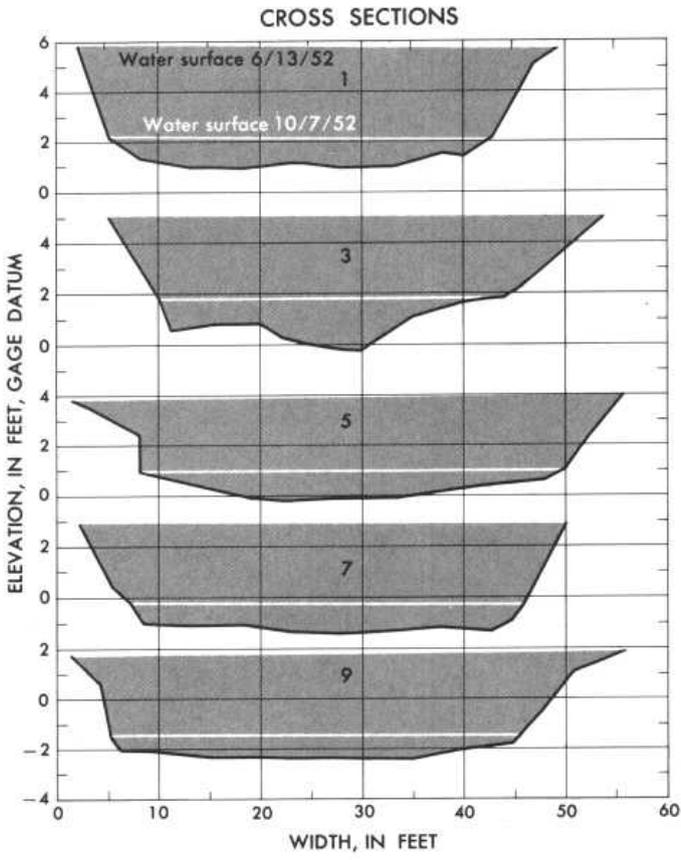
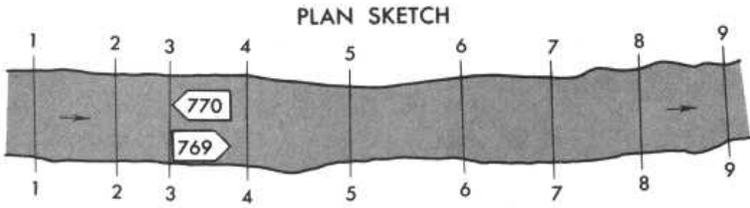
Computed roughness coefficient.—Manning $n=0.045; 0.073$.

Description of channel.—Bed and banks consist of smooth rounded rocks as much as 1 ft in diameter. Some undergrowth is below water elevations of June 13.

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
June 13, 1952							
1	184	47	3.9	3.70	6.52	.....	.....
3	171	49	3.5	3.33	7.02	88	0.67
5	173	55	3.1	3.02	6.95	109	1.04
7	173	48	3.6	3.43	6.95	117	1.10
9	183	55	3.3	3.22	6.56	116	1.04
Oct. 7, 1952							
1	36	38	1.0	0.95	1.79	.....	.....
3	38	34	1.1	1.10	1.70	88	0.32
5	34	32	1.1	.82	1.90	109	.84
7	34	39	.9	.86	1.91	117	1.28
9	31	41	.8	.76	2.08	116	1.12

Notes.—



Plan sketch and cross sections, Provo River near Hailstone, Utah.

$n = 0.045; 0.073$



No. 769 downstream from section 3, Provo River near
Hailstone, Utah.



No. 770 upstream from section 3, Provo River near
Hailstone, Utah.

$n = 0.046; 0.097$

3-3015. Rolling Fork near Boston, Ky.

Gage location.—Lat $37^{\circ}46'02''$, long $85^{\circ}42'14''$, on downstream side near center of span of bridge on U.S. Highway 62, 0.4 mile downstream from Beech Fork and 2.3 miles southwest of Boston, Nelson County. Section 1 is 650 ft upstream from gage.

Drainage area.—1,299 sq mi.

Date of flood.—Mar. 11, 1949.

Gage height.—26.30 ft at gage; 26.63 ft at section 1.

Peak discharge.—6,094 cfs (5,770 cfs in main channel and 324 cfs in right overflow channel).

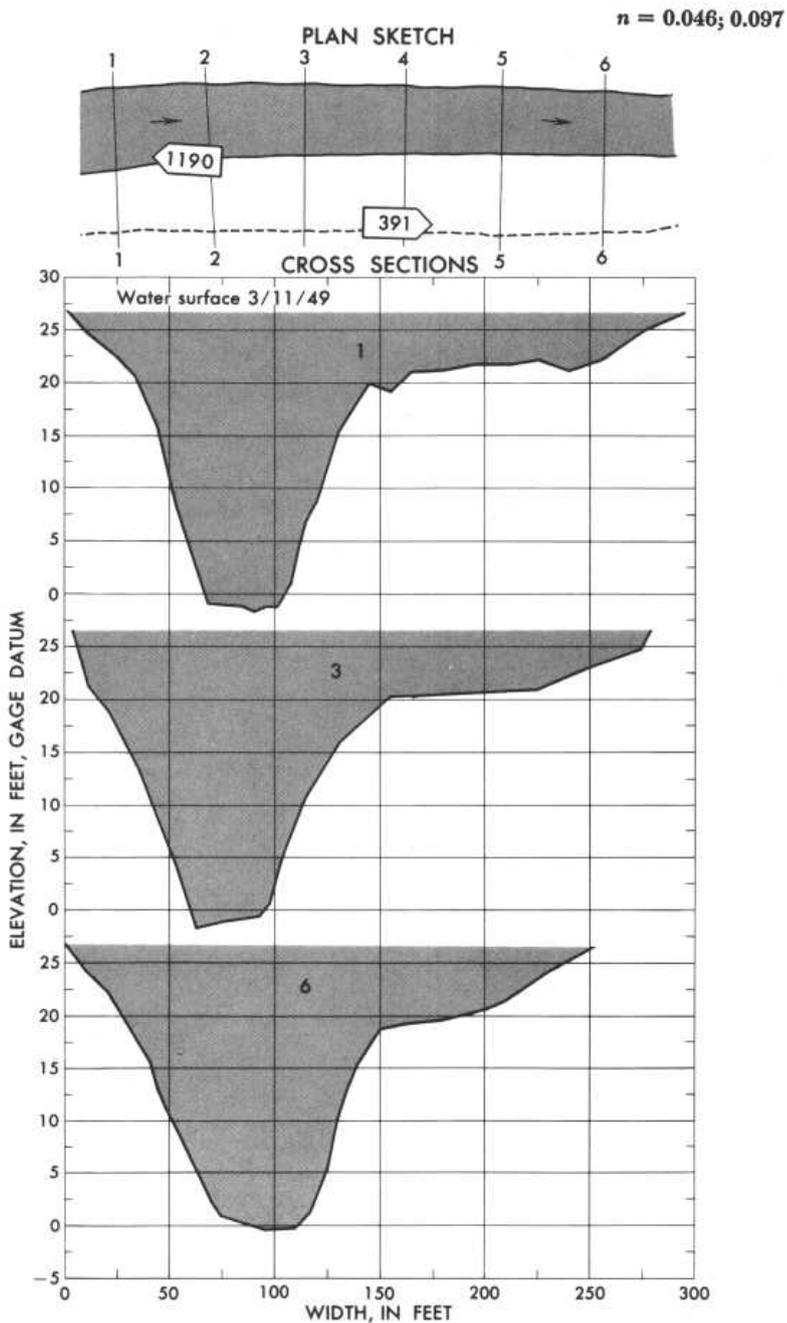
Computed roughness coefficient.—Manning $n=0.046$ in main channel and 0.097 in right overflow channel.

Description of channel.—Main channel bed is clay and silt. Both banks are lined with overhanging trees. Right overflow channel is rather uniform with fairly dense stand of trees as much as 6 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
Main channel							
1	2,301	143	16.1	14.25	2.51	.....	.....
2	2,304	139	16.6	15.33	2.51	136	0.011
3	2,524	152	16.6	15.50	2.28	103	.028
4	2,416	140	17.2	15.95	2.39	127	.014
5	2,544	147	17.3	16.12	2.27	117	.004
6	2,483	150	16.6	15.52	2.32	86	.033
Right overflow channel							
1	668	150	4.4	4.44	0.48	.....	.....
2	643	138	4.7	4.63	.50	136	0.011
3	601	124	4.8	4.83	.54	103	.028
4	602	120	5.0	5.00	.54	127	.014
5	593	112	5.3	5.27	.55	117	.004
6	513	104	4.9	4.93	.63	86	.033

Notes.—



Plan sketch and cross sections, Rolling Fork near Boston, Ky.
Dashed line shows limit of overbank flooding.

$n = 0.046; 0.097$



No. 1190 upstream from left bank below section 6,
Rolling Fork at Boston, Ky.



No. 391 downstream through right overflow from section 2,
Rolling Fork at Boston, Ky.