

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*



$n = 0.033$

1-4205. Beaver Kill at Cooks Falls, N. Y.

Gage location.—Lat $41^{\circ}56'50''$, long $74^{\circ}58'45''$, on left bank 125 ft downstream from highway bridge in Cooks Falls, Delaware County, and 5.5 miles downstream from Willowemoc Creek. Section 5 is about 2,700 ft downstream from gage.

Drainage area.—241 sq mi.

Date of flood.—Mar. 22, 1948.

Gage height.—11.69 ft at gage; 42.65 ft (different datum) at section 5.

Peak discharge.—15,500 cfs.

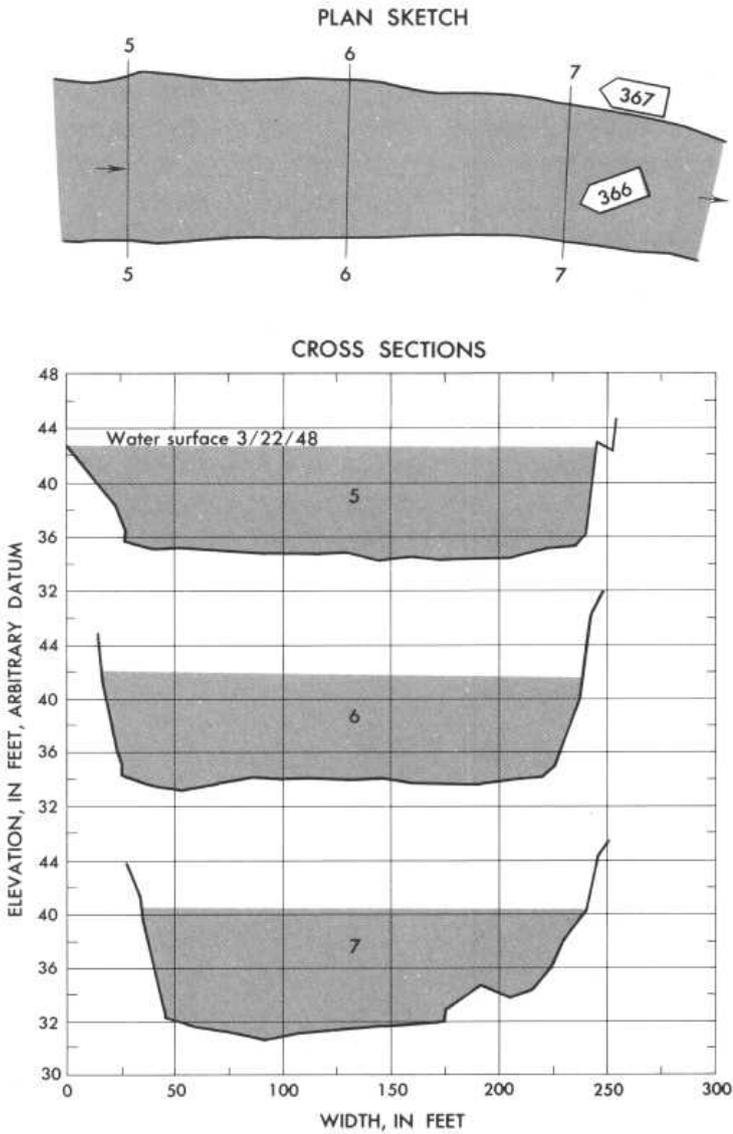
Computed roughness coefficient.—Manning $n = 0.033$.

Description of channel.—Bed consists of coarse gravel and cobbles with scattered boulders. Light brush is on both banks and some trees are near water's edge on 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
5	1,700	244	7.0	6.85	9.11	.....	.....
6	1,660	221	7.5	7.36	9.33	279	0.65
7	1,590	206	7.7	7.59	9.72	283	1.25

Notes.—

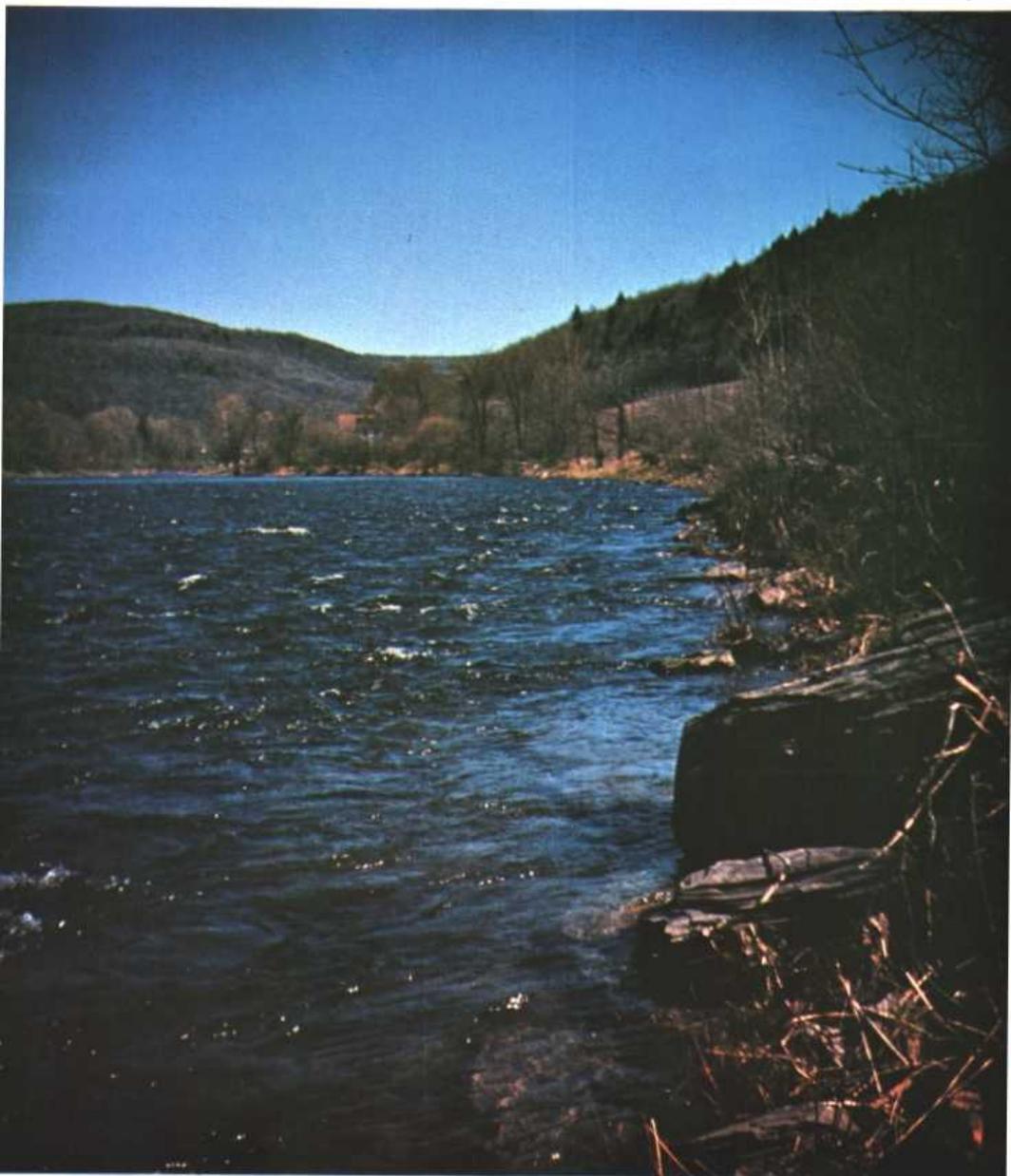


Plan sketch and cross sections, Beaver Kill at Cooks Falls, N.Y.

$n = 0.033$



No. 366 upstream toward right bank from section 7, Beaver Kill at Cooks Falls, N.Y.



No. 367 upstream along left bank from section 7, Beaver Kill
at Cooks Falls, N.Y.

$n = 0.033$

13-3390. Clearwater River at Kamiah, Idaho

Gage location.—Lat $46^{\circ}14'$, long $116^{\circ}01'$, in sec. 1, T. 33 N., R. 3 E., on left bank 0.25 mile downstream from highway bridge at Kamiah, 0.75 mile downstream from Lawyer Creek, and 6 miles downstream from South Fork. Section 1 is about 5.8 miles downstream from gage.

Drainage area.—4,850 sq mi, approximately.

Date of flood.—May 29, 1948.

Gage height.—19.22 ft at gage; 46.17 ft at section 1.

Peak discharge.—99,000 cfs.

Computed roughness coefficient.—Manning $n = 0.033$.

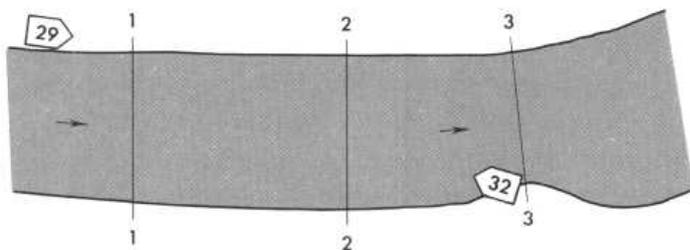
Description of channel.—Bed is composed of gravel and boulders with some exposed bedrock. Channel is bordered by railroad on the right and highway on the left. Banks are gravel and rock and have light vegetation cover.

Reach properties

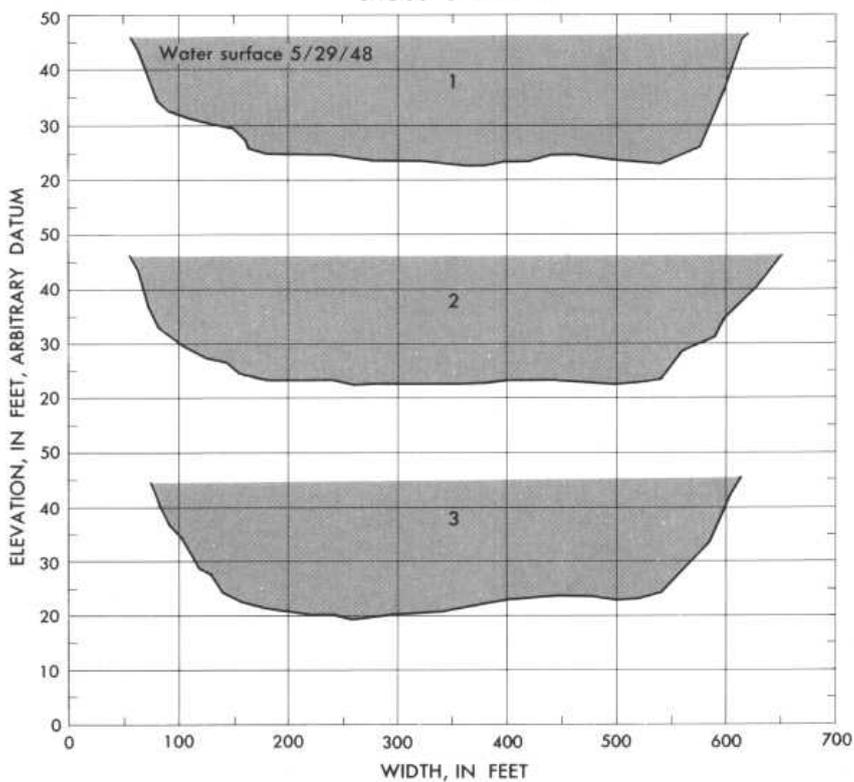
Section	Area (sq ft)	Top width (ft)	Mean depth (ft)	Hydraulic radius (ft)	Mean velocity (ft per sec)	Length (ft) between sections	Fall (ft) between sections
1.....	11,100	562	19.25	19.45	8.92	.....	.....
2.....	11,603	593	19.58	19.34	8.53	732	0.35
3.....	10,937	538	20.32	20.04	9.05	560	.67

Notes.—

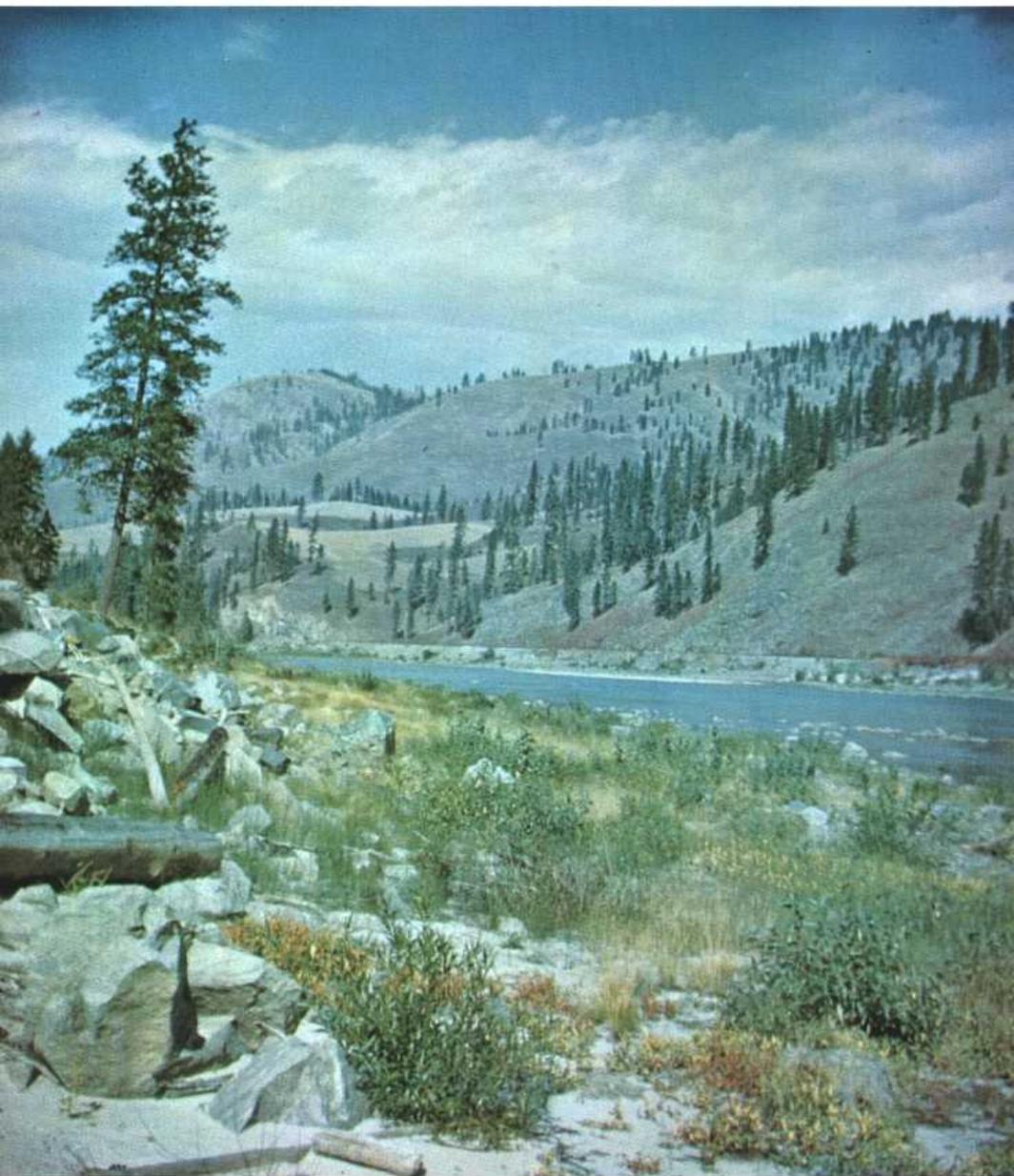
PLAN SKETCH



CROSS SECTIONS



Plan sketch and cross sections, Clearwater River at Kamiah, Idaho.



No. 29 downstream along left bank from above section 1,
Clearwater River at Kamiah, Idaho.



No. 32 upstream from left bank at section 3. Clearwater River
at Kamiah, Idaho.

$n = 0.041; 0.039; 0.035$

2-3890. Etowah River near Dawsonville, Ga.

Gage location.—Lat 34°23', long 84°04', on left bank 0.5 mile upstream from Palmer Creek, 1 mile downstream from Russell Creek, 4 miles southeast of Dawsonville, Dawson County, and 7.5 miles upstream from Shoal Creek. Section 7 is 477 ft downstream from gage.

Drainage area.—103 sq mi.

Date of flood.—Jan. 22, Feb. 13, Feb. 14, 1959.

Gage height.—9.45 ft, 7.95 ft, 2.85 ft at gage; 9.02 ft, 7.55 ft, 2.18 ft at section 7.

Peak discharge.—2,260 cfs; 1,850 cfs; 515 cfs.

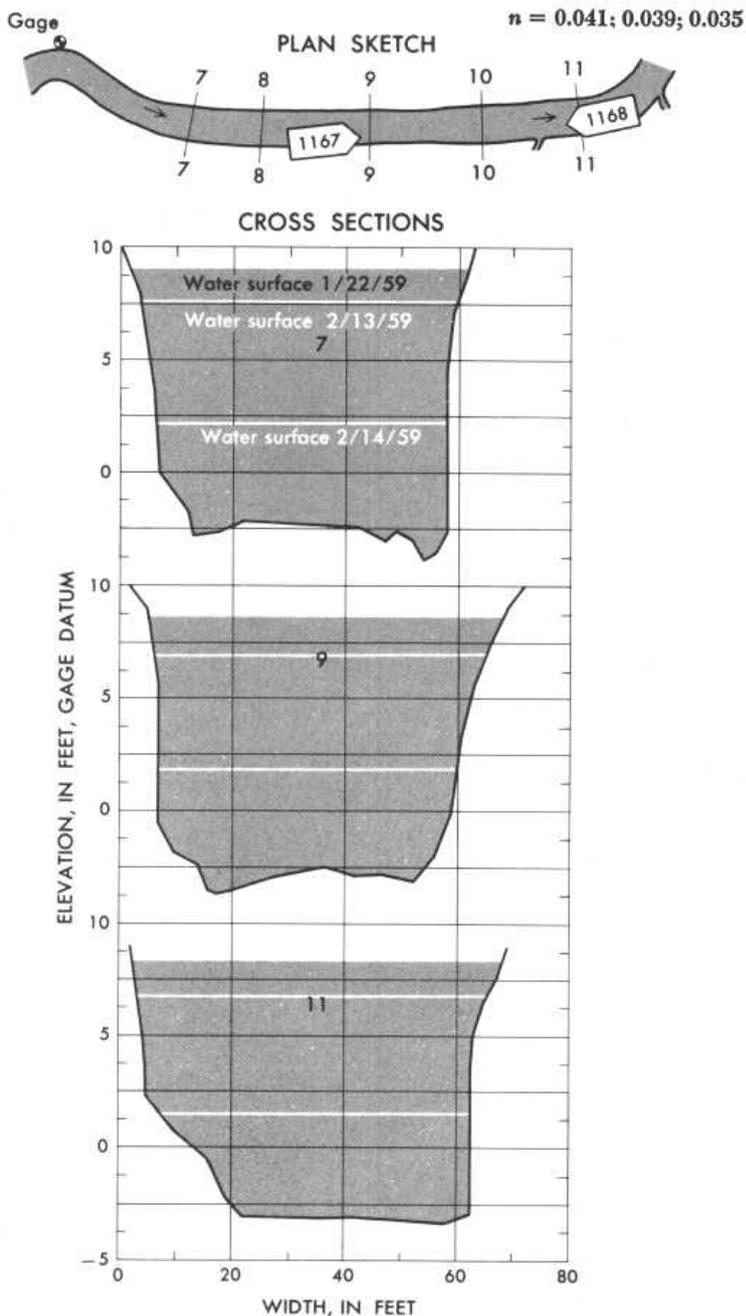
Computed roughness coefficient.—Manning $n = 0.041; 0.039; 0.035$.

Description of channel.—Bed is sand and gravel with several fallen trees in the reach. Banks are lined with overhanging trees and underbrush.

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
Jan. 22, 1959							
7.....	618	60	10.3	8.15	3.66	.....	.....
8.....	621	66	9.4	7.77	3.64	316	0.22
9.....	619	63	9.8	8.18	3.65	286	.18
10.....	610	63	9.7	7.77	3.70	293	.14
11.....	622	66	9.4	7.89	3.63	203	.17
Feb. 13, 1959							
7.....	528	57	9.3	7.37	3.50	.....	.....
8.....	531	64	8.3	6.95	3.48	316	0.19
9.....	532	59	9.0	7.56	3.48	286	.20
10.....	525	61	8.6	7.00	3.52	293	.14
11.....	530	62	8.6	7.10	3.49	203	.14
Feb. 14, 1959							
7.....	240	51	4.7	4.04	2.15	.....	.....
8.....	209	59	3.5	3.27	2.46	316	0.16
9.....	235	53	4.4	4.04	2.19	286	.17
10.....	203	59	3.4	3.19	2.54	293	.19
11.....	219	55	4.0	3.59	2.35	203	.15

Notes.—



Plan sketch and cross sections, Etowah River
near Dawsonville, Ga.

$n = 0.041; 0.039; 0.035$



No. 1167 downstream from right bank above section 9, Etowah River near Dawsonville, Ga.



No. 1168 upstream from right bank at section 11, Etowah River near Dawsonville, Ga.

$n = 0.036$

12-3425. West Fork Bitterroot River near Conner, Mont.

Gage location.—Lat $45^{\circ}44'$, long $114^{\circ}17'$, in NE $\frac{1}{4}$ NW $\frac{1}{4}$ sec. 26, T. 1 S., R. 22 W., on right bank 0.5 mile downstream from Painted Rocks Lake, 6 miles upstream from Nez Perce Creek, and 16 miles southwest of Conner. Section 1 is about 600 ft downstream from gage.

Drainage area.—317 sq mi.

Date of flood.—May 29, 1948.

Gage height.—6.08 ft at gage; 3.27 ft at section 1.

Peak discharge.—3,880 cfs.

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

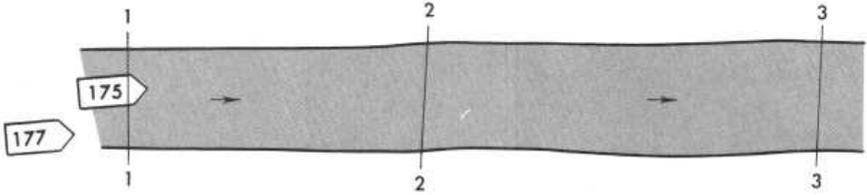
Description of channel.—Bed is gravel and boulders; $d_{50} = 172$ mm, $d_{84} = 265$ mm. The left bank is lined with overhanging bushes. The right bank is lined with trees.

Reach properties

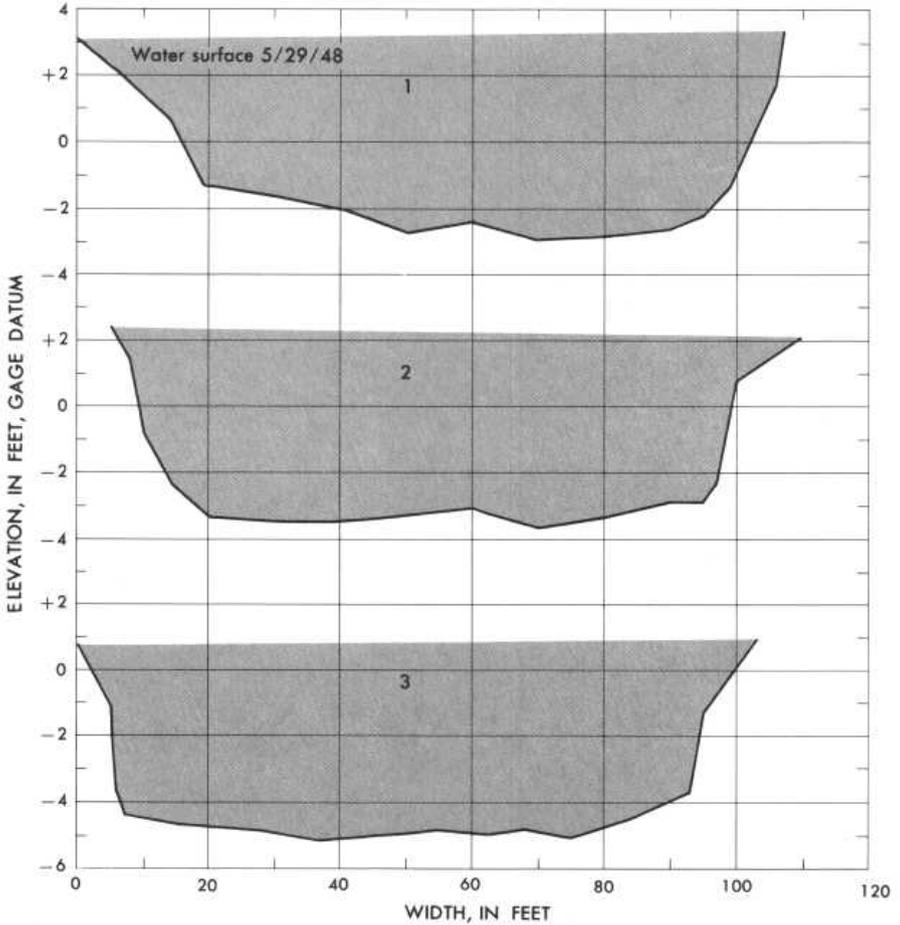
Section	Area (sq ft)	Top width (ft)	Mean depth (ft)	Hydraulic radius (ft)	Mean velocity (ft per sec)	Length (ft) between sections	Fall (ft) between sections
1.....	504	107	4.7	4.62	7.70	.....	.....
2.....	494	105	4.7	4.57	7.85	222	1.02
3.....	516	103	5.0	4.82	7.52	302	1.40

Notes.—

PLAN SKETCH

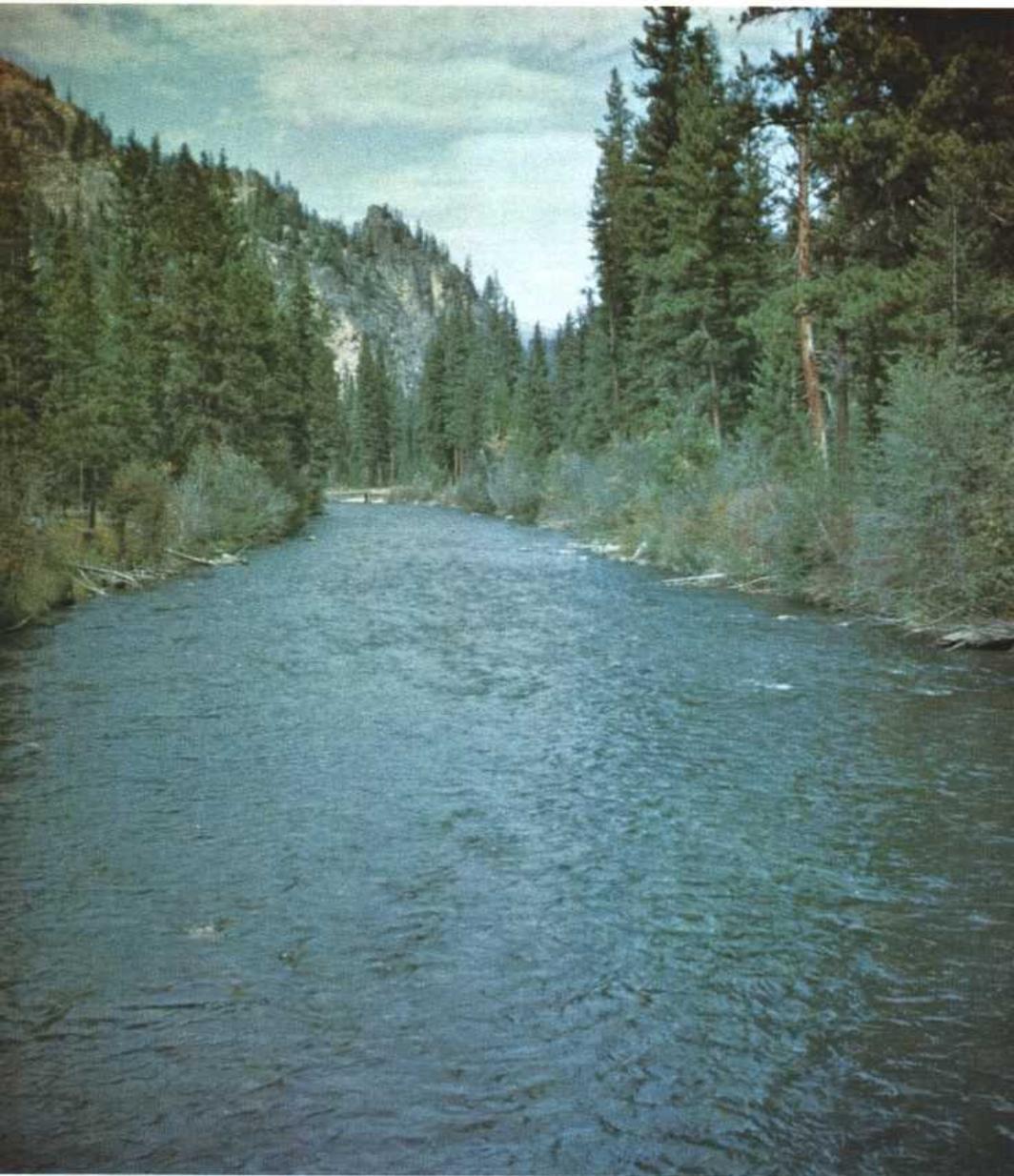


CROSS SECTIONS

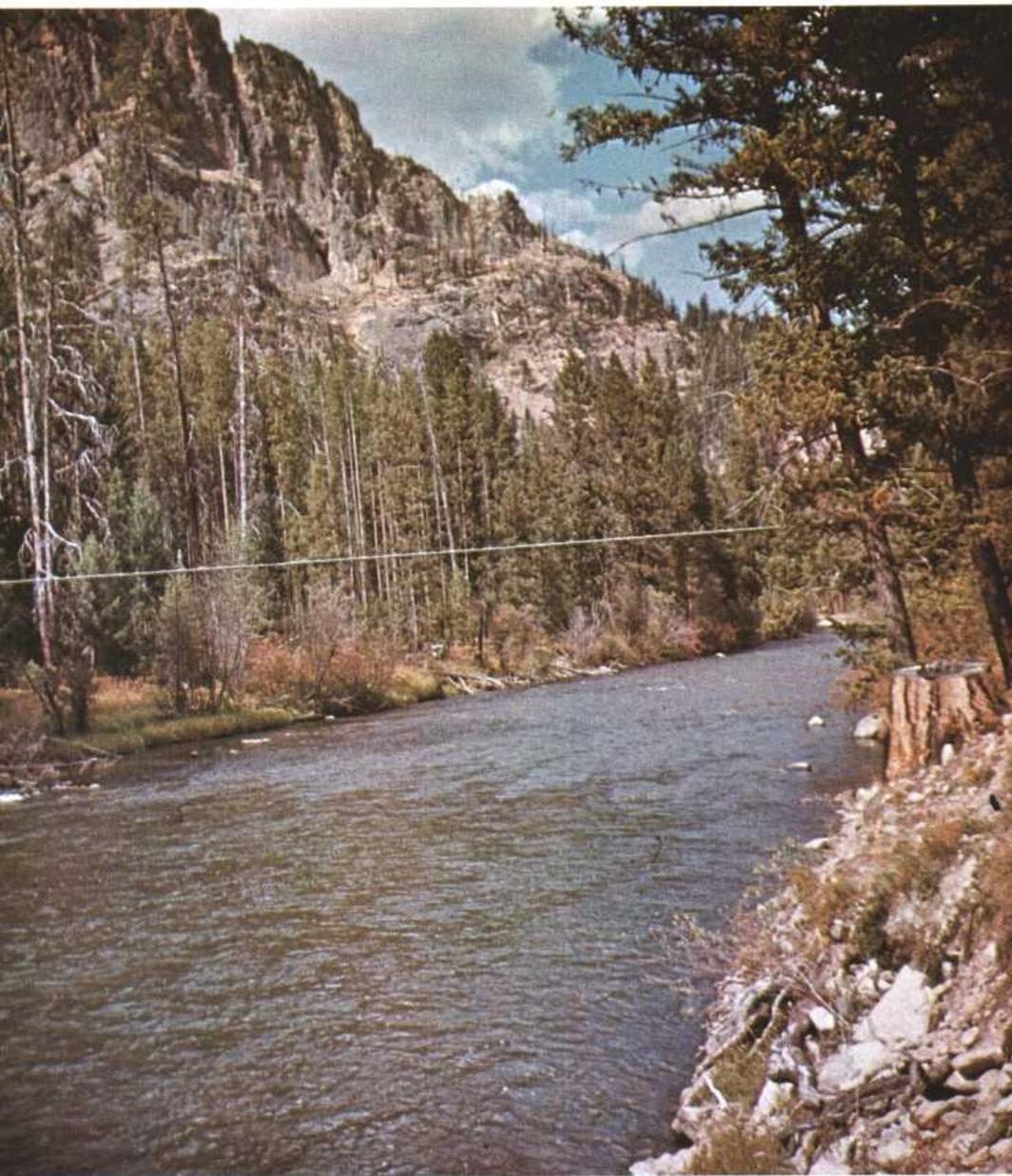


Plan sketch and cross sections, West Fork Bitterroot River near Conner, Mont.

n = 0.036



No. 175 downstream from section 1, West Fork Bitterroot
River near Conner, Mont.



No. 177 downstream from right bank above section 1, West Fork Bitterroot River near Conner, Mont.

$n = 0.036$

12-4845. Yakima River at Umtanum, Wash.

Gage location.—Lat $46^{\circ}51'45''$, long $120^{\circ}28'30''$, in NW $\frac{1}{4}$ sec. 20, T. 16 N., R. 19 E., on right bank at Umtanum, 0.5 mile upstream from Umtanum Creek and 10 miles south of Ellensburg. Section 1 is about 650 ft upstream from gage.

Drainage area.—1,590 sq mi, approximately.

Date of flood.—May 29, 1948.

Gage height.—38.98 ft at gage; 41.27 ft at section 1.

Peak discharge.—27,700 cfs.

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

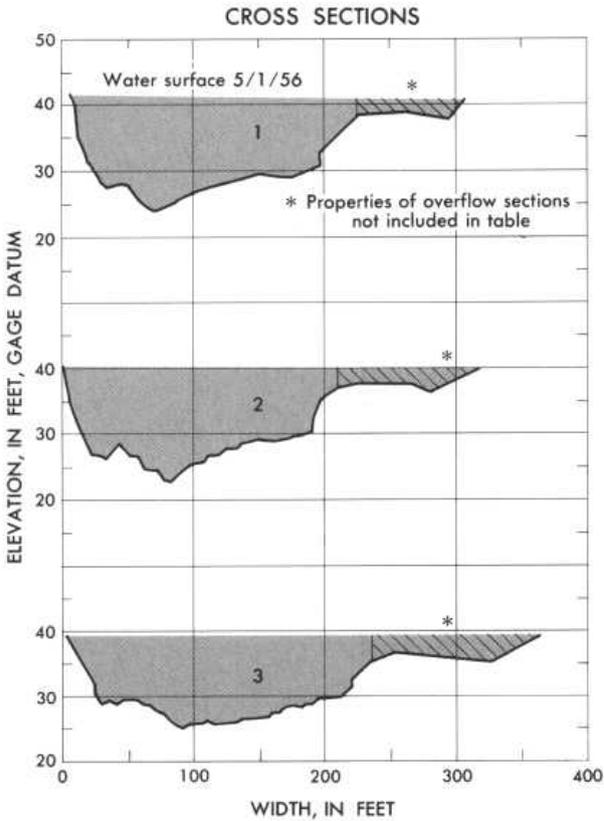
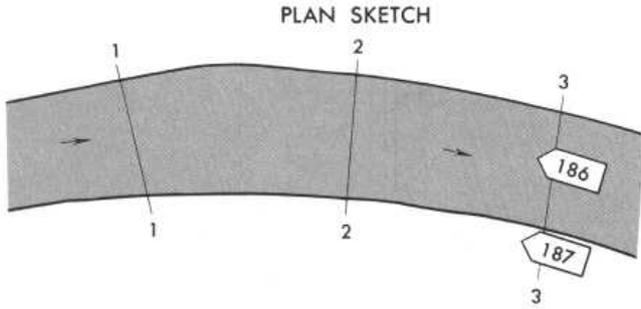
Description of channel.—Bed consists of gravel and boulders.

Left bank is rock riprap with bushes. Right bank is mildly sloped and has some boulders, brush, and weed cover.

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	2,680	222	12.1	11.62	10.34	.....	.....
2	2,550	208	12.3	11.61	10.86	324	0.99
3	2,490	232	10.7	10.32	11.12	302	.86

Notes.—

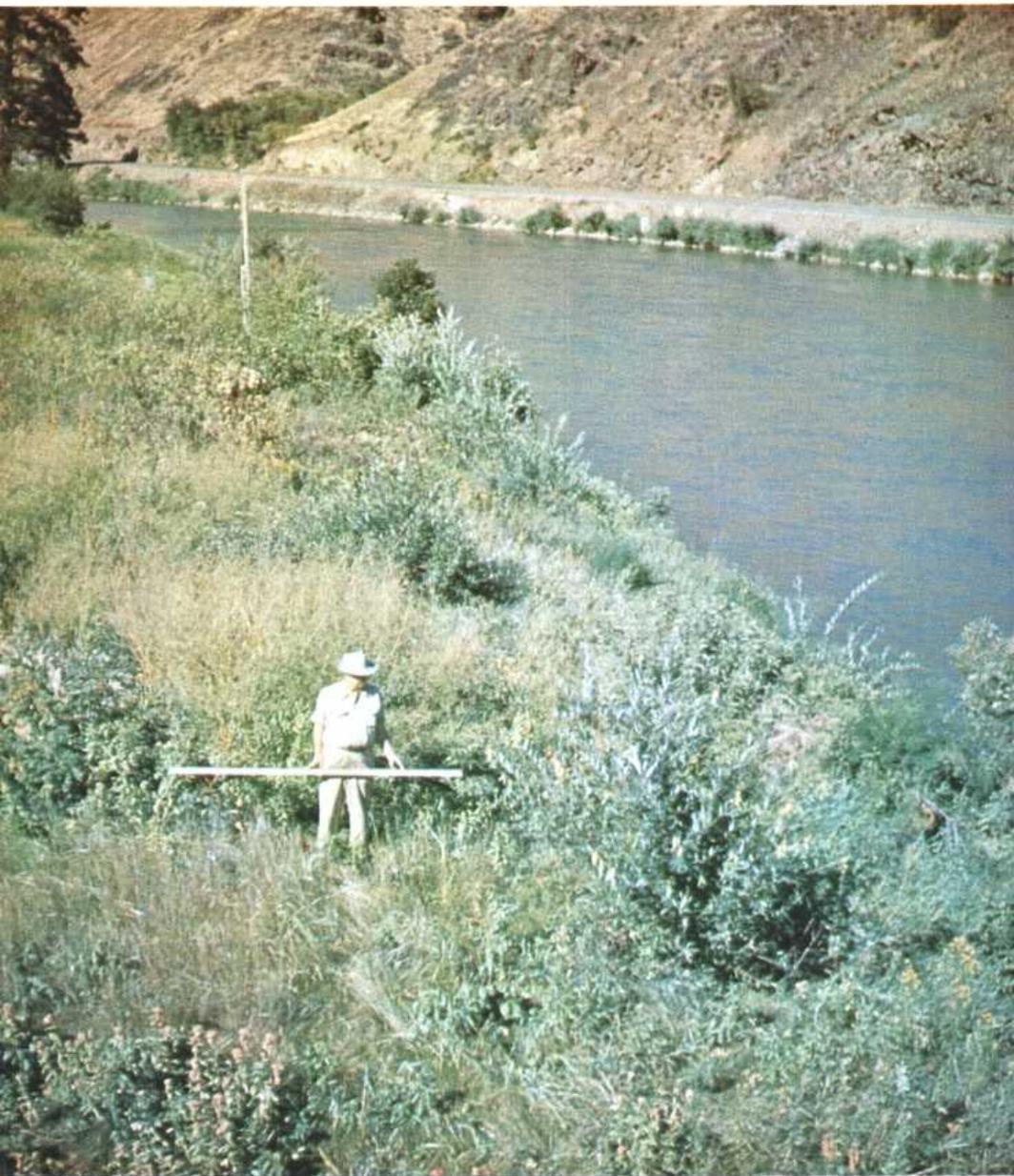


Plan sketch and cross sections, Yakima River at Umtanum, Wash.

$n = 0.036$



No. 186 upstream from section 3, Yakima River
at Umtanum, Wash.



No. 187 upstream along right bank from below section 3,
Yakima River at Umtanum, Wash.

$n = 0.037$

5—Misc. Middle Fork Vermilion River near Danville, Ill.

Gage location.—Lat $40^{\circ}08'$, long $87^{\circ}45'$, in NE $\frac{1}{4}$ SW $\frac{1}{4}$ sec. 5, T. 19 N., R. 12 W., at downstream side of bridge in Kickapoo State Park. Section 1 is 30 ft downstream from bridge.

Drainage area.—417 sq mi.

Date of flood.—May 1, 1956.

Gage height.—549.20 ft at gage; 549.13 ft at section 1.

Peak discharge.—1,620 cfs.

Computed roughness coefficient.—Manning $n = 0.037$.

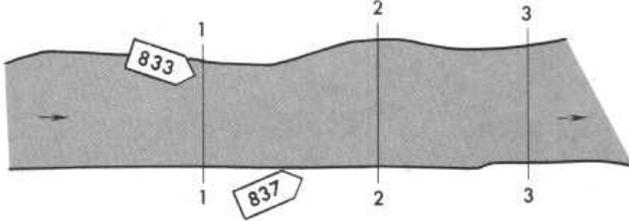
Description of channel.—Bed is gravel and small cobbles. Banks are lined with trees and small underbrush.

Reach properties

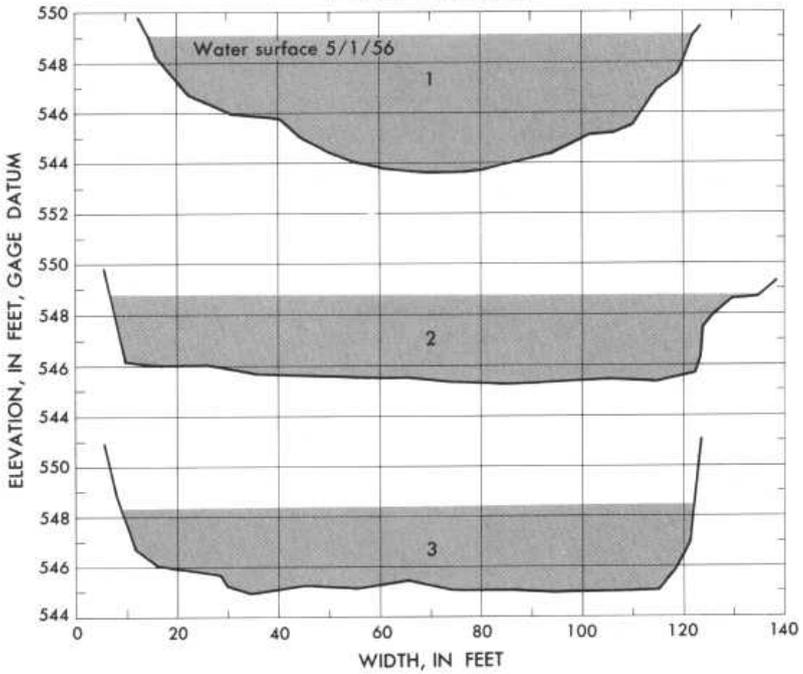
Section	Area (sq ft)	Top width (ft)	Mean depth (ft)	Hydraulic radius (ft)	Mean velocity (ft per sec)	Length (ft) between sections	Fall (ft) between sections
1.....	423	108	3.9	3.88	3.82	.....	.....
2.....	369	129	2.9	2.82	4.40	123	0.36
3.....	344	114	3.0	2.97	4.72	106	.35

Notes.—

PLAN SKETCH



CROSS SECTIONS



Plan sketch and cross sections, Middle Fork Vermilion River near Danville, Ill.



No. 833 downstream from left bank at section 1, Middle Fork
Vermilion River near Danville, Ill.



No. 837 downstream from right bank at section 1, Middle Fork Vermilion River near Danville, Ill.

$n = 0.037$

12-4570. Wenatchee River at Plain, Wash.

Gage location.—Lat $47^{\circ}45'50''$, long $120^{\circ}39'30''$, in lot 8, sec. 12, T. 26 N., R. 17 E., on left bank at Plain, 0.25 mile downstream from Beaver Creek, 7.5 miles downstream from Nason Creek, and 12 miles north of Leavenworth. Section 1 is 1,360 ft upstream from gage.

Drainage area.—591 sq mi.

Date of flood.—May 29, 1948.

Gage height.—12.43 ft at gage; 16.50 ft at section 1.

Peak discharge.—22,700 cfs.

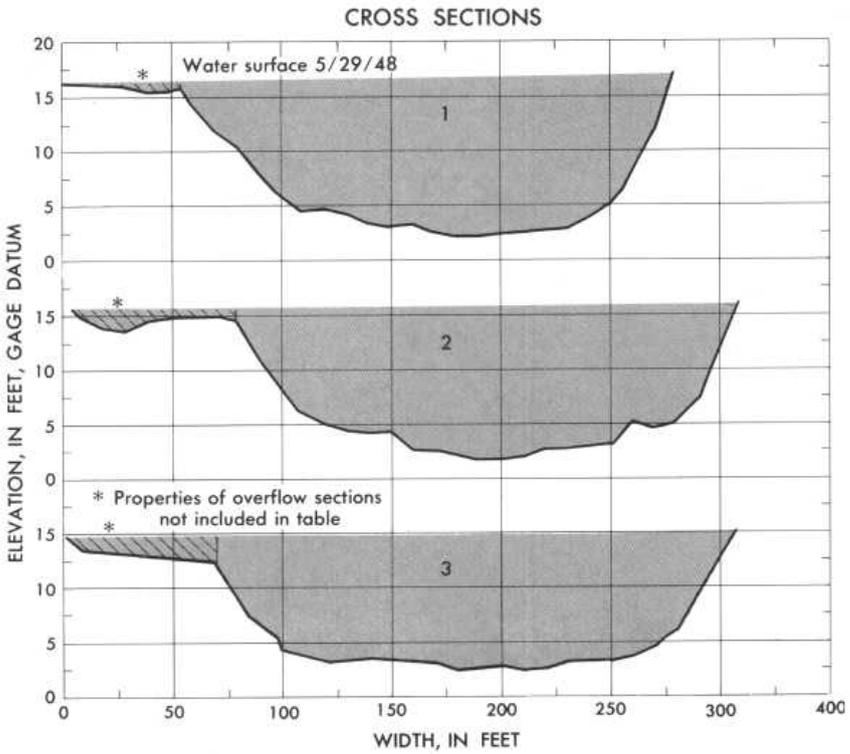
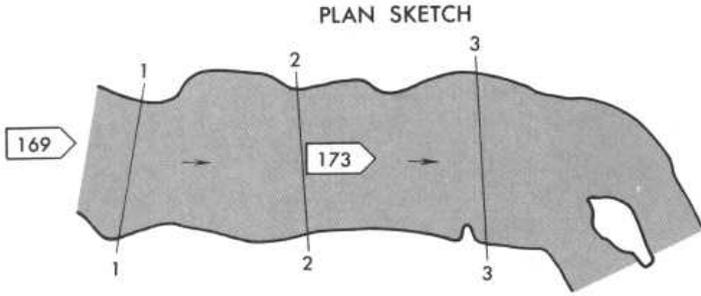
Computed roughness coefficient.—Manning $n = 0.037$.

Description of channel.—Bed is boulders; $d_{50} = 162$ mm, $d_{85} = 320$ mm. Banks are lined with trees and 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.....	2,480	224	11.1	10.86	9.15	.....	.....
2.....	2,470	228	10.8	10.58	9.19	311	0.75
3.....	2,440	237	10.3	10.05	9.30	325	.75

Notes.—

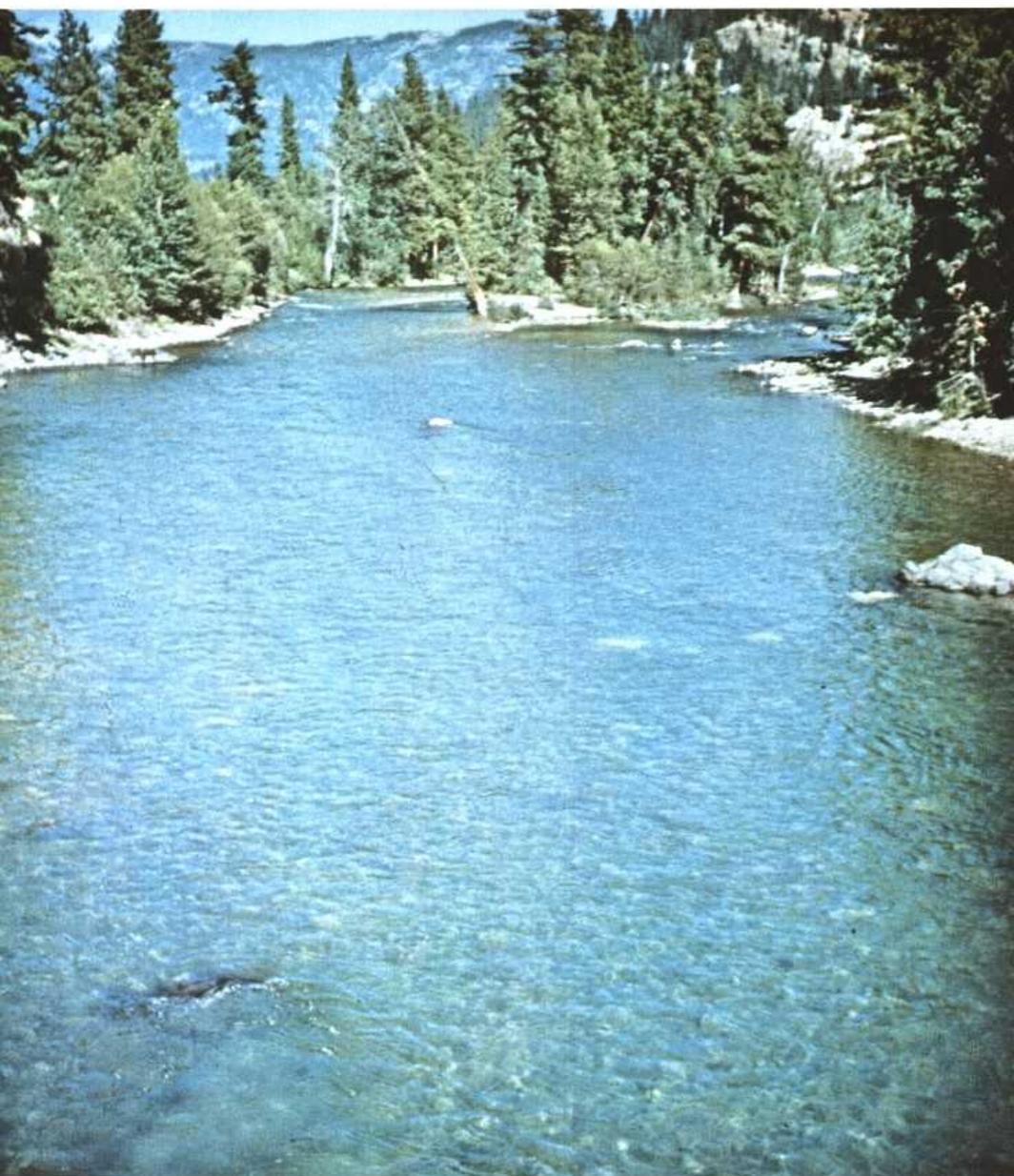


Plan sketch and cross sections, Wenatchee River at Plain, Wash.

$n = 0.037$



No. 169 downstream from above section 1, Wenatchee River
at Plain, Wash.



No. 173 downstream from section 2, Wenatchee River
at Plain, Wash.