DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY
GEORGE OTIS SMITH, DIRECTOR

WATER-SUPPLY PAPER 340—L

STREAM-GAGING STATIONS
AND
PUBLICATIONS RELATING TO WATER RESOURCES
1885–1913

PART XII. NORTH PACIFIC SLOPE DRAINAGE BASINS

COMPILED BY B. D. WOOD

Part of Water-Supply Paper 340

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STREAM-GAGING STATIONS AND PUBLICATIONS RELATING TO WATER RESOURCES, 1885-1913.

Compiled by B. D. Wood.

INTRODUCTION.

Investigation of water resources by the United States Geological Survey has consisted in large part of measurements of the volume of flow of streams and studies of the conditions affecting that flow, but it has comprised also investigation of such closely allied subjects as irrigation, water storage, water powers, underground waters, and quality of waters. Most of the results of these investigations have been published in the series of water-supply papers, but some have appeared in the bulletins, monographs, professional papers, and annual reports.

The results of stream-flow measurements are now published annually in 12 parts, each part covering an area whose boundaries coincide with natural drainage features as indicated below:

Part I. North Atlantic slope basins.
II. South Atlantic slope and eastern Gulf of Mexico basins.
III. Ohio River basin.
IV. St. Lawrence River basin.
V. Upper Mississippi River and Hudson Bay basins.
VI. Missouri River basin.
VII. Lower Mississippi River basin.
VIII. Western Gulf of Mexico basins.
IX. Colorado River basin.
X. Great Basin.
XI. Pacific slope basins in California.
XII. North Pacific slope basins.

HOW GOVERNMENT REPORTS MAY BE OBTAINED OR CONSULTED.

Water-supply papers and other publications of the United States Geological Survey containing data in regard to the water resources of the United States may be obtained or consulted as indicated below.

1. Copies may be obtained free of charge by applying to the Director of the Geological Survey, Washington, D. C. The edition printed for free distribution is, however, small and is soon exhausted.

2. Copies may be purchased at nominal cost from the Superintendent of Documents, Government Printing Office, Washington, D. C., who will on application furnish lists giving prices.

3. Sets of the reports may be consulted in the libraries of the principal cities in the United States.

4. Complete sets are available for consultation in the local offices of the water-resources branch of the Geological Survey, as follows:

Albany, N. Y., Room 18, Federal Building.
Atlanta, Ga., Post Office Building.
Madison, Wis., Capitol Building.
St. Paul, Minn., Old Capitol Building.
Helena, Mont., Montana National Bank Building.
Denver, Colo., 302 Chamber of Commerce Building.
Salt Lake City, Utah, Federal Building.
Boise, Idaho, 615 Idaho Building.
Phoenix, Ariz., 417 Fleming Building.
Portland, Oreg., 416 Couch Building.
Tacoma, Wash., Federal Building.
San Francisco, Cal., 505 Customhouse.
Los Angeles, Cal., Federal Building.
Honolulu, Hawaii, Kapiolani Building.

A list of the Geological Survey's publications will be sent on application to the Director of the United States Geological Survey, Washington, D. C.

STREAM-FLOW REPORTS.

Stream-flow records have been obtained at more than 1,550 points in the United States, and the data obtained have been published in the reports tabulated below:

Stream-flow data in reports of the United States Geological Survey.

[A=Annual Report; B=Bulletin; WS=Water-Supply Paper.]

Report.	Character of data.	Year.
10th A, pt. 2	Descriptive information only	
11th A, pt. 2	Monthly discharge and descriptive information	1884 to September, 1890.
12th A, pt. 2	do	1884 to June 30, 1891.
13th A, pt. 3	Mean discharge in second-feet	1884 to Dec. 31, 1892.
14th A, pt. 2	Monthly discharge (long-time records, 1871 to 1893)	1888 to Dec. 31, 1893.
B 131	Descriptions, measurements, gage heights, and ratings	1893 and 1894.
16th A, pt. 2	Descriptive information only	
B 140	Descriptions, measurements, gage heights, ratings, and monthly discharge (also many data covering earlier years).	1895.
WS 11	Gage heights (also gage heights for earlier years)	1896.
18th A, pt. 4	Descriptions, measurements, ratings, and monthly discharge (also similar data for some earlier years).	1895 and 1896.
WS 15	Descriptions, measurements, and gage heights, eastern United States, eastern Mississippi River, and Missouri River above junction with Kansas.	1897.
WS 16	Descriptions, measurements, and gage heights, western Mississippi River below junction of Missouri and Platte, and western United States.	1897.
19th A, pt. 4	Descriptions, measurements, ratings, and monthly discharge (also some long-time records).	1897.
WS 27	Measurements, ratings, and gage heights, eastern United States, eastern Mississippi River, and Missouri River.	1898.

Stream-flow data in reports of the United States Geological Survey—Continued.

Report.	Character of data.	Year.
WS 28	Measurements, ratings, and gage heights, Arkansas River and western United States.	1898.
20th A, pt. 4	Monthly discharge (also for many earlier years)	1898.
WS 35 to 39	Descriptions, measurements, gage heights, and ratings	1899.
21st A, pt. 4	Monthly discharge	1899.
WS 47 to 52	Descriptions, measurements, gage heights, and ratings	1900.
22d A, pt. 4	Monthly discharge	1900.
WS 65, 66	Descriptions, measurements, gage heights, and ratings	1901.
WS 75	Monthly discharge	1901.
WS 82 to 85	Complete data	1902.
WS 97 to 100	do	1903.
WS 124 to 135	do	1904.
WS 165 to 178	do	1905.
WS 201 to 214	do	1906.
WS 241 to 252	do	1907–8.
WS 261 to 272	do	1909.
WS 281 to 292	do	1910.
WS 301 to 312	do	1911.
WS 321 to 332[a]	do	1912.
WS 351 to 362[a]	do	1913.

[a] In preparation.

The records at most of the stations discussed in these reports extend over a series of years, and miscellaneous measurements at many points other than regular gaging stations have been made each year. An index of the reports containing records obtained prior to 1904 has been published in Water-Supply Paper 119.

The following table gives, by years and drainage basins, the numbers of the papers on surface-water supply published from 1899 to 1913. The data for any particular station will, as a rule, be found in the reports covering the years during which the station was maintained. For example, data for Machias River at Whitneyville, Me., 1903 to 1913, are published in Water-Supply Papers 97, 124, 165, 201, 241, 261, 281, 301, 321, and 351, which contain records for the New England streams from 1903 to 1913. Results of miscellaneous measurements are published by drainage basins.

Numbers of water-supply papers containing results of stream measurements, 1899–1913.

	1899[a]	1900[b]	1901	1902	1903	1904	1905	1906	1907–8	1909	1910	1911	1912	1913
North Atlantic slope	35	47, [c]48	65,75	82	97	[d]124, [e]125 [f]126	[d]165, [e]166 [f]167	[d]201, [e]202 [f]203	241	261	281	301	321	351
South Atlantic slope and eastern Gulf of Mexico	[g]35,36	48	65,75	[g]82,83	[g]97,98	[f]126,127	[f]167,168	[f]203,204	242	262	282	302	322	352
Ohio River basin	36	48, [h]49	65,75	83	98	128	169	205	243	263	283	303	323	353
St. Lawrence River and Great Lakes	36	49	65,75	[i]82,83	97	129	170	206	244	264	284	304	324	354
Hudson Bay and Upper Mississippi River	36	49	[j]65,66,75	[j]83,85	[j]98,99, [k]100	[j]128,130	171	207	245	265	285	305	325	355
Missouri River	[l]36,37	49, [m]50	66,75	84	99	130, [n]131	172	208	246	266	286	306	326	356
Lower Mississippi River	37	50	[j]65,66,75	[j]83,84	[j]98,99	[j]128,131	[j]169, 173	[j]205,209	247	267	287	307	327	357
Western Gulf of Mexico	37	50	66,75	84	99	132	174	210	248	268	288	308	328	358
Colorado River	[o]37,38	50	66,75	85	100	133	175, [p]177	211	249	269	289	309	329	359
Great Basin	38, [q]39	51	66,75	85	100	133, [r]134	176, [r]177	212, [r]213	250, [r]251	270, [r]271	290, [r]291	310	330	360
California	38, [s]39	51	66,75	85	100	134	177	213	251	271	291	311	331	361
North Pacific slope	38	51	66,75	85	100	135	[t]177,178	214	252	272	292	312	[u]332	[u]362

[a] Rating tables and index to Water-Supply Papers 35–39 contained in Water-Supply Paper 39.
[b] Rating tables and index to Water-Supply Papers 47–52 and data on precipitation, wells, and irrigation in California and Utah contained in Water-Supply Paper 52.
[c] Wissahickon and Schuylkill rivers to James River.
[d] New England rivers only.
[e] Hudson River to Delaware River, inclusive.
[f] Susquehanna River to Yadkin River, inclusive.
[g] James River only.
[h] Scioto River.
[i] Lake Ontario and tributaries to St. Lawrence River proper.
[j] Tributaries of Mississippi from east.
[k] Hudson Bay only.
[l] Gallatin River.
[m] Loup and Platte rivers near Columbus, Nebr., and all tributaries below junction with Platte.
[n] Platte and Kansas rivers.
[o] Green and Gunnison rivers and Grand River above junction with Gunnison.
[p] Below junction with Gila.
[q] Mohave River only.
[r] Great Basin in California, excepting Truckee and Carson drainage basins.
[s] Kings and Kern rivers only.
[t] Rogue, Umpqua, and Siletz rivers only.
[u] In three parts: *A*, Pacific slope drainage basins in Washington and upper Columbia River basin; *B*, Snake River basin; *C*, Lower Columbia River basin and Pacific slope drainage basins in Oregon.

In these papers and in the following lists the stations are arranged in downstream order. The main stem of any river is determined by measuring or estimating its drainage area—that is, the headwater stream having the largest drainage area is considered the continuation of the main stream, and local changes in name and lake surface are disregarded. All stations from the source to the mouth of the main stem of the river are presented first, and the tributaries in regular order from source to mouth follow, the streams in each tributary basin being listed before those of the next basin below.

The exceptions to this rule occur in the records for Mississippi River, which are given in four parts, as indicated on page III, and in the records for large lakes, where it is simpler to take up the streams in regular order around the rim of the lake than to cross back and forth over the lake surface.

PART XII. NORTH PACIFIC SLOPE DRAINAGE BASINS.

PRINCIPAL STREAMS.

The largest rivers discharging into the Pacific Ocean in Oregon and Washington are Rogue, Umpqua, and Columbia rivers and streams that reach the ocean through Puget Sound. The principal tributaries of the Columbia are Clark Fork, Kootenai, Spokane, Wenatchee, Yakima, Snake, Bruneau, Boise, Walla Walla, Umatilla, John Day, Deschutes, Hood, and Willamette rivers. Nisqually, Puyallup, White, Snoqualmie, and Skagit rivers flow into Puget Sound. The streams of this division drain wholly or in part the States of Idaho, Montana, Nevada, Oregon, Utah, Washington, and Wyoming.

In addition to the list of gaging stations and the annotated list of publications relating specifically to the section, these pages contain a similar list of reports that are of general interest in many sections and cover a wide range of hydrologic subjects, and also brief references to reports published by State and other organizations. (See p. 168.)

GAGING STATIONS.

NOTE.—Dash after a date indicates that station was being maintained June 30, 1913. Period after a date indicates discontinunce.

BETWEEN KLAMATH RIVER AND COLUMBIA RIVER.

Rogue River, North Fork (head of Rogue River) at Prospect, Oreg., 1907–
Rogue River at Trail, Oreg., 1910–
Rogue River near Tolo, Oreg., 1905–
Rogue River near Galice, Oreg., 1906.
Mill Creek near Prospect, Oreg., 1910.
Big Butte Creek, South Fork (head of Big Butte Creek), at Butte Falls, Oreg., 1910–11.
Little Butte Creek, South Fork (head of Little Butte Creek), near Lake Creek, Oreg., 1910–
Little Butte Creek near Eagle Point, Oreg., 1907–
North Fork of Little Butte Creek near Lake Creek, Oreg., 1911–
Bear Creek at Talent, Oreg., 1907–
Applegate Creek near Buncom, Oreg., 1911–
Applegate Creek at Murphy, Oreg., 1907–1910.
Cameron ditch near Buncom, Oreg., 1911–
Umpqua River, North Fork of South Fork (head of Umpqua River), near Tiller, Oreg., 1910–11.

Umpqua River, South Fork, near Brockway, Oreg., 1905–
Umpqua River near Elkton, Oreg., 1905–
Cow Creek at Riddle, Oreg., 1911–
North Fork of Umpqua River near Hoaglin, Oreg., 1910–
North Fork of Umpqua River near Oak Creek and Winchester, Oreg., 1905–
Mill Creek near Ash, Oreg., 1907–
Siletz River at Siletz, Oreg., 1905–

COLUMBIA RIVER BASIN.

Columbia River at Wenatchee, Wash., 1910.
Columbia River near Julia, Wash., 1905.
Columbia River at Hanford, Wash., 1910.
Columbia River at Pasco, Wash., 1904–1910.
Columbia River at Cascade Locks and The Dalles, Oreg., 1879–
Kootenai River at Libby, Mont., 1910–
Kootenai River near Bonners Ferry, Idaho, 1904.
Kootenai River near Porthill, Idaho, 1904.
Callahan Creek near Troy, Mont., 1911–
Yaak Creek near Troy, Mont., 1910–
Moyie River near Snyder, Idaho, 1911–
Clark Fork at Missoula, Mont., 1898–1907.
Clark Fork at St. Regis, Mont., 1910–
Clark Fork near Plains, Mont., 1910–
Clark Fork at Priest River, Idaho, 1903–1905.
Clark Fork at Newport, Wash., 1904–1910.
Clark Fork at Metaline, Wash., 1908–1910.
Racetrack Creek near Anaconda, Mont., 1911–
Little Blackfoot River and ditch near Elliston, Mont., 1910–
Rock Creek near Quigley, Mont., 1910–
Big Blackfoot River at Bonner, Mont., 1898–1905.
Rattlesnake Creek at Missoula, Mont., 1898–1900.
Bitterroot River, West Fork (head of Bitterroot River), near Darby, Mont., 1910–
Bitterroot River near Grantsdale, Mont., 1902–1907.
Bitterroot River near Missoula, Mont., 1898–1901; 1903–4.
East Fork of Bitterroot River near Darby, Mont., 1910–
Lolo Creek near Lolo, Mont., 1910–
St. Regis River near St. Regis, Mont., 1910–
Flathead River, North Fork (head of Flathead River) near Columbia Falls, Mont., 1910–
Flathead River at Demersville near Kalispell, Mont., 1910–
Flathead River at Damon's ranch near Kalispell, Mont., 1910–
Flathead River at Keller's ranch near Holt, Mont., 1910–
Flathead Lake (on Flathead River) at Polson, Mont., 1908–
Flathead River near Polson, Mont., 1907–
Middle Fork of Flathead River at Belton, Mont., 1910–
Lake McDonald outlet at Lake McDonald, Mont., 1912–
South Fork of Flathead River near Columbia Falls, Mont., 1910–
Swan River near Big Fork, Mont., 1910–11.
Stillwater River near Kalispell, Mont., 1906–7.
Whitefish River near Kalispell, Mont., 1906.
Little Bitterroot Creek near Marion, Mont., 1910–

Columbia River tributaries—Continued.
Clark Fork tributaries—Continued.
Flathead River tributaries—Continued.
Little Bitterroot Creek near Hubbart, Mont., 1909–
Little Bitterroot Creek near Dayton, Mont., 1908–9.
Crow Creek near Ronan, Mont., 1906–
Crow Creek at Lozeau's ranch near Ronan, Mont., 1911–
Mud Creek near Ronan, Mont., 1908–1910.
Mission Creek near St. Ignatius, Mont., 1906–
Dry Creek near St. Ignatius, Mont., 1908–
Post Creek near Ronan, Mont., 1906–1911.
Post Creek near St. Ignatius, Mont., 1912.
Jocko River, North Fork (head of Jocko River), near Jocko, Mont., 1912–
Jocko River near Jocko, Mont., 1908–
Jocko River at Ravalli, Mont., 1906–1911.
Falls Creek near Jocko, Mont., 1912–
South Fork of Jocko River near Jocko, Mont., 1912–
Middle Fork of Jocko River near Jocko, Mont., 1912–
Big Knife Creek near Jocko, Mont., 1908–
Agency Creek near Jocko, Mont., 1908–
Blodgett Creek near Jocko, Mont., 1909–10.
Finley Creek near Jocko, Mont., 1908–
East Finley Creek near Jocko, Mont., 1908–
Indian ditch near Jocko, Mont., 1908–
Valley Creek near Ravalli, Mont., 1908–1911.
Revais Creek near Dixon, Mont., 1911–
Thompson River near Thompson Falls, Mont., 1911–
Prospect Creek near Thompson Falls, Mont., 1911–
Priest River at Priest Lake near Coolin, Idaho, 1912–
Priest River at Falk's ranch near Priest River, Idaho, 1911–
Priest River near Priest River, Idaho, 1903–1905; 1910–11.
Sullivan Lake near Metaline, Wash., 1912–
Sullivan Creek near Metaline, Wash., 1912–
Kettle River at Curlew, Wash., 1911–
Cœur d'Alene River, North Fork (head of Cœur d'Alene River and through Cœur d'Alene Lake of Spokane River) at Prichard, Idaho, 1911–
Cœur d'Alene River near Enaville, Idaho, 1911–12.
Cœur d'Alene River at Cataldo, Idaho, 1911–
Cœur d'Alene Lake at Cœur d'Alene, Idaho, 1903–1910.
Spokane River near Trent, Wash., 1912–
Spokane River at Washington Water Power Co. dam at Spokane, Wash., 1891–1896.
Spokane River at Spokane, Wash., 1896–
Spokane Valley Land & Water Co. canal near Post Falls, Wash., 1911–
Spokane River near Long Lake, Wash., 1912–
Little North Fork of Cœur d'Alene River near Enaville, Idaho, 1911–
St. Joe River at Avery, Idaho, 1911–
St. Joe River near Calder, Idaho, 1911–
Latah [Hangman] Creek at and near Tekoa, Wash., 1904–1905.
North Fork of Latah Creek near Spokane, Wash., 1904–5.
Little Spokane River near Spokane, Wash., 1903–1905; 1911–
San Poil River at Keller, Wash., 1911–

Columbia River tributaries—Continued.
Nespelem River near Nespelem, Wash., 1911–
Okanogan River at Okanogan, Wash., 1911–
Similkameen River near Oroville, Wash., 1911–
Sinlahekin Creek near Loomis, Wash., 1903–1905.
Johnson Creek near Riverside, Wash., 1903–1907.
Salmon Creek near Okanogan (Malott), Wash., 1903–
Methow River at Winthrop, Wash., 1912–
Methow River at Pateros, Wash., 1903–
Twisp River near Twisp, Wash., 1912–
Stehekin River (head of Chelan River) near Stehekin, Wash., 1910–
Chelan Lake at Lakeside, Wash., 1897–1899; 1905.
Chelan Lake at Chelan, Wash., 1910–
Chelan River at Chelan, Wash., 1903–
Railroad Creek at Lucerne, Wash., 1910–
Entiat River at Entiat, Wash., 1910–
Wenatchee River near Chiwaukum, Wash., 1912–
Wenatchee River near Leavenworth, Wash., 1910–
Wenatchee River at Sherman Spur, above Cashmere, near Dryden, Wash., 1909–10.
Wenatchee River at Cashmere, Wash., 1904–
Wenatchee River at Dryden, Wash., 1912–
Wenatchee River at Wenatchee, Wash., 1897.
Wenatchee Valley canal at Dryden, Wash., 1912–
White River near Chiwaukum, Wash., 1911–
Nason Creek near Nason, Wash., 1911–
Chiwawa River near Leavenworth, Wash., 1911–
Chiwaukum Creek near Chiwaukum, Wash., 1911.
Icicle Creek near Leavenworth, Wash., 1911–
Peshastin Creek near Leavenworth, Wash., 1911–
Crab Creek at Wilson Creek, Wash., 1904.
Crab Creek near Adrian, Wash., 1910–
Crab Creek near Ephrata, Wash., 1909.
Moses Lake at Moses Lake, Wash., 1909–
Crab Creek near Warden, Wash., 1909–
Rockyford Creek near Ephrata, Wash., 1910–
Keechelus Lake (on Yakima River) near Martin, Wash., 1906–
Yakima River near Martin, Wash., 1903–
Yakima River at Easton, Wash., 1904; 1910–
Yakima River at Clealum, Wash., 1906–
Yakima River at Umtanum, Wash, 1906–
Yakima River at Selah Gap, near North Yakima, Wash., 1897–8; 1904–5; 1911–
Yakima River at Union Gap, near Yakima, Wash., 1893–
Yakima River near Wapato, Wash., 1908–
Yakima River at Mabton, Wash., 1911–
Yakima River at Prosser, Wash., 1904–1906.
Yakima River at Kiona, Wash., 1895–
Yakima River near Richland, Wash., 1906–1911.
Cabin Creek near Easton, Wash., 1909–
Kachess Lake (on Kachess River) near Easton, Wash., 1905–
Kachess Lake evaporation records, 1907–1910.
Kachess River near Easton, Wash., 1903–
Big Creek near Clealum, Wash., 1909.

Columbia River tributaries—Continued.
Yakima River tributaries—Continued.
Clealum River, North Fork (head of Clealum River), at Galena, Wash., 1907; 1911.
Clealum Lake near Roslyn, Wash., 1906–
Clealum River near Roslyn, Wash., 1903–
Teanaway River below Forks near Clealum, Wash., 1911–
Teanaway River near Clealum, Wash., 1909–
Swauk Creek near Clealum, Wash., 1909–
Taneum Creek near Thorp, Wash., 1909–
Manastash Creek near Ellensburg, Wash., 1909–
Wilson Creek near Thrall, Wash., 1911.
Wenas Creek near Selah, Wash., 1909–1912.
Naches River at Anderson's ranch near Nile, Wash., 1909–
Naches River at Oak Flat near Nile, Wash., 1904–
Naches River below Tieton River near Naches, Wash., 1905; 1909–
Naches River at North Yakima, Wash., 1893–
Bumping Lake (on Bumping River) near Nile, Wash., 1909–
Bumping River at Bumping Lake near Nile, Wash., 1906; 1909–
American River near Nile, Wash., 1909–
Tieton River at McAllister Meadows, near Naches, Wash., 1908–
Tieton River at headworks of Tieton canal, near Naches, Wash., 1906–
Tieton River at Cobb's ranch, near Naches, Wash., 1902–
Atanum Creek, North Fork (head of Atanum Creek) near Tampico, Wash., 1907–
Atanum Creek at The Narrows, near Tampico, Wash., 1908–
Atanum Creek near Yakima, Wash., 1904; 1907–
South Fork of Atanum Creek near Tampico, Wash., 1907–
Toppenish Creek near Fort Simcoe, Wash., 1909–
Toppenish Creek near White Swan (Wapato), Wash., 1909–
Toppenish Creek at railway bridge near Toppenish, Wash., 1894–1896.
Toppenish Creek near Toppenish, Wash., 1908–9.
Toppenish Creek at Alfalfa, Wash., 1909–
Simcoe Creek near Fort Simcoe, Wash., 1909–
Satus Creek near Toppenish, Wash., 1908–
Satus Creek near Alfalfa, Wash., 1905.
Satus Creek near Satus, Wash., 1894–1896.

Canals in Yakima River basin.

Diversions in Kittitas Valley:
Cascade canal near Thorp, Wash., 1905; 1909.
West Kittitas canal near Thorp, Wash., 1904–5; 1909–
Ellensburg Water Co. canal near Ellensburg, Wash., 1904; 1909.
Town canal near Ellensburg, Wash., 1904–5.
Olson canal near Ellensburg, Wash., 1905; 1909.
Bull canal near Ellensburg, Wash., 1909.
Diversions in Yakima and Moxee valleys:
Selah-Moxee canal near Selah, Wash., 1904; 1909.
Taylor canal near Selah, Wash., 1905; 1909.
Moxee canal near North Yakima, Wash., 1904–5; 1909.
Hubbard canal near North Yakima, Wash., 1904–5; 1909.

Columbia River tributaries—Continued.
Yakima River tributaries—Continued.
Diversions in Yakima and Moxee valleys—Continued.
Fowler canal near North Yakima, Wash., 1904–5; 1909.
Granger canal near North Yakima, Wash., 1904; 1909.
Indian Reservation diversions:
New Reservation canal near Yakima, Wash., 1904–
Old Reservation canal near Wapato, Wash., 1904–
Sunnyside canal near Wapato, Wash., 1904–
Sunnyside canal wasteways, 1911.
Sunnyside canal at Zillah, Wash., evaporation records, 1907–8.
Gilbert canal near Toppenish, Wash., 1904.
Hatch canal near Toppenish, Wash., 1904.
Diversions from Lower Yakima
Prosser Falls Irrigation Co.'s canal at Prosser, Wash., 1904.
Benton Water Co.'s canal near Kiona, Wash., 1905.
Kiona canal near Kiona, Wash., 1904–5; 1908–9.
Kiona Water Supply Co.'s canal near Kiona, Wash., 1905.
Grosscup canal near Kiona, Wash., 1905.
Kennewick canal near Kennewick, Wash., 1905.
Diversions from Naches River:
Selah Valley canal near Naches, Wash., 1904–5; 1911–
Tieton canal near Naches, Wash., 1910–
Wapatox canal, upper and lower, near Naches, Wash., 1904–5; 1909.
Clark canal near Naches, Wash., 1905; 1909.
Upper Scott canal near Naches, Wash., 1909.
Lowery canal near Naches, Wash., 1905; 1909.
Kelly canal near Naches, Wash., 1909.
Fortune canal near Naches, Wash., 1905; 1909.
Lower Scott canal near Naches, Wash., 1905; 1909.
Gleed canal near Naches, Wash., 1904–5; 1909–1911.
Morrisey canal near Naches, Wash., 1909.
Congdon (Yakima Valley) canal near Naches, Wash., 1904–5; 1909.
White & Leach canal near Naches, Wash., 1905; 1909.
McCormick canal near Naches, Wash., 1905; 1909.
Schuler & Rodenbach canal near North Yakima, Wash., 1909.
Naches-Cowiche canal near North Yakima, Wash., 1904–5.
Power canal at North Yakima, Wash., 1904–5.
Fruitvale-Schanno canal at North Yakima, Wash., 1909.
R. S. & C. canal at North Yakima, Wash., 1909.
Schanno canal at North Yakima, Wash., 1904–5; 1909.
Broadgage canal near North Yakima, Wash., 1904–5; 1909.
Union canal at North Yakima, Wash., 1904; 1909.
North Yakima Town canal at North Yakima, Wash., 1904; 1909.
Jackson Lake (Snake River) near Moran, Wyo., 1908.
Snake River[1] at Moran, Wyo., 1903–
Snake River[1] at Grovant, Wyo., 1899.
Snake River[1] near Lyon, Idaho, 1903–
Snake River[1] near Heise, Idaho, 1910–
Snake River at Idaho Falls, Idaho, 1889–1893.
Snake River near Blackfoot, Idaho, 1910–
Snake River at Neeley, Idaho, 1906–

[1] Decision of United States Geographic Board; formerly called South Fork of Snake River.

Columbia River tributaries—Continued.
Snake River at Howells Ferry near Minidoka, Idaho, 1910–
Snake River near Minidoka, Idaho, 1895–1899; 1901–1910.
Lake Milner (on Snake River) at Milner, Idaho, 1911–
Snake River at Milner, Idaho, 1909–
Snake River near Twin Falls, Idaho, 1912–
Snake River near Hagerman, Idaho, 1912–
Snake River at King Hill, Idaho, 1909–
Snake River at Weiser, Idaho, 1910–
Snake River at Lewiston, Idaho, 1910–
Snake River near Burbank, Wash., 1907–
Pacific Creek near Moran, Wyo., 1906.
Buffalo River near Elk, Wyo., 1906.
Henrys Fork[1] at Warm River, Idaho, 1910–
Henrys Fork near Ora, Idaho, 1902–1909.
Henrys Fork at Ferry, Idaho, 1890.
Henrys Fork near Rexburg, Idaho, 1909–
Warm River near Warm River, Idaho, 1912–
Robinson Creek near Warm River, Idaho, 1912–
Fall River near Marysville, Idaho, 1902–3.
Fall River at Fremont, Idaho, 1904–1909 (replaces Marysville station).
Fall River at Canyon, Idaho, 1890–1901.
Teton River near St. Anthony, Idaho, 1903–1909.
Teton River at Chase's ranch, Idaho, 1890–1893.
Willow Creek near Prospect, Idaho, 1904.
Blackfoot River near Rossfork, Idaho, 1908– (now called "near Henry").
Blackfoot River near Shelley, Idaho, 1909–
Big Lost River near Chilly, Idaho, 1904–1906; 1907–
Big Lost River near Mackay, Idaho, 1903–1906; 1912–
Thousand Springs Creek near Mackay, Idaho, 1912–
Cedar Creek above forks near Mackay, Idaho, 1912–
Cedar Creek below forks near Mackay, Idaho, 1912–
Little Lost River near Clyde, Idaho, 1910–
Birch Creek near Kaufman, Idaho, 1910–
Camas Creek near Hamer, Idaho, 1912–
Portneuf River above reservoir, near Chesterfield, Idaho, 1912–
Portneuf River below reservoir near Chesterfield, Idaho, 1912–
Portneuf River near Pebble, Idaho, 1910–
Portneuf River near McCammon, Idaho, 1896.
Portneuf River at Pocatello, Idaho, 1897–1899; 1912–
Topons Creek near Pebble, Idaho, 1912–
Birch Creek near Downey, Idaho, 1912–
Raft River near Bridge, Idaho, 1909–
Clear Creek near Naf, Idaho, 1910–
Cassia Creek near Conant, Idaho, 1909–
Goose Creek above Trapper Creek near Oakley, Idaho, 1911–
Goose Creek near Oakley, Idaho, 1909–1911.
Trapper Creek near Oakley, Idaho, 1911–
Birch Creek near Oakley, Idaho, 1912–

[1] Decision of United States Geographic Board; formerly called North Fork of Snake River.

Columbia River tributaries—Continued.
Snake River tributaries—Continued.
Big Cottonwood Creek near Oakley, Idaho, 1909–
Dry Creek near Artesian City, Idaho, 1912–
Rock Creek near Rock Creek, Idaho 1909–
McMullen Creek near Rock Creek, Idaho, 1910; 1912–
Salmon Falls River near San Jacinto, Nev., 1909–
Salmon Falls River near Twin Falls, Idaho, 1909–10.
Cedar Creek near Roseworth, Idaho, 1909–
Devil Creek near Three Creek, Idaho, 1912–
Big Wood River near Gillet, Idaho, 1904–5.
Big Wood River near Hailey, Idaho, 1889.
Big Wood River near Bellevue, Idaho, 1911–
Big Wood River below Magic Dam near Richfield, Idaho, 1911–
Big Wood River near Shoshone, Idaho, 1905–6; 1908–
Big Wood River at Toponis (Gooding?), Idaho, 1896–1899.
Big Wood River near Bliss, Idaho, 1899.
Little Camas Creek near Little Camas Store, Idaho, 1896.
Malad River[1] near Blaine, Idaho, 1912–
Little Wood River near Carey, Idaho, 1904–5.
Little Wood River near Richfield, Idaho, 1911–
Little Wood River at Toponis (Gooding?), Idaho, 1896–1899.
Dry Creek near Blanche, Idaho, 1912–
Little Canyon Creek at Glenns Ferry, Idaho, 1909–
Alkali Creek near Glenns Ferry, Idaho, 1909–
Cold Spring Creek near Hammett, Idaho, 1909–
Bennett Creek near Hammett, Idaho, 1909–
Bruneau River near Tindall, Idaho, 1910–
Bruneau River near Hot Spring, Idaho, 1909–
Bruneau River near Grandview, Idaho, 1895–1903; 1909–
Sheep Creek near Tindall, Idaho, 1910–
Marys Creek at Tindall, Idaho, 1910–
Louse Creek near Wickahoney, Idaho, 1911.
East Fork of Bruneau River near Hot Spring, Idaho, 1910–
Big Flat Creek near Three Creek, Idaho, 1912–
Cherry Creek near Three Creek, Idaho, 1912–
Three Creek near Three Creek, Idaho, 1912–
Deadwood Creek near Three Creek, Idaho, 1912–
Castle Creek near Castle Creek, Idaho, 1910–11.
Succor Creek near Homedale, Idaho, 1903–1910.
Owyhee River at Owyhee, Oreg., 1890–1896; 1903–
Jordan Creek near Jordan Valley, Oreg., 1911–
Boise River near Twin Springs, Idaho, 1911–
Boise River at Dowling's ranch near Arrowrock (Highland), Idaho, 1911–
Boise River near Highland, Idaho, 1905– (replaces the Boise station).
Boise River near Boise, Idaho, 1894–1904.
Boise River at Caldwell, Idaho, 1895–96.
South Fork of Boise River near Prairie, Idaho, 1911–
Grimes Creek near Centerville, Idaho, 1909–10.
Spring Creek near Boise, Idaho, 1912–
Malheur River above South Fork at Riverside, Oreg., 1906–1910.

[1] Decision of United States Geographic Board; formerly called Camas Creek.

Columbia River tributaries—Continued.
Snake River tributaries—Continued.
Malheur River at Riverside, Oreg., 1909–
Malheur River near Harpers ranch, near Westfall, Oreg., 1903–1905.
Malheur River at McLaughlin's bridge, near Vale, Oreg., 1904–1906.
Malheur River at Vale, Oreg., 1890–91; 1895–6; 1903–
Malheur River at Halliday's bridge, near Ontario, Oreg., 1904–5.
South Fork of Malheur River at Riverside, Oreg., 1910–
North Fork of Malheur River near Beulah, Oreg., 1909–
Bully Creek near Westfall, Oreg., 1911–
Bully Creek at Warm Springs near Vale, Oreg., 1903–4; 1905–1907; 1911–
Bully Creek at Vale, Oreg., 1904–5.
Willow Creek near Malheur, Oreg., 1904–5; 1911–
Willow Creek near Brogan, Oreg., 1910–
Willow Creek at Dell, Oreg., 1904–1906.
Cow Creek near Malheur, Oreg., 1912–
Pole Creek near Brogan, Oreg., 1912–
Payette River near Horseshoe Bend, Idaho, 1906–
Payette River at Payette, Idaho, 1895–1897.
North Fork of Payette River at Lardo, Idaho, 1908–
North Fork of Payette River at Van Wyck, Idaho, 1912–
Lake Fork of Payette River near McCall, Idaho, 1909–
Shafer Creek near Horseshoe Bend, Idaho, 1911–
Harris Creek near Horseshoe Bend, Idaho, 1911–
Weiser River near Weiser, Idaho, 1890–91; 1895–1904; 1910–
Weiser River, West Fork, near Fruitvale, Idaho, 1910–
Lost Creek near Tamarack, Idaho, 1911–
Middle Fork of Weiser River at Middle Fork, Idaho, 1910–
Crane Creek near Midvale, Idaho, 1910–
Mann Creek near Weiser, Idaho, 1911–
Monroe Creek (upper station) near Weiser, Idaho, 1912–
Monroe Creek (lower station) near Weiser, Idaho, 1912–
Powder River at Salisbury, Oreg., 1903–1911.
Powder River near Baker, Oreg., 1912–
Powder River near North Powder, Oreg., 1909–
North Powder River near North Powder, Oreg., 1912–
Eagle Creek above West Fork near Baker City, Oreg., 1911.
Eagle Creek near Baker City, Oreg., 1909–10.
West Fork of Eagle Creek near Baker City, Oreg., 1911.
Salmon River near Pierson, Idaho, 1911–
Salmon River at Salmon, Idaho, 1912–
Salmon River near White Bird, Idaho, 1910–
Lake Creek near Stanley, Idaho, 1910–
Valley Creek near Stanley, Idaho, 1910–
Pahsimeroi River near Goldburg, Idaho, 1910–
Goldburg Creek near Goldburg, Idaho, 1910.
Big Creek near Patterson, Idaho, 1910–
Timber Creek near Leadore, Idaho, 1912–
West Fork of Timber Creek near Leadore, Idaho, 1912–
Eightmile Creek near Leadore, Idaho, 1912–
North Fork of Salmon River near North Fork, Idaho, 1912–

Columbia River tributaries—Continued.
Snake River tributaries—Continued.
Salmon River tributaries—Continued.
Grande Ronde River at Hilgard, Oreg., 1903–
Grande Ronde River at Elgin, Oreg., 1903–
Grande Ronde River at Zindel, Wash., 1904–
Catherine Creek near Union, Oreg., 1906–7; 1911–
Wallowa Lake (on Wallowa River) near Joseph, Oreg., 1905–
Wallowa River near Wallowa, Oreg., 1903–1907.
Wallowa River at Minam (near Elgin), Oreg., 1903–
South Fork of Wallowa River near Lostine, Oreg., 1912–
Minam River at Minam, Oreg., 1912–
Asotin Creek near Shelmans ranch near Asotin, Wash., 1904–1906.
Asotin Creek near Asotin, Wash., 1904–5; 1911.
Selway River (head of Clearwater River), near Lowell, Idaho, 1911–
Clearwater River at Kamiah, Idaho, 1910–
Clearwater River near Lewiston, Idaho, 1910–
Lochsa River near Lowell, Idaho, 1910–
South Fork of Clearwater River near Grangeville, Idaho, 1911–
South Fork of Clearwater River at Kooskia, Idaho, 1911–
Lolo Creek at Greer, Idaho, 1912–
Palouse River at Elberton, Wash., 1904–5.
Palouse River at Hooper, Wash., 1897–
Rock Creek near St. John, Wash., 1903–1905.
Cow Creek near Keystone, Wash., 1904–5.
Cow Creek near Hooper, Wash., 1904.

Canals in Snake River basin.

Upper Snake River basin:
Idaho canal near Shelley, Idaho, 1912–
North side Minidoka canal near Minidoka, Idaho, 1909–
South side Minidoka canal near Minidoka, Idaho, 1909–
North side Twin Falls canal near Milner, Idaho, 1909–
South side Twin Falls canal near Milner, Idaho, 1909–
Fort Hall upper canal near Blackfoot, Idaho, 1912–
Fort Hall lower canal near Blackfoot, Idaho, 1912–
Sharp ditch near Mackay, Idaho, 1912–
Streeter ditch near Mackay, Idaho, 1913–
Buckaroo ditch near Hot Spring, Idaho, 1912–
Grandview canal near Comet, Idaho, 1912–
Wilson ditch near Ontario, Oreg., 1904–5.
Owyhee River basin:
Owyhee ditch near Owyhee, Oreg., 1904–5; 1911–
Malheur River basin:
Vines ditch above Vale, Oreg., 1904–5.
Malheur Farmer's canal above Vale, Oreg., 1904–5.
McLaughlin ditch above Vale, Oreg., 1904–5.
"J. H." ditch above Vale, Oreg., 1904–5.
Gellerman & Frohman ditch above Vale, Oregon, 1904–5.
Sand Hollow ditch above Vale, Oreg., 1904–5.
Hope Mill ditch at Vale, Oreg., 1905.
Nevada ditch below Vale, Oreg., 1904–5.

Columbia River tributaries—Continued.
Snake River canals.
On Wallowa River in Grande Ronde basin:
Silver Lake ditch near Joseph, Oreg., 1905.
Farmers and Citizens ditch near Joseph, Oreg., 1905.
Granger ditch at Joseph, Oreg., 1905.
Big Bend ditch at Joseph, Oreg., 1905.
Company ditch near Wallowa, Oreg., 1905.
Walla Walla River near Milton, Oreg., 1903–
Walla Walla River at Whitman, Wash., 1897–1899.
South Fork of Walla Walla River near Milton, Oreg., 1903–
Umatilla River at Gibbon, Oreg., 1896–
Umatilla River at Pendleton, Oreg., 1891–92; 1903–1905.
Umatilla River near Yoakum, Oreg., 1903–
Umatilla River near Umatilla, Oreg., 1903–
North Fork of Umatilla River near Gibbon, Oreg., 1912–
McKay Creek near Pendleton, Oreg., 1903–4.

Canals in Umatilla River basin.

Farmers' mill ditch at Pendleton, Oreg., 1906.
Slusher & Gould ditch near Nolin, Oreg., 1905.
Lisle & Crane ditch near Echo, Oreg., 1905.
Charles Lisle ditch at Echo, Oreg., 1905.
Henrietta mill ditch at Echo, Oreg., 1905.
Wilson & Co.'s ditch at Echo, Oreg., 1905.
Allen ditch at Echo, Oreg., 1905.
Hinckle ditch at Echo, Oreg., 1905.
Pioneer ditch at Echo, Oreg., 1905.
Maxwell ditch at Echo, Oreg., 1905.
Hermiston ditch near Hermiston, Oreg., 1905.
Beitle ditch near Hermiston, Oreg., 1905.
Oregon Land & Water Co.'s ditch at Umatilla, Oreg., 1905.
Brownell ditch at Umatilla, Oreg., 1905.

Willow Creek near Arlington, Oreg., 1905–6.
Rock Creek near Goldendale, Wash., 1912–
Squaw Creek near Goldendale, Wash., 1912–
John Day River near Dayville, Oreg., 1908–
John Day River at McDonald, Oreg., 1904–
South Fork of John Day River at Dayville, Oreg., 1908–
Dayville ditch at Dayville, Oreg., 1910–
Rock Creek near Arlington, Oreg., 1905; 1911.
Big Marsh outlet on Deschutes River near Crescent, Oreg., 1912–
Deschutes River near Crescent, Oreg., 1912–
Deschutes River near Lapine, Oreg., 1910–
Deschutes River at Allen's ranch near Lava, Oreg., 1905; 1908–
Deschutes River at West's ranch near Lava, Oreg., 1906–1909.
Deschutes River at Benham Falls, Oreg., 1909–
Deschutes River at Bend, Oreg., 1904–
Deschutes River at Laidlaw, Oreg., 1909–
Deschutes River near Cline Falls, Oreg., 1910–
Deschutes River at Mecca, Oreg., 1911–
Deschutes River at Moro, Oreg., 1897–1899.

Columbia River tributaries—Continued.

Deschutes River at Moody (Biggs), Oreg., 1906– (replaces Moro station).
Crescent Lake outlet near Crescent, Oreg., 1911–
East Fork of Deschutes River at Crescent, Oreg., 1904–1908; 1910–
West Fork of Deschutes River near Lapine, Oreg., 1910–
West Fork of Deschutes River near Lava, Oreg., 1905–1907; 1909–
Tumalo Creek near Laidlaw and Bend, Oreg., 1906–
Lewis Creek near Laidlaw, Oreg., 1908–9.
Squaw Creek and McAllister ditch near Sisters, Oreg., 1906–
Crooked River near Post, Oreg., 1908–1911.
Crooked River near Prineville, Oreg., 1908–
Ochoco Creek near Howard, Oreg., 1910–11.
Ochoco Creek and Elliott ditch near Prineville, Oreg., 1908–
Metolius River at Allingham ranger station, near Sisters, Oreg., 1910–
Metolius River at Hubbard's ranch, near Sisters, Oreg., 1910–
Metolius River at Riggs's ranch, near Sisters, Oreg., 1908–
Lake Creek near Sisters, Oreg., 1911–
Whitewater Creek near Sisters, Oreg., 1911–
Shitike Creek at Warmspring, Oreg., 1911–
Warm Spring River near Warmspring, Oreg., 1911–
White River near Tygh Valley, Oreg., 1911–
Tygh Creek at Tygh Valley, Oreg., 1911–

Canals in Deschutes River basin.

Central Oregon canal near Bend, Oreg., 1910.
Pilot Butte canal near Bend, Oreg., 1910–
Wimer canal near Laidlaw, Oreg., 1906–
Columbia Southern canal near Laidlaw, Oreg., 1906–

Klickitat River near Glenwood, Wash., 1910–
Klickitat River above and below Big Muddy River near Wright, Wash., 1905; 1907–8.
Klickitat River at Camp Klickitat, Wash., 1908–9.
Klickitat River at Hanson's cable near Klickitat, Wash., 1908–9.
Klickitat River at Klickitat (Wright), Wash., 1907; 1909–
Klickitat River at Wols Ferry, near Lyle, Wash., 1908–1910.
Klickitat River at Lyle, Wash., 1912–
Big Muddy River above mouth of Cougar Creek near Wright, Wash., 1905; 1908–1910.
West Fork of Klickitat River near Goldendale, Wash., 1910–
Little Klickitat River near Goldendale, Wash., 1910–1912.
Hood River at Winans, Wash., 1905–1907; 1910–1912.
Hood River at Tucker's bridge, Wash., 1897–1899.
White Salmon River at splash dam near Trout Lake, Wash., 1912–
White Salmon River at Husum, Wash., 1909–
Trout Creek at Guler, Wash., 1909–
Little White Salmon River below Lava Creek near Cooks, Wash., 1903–1906.[1]
Little White Salmon River near Cooks, Wash., 1909.
Latourelle Creek at Latourelle, Oreg., 1912–
Sandy River above Salmon River at Brightwood, Oreg., 1910–
Sandy River below Salmon River at Brightwood, Oreg., 1907–

[1] Results published in U. S. Geol. Survey Water-Supply Paper 272, pp. 428–429.

Columbia River tributaries—Continued.
Sandy River near Marmot, Oreg., 1911–
Sandy River above Bull Run River near Bull Run, Oreg., 1910–
Sandy River below Bull Run River near Bull Run, Oreg., 1910–
Still Creek near Rowe, Oreg., 1910–
Salmon River near Rowe, Oreg., 1910–
Bull Run River near Bull Run, Oreg., 1907–
Little Sandy River near Bull Run, Oreg., 1911–
Willamette River, Middle Fork (head of Willamette River), near Hazeldell, Oreg., 1911–
Willamette River, Middle Fork, at Jasper, Oreg., 1905–
Willamette River at Springfield, Oreg., 1912–
Willamette River at Eugene, Oreg., 1912–
Willamette River at Albany, Oreg., 1895–
Willamette River at Salem, Oreg., 1910–
Willamette River at Oregon City, Oreg., 1909–
Kelsey River near Hazeldell, Oreg., 1909.
North Fork of Middle Fork of Willamette River near Hazeldell, Oreg., 1909–
Big Fall Creek near Fall Creek, Oreg., 1912.
Coast Fork of Willamette River near Goshen, Oreg., 1905–1912.
Bow River near Disston, Oreg., 1910–
McKenzie River at Clear Lake, Oreg., 1912–
McKenzie River near McKinzie Bridge, Oreg., 1911–
McKenzie River at Martins Rapids, Oreg., 1910–
McKenzie River near Springfield, Oreg., 1905–
Eugene power canal near Walterville, Oreg., 1912–
Santiam River, North Fork (head of Santiam River), near Hoover, Oreg., 1907–
Santiam River, North Fork, at Niagara, Oreg., 1908–
Santiam River, North Fork, at Mehama, Oreg., 1905–1907; 1910.
Santiam River at Jefferson, Oreg., 1905–6; 1908–
Marion Fork of Santiam River at Marion Lake, near Hoover, Oreg., 1907; 1909–
Puzzle Creek near Detroit, Oreg., 1907; 1909–10.
North Fork of Puzzle Creek near Hoover, Oreg., 1909–
South Fork of Puzzle Creek near Hoover, Oreg., 1909–
Permelia Creek near Detroit, Oreg., 1907; 1909–
Whitewater Creek near Detroit, Oreg., 1907.
Breitenbush Creek near Detroit, Oreg., 1910–
South Fork of Santiam River near Cascadia, Oreg., 1910–
South Fork of Santiam River near Foster, Oreg., 1911.
South Fork of Santiam River at Waterloo, Oreg., 1905–1907; 1910–
Middle Fork of Santiam River near Foster, Oreg., 1911.
Luckiamute River near Suver, Oreg., 1905–1911.
Yamhill River, South Fork (head of Yamhill River), at Sheridan, Oreg., 1906–
Yamhill River at La Fayette, Oreg., 1908–
Molalla River near Molalla, Oreg., 1905–1909.
Clackamas River near Cazadero, Oreg.,[1] 1909–
Clackamas River at Estacada, Oreg., 1908–1911.

[1] Evaporation records 1909–10; 1912–

Columbia River tributaries—Continued.
Willamette River tributaries—Continued.
Clackamas River near Barton, Oreg., 1905–1908 (replaced by Estacada station).
Clackamas River at Park Place, Oreg., 1912–
Lewis River above Muddy River near Cougar, Wash., 1909.
Lewis River near Cougar, Wash., 1909–
Lewis River near Amboy, Wash., 1911–
Lewis River at Ariel, Wash., 1909.
Muddy River at mouth, near Cougar, Wash., 1909.
Pine Creek at mouth, near Cougar, Wash., 1909.
Swift Creek at mouth, near Cougar, Wash., 1909.
Kalama River near Kalama, Wash., 1911–
Ohanapecosh River (head of Cowlitz River) near Lewis, Wash., 1911–
Cowlitz River near Lewis, Wash., 1911–
Cowlitz River at Randle, Wash., 1910–
Cowlitz River at Mayfield, Wash., 1910–11.
Clear Fork near Lewis, Wash., 1911–
Coal Creek near Lewis, Wash., 1911–
Lake Creek at mouth near Lewis, Wash., 1911–
Johnson Creek at mouth, near Lewis, Wash., 1911–
Cispus River near Randle, Wash., 1910–
Toutle River at St. Helen, Wash., 1909.
Toutle River near Castle Rock, Wash., 1909–

BETWEEN COLUMBIA RIVER AND PUGET SOUND.

Chehalis River near Centralia, Wash., 1910–11.
Queniult River near Quiniault, Wash., 1912–
Soleduck River near Quillayute, Wash., 1897–1901.
Kalawa River near Forks, Wash., 1897–1901.

PUGET SOUND DRAINAGE BASINS.

Elwha River at McDonald, Wash., 1897–1901.
Elwha River near Port Angeles, Wash., 1911–
Dungeness River at Seguin, Wash, 1897–98.
Dungeness River at Dungeness, Wash., 1897–1901.
Dosewallips River at Brinnon, Wash., 1910–11.
Duckabush River near Duckabush, Wash., 1910–
Skokomish River, North Fork (head of Skokomish River), near Hoodsport, Wash., 1910–11.
Nisqually River near Ashford, Wash., 1910–
Nisqually River near La Grande, Wash., 1906–
Puyallup River near Electron, Wash., 1911–
Carbon River at Fairfax, Wash., 1910–
White River below Forks, near Enumclaw, Wash., 1912–
White River at Buckley, Wash., 1899–1903; 1910–
Greenwater River at mouth, near Enumclaw, Wash., 1912–
Green River at Kanaskat, Wash., 1911.
Cedar River at Vaughn Bridge, near Cedar Lake, Wash., 1898.
Cedar River at Cedar Lake near North Bend, Wash., 1902–3.
Cedar River near Ravensdale, Wash., 1902–
Cedar River near Seattle, Wash., 1895–1898.

Skykomish River, South Fork (head of Skykomish River), near Berlin, Wash., 1910–11.
Skykomish River at Sultan, Wash., 1910–11.
Foss River near Skykomish, Wash., 1911–
East Fork of Foss River near Skykomish, Wash., 1911.
Miller Creek near Berlin, Wash., 1911–
West Fork of Miller Creek near Berlin, Wash., 1911–
North Fork of Skykomish River at Index, Wash., 1910–
Snoqualmie River at Snoqualmie Falls, Wash., 1902–1906.
Pilchuck Creek near Granite Falls, Wash., 1911.
Stillaguamish River, South Fork (head of Stillaguamish River), near Silverton, Wash., 1910–
Stillaguamish River, South Fork, near Robe, Wash., 1902.
Stillaguamish River, South Fork, near Granite Falls, Wash., 1911–
Canyon Creek near Granite Falls, Wash., 1912–
Skagit River near Marblemount, Wash., 1908–
Skagit River near Sedro Woolley, Wash., 1908–
Cascade River near Marblemount, Wash., 1909–
Sauk River above Whitechuck River near Darrington, Wash., 1910.
Sauk River above Clear Creek near Darrington, Wash., 1910–
Sauk River at Suiattle Crossing, near Sauk, Wash., 1910–
Whitechuck River near Darrington, Wash., 1910.
Clear Creek near Darrington, Wash., 1910–
Baker Lake (on Baker River) near Concrete, Wash., 1910–
Baker River below Anderson Creek, near Concrete, Wash., 1910–
Baker River at Concrete, Wash., 1910–
Whatcom Creek near Bellingham, Wash., 1910–
Nooksack River, North Fork (head of Nooksack River), near Glacier, Wash., 1910–11.
Nooksack River near Deming, Wash., 1910–11.
Middle Fork of Nooksack River at ranger station, near Deming, Wash., 1910–11.
Middle Fork of Nooksack River near Deming, Wash., 1910–11.

REPORTS ON WATER RESOURCES OF THE NORTH PACIFIC SLOPE DRAINAGE BASINS.

PUBLICATIONS OF UNITED STATES GEOLOGICAL SURVEY.

WATER-SUPPLY PAPERS.

Water-supply papers are distributed free by the Geological Survey as long as its stock lasts. An asterisk (*) indicates that this stock has been exhausted. Many of the papers marked in this way may, however, be purchased (at price noted) from the SUPERINTENDENT OF DOCUMENTS, WASHINGTON, D. C. Omission of the price indicates that the report is not obtainable from Government sources. Water-supply papers are of octavo size.

*53. Geology and water resources of Nez Perce County, Idaho, Part I, by I. C. Russell. 1901. 86 pp., 10 pls. 10c.

*54. Geology and water resources of Nez Perce County, Idaho, Part II, by I. C. Russell. 1901. 87–141 pp.

Nos. 53 and 54 relate to an area "in western Idaho, bordered on the west by portions of Washington and Oregon," drained through Snake River to the Columbia; they describe the topography, geology, and soils of the region, discuss the relation of the surface features—plateaus, canyons, streams, etc.—to the geology and the climate, the source and quantity of the water supply, including springs and artesian wells, and refer briefly to the occurrence of building stones, lignite, gold, silver, and copper. They include also a short bibliography of artesian waters and two appendices—one giving list of elevations, and the other, notes concerning Portland cement.

55. Geology and water resources of a portion of Yakima County, Wash., by G. O. Smith. 1901. 68 pp., 7 pls. 10c.

Describes topography, climate, soil, agriculture, geologic and surface and underground waters of an area comprising about 50 square miles in the vicinity of North Yakima; discusses in some detail the artesian basins and wells.

57. Preliminary list of deep borings in the United States, Part I (Alabama-Montana), by N. H. Darton. 1902. 60 pp. (See No. 149.) 5c.

61. Preliminary list of deep borings in the United States, Part II (Nebraska-Wyoming), by N. H. Darton. 1902. 67 pp. 5c.

Nos. 57 and 61 contain information as to depth, diameter, yield, and head of water in borings more than 400 feet deep; under head "Remarks" gives information concerning temperature, quality of water, purposes of boring, etc. The lists are arranged by States, and the States are arranged alphabetically. A second revised edition was published in 1905 as Water-Supply Paper 149 (q. v.). 5c.

78. Preliminary report on artesian basins in southwestern Idaho and southeastern Oregon, by I. C. Russell. 1903. 53 pp., 2 pls. 5c.

Discusses briefly the rocks and geologic structure of a part of the Snake River plains in Canyon and Owyhee counties, Idaho, and Malheur and Harney counties, Oreg.; describes briefly the condition on which artesian flow depends, and in some detail the springs and drilled wells in the Lewis, Otis, Harney, and Whitehorse artesian basins; also describes artesian wells in alluvial deposits and discusses the size of drill holes, casings, etc., the preservation of well records, and the importance of laws to govern the use of artesian waters; gives list of publications bearing on artesian waters.

93. Proceedings of first conference of engineers of Reclamation Service, with accompanying papers, compiled by F. H. Newell, chief engineer, 1904. 361 pp. 25c. [Inquiries concerning this report should be addressed to the Reclamation Service.] Contains:

Investigations in Idaho, by D. W. Ross. Describes the irrigable lands in the area drained by Snake River.

Investigations in Oregon, by J. T. Whistler. Mentions the Umatilla, Malheur, and Harney projects.

Work in Washington, by T. A. Noble. Describes the plains of Columbia River.

96. Destructive floods in the United States in 1903, by E. C. Murphy. 1904. 81 pp., 13 pls. 15c.

Gives an account of a flood (commonly spoken of as the "Heppner disaster") on Willow Creek, a tributary of Columbia River, in Morrow County, Oreg.

111. Preliminary report on the underground waters of Washington, by Henry Landes. 1905. 85 pp., 1 pl. 10c.

Describes, by counties, the municipal water supplies, deep wells, and springs in the State, giving also for each county a brief account of the climate, rainfall, topography, drainage, and geology.

118. Geology and water resources of a portion of east-central Washington, by F. C. Calkins. 1905. 96 pp., 4 pls. 5c.

Describes briefly the topography, geology, climate, vegetation, grazing, and agriculture on the Columbia Plains and in the Kittitas Valley; discusses the streams, springs, and shallow and deep wells.

149. Preliminary list of deep borings in the United States, second edition with additions, by N. H. Darton. 1905. 175 pp. 10c.

Gives by States (and within the States by counties), location, depth, diameter, yield, height of water, and other available information, concerning wells 400 feet or more in depth; includes all wells listed in Water-Supply Papers 57 to 61; mentions also principal publications relating to deep borings.

*162. Destructive floods in the United States in 1905, with a discussion of flood discharge and frequency and an index to flood literature, by E. C. Murphy and others. 1906. 105 pp., 4 pls. 15c.

Gives estimates (p. 85) of flood discharge and frequency for Boise River at Boise and Weiser River at Weiser, Idaho; also index to literature on floods on American streams.

253. Water powers of the Cascade Range, Part I: Southern Washington, by J. C. Stevens. 1910. 94 pp., 21 pls. 40c.

Discusses conditions governing hydraulic development, water laws of Washington, and variations in streams; describes the drainage basins of Klickitat, White Salmon, Little White Salmon, Lewis, and Toutle rivers; gives results of observations at gaging stations, estimates of average minimum discharge, and of the available horsepower at the power sites.

274. Some stream waters of the western United States, with chapters on sediment carried by the Rio Grande and the industrial application of water analyses, by Herman Stabler. 1911. 188 pp. 15c.

Describes collection of samples, plan of analytical work, and methods of analyses; discusses soap-consuming power of waters, water softening, boiler waters, and water for irrigation; gives results of analyses of waters of Boise, Malheur, Payette, and Palouse rivers, and Salmon Creek.

313. Water powers of the Cascade Range, Part II: Cowlitz, Nisqually, Puyallup, White, Green, and Cedar drainage basins, by F. F. Henshaw and G. L. Parker. 1913. 170 pp., 16 pls. 55c.

Describes the geologic features and history of the drainage basins, topography and drainage, soils and vegetation, and precipitation; gives stream flow records and discusses water powers, storage, and power sites; discusses also natural resources and harbors of the Pacific Coast, central electric stations, and power utilization, and gives commercial and residential rates. (See also 253.)

316. Geology and water resources of a portion of south-central Washington, by G. A. Waring. 1913. 46 pp., 1 pl. 5c.

Describes settlements, climate and vegetation, agriculture, grazing, geographic province, relation of surface features and structure, and geology; discusses shallow and artesian waters and irrigation enterprises in Sunnyside and Reservation valleys, Horse Heaven Plateau, and the Columbia River plains, and irrigation along lower Yakima River; gives tabulated data concerning wells and springs.

ANNUAL REPORTS.

Each of the papers contained in the annual reports was also issued in separate form. Annual reports are distributed free by the Geological Survey as long as its stock lasts. An asterisk (*) indicates that this stock has been exhausted. Many of the papers so marked, however, may be purchased from the SUPERINTENDENT OF DOCUMENTS, WASHINGTON, D. C.

*Tenth Annual Report of the United States Geological Survey, 1888–89, J. W. Powell, Director. 1890. 2 parts. *Pt. II. Irrigation, viii, 123 pp. 35c.

Makes a preliminary report on the organization and prosecution of the survey of the arid lands for purposes of irrigation; includes an account of the methods of topographic and hydraulic work, the segregation work on reservoir sites and irrigable lands, field and office methods, and brief descriptions of the topography of some of the river basins.

Eleventh Annual Report of the United States Geological Survey, 1889–90, J. W. Powell, Director. 1891. 2 parts. Pt. II. Irrigation, pp. xiv, 395. 30 plates and maps. $1.25. Contains:

*Hydrography, pp. 1–110. Discusses scope of work, methods of stream measurement, rainfall and evaporation, and describes the more important streams.

*Engineering, pp. 111–200. Defines the scope of the work and gives an account of the surveys in the Sun River Basin and in the Arkansas, Rio Grande, California, Lahontan, Utah, and Snake River divisions.

*Topography, pp. 291–343. Comprises reports of the topographic surveys in California, Nevada, Colorado, Idaho, Montana, and New Mexico, and a report on reservoir sites.

*Irrigation literature, pp. 345–388. Gives a list of books and pamphlets on irrigation and allied subjects, mainly contained in the library of the United States Geological Survey.

Twelfth Annual Report of the United States Geological Survey, 1890–91, J. W. Powell, Director. 1891. 2 parts. Pt. II. Irrigation, xviii, 576 pp., 93 pls. $2. Contains:

*Hydrography of the arid regions, by F. H. Newell, pp. 213–361, Pls. LVIII–CVI. Discusses the available water supply of the arid regions, the duty of water, flood waters, relation of rainfall to river flow; classifies the drainage basins; and describes the rivers of the Missouri, Arkansas, Rio Grande, Colorado, Sacramento, and San Joaquin basins, and the principal streams of the Great Basin in Nevada and Utah and the Snake River drainage.

Thirteenth Annual Report of the United States Geological Survey, 1891–92, J. W. Powell, Director. 1892. (Pts. II and III, 1893.) 3 parts, Pt. III, Irrigation, pp. xi, 486, 77 plates. $1.85. Contains:

*Engineering results of irrigation survey, by H. N. Wilson, pp. 351–437, Pls. cxlvii–clxxxii. Describes structures on the Pocatello Canal, Idaho.

*Sixteenth Annual Report of the United States Geological Survey, 1894–95, Charles D. Walcott, Director. 1896. (Pts. II, III, and IV, 1895.) 4 parts. *Pt. II. Papers of an economic character, pp. xix, 598, 43 pls. $1.25. Contains:

The public lands and their water supply, by F. H. Newell, pp. 457–533, Pls. XXXV–XXXIX. Describes general character of the public lands, the lands disposed of (railroad, grant and swamp lands, and private miscellaneous entries), lands reserved (Indian, forest, and military reservations), the vacant lands, and the rate of disposal of vacant lands; discusses the streams, wells, and reservoirs as sources of water supply; gives details for each State.

Nineteenth Annual Report of the United States Geological Survey, 1897–98, Charles D. Walcott, Director. 1898. (Parts II, III, and V, 1899.) 6 parts in 7 vols. and separate case for maps with Pt. V. *Pt. V, Forest reserves, pp. xvii, 400, 110 plates, $1.25. 16 maps in separate case, 75c. Contains:

*Priest River Forest Reserve, by J. B. Leiberg, pp. 217–252, Pls. XLVI–LXI.

*Bitterroot Forest Reserve, by J. B. Lieberg, pp. 253–282, Pls. LXII–LXXIII.

*Washington Forest Reserve, by H. B. Ayres, pp. 283–313, Pls. LXXIV–C.

*Eastern part of Washington Forest Reserve, by M. W. Gorman, pp. 315–349, Pl. CI.

*Forest conditions of northern Idaho, by J. B. Leiberg, pp. 373–386, Pls. CIX–CX.

These reports describe the topography and the streams of the forest reserves.

Twentieth Annual Report of the United States Geological Survey, 1898–99, Charles D. Walcott, Director. 1899. (Parts II, III, IV, V, and VII, 1900.) 7 parts in 8 vols. and separate case for maps with Pt. V. *Pt. V, Forest reserves, pp. xix, 498, 159 plates, 8 maps in separate case. $2.80. Contains:

*Flathead Forest Reserve, by H. B. Ayres, pp. 245–316, Pls. LXXVI–CXIII.

*Bitterroot Forest Reserve, by J. B. Leiberg, pp. 317–409, Pls. CXIV–CXLII. Contains brief descriptions of the streams and lakes in the reserves, state that the water is too poor for use for irrigation.

Twenty-first Annual Report of the United States Geological Survey, 1899–1900, Charles D. Walcott, Director. 1900. (Parts III, IV, VI, VI continued, and VII, 1901.) 7 parts in 8 vols. and separate case for maps with Pt. V. *Pt. V, Forest reserves, 711 pp., 143 pls., 39 maps in separate case. $3.85. Contains:

*Mount Rainier Forest Reserve, Washington, by F. G. Plummer, pp. 81–143, Pls. XXXIII–L.

*Olympic Forest Reserve, Washington, from field notes by Arthur Dodwell and T. F. Rixon, pp. 145–208, Pls. LI–LXX.

*Cascade Forest Reserve, Oregon, from T. 28 S. to T. 37 S., inclusive, together with the Ashland Forest Reserve and adjacent forest regions from T. 28 S. to T. 41 S., inclusive, and from R. 2 W. to R. 14 E., Willamette meridian, inclusive, by J. B. Leiberg, pp. 209–498, Pls. LXXXI–LXXXIV.

Contains descriptions of many of the streams flowing through the forest reserves.

BULLETINS.

An asterisk (*) indicates that the Geological Survey's stock of the paper is exhausted. Many of the papers so marked may be purchased from the SUPERINTENDENT OF DOCUMENTS, WASHINGTON, D. C. Bulletins are of octavo size.

*199. Geology and water resources of the Snake River Plains of Idaho, by I. C. Russell. 1902. 192 pp., 25 pls. 25c.

Describes the topography, geology, climate, vegetation, fauna, and soils of an area extending entirely across the southern part of Idaho; discusses streams, springs, water powers, irrigation and agriculture, industries, routes of transportation and highways; treats of the origin of surface and subsurface waters, the requisite conditions for artesian wells and the quantity of water available.

252. Preliminary report on the geology and water resources of central Oregon, by I. C. Russell. 1905. 138 pp., 24 pls. 15c.

Describes a portion of the extreme northern part of the Great Basin and a part of the drainage area of Deschutes River and its principal tributary, Crooked River; gives an account of the topography, drainage, rainfall and temperature, winds, and forests; describes the volcanic sedimentary rock formations, and discusses by counties the geology and topography, the surface and underground waters; treats of artesian conditions in the Deschutes basin and makes suggestions concerning artesian-well records.

*298. Record of deep-well drilling for 1905, by M. L. Fuller and Samuel Sanford. 1906. 299 pp. 25c.

Gives an account of progress in the collection of well records and samples; contains tabulated records of wells in Idaho, Montana, Nevada, Oregon, Washington, and Wyoming, and detailed records of wells in Benton, Jefferson, and Walla Walla counties, Wash. The wells of which detailed sections are given were selected because they afford valuable stratigraphic information.

GEOLOGIC FOLIOS.

Under the plan adopted for the preparation of a geologic map of the United States the entire area is divided into small quadrangles, bounded by certain meridians and parallels, and these quadrangles, which number several thousand, are separately surveyed and mapped.[1] The unit of survey is also the unit of publication, and the maps and description of each quadrangle are issued in the form of a folio. When all the folios are completed they will constitute a Geologic Atlas of the United States.

A folio is designated by the name of the principal town or of a prominent natural feature within the quadrangle. Each folio includes maps showing the topography, geology, underground structure, and mineral deposits of the area mapped and several pages of descriptive text. The text explains the maps and describes the topographic and geologic features of the country and its mineral products. The topographic map shows roads, railroads, waterways, and, by contour lines, the shapes of the hills and valleys and the height above sea level of all points in the quadrangle. The areal-geology map shows the distribution of the various rocks at the surface. The structural-geology map shows the relations of the rocks to one another underground. The economic-geology map indicates the location of mineral deposits that are commercially valuable. The

[1] Index maps showing areas in the North Pacific slope basins covered by topographic maps and by geologic folios will be mailed on receipt of request addressed to the Director, U. S. Geological Survey, Washington, D. C.

artesian-water map shows the depth to underground-water horizons. Economic-geology and artesian-water maps are included in folios if the conditions in the areas mapped warrant their publication. The folios are of special interest to students of geography and geology and are valuable as guides in the development and utilization of mineral resources.

The folios numbered from 1 to 163, inclusive, are published in only one form (18 by 22 inches), called the library edition. Some of the folios that bear numbers higher than 163 are published also in an octavo edition (6 by 9 inches). Owing to a fire in the Geological Survey building May 18, 1913, the stock of geologic folios was more or less damaged by fire and water, but 80 or 90 per cent of the folios are usable. They will be sold at the uniform price of 5 cents each, with no reduction for wholesale orders. This rate applies to folios in stock from 1 to 184, inclusive (except reprints), also the library edition of folio 186. The library edition of folios 185, 187, and higher numbers sells for 25 cents a copy, except that some folios which contain an unusually large amount of matter sell at higher prices. The octavo edition of folio 185 and higher numbers sells for 50 cents a copy except folio 193, which sells for 75 cents a copy. If 34 folios selling at 25 cents each (or their equivalent in higher-priced folios) are ordered at one time a discount of 40 per cent is allowed; $5.10 is the minimum amount accepted at this rate.

All the folios contain descriptions of the drainage of the quadrangles. The folios in the following list contain also brief discussions of the underground waters in connection with the economic resources of the areas and more or less information concerning the utilization of the water resources.

An asterisk (*) indicates that the stock of the folio is exhausted.

*45. Boise folio, Idaho.

Describes geography and geology, cold springs and cold artesian waters, and hot springs and hot artesian waters.

103. Nampa folio, Idaho-Oregon.

Describes the relief, drainage, climate, and vegetation of the area; discusses the geologic history and geologic formations, and, under "Economic geology," the surface waters available for irrigation, the springs and shallow wells, and the artesian wells; indicates areas of possible artesian flow.

104. Silver City quadrangle, Idaho.

Describes the relief, drainage, climate, vegetation, and culture of the Silver City quadrangle; discusses the geologic history and the geologic formations, and, under "Economic geology," the surface waters available for irrigation or water-power development, warm springs, and artesian wells; notes possible chances for artesian waters; gives records of wells near Enterprise and Duffy; see also Water-Supply Paper 78.

139. Snoqualmie folio, Washington.

Describes the relief and drainage of an area including portions of Kittitas, Yakima, Pierce, and King counties; the stratigraphic, structural, and historical geology, and, under "Economic geology," includes a brief paragraph on the utilization of the water supply.

MISCELLANEOUS REPORTS.

Other Federal bureaus and State and other organizations have from time to time published reports relating to the water resources of various sections of the country. Notable among those pertaining to the northern Pacific coast drainage basins are the reports of

the commissioner of conservation [State of Montana]; the State land commission; the State engineer of Idaho; the Bureau of Industry, Agriculture, and Irrigation of Nevada; the State engineers of Nevada, Oregon, Utah, and Washington; the annual reports of the United States Reclamation Service; and the reports of the Chief of Engineers, U. S. Army. The following reports deserve special mention:

The Oregon system of water titles, by John H. Lewis: Oregon State Engineer Bull. 2, 1912.

State and National water laws, with a detailed statement of the Oregon system of water titles, by John H. Lewis, with a discussion by Clarence T. Johnston and L. J. Le Conte: Am. Soc. Civil Eng. Trans., vol. 76, pp. 637–758, 1913.

Report of the commissioner of conservation [State of Montana] on bills relating to public lands, water rights, and the protection and preservation of the forests: Helena, 1911; also report of the governor of the State of Montana on the same subject.

How to appropriate the public waters of the State of Nevada, compiled by W. M. Kearney, State engineer, 1911.

Requirements and regulations, including suggestions and instructions in relation to the preparation, use, and measurement of water in the State of Nevada: State engineer of Nevada, 1912.

Irrigation pumping in Nevada, etc., by Charles Norcross: Nevada Bur. of Industry, Agr., and Irr. Bull. 8, 1913.

The water resources of Washington: Potable and mineral water, by L. G. Byers; artesian water, by C. A. Ruddy; water power, by R. E. Heine: Washington, Geol. Survey Ann. Rept. for 1901, vol. 1, pt. 5, 1902.

Preliminary report on the Quincy Valley irrigation project, by Henry Landes and others: Washington, Geol. Survey Bull. 14, 1912.

Biennial Report of the State Commission of Arid Lands [Washington], 1895–96 and 1897–98.

The irrigated lands of the State of Washington, by George M. Allen, deputy commissioner: State Bureau of Statistics and Immigration, 1910.

Irrigation laws of the State of Wyoming, prepared for publication in the office of the State engineer, 1909.

GEOLOGICAL SURVEY HYDROLOGIC REPORTS OF GENERAL INTEREST.

The following list comprises reports not readily classifiable by drainage basins and covering a wide range of hydrologic investigations.

WATER-SUPPLY PAPERS.

*1. Pumping water for irrigation, by H. M. Wilson. 1896. 57 pp., 9 pls.

Describes pumps and motive powers, windmills, water wheels, and various kinds of engines; also storage reservoirs to retain pumped water until needed for irrigation.

*3. Sewage irrigation, by G. W. Rafter. 1897. 100 pp., 4 pls. (See Water-Supply Paper 22.) 10c.

Discusses methods of sewage disposal by intermittent filtration and by irrigation; describes utilization of sewage in Germany, England, and France, and sewage purification in the United States.

*8. Windmills for irrigation, by E. C. Murphy. 1897. 49 pp., 8 pls. 10c.

Gives results of experimental tests of windmills during the summer of 1896 in the vicinity of Garden, Kansas; describes instruments and methods and draws conclusions.

*14. New tests of certain pumps and water lifts used in irrigation, by O. P. Hood. 1898. 91 pp., 1 pl. 10c.

Discusses efficiency of pumps and water lifts of various types.

*20. Experiments with windmills, by T. O. Perry. 1899. 97 pp., 12 pls. 15c.

Includes tables and descriptions of wind wheels, makes comparisons of wheels of several types and discusses results.

*22. Sewage irrigation, Part II, by G. W. Rafter. 1899. 100 pp., 7 pls. 15c.

Gives résumé of Water-Supply Paper No. 3; discusses pollution of certain streams, experiments on purification of factory wastes in Massachusetts, value of commercial fertilizers, and describes American sewage disposal plants by States; contains bibliography of publications relating to sewage utilization and disposal.

32. Water resources of Puerto Rico, by H. M. Wilson. 1899. 48 pp., 17 pls. 15c.

Describes briefly topography, climate, rivers, irrigation methods, soils, forestation, water power, and transportation facilities.

*41. The windmill; its efficiency and economic use, Part I, by E. C. Murphy. 1901. 72 pp., 14 pls. 15c.

*42. The windmill; its efficiency and economic use, Part II, by E. C. Murphy. 1901. 75 pp., 2 pls. 10c.

Nos. 41 and 42 give details of results of experimental tests with windmills of various types.

*43. Conveyance of water in irrigation canals, flumes, and pipes, by Samuel Fortier. 1901. 86 pp., 15 pls. 15c.

*44. Profiles of rivers in the United States, by Henry Gannett. 1901. 100 pp., 11 pls. 15c.

Gives elevations and distance along rivers of the United States, also brief descriptions of many of the streams. Arrangement geographic. Many river profiles are scattered through other reports on surface waters in various parts of the United States.

*56. Methods of stream measurement. 1901. 51 pp., 12 pls. 15c.

Describes the methods used by the Survey in 1901–2. (See also Nos. 64, 94, and 95.)

57. Preliminary list of deep borings in the United States, Part I (Alabama-Montana), by N. H. Darton. 1902. 60 pp. (See No. 149.) 5c.

61. Preliminary list of deep borings in the United States, Part II (Nebraska-Wyoming), by N. H. Darton. 1902. 67 pp. 5c.

Nos. 57 and 61 contain information as to depth, diameter, yield, and head of water in borings more than 400 feet deep; under head "Remarks" gives information concerning temperature, quality of water, purposes of boring, etc. The lists are arranged by States, and the States are arranged alphabetically. A second revised edition was published in 1905 as Water-Supply Paper 149 (q. v.). 5c.

64. Accuracy of stream measurements, by E. C. Murphy. 1902. 99 pp., 4 pls. (See No. 95.) 10c.

Describes methods of measuring velocity of water and of measuring and computing stream flow and compares results obtained with the different instruments and methods; describes also experiments and results at the Cornell University hydraulic laboratory. A second, enlarged, edition published as Water-Supply Paper 95.

*67. The motions of underground waters, by C. S. Slichter. 1902. 106 pp., 8 pls. 15c.

Discusses origin, depth, and amount of underground waters; permeability of rocks and porosity of soils; causes, rates, and laws of motions of underground water; surface and deep zones of flow, and recovery of waters by open wells and artesian and deep wells; treats of the shape and position of the water table; gives simple methods of measuring yield of flowing well; describes artesian wells at Savannah, Ga.

72. Sewage pollution in the metropolitan area near New York City and its effect on inland water resources, by M. O. Leighton. 1902. 75 pp., 8 pls. 10c.

Defines "normal" and "polluted" waters and discusses the damage resulting from pollution.

77. The water resources of Molokai, Hawaiian Islands, by Waldemar Lindgren. 1903. 62 pp., 4 pls. 10c.

Describes briefly the topography, geology, coral reefs, climate, soils, vegetation, forests, fauna of the island, the springs, running streams, and wells, and discusses the utilization of the surface and underground waters.

*80. The relation of rainfall to run-off, by G. W. Rafter. 1903. 104 pp. 10c.

Treats of measurements of rainfall and laws and measurements of stream flow; gives rainfall, run-off, and evaporation formulas; discusses effect of forests on rainfall and run-off.

87. Irrigation in India (second edition), by H. M. Wilson. 1903. 238 pp., 27 pls. 25c.

First edition was published in Part II of the Twelfth Annual Report.

93. Proceedings of first conference of engineers of Reclamation Service, with accompanying papers, compiled by F. H. Newell, chief engineer. 1904. 361 pp. 25c.

Contains, in addition to an account of the organization of the hydrographic [water-resources] branch of the United States Geological Survey, and the reports of the conference, the following papers of more or less general interest:

Limits of an irrigation project, by D. W. Ross.
Relation of Federal and State laws to irrigation, by Morris Bien.
Electrical transmission of power for pumping, by H. A. Storrs.
Correct design and stability of high masonry dams, by Geo. Y. Wisner.
Irrigation surveys and the use of the plane-table, by J. B. Lippincott.
The use of alkaline waters for irrigation, by Thomas A. Means.

*94. Hydrographic manual of the United States Geological Survey, prepared by E. C. Murphy, J. C. Hoyt, and G. B. Hollister. 1904. 76 pp., 3 pls. 10c.

Gives instruction for field and office work relating to measurements of stream flow by current meters. (See also No. 95.)

95. Accuracy of stream measurements (second, enlarged, edition), by E. C. Murphy. 1904. 169 pp., 6 pls.

Describes methods of measuring and computing stream flow and compares results derived from different instruments and methods. (See also No. 94.)

103. A review of the laws forbidding pollution of inland waters in the United States; by E. B. Goodell. 1904. 120 pp. (See No. 152.)

Explains the legal principles under which antipollution statutes become operative, quotes court decisions to show authority for various deductions, and classifies according to scope the statutes enacted in the different States.

110. Contributions to the hydrology of eastern United States, 1904; M. L. Fuller, geologist in charge. 1905. 211 pp., 5 pls. 10c.

Contains the following reports of general interest. The scope of each paper is indicated by its title.

Description of underflow meter used in measuring the velocity and direction of underground water, by Charles S. Slichter.

The California or "stovepipe" method of well construction, by Charles S. Slichter.

Approximate methods of measuring the yield of flowing wells, by Charles S. Slichter.

Corrections necessary in accurate determinations of flow from vertical well casings, from notes furnished by A. N. Talbot.

Experiment relating to problems of well contamination at Quitman, Ga., by S. W. McCallie.

Notes on the hydrology of Cuba, by M. L. Fuller.

113. The disposal of strawboard and oil-well wastes, by R. L. Sackett and Isaiah Bowman. 1905. 52 pp., 4 pls. 5c.

The first paper discusses the pollution of streams by sewage and by trade wastes, describes the manufacture of strawboard, and gives results of various experiments in disposing of the waste.

The second paper describes briefly the topography, drainage, and geology of the region about Marion, Ind., the contamination of rock wells and of streams by waste oil and brine.

114. Underground waters of eastern United States; M. L. Fuller, geologist in charge. 1905. 285 pp., 18 pls. 25c.

Contains report on "Occurrence of underground waters," by M. L. Fuller, discussing sources, amount, and temperature of waters, permeability and storage capacity of rocks, water-bearing formation, recovery of water by springs, wells, and pumps, essential conditions of artesian flows, and general conditions affecting underground waters in eastern United States.

115. River surveys and profiles made during 1903, by W. C. Hall and J. C. Hoyt. 1905. 115 pp., 4 pls. 10c.

Contains results of surveys made to determine location of undeveloped power sites.

119. Index to the hydrographic progress reports of the United States Geological Survey, 1888 to 1903, by J. C. Hoyt and B. D. Wood. 1905. 253 pp. 15c.

Scope indicated by title.

120. Bibliographic review and index of papers relating to underground waters published by the United States Geological Survey, 1879–1904, by M. L. Fuller. 1905. 128 pp. 10c.

Scope indicated by title.

122. Relation of the law to underground waters, by D. W. Johnson. 1905. 55 pp. 5c.

Defines and classifies underground waters, gives common-law rules relating to their use, and cites State legislative acts affecting them.

140. Field measurements of the rate of movement of underground waters, by C. S. Slichter. 1905. 122 pp., 15 pls. 15c.

Discusses the capacity of sand to transmit water, describes measurements of underflow in Rio Hondo, San Gabriel, and Mohave River valleys, Cal., and on Long Island, N. Y.; gives results of tests of wells and pumping plants, and describes stovepipe method of well construction.

143. Experiments on steel-concrete pipes on a working scale, by J. H. Quinton. 1905. 61 pp., 4 pls.

Scope indicated by title.

144. The normal distribution of chlorine in the natural waters of New York and New England, by D. D. Jackson. 1905. 31 pp., 5 pls. 10c.

Discusses common salt in coast and inland waters, salt as an index to pollution of streams and wells, the solutions and methods used in chlorine determinations, and the use of the normal chlorine map; gives charts and tables for chlorine in the New England States and New York.

145. Contributions to the hydrology of eastern United States, 1905; M. L. Fuller, geologist in charge. 1905. 220 pp., 6 pls.

Contains brief reports of general interest as follows:

Drainage of ponds into drilled wells, by Robert E. Horton. Discusses efficiency, cost, and capacity of drainage wells, and gives statistics of such wells in southern Michigan.

Construction of so-called fountain and geyser springs, by Myron L. Fuller.

A convenient gage for determining low artesian heads, by Myron L. Fuller.

146. Proceedings of second conference of engineers of the Reclamation Service, with accompanying papers, compiled by F. H. Newell, chief engineer. 1905. 267 pp. 15c.

Contains brief account of the organization of the hydrographic [water-resources] branch and the Reclamation Service, reports of conferences and committees, circulars of instruction, and many brief reports on subjects closely related to reclamation, and a bibliography of technical papers by members of the service. Of the papers read at the conference those listed below (scope indicated by title) are of more or less general interest:

Proposed State code of water laws, by Morris Bien.

Power engineering applied to irrigation problems, by O. H. Ensign.

Estimates on tunneling in irrigation projects, by A. L. Fellows.

Collection of stream-gaging data, by N. C. Grover.

Diamond-drill methods, by G. A. Hammond.

Mean-velocity and area curves, by F. W. Hanna.

Importance of general hydrographic data concerning basins of streams gaged, by R. E. Horton.

Effect of aquatic vegetation on stream flow, by R. E. Horton.

Sanitary regulations governing construction camps, by M. O. Leighton.

Necessity of draining irrigated land, by Thos. H. Means.

Alkali soils, by Thos. H. Means.

Cost of stream-gaging work, by E. C. Murphy.

Equipment of a cable gaging station, by E. C. Murphy.

Silting of reservoirs, by W. M. Reed.

Farm-unit classification, by D. W. Ross.

Cost of power for pumping irrigating water, by H. A. Storrs.

Records of flow at current-meter gaging stations during the frozen season, by F. H. Tillinghast.

147. Destructive floods in United States in 1904, by E. C. Murphy. 15c.

Contains a brief account of "A method of computing cross-section area of waterways," including formulas for maximum discharge and areas of cross section.

149. Preliminary list of deep borings in the United States, second edition with additions, by N. H. Darton. 1905. 175 pp. 10c.

Gives by States (and within the States by counties), location, depth, diameter, yield, height of water, and other available information, concerning wells 400 feet or more in depth; includes all wells listed in Water-Supply Papers 57 and 61; mentions also principal publications relating to deep borings.

150. Weir experiments, coefficients, and formulas, by R. E. Horton. 1906. 189 pp., 38 pls. (See Water-Supply Paper 200.) 15c.

Scope indicated by title.

*151. Field assay of water, by M. O. Leighton. 1905. 77 pp., 4 pls. 10c.

Discusses methods, instruments, and reagents used in determining turbidity, color, iron, chlorides, and hardness in connection with the studies of the quality of water in various parts of the United States.

152. A review of the laws forbidding pollution of inland waters in the United States (second edition), by E. B. Goodell. 1905. 149 pp.

Scope indicated by title.

155. Fluctuations of the water level in wells, with special reference to Long Island, N. Y., by A. C. Veatch. 1906. 83 pp., 9 pls. 25c.

Includes general discussion of fluctuation due to rainfall and evaporation, barometric changes, temperature changes in rivers, changes in lake level, tidal changes, effects of settlement, irrigation, dams, underground water developments, and to indeterminate causes.

*160. Underground water papers, 1906; M. L. Fuller, geologist in charge. 1906. 104 pp., 1 pl.

Gives account of work in 1905, lists of publications relating to underground waters, and contains the following brief reports of general interest:

Significance of the term "artesian," by Myron L. Fuller.
Representation of wells and springs on maps, by Myron L. Fuller.
Total amount of free water in the earth's crust, by Myron L. Fuller.
Use of fluorescein in the study of underground waters, by R. B. Dole.
Problems of water contamination, by Isaiah Bowman.
Instances of improvement of water in wells, by Myron L. Fuller.

*162. Destructive floods in the United States in 1905, with a discussion of flood discharge and frequency and an index to flood literature, by E. C. Murphy and others. 1906. 105 pp., 4 pls. 15c.

163. Bibliographic review and index of underground-water literature published in the United States in 1905, by M. L. Fuller, F. G. Clapp, and B. L. Johnson. 1906. 130 pp. 15c.

Scope indicated by title.

*179. Prevention of stream pollution by distillery refuse, based on investigations at Lynchburg, Ohio, by Herman Stabler. 1906. 34 pp., 1 pl. 10c.

Describes grain distillation, treatment of slop, sources, character, and effects of effluents on streams; discusses filtration, precipitation, fermentation, and evaporation methods of disposal of wastes without pollution.

180. Turbine water-wheel tests and power tables, by R. E. Horton. 1906. 134 pp., 2 pls. 20c.

Scope indicated by title.

*185. Investigations on the purification of Boston sewage, by C.-E. A. Winslow and E. B. Phelps. 1906. 163 pp. 25c.

Discusses composition, disposal, purification, and treatment of sewages and recent tendencies in sewage-disposal practice in England, Germany, and the United States; describes character of crude sewage at Boston, removal of suspended matter, treatment in septic tanks, and purification in intermittent sand filtration and coarse material; gives bibliography.

*186. Stream pollution by acid-iron wastes, a report based on investigations made at Shelby, Ohio, by Herman Stabler. 1906. 36 pp., 1 pl. 10c.

Gives history of pollution by acid-iron wastes at Shelby, Ohio, and resulting litigation; discusses effect of acid-iron liquors on sewage purification processes, recovery of copperas from acid-iron wastes, and other processes for removal of pickling liquor.

*187. Determination of stream flow during the frozen season, by H. K. Barrows and R. E. Horton. 1907. 93 pp., 1 pl. 15c.

Scope indicated by title.

*189. The prevention of stream pollution by strawboard waste, by E. B. Phelps. 1906. 29 pp., 2 pls. 5c.

Describes manufacture of strawboard, present and proposed methods of disposal of waste liquors, laboratory investigations of precipitation and sedimentation, and field studies of amounts and character of water used, raw material and finished product, and mechanical filtration.

*194. Pollution of Illinois and Mississippi rivers by Chicago sewage (a digest of the testimony taken in the case of the State of Missouri *v.* The State of Illinois and the Sanitary District of Chicago), by M. O. Leighton. 1907. 369 pp., 2 pls. 40c.

Scope indicated by amplification of title.

*196. Water supply of Nome region, Seward Peninsula, Alaska, 1906, by J. C. Hoyt and F. F. Henshaw. 1907. 52 pp., 6 pls. 15c.

Gives results of measurements of flow of Alaskan streams, discusses available water supply for ditch and pipe lines and power development; presents notes for investors.

*200. Weir experiments, coefficients, and formulas, revision of paper No. 150, by R. E. Horton. 1907. 195 pp., 38 pls. 35c.

Scope indicated by title.

*218. Water-supply investigations in Alaska, 1906–7 (Nome and Kougarok regions, Seward Peninsula; Fairbanks district, Yukon-Tanana region), by F. F. Henshaw and C. C. Covert. 1908. 156 pp., 12 pls. 25c.

Describes the drainage basins, gives results of observations at the gaging stations, and discusses the water supply of the ditches and pipe lines, and possibilities of development; gives also meteorological records.

*226. The pollution of streams by sulphite pulp waste, a study of possible remedies, by E. B. Phelps. 1908. 37 pp., 1 pl. 10c.

Describes manufacture of sulphite pulp, the waste liquors, and the experimental work leading to suggestions as to methods of preventing stream pollution.

228. Water-supply investigations of the Yukon-Tanana region, Alaska, 1907 and 1908 (Fairbanks, Circle, and Rampart districts), by C. C. Covert and C. E. Ellsworth. 1909. 108 pp., 7 pls. 20c.

Describes the drainage basins; gives results of observations at gaging stations; discusses the water supplies of the ditches and pipe lines and possibilities of hydraulic development.

*229. The disinfection of sewage and sewage filter effluents, with a chapter on the putrescibility and stability of sewage effluents, by E. B. Phelps. 1909. 91 pp., 1 pl. 15c.

Scope indicated by title.

234. Papers on the conservation of water resources. 1909. 96 pp., 2 pls. 15c.

Contains the following papers, whose scope is indicated by their titles: Distribution of rainfall, by Henry Gannett; Floods, by M. O. Leighton; Developed water papers, compiled under the direction of W. M. Steuart, with discussion by M. O. Leighton; Undeveloped water powers, by M. O. Leighton; Irrigation, by F. H. Newell; Underground waters, by W. C. Mendenhall; Denudation, by R. B. Dole and Herman Stabler; Control of catchment areas, by H. N. Parke.

*235. The purification of some textile and other factory wastes, by Herman Stabler and G. H. Pratt. 1909. 76 pp. 10c.

Discusses waste waters from wool-scouring, bleaching, and dyeing cotton yarn, bleaching cotton piece goods, and manufacture of oleomargarine, fertilizer, and glue.

236. The quality of surface waters in the United States: Part I, Analyses of waters east of the one-hundredth meridian, by R. B. Dole. 1909. 123 pp. 10c.

Describes collection of samples, method of examination, preparation of solutions, accuracy of estimates, and expression of analytical results.

238. The public utility of water powers and their governmental regulation, by René Tavernier and M. O. Leighton. 1910. 161 pp. 15c.

Discusses hydraulic power and irrigation, French, Italian, and Swiss legislation relative to the development of water powers, and laws proposed in the French Parliament; reviews work of bureau of hydraulics and agricultural improvement of the French department of agriculture, and gives résumé of Federal and State water-power legislation in the United States.

255. Underground waters for farm use, by M. L. Fuller. 1910. 58 pp., 17 pls. 15c.

Discusses rocks as sources of water supply and the relative safety of supplies from different materials; springs, and their protection; open or dug and deep wells, their location, yield, relative cost, protection, and safety; advantages and disadvantages of cisterns and combination wells and cisterns.

*257. Well-drilling methods, by Isaiah Bowman. 1911. 139 pp., 4 pls. 15c.

Discusses amount, distribution, and disposal of rainfall, water-bearing rocks, amount of underground water, artesian conditions, and oil and gas bearing formations; gives history of well drilling in Asia, Europe, and the United States; describes in detail the various methods and the machinery used; discusses loss of tools and geologic difficulties; contamination of well waters and methods of prevention; tests of capacity and measurement of depth; and costs of sinking wells.

258. Underground water papers, 1910, by M. L. Fuller, F. G. Clapp, G. C. Matson, Samuel Sanford, and H. C. Wolff. 1911. 125 pp., 2 pls. 15c.

Contains the following papers (scope indicated by titles) of general interest:
Drainage by wells, by M. L. Fuller.
Freezing of wells and related phenomena, by M. L. Fuller.
Pollution of underground waters in limestone, by G. C. Matson.
Protection of shallow wells in sandy deposits, by M. L. Fuller.
Magnetic wells, by M. L. Fuller.

*259. The underground waters of southwestern Ohio, by M. L. Fuller and F. G. Clapp, with a discussion of the chemical character of the waters, by R. B. Dole. 1912. 228 pp., 9 pls. 35c.

Describes the topography, climate, and geology of the region, the water-bearing formations, the source, mode of occurrence, and head of the waters, and municipal supplies; gives details by counties; discusses in supplement, under chemical character, method of analysis and expression of results, mineral constituents, effect of the constituents on waters for domestic, industrial, or medicinal uses, methods of purification, chemical composition; many analyses and field assays. The matter in the supplement was also published in Water-Supply Paper 254 (The underground waters of north-central Indiana).

274. Some stream waters of the western United States, with chapters on sediment carried by the Rio Grande and the industrial application of water analyses, by Herman Stabler. 1911. 188 pp. 15c.

Describes collection of samples, plan of analytical work, and methods of analyses; discusses soap-consuming power of waters, water softening, boiler waters, and water for irrigation; gives results of analyses of waters of the Rio Grande and of Pecos, Gallinas, and Hondo rivers.

*280. Gaging stations maintained by the United States Geological Survey, 1888–1910, and Survey publications relating to water resources, compiled by B. D. Wood. 1912. 102 pp. 10c.

314. Surface water supply of Seward Peninsula, Alaska, by F. F. Henshaw and G. L. Parker, with a sketch of the geography and geology by P. S. Smith, and a description of methods of placer mining by A. H. Brooks. 1913. 317 pp., 17 pls. 45c.

Contains results of work at gaging stations.

*315. The purification of public water supplies, by G. A. Johnson. 1913. 84 pp., 8 pls. 10c.

Discusses ground, lake, and river waters as public supplies, development of waterworks systems in the United States, water consumption, and typhoid fever; describes methods of filtration and sterilization of water, and municipal water softening.

*318. Water resources of Hawaii, 1909–1911, by W. F. Martin and C. H. Pierce. 1913. 552 pp., 15 pls. 50c.

Describes the general features of the islands and gives results of measurements of streams and of observations of rainfall and evaporation; contains a gazetteer.

334. The Ohio Valley flood of March–April, 1913 (including comparisons with some earlier floods), by A. H. Horton and H. J. Jackson. 1913. 96 pp., 32 pls. 20c.

Although relating specifically to floods in the Ohio Valley, this report discusses also the causes of floods and the prevention of damage by floods.

336. Water resources of Hawaii, 1912, by C. H. Pierce and G. K. Larrison. 1914. 392 pp. 50c.

Contains results of stream measurements on the islands in 1912.

337. The effects of ice on stream flow, by William Glenn Hoyt. 1913. 76 pp., 7 pls. 15c.

Discusses methods of measuring the winter flow of streams.

ANNUAL REPORTS.

*Fifth Annual Report of the United States Geological Survey, 1883–84, J. W. Powell, Director. 1885. xxxvi, 469 pp., 58 pls. $2.25. Contains:

*The requisite and qualifying conditions of artesian wells, by T. C. Chamberlain, pp. 125 to 173, Pl. XXI. Scope indicated by title.

Twelfth Annual Report of the United States Geological Survey, 1890–91, J. W. Powell, Director. 1891. 2 parts. Pt. II, Irrigation, xviii, 576 pp., 93 pls. $2. Contains:

*Irrigation in India, by H. M. Wilson, pp. 368–561, Pls. CVII to CXLVI. (See Water-Supply Paper 87.)

Thirteenth Annual Report of the United States Geological Survey, 1891–92, J. W. Powell, Director. 1892. (Pts. II and III, 1893.) 3 parts. Pt. III, Irrigation, pp. xi, 486, 77 plates. $1.85. Contains:

*American irrigation engineering, by H. M. Wilson, pp. 101–349, Pls. CXI to CXLV. Discusses the economical aspects of irrigation, alkaline drainage, silt and sedimentation; gives brief history of legislation; describes perennial canals in Idaho-California, Wyoming, and Arizona; discusses water storage at reservoirs of the California and other projects, subsurface sources of supply pumping and subirrigation.

Fourteenth Annual Report of the United States Geological Survey, 1892–93, J. W. Powell, Director. 1893. (Pt. II, 1894.) 2 parts. *Pt. II, Accompanying papers, pp. xx, 597, 73 pls. $2.10. Contains:

*Potable waters of the eastern United States, by W J McGee, pp. 1 to 47. Discusses cistern water, stream waters, and ground waters, including mineral springs and artesian wells.

*Natural mineral waters of the United States, by A. C. Peale, pp. 49–88, Pls. III and IV. Discusses the origin and flow of mineral springs, the source of mineralization, thermal springs, the chemical composition and analysis of spring waters, geographic distribution, and the utilization of mineral waters; gives a list of American mineral spring resorts; contains also some analyses.

Nineteenth Annual Report of the United States Geological Survey, 1897–98, Charles D. Walcott, Director. 1898. (Parts II, III, and V, 1899.) 6 parts in 7 vols. and separate case for maps with Pt. V. *Pt. II, papers chiefly of a theoretical nature, pp. v, 958, 172 plates. $2.65. Contains:

*Principles and conditions of the movements of ground water, by F. H. King, pp. 59–294, Pls. VI to XVII. Discusses the amount of water stored in sandstone, in soil, and in other rocks, the depth to which ground water penetrates; gravitational, thermal, and capillary movements of ground waters, and the configuration of the ground-water surface; gives the results of experimental investigations on the flow of air and water through a rigid, porous media, and through sands, sandstones, and silts; discusses results obtained by other investigators, and summarizes results of observations; discusses also rate of flow of water through sand and rock, the growth of rivers, rate of filtration through soil, interference of wells, etc.

*Theoretical investigation of the motion of ground waters, by C. S. Slichter, pp. 295–384, Pls. XVII. Scope indicated by title.

Twentieth Annual Report of the United States Geological Survey, 1898–99, Charles D. Walcott, Director. 1899. (Parts II, III, IV, V, and VII, 1900.) 7 parts in 8 vols. and separate case for maps with Pt. V. *Pt. IV, Hydrography, vii, 660 pp., 75 plates. $1.40. Contains:

*Hydrography of Nicaragua, by A. P. Davis, pp. 563–637, Pls. LXIV to XXV. Describes the topographic features of the boundary, the lake basin, and Rio San Juan; gives a brief résumé of the boundary dispute, discusses rainfall, temperature, and relative humidity, evaporation, resources, and productions, the ship, railway, and canal projects; gives the history of the investigations by the Canal Commission, and results of measurements on the Rio Grande, on streams tributary to Lake Nicaragua, and on Rio San Juan and its tributaries.

Twenty-second Annual Report of the United States Geological Survey, 1900–1901, Charles D. Walcott, Director. 1901. (Parts III and IV, 1902.) 4 parts. Pt. IV, Hydrography, 690 pp., 65 pls. $2.20. Contains:

*Hydrography of the American Isthmus, by A. P. Davis, pp. 507–630, Pls. XXXVII to L. Describes the physiography, temperature, rainfall, and winds of Central America; discusses the hydrography of the Nicaragua Canal route and the Panama Canal route; gives estimated monthly discharges of many of the streams, rainfall, and evaporation tables at various points.

PROFESSIONAL PAPERS.

*72. Denudation and erosion in the southern Appalachian region and the Monongahela basin, by L. C. Glenn. 1911. 137 pp., 21 pls. 35c.

Describes the topography, geology, drainage, forests, climate and population, and transportation facilities of the region, the relation of agriculture, lumbering, mining, and power development to erosion and denudation, and the nature, effects, and remedies of erosion; gives details of conditions in Holston, Nolichucky, French Broad, Little Tennessee, and Hiwassee river basins, along Tennessee River proper, and in the basins of the Coosa-Alabama system, Chattahoochee, Savannah, Saluda, Broad, Catawba, Yadkin, New, and Monongahela rivers.

BULLETINS.

*32. Lists and analyses of the mineral springs of the United States (a preliminary study), by A. C. Peale. 1886. 235 pp.

Defines mineral waters, lists the springs by States, and gives tables of analyses so far as available.

264. Record of deep-well drilling for 1904, by M. L. Fuller, E. F. Lines, and A. C. Veatch. 1905. 106 pp. 10c.

*298. Record of deep-well drilling for 1905, by M. L. Fuller and Samuel Sanford. 1906. 299 pp. 25c.

Bulletins 264 and 298 discuss the importance of accurate well records to the driller, to owners of oil, gas, and water wells, and to the geologist; describes the general methods of work; gives tabulated records of wells by States, and detailed records selected as affording valuable stratigraphic information.

*319. Summary of the controlling conditions of artesian flows, by Myron L. Fuller, 1908. 10c.

Describes underground reservoirs, the sources of underground waters, the confining agents, the primary and modifying factors of artesian circulation, the essential and modifying factors of artesian flow, and typical artesian systems.

479. The geochemical interpretation of water analyses, by Chase Palmer. 1911. 31 pp. 5c.

Discusses the expression of chemical analyses, the chemical character of water and the properties of natural waters; gives a classification of waters based on property values and reacting values, and discusses the character of the waters of certain rivers as interpreted directly from the results of analyses; discusses also the relation of water properties to geologic formations, silica in river water, and the character of the water of the Mississippi and the Great Lakes and St. Lawrence River as indicated by chemical analyses.

INDEX BY AREAS AND SUBJECTS.

[A=Annual Reports; M=Monograph; B=Bulletin; P=Professional Paper; W=Water-Supply Paper; G F=Geologic folio.]

[1] Many of the reports contain brief subject bibliographies. See abstracts.

[2] Many analyses of river, spring, and well waters are scattered through publications, as noted in abstracts.

INDEX OF STREAMS.