DEPARTMENT OF THE INTERIOR
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SURFACE WATER SUPPLY OF THE UNITED STATES

1925

PART XII. NORTH PACIFIC SLOPE DRAINAGE BASINS

A. PACIFIC BASINS IN WASHINGTON AND UPPER COLUMBIA RIVER BASIN

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Monthly discharge of Deer Creek at Oso Wash., for the year ending September 30, 1925

[Drainage area, 84 square miles]

Month	Discharge in second-feet				Run-off	
	Maximum	Minimum	Mean	Per square mile	Inches	Acre-feet
October	2,620	143	860	10.2	11.76	52,900
November			782	9.31	10.39	46,500
December	4,820	212	1,140	13.6	15.68	70,100
January	3,860	280	1,060	12.6	14.53	65,200
February	3,380	64	978	11.6	12.08	54,200
March	1,220	175	443	5.27	6.08	27,200
April	1,630	239	676	8.05	8.98	40,200
May	1,550	425	895	10.7	12.34	55,000
June	509	147	324	3.86	4.31	19,300
July	127	40	75.0	.893	1.03	4,610
August	291	30	58.2	.693	.80	3,580
September	52	25	32.1	.382	.43	1,910
The year	4,820	25	609	7.25	98.41	441,000

SKAGIT RIVER BASIN

SKAGIT RIVER BELOW RUBY CREEK, NEAR MARBLEMOUNT, WASH.

LOCATION.—In Whatcom County, three-fourths of a mile below Ruby Creek, 5 miles above Reflector Bar, and 23 miles northeast of Marblemount, Skagit County.

DRAINAGE AREA.—978 square miles. Area in United States, 588 square miles measured on Washington National Forest map, edition 1922; area in British Columbia, 390 square miles.[4]

RECORDS AVAILABLE.—June 1, 1919, to September 30, 1925.

GAGE.—Stevens continuous water-stage recorder on right bank; installed June 9, 1919; inspected by F. E. Davis.

DISCHARGE MEASUREMENTS.—Made from cable 40 feet below gage.

CHANNEL AND CONTROL.—Control at head of rapids about 125 feet below gage composed of large, angular boulders and perhaps some bedrock. Banks high and wooded, not subject to overflow. One channel at all stages.

EXTREMES OF DISCHARGE.—Maximum stage during year, from water-stage recorder, 11.6 feet from 11 p. m. May 19 to 1 a. m. May 20 (discharge, 23,200 second-feet); minimum stage from recorder, 3.49 feet at midnight September 30 (discharge, 674 second-feet).

1919–1925: Maximum stage recorded, 16.1 feet at 7 p. m. December 12, 1921 (discharge, 45,700 second-feet); minimum stage, 3.30 feet at 10 p. m. November 11, 1919 (discharge, 555 second-feet).

ICE.—Stage-discharge relation slightly affected by ice during severe winters. Flow estimated from observer's notes and weather records.

DIVERSIONS.—None.

REGULATION.—None.

ACCURACY.—Stage-discharge relation permanent; affected by ice December 17 to January 1. Rating curve well defined below 20,000 second-feet. Operation of water-stage recorder satisfactory. Daily discharge ascertained by applying to rating table mean daily gage height determined from recorder graph by inspection or, for days when there was considerable variation in stage, by averaging results obtained by applying to rating table mean gage heights for shorter intervals. Records excellent.

The following discharge measurements were made:
June 3, 1925: Gage height, 7.44 feet; discharge, 6,670 second-feet.
August 1, 1925: Gage height, 5.62 feet; discharge, 3,020 second-feet.
September 15, 1925: Gage height, 4.07 feet; discharge, 1,130 second-feet.

[4] White, A. V., Water powers of British Columbia, p. 483, Commission of Conservation, Canada, 1919.

Daily discharge

Day	Oct.
1	2,160
2	2,020
3	2,000
4	1,880
5	1,470
6	1,320
7	1,220
8	1,220
9	1,190
10	1,080
11	1,040
12	1,040
13	1,040
14	1,270
15	1,520
16	1,420
17	1,320
18	1,180
19	1,130
20	1,130
21	1,080
22	1,040
23	1,040
24	2,020
25	6,840
26	5,120
27	4,420
28	3,710
29	3,220
30	2,920
31	2,700

Monthly disch

October
November
December
January
February
March
April
May
June
July
August
September
The year

SKAGIT RIVER NEAR MARBLEMOUNT, WASH.

LOCATION.—In SE. ¼ sec. 21, T. 37 N., R. 12 E., at city of Seattle power camp, Whatcom County, one-fourth mile above Newhalem Creek, 6½ miles below Stetattle Creek, and 16 miles above Marblemount.

DRAINAGE AREA.—1,160 square miles. Area in Canada, 390 square miles;[5] area in United States 770 square miles, measured on Washington National Forest maps.

RECORDS AVAILABLE.—December 21, 1908, to May 23, 1914; October 1, 1920, to September 30, 1925.

GAGE.—Stevens water-stage recorder installed June 5, 1923, on right bank about 300 feet below suspension footbridge and trail to Newhalem Creek power plant; inspected by F. E. Davis. Present gage datum 400 feet United States Geological Survey datum.

DISCHARGE MEASUREMENTS.—Made from suspension bridge or from cable at gage.

CHANNEL AND CONTROL.—Right bank high, is not overflowed; left bank gently sloping and wooded, will be overflowed at extremely high stage. Channel straight for several hundred feet above and for long distance below gage. Control is gravel and boulder riffle; will shift at high stages.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, from water-stage recorder, 89.65 feet from 1 to 3 a. m. May 20 (discharge, 25,400 second-feet); minimum stage from recorder, 80.10 feet at 2.10 a. m. September 20 and 11.45 p. m. September 30 (discharge, 655 second-feet).

1908–1914; 1920–1925: Maximum stage recorded, 94.2 feet at 8 p. m. December 12, 1921 (discharge, 60,000 second-feet); minimum stage, that of September 20 and 30, 1925.

ICE.—Stage-discharge relation seriously affected by ice during severe winters.

DIVERSIONS.—Seattle municipal power plant diverts water directly from river about 3 miles by river above gage, through a pressure tunnel, and returns it to the river at the plant just above gage. The entire low-water flow may be carried through the plant.

REGULATION.—Daily flow partly controlled at very low water by storage and release of water at tunnel intake to accommodate requirements of power plant.

ACCURACY.—Stage-discharge relation changed December 12 and February 2; not affected by ice. Rating curves well defined. Operation of water-stage recorder satisfactory except as noted in footnote to table of daily discharge. Discharge determined by use of discharge integrator except for high water, when daily discharge was ascertained by applying to rating table mean daily gage height determined from recorder graph by inspection or, for days of considerable variation in stage, by averaging results obtained by applying mean gage heights for shorter intervals. Records excellent.

Discharge measurements of Skagit River near Marblemount, Wash., during the year ending September 30, 1925

Date	Gage height	Discharge	Date	Gage height	Discharge	Date	Gage height	Discharge
	Feet	*Sec.-ft.*		*Feet*	*Sec.-ft.*		*Feet*	*Sec.-ft.*
Jan. 7	81.71	2,010	June 1	85.44	8,780	Sept. 13	81.75	2,010
Jan. 18	81.27	1,600	June 4	84.80	7,200	Sept. 16	81.22	1,480
Jan. 19	81.83	2,140	July 30	83.62	4,700			
Feb. 8	83.37	4,020	Aug. 2	83.49	4,360			

[5] White, A. V., Water powers of British Columbia, p. 483, Commission of Conservation, Canada, 1919.

SKAGIT RIVER NEAR CONCRETE, WASH.

LOCATION.—In sec. 16, T. 35 N., R. 8 E., at The Dalles, 2 miles below mouth of Baker River, 2½ miles southwest of Concrete, Skagit County.

DRAINAGE AREA.—2,700 square miles. Area in United States, 2,310 square miles measured on topographic maps and Washington National Forest map, edition of 1922. Area in British Columbia, 390 square miles.[6]

RECORDS AVAILABLE.—September 15, 1924, to September 30, 1925.

GAGE.—Since December 10, 1924, Stevens continuous recorder in concrete shelter, on right bank at The Dalles. Gage used prior to December 10, 1924, was vertical and inclined staff on right bank about 200 feet above present gage. Both gage readings refer to same datum, 163 feet above sea level.

DISCHARGE MEASUREMENTS.—Made from cable three-fourths of a mile below gage.

CHANNEL AND CONTROL.—Control formed by boulder riffle below canyon for low stages and by rock canyon forming The Dalles for high stages.

EXTREMES OF DISCHARGE.—Maximum stage recorded during period September 15, 1924, to September 30, 1925, 19.75 feet at 1 p. m. December 12 (discharge, 92,500 second-feet); minimum daily discharge, estimated at 3,400 second-feet September 30, 1925.

High-water marks at gage height 56.6 feet indicate a flood of 500,000 second-feet to have occurred about 1815. Other floods are known to have occurred about as follows:

Date	Gage height	Discharge	Date	Gage height	Discharge
	Feet	*Sec.-ft.*		*Feet*	*Sec.-ft.*
1856	44.6	350,000	Dec. 30, 1917	33.0	220,000
Nov. 19, 1897	38.4	275,000	Dec. 13, 1921	34.9	240,000
Nov. 30, 1909	36.4	260,000			

DIVERSIONS.—Water is diverted for the operation of Seattle's municipal power plant in sec. 21, T. 37 N., R. 12 E., and at low stage the entire flow at that point may be carried through the plant, but return to the river is made at power plant so that all water passes this station.

REGULATION.—At very low stage flow of upper river is partly controlled by storage and release of water at tunnel intake of Seattle's municipal power plant, to accommodate plant requirements.

ACCURACY.—Stage-discharge relation permanent. Rating curve well defined. Staff gage read to hundredths once daily prior to December 10, 1924. Operation of water-stage recorder, used thereafter, satisfactory except as noted in footnote to table of daily discharge, and except for the period August 25 to September 5, when clogged intake interfered with correct registering of the low-water stages. Discharge September 15 to December 9, 1924, ascertained by applying daily gage height to rating table, thereafter by applying to rating table mean daily gage height obtained from recorder graph by inspection or, for days of considerable variation in stage, by averaging results obtained by applying mean gage heights for shorter intervals. Records good September to November, excellent December to July, and fair August and September.

COOPERATION.—Gage-height record and some discharge measurements furnished by Skagit County.

[6] White, A. V., Water powers of British Columbia, p. 483, Commission of Conservation, Canada, 1919

Monthly discharge of Thunder Creek near Marblemount, Wash., for the year ending September 30, 1925

[Drainage area, 111 square miles]

Month	Discharge in second-feet				Run-off	
	Maximum	Minimum	Mean	Per square mile	Inches	Acre-feet
October	1,970	185	443	3.99	4.60	27,200
November	543	228	315	2.84	3.17	18,700
December	3,060	----------	563	5.07	5.84	34,600
January	313	134	196	1.77	2.04	12,100
February	774	185	323	2.91	3.03	17,900
March	278	166	208	1.87	2.16	12,800
April	1,030	197	522	4.70	5.24	31,100
May	2,420	516	1,300	11.7	13.49	79,900
June	2,660	636	1,400	12.6	14.06	83,300
July	1,910	1,230	1,560	14.1	16.26	95,900
August	1,770	470	1,030	9.28	10.70	63,300
September	906	222	598	5.39	6.01	35,600
The year	3,060	----------	708	6.38	86.60	512,000

SAUK RIVER AT DARRINGTON, WASH.

LOCATION.—In SE. ¼ sec. 24, T. 32 N., R. 9 E., at suspension footbridge, half a mile southeast of Darrington, Snohomish County, 2½ miles below Clear Creek, and 23 miles above mouth of river.

DRAINAGE AREA.—293 square miles (measured on topographic maps).

RECORDS AVAILABLE.—June 15, 1914, to September 30, 1925.

GAGE.—Vertical and inclined staff on right bank at suspension footbridge; installed April 14, 1922; read by Wilber Whaite and E. L. Jackson.

DISCHARGE MEASUREMENTS.—Made by wading or from the suspension footbridge.

CHANNEL AND CONTROL.—Bed composed of gravel and large boulders. Right bank at gage high and not subject to overflow; left bank flat and subject to overflow at extremely high stages.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 7.6 feet, on February 2 (discharge, 10,800 second-feet); higher stage probably occurred on October 25, while gage was not being read. Minimum stage recorded, 1.55 feet on September 30 (discharge, 398 second-feet).

1914–1925: Maximum stage, 15.0 feet at 9 a. m. December 29, 1917, and 4 p. m. December 12, 1921, determined by levels to high-water mark (discharge, 36,000 second-feet); minimum stage recorded, 1.15 feet on March 26, 1922 (discharge, 315 second-feet).

ICE.—Stage-discharge relation only slightly affected by ice during severe winters.

DIVERSIONS.—An average diversion of possibly 10 second-feet is made from a point about one-fourth mile above gage for the purpose of driving shingle bolts to mill pond at Darrington.

REGULATION.—None.

ACCURACY.—Stage-discharge relation practically permanent; not affected by ice. Rating curve well defined below 10,000 second-feet. Gages read to hundredths once daily. Daily discharge ascertained by applying daily gage height to rating table. Records good, except for estimated periods.

COOPERATION.—Gage-height record furnished by United States Forest Service.

BAKER RIVER BELOW ANDERSON CREEK, NEAR CONCRETE, WASH.

LOCATION.—In SE. ¼ sec. 30, T. 37 N., R. 9 E., Whatcom County, 350 feet below Anderson Creek, a quarter of a mile above Baker River ranger station, and 11 miles above Concrete.

DRAINAGE AREA.—184 square miles (measured on topographic maps).

RECORDS AVAILABLE.—September 10, 1910, to October 3, 1925, when station was discontinued.

GAGE.—Stevens continuous water-stage recorder on left bank; installed September 24, 1915; inspected by Charles Bagnell.

DISCHARGE MEASUREMENTS.—Made from cable 300 feet above gage.

CHANNEL AND CONTROL.—Bed composed of boulders and gravel over bedrock; not likely to shift except during extremely high water. Right bank high and rocky; left bank fairly high, wooded, subject to overflow at about 11-foot stage.

EXTREMES OF DISCHARGE.—Maximum stage during period October 1, 1924, to October 3, 1925, occurred during period December 12–15, when recorder was not operating; stage and discharge not determined. Minimum stage from recorder 1.92 feet from 2 to 4 p. m. October 2, 1925 (discharge, 474 second-feet).

1910–1925: Maximum stage recorded, 13.7 feet at 12.30 p. m. December 29, 1917 (discharge, 36,800 second-feet); minimum stage recorded, 1.21 feet on December 15 and 16, 1919 (discharge, 219 second-feet).

ICE.—Stage-discharge relation not affected by ice.

DIVERSIONS.—None.

REGULATIONS.—None.

ACCURACY.—Stage-discharge relation changed at high water December 12–15. Rating curves fairly well defined below 10,000 second-feet. Operation of water-stage recorder satisfactory except as noted in footnote to table of daily discharge. Daily discharge ascertained by applying to rating table mean daily gage height determined from recorder graph by inspection or, for a few days when range of stage was considerable, by averaging results obtained by applying mean gage heights for shorter intervals. Records fair.

The following discharge measurement was made:

September 11, 1925: Gage height, 2.75 feet; discharge, 925 second-feet.

Daily discharge, in second-feet, of Baker River below Anderson Creek, near Concrete, Wash., for the year ending September 30, 1925

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	4,650	1,820	974	1,300	4,160	1,320	828	2,120	2,320	2,680	2,270	1,000
2	3,970	2,630	1,010	1,280	8,180	1,750	828	2,430	2,270	3,100	2,020	990
3	3,370	2,380	1,010	1,200	7,860	1,880	888	2,270	2,070	3,490	1,750	1,080
4	2,070	2,380	1,060	1,120	5,030	1,880	1,040	2,120	1,880	3,490	1,620	1,120
5	1,490	2,020	998	1,240	3,650	1,660	1,200	2,550	1,930	3,180	1,660	1,080
6	1,230	1,580	882	1,200	2,810	1,440	1,360	3,730	2,020	2,880	1,700	1,040
7	1,070	1,670	788	1,050	2,270	1,280	1,480	4,440	1,980	2,430	1,800	1,040
8	1,030	1,490	715	902	1,880	1,160	1,840	3,330	2,320	2,620	1,930	1,040
9	998	1,310	688	881	1,700	1,080	2,680	2,740	2,740	2,950	2,020	998
10	889	1,150	1,870	874	1,480	982	3,730	3,020	2,620	3,410	1,930	960
11	814	1,050	8,500	874	1,360	916	4,070	3,570	2,380	3,820	1,880	975
12	1,110	889		771	1,280	881	4,250	3,490	2,550	3,410	1,800	1,000
13	1,230	801	12,500	730	1,200	847	3,570	3,900	2,740	3,100	1,620	1,040
14	2,600	769		724	1,160	860	2,550	4,440	2,490	3,100	1,440	1,040
15	2,770	775		724	1,080	895	2,220	4,840	3,410	2,880	1,240	968
16	2,170	834	6,000	718	1,040	902	2,880	5,620	3,980	2,950	1,120	1,040
17	1,580	990	4,000	730	975	874	3,730	5,740	3,730	2,950	1,160	909
18	1,270	1,270	3,000	840	930	828	2,880	5,860	3,730	2,620	1,200	847
19	1,110	5,610	2,600	1,280	888	860	2,270	6,250	3,820	2,320	1,360	777
20	1,010	3,530	2,200	1,360	895	902	1,930	6,120	4,070	2,270	1,570	752