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

WATER-SUPPLY PAPER 286

SURFACE WATER SUPPLY OF THE UNITED STATES

1910

PART VI. MISSOURI RIVER BASIN

PREPARED UNDER THE DIRECTION OF M. O. LEIGHTON

BY

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SURFACE WATER SUPPLY OF MISSOURI RIVER BASIN, 1910.

By W. A. LAMB, W. B. FREEMAN, RAYMOND RICHARDS, and R. C. RICE.

INTRODUCTION.

AUTHORITY FOR INVESTIGATIONS.

This volume contains results of measurements of the flow of certain streams in the United States. The work was performed by the United States Geological Survey, either independently or in cooperation with private or State organizations. The organic law of the Geological Survey (Stat. L., vol. 20, p. 394) contains the following paragraph:

Provided, That this officer [the Director] shall have the direction of the geological survey and the classification of public lands and examination of the geological structure, mineral resources, and products of the national domain.

As water is the most abundant and most valuable of the minerals the investigation of water resources is authorized under the provision for examining mineral resources. The work has been supported since the fiscal year ending June 30, 1895, by appropriations in successive sundry civil bills passed by Congress under the following item:

For gaging the streams and determining the water supply of the United States, and for the investigation of underground currents and artesian wells, and for the preparation of reports upon the best methods of utilizing the water resources.

The various appropriations that have been made for this purpose are as follows:

Annual appropriations for the fiscal year ending June 30—

1895	$12,500
1896	20,000
1897 to 1900, inclusive	50,000
1901 to 1902, inclusive	100,000
1903 to 1906, inclusive	200,000
1907	150,000
1908 to 1910, inclusive	100,000
1911	150,000

SCOPE OF INVESTIGATIONS.

These investigations are not complete nor are they inclusive of all the streams that might purposefully be studied. The scope of the work is limited by the appropriations available. The field covered is the widest and the character of the work is believed to be the best possible under the controlling conditions. The work would undoubtedly have greater scientific importance and ultimately be of more practical value if the money now expended for wide areas were concentrated on a few small drainage basins; but such a course is impossible because general appropriations made by Congress are applicable to all parts of the country. Each part demands its proportionate share of the benefits.

It is essential that records of stream flow shall be kept during a period of years long enough to determine within reasonable limits the entire range of flow from the absolute maximum to the absolute minimum. The length of such a period manifestly differs for different streams. Experience has shown that the records for some streams should cover 5 to 10 years, and those for other streams 20 years or even more, the limit being determined by the relative importance of the stream and the interdependence of the results with other long-time records on adjacent streams.

In the performance of this work an effort is made to reach the highest degree of precision possible with a rational expenditure of time and a judicious expenditure of a small amount of money. In all engineering work there is a point beyond which refinement is needless and wasteful, and this statement applies with especial force to stream-flow measurements. It is confidently believed that the stream-flow data presented in the publications of the Survey are in general sufficiently accurate for all practical purposes. Many of the records are, however, of insufficient length, owing to the unforeseen reduction of appropriations and consequent abandonment of stations. All persons are cautioned to exercise the greatest care in using such incomplete records.

Records have been obtained at nearly 2,000 different points in the United States. The surface water supply of small areas in Seward Peninsula and the Yukon-Tanana region, Alaska, and in Hawaii has also been investigated. During 1910 regular gaging stations were maintained by the Survey and cooperating organizations at about 1,100 points in the United States, and many discharge measurements were made at other points. Data were also obtained in regard to precipitation, evaporation, storage reservoirs, river profiles, and water power in many sections of the country, and will be made available in the regular surface water-supply papers and in special papers from time to time.

PUBLICATIONS.

The data on stream flow collected by the United States Geological Survey have appeared in the annual reports, bulletins, and water-supply papers. Owing to natural processes of evolution and to changes in governmental requirements the character of the work and the territory covered by these different publications have varied greatly. For the purpose of uniformity in the presentation of reports a general plan has been agreed upon by the United States Reclamation Service, the United States Forest Service, the United States Weather Bureau, and the United States Geological Survey, according to which the area of the United States has been divided into twelve parts, whose boundaries coincide with certain natural drainage lines. The areas so described are indicated by the following list of papers on surface water supply for 1910. The dividing line between the north Atlantic and south Atlantic drainage areas lies between York and James rivers.

Papers on surface water supply of the United States, 1910.

Part.	No.	Title.
I	281	North Atlantic coast.
II	282	South Atlantic coast and eastern Gulf of Mexico.
III	283	Ohio River basin.
IV	284	St. Lawrence River basin.
V	285	Upper Mississippi River and Hudson Bay basins.
VI	286	Missouri River basin.
VII	287	Lower Mississippi River basin.
VIII	288	Western Gulf of Mexico.
IX	289	Colorado River basin.
X	290	Great basin.
XI	291	California.
XII	292	North Pacific coast.

The following table gives the character of data regarding stream flow at regular stations to be found in the various publications of the United States Geological Survey, exclusive of special papers:

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

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

Report.	Character of data.	Year.
10th A., pt. 2	Descriptive information only	
11th A., pt. 2	Monthly discharge	1884 to Sept., 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.
W S. 11	Gage heights (also gage heights for earlier years).	1896.
18th A., pt. 4	Descriptions, measurements, ratings, and monthly discharge (also similar data for earlier years).	1895 and 1896.
W S. 15	Descriptions, measurements, and gage heights, eastern United States, eastern Mississippi River, and Missouri River above junction with Kansas.	1897.

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

Report.	Character of data.	Year.
W S. 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.
W S. 27	Measurements, ratings, and gage heights, eastern United States, eastern Mississippi River, and Missouri River.	1898.
W S. 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.
W S. 35 to 39	Descriptions, measurements, gage heights, and ratings	1899.
21st A., pt. 4	Monthly discharge	1899.
W S. 47 to 52	Descriptions, measurements, gage heights, and ratings	1900.
22d A., pt. 4	Monthly discharge	1900.
W S. 65, 66	Descriptions, measurements, gage heights, and ratings	1901.
W S. 75	Monthly discharge	1901.
W S. 82 to 85	Complete data	1902.
W S. 97 to 100	do	1903.
W S. 124 to 135	do	1904.
W S. 165 to 178	do	1905.
W S. 201 to 214	Complete data, except descriptions	1906.
W S. 241 to 252	Complete data	1907–8.
W S. 261 to 272	do	1909.
W S. 281 to 292	do	1910.

NOTE.—No data regarding stream flow are given in the fifteenth and seventeenth annual reports.

The records at most of the stations discussed in these reports extend over a series of years. An index of the reports containing records prior to 1904 has been published in Water-Supply Paper 119.

The first table which follows gives, by years and drainage basins, the numbers of the papers on surface water supply published from 1899 to 1910. Wherever the data for a drainage basin appear in two papers the number of one is placed in parentheses and the portion of the basin covered by that paper is indicated in the second table. For example, in 1904 the data for Missouri River were published in Water-Supply Papers 130 and 131, and the portion of the records contained in Water-Supply Paper 131, as indicated by the second table, is that relating to Platte and Kansas rivers.

Numbers of water-supply papers containing results of stream measurements, 1899–1910.

	1899[a]	1900[b]	1901	1902	1903
Atlantic coast and eastern Gulf of Mexico:					
New England rivers	35	47	65,75	82	97
Hudson River to Delaware River, inclusive	35	47,(48)	65,75	82	97
Susquehanna River to York River, inclusive	35	48	65,75	82	97
James River to Yadkin River, inclusive	(35),36	48	65,75	(82),83	(97),98
Santee River to Pearl River, inclusive	36	48	65,75	83	98
St. Lawrence River	36	49	65,75	(82),83	97
Hudson Bay			66,75	85	100
Mississippi River:					
Ohio River	36	48,(49)	65,75	83	98
Upper Mississippi River	36	49	65,75	83	98,(99)
Missouri River	(36),37	49,(50)	66,75	84	99
Lower Mississippi River	37	50	(65), 66,75	(83),84	(98),99
Western Gulf of Mexico	37	50	66,75	84	99
Pacific coast and Great Basin:					
Colorado River	(37),38	50	66,75	85	100
Great Basin	38,(39)	51	66,75	85	100
South Pacific coast to Klamath River, inclusive	(38),39	51	66,75	85	100
North Pacific coast	38	51	66,75	85	100

[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.

Numbers of water-supply papers containing results of stream measurements, 1899–1910— Continued.

	1904	1905	1906	1907–8	1909	1910
Atlantic coast and eastern Gulf of Mexico:						
New England rivers	124	165	201	241	261	281
Hudson River to Delaware River, inclusive	125	166	202	241	261	281
Susquehanna River to York River, inclusive	126	167	203	241	261	281
James River to Yadkin River, inclusive	126	167	203	242	262	282
Santee River to Pearl River, inclusive	127	168	204	242	262	282
St. Lawrence River	129	170	206	244	264	284
Hudson Bay	130	171	207	245	265	285
Mississippi River:						
Ohio River	128	169	205	243	263	283
Upper Mississippi River	128, (130)	171	207	245	265	285
Missouri River	130, (131)	172	208	246	266	286
Lower Mississippi River	(128), 131	(169), 173	(205). 209	247	267	287
Western Gulf of Mexico	132	174	210	248	268	288
Pacific coast and Great Basin:						
Colorado River	133, (134)	175, (177)	211, (213)	249, (251)	269, (271)	289, (291)
Great Basin	133, (134)	176, (177)	212, (213)	250, (251)	270, (271)	290, (291)
South Pacific coast to Klamath River, inclusive	134	177	213	251	271	291
North Pacific coast	135	(177), 178	214	252	272	292

Numbers of water-supply papers containing data covering portions of drainage basins.

No.	River basin.	Tributaries included.
35	James	
36	Missouri	Gallatin.
37	Colorado	Green, Gunnison, Grand above junction with Gunnison.
38	Sacramento	Except Kings and Kern.
39	Great Basin	Mohave.
48	Delaware	Wissahickon and Schuylkill.
49	Ohio	Scioto.
50	Missouri	Loup and Platte near Columbus, Nebr. All tributaries below junction with Platte.
65	Lower Mississippi	Yazoo.
82	James	
	St. Lawrence	Lake Ontario, tributaries to St. Lawrence River proper.
83	Lower Mississippi	Yazoo.
97	James	
98	Lower Mississippi	Do.
99	Upper Mississippi	Tributaries from the west.
128	Lower Mississippi	Yazoo.
130	Upper Mississippi	Tributaries from the west.
131	Missouri	Platte, Kansas.
134	Colorado	Data near Yuma, Ariz., repeated.
	Great Basin	Susan, Owens, Mohave.
169	Lower Mississippi	Yazoo.
177	Colorado	Below junction with Gila.
	Great Basin	Susan repeated, Owens, Mohave.
	North Pacific coast	Rogue, Umpqua, Siletz.
205	Lower Mississippi	Yazoo, Homochitto.
213	Colorado	Data at Hardyville repeated; at Yuma, Salton Sea.
	Great Basin	Owens, Mohave.
251	Colorado	Yuma and Salton Sea stations repeated.
271	Great Basin	Owens River basin.
291		

The order of treatment of stations in any basin in these papers is downstream. The main stem of any river is determined by measuring or estimating the 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. Records for all stations from the source to the mouth of the main stem of the river are presented first, and records for the tributaries in regular order from source to mouth follow, all records in each tributary basin being given 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 above, 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.

DEFINITION OF TERMS.

The volume of water flowing in a stream—the "run-off" or "discharge"—is expressed in various terms, each of which has become associated with a certain class of work. These terms may be divided into two groups—(1) those which represent a rate of flow, as second-feet, gallons per minute, miner's inches, and run-off in second-feet per square mile, and (2) those which represent the actual quantity of water, as run-off in depth in inches and acre-feet. The units used in this series of reports are second-feet, feet per square mile, and run-off in inches and acre-feet. They may be defined as follows:

"Second-foot" is an abbreviation for cubic foot per second and is the rate of discharge of water flowing in a stream 1 foot wide, 1 foot deep, at a rate of 1 foot per second. It is generally used as a fundamental unit from which others are computed by the use of the factors given in the following table of equivalents.

"Second-feet per square mile" is the average number of cubic feet of water flowing per second from each square mile of area drained, on the assumption that the run-off is distributed uniformly both as regards time and area.

"Run-off in inches" is the depth to which the drainage area would be covered if all the water flowing from it in a given period were conserved and uniformly distributed on the surface. It is used for comparing run-off with rainfall, which is usually expressed in depth in inches.

"Acre-foot" is equivalent to 43,560 cubic feet, and is the quantity required to cover an acre to the depth of 1 foot. It is commonly used in connection with storage for irrigation work.

CONVENIENT EQUIVALENTS.

The following is a list of convenient equivalents for use in hydraulic computations:

1 second-foot equals 40 California miner's inches (law of March 23, 1901).
1 second-foot equals 38.4 Colorado miner's inches.
1 second-foot equals 40 Arizona miner's inches.
1 second-foot equals 7.48 United States gallons per second; equals 448.8 gallons per minute; equals 646,272 gallons for one day.
1 second-foot equals 6.23 British imperial gallons per second.
1 second-foot for one year covers 1 square mile 1.131 feet or 13.572 inches deep.
1 second-foot for one year equals 31,536,000 cubic feet.
1 second-foot equals about 1 acre-inch per hour.
1 second-foot for one day covers 1 square mile 0.03719 inch deep.
1 second-foot for one 28-day month covers 1 square mile 1.041 inches deep.
1 second-foot for one 29-day month covers 1 square mile 1.079 inches deep.
1 second-foot for one 30-day month covers 1 square mile 1.116 inches deep.
1 second-foot for one 31-day month covers 1 square mile 1.153 inches deep.
1 second-foot for one day equals 1.983 acre-feet.
1 second-foot for one 28-day month equals 55.54 acre-feet.
1 second-foot for one 29-day month equals 57.52 acre-feet.
1 second-foot for one 30-day month equals 59.50 acre-feet.
1 second-foot for one 31-day month equals 61.49 acre-feet.
100 California miner's inches equals 18.7 United States gallons per second.
100 California miner's inches equals 96.0 Colorado miner's inches.
100 California miner's inches for one day equals 4.96 acre-feet.
100 Colorado miner's inches equals 2.60 second-feet.
100 Colorado miner's inches equals 19.5 United States gallon per second.
100 Colorado miner's inches equals 104 California miner's inches.
100 Colorado miner's inches for one day equals 5.17 acre-feet.
100 United States gallons per minute equals 0.223 second-foot.
100 United States gallons per minute for one day equals 0.442 acre-foot.
1,000,000 United States gallons per day equals 1.55 second-feet.
1,000,000 United States gallons equals 3.07 acre-feet.
1,000,000 cubic feet equals 22.95 acre-feet.
1 acre-foot equals 325,850 gallons.
1 inch deep on 1 square mile equals 2,323,200 cubic feet.
1 inch deep on 1 square mile equals 0.0737 second-foot per year.
1 foot equals 0.3048 meter.
1 mile equals 1.60935 kilometers.
1 mile equals 5,280 feet.
1 acre equals 0.4047 hectare.
1 acre equals 43,560 square feet.
1 acre equals 209 feet square, nearly.
1 square mile equals 2.59 square kilometers.
1 cubic foot equals 0.0283 cubic meter.
1 cubic foot equals 7.48 gallons.
1 cubic foot of water weighs 62.5 pounds.
1 cubic meter per minute equals 0.5886 second-feet.
1 horsepower equals 550 foot-pounds per second.
1 horsepower equals 76.0 kilogram-meters per second.
1 horsepower equals 746 watts.
1 horsepower equals 1 second-foot falling 8.80 feet.
1⅓ horsepower equals about 1 kilowatt.

To calculate water power quickly: $\frac{\text{Sec.-ft.} \times \text{fall in feet}}{11}$ = net horsepower on water wheel realizing 80 per cent of theoretical power.

EXPLANATION OF DATA.

For each drainage basin there is given a brief general description covering such items as area, source, tributaries, topography, geology, forestation, rainfall, irrigation, storage, power, and other interesting or important facts.

For each regular current-meter gaging station the following data, so far as available, are given: Description of station, list of discharge measurements, table of daily gage heights, table of daily discharges, table of monthly and yearly discharges and run-off. For stations located at weirs or dams the gage-height table is omitted.

In addition to statements regarding the location and installation of current-meter stations, the descriptions give information in regard to any conditions which may affect the constancy of the relation of gage height to discharge, covering such points as ice, logging, shifting channels, and backwater; also information regarding diversions which decrease the total flow at the measuring section. Statements are also made regarding the accuracy and reliability of the data.

The discharge-measurement table gives the results of the discharge measurements made during the year, including the date, name of hydrographer, width and area of cross section, gage height, and discharge in second-feet.

The table of daily gage heights records the daily fluctuations of the surface of the river as found from the mean of the gage readings taken each day. At most stations the gage is read in the morning and in the evening. The gage height given in the table represents the elevation of the surface of the water above the zero of the gage. All gage heights affected by the presence of ice in the streams or by backwater from obstructions are published as recorded, with suitable footnotes. The rating table is not applicable for such periods unless the proper corrections to the gage heights are known and applied. Attention is called to the fact that the zero of the gage is placed at an arbitrary datum and has no relation to zero flow or the bottom of the river. In general the zero is located somewhat below the lowest known flow, so that negative readings shall not occur.

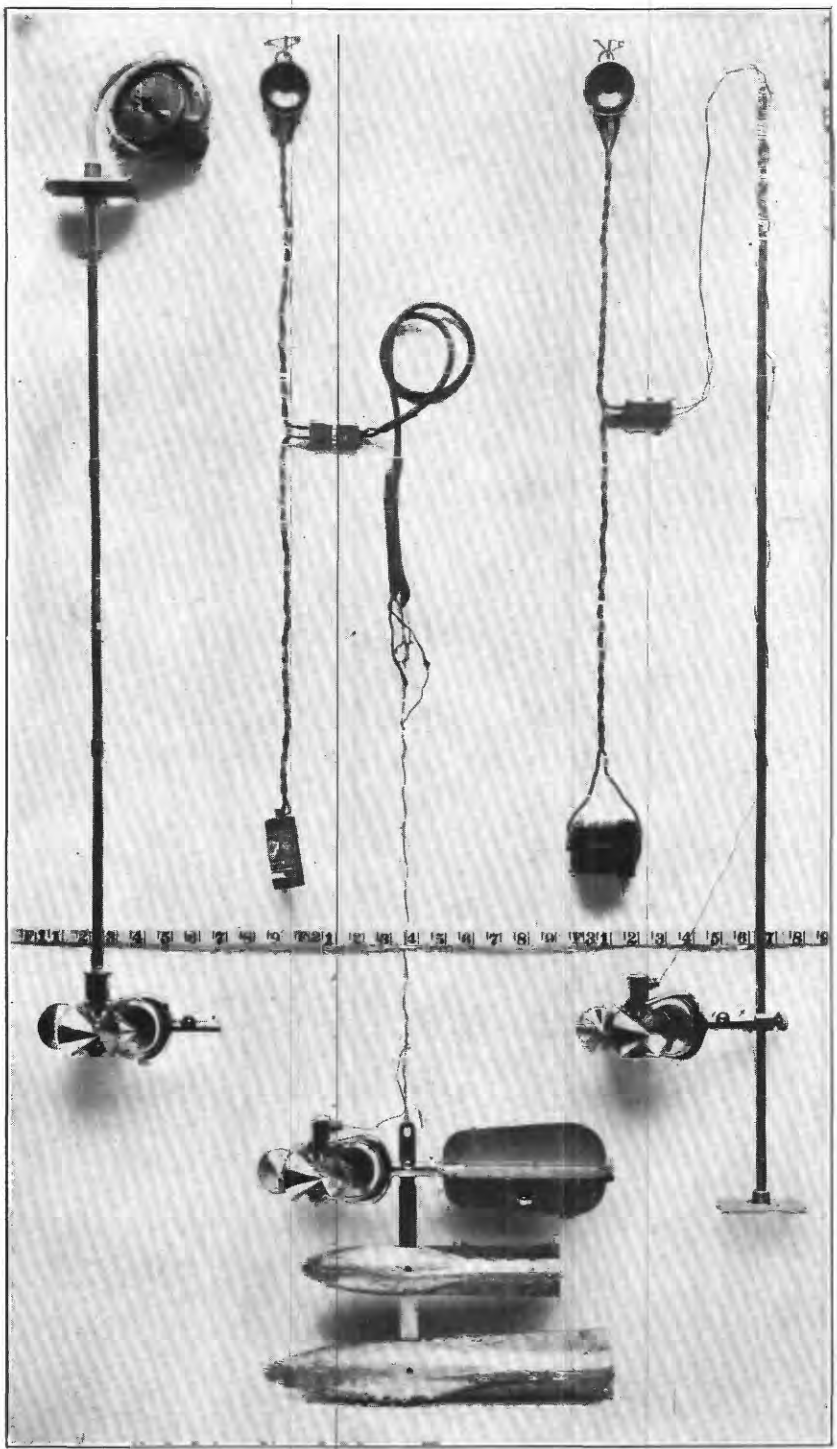
The discharge measurements and gage heights are the base data from which rating tables, daily discharge tables, and monthly discharge tables are computed.

The rating table gives, either directly or by interpolation, the discharge in second-feet corresponding to every stage of the river recorded during the period for which it is applicable. It is not published in this report, but can be determined from the daily gage heights and daily discharges for the purpose of verifying the published results as follows:

A. FOR BRIDGE MEASUREMENT.

B. FOR WADING MEASUREMENT.

TYPICAL GAGING STATIONS.



SMALL PRICE CURRENT METERS.

First plot the discharge measurements for the current and earlier years on cross-section paper, with gage heights in feet as ordinates and discharge in second-feet as abscissas. Then tabulate a number of gage heights taken from the daily gage-height table for the complete range of stage given and the corresponding discharges for the days selected from the daily discharge table and plot the values on cross-section paper. The last points plotted will define the rating curve used and will lie among the plotted discharge measurements. After drawing the rating curve, a table can be developed by scaling off the discharge in second-feet for each tenth foot of gage height. These values should be so adjusted that the first differences shall always be increasing or constant, except for known backwater periods.

The table of daily discharges gives the discharges in second-feet corresponding to the observed gage heights as determined from the rating tables.

In the table of monthly discharge the column headed "Maximum" gives the mean flow, as determined from the rating table, for the day when the mean gage height was highest. As the gage height is the mean for the day, it does not indicate correctly the stage when the water surface was at crest height and the corresponding discharge was consequently larger than given in the maximum column. Likewise, in the column of "Minimum" the quantity given is the mean flow for the day when the mean gage height was lowest. The column headed "Mean" is the average flow in cubic feet for each second during the month. On this the computations for the remaining columns, which are defined on page 6, are based.

The field methods used in the collection of the data presented in this series of reports are described in the introductory sections of Water-Supply Papers 261 to 272, inclusive, "Surface water supply of the United States, 1909." Plate I shows typical gaging stations, indicating the method of suspending the current meter; Plate II shows the various types of current meters [1] used in the work. A sample rating curve is shown in figure 1 (p. 166).

ACCURACY AND RELIABILITY OF FIELD DATA AND COMPARATIVE RESULTS.

The accuracy of stream-flow data depends primarily on the natural conditions at the gaging station and on the methods and care with which the data are collected. Errors of the first group depend on the degree of permanency of channel and of permanency of the relation between discharge and stage.

[1] See Hoyt, J. C., and others, Use and care of current meter as practiced by the U. S. Geological Survey: Trans. Am. Soc. Civil Eng., vol. 66, 1910, p. 70.

Errors of the second class are due, first, to errors in observation of stage; second, to errors in measurements of flow, and, third, to errors due to misinterpretation of stage and flow data.

Practically all discharge measurements made under fair conditions are well within 5 per cent of the true discharge at the time of observation. Inasmuch as the errors of meter measurements are largely compensating, the mean rating curve, when well defined, is much more accurate than the individual measurements. Numerous experiments made to test the accuracy of current-meter work show that it compares very favorably with the results from standard weirs and, owing to simplicity of methods, usually gives results that are much more reliable than those from stations at dams, where the coefficient may be uncertain and conditions of flow are complicated.

The work is, of course, dependent on the reliability of the gage observers. With relatively few exceptions the observers perform their work honestly. The records are, however, closely watched, and the cause of any discrepancy is investigated. It is obvious that one gage reading a day does not always give the mean height for that day. As an almost invariable rule, however, errors from this source are compensating and virtually negligible in a period of one month, although a single day's reading may, when taken by itself, be considerably in error.

An effort is made to visit every station at least once each year for the purpose of making a measurement to determine the constancy of conditions of flow since the last measurement made in the preceding year, and also to check the elevation of the gage. On account of lack of funds or for other causes some stations were not visited during the current year. If conditions of flow have been reasonably permanent up to the time of the last preceding measurement, it is considered best to publish estimates of discharge based on the latest verified rating curve rather than to omit them altogether, although it should be distinctly understood that such records are at times subject to considerable error. This is also true, although to a less degree, of the period of records since the date of the last measurement of the current year. As a rule, the accuracy notes are based on the assumption that the rating curve used is strictly applicable to the current year.

In order to give engineers and others information regarding the probable accuracy of the computed results, footnotes are added to the daily discharge tables, stating the probable accuracy of the rating tables used, and an accuracy column is inserted in the monthly discharge table. For the rating tables "well defined" indicates, in general, that the rating is probably accurate within 5 per cent; "fairly well defined," within 10 per cent; "poorly defined" or "approximate," within 15 to 25 per cent. These notes are very general and are based

on the plotting of the individual measurements with reference to the mean rating curve.

The accuracy column in the monthly discharge table does not apply to the maximum or minimum nor to any individual day, but to the monthly mean. It is based on the accuracy of the rating, the probable reliability of the observer, and knowledge of local conditions. In this column A indicates that the mean monthly flow is probably accurate within 5 per cent; B, within 10 per cent; C, within 15 per cent; D, within 25 per cent. Special conditions are covered by footnotes.

In general, the base data which are collected in the field each year by the Survey engineers are published, not only to comply with the law, but also for the express purpose of giving to any engineer the opportunity of examining the computed results and of changing and adjusting them as may seem best to him. Although it is believed that the rating tables and computed monthly discharges are as good as the base data up to and including the current year will warrant, it should always be borne in mind that the additional data collected at each station from year to year nearly always throw new light on data already collected and published, and hence allow more or less improvement in the computed results of earlier years. It is therefore expected that the engineer who makes serious use of the figures presented in these papers will verify all ratings and make such adjustments for earlier years as may seem necessary. The work of compiling, studying, revising, and republishing data for different drainage basins for 5 or 10 year periods or more is carried on by the United States Geological Survey so far as the funds for such work are available.

The estimates in the table of monthly discharge are so arranged as to give only a general idea of the conditions of flow at the station, and it is not expected that they will be used for other than preliminary estimates.

The daily discharges are published to allow a more detailed study of the variation in flow and to determine the periods of deficient flow.

COOPERATIVE DATA.

Cooperative data of various kinds and data regarding the run-off at many stations maintained wholly by private funds are incorporated in the surface water-supply reports of the United States Geological Survey.

Many stations throughout the country are maintained for specific purposes by private parties who supply the records gratuitously to the United States Geological Survey for publication. When such

records are furnished by responsible parties and appear to be reasonably accurate, they are verified, so far as possible, and estimated values of accuracy are given. Records clearly worthless or misleading are not published. As it is, however, impossible to completely verify all such records furnished—because of lack of funds or for other causes—they are published for what they are worth, as they are of value as a matter of record and afford at least approximate information regarding stream flow at the particular localities. The Survey does not, however, assume any responsibility for inaccuracies found in such records, although most of them are believed to be reasonably good.

COOPERATION AND ACKNOWLEDGMENTS.

Much of the work in Montana has been carried on under cooperative agreement with the United States Reclamation Service, the work being done by the Geological Survey and the expense borne by the Reclamation Service. The State engineer of Montana has a fund available for this work, which is expended in accordance with paragraph 3, section 2244 of the revised codes of 1907 of the State of Montana, which reads as follows:

> The State engineer shall become conversant with the waterways of the State and the needs of the State as to irrigation matters, shall make, or cause to be made, measurements and calculations of the ordinary and flood discharge of streams, cooperating in this work as much as possible with the United States Geological Survey and the Montana Experiment Station; such measurements to be made on streams in order of their importance, provided that measurements already made, if deemed reliable, may be adopted.

This fund has been expended chiefly for observers' salaries and field work on stations in connection with Carey projects. From July 1 to December 31, 1910, a State hydrographer was employed, whose salary and traveling expenses were paid from this fund and whose time was spent in stream-gaging work under the direction of the Geological Survey.

Since July, 1910, several stations have been maintained in the western part of the State in cooperation with the Forest Service; the gage observations being made by the forest rangers and occasional discharge measurements being made by the district engineer of the Forest Service.

Acknowledgments are due to the Great Northern and Northern Pacific railway companies for transportation furnished during the year.

The following tables show the amounts appropriated and expended for hydrographic work in the Missouri River basin in Montana in 1910, and the distribution of expenditures.

Statement of hydrographic work in the Missouri River drainage basin in Montana, calendar year 1910.

Appropriations:	
United States Geological Survey	$6,833.39
United States Reclamation Service	2,996.14
Total Government funds	9,829.53
State of Montana	2,036.00
Total expenditures for maintenance of river stations and allied investigations	11,865.53
Number of stations maintained	88
Number of stream gagings made	401
Cost per station	$134.84
Cost per gaging	$29.59
Distribution of expenditures:	
Field services	per cent. 38
Office services	do. 15
Traveling expenses	do. 29
Supplies and equipment	do. 7
Lost time (Sundays, holidays, etc.)	do. 6
Rent and storage	do. 2
General	do. 3

Special acknowledgments are due to the following persons:

Mr. E. C. Simmons, State engineer of Nebraska, who spent over $500 on stream-gaging work under a cooperative contract with the United States Geological Survey.

Mr. C. W. Comstock, State engineer of Colorado, who paid the salaries of the gage observers and the expenses of the United States Geological Survey engineers, amounting to several hundred dollars. He also furnished a number of records, published in this paper, for stations which his office maintained independently of the United States Geological Survey.

Mr. George B. McFadden, an engineer representing a Denver company, who spent several hundred dollars in the maintenance of two stations on the Cache la Poudre in cooperation with the United States Geological Survey. He has contributed a number of valuable photographs taken on Cache la Poudre River, some of which are reproduced in this report.

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Thanks are also due to the United States Weather Bureau, the Denver Union Water Co., the Denver Reservoir & Irrigation Co., and all other companies and persons who have rendered assistance and furnished records.

DIVISION OF WORK.

The work in the upper Missouri River drainage basin was under the direction of William A. Lamb, district engineer, assisted by Raymond Richards, M. E. McChristie, John C. Beebe, Benjamin E. Jones, junior engineers, and C. S. Heidel, State hydrographer.

The work in North Dakota was carried on by E. F. Chandler, assistant engineer.

The field data for the Missouri River drainage area in Colorado and Nebraska and the North Platte and Upper Bighorn basins in Wyoming were collected under the direction of W. B. Freeman, district engineer, assisted by G. H. Russell, H. D. Padgett, G. J. Lyon, S. T. Harding, E. O. Christiansen, and Arthur Dobson. The work in Nebraska was under the more immediate direction of Mr. E. C. Simmons, State engineer, and some of the stream-gaging work was done by his assistants.

The ratings and special estimates were made and the completed data prepared for publication by Raymond Richards and R. C. Rice. Computations have been made by G. C. Stevens, J. G. Mathers, J. J. Phelan, H. D. Padgett, and M. E. McChristie. The report has been edited by Mrs. B. D. Wood.

GAGING STATIONS MAINTAINED IN THE MISSOURI RIVER DRAINAGE BASIN.

The following list comprises the gaging stations maintained in the Missouri River drainage basin by the United States Geological Survey and cooperative parties. Data for these stations have been published in the reports listed on pages 3 to 5. The stations are arranged by river basins, in downstream order, tributaries of main streams being indicated by indention. (See p. 6.)

Red Rock River (head of Missouri) at Lima, Mont., 1907–1910.
Red Rock River at Red Rock, Mont., 1890.
Beaverhead River (continuation of Red Rock River) at Barratts, Mont., 1907–1910.
Beaverhead River at Dillon, Mont., 1907.
Jefferson River (continuation of Red Rock-Beaverhead River) near Sappington, Mont., 1896–1905.
Jefferson River near Silverstar, Mont., 1910.
Missouri River near Townsend, Mont., 1895–1904.
Missouri River at Canyon Ferry, Mont., 1889.
Missouri River near Craig, Mont., 1890–1902.
Missouri River at Cascade, Mont., 1902–1910.
Missouri River at Great Falls, Mont., 1897–1905.
Missouri River at Fort Benton, Mont., 1910.
Missouri River near Williston, N. Dak., 1905–1907.
Missouri River at Mannhaven, N. Dak., 1904.
Missouri River at Washburn, N. Dak., 1905.
Missouri River near Bismarck, N. Dak., 1904–5.

Missouri River at Kansas City, Mo., 1905–6.
Bighole River near Dewey, Mont., 1910.
Pipestone Creek near Whitehall, Mont., 1910.
Whitetail Creek near Whitehall, Mont., 1910.
Madison River near Red Bluff, Mont., 1890–1893.
Madison River near Norris, Mont., 1897–1905, 1910.
Madison River near Three Forks, Mont., 1895–1897.
West Gallatin River (head of Gallatin River) near Salesville, Mont., 1895–1905, 1910.
West Gallatin River near Bozeman, Mont., 1889–1893.
Gallatin River at Logan, Mont., 1895–1905.
Middle Creek near Bozeman, Mont., 1895–96, 1898–1900, 1901.
Crow Creek near Radersburg, Mont., 1903.
Prickly Pear Creek near Clancy, Mont., 1908–1910.
Prickly Pear Creek at East Helena, Mont., 1908–1910.
Lump Gulch Creek at Clancy, Mont., 1908–1910.
Tenmile Creek near Helena, Mont., 1908–1910.
Sevenmile Creek near Birdseye, Mont., 1908–1910.
Little Prickly Pear Creek near Marysville, Mont., 1909–10.
Little Prickly Pear Creek near Canyon Creek, Mont., 1909–10.
Deadman Creek near Marysville, Mont., 1909–10.
Lost Horse Creek near Marysville, Mont., 1909–10.
Marsh Creek near Marysville, Mont., 1909–10.
Dearborn River near Clemons, Mont., 1908–1910.
Falls Creek near Clemons, Mont., 1908–1910.
Smith River at Truly, Mont., 1905–1907.
Sun River (North Fork) near Augusta, Mont., 1889–90, 1903–1910.
Sun River at Sun River, Mont., 1905–1910.
Sun River near Great Falls, Mont., 1897.
Willow Creek near Augusta, Mont., 1910.
Sun River (South Fork) at Augusta, Mont., 1904–1910.
Ford Creek near Augusta, Mont., 1906–1910.
Smith Creek near Augusta, Mont., 1906–1910.
Belt Creek near Belt, Mont., 1905–6.
Highwood Creek near Highwood, Mont., 1905–6.
Marias River near Shelby, Mont., 1902–1907.
Two Medicine River near Midvale, Mont., 1902–3.
Two Medicine River at Family, Mont., 1907–1910.
Badger Creek near Family, Mont., 1907–1910.
Cutbank Creek at Cutbank, Mont., 1905–1910.
Birch Creek near Dupuyer, Mont., 1907–1910.
Dupuyer Creek at Dupuyer, Mont., 1908–1910.
Teton River at Chouteau, Mont., 1905–6.
Teton River near Belleview (Strabone) Mont., 1905–6, 1908–1910.
Judith River near Lewistown, Mont., 1910.
Musselshell River (North Fork) near Delpine, Mont., 1909–10.
Musselshell River (North Fork) near Martinsdale, Mont., 1907–1910.
Musselshell River at Harlowton, Mont., 1907–1910.
Musselshell River at Shawmut, Mont., 1902–1907.
Musselshell River at Lavina, Mont., 1906.
Checkerboard Creek near Delpine, Mont., 1909–10.
Musselshell River (South Fork) near Martinsburg, Mont., 1907–1910.
American Fork near Harlowton, Mont., 1907–1910.
Lebo Creek near Harlowton, Mont., 1907–1910.

Missouri River—Continued.
- Milk River (South Fork) near Browning, Mont., 1905–1910.
- Milk River at Havre, Mont., 1898–1910.
- Milk River at Chinook, Mont., 1897.
- Milk River at Malta, Mont., 1902–1910.
- Milk River at Hinsdale, Mont., 1908–9.
  - Milk River (West Fork) at Chinook, Mont., 1906–1908.
  - Milk River (North Fork) near Chinook, Mont., 1906–1910.
  - Beaver Creek near (Ashfield) Saco, Mont., 1903–1906, 1908–1910.
  - Beaver Creek overflow near Bowdoin, Mont., 1903–1906, 1908–1910.
  - Rock Creek near Hinsdale, Mont., 1905–1907.
  - Porcupine Creek near Nashua, Mont., 1908–1910.
  - Canals in the Milk River Basin—
    - Paradise Valley canal near Chinook, Mont., 1903–1909.
    - Cook canal near Chinook, Mont., 1905–1910.
    - Matheson canal near Chinook, Mont., 1905–6, 1908–1910.
    - Reser ditch near Chinook, Mont., 1905–6.
    - West Fork ditch near Chinook, Mont., 1905–6.
    - Harlem canal near Zurich, Mont., 1904–1906, 1908–1910.
    - Agency ditch near Harlem, Mont., 1905–1910.
    - Fort Belknap canal near Chinook, Mont., 1903–1910.
    - Winter Anderson canal near Chinook, Mont., 1906, 1908.
    - Rock Creek canal near Hinsdale, Mont., 1905–1907.
- Little Porcupine Creek near Frazer, Mont., 1908–1910.
- Wolf Creek at Wolf Point, Mont., 1908–1910.
- Wolf Point ditch at Wolf Point, Mont., 1909–10.
- Poplar Creek near Poplar, Mont., 1908–1910.
- Big Muddy River near Culbertson, Mont., 1908–1910.
- Yellowstone River at Corwin Springs, Mont., 1910.
- Yellowstone River near Horr, Mont., 1888–1893.
- Yellowstone River at Livingston, Mont., 1897–1905.
- Yellowstone River at Billings, Mont., 1904–5.
- Yellowstone River at Huntley, Mont., 1907–1910.
- Yellowstone River at Junction, Mont., 1906–7.
- Yellowstone River at Glendive, Mont., 1897–1910.
  - Big Timber Creek (North Fork) near Big Timber, Mont., 1907–1910.
  - Big Timber Creek (South Fork) near Big Timber, Mont., 1907–1910.
  - Boulder River near Contact, Mont., 1910.
    - Boulder River (East Fork) near McLeod, Mont., 1907–1909.
    - Boulder River (West Fork) near Bruffeys, Mont., 1907–1910.
    - Boulder River (West Fork) near McLeod, Mont., 1907–1910.
  - Sweetgrass Creek above Melville, Mont., 1907–1910.
  - Sweetgrass Creek below Melville, Mont., 1907–1910.
  - Stillwater River near Absarokee, Mont., 1910.
    - Rosebud River at Absarokee, Mont., 1910.
  - Clark Fork at Fromberg, Mont., 1906–1910.
  - Pryor Creek near Huntley, Mont., 1904–1910.
  - Big Wind River (head of Bighorn) near Wind River, Wyo., 1908–9.
  - Big Wind River near Riverton, Wyo., 1906–1908.
  - Bighorn River at Thermopolis, Wyo., 1900–1905, 1910.
  - Bighorn River near Hardin, Mont., 1904–1910.
    - Red Creek near Dubois, Wyo., 1909.
    - Dinwoody Creek near Crowheart, Wyo., 1909.
    - Dry Creek at Crowheart, Wyo., 1909.

Missouri River—Continued.
Yellowstone River—Continued.
Bighorn River—Continued.
Meadow Creek near J. K. ranch, Wyo., 1909.
Willow Creek at J. K. ranch, Wyo., 1909.
Bull Lake Creek near J. K. ranch, Wyo., 1909.
Little Wind River at Fort Washakie, Wyo., 1908–9.
Little Wind River above Arapahoe Agency, Wyo., 1906–1909.
Little Wind River below Arapahoe Agency, Wyo., 1906–1909.
Little Wind River (South Fork) near Wind River, Wyo., 1909.
St. Lawrence Creek near Wind River, Wyo., 1909.
Trout Creek at Wind River, Wyo., 1909.
Little Popo Agie River at Hudson, Wyo., 1907–1909.
Owl Creek near Thermopolis, Wyo., 1910.
No Wood River at Bonanza, Wyo., 1910.
Tensleep Creek near Tensleep, Wyo., 1910.
Paint Rock Creek near Bonanza, Wyo., 1910.
Greybull River near Meeteese, Wyo., 1897, 1903, 1910.
Wood River near Meeteese, Wyo., 1910.
Shoshone River at Cody, Wyo., 1902–1910.
Shoshone River at Corbett Dam, Wyo., 1908–1910.
Shoshone River near Lovell, Wyo., 1897–1899.
Shoshone River (South Fork) at Marquette, Wyo., 1903–1908.
Little Bighorn River at Crow Agency, Mont., 1905–6.
Prairie Dog ditch near Story, Wyo., 1903.
Tongue River near Dayton, Wyo., 1903.
Big Goose Creek near Sheridan, Wyo., 1895–1897.
Little Goose Creek near Sheridan, Wyo., 1896-97.
Powder River:
Clear Creek at Buffalo, Wyo., 1896–1904.
Piney Creek at Kearney, Wyo., 1902–1906.
Cruez ditch near Story, Wyo., 1903.
Little Muddy River near Williston, N. Dak., 1904–1909.
Little Missouri River at Alzada, Mont., 1904–1906.
Little Missouri River at Camp Crook, S. Dak., 1903–1906.
Little Missouri River at Medora, N. Dak., 1903–1908.
Knife River at (near) Broncho, N. Dak., 1903–1910.
Painted Woods Creek near Washburn, N. Dak., 1909–10.
Turtle Creek near Washburn, N. Dak., 1909–10.
Heart River near Richardton, N. Dak., 1903–1910.
Apple Creek near Bismarck, N. Dak., 1905.
Cannon Ball River at Stevenson, N. Dak., 1903–1909.
Grand River (North Fork) at Haley, N. Dak., 1908–1910.
Grand River near Seim, S. Dak., 1904–1906.
Owl (Moreau) River near Bixby, S. Dak., 1904–1906.
Cheyenne River at Edgemont, S. Dak., 1903–1906.
Beaver Creek near Edgemont, S. Dak., 1905–6.
Hat Creek near Edgemont, S. Dak., 1905–6.
Battle Creek near Hermosa, S. Dak., 1903.
Spring Creek near Rapid, S. Dak., 1903–1906.
Rapid Creek at Rapid, S. Dak., 1903–1906.
Box Elder Creek at Blackhawk, S. Dak., 1903–1905.
Corbin-Morse ditch at Rapid, S. Dak., 1906.

Missouri River—Continued.
Cheyenne River—Continued.
Elk Creek near Piedmont, S. Dak., 1903.
Belle Fourche River at Belle Fourche, S. Dak., 1903–1906.
Belle Fourche River near Belle Fourche, S. Dak., 1906.
Redwater River at Belle Fourche, S. Dak., 1903–1906.
Redwater River near Minnesela, S. Dak., 1903.
Redwater Canal at Minnesela, S. Dak., 1904–1906.
Spearfish Creek near Spearfish, S. Dak., 1903–1906.
Crow Creek near Belle Fourche, S. Dak., 1904.
Owl Creek near Belle Fourche, S. Dak., 1904.
Indian Creek near Belle Fourche, S. Dak., 1904.
White River at Interior, S. Dak., 1904–1906.
Niobrara River near Valentine (Fort Niobrara), Nebr., 1897, 1899, 1901–1906.
Niobrara River near Spencer, Nebr., 1908.
Niobrara River near Niobrara, Nebr., 1902, 1910.
Red Deer Lake (head of Plum Creek) near Woodlake, Nebr., 1904–5.
James River near Lamoure, N. Dak., 1903.
Big Sioux River near Watertown, S. Dak., 1900–1903.
Big Sioux River near Sioux Falls, S. Dak., 1900–1901.
Grizzly Creek at Hebron, Colo., 1904–5.
North Platte River (head of Platte River) near Hebron, Colo., 1904–5.
North Platte River near Cowdrey, Colo., 1904–5.
North Platte River near Pinkhampton, Colo., 1904.
North Platte River at Saratoga, Wyo., 1903–1906, 1909.
North Platte River at Pathfinder, Wyo., 1905–1910.
North Platte River at Alcova, Wyo., 1904–5.
North Platte River near Douglas, Wyo., 1894.
North Platte River near Orin Junction, Wyo., 1895–1900.
North Platte River near Fort Laramie, Wyo., 1887–1889.
North Platte River at Guernsey, Wyo., 1900–1908.
North Platte River at Whalen, Wyo., 1909.
North Platte River and Interstate canal at Whalen, Wyo., 1910.
North Platte River near Mitchell, Nebr., 1901–1910.
North Platte River near Gering, Nebr., 1897–1900.
North Platte River near Camp Clark, Nebr., 1896–1900.
North Platte River at Bridgeport, Nebr., 1902–1906.
North Platte River at North Platte, Nebr., 1894–1910.
Platte River near Lexington, Nebr., 1902–1906.
Platte River at Columbus, Nebr., 1895–1910.
Platte River near South Bend, Nebr., 1903.
Little Grizzly Creek at Hebron, Colo., 1904–5.
North Platte (Roaring Fork) near Hebron, Colo., 1904–5.
North Platte (North Fork) at Higho, Colo., 1904–5.
Michigan Creek near Walden, Colo., 1904–5.
Michigan Creek near Cowdrey, Colo., 1904–5.
Canadian River at Cowdrey, Colo., 1904–5.
Grand Encampment Creek near Peryam's ranch, Wyo., 1900.
Medicine Bow River near Medicine Bow, Wyo., 1901.
Sweetwater River near Splitrock, Wyo., 1902–3.
Laramie River at Glendevey, Colo., 1904–5, 1910.
Laramie River near Jelm, Wyo., 1904–5.
Laramie River near Woods Landing, Wyo., 1895–1900.

Missouri River—Continued.
Platte River—Continued.
Laramie River near Uva, Wyo., 1895–1900, 1903.
McIntyre Creek near Gleneyre, Colo., 1904–5.
Little Laramie River near Hatton, Wyo., 1902–3.
Little Laramie River near Laramie, Wyo., 1903.
South Platte (South Fork) near Cheesman Lake, Colo., 1899–1901.
South Platte (South Fork) at Fairplay, Colo., 1910.
South Platte (South Fork) at Lake George, Colo., 1910.
South Platte (South Fork) at South Platte, Colo., 1905–1910.
South Platte River at South Platte, Colo., 1902–1910.
South Platte River near Deansbury (Platte Canyon), Colo., 1887–1892, 1895–1900.
South Platte River at Denver, Colo., 1895–1906, 1909–10.
South Platte River near Kersey, Colo., 1901–1903, 1905–1910.
South Platte River near Orchard, Colo., 1895–1900.
South Platte River near Julesburg, Colo., 1902–1906, 1908–1910.
South Platte River near Big Spring, Nebr., 1902–3.
Tarryall Creek near Jefferson, Colo., 1910.
Tarryall Creek near Hayman, Colo., 1910.
Jefferson Creek near Jefferson, Colo., 1910.
Michigan Creek near Jefferson, Colo., 1910.
Goose Creek near Cheesman Lake, Colo., 1899.
South Platte River (North Fork) at Grant, Colo., 1910.
South Platte River (North Fork) at Cassells, Colo., 1908–1910.
South Platte River (North Fork) at South Platte, Colo., 1909–10.
Geneva Creek above Jackwhacker Creek, near Grant, Colo., 1909–10.
Geneva Creek at Old Geneva smelter, near Grant, Colo., 1909–10.
Geneva Creek at Sullivan's ranch, near Grant, Colo., 1908–1910.
Smelter Creek at Old Geneva smelter, near Grant, Colo., 1909–10.
Duck Lake Creek near Grant, Colo., 1909–10.
Scott Gomer Creek at Geneva Power Co's. dam site, Colo., 1909.
Scott Gomer Creek at Sullivan's ranch near Grant, Colo., 1909–10
Bear Creek near Morrison, Colo., 1888–1891, 1895–1902.
Clear Creek at Forkscreek, Colo., 1899–1910.
Clear Creek at Idaho Springs, Colo., 1910.
Clear Creek at Golden, Colo., 1897–98 and 1909.
St. Vrain Creek near Lyons, Colo., 1888–1892, 1895–1903, 1909.
Boulder Creek at Orodell, Colo., 1907–8, 1910.
Boulder Creek near Boulder, Colo., 1888–1892, 1895–1901, 1907–1909.
North Boulder Creek near Boulder, Colo., 1887–1890.
South Boulder Creek near Marshall, Colo., 1888–1892, 1895–1901, 1909.
Community canal near Marshall, Colo., 1909.
Big Thompson Creek near Arkins, Colo., 1888–1890, 1895–1903, 1909.
Big Thompson Creek near Loveland, Colo., 1888–1890.
Handy ditch near Arkins, Colo., 1899–1900, 1903.
Cache la Poudre River near Elkhorn, Colo., 1909–10.
Cache la Poudre River near Fort Collins, Colo., 1909–10.
Cache la Poudre River at mouth of canyon near Fort Collins, Colo., 1884–1901, 1910.
Cache la Poudre River near Greeley, Colo., 1903.
Middle Crow Creek near Hecla, Wyo., 1902–3.

Missouri River—Continued.
Platte River—Continued.
Loup River at Columbus, Nebr., 1894–1910.
Middle Loup River near St. Paul, Nebr., 1895, 1897, 1899, 1903.
North Loup River near St. Paul, Nebr., 1895, 1897, 1899, 1903.
Elkhorn River near Norfolk, Nebr., 1896–1903.
Elkhorn River near Arlington, Nebr., 1898–1903.
Elkhorn River (South Fork) near Norfolk, Nebr., 1896.
Republican River (North Fork) (head of Kansas River) near Benkleman, Nebr., 1895.
Republican River at Benkleman, Nebr., 1903–1906.
Republican River at Bostwick, Nebr., 1904–1910.
Republican River near Superior, Nebr., 1896–1903.
Republican River at Junction, Kans., 1895–1905.
Kansas River near St. George, Kans., 1904.
Kansas River near Topeka, Kans., 1904.
Kansas River near Lecompton, Kans., 1899–1901, 1903–1906.
Kansas River near Lawrence, Kans., 1895–1899.
Republican River (South Fork) at Benkleman, Nebr., 1895, 1903–1906.
Frenchman River near Wauneta, Nebr., 1895.
Frenchman River near Palisade, Nebr., 1895–96.
Smoky Hill River at Ellsworth, Kans., 1895–1902, 1904–5.
Smoky Hill River at Solomon, Kans., 1902–1904.
Beaver (Ladder) Creek near Scott City, Kans., 1904–5.
Saline River near Salina, Kans., 1895–1903.
Solomon River near Niles, Kans., 1895–1903.
Big Blue River (head of Blue River) at Beatrice, Nebr., 1910.
Blue River at Manhattan, Kans., 1895–1905.
Little Blue River near Fairbury, Nebr., 1908–1910.
Osage River at Ottawa, Kans., 1902–1905.
Gasconade River at Arlington, Mo., 1903–1906.
Gasconade River (Piney Fork) near Houston, Mo., 1908.
Gasconade River (Piney Fork) near Hooker, Mo., 1903. (Also called Big Piney Creek.)
Little Piney Creek near Arlington, Mo., 1903.

GENERAL FEATURES OF MISSOURI RIVER DRAINAGE BASIN.

Missouri River and its innumerable tributaries drain an immense area in the northern and western sections of the United States. The northern boundary of this area is approximately the fiftieth parallel, the southern the thirty-ninth; to the west it is limited by the Rocky Mountains; to the east the divide between it and the upper Mississippi basin crosses eastern North and South Dakota, western Iowa, and northeastern Missouri. Its extent east and west is about 900 miles; north and south it is 600 miles; and it comprises a total of 492,000 square miles.

The topography of the basin shows all gradations from the mountainous regions of Montana, Wyoming, and Colorado to the rolling prairies of the Dakotas, Nebraska, and Kansas. The upper tribu-

taries drain a forested region, but the main stream flows through a country almost wholly devoid of forests. The precipitation in the mountainous portion of the basin is mainly in the form of snow, but a great part of the area lies within the arid and semiarid regions and it is probable that the annual average precipitation throughout the entire basin is less than 20 inches.

The tributaries are chiefly in the upper course of the river and from the western side of the basin. The most important of these are Musselshell, Sun, Marias, Milk, Yellowstone, Cheyenne, Platte, and Kansas rivers.

Owing to the high altitude and northern climate ice prevails in the upper portions of this basin from November to April. The Missouri itself freezes over entirely, but many of its tributaries remain partly open on account of the extreme rapidity of the current. The amount of snow falling on the prairies is usually small, but among the mountains the snows begin early, continue late, and accumulate to great depths.

Irrigation is practiced to a great extent on the various tributaries of the Missouri and agriculture has been extensively developed in many of the valleys. The Madison and Gallatin and many other of the mountain tributaries afford unsurpassed storage facilities, the waters of the Beaverhead, Bighole, Madison, Jefferson, and Gallatin rivers furnish great supplies for irrigation, and the basins of Milk, Sun, Yellowstone, and Musselshell rivers, already extensively utilized, still offer opportunities for border irrigation, storage, and water-power development.

MISSOURI RIVER PROPER.

DESCRIPTION.

Missouri River proper is formed in southwestern Montana by the union of three streams, which were discovered by Lewis and Clark in 1806 and named by them Jefferson, Madison, and Gallatin rivers. Jefferson and Madison rivers come together first, and within 2 miles they are joined by the Gallatin. The head of the Missouri thus formed lies about in latitude 45° 56′ north and longitude 111° 32′ west. Each of the three headwater rivers is about 90 feet wide, flows with great velocity, and discharges large quantities of water. The Gallatin is the most rapid of the three, but the Jefferson drains the largest area, and is here treated as the continuation of the main river. The Jefferson itself is formed by the union of two forks—Bighole and Beaverhead rivers—the Beaverhead draining the larger area and having as its master headwater stream Red Rock River. The source of this last-named river—the Red Rock Lakes, lying in the Rocky Mountains 6,700 feet above sea level—may, therefore, be regarded as the ultimate source of the great Missouri.

Below the junction of the Jefferson, Madison, and Gallatin the course of the Missouri lies through mountain valleys and deep canyons, from which it finally emerges through a gorge in a range of rocks, called by Lewis and Clark the "gates of the Rocky Mountains." Thirty-five miles above Fort Benton the river pours over Great Falls, and from that point onward it is a navigable stream. For miles below the falls the river flows in a deep canyon, with banks ranging from 100 to 160 feet in height. Below the mouth of Marias River, which enters from the north, the banks are less abrupt and rise with gentle slopes to the bluffs. The high-water width of the river, which in the vicinity of Fort Benton is 500 to 1,000 feet, increases to 1,500 feet at the mouth of Milk River and to 2,000 feet near the mouth of the Yellowstone. Below the Yellowstone the width gradually increases from 2,000 to 3,000 feet, and this remains approximately the average width for 600 miles of its course.

From the mouth of the Yellowstone the Missouri follows a winding but on the whole southeasterly course until it is joined by the Kansas; thence it flows more to the east across the State of Missouri, and empties into the Mississippi 16 miles above St. Louis, 189 miles above the mouth of the Ohio, and 2,340 [1] miles below the junction of its three upper forks.

For the first 350 miles below the union of the three forks the Missouri is a comparatively clear stream, but approximately midway between the forks and the mouth of the Yellowstone its character gradually changes and it becomes turbid. Although a large amount of the sediment carried by the Missouri is undoubtedly brought in by the drainage of its tributaries, the greater part is derived from the caving of its banks.

Except in the mountain canyons the Missouri flows through an alluvial bottom land of the most fertile character, varying in width from 1½ miles near the mouth to 17 miles in the vicinity of Sioux City.

The volume of Missouri River is subject to great variations, the ordinary high-water discharge at the mouth being about 28 times the low-water discharge. The freshets are caused by melting snows and heavy summer rains. The regular floods occur in May, June, and July, the June discharge being the greatest. Thereafter the river steadily decreases in volume, the minimum being reached during the winter months. Records obtained at Cascade and Townsend indicate 1899 as the year of greatest flow and 1905 as the time of least flow.

The Missouri itself has not been used for irrigation owing to its high banks and consequent difficulty of diversion. Approximately 150,000 acres of land are now under irrigation in Beaverhead Valley,

[1] Given as 2,824 miles in Water-Supply Paper 246. This figure was taken from the report of the Tenth Census. More reliable information has since been published. See Water-Supply Paper 44, p. 70.

and by storing the waters of the upper Beaverhead or Red Rock River in Red Rock Lakes fully 125,000 acres more can be put under irrigation.

In Montana the Missouri, with its tributaries, affords many opportunities for power development. A number of large, substantial power stations have been built, and approximately 75,000 horsepower is now being developed. Engineers estimate that 350,000 horsepower can be developed on the Missouri River near Great Falls.

RED ROCK RIVER AT LIMA, MONT.

This station, which was established August 14, 1907, to obtain data concerning the amount of water available for irrigation, is located near the Gleed ranch, 1 mile east of Lima.

The tributaries above the station are small and unimportant, the stream at the gaging station receiving its water supply chiefly from the melting snow in the mountains. Below the station Sheep and Sage creeks are the principal tributaries.

Diversions from this stream are many. Above the station three ditches, carrying approximately 900 miner's inches each, receive their water supply from the Red Rock. The water is all appropriated above the station but the rights are unadjudicated. The dam of the reservoir storing the water of the Red Rock has been completed, but no canals have been built. It is an earthen dam with concrete core, is 50 feet high, and has a capacity of 90,000 acre-feet. The dam is 16 miles above Lima, Mont., and 27 miles below lower Red Rock Lakes. Its top elevation is 6,700 feet. This water will be used to irrigate 25,000 acres of land near Lima.

On October 27, 1908, a new chain gage with a new datum was installed just above the cable, 300 feet farther downstream than the old staff gage which it replaces. The stream bed is permanent and the results obtained should be good. During the first six months of 1910 the gage height records are not as reliable as desired. A large spring enters the stream just above the gage and the river remains open the entire year. Measurements are made from a cable in ordinary and high-water stages, but in extreme low water measurements may be made by wading just below the cable section.

Discharge measurements of Red Rock River near Lima, Mont., in 1910.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Mar. 2	Raymond Richards	36	44	1.08	92
July 8	W. A. Lamb	29	23	.98	42
Sept. 14	Raymond Richards	31	24	.94	52
Nov. 7	J. C. Beebe	38	69	1.45	104
Do	do	36	69	1.42	100

Daily gage height, in feet, of Red Rock River at Lima, Mont., for 1910.

[Alice Gleed, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.2	1.0	1.1	1.7	3.8	2.3	1.0	1.1	1.6	3.8	1.5	1.2
2	1.15	1.05	1.1	1.95	3.7	2.3	1.0	1.2	1.2	3.6	1.5	1.2
3	1.1	1.05	1.1	1.95	3.7	2.25	1.6	1.2	1.2	3.6	1.5	1.2
4	1.1	1.0	1.1	2.6	3.7	2.2	1.7	1.3	.8	3.0	1.5	1.2
5	1.1	1.0	1.15	2.7	3.7	2.6	1.7	1.3	1.0	2.0	1.5	1.15
6	1.15	1.1	1.15	2.8	3.7	2.75	.9	1.3	.8	1.5	1.45	1.15
7	1.1	1.1	1.15	3.5	3.6	3.2	.9	1.4	.8	1.0	1.5	1.1
8	1.1	1.1	1.15	3.55	3.6	3.6	1.0	1.6	.8	1.0	1.55	1.1
9	1.1	1.05	1.15	3.6	3.6	3.75	1.05	1.5	.8	1.5	1.55	1.1
10	1.15	1.05	1.15	3.6	3.7	3.7	1.0	1.5	.8	1.5	1.55	1.1
11	1.15	1.05	1.15	4.1	3.6	3.75	1.0	1.5	.85	1.5	1.5	1.1
12	1.2	1.05	1.15	4.0	3.6	3.2	1.0	1.5	.85	1.5	1.5	1.1
13	1.1	1.1	1.2	4.0	3.6	3.1	1.0	1.5	.85	1.5	1.4	1.1
14	1.15	1.05	1.2	4.0	3.5	3.1	1.0	1.5	.85	1.5	1.4	1.1
15	1.2	1.05	1.2	4.1	3.5	3.2	1.05	1.5	1.0	1.5	1.4	1.1
16	1.1	1.05	1.2	4.2	3.2	3.0	1.05	1.45	1.8	1.5	1.4	1.1
17	1.1	1.05	1.2	4.0	3.0	3.0	1.15	1.35	1.8	1.5	1.4	1.1
18	1.15	1.05	1.2	4.0	2.7	3.0	1.15	1.4	2.4	1.5	1.45	1.1
19	1.15	1.05	1.2	4.2	2.7	3.0	1.25	1.45	2.6	1.5	1.4	1.1
20	1.1	1.05	1.2	4.0	2.4	2.9	1.15	1.45	2.6	1.5	1.4	1.1
21	1.1	1.05	1.2	3.8	2.1	2.8	1.15	1.4	2.8	1.5	1.45	1.1
22	1.1	1.05	1.2	4.0	2.0	2.8	1.0	1.4	2.8	1.5	1.45	1.0
23	1.1	1.05	1.2	4.1	2.0	2.7	1.0	1.45	2.8	1.5	1.45	1.0
24	1.1	1.1	1.2	4.0	2.1	2.0	1.0	1.5	2.8	1.55	1.45	1.0
25	1.1	1.1	1.2	3.9	2.1	1.5	1.0	1.4	2.9	1.5	1.5	1.0
26	1.15	1.1	1.2	3.8	2.15	1.3	1.0	1.3	2.9	1.5	1.5	1.0
27	1.1	1.1	1.2	3.95	2.15	1.2	1.0	1.3	3.2	1.5	1.4	1.05
28	1.1	1.1	1.2	3.95	2.2	1.0	1.05	1.4	3.3	1.55	1.3	1.0
29	1.1	.....	1.3	3.9	2.25	1.0	1.05	1.4	3.3	1.55	1.3	1.0
30	1.1	.....	1.5	3.9	2.3	.9	.9	1.5	3.3	1.5	1.2	1.0
31	1.1	.....	1.7	.....	2.5	.....	.95	1.6	.....	1.45	.....	1.0

Daily discharge, in second-feet, of Red Rock River at Lima, Mont., for 1910.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	105	79	91	190	765	284	48	59	129	765	113	71
2	98	85	91	245	730	284	48	71	71	695	113	71
3	91	85	91	245	730	271	129	71	71	695	113	71
4	91	79	91	421	730	258	146	84	29	490	113	71
5	91	79	98	452	730	370	146	84	48	209	113	65
6	98	91	98	485	730	415	38	84	29	113	106	65
7	91	91	98	725	695	555	38	98	29	48	113	59
8	91	91	98	742	695	695	48	129	29	48	121	59
9	91	85	98	760	695	748	54	113	29	113	121	59
10	98	85	98	760	730	730	48	113	29	113	121	59
11	98	85	98	936	695	748	48	113	34	113	113	59
12	105	85	98	900	695	555	48	113	34	113	113	59
13	91	91	105	900	695	520	48	113	34	113	98	59
14	98	85	105	900	660	520	48	113	34	113	98	59
15	105	85	105	936	660	555	54	113	48	113	98	59
16	91	85	105	920	555	490	54	106	165	113	98	59
17	91	85	105	840	490	490	65	91	165	113	98	59
18	98	85	105	840	400	490	65	98	311	113	106	59
19	98	85	105	920	400	490	78	106	370	113	98	59
20	91	85	105	840	311	460	65	106	370	113	98	59
21	91	85	105	765	233	430	65	98	430	113	106	59
22	91	85	105	840	209	430	48	98	430	113	106	48
23	91	85	105	880	209	400	48	106	430	113	106	48
24	91	91	105	840	233	209	48	113	430	121	106	48
25	91	91	105	800	233	113	48	98	460	113	113	48
26	98	91	105	765	246	84	48	84	460	113	113	48
27	91	91	105	820	246	71	48	84	555	113	98	54
28	91	91	105	820	258	48	54	98	590	121	84	48
29	91	.....	120	800	271	48	54	98	590	121	84	48
30	91	.....	153	800	284	38	38	113	590	113	71	48
31	91	.....	190	.....	340	.....	43	129	.....	106	.....	48

NOTE.—These discharges are based on fairly well defined rating curves applicable as follows: Jan. 1 to Apr. 15, Apr. 16 to Dec. 31.

Monthly discharge of Red Rock River at Lima, Mont., for 1910.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
January	105	91	94.2	5,790	B.
February	91	79	86.3	4,790	B.
March	190	91	106	6,520	B.
April	936	190	736	43,800	B.
May	765	209	502	30,900	B.
June	748	38	393	23,400	B.
July	146	38	59.9	3,680	B.
August	129	59	99.9	6,140	A.
September	590	29	234	13,900	A.
October	765	48	183	11,300	A.
November	121	71	105	6 250	A.
December	71	48	57.6	3,540	B.
The year	936	29	221	160,000	

NOTE.—Approximately 40,000 acre-feet of water were stored in the Red Rock reservoir in 1909 and released during the irrigating season of 1910.

BEAVERHEAD RIVER AT BARRATTS, MONT.

This station, which was established August 12, 1907, to obtain data for the solution of irrigation problems, is located 1 mile above Barratts and 10 miles southwest of Dillon, Mont.

This stream is called Red Rock River from its source in Red Rock Lakes to the post office of Red Rock, below which to its junction with Bighole River it is called the Beaverhead. The principal tributaries to the Beaverhead above the station are Grasshopper Creek, 12 miles south of Dillon; Horse Prairie Creek, 20 miles south, and Rattlesnake and Blacktail Deer creeks.

Irrigation has probably been practiced in Beaverhead Valley longer than in any other valley in Montana, ditches constructed in the early seventies being still in operation. Innumerable diversions are made. Decreed water rights aggregating 85,866 inches of water are filed on from Lima on Red Rock River to a point 10 miles above Twin Bridges. The three largest canals diverted below the gaging station are Canyon Creek canal, appropriating 6,000 inches; Union canal, appropriating 4,000, and the Beaverhead canal, diverted just north of Dillon, appropriating 5,000 inches. The Union Electric Co., of Dillon, has a canal with a carrying capacity of 6,000 inches.

An ordinary staff gage, fastened to the downstream side of the bridge, was used till June 22, 1908, when it was replaced by a standard chain gage. Measurements are made from the downstream side of the bridge.

The stream remains open during the winter months. The gaging section has a rocky bottom and should not shift. Records obtained are good.

It is worthy of note that the number and quantity of flow of springs in this valley have increased since irrigation began. The ground evidently serves as a reservoir, the water being absorbed as by a sponge and later coming to the surface as springs.

Discharge measurements of Beaverhead River at Barratts, Mont., in 1910.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Mar. 3 [a]	Raymond Richards	66	206	2.04	862
July 8 [b]	W. A. Lamb	86	96	.70	179
Aug. 15 [b]	J. C. Beebe	64	146	.82	304
Sept. 14 [b]	Raymond Richards	72	84	.65	188
Nov. 7 [a]	J. C. Beebe	60	142	1.20	406

[a] Made at bridge. [b] Made by wading below bridge.

Daily gage height, in feet, of Beaverhead River at Barratts, Mont., for 1910.

[W. A. Meeds, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.30	1.22	1.22	1.75	.....	1.45	.....	0.79	0.60	1.36	1.20	1.30
2	1.28	1.20	1.50	1.97	.....	1.36	.....	.78	.59	1.40	1.20	1.25
3	1.45	1.15	2.22	1.88	2.50	1.35	.....	.78	.55	1.44	1.20	1.26
4	1.50	1.18	3.55	1.92	2.58	1.30	.....	.78	.60	1.45	1.20	1.25
5	1.55	1.20	3.70	2.00	2.68	1.30	.....	.74	.59	1.24	1.20	1.21
6	1.50	1.24	2.35	2.05	2.90	1.30	.....	.74	.56	1.20	1.20	1.19
7	1.50	1.26	2.02	2.15	2.90	1.38	.....	.75	.58	1.12	1.20	1.15
8	1.25	1.10	1.94	2.25	2.60	1.48	0.70	.88	.58	1.09	1.32	1.12
9	1.28	1.15	1.85	2.35	2.72	1.49	.70	.85	.58	1.05	1.50	1.12
10	1.24	1.20	1.64	2.48	2.92	1.38	.70	.85	.58	1.05	1.30	1.20
11	1.11	1.19	1.70	2.68	2.98	1.25	.70	.85	.60	1.05	1.30	1.18
12	1.08	1.12	1.76	2.75	3.02	1.16	.70	.85	.60	1.04	1.30	1.15
13	1.10	1.15	1.91	2.78	2.92	1.11	.70	.85	.60	1.05	1.42	1.10
14	1.10	1.16	1.91	2.75	2.78	1.08	.71	.85	.64	1.05	1.48	1.15
15	1.16	1.10	1.97	2.62	2.72	1.05	.75	.85	.65	1.05	1.39	1.02
16	1.21	1.15	1.97	2.62	2.68	1.02	.75	.85	.68	1.05	1.32	1.16
17	1.25	1.18	2.00	2.60	2.58	1.00	.75	.85	.69	1.06	1.32	1.00
18	1.10	1.25	2.18	2.55	2.50	.90	.74	.86	.74	1.10	1.30	.99
19	1.22	1.16	2.50	2.55	2.35	.60	.70	.80	.82	1.10	1.25	1.00
20	1.22	1.18	2.80	2.60	2.26	.50	.70	.78	.89	1.06	1.20	1.00
21	1.26	1.26	2.92	2.78	2.19	.50	.74	.74	.98	1.06	1.35	1.00
22	1.30	1.20	3.00	2.82	1.90	.45	.80	.71	1.15	1.10	1.35	1.00
23	1.32	1.10	2.90	2.75	1.70	.42	.78	.70	1.28	1.10	1.34	1.02
24	1.35	1.18	2.48	2.70	1.59	.45	.75	.70	1.35	1.10	1.22	1.01
25	1.32	1.18	1.97	2.74	1.55	.51	.78	.68	1.40	1.10	1.30	1.04
26	1.25	1.10	1.90	2.74	1.69	.55	.78	.66	1.40	1.10	1.30	1.06
27	1.19	1.15	1.75	2.76	1.72	.51	.75	.64	1.40	1.10	1.30	1.12
28	1.20	1.15	1.70	2.76	2.05	.55	.76	.62	1.35	1.10	1.30	1.10
29	1.28	.....	1.62	2.78	1.95	.55	.78	.60	1.35	1.10	1.30	1.00
30	1.25	.....	1.60	2.80	1.72	.....	.78	.60	1.35	1.14	1.25	.99
31	1.30	.....	1.70	.....	1.55	.....	.79	.60	.....	1.19	.....	1.00

NOTE.—Gage stolen June 29. Replaced at same datum July 8.

Daily discharge, in second-feet, of Beaverhead River at Barratts, Mont., for 1910.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	455	415	415	688	1,270	530	155	231	160	485	405	455
2	445	405	555	812	1,200	485	160	227	157	505	405	430
3	530	382	962	759	1,140	480	165	227	145	525	405	435
4	555	396	1,900	782	1,190	455	170	227	160	530	405	430
5	580	405	2,010	830	1,260	455	175	211	157	425	405	410
6	555	425	1,040	860	1,420	455	180	211	148	405	405	400
7	555	435	842	920	1,420	495	185	215	154	369	405	382
8	430	360	794	980	1,200	545	195	267	154	356	465	369
9	445	382	742	1,040	1,290	550	195	255	154	338	555	369
10	425	405	627	1,130	1,430	495	195	255	154	338	455	405
11	364	400	660	1,260	1,480	430	195	255	160	338	455	396
12	351	369	693	1,310	1,500	387	195	255	160	333	455	382
13	360	382	776	1,330	1,430	364	195	255	160	338	515	360
14	360	387	776	1,310	1,300	351	199	255	174	338	545	382
15	387	360	812	1,220	1,290	338	215	255	178	338	500	324
16	410	382	812	1,220	1,260	324	215	255	188	338	465	387
17	430	396	830	1,200	1,190	315	215	255	192	342	465	315
18	360	430	938	1,170	1,140	275	211	259	215	360	455	311
19	415	387	1,140	1,170	1,040	160	195	235	243	360	430	315
20	415	396	1,340	1,200	986	130	195	227	271	342	405	315
21	435	435	1,430	1,340	944	130	211	211	307	342	480	315
22	455	405	1,490	1,360	770	120	235	199	382	360	480	315
23	465	360	1,420	1,310	660	114	227	195	445	360	475	324
24	480	396	1,130	1,280	600	120	215	195	480	360	415	320
25	465	396	812	1,300	580	133	227	188	505	360	455	333
26	430	360	770	1,300	654	145	227	181	505	360	455	342
27	400	382	688	1,320	671	133	215	174	505	360	455	369
28	405	382	660	1,320	860	145	219	167	480	360	455	360
29	445	.....	616	1,340	800	145	227	160	480	360	455	315
30	430	.....	605	1,340	671	150	227	160	480	378	430	311
31	455	.....	660	.....	580	.....	231	160	.....	400	.....	315

NOTE.—These discharges are based on a rating curve that is fairly well defined between 130 and 1,140 second-feet. Discharges interpolated for days on which gage heights were not recorded.

Monthly discharge of Beaverhead River at Barratts, Mont., for 1910.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
January	580	351	442	27,200	B.
February	435	360	393	21,800	B.
March	2,010	415	934	57,400	A.
April	1,360	688	1,150	68,400	A.
May	1,500	580	1,070	65,800	A.
June	550	114	304	18,100	A.
July	235	155	202	12,400	B.
August	267	160	220	13,500	B.
September	505	145	268	15,900	B.
October	530	338	378	23,200	A.
November	555	405	452	26,900	A.
December	455	311	361	22,200	A.
The year	2,010	114	515	373,000	

JEFFERSON RIVER NEAR SILVERSTAR, MONT.

This station, which was established August 11, 1910, is located a few miles below the junction of Bighole and Beaverhead rivers, on the big highway bridge on the road from Iron Rod to Silverstar about 1 mile from Iron Rod station on a branch of the Northern Pacific Railway, 18 miles from Whitehall and 8 miles from Twin Bridges. The principal tributaries below the station are Pipestone and Whitetail creeks.

A standard staff gage is fastened to outer pier on the downstream side of the bridge from which discharge measurements are made.

Irrigation is carried on extensively from the headwaters of this stream to its mouth.

Discharge measurements of Jefferson River near Silverstar, Mont., in 1910.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Aug. 11	Raymond Richards	152	289	1.80	353
Nov. 6	J. C. Beebe	200	515	2.78	1,180

Daily gage height, in feet, and discharge, in second-feet, of Jefferson River near Silverstar, Mont., for 1910.

[C. A. Barkell, observer.]

Day.	Aug.		Sept.		Oct.		Nov.		Dec.	
	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
1			1.85	368	2.55	865	2.80	1,210	2.97	1,490
2			1.90	385	2.50	805	2.80	1.210	3.00	1,540
3			1.95	405	2.55	865	2.85	1,290	3.10	1,720
4			1.95	405	2.60	925	2.85	1,290	3.00	1,540
5			2.00	425	2.65	993	2.80	1,210	3.00	1,540
6			2.00	425	2.60	925	2.80	1,210	2.90	1,370
7			2.00	425	2.55	865	2.80	1,210	2.90	1,370
8			2.00	425	2.55	865	2.80	1,210	2.80	1,210
9			2.05	450	2.55	865	2.84	1,270	2.80	1,210
10			2.10	475	2.60	925	2.86	1,310	2.80	1,210
11	1.80	350	2.10	475	2.60	925	2.92	1,400	2.80	1,210
12	1.80	350	2.15	505	2.65	993	2.94	1,440	2.86	1,310
13	1.85	368	2.15	505	2.65	993	2.96	1,470	2.86	1,310
14	1.90	385	2.10	475	2.65	993	3.00	1,540	2.90	1,370
15	1.90	385	2.10	475	2.60	925	3.00	1,540	2.90	1,370
16	1.90	385	2.10	475	2.60	925	3.10	1,720	2.90	1,370
17	1.90	385	2.05	450	2.65	993	3.20	1,910	2.90	1,370
18	1.90	385	2.05	450	2.65	993	3.10	1,720	2.90	1,370
19	1.85	368	2.10	475	2.60	925	3.10	1,720	2.96	1,470
20	1.85	368	2.20	535	2.60	925	3.00	1,540	2.94	1,440
21	1.75	335	2.60	925	2.65	993	3.00	1,540	2.90	1,370
22	1.70	320	2.40	700	2.65	993	3.00	1,540	2.88	1,340
23	1.75	335	2.30	610	2.65	993	2.90	1,370	2.86	1,320
24	1.75	335	2.30	610	2.65	993	2.90	1,370	2.88	1,340
25	1.75	335	2.50	805	2.70	1,060	2.96	1,470	2.80	1,210
26	1.80	350	2.60	925	2.75	1,140	2.98	1,510	2.86	1,310
27	1.80	350	2.55	865	2.75	1,140	3.00	1,540	2.90	1,370
28	1.80	350	2.55	865	2.70	1,060	3.00	1,540	2.90	1,370
29	1.85	368	2.60	925	2.70	1,060	2.95	1,460	2.90	1,370
30	1.85	368	2.60	925	2.75	1,140	2.90	1,370	2.90	1,370
31	1.85	368			2.75	1,140			2.90	1,370

NOTE.—These discharges are based on a rating curve fairly well defined between 340 and 2,800 second-feet.

Monthly discharge of Jefferson River near Silverstar, Mont., for 1910.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
Aug. 11-31	385	320	359	15,000	B.
September	925	368	572	34,000	B.
October	1,140	805	974	59,900	A.
November	1,910	1,210	1,440	85,700	A.
December	1,720	1,210	1,370	84,200	A.

MISSOURI RIVER AT TOSTON, MONT.

A station was established on the Missouri River at the highway bridge at Toston, Mont., on April 5, 1910. Gallatin, Jefferson, and Madison rivers unite about 25 miles above the station. Sixteenmile Creek is the only tributary of importance between the station and the headwaters. Between Toston and the station at Cascade, Prickly Pear and Little Prickly Pear creeks and Dearborn River enter the Missouri.

A standard chain gage is fastened to the downstream side of the public highway bridge. Measurements are made from a newly constructed cable equipment just above the bridge. Excellent results can be obtained. The discharge is affected by ice only in extremely cold weather.

Discharge measurements of Missouri River at Toston, Mont., in 1910.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Apr. 15	W. A. Lamb	448	1,740	4.50	6,390
May 6	do	450	2,260	5.75	10,500
June 2	do	445	2,530	6.19	13,300
Do.	M. E. McChristie	455	2,520	6.19	13,600
July 7	J. C. Beebe	397	1,180	3.30	2,420
22	M. E. McChristie	384	1,140	3.20	2,340
Aug. 13	B. E. Jones	374	1,030	2.95	1,860
Do.	W. A. Lamb	407	1,010	2.95	1,820
Nov. 5	B. E. Jones	455	1,360	3.71	4,030
Dec. 7	W. A. Lamb	453	1,330	3.75	3,700
Do.	B. E. Jones	455	1,330	3.75	[a] 3,520

[a] Meter affected by ice; results low.

Daily gage height, in feet, of Missouri River at Toston, Mont., for 1910.

[W. B. Lorentz, observer.]

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	6.60	6.10	3.35	2.80	3.00	3.55	3.65	3.68
2	.....	6.50	6.00	3.35	2.90	3.02	3.48	3.60	3.68
3	.....	6.20	5.95	3.40	2.90	2.97	3.45	3.65	3.75
4	.....	5.90	5.65	3.40	3.25	3.05	3.75	3.75	3.78
5	4.50	5.75	5.55	3.35	2.95	3.10	3.80	3.65	3.82
6	4.40	5.70	5.30	3.40	2.95	3.15	3.75	3.70	3.68
7	4.40	5.75	5.25	3.25	2.95	3.20	3.73	3.68	3.75
8	4.50	5.90	5.05	3.35	2.80	3.32	3.65	.....	3.75
9	4.65	6.00	4.95	3.35	2.90	3.20	3.50	3.62	3.75
10	4.95	6.20	5.00	3.25	2.85	3.27	3.60	3.68	3.60

Daily gage height, in feet, of Missouri River at Toston, Mont., for 1910—Continued.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
11	5.05	6.65	5.00	3.20	2.95	3.27	3.52	3.75	3.60
12	5.20	7.10	4.90	3.15	3.00	3.30	3.52	3.75	3.58
13	5.50	7.05	4.80	3.20	2.95	3.27	3.52	3.80	3.60
14	5.50	6.90	4.70	3.30	2.95	3.25	3.60	3.98	3.62
15	5.35	6.80	4.60	3.35	2.90	3.23	3.75	3.95	3.62
16	5.05	6.65	4.40	3.25	2.90	3.22	3.70	3.95	3.62
17	5.00	6.55	4.15	3.30	2.95	3.25	3.50	3.87	3.42
18	5.00	6.35	4.20	3.30	2.90	3.25	3.50	3.85	3.45
19	5.00	6.10	4.20	3.30	2.95	3.25	3.65	3.70	3.50
20	5.05	6.00	4.10	3.25	2.90	3.38	3.72	3.78	3.40
21	5.15	5.85	3.95	3.30	2.87	3.50	3.73	3.75	3.35
22	5.30	5.50	3.85	3.10	2.88	3.53	3.68	3.82	3.40
23	5.35	5.45	3.70	2.90	2.67	3.43	3.65	3.82	3.40
24	5.45	5.40	3.60	2.95	2.95	3.50	3.68	3.85	3.35
25	5.55	5.55	3.45	2.85	2.95	3.58	3.68	3.80	3.50
26	5.65	5.75	3.60	2.85	2.95	3.55	3.67	3.88	3.42
27	5.85	5.85	3.50	2.75	2.85	3.63	3.66	3.70	3.30
28	6.20	6.05	3.50	2.85	2.95	3.63	3.63	3.62	3.40
29	6.60	6.10	3.40	2.85	2.90	3.60	3.75	3.65	3.40
30	6.75	6.15	3.35	2.85	2.90	3.65	3.78	3.68	3.38
31	.....	6.20	.....	2.90	3.00	.....	3.67	.....	3.40

Daily discharge, in second-feet, of Missouri River at Toston, Mont., for 1910.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	15,400	13,100	2,720	1,560	1,920	3,240	3,520	3,660
2	.....	14,900	12,600	2,720	1,730	1,960	3,060	3,380	3,660
3	.....	13,500	12,400	2,850	1,730	1,860	2,980	3,520	3,800
4	.....	12,200	11,100	2,850	2,480	2,020	3,800	3,800	3,800
5	6,310	11,500	10,600	2,720	1,820	2,130	3,950	3,520	4,010
6	5,940	11,300	9,560	2,850	1,820	2,240	3,800	3,660	3,600
7	5,940	11,500	9,340	2,480	1,820	2,360	3,750	3,660	3,800
8	6,310	12,200	8,500	2,720	1,560	2,650	3,520	[a] 3,550	3,800
9	6,880	12,600	8,090	2,720	1,730	2,360	3,110	3,440	3,800
10	8,100	13,500	8,300	2,480	1,640	2,530	3,380	3,600	3,380
11	8,500	15,600	8,300	2,360	1,820	2,530	3,160	3,800	3,380
12	9,130	17,800	7,890	2,240	1,920	2,600	3,160	3,800	3,330
13	10,400	17,500	7,480	2,360	1,820	2,530	3,160	3,950	3,380
14	10,400	16,800	7,080	2,600	1,820	2,480	3,380	4,500	3,440
15	9,780	16,400	6,690	2,720	1,730	2,430	3,800	4,400	3,440
16	8,500	15,600	5,940	2,480	1,730	2,410	3,660	4,400	3,440
17	8,300	15,200	5,060	2,600	1,820	2,480	3,110	4,160	2,900
18	8,300	14,200	5,230	2,600	1,730	2,480	3,110	4,100	2,980
19	8,300	13,100	5,230	2,600	1,820	2,480	3,520	3,660	3,110
20	8,500	12,600	4,890	2,480	1,730	2,800	3,720	3,890	2,850
21	8,920	11,900	4,410	2,600	1,680	3,110	3,750	3,800	2,720
22	9,560	10,400	4,100	2,130	1,700	3,190	3,600	4,010	2,850
23	9,780	10,200	3,660	1,730	1,370	2,930	3,520	4,010	2,850
24	10,200	9,990	3,380	1,820	1,820	3,110	3,600	4,100	2,720
25	10,600	10,600	2,980	1,640	1,820	3,330	3,600	3,950	3,110
26	11,100	11,500	3,380	1,640	1,820	3,240	3,580	4,190	2,900
27	11,900	11,900	3,110	1,480	1,640	3,460	3,550	3,660	2,600
28	13,500	12,800	3,110	1,640	1,820	3,460	3,460	3,440	2,850
29	15,400	13,100	2,850	1,640	1,730	3,380	3,800	3,520	2,850
30	16,100	13,300	2,720	1,640	1,730	3,520	3,890	3,660	2,800
31	.....	13,500	.....	1,730	1,920	.....	3,580	.....	2,850

[a] Interpolated.

NOTE.—These discharges are based on a well-defined rating curve.

Monthly discharge of Missouri River at Toston, Mont., for 1910.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
Apr. 5-30	16,100	5,940	9,490	489,000	A.
May	17,800	9,990	13,300	818,000	A.
June	13,100	2,720	6,700	399,000	A.
July	2,850	1,480	2,320	143,000	A.
August	2,480	1,370	1,770	109,000	A.
September	3,520	1,860	2,670	159,000	A.
October	3,950	2,980	3,490	215,000	A.
November	4,500	3,380	3,820	227,000	A.
December	4,010	2,720	3,140	193,000	A.
The period				2,750,000	

MISSOURI RIVER AT CASCADE, MONT.

This station, which was established July 20, 1902, to obtain records for use in connection with irrigation and power development, is located on the highway bridge on the east side of the town of Cascade, Mont., 100 yards from the Great Northern Railway.

The Missouri receives many tributaries above the station, the most important being Dearborn River, Little Prickly Pear Creek, and Prickly Pear Creek; within 100 miles below the station Sun and Marias rivers enter. The drainage area at the station is 18,300 square miles.

Although irrigation is extensively developed in the Missouri River Valley the water is taken from the tributary streams, the Missouri itself, because of its high banks, great variation in flow, and difficulty of diversion, being little used.

The datum of the standard chain gage on the bridge used at this station has remained unchanged. All measurements are made from the lower side of the bridge.

Records obtained have been very good, the channel being permanent except in extreme floods. Gage heights are affected by ice during the winter months.

Discharge measurements of Missouri River at Cascade, Mont., in 1910.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Feb. 28	Raymond Richards	470	1,900	(a)	4,050
July 8	J. C. Beebe	354	2,700	4.36	3,270
23	R. H. Bolster	356	2,820	4.05	2,500
Aug. 9	M. E. McChristie	349	2,420	3.61	1,630
Sept. 22	B. E. Jones	359	2,850	4.80	4,420
Nov. 25	C. S. Heidel	360	2,930	a 5.21	5,070

a Discharge affected by ice.

Daily gage height, in feet, of Missouri River at Cascade, Mont., for 1910.

[Wm. W. Doan, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	4.6	4.6	5.5	6.4	8.2	8.0	4.5	3.9	3.82	4.5	4.5	4.9
2	4.6	4.6	6.05	6.4	8.05	7.9	4.5	3.9	3.85	4.4	4.7	4.9
3	4.6	4.6	7.25	6.4	7.85	7.7	4.4	3.9	3.7	4.7	4.6	5.0
4	4.6	4.6	8.1	6.5	7.55	7.3	4.4	3.8	3.65	4.95	4.7	5.1
5	4.6	4.6	10.25	6.5	7.5	7.0	4.4	3.8	3.65	4.6	4.7	5.1
6	4.6	4.6	10.7	6.6	7.4	7.0	4.4	3.7	3.7	4.6	4.7	5.1
7	4.6	4.6	9.3	6.6	7.5	7.1	4.3	3.6	3.95	4.5	4.7	5.0
8	4.6	4.6	7.7	6.6	7.8	7.2	4.3	3.5	4.22	4.5	4.7	5.0
9	4.5	4.6	6.8	6.6	8.05	7.3	4.3	3.6	4.22	4.5	4.8	5.1
10	4.5	4.6	6.7	6.6	8.25	7.1	4.3	3.6	4.3	4.5	4.9	5.1
11	4.5	4.6	6.5	6.6	8.45	6.7	4.4	3.7	4.38	4.4	5.1	5.1
12	4.5	4.6	6.1	6.7	8.7	6.45	4.4	3.7	4.3	4.4	5.1	5.0
13	4.5	4.6	5.85	6.8	8.9	6.2	4.4	3.6	4.4	4.4	4.9	5.0
14	4.5	4.6	5.7	6.95	8.9	6.1	4.3	3.6	4.3	4.5	4.9	5.0
15	4.6	4.6	5.7	7.0	8.8	6.0	4.2	3.6	4.4	4.4	5.0	4.9
16	4.6	4.6	5.7	6.9	8.65	6.0	4.1	3.6	4.4	4.5	5.1	4.8
17	4.6	4.6	5.7	6.9	8.45	5.9	4.15	3.7	4.4	4.5	5.0	4.7
18	4.6	4.6	5.85	6.9	8.3	5.8	4.15	3.7	4.4	4.8	5.0	4.8
19	4.6	4.6	6.05	6.95	8.0	5.7	4.1	3.8	4.8	4.9	5.0	4.8
20	4.6	4.6	6.15	7.0	8.1	5.6	4.1	3.68	4.4	4.7	5.0	4.8
21	4.6	4.7	6.2	7.0	8.0	5.45	4.1	3.72	4.6	4.5	5.0	4.9
22	4.6	4.7	6.2	7.0	7.85	5.25	4.0	3.75	4.7	4.5	5.0	4.9
23	4.6	4.7	6.35	7.0	7.75	5.15	4.0	3.75	4.6	4.9	5.0	4.9
24	4.6	4.8	6.6	7.0	7.5	5.0	4.0	3.62	4.6	4.9	5.1	4.9
25	4.6	4.8	6.85	7.15	7.1	4.9	4.0	3.65	4.7	4.7	5.1	5.0
26	4.6	5.0	6.9	7.2	7.35	4.75	4.0	3.64	4.6	4.9	5.1	5.0
27	4.6	5.1	6.9	7.2	7.6	4.6	3.9	3.64	4.2	5.0	5.1	5.0
28	4.6	5.2	6.9	7.25	7.6	4.6	3.95	3.65	4.1	5.1	5.1	6.0
29	4.6	.....	6.85	7.35	7.7	4.5	4.1	3.60	4.1	4.9	5.1	6.1
30	4.6	.....	6.65	7.95	7.8	4.5	4.0	3.68	4.0	4.6	5.1	6.1
31	4.6	.....	6.4	.....	7.9	.....	3.9	3.72	.....	4.5	.....	6.1

NOTE.—Gage heights distorted by ice Jan. 1 to Mar. 10 and Dec. 26 to 31.

Daily discharge, in second-feet, of Missouri River at Cascade, Mont., for 1910.

[Wm. W. Doan, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	.....	4,500	9,790	16,800	16,000	3,600	2,160	2,010	3,600	3,600	3,740
2	.....	.....	6,000	9,790	16,200	15,500	3,600	2,160	2,060	3,340	4,150	3,740
3	.....	.....	9,000	9,790	15,300	14,700	3,340	2,160	1,800	4,150	3,870	5,040
4	.....	.....	10,000	10,200	14,100	13,100	3,340	1,970	1,720	3,890	4,150	5,350
5	.....	.....	10,000	10,200	13,900	12,000	3,340	1,970	1,720	3,870	4,150	5,350
6	.....	.....	10,000	10,500	13,500	12,000	3,340	1,800	1,800	3,870	4,150	5,350
7	.....	.....	10,000	10,500	13,900	12,400	3,090	1,650	2,260	3,600	4,150	5,040
8	.....	.....	11,000	10,500	15,100	12,700	3,090	1,520	2,890	3,600	4,150	5,040
9	.....	.....	11,000	10,500	16,200	13,100	3,090	1,650	2,890	3,600	4,440	5,350
10	.....	.....	10,600	10,500	17,000	12,400	3,090	1,650	3,090	3,600	3,740	5,350
11	.....	.....	10,200	10,500	17,800	10,900	3,340	1,800	3,290	3,340	5,350	5,350
12	.....	.....	8,710	10,900	18,900	9,970	3,340	1,800	3,090	3,340	5,350	5,040
13	.....	.....	7,840	11,300	19,700	9,070	3,340	1,650	3,340	3,340	3,740	5,040
14	.....	.....	7,320	11,800	19,700	8,710	3,090	1,650	3,090	3,600	3,740	5,040
15	.....	.....	7,320	12,000	19,300	8,360	2,840	1,650	3,340	3,340	5,040	3,740
16	.....	.....	7,320	11,600	18,700	8,360	2,600	1,650	3,340	3,600	5,350	4,440
17	.....	.....	7,320	11,600	17,800	8,010	2,720	1,800	3,340	3,600	5,040	4,150
18	.....	.....	7,840	11,600	17,200	7,660	2,720	1,800	3,340	4,440	5,040	4,440
19	.....	.....	8,540	11,800	16,000	7,320	2,600	1,970	4,440	3,740	5,040	4,440
20	.....	.....	8,890	12,000	16,400	6,980	2,600	1,770	3,340	4,150	5,040	4,440
21	.....	.....	9,070	12,000	16,000	6,480	2,600	1,830	3,870	3,600	5,040	3,740
22	.....	.....	9,070	12,000	15,300	5,830	2,370	1,880	4,150	3,600	5,040	3,740
23	.....	.....	9,610	12,000	14,900	5,510	2,370	1,880	3,870	3,740	5,040	3,740
24	.....	.....	10,500	12,000	13,900	5,040	2,370	1,680	3,870	3,740	5,350	3,740
25	.....	.....	11,400	12,600	12,400	3,740	2,370	1,720	4,150	4,150	5,350	5,040
26	.....	.....	11,600	12,700	13,300	4,300	2,370	1,710	3,870	3,740	5,350	5,040
27	.....	.....	11,600	12,700	14,300	3,870	2,160	1,710	2,840	5,040	5,350	5,040
28	.....	.....	11,600	12,900	14,300	3,870	2,260	1,720	2,600	5,350	5,350	5,040
29	.....	.....	11,400	13,300	14,700	3,600	2,600	1,650	2,600	3,740	5,350	5,040
30	.....	.....	10,700	15,800	15,100	3,600	2,370	1,770	2,370	3,870	5,350	5,040
31	.....	.....	9,790	.....	15,500	.....	2,160	1,830	.....	3,600	.....	5,040

NOTE.—These discharges are based on a fairly well defined curve. Discharges Mar. 1 to 10 and Dec. 26 to 31 estimated.

Monthly discharge of Missouri River at Cascade, Mont., for 1910.

[Drainage area, 18,300 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
January			a 3,400	0.186	0.21	209,000	D.
February			a 3,450	.188	.20	192,000	D.
March			a 9,480	.518	.60	583,000	C.
April	15,800	9,790	11,500	.628	.70	684,000	B.
May	19,700	12,400	15,900	.869	1.00	978,000	B.
June	16,000	3,600	8,840	.483	.54	526,000	B.
July	3,600	2,160	2,840	.155	.18	175,000	B.
August	2,160	1,520	1,800	.098	.11	111,000	B.
September	4,440	1,720	3,010	.164	.18	179,000	B.
October	5,350	3,340	3,800	.208	.24	234,000	B.
November	5,350	3,600	4,730	.258	.29	281,000	B.
December	5,350	3,740	4,700	.257	.30	289,000	C.
The year			6,120	.334	4.55	4,440,000	

a Estimated from records obtained at Canyon Ferry Dam.

MISSOURI RIVER AT FORT BENTON, MONT.

This station was established by the United States Weather Bureau on July 1, 1902, and gage-height readings have been obtained since that date. On April 28, 1910, a regular gaging station was established by the United States Geological Survey and partial estimates of run-off have been obtained for the year 1910. A Mott tape-and-weight gage was installed April 11, 1907, on the upstream side of the public highway bridge at Fort Benton. The gage datum has remained constant since that date. Current-meter measurements are made from the downstream side of the bridge.

Many tributaries enter Missouri River above the station. The drainage area at Fort Benton embraces 112,000 square miles.

Discharge measurements of Missouri River at Fort Benton, Mont., in 1910.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Apr. 28	W. A. Lamb	553	3,540	4.40	17,100
May 23	M. E. McChristie	554	3,690	4.62	19,400
30	do	554	3,690	4.52	18,800
July 16	do	411	1,800	.88	4,070
24	do	422	1,610	.63	3,250
Aug. 10	do	377	1,460	.25	2,380
16	do	389	1,500	.35	2,550
Sept. 21	B. E. Jones	452	1,870	1.12	4,750

Daily gage height, in feet, and discharge, in second-feet, of Missouri River at Fort Benton, Mont., for 1910.

[Guy Quick, observer.]

Day.	Aug.		Sept.		Oct.		Nov.		Dec.	
	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
1	.....	.....	0.58	3,160	0.82	3,830	1.31	5,400	.....	.....
2	.....	.....	.58	3,160	.96	4,260	1.12	4,770	1.29	5,340
3	.....	.....	.66	3,370	1.12	4,770	1.14	4,830	1.30	5,370
4	.....	.....	.62	3,260	.....	4,800	1.16	4,900	1.30	5,370
5	.....	.....	.48	2,910	.....	4,800	1.27	5,270	1.28	5,300
6	.....	.....	.52	3,010	.....	4,800	1.19	5,000	1.28	5,300
7	.....	.....	.46	2,780	.....	4,900	1.32	5,440	1.00	4,380
8	.....	.....	.55	3,080	.....	4 900	1.32	5,440	1.30	5,370
9	.....	.....	.81	3,800	.....	4,950	1.43	5,820	1.30	5,370
10	.....	.....	.90	4,070	1.20	5,030	1.41	5,740	1.30	5,370
11	.....	.....	.96	4,260	1.20	5,030	.....	.....	1.40	5,710
12	.....	.....	1.00	4,380	1.12	4,770	.....	.....	1.40	5,710
13	.....	.....	1.06	4,570	1.16	4,900	.....	.....	1.30	5,370
14	.....	.....	1.04	4,510	1.14	4,830	.....	.....	1.30	5,370
15	.....	.....	1.05	4,540	1.12	4,770	.....	.....	1.20	5,030
16	.....	.....	1.05	4,540	1.16	4,900	.....	.....	1.15	4,860
17	0.30	2,520	1.02	4,440	1.19	5,000	.....	.....	1.10	4,700
18	.35	2,620	1.04	4,510	1.20	5,030	.....	.....	1.10	4,700
19	.38	2,690	1.10	4,700	1.31	5,400	.....	.....	1.10	4,700
20	.39	2,710	1.31	5,400	1.44	5,850	.....	.....	1.00	4,380
21	.30	2,520	1.20	5,030	1.42	5,780	.....	.....	1.00	4,380
22	.39	2,710	1.14	4,830	1.39	5,680	.....	.....	1.00	4,380
23	.36	2,650	1.24	5,170	1.12	4,770	.....	.....	.90	4,070
24	.42	2,780	1.25	5,200	1.26	5,240	.....	.....	.90	4,070
25	.44	2,820	1.22	5,110	1.44	5,850	.....	.....	.90	4,070
26	.40	2,730	1.29	5,340	1.46	5,920	.....	.....	.80	3,770
27	.37	2,670	1.29	5,340	1.46	5,920	.....	.....	.80	3,770
28	.45	2,840	1.14	4,830	1.51	6,100	.....	.....	.60	3,210
29	.47	2,890	.92	4,130	1.57	6,300	.....	.....	.60	3,210
30	.47	2,890	.89	4,070	1.59	6,380	.....	.....	.70	3,480
31	.56	3,110	.....	.....	1.56	6,270	.....	.....	.70	3,480

NOTE.—The daily discharges are based on a fairly well defined curve. Discharges Oct. 4 to 9 interpolated.

Monthly discharge of Missouri River at Fort Benton, Mont., for 1910.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
Aug. 17-31	3,110	2,520	2,740	81,500	A.
September	5,400	2,780	4,250	253,000	A.
October	6,380	3,830	5,220	321,000	A.
November	(a)	(a)	5,460	325,000	B.
December	5,710	3,210	4,680	288,000	A.

[a] Nov. 11 to Dec. 1 discharge interpolated.

TRIBUTARY BASINS.

BIGHOLE RIVER BASIN.

BIGHOLE RIVER NEAR DEWEY, MONT.

Bighole River rises in the Bitterroot Mountains, flows in an easterly direction, and unites with the Beaverhead to form Jefferson River just below Twin Bridges, Mont. The most important tributary of the Bighole is Wise River.

The valley of the Bighole is exceptionally well irrigated by water from the stream. The river also offers opportunities for power development. Good reservoir sites exist on the upper portions of the Bighole and its tributaries.

A gaging station was established September 15, 1910, at Young's bridge, 4 miles above Dewey and 11 above Divide, Mont. Wise River enters a few miles above the gaging station.

A staff gage is fastened to southeast piling of bridge on downstream side. Discharge measurements are made from the bridge.

The channel is rocky, clean, and nonshifting.

Ice is common during the winter months. A large hydroelectric power plant is in operation about 8 miles below the station.

Discharge measurements of Bighole River near Dewey, Mont., in 1910.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Sept. 15	Raymond Richards	63	139	1.99	184
Nov. 8	J. C. Beebe	108	482	2.70	511

Daily gage height, in feet, and discharge, in second-feet, of Bighole River near Dewey, Mont., for 1910.

[Wm. J. Fish, observer.]

Day.	Sept.		Oct.		Nov.		Dec.	
	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
1			2.30	304	2.60	430	2.71	478
2			2.32	312	2.65	452	2.61	434
3			2.35	324	2.70	474	2.60	430
4			2.85	542	2.70	474	2.60	430
5			2.65	452	2.70	474	2.60	430
6			2.55	409	2.75	496	2.60	430
7			2.50	387	2.75	496	2.50	387
8			2.50	387	2.75	496	2.53	400
9			2.50	387	2.76	500	2.50	387
10			2.50	387	2.77	505	2.50	387
11			2.50	387	2.76	500		
12			2.50	387	2.76	500		
13			2.50	387	2.76	500		
14			2.50	387	2.76	500		
15	2.00	187	2.50	387	2.77	505		

Daily gage height, in feet, and discharge, in second-feet, of Bighole River near Dewey, Mont., for 1910—Continued.

Day.	Sept.		Oct.		Nov.		Dec.	
	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
16	2.00	187	2.40	345	2.77	505	.....	.....
17	2.10	225	2.50	387	2.78	510	.....	.....
18	2.40	345	2.50	387	2.79	515	.....	.....
19	2.40	345	2.50	387	2.79	515	.....	.....
20	2.20	264	2.40	345	2.80	519	.....	.....
21	2.10	225	2.40	345	2.80	519	.....	.....
22	2.20	264	2.40	345	2.79	515	.....	.....
23	.....	[a] 264	2.50	387	2.79	515	.....	.....
24	2.20	264	2.60	430	2.78	510	.....	.....
25	2.50	387	2.60	430	2.79	515	.....	.....
26	2.50	387	2.60	430	2.80	519	.....	.....
27	2.40	345	2.60	430	2.81	524	.....	.....
28	2.30	304	2.60	430	2.81	524	.....	.....
29	2.30	304	2.60	430	2.81	524	.....	.....
30	2.30	304	2.60	430	2.71	.478	.....	.....
31	.....	.....	2.60	430	.....	.....	.....	.....

[a] Interpolated.

NOTE.—Discharges are based on a fairly well defined rating curve.

Monthly discharge of Bighole River near Dewey, Mont., for 1910.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
Sept. 15-31	387	187	271	9,140	C.
October	542	304	393	24,200	C.
November	524	430	500	29,800	C.
December	478	.....	367	22,600	D.

NOTE.—Discharge estimated Dec. 11 to 31 by comparison with stations on Beaverhead River at Barratts and Jefferson River near Silverstar, Mont.

PIPESTONE CREEK BASIN.

PIPESTONE CREEK NEAR WHITEHALL, MONT.

Pipestone Creek rises near the Continental Divide, just east of Butte, Mont., flows in a southeasterly direction, and joins Jefferson River near Whitehall. Its principal tributary is the Little Pipestone.

A gaging station was established October 15, 1910, 6 miles west of Whitehall, Mont., at Peyton Allred's ranch, a short distance above the junction of the creek with the Little Pipestone.

A staff gage is fastened to a large post on the left bank of the stream directly north of the observer's house.

The bed of the creek is sandy and shifting.

Discharge measurements of Pipestone Creek near Whitehall, Mont., in 1910.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Oct. 13	Raymond Richards	9	2.6	0.50	2.4
13	do	9	2.7	.50	2.3

NOTE.—Measurements made by wading one-eighth mile below gage.

Daily gage height, in feet, of Pipestone Creek near Whitehall, Mont., for 1910.

[Peyton Allred, observer.]

Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.
1	.....	0.6	0.85	11	.....	0.6	0.8	21	0.5	0.8	0.7
2	.....	.6	.8	12	.....	.6	.8	22	.5	.8	.7
3	.....	.6	.8	13	0.5	.6	.75	23	.5	.8	.7
4	.....	.55	.85	14	.5	.5	.75	24	.5	.75	.7
5	.....	.5	.85	15	.5	.5	.7	25	.55	.75	.7
6	.....	.55	.9	16	.5	.5	.7	26	.55	.75	.7
7	.....	.55	.9	17	.5	.7	.75	27	.55	.75	.7
8	.....	.6	.85	18	.55	.8	.75	28	.55	.8	.7
9	.....	.6	.85	19	.55	.8	.75	29	.55	.8	.7
10	.....	.6	.8	20	.55	.8	.7	30	.55	.85	.7
								31	.55	.....	.7

WHITETAIL CREEK BASIN.

WHITETAIL CREEK NEAR WHITEHALL, MONT.

Whitetail Creek rises in the central part of Jefferson County and flows southward to its junction with Jefferson River near Whitehall. The stream furnishes water for irrigation.

A gaging station was established October 14, 1910, 6 miles north of Whitehall, Mont., and 1 mile above the junction of the creek with the Little Whitetail, the principal tributary. A private wagon bridge spans the stream about 300 feet below the station.

A staff gage is nailed to a large tree on the right bank of the stream. The channel is sandy and shifting.

At low and ordinary stages discharge measurements are made by wading near the gage; at flood stages the private wagon bridge about 300 feet below the station may be used.

No gage heights were obtained for 1910.

The following discharge measurement was made by Raymond Richards:

October 14, 1910: Width, 9.5 feet; area, 4.70 square feet; gage height, 1.10 feet; discharge, 3.54 second-feet. Made by wading.

MADISON RIVER BASIN.

MADISON RIVER NEAR NORRIS, MONT.

Madison River, the largest of the three forks of the Missouri, rises in Yellowstone National Park and flows northwestward, draining through many small tributaries a heavily timbered and mountainous region. The river affords opportunity for large power and irrigation developments. On the lower portions of the stream irrigation is extensively practiced.

A gaging station was established August 12, 1910, on the public highway bridge over the Madison, about 5 miles east of Norris, Mont. Previous to this date records were obtained on the Madison as follows:

August 24, 1893 to May 1, 1897, at the Northern Pacific Railway bridge, near Three Forks, Mont.

May 2, 1897, to December 31, 1905, 5 miles below the present location, at the ranch of S. A. Black.

The gage is an ordinary staff fastened to a tubular pier on the left bank. Discharge measurements are made from the downstream side of the bridge. Cherry Creek enters the stream a few miles below the station. The stream remains open practically the entire year.

Discharge measurements of Madison River near Norris, Mont., in 1910.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Aug. 13	Raymond Richards	224	421	1.69	1,480
Nov. 3	J. C. Beebe	219	379	1.60	1,260

Daily gage height, in feet, and discharge, in second-feet, of Madison River near Norris, Mont., for 1910.

[William H. Foster, observer.]

Day.	Aug.		Sept.		Oct.		Nov.	
	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
1			1.5	1,050	1.7	1,500		1,380
2			1.6	1,270	1.6	1,270	1.6	1,270
3			1.5	1,050	1.9	2,020	1.6	1,270
4			1.6	1,270	1.9	2,020	1.7	1,500
5			1.6	1,270	1.8	1,750	1.6	1,270
6			1.6	1,270	1.9	2,020	1.6	1,270
7			1.5	1,050	1.7	1,500	1.5	1,050
8			1.6	1,270	1.6	1,270	1.7	1,500
9			1.7	1,500	1.7	1,500	1.6	1,270
10			1.7	1,500	1.6	1,270	1.7	1,500
11			1.7	1,500	1.7	1,500	1.6	1,270
12	1.7	1,500	1.7	1,500	1.6	1,270	1.7	1,500
13	1.7	1,500	1.6	1,270	1.6	1,270	1.7	1,500
14	1.6	1,270	1.5	1,050	1.8	1,750	1.8	1,750
15	1.65	1,380	1.6	1,270	1.9	2,020	1.7	1,500

Daily gage height, in feet, and discharge, in second-feet, of Madison River near Norris, Mont., for 1910—Continued.

Day.	Aug.		Sept.		Oct.		Nov.	
	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
16	1.7	1,500	1.6	1,270	1.8	1,750	2.0	2,300
17	1.65	1,380	1.6	1,270	1.6	1,270	1.7	1,500
18	1.75	1,620	1.7	1,500	1.75	1,620	1.7	1,500
19	1.75	1,620	1.7	1,500	1.8	1,750	1.6	1,270
20	1.6	1,270	1.7	1,500	1.75	1,620	1.6	1,270
21	1.6	1,270	1.6	1,270	1.6	1,270	.....	.....
22	1.55	1,160	1.7	1,500	1.7	1,500	.....	.....
23	1.65	1,380	1.8	1,750	1.8	1,750	.....	.....
24	1.8	1,750	1.7	1,500	1.75	1,620	.....	.....
25	1.6	1,270	1.7	1,500	1.7	1,500	.....	.....
26	1.4	850	1.7	1,500	1.75	1,620	.....	.....
27	1.45	950	1.7	1,500	1.65	1,380	.....	.....
28	1.4	850	1.7	1,500	1.7	1,500	.....	.....
29	1.5	1,050	1.6	1,270	1.6	1,270	.....	.....
30	1.6	1,270	1.7	1,500	1.7	1,500	.....	.....
31	1.6	1,270	.....	.....	1.7	1,500	.....	.....

NOTE.—Ice after November 20. The daily discharges are based on a fairly well defined rating curve.

Monthly discharge of Madison River near Norris, Mont., for 1910.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
August 12–31	1,750	850	1,310	52,000	A.
September	1,750	1,050	1,360	80,900	A.
October	2,020	1,270	1,560	95,900	A.
November 1–20	2,300	1,050	1,430	56,700	A.

GALLATIN RIVER BASIN.

WEST GALLATIN RIVER NEAR SALESVILLE, MONT.

Gallatin River proper is formed just east of Logan by the union of East and West Gallatin rivers. West Gallatin, the larger and more important stream, rises in the northwestern part of Yellowstone Park, and flows in a mountainous, timbered, and precipitous area. On the lower portions of the stream irrigation is extensively practiced.

A gaging station was maintained at the highway bridge just below the mouth of the canyon and 4 miles above Salesville, Mont., from July 18, 1895, to December 31, 1905, and was reestablished August 9, 1910.

Spanish Creek is the most important tributary above the station.

The drainage area at this point is 860 square miles.

A standard chain gage, boxed, is fastened near middle of bridge on upstream side. The datum of the gage remained constant. Discharge measurements are made from the lower side of the bridge.

The bed of stream is of gravel and small bowlders and will not shift.

Discharge measurements of West Gallatin River near Salesville, Mont., in 1910.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Aug. 9	Raymond Richards	94	212	3.29	446
Nov. 2[a]	J. C. Beebe	60	199	3.22	434

[a] Made by wading below bridge. Rough section.

Daily gage height, in feet, of West Gallatin River near Salesville, Mont., for 1910.

Day.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	3.1	3.1	3.25	3.2	16	3.2	3.2	3.2	3.0	3.0
2	.....	3.1	3.2	3.35	3.05	17	3.1	3.2	3.3	3.0	2.95
3	.....	3.1	3.2	3.25	3.05	18	3.1	3.2	3.3	3.1	3.0
4	.....	3.2	3.2	3.25	3.15	19	3.1	3.2	3.3	3.2	3.05
5	.....	3.2	3.3	3.2	3.0	20	3.1	3.2	3.4	3.1	3.05
6	.....	3.2	3.3	3.2	3.0	21	3.0	3.2	3.2	3.1	2.95
7	.....	3.2	3.3	3.2	3.05	22	3.0	3.2	3.2	3.25	3.0
8	.....	3.2	3.3	3.2	3.1	23	3.0	3.2	3.3	3.15	3.05
9	3.3	3.2	3.2	3.2	3.0	24	3.1	3.2	3.2	3.15	3.0
10	3.2	3.2	3.3	3.1	2.9	25	3.1	3.1	3.2	3.25	2.95
11	3.2	3.2	3.2	3.1	3.0	26	3.1	3.2	3.3	3.15	3.0
12	3.2	3.2	3.2	3.2	3.0	27	3.1	3.2	3.3	3.1	3.05
13	3.4	3.2	3.3	3.05	2.95	28	3.0	3.2	3.2	3.2	3.05
14	3.2	3.2	3.2	3.05	2.95	29	3.0	3.1	3.2	3.1	2.95
15	3.2	3.2	3.2	3.15	3.0	30	3.1	3.0	3.3	3.1	3.0
						31	3.1	.....	3.2	.....	3.05

PRICKLY PEAR CREEK BASIN.

DESCRIPTION.

Prickly Pear Creek rises in the mountains in the northwestern part of Jefferson County, Mont., and takes a general northeasterly course to its junction with the Missouri near Eldorado bar in the southeastern part of Lewis and Clark County. Its principal tributaries are McClellan, Lump Gulch, Tenmile, and Silver creeks. Its upper valley is narrow and little irrigation is practiced, but below Helena the entire normal flow is diverted for irrigation.

The flood of June, 1908, was probably greater than any other in this valley for many years.

PRICKLY PEAR CREEK NEAR CLANCY, MONT.

This station was originally established July 15, 1908, about 2 miles below Clancy and 12 miles south of Helena, and about 1 mile below the mouth of Lump Gulch Creek. It was discontinued June 5, 1909. On July 12, 1910, it was reestablished at the private wagon bridge back of the ranch buildings on the Stafford ranch, and just to the right of the Great Northern Railway, about 1 mile below Clancy and just below the mouth of Lump Gulch Creek.

A staff gage is nailed to the downstream side of the bridge abutment.

All discharge measurements at the old location were made by wading near the staff gage, the datum of which remained unchanged during the period of its use.

Discharge measurements at the new location are made from the wagon bridge or by wading.

Ice is common at this station in extreme cold weather.

Discharge measurements of Prickly Pear Creek near Clancy, Mont., in 1910.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
July 12	Raymond Richards	26	17	1.60	23
Aug. 19	B. E. Jones	16	9.6	1.46	14
Do	J. C. Beebe	16	9.7	1.46	15
Sept. 27	B. E. Jones	20	21	1.95	61
Nov. 12	do	20	18	1.85	46
Dec. 10	J. C. Beebe	28	22	1.75	35

Daily gage height, in feet, and discharge, in second-feet, of Prickly Pear Creek near Clancy, Mont., for 1910.

[H. Y. Barrow, observer.]

Day.	July.		Aug.		Sept.		Oct.		Nov.		Dec.	
	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
1	.....	.....	1.45	14	1.85	47	1.80	41	1.79	40	1.68	29
2	.....	.....	1.45	14	1.90	53	1.90	53	1.79	40	1.69	30
3	.....	.....	1.45	14	1.90	53	1.85	47	1.78	39	1.70	31
4	.....	.....	1.40	12	1.80	41	1.90	53	1.75	36	1.74	35
5	.....	.....	1.40	12	1.80	41	1.85	47	1.71	32	1.72	33
6	.....	.....	1.40	12	1.80	41	1.80	41	1.74	35	1.88	50
7	.....	.....	1.40	12	1.90	53	1.80	41	1.77	38	1.96	62
8	.....	.....	1.40	12	1.85	47	1.78	39	1.76	37	1.73	34
9	.....	.....	1.40	12	1.85	47	1.78	39	1.79	40	1.73	34
10	.....	.....	1.40	12	1.80	41	1.75	36	1.79	40	1.75	36
11	.....	.....	1.40	12	1.80	41	1.72	33	1.79	40	2.00	.....
12	1.60	23	1.40	12	1.80	41	1.73	34	1.81	42	2.20	.....
13	1.55	20	1.40	12	1.80	41	1.72	33	1.80	41	2.58	.....
14	1.50	16	1.40	12	1.75	36	1.73	34	1.70	31	2.64	.....
15	1.50	16	1.40	12	1.75	36	1.71	32	1.64	26	2.80	.....
16	1.50	16	1.40	12	1.75	36	1.71	32	1.69	30	2.79	.....
17	1.50	16	1.45	14	1.70	31	1.70	31	1.69	30	2.76	.....
18	1.50	16	1.40	12	1.70	31	1.80	41	1.74	35	2.96	.....
19	1.50	16	1.40	12	1.70	31	1.83	45	1.75	36	3.05	.....
20	1.45	14	1.40	12	1.70	31	1.79	40	1.74	35	2.86	.....
21	1.45	14	1.40	12	1.75	36	1.77	38	1.73	34	2.96	.....
22	1.50	16	1.40	12	1.90	53	1.75	36	1.75	36	3.08	.....
23	1.50	16	1.40	12	1.95	60	1.74	35	1.75	36	2.15	.....
24	1.45	14	1.40	12	2.00	68	1.73	34	1.69	30	2.00	.....
25	1.50	16	1.40	12	2.10	84	1.77	38	1.73	34	1.82	.....
26	1.50	16	1.40	12	2.00	68	1.82	43	1.66	28	.....	.....
27	1.45	14	1.45	14	2.00	68	1.72	33	1.70	31	.....	.....
28	1.45	14	1.45	14	1.90	53	1.72	33	1.70	31	.....	.....
29	1.45	14	1.55	20	1.90	53	1.77	38	1.64	26	.....	.....
30	1.45	14	1.70	31	1.80	41	1.72	33	1.62	25	.....	.....
31	1.45	14	1.75	36	.....	.....	1.76	37	.....	.....	.....	.....

NOTE.—Ice Dec. 11 to 31. The daily discharge is based on a fairly well defined rating curve.

Monthly discharge of Prickly Pear Creek near Clancy, Mont., for 1910.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
July 12-31	23	14	15.8	627	B.
August	36	12	14.0	861	A.
September	84	31	46.8	2,780	A.
October	53	31	38.4	2,360	A.
November	42	25	34.5	2,050	A.
December	62	.....	[a] 32.4	1,990	C.
The period	.....	.....	.....	10,700	

[a] Dec. 11-31 estimated because of ice.

PRICKLY PEAR CREEK AT EAST HELENA, MONT.

This station, which was established July 18, 1908, is located where the Northern Pacific Railway crosses the stream at East Helena, Mont.

McClellan and Lump Gulch creeks are the only important tributaries entering above the station; Tenmile and Silver creeks come in below. All the normal flow of this stream is used for irrigation, the greater part of the water being diverted below this station.

At the gaging section the channel is rocky, clean, and nonshifting. The bed of the stream is so extremely rough that even in low water measurements are difficult. Fair results, however, have been obtained.

A staff gage is securely fastened to the piling on the Northern Pacific Railway bridge. The gage datum has remained the same. Measurements are made by wading just below the gage or from the highway bridge near by.

Discharge measurements of Prickly Pear Creek at East Helena, Mont., in 1910.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Mar. 29	W. A. Lamb	37	37	1.25	77
May 16	R. Richards	36	34	1.23	76
June 4	W. A. Lamb	26	22	1.15	61
July 6	M. E. McChristie	22	20	1.00	38
Sept. 10	C. S. Heigel	26	16	.91	28
Oct. 1	B. E. Jones	26	29	1.10	50
Nov. 14	.....do	25	21	1.00	37
Nov. 16	.....do	24	19	.93	32
Dec. 10	.....do	26	22	1.04	43
Dec. 20	.....do	24	18	.98	34

Daily gage height, in feet, of Prickly Pear Creek at East Helena, Mont., for 1910.

[J. P. McNamara, observer.]

Day.	Mar.	Apr.	May.	June.	Nov.	Day.	Mar.	Apr.	May.	June.	Nov.
1			1.2			16	1.4	1.2	1.4		.98
2		1.2	1.1	1.1		17	1.4	1.1	1.3	1.2	1.01
3		1.2	1.1	1.1		18	1.4	1.1	1.2		1.01
4		1.2	1.2			19	1.5	1.1	1.2		1.02
5			1.2			20	1.5	1.1	1.3	1.2	1.03
6	1.3	1.2	1.2			21	1.5	1.1		1.2	.94
7	1.3	1.2		1.2		22	1.5	1.1	1.2	1.3	.96
8	1.3	1.2	1.2	1.4		23	1.3	1.1		1.3	.95
9	1.3	1.5		1.3		24	1.3	1.1	1.1		1.03
10	1.4	1.4	1.5			25	1.3	1.1	1.1		1.03
11	1.4	1.3	1.4			26	1.2	1.1	1.1	1.2	1.05
12	1.4	1.3	1.2	1.3		27	1.2	1.1			1.06
13	1.4	1.3	1.2	1.3		28	1.2	1.2			1.00
14	1.4					29	1.2	1.3	1.2		1.06
15	1.4	1.2	1.2	1.3	0.96	30		1.2			1.04
						31					

NOTE.—No observer June 27 to November 14. Probable ice in January and February.

Daily discharge, in second-feet, of Prickly Pear Creek at East Helena, Mont., for 1910.

Day.	Mar.	Apr.	May.	June.	Nov.	Day.	Mar.	Apr.	May.	June.	Nov.
1		68	68	60		16	112	68	112	78	35
2		68	51	51		17	112	51	88	68	38
3		68	51	51		18	112	51	68	68	38
4		68	68	60		19	140	51	68	68	40
5		68	68	60		20	140	51	88	68	41
6	88	68	68	60		21	140	51	78	68	30
7	88	68	68	68		22	140	51	68	88	33
8	88	68	68	112		23	88	51	60	88	32
9	88	140	104	88		24	88	51	51	78	41
10	112	112	140	88		25	88	51	51	78	41
11	112	88	112	88		26	68	51	51	68	44
12	112	88	68	88		27	68	51	60	66	45
13	112	88	68	88		28	68	68	60	64	37
14	112	78	68	88		29	68	88	68	62	45
15	112	68	68	88	33	30	68	68	60	60	43
						31	68		60		

NOTE.—Daily discharges based on a fairly well-defined rating curve. Discharges estimated or interpolated for days on which gage heights were not recorded.

Monthly discharge of Prickly Pear Creek at East Helena, Mont., for 1910.

Month.	Mean discharge in second-feet.	Run-off (total in acre-feet).	Accuracy.
March	[a] 93.3	5,740	A.
April	68.6	4,080	A.
May	71.9	4,420	A.
June	73.6	4,380	B.
November	[a] 39.1	2,330	C.
December	[b] 38	2,340	C.
The period		23,300	

[a] Mar. 1 to 5 and Nov. 1 to 14 estimated by comparison with stations on Prickly Pear Creek near Clancy and from discharge measurements.

[b] Estimated by comparison with records at Clancy station and from discharge measurements made during the month.

LUMP GULCH CREEK AT CLANCY, MONT.

Lump Gulch Creek, a small mountain stream with no important tributaries, has been quite extensively used for placer mining. At present the creek furnishes some water for irrigation, but the valley is narrow and affords but little irrigable land. The normal flow of the stream is appropriated.

The gaging station, which was established July 15, 1908, is located at the ranch of Charles Zastrow, 1 mile from Clancy, 15 miles from Helena, and one-half mile above the stream's junction with Prickly Pear Creek.

The stream bed is gravelly, unclean, and shifting, making it difficult to obtain satisfactory data. Gage heights are affected by ice. No flood records have been obtained.

A staff gage is located on the left bank of the stream directly south of the observer's house. On November 12, 1910, a new gage was installed at the same location, but at a datum 1.0 foot lower than that previously used. All gage heights for 1910 have been reduced to the new datum. All measurements are made by wading.

Discharge measurements of Lump Gulch Creek at Clancy, Mont., in 1910.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
July 12	C. S. Heidel	6	1.6	1.11	1.9
Aug. 19	B. E. Jones	3	.5	1.00	.2
Do	J. C. Beebe	2.5	.3	1.00	.2
Sept. 27	B. E. Jones	8	4.1	1.25	6.1
Nov. 12	do	10	9.7	1.39	9.7
Dec. 10[a]	J. C. Beebe	6	3.2	1.14	4.0

[a] Ice.

NOTE.—All gage heights refer to datum of gage set Nov. 12, which is 1 foot lower than that used in 1909.

Daily gage height, in feet, of Lump Gulch Creek at Clancy, Mont., for 1910.

[Chas. Zastrow, observer.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	1.65	1.55	1.30	1.10	1.02	1.10	1.20	1.25
2	.....	1.65	1.55	1.30	1.10	1.02	1.10	1.20	1.25
3	.....	1.75	1.55	1.30	1.10	1.02	1.10	1.20	1.25
4	.....	1.75	1.50	1.30	1.10	1.02	1.10	1.20	1.25
5	.....	1.75	1.50	1.30	1.10	1.02	1.15	1.20	1.25
6	1.45	1.70	1.50	1.30	1.10	1.02	1.15	1.20	1.25
7	1.45	1.70	1.50	1.45	1.10	1.02	1.15	1.20	1.40
8	1.45	1.70	1.45	1.50	1.10	1.02	1.15	1.20	1.40
9	1.45	1.70	1.45	1.50	1.10	1.02	1.15	1.20	1.40
10	1.45	1.70	1.45	1.40	1.10	1.02	1.15	1.20	1.40
11	1.45	1.65	1.40	1.35	1.10	1.02	1.15	1.15	1.40
12	1.45	1.65	1.40	1.30	1.10	1.02	1.20	1.15	1.40
13	1.50	1.65	1.40	1.30	1.05	1.02	1.20	1.15	1.40
14	1.50	1.65	1.40	1.30	1.05	1.02	1.20	1.15	1.40
15	1.50	1.65	1.40	1.25	1.05	1.02	1.20	1.15	1.40

Daily gage height, in feet, of Lump Gulch Creek at Clancy, Mont., for 1910—Continued.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
16	1.50	1.60	1.55	1.25	1.05	1.02	1.20	1.15	1.30
17	1.60	1.60	1.60	1.25	1.05	1.02	1.20	1.20	1.28
18	1.60	1.60	1.55	1.25	1.05	1.02	1.20	1.20	1.28
19	1.70	1.55	1.50	1.25	1.05	1.02	1.20	1.20	1.28
20	1.75	1.55	1.50	1.20	1.05	1.02	1.20	1.20	1.30
21	1.80	1.55	1.40	1.20	1.05	1.02	1.25	1.20	1.30
22	1.85	1.55	1.40	1.20	1.05	1.02	1.30	1.20	1.35
23	1.90	1.55	1.40	1.20	1.05	1.02	1.30	1.20	1.35
24	1.90	1.55	1.35	1.20	1.05	1.02	1.30	1.20	1.38
25	1.50	1.55	1.35	1.20	1.05	1.02	1.25	1.20	1.38
26	1.50	1.55	1.30	1.15	1.05	1.02	1.25	1.20	1.38
27	1.50	1.60	1.40	1.15	1.05	1.02	1.25	1.20	1.38
28	1.50	1.60	1.40	1.15	1.05	1.02	1.25	1.20	1.38
29	1.60	1.60	1.40	1.15	1.05	1.10	1.25	1.20	1.38
30	1.60	1.60	1.35	1.15	1.05	1.10	1.25	1.20	1.38
31	1.60	.....	1.35	.....	1.05	1.10	.....	1.20	.....

NOTE.—All gage heights for 1910 refer to a datum 1 foot lower than that used in 1909. Ice in January, February, and December.

Daily discharge, in second-feet, of Lump Gulch Creek at Clancy, Mont., for 1910.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	23	18	7.2	1.7	0.5	1.7	4.0	5.6
2	.....	23	18	7.2	1.7	.5	1.7	4.0	5.6
3	.....	29	18	7.2	1.7	.5	1.7	4.0	5.6
4	.....	29	16	7.2	1.7	.5	1.7	4.0	5.6
5	.....	29	16	7.2	1.7	.5	2.8	4.0	5.6
6	14	26	16	7.2	1.7	.5	2.8	4.0	5.6
7	14	26	16	14	1.7	.5	2.8	4.0	11
8	14	26	14	16	1.7	.5	2.8	4.0	11
9	14	26	14	16	1.7	.5	2.8	4.0	11
10	14	26	14	11	1.7	.5	2.8	4.0	11
11	14	23	11	9.2	1.7	.5	2.8	2.8	11
12	14	23	11	7.2	1.7	.5	4.0	2.8	11
13	16	23	11	7.2	1.0	.5	4.0	2.8	11
14	16	23	11	7.2	1.0	.5	4.0	2.8	11
15	16	23	11	5.6	1.0	.5	4.0	2.8	11
16	16	21	18	5.6	1.0	.5	4.0	2.8	7.2
17	21	21	21	5.6	1.0	.5	4.0	4.0	6.6
18	21	21	18	5.6	1.0	.5	4.0	4.0	6.6
19	26	18	16	5.6	1.0	.5	4.0	4.0	6.6
20	29	18	16	4.0	1.0	.5	4.0	4.0	7.2
21	32	18	11	4.0	1.0	.5	5.6	4.0	7.2
22	35	18	11	4.0	1.0	.5	7.2	4.0	9.2
23	38	18	11	4.0	1.0	.5	7.2	4.0	9.2
24	38	18	9.2	4.0	1.0	.5	7.2	4.0	10
25	16	18	9.2	4.0	1.0	.5	5.6	4.0	10
26	16	18	7.2	2.8	1.0	.5	5.6	4.0	10
27	16	21	11	2.8	1.0	.5	5.6	4.0	10
28	16	21	11	2.8	1.0	.5	5.6	4.0	10
29	21	21	11	2.8	1.0	1.7	5.6	4.0	10
30	21	21	9.2	2.8	1.0	1.7	5.6	4.0	10
31	21	.....	9.2	.....	1.0	1.7	.....	4.0	.....

NOTE.—These discharges are based on a fairly well defined rating curve.

Monthly discharge of Lump Gulch Creek at Clancy, Mont., for 1910.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
January	.....	.....	[a]9.0	553	
February	.....	.....	[a]9.0	500	
March	38	9	[a]18.8	1,160	A.
April	29	18	22.3	1,330	A.
May	18	7.2	13.4	824	A.
June	16	2.8	6.57	391	B.
July	1.7	1.0	1.27	78	C.
August	1.7	.5	.616	38	D.
September	7.2	1.7	4.11	245	B.
October	4.0	2.8	3.77	232	B.
November	11	5.6	8.75	521	B.
December	.....	.....	[a]9.0	553	
The year	.....	.....	8.88	6,420	

[a] Discharge estimated Jan. 1 to Mar. 5, and month of December. Means for January, February, and December are only approximate.

TENMILE CREEK NEAR HELENA, MONT.

This station, which is located opposite the Broadwater Hotel, near Helena, Mont., was established July 8, 1908, to determine the amount of water available for irrigation and for municipal supply.

Part of the water supply of the city of Helena is taken from Tenmile Creek above the station. Two irrigation ditches also take their water from this creek above the gage. The entire low-water flow is appropriated and used before it reaches the mouth of the creek.

The principal tributaries above the gaging station are Blue Cloud, Spring, and Walker creeks; Sevenmile Creek enters 2 miles below.

The channel shifts somewhat during flood stages, but at medium and low water the conditions are good for obtaining accurate discharge data. The stream freezes partly over during the winter months.

The gage is of the staff type and is located on right bank of stream. The datum has remained the same. Measurements are made by wading.

Discharge measurements of Tenmile Creek near Helena, Mont., in 1910.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Mar. 31	W. A. Lamb	23	19	2.40	42
May 15	Raymond Richards	23	18	2.30	36
July 6	M. E. McChristie	12	5.1	1.58	2.4
6	J. C. Beebe	14	5.1	1.58	2.3
Sept. 8	C. S. Heidel	.....	.....	1.12	[a].1
27	B. E. Jones	20	11	1.88	10.8
Nov. 14	.....do	20	14	1.90	9.7
16	.....do	20	12	1.78	6.4
Dec. 9	.....do	17	8.2	1.62	3.3
10	.....do	18	10	1.77	6.7

[a] Discharge estimated.

Daily gage height, in feet, of Tenmile Creek near Helena, Mont., for 1910.

[Harry Hillman, observer.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	2.4	2.4	1.8	1.4	1.2	1.15	1.8	1.9	1.84
2	.....	2.4	2.4	1.8	1.4	1.2	1.15	1.8	1.9	1.84
3	.....	2.4	2.3	1.8	1.4	1.2	1.15	1.8	1.9	1.84
4	.....	2.4	2.3	1.8	1.5	1.2	1.15	1.85	1.9	1.80
5	.....	2.4	2.3	1.7	1.6	1.15	1.15	1.85	1.9	1.76
6	.....	2.4	2.3	1.7	1.6	1.15	1.15	1.85	1.9	1.74
7	2.0	2.5	2.3	1.7	1.6	1.15	1.15	1.85	1.9	1.72
8	2.0	2.5	2.3	1.8	1.6	1.15	1.15	1.85	1.9	.....
9	2.0	2.6	2.3	2.0	1.6	1.15	1.15	1.8	1.95	.....
10	1.9	2.6	2.6	2.0	1.6	1.15	1.15	1.75	1.95	1.77
11	2.0	2.7	2.4	1.9	1.6	1.15	1.2	1.75	1.95	.....
12	2.0	2.7	2.3	1.8	1.5	1.15	1.4	1.7	1.95	.....
13	2.0	2.6	2.3	1.8	1.4	1.15	1.4	1.7	1.90	.....
14	2.1	2.6	2.1	1.7	1.4	1.15	1.5	1.7	1.90	.....
15	2.2	2.6	2.3	1.7	1.4	1.15	1.6	1.7	1.82	.....
16	2.2	2.6	2.3	1.6	1.3	1.15	1.7	1.65	1.78	.....
17	2.2	2.6	2.4	1.5	1.3	1.15	1.7	1.65	1.90	.....
18	2.3	2.6	2.4	1.5	1.3	1.15	1.7	1.7	1.93	.....
19	2.4	2.7	2.4	1.4	1.3	1.15	1.6	1.7	1.92	.....
20	2.5	2.8	2.4	1.4	1.3	1.15	1.55	1.75	1.91	.....
21	2.6	2.7	2.3	1.4	1.3	1.15	1.7	1.75	1.91	.....
22	2.7	2.6	2.1	1.4	1.3	1.15	2.0	1.75	1.91	.....
23	2.6	2.6	2.1	1.7	1.3	1.15	1.9	1.8	1.91	.....
24	2.6	2.6	2.1	1.6	1.25	1.15	1.8	1.8	1.88	.....
25	2.5	2.6	2.1	1.5	1.25	1.15	1.8	1.85	1.86	.....
26	2.5	2.6	2.1	1.4	1.25	1.15	1.8	1.85	1.84	.....
27	2.4	2.6	2.0	1.4	1.25	1.15	1.9	1.85	1.63	.....
28	2.4	2.5	2.0	1.4	1.25	1.15	1.9	1.85	1.64	.....
29	2.4	2.5	1.9	1.4	1.25	1.15	1.85	1.85	1.90	.....
30	2.4	2.4	1.9	1.4	1.25	1.15	1.8	1.9	1.86	.....
31	2.4	.....	1.9	.....	1.2	1.15	.....	1.9	.....	.....

NOTE.—Ice in January, February, and after Dec. 10.

Daily discharge, in second-feet, of Tenmile Creek near Helena, Mont., for 1910.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	43	43	7.0	0.8	0.2	0.15	7.0	10	8.4
2	.....	43	43	7.0	.8	.2	.15	7.0	10	8.4
3	.....	43	34	7.0	.8	.2	.15	7.0	10	8.4
4	.....	43	34	7.0	1.5	.2	.15	8.7	10	7.0
5	.....	43	34	4.5	2.7	.15	.15	8.7	10	6.0
6	.....	43	34	4.5	2.7	.15	.15	8.7	10	5.5
7	15	53	34	4.5	2.7	.15	.15	8.7	10	5.0
8	15	53	34	7.0	2.7	.15	.15	8.7	10	a5.4
9	15	63	34	15	2.7	.15	.15	7.0	13	a5.8
10	10	63	63	15	2.7	.15	.15	5.8	13	6.2
11	15	74	43	10	2.7	.15	.2	5.8	13	.....
12	15	74	34	7.0	1.5	.15	.8	4.5	13	.....
13	15	63	34	7.0	.8	.15	.8	4.5	10	.....
14	20	63	20	4.5	.8	.15	1.5	4.5	10	.....
15	26	63	34	4.5	.8	.15	2.7	4.5	7.7	.....
16	26	63	34	2.7	.4	.15	4.5	3.6	6.5	.....
17	26	63	43	1.5	.4	.15	4.5	3.6	10	.....
18	34	63	43	1.5	.4	.15	4.5	4.5	11	.....
19	43	74	43	.8	.4	.15	2.7	4.5	11	.....
20	53	85	43	.8	.4	.15	2.1	5.8	11	.....
21	63	74	34	.8	.4	.15	4.5	5.8	11	.....
22	74	63	20	.8	.4	.15	15	5.8	11	.....
23	63	63	20	4.5	.4	.15	10	7.0	11	.....
24	63	63	20	2.7	.3	.15	7	7.0	9.7	.....
25	53	63	20	1.5	.3	.15	7	8.7	9.0	.....
26	53	63	20	.8	.3	.15	7	8.7	8.4	.....
27	43	63	15	.8	.3	.15	10	8.7	3.2	.....
28	43	53	15	.8	.3	.15	10	8.7	3.4	.....
29	43	53	10	.8	.3	.15	8.7	8.7	10	.....
30	43	43	10	.8	.3	.15	7.0	10	9.0	.....
31	43	.....	10	.....	.2	.15	.....	10	.....	.....

a Discharges estimated.

NOTE.—These discharges are based on a well-defined rating curve.

Monthly discharge of Tenmile Creek near Helena, Mont., for 1910.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
January	.....	.....	[a] 3.0	184	
February	.....	.....	[a] 4.0	222	
March	74	.....	[a] 31.2	1,920	A.
April	85	43	59.2	3,520	A.
May	63	10	30.7	1,890	A.
June	15	.8	4.44	264	B.
July	2.7	.2	1.04	64	B.
August	.2	.15	.144	9	C.
September	15.	.15	3.73	222	B.
October	10	3.6	6.85	421	B.
November	13	3.2	9.83	585	B.
December	.....	.....	[a] 4.99	307	
The year	.....	.....	13.3	9,610	

[a] Discharge estimated January, February, Mar. 1 to 6 and Dec. 11 to 31.

NOTE.—The means for January, February, and December are only approximate.

SEVENMILE CREEK NEAR BIRDSEYE, MONT.

This station, which is located at Richard Tobin's ranch, one-fourth mile from Birdseye, Mont., was established March 27, 1909. From July 16, 1908, to August 26, 1908, a station was maintained on this stream at Dr. Head's ranch, near Helena, Mont. The records determine the value of the stream for irrigation and municipal water supply.

The entire flow of this creek is appropriated and used for irrigation. A staff gage is used. All measurements are made by wading.

The channel is sandy and shifting.

Discharge measurements of Sevenmile Creek near Birdseye, Mont., in 1910.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 5	Raymond Richards	10	4.3	2.40	8
June 15	do	8	2.3	2.22	2.3
Aug. 30	C. S. Heidel	7	2.3	2.27	3.6
Nov. 16	B. E. Jones	6	2.8	2.30	4.4
Dec. 21[a]	do	11	3.9	2.50	3.7

[a] Flow affected by ice.

Daily gage height, in feet, of Sevenmile Creek near Birdseye, Mont., for 1910.

[Richard Tobin, observer.]

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	2.5	2.3	2.45	2.1	2.3	2.3	2.3	2.2
2	.....	2.5	2.3	2.35	2.1	2.3	2.3	2.3	2.2
3	.....	2.5	2.3	2.3	2.1	2.3	2.3	2.3	2.2
4	.....	2.5	2.3	2.3	2.1	2.3	2.3	2.3	2.2
5	.....	2.4	2.2	2.2	2.0	2.2	2.2	2.2	2.2
6	.....	2.4	2.3	2.3	2.1	2.3	2.3	2.25	2.2
7	.....	2.4	2.3	2.3	2.1	2.3	2.3	2.25	2.2
8	.....	2.4	2.3	2.3	2.1	2.3	2.3	2.3	.....
9	2.6	2.4	2.3	2.35	2.1	2.3	2.3	2.3	.....
10	2.5	2.4	2.2	2.2	2.0	2.2	2.2	2.2	.....

Daily gage height, in feet, of Sevenmile Creek near Birdseye, Mont., for 1910—Continued.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
11	2.6	2.4	2.3	2.3	2.1	2.3	2.3	2.35	.....
12	2.6	2.4	2.3	2.3	2.1	2.3	2.3	2.35	.....
13	2.6	2.45	2.3	2.3	2.1	2.3	2.3	2.3	.....
14	2.6	2.4	2.3	2.3	2.1	2.3	2.3	2.3	.....
15	2.45	2.4	2.2	2.25	2.2	2.2	2.2	2.2	.....
16	2.5	2.5	2.3	2.2	2.2	2.3	2.2	2.25	.....
17	2.5	2.5	2.3	2.35	2.25	2.3	2.25	2.3	.....
18	2.5	2.5	2.3	2.35	2.2	2.3	2.3	2.3	.....
19	2.4	2.45	2.3	2.3	2.2	2.3	2.2	2.3	.....
20	2.3	2.4	2.4	2.2	2.1	2.2	2.15	2.3	.....
21	2.45	2.5	2.4	2.2	2.2	2.3	2.3	2.3	.....
22	2.4	2.5	2.4	2.3	2.2	2.1	2.25	2.3	.....
23	2.4	2.5	2.4	2.3	2.3	2.1	2.2	2.3	.....
24	2.4	2.4	2.4	2.3	2.35	2.1	2.2	2.3	.....
25	2.3	2.3	2.25	2.2	2.2	2.1	2.2	2.3	.....
26	2.4	2.4	2.35	2.3	2.3	2.2	2.2	2.3	.....
27	2.4	2.4	2.3	2.2	2.3	2.3	2.25	2.3	.....
28	2.5	2.4	2.3	2.2	2.3	2.3	2.3	2.3	.....
29	2.5	2.4	2.3	2.1	2.3	2.3	2.3	2.3	.....
30	2.45	2.3	2.3	2.0	2.2	2.2	2.2	2.25	.....
31	.....	2.3	.....	2.1	2.3	.....	2.3	.....	.....

NOTE.—Ice in January, February, and after Dec. 7. The stream was undoubtedly open during March and the first part of April, but gage observations were not begun until Apr. 9.

Daily discharge, in second-feet, of Sevenmile Creek near Birdseye, Mont., for 1910.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	12	4.4	10	0.6	4.4	4.4	4.4	1.9
2	.....	12	4.4	6.2	.6	4.4	4.4	4.4	1.9
3	.....	12	4.4	4.4	.6	4.4	4.4	4.4	1.9
4	.....	12	4.4	4.4	.6	4.4	4.4	4.4	1.9
5	.....	8	1.9	1.9	.1	1.9	1.9	1.9	1.9
6	.....	8	4.4	4.4	.6	4.4	4.4	3.1	1.9
7	.....	8	4.4	4.4	.6	4.4	4.4	3.1	1.9
8	.....	8	4.4	4.4	.6	4.4	4.4	4.4	.....
9	17	8	4.4	6.2	.6	4.4	4.4	4.4	.....
10	12	8	1.9	1.9	.1	1.9	1.9	1.9	.....
11	17	8	4.4	4.4	.6	4.4	4.4	6.2	.....
12	17	8	4.4	4.4	.6	4.4	4.4	6.2	.....
13	17	10	4.4	4.4	.6	4.4	4.4	4.4	.....
14	17	8	4.4	4.4	.6	4.4	4.4	4.4	.....
15	10	8	1.9	3.1	1.9	1.9	1.9	1.9	.....
16	12	12	4.4	1.9	1.9	4.4	1.9	3.1	.....
17	12	12	4.4	6.2	3.1	4.4	3.1	4.4	.....
18	12	12	4.4	6.2	1.9	4.4	4.4	4.4	.....
19	8.0	10	4.4	4.4	1.9	4.4	1.9	4.4	.....
20	4.4	8	8.0	1.9	.6	1.9	1.2	4.4	.....
21	10	12	8.0	1.9	1.9	4.4	4.4	4.4	.....
22	8.0	12	8.0	4.4	1.9	.6	3.1	4.4	.....
23	8.0	12	8.0	4.4	4.4	.6	1.9	4.4	.....
24	8.0	8	8.0	4.4	6.2	.6	1.9	4.4	.....
25	4.4	4.4	3.1	1.9	1.9	.6	1.9	4.4	.....
26	8	8	6.2	4.4	4.4	1.9	1.9	4.4	.....
27	8	8	4.4	1.9	4.4	4.4	3.1	4.4	.....
28	12	8	4.4	1.9	4.4	4.4	4.4	4.4	.....
29	12	8	4.4	.6	4.4	4.4	4.4	4.4	.....
30	10	4.4	4.4	.1	1.9	1.9	1.9	3.1	.....
31	.....	4.4	.....	.6	4.4	.....	4.4	.....	.....

NOTE.—These discharges are based on a rating curve fairly well defined.

Monthly discharge of Sevenmile Creek near Birdseye, Mont., for 1910.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
January	.....	.....	[a] 4	246	
February	.....	.....	[a] 4	222	
March	.....	.....	[a] 10	615	
April	17	4.4	[a] 11.7	696	B.
May	12	4.4	9.07	558	A.
June	8.0	1.9	4.77	284	A.
July	10	.1	3.74	230	A.
August	6.2	.1	1.90	117	B.
September	4.4	.6	3.39	202	B.
October	4.4	1.2	3.36	207	B.
November	6.2	1.9	4.10	244	B.
December	.....	.....	[a] 1.9	117	
The year	.....	.....	5.16	3,740	

[a] Discharge estimated Jan. 1 to Apr. 8, and Dec. 8 to 31.

NOTE.—The means for January, February, March, and December are only approximate.

LITTLE PRICKLY PEAR CREEK BASIN.

DESCRIPTION.

Little Prickly Pear Creek rises in the Rocky Mountains near the continental divide, about 10 miles northwest of Marysville, Mont., and flows in a northeasterly direction to its junction with Missouri River, about 45 miles below Helena. The principal tributaries are Deadman, Marsh, Canyon, and Wolf creeks.

The valley of the Little Prickly Pear is narrow and bounded by high mountains and is exceptionally well irrigated on the upper portion of the stream. Additional water supply may be obtained by storage.

LITTLE PRICKLY PEAR CREEK NEAR MARYSVILLE, MONT.

This station, which is located on the upper portion of the stream at the Pearce ranch, 6 miles west and 3 miles north of Marysville, Mont., was established May 18, 1909, to obtain data for use in connection with irrigation.

Above this station Little Prickly Pear Creek has no important tributaries. Many small ditches take water from the stream, practically the entire flow of the stream being appropriated.

A staff gage is used, the datum of which has remained unchanged since the station was established. All measurements are made by wading.

The channel bed shifts in high water. The discharge is affected by ice during the winter months.

Discharge measurements of Little Prickly Pear Creek near Marysville, Mont., in 1910.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Feet.*	*Sec.-ft.*
May 17	Raymond Richards	15	9.2	2.93	19.5
June 17	....do	13	7.0	2.70	11.7
Aug. 3	C. S. Heidel	10	5.7	2.49	4.9
Sept. 9	....do	10	5.0	2.49	5.5
Nov. 10[a]	....do	9	4.1	2.42	3.5

[a] Made by wading above bridge.

Daily gage height, in feet, of Little Prickly Pear Creek near Marysville, Mont., for 1910.

[Gertrude P. Johnson, observer.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	2.65	3.05	2.85	2.65	2.55	2.5	2.45	2.4	2.40
2	.....	2.65	3.0	2.8	2.65	2.55	2.5	2.45	2.4	2.40
3	.....	2.6	3.0	2.8	2.65	2.55	2.5	2.45	2.4	2.40
4	.....	2.6	2.95	2.8	2.65	2.55	2.5	2.45	2.4	2.40
5	.....	2.55	2.85	2.7	2.6	2.5	2.45	2.45	2.4	2.40
6	.....	2.6	2.9	2.75	2.65	2.55	2.5	2.45	2.4	2.40
7	.....	2.6	2.9	2.75	2.65	2.55	2.5	2.45	2.4	2.40
8	.....	2.6	2.9	2.75	2.65	2.55	2.5	2.45	2.35	2.40
9	.....	2.6	2.95	2.75	2.65	2.55	2.5	2.45	2.35	2.40
10	.....	2.55	2.9	2.7	2.6	2.5	2.45	2.45	2.42	2.40
11	.....	2.65	2.95	2.75	2.65	2.5	2.5	2.45	2.42	2.40
12	.....	2.65	3.0	2.75	2.65	2.5	2.5	2.45	2.42	2.40
13	2.35	2.75	3.0	2.75	2.6	2.5	2.5	2.45	2.42	2.40
14	2.35	2.8	3.0	2.75	2.6	2.5	2.5	2.45	2.42	2.40
15	2.35	2.75	2.9	2.7	2.55	2.45	2.45	2.45	2.42	2.40
16	2.4	2.8	2.95	2.75	2.6	2.5	2.5	2.45	2.42	2.39
17	2.45	2.85	2.95	2.75	2.6	2.5	2.55	2.45	2.42	2.39
18	2.5	2.85	3.0	2.75	2.6	2.5	2.55	2.45	2.42	2.39
19	2.5	2.85	2.95	2.75	2.6	2.5	2.5	2.45	2.42	2.39
20	2.45	2.85	2.9	2.7	2.55	2.45	2.5	2.45	2.42	2.39
21	2.5	2.9	2.9	2.75	2.6	2.5	2.5	2.45	2.42	2.38
22	2.5	2.95	2.9	2.75	2.6	2.5	2.5	2.45	2.42	2.38
23	2.5	3.0	2.85	2.7	2.6	2.5	2.5	2.45	2.42	2.38
24	2.5	3.0	2.85	2.7	2.6	2.5	2.5	2.45	2.42	2.38
25	2.5	3.05	2.8	2.65	2.65	2.45	2.5	2.45	2.42	2.38
26	2.55	3.1	2.85	2.7	2.6	2.5	2.5	2.45	2.42	2.38
27	2.6	3.1	2.85	2.7	2.55	2.5	2.5	2.4	2.41	2.38
28	2.65	3.1	2.85	2.7	2.55	2.5	2.5	2.4	2.40	2.38
29	2.7	3.1	2.85	2.7	2.55	2.5	2.5	2.4	2.40	2.38
30	2.6	3.05	2.8	2.6	2.5	2.45	2.5	2.4	2.40	2.38
31	2.6	.....	2.85	.....	2.55	2.5	.....	2.4	.....	2.38

NOTE.—No gage record kept prior to Mar. 13. Probably little or no ice effect.

Daily discharge, in second-feet, of Little Prickly Pear Creek near Marysville, Mont., for 1910.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	10	24	17	10	6.9	5.4	4.2	3.1	3.1
2	.....	10	22	15	10	6.9	5.4	4.2	3.1	3.1
3	.....	8.4	22	15	10	6.9	5.4	4.2	3.1	3.1
4	.....	8.4	20	15	10	6.9	5.4	4.2	3.1	3.1
5	.....	6.9	17	12	8.4	5.4	4.2	4.2	3.1	3.1
6	.....	8.4	18	13	10	6.9	5.4	4.2	3.1	3.1
7	.....	8.4	18	13	10	6.9	5.4	4.2	3.1	3.1
8	.....	8.4	18	13	10	6.9	5.4	4.2	2.3	3.1
9	.....	8.4	20	13	10	6.9	5.4	4.2	2.3	3.1
10	.....	6.9	18	12	8.4	5.4	4.2	4.2	3.6	3.1

Daily discharge, in second-feet, of Little Prickly Pear Creek near Marysville, Mont., for 1910—Continued.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
11	.....	10	20	13	10	5.4	5.4	4.2	3.6	3.1
12	.....	10	22	13	10	5.4	5.4	4.2	3.6	3.1
13	2.3	13	22	13	8.4	5.4	5.4	4.2	3.6	3.1
14	2.3	15	22	13	8.4	5.4	5.4	4.2	3.6	3.1
15	2.3	13	18	12	6.9	4.2	4.2	4.2	3.6	3.1
16	3.1	15	20	13	8.4	5.4	5.4	4.2	3.6	2.9
17	4.2	17	20	13	8.4	5.4	6.9	4.2	3.6	2.9
18	5.4	17	22	13	8.4	5.4	6.9	4.2	3.6	2.9
19	5.4	17	20	13	8.4	5.4	5.4	4.2	3.6	2.9
20	4.2	17	18	12	6.9	4.2	5.4	4.2	3.6	2.9
21	5.4	18	18	13	8.4	5.4	5.4	4.2	3.6	2.8
22	5.4	20	18	13	8.4	5.4	5.4	4.2	3.6	2.8
23	5.4	22	17	12	8.4	5.4	5.4	4.2	3.6	2.8
24	5.4	22	17	12	8.4	5.4	5.4	4.2	3.6	2.8
25	5.4	24	15	10	10	4.2	5.4	4.2	3.6	2.8
26	6.9	26	17	12	8.4	5.4	5.4	4.2	3.6	2.8
27	8.4	26	17	12	6.9	5.4	5.4	3.1	3.3	2.8
28	10	26	17	12	6.9	5.4	5.4	3.1	3.1	2.8
29	12	26	17	12	6.9	5.4	5.4	3.1	3.1	2.8
30	8.4	24	15	8.4	5.4	4.2	5.4	3.1	3.1	2.8
31	8.4	.....	17	.....	6.9	5.4	.....	3.1	.....	2.8

NOTE.—The above discharges are based on a rating curve that is well defined.

Monthly discharge of Little Prickly Pear Creek near Marysville, Mont., for 1910.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
January	.....	.....	[a] 3.3	203	
February	.....	.....	[a] 3.0	167	
March	12	2.3	[a] 4.58	282	C.
April	26	6.9	15.4	916	A.
May	24	15	18.9	1,160	A.
June	17	8.4	12.7	756	A.
July	10	5.4	8.58	528	A.
August	6.9	4.2	5.63	346	A.
September	6.9	4.2	5.21	310	A.
October	4.2	3.1	4.02	247	B.
November	3.6	3.1	3.33	198	B.
December	3.1	2.8	2.96	182	B.
The year	.....	.....	7.30	5,300	

[a] Discharge estimated Jan. 1 to Mar. 12.

NOTE.—The means for January and February are only approximate.

LITTLE PRICKLY PEAR CREEK NEAR CANYON CREEK, MONT.

This station, which is located near Canyon Creek post office, was established April 1, 1909, to determine the quantity of water available for irrigation. Above this station Canyon, Marsh, Lost Horse, and Deadman creeks are the principal tributaries. Many small ditches take water from this stream and the low-water flow is practically all appropriated.

The channel at the gaging station will shift in flood, but at ordinary stages remains permanent.

Ice is common at this station during the winter months. The staff gage datum has remained the same. Measurements are made by wading.

Discharge measurements of Little Prickly Pear Creek near Canyon Creek, Mont., in 1910.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 17	Raymond Richards	30	39	2.77	74
June 17	do	6	1.4	1.70	1.9
Aug. 4	C. S. Heidel	5.5	1.3	1.74	1.3
Sept. 9	do	14	7.9	1.99	7.7
Nov. 11	do	24	26	2.32	26

NOTE.—These measurements have been made by wading at different sections.

Daily gage height, in feet, of Little Prickly Pear Creek near Canyon Creek, Mont., for 1910.

[W. J. Carbis, observer.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	2.65	2.85	1.75	1.6	1.6	1.9	2.05	2.25	2.32
2	.....	2.75	2.85	1.8	1.6	1.6	1.9	2.05	2.25	2.32
3	.....	2.7	2.85	1.8	1.6	1.65	1.9	2.05	2.25	2.32
4	.....	2.75	2.8	1.85	1.6	1.65	1.95	2.25	2.25	2.22
5	.....	2.7	2.8	1.85	1.6	1.65	1.95	2.30	2.35	2.22
6	.....	2.7	2.8	1.85	1.6	1.65	2.0	2.25	2.35	2.22
7	2.45	2.75	2.75	1.95	1.6	1.7	2.0	2.25	2.35	2.32
8	2.4	2.75	2.75	2.15	1.6	1.75	2.05	2.15	2.40	2.32
9	2.4	2.85	2.7	2.15	1.6	1.75	2.0	2.15	2.40	2.22
10	2.45	3.05	2.7	2.05	1.65	1.7	2.0	2.25	2.40	2.22
11	2.45	3.15	2.65	2.05	1.65	1.65	1.95	2.15	2.32	2.32
12	2.45	3.25	2.65	1.95	1.7	1.75	2.0	2.15	2.32	2.32
13	2.6	3.15	2.65	1.85	1.75	1.75	2.0	2.15	2.32	2.32
14	2.75	3.05	2.65	1.85	1.75	1.7	2.0	2.25	2.32	2.32
15	2.75	3.05	2.55	1.75	1.75	1.65	2.0	2.30	2.31	2.32
16	2.75	3.05	2.55	1.75	1.65	1.65	2.0	2.25	2.31	2.32
17	2.75	3.15	2.5	1.65	1.65	1.65	2.05	2.25	2.32	2.32
18	2.75	3.25	2.5	1.65	1.65	1.65	2.05	2.30	2.32	2.22
19	2.85	3.35	2.45	1.65	1.65	1.75	2.05	2.35	2.32	2.22
20	2.9	3.25	2.4	1.65	1.7	1.8	2.05	2.40	2.32	2.32
21	2.75	3.25	2.3	1.6	1.6	1.75	2.0	2.35	2.32	2.32
22	2.7	3.25	2.25	1.6	1.55	1.7	2.05	2.35	2.32	2.32
23	2.65	3.25	2.0	1.6	1.65	1.7	2.05	2.25	2.32	2.22
24	2.65	3.25	2.0	1.6	1.7	1.7	2.05	2.25	2.32	2.22
25	2.6	3.25	1.9	1.6	1.7	1.75	2.1	2.30	2.32	2.22
26	2.55	3.15	1.85	1.6	1.7	1.7	2.1	2.20	2.32	2.22
27	2.55	3.15	1.85	1.6	1.75	1.7	2.1	2.15	2.32	2.32
28	2.6	3.05	1.9	1.6	1.75	1.65	2.1	2.15	2.32	2.32
29	2.55	3.1	1.9	1.65	1.7	1.65	2.1	2.15	2.32	2.32
30	2.65	2.95	1.85	1.65	1.7	1.75	2.1	2.20	2.32	2.32
31	2.65	.....	.....	.....	1.65	1.7	.....	2.15	.....	2.32

NOTE.—Probably more or less affected by ice from January 1 to March 6.

Daily discharge, in second-feet, of Little Prickly Pear Creek near Canyon Creek, Mont., for 1910.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1			25	58	86	2.2	0	0	5	10	20	25
2			25	71	86	3	0	0	5	10	20	25
3			25	64	86	3	0	.8	5	10	20	25
4			25	71	78	4	0	.8	6.5	20	20	18
5			30	64	78	4	0	.8	6.5	23	27	18
6			30	64	78	4	0	.8	8	20	27	18
7			35	71	71	6.5	0	1.5	8	20	27	25
8			31	71	71	14	0	2.2	10	14	31	25
9			31	86	64	14	0	2.2	8	14	31	18
10			35	120	64	10	.8	1.5	8	20	31	18
11			35	138	58	10	.8	.8	6.5	14	25	25
12			35	156	58	6.5	1.5	2.2	8	14	25	25
13			51	138	58	4	2.2	2.2	8	14	25	25
14			71	120	58	4	2.2	1.5	8	20	25	25
15			71	120	46	2.2	2.2	.8	8	23	24	25
16			71	120	46	2.2	.8	.8	8	20	24	25
17			71	138	40	.8	.8	.8	10	20	25	25
18			71	156	40	.8	.8	.8	10	23	25	18
19			86	176	36	.8	.8	2.2	10	27	25	18
20			94	156	31	.8	1.5	3.0	10	31	25	25
21			71	156	23	0	0	2.2	8	27	25	25
22			64	156	20	0	0	1.5	10	27	25	25
23			58	156	8	0	.8	1.5	10	20	25	18
24			58	156	8	0	1.5	1.5	10	20	25	18
25			51	156	5	0	1.7	2.2	12	23	25	18
26			46	138	4	0	1.7	1.5	12	17	25	18
27			46	138	4	0	2.2	1.5	12	14	25	25
28			51	120	5	0	2.2	.8	12	14	25	25
29			46	129	5	.8	1.5	.8	12	14	25	25
30			58	102	4	.8	1.5	2.2	12	17	25	25
31			58	.....	3	.....	.8	1.5	.....	14	.....	25

NOTE.—These daily discharges are based on a fairly well defined rating curve. Discharges estimated for March 1 to 6.

Monthly discharge of Little Prickly Pear Creek near Canyon Creek, Mont., for 1910.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
January	.....	.....	[a] 25	1,540	D.
February	.....	.....	[a] 25	1,390	D.
March	.....	.....	50.2	3,090	C.
April	176	58	119	7,080	B.
May	86	3	42.6	2,620	B.
June	14	0	3.28	195	B.
July	2.2	0	.91	56	B.
August	3	0	1.38	85	B.
September	12	5	8.88	528	B.
October	31	10	18.5	1,140	B.
November	31	20	25.1	1,490	B.
December	25	18	22.5	1,380	B.
The year	.....	.....	28.5	20,600	

[a] Estimated.

NOTE.—Means for January and February are only approximate.

DEADMAN CREEK NEAR MARYSVILLE, MONT.

This station, which is located near the ranch of Charles Johnson, one-half mile above the junction of Lost Horse Creek and Deadman Creek and 6 miles from Marysville, was established April 2, 1909, to

obtain data for use in connection with irrigation development. One or two small ditches take water from the stream.

On June 8, 1909, the staff gage was moved downstream 300 yards and was given a new datum.

The channel does not shift. Measurements are made by wading. Ice is common at this station during the winter months.

Discharge measurements of Deadman Creek near Marysville, Mont., in 1910.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 17	Raymond Richards	18	9.7	2.23	24
June 17	....do	16	7.4	1.99	9.3
Aug. 3	C. S. Heidel	6	3.3	1.80	3.1
Sept. 9	.....do	6	3.2	1.76	2.6
Nov. 10	.....do	7	4.0	1.93	5.9

NOTE.—Discharge measurements made by wading above the gage.

Daily gage height, in feet, of Deadman Creek near Marysville, Mont., for 1910.

[Charles Johnson, observer.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	2.10	2.64	2.15	1.92	1.85	1.82	1.82	1.85	1.92
2	.....	2.08	2.65	2.15	1.92	1.85	1.82	1.82	1.85	1.92
3	.....	2.05	2.65	2.10	1.92	1.82	1.82	1.82	1.85	1.92
4	.....	2.05	2.65	2.10	1.92	1.82	1.82	1.82	1.85	1.92
5	.....	2.05	2.70	2.10	1.92	1.82	1.80	1.82	1.85	1.92
6	.....	2.05	2.70	2.10	1.92	1.82	1.80	1.82	1.90	1.92
7	.....	2.05	2.70	2.10	1.92	1.82	1.78	1.80	1.90	1.92
8	.....	2.05	2.75	2.10	1.92	1.82	1.77	1.80	1.91	1.92
9	.....	2.18	2.72	2.10	1.92	1.82	1.76	1.80	1.92	1.92
10	.....	2.28	2.76	2.10	1.92	1.82	1.74	1.80	1.92	1.92
11	.....	2.35	2.65	2.10	1.92	1.82	1.75	1.80	1.92	1.92
12	.....	2.40	2.58	2.10	1.92	1.82	1.75	1.80	1.95	1.92
13	.....	2.45	2.46	2.05	1.92	1.82	1.75	1.80	1.95	1.92
14	2.00	2.40	2.30	2.05	1.92	1.82	1.78	1.80	1.95	1.94
15	2.00	2.42	2.25	2.00	1.92	1.82	1.80	1.80	1.95	1.95
16	2.00	2.40	2.22	1.98	1.92	1.82	1.82	1.80	1.95	1.95
17	2.05	2.02	2.22	1.95	1.92	1.82	1.82	1.80	1.95	1.95
18	2.08	2.05	2.20	1.95	1.92	1.82	1.80	1.80	1.95	1.95
19	2.12	2.18	2.20	1.95	1.91	1.80	1.80	1.80	1.95	1.95
20	2.18	2.22	2.18	1.95	1.90	1.80	1.80	1.80	1.95	1.95
21	2.26	2.32	2.18	1.95	1.90	1.80	1.80	1.80	1.95	1.95
22	2.30	2.35	2.18	1.95	1.90	1.80	1.80	1.80	1.95	1.95
23	2.32	2.44	2.18	1.95	1.90	1.82	1.85	1.80	1.95	1.95
24	2.32	2.50	2.18	1.95	1.90	1.82	1.85	1.82	1.92	1.95
25	2.28	2.52	2.18	1.95	1.90	1.82	1.85	1.82	1.92	1.95
26	2.20	2.55	2.15	1.95	1.90	1.82	1.85	1.82	1.92	1.95
27	2.20	2.58	2.15	1.95	1.90	1.82	1.85	1.82	1.92	1.95
28	2.10	2.59	2.15	1.95	1.90	1.82	1.85	1.82	1.92	1.92
29	2.10	2.61	2.15	1.92	1.90	1.82	1.82	1.82	1.92	1.92
30	2.05	2.64	2.15	1.92	1.90	1.82	1.82	1.85	1.92	1.92
31	2.05	.....	2.15	.....	1.88	1.82	.....	1.85	.....	.....

NOTE.—Probably affected by ice from January to about Mar. 13.

Daily discharge, in second-feet, of Deadman Creek near Marysville, Mont., for 1910.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	15	62	18	6.3	4.3	3.6	3.6	4.3	6.3
2	.....	14	63	18	6.3	4.3	3.6	3.6	4.3	6.3
3	.....	12	63	15	6.3	3.6	3.6	3.6	4.3	6.3
4	.....	12	63	15	6.3	3.6	3.6	3.6	4.3	6.3
5	.....	12	68	15	6.3	3.6	3.1	3.6	4.3	6.3
6	.....	12	68	15	6.3	3.6	3.1	3.6	5.6	6.3
7	.....	12	68	15	6.3	3.6	2.9	3.1	5.6	6.3
8	.....	12	73	15	6.3	3.6	2.8	3.1	6.0	6.3
9	.....	20	70	15	6.3	3.6	2.7	3.1	6.3	6.3
10	.....	28	74	15	6.3	3.6	2.4	3.1	6.3	6.3
11	.....	34	63	15	6.3	3.6	2.6	3.1	6.3	6.3
12	.....	38	56	15	6.3	3.6	2.6	3.1	7.4	6.3
13	.....	43	44	12	6.3	3.6	2.6	3.1	7.4	6.3
14	9.3	38	30	12	6.3	3.6	2.9	3.1	7.4	7.1
15	9.3	40	26	9.3	6.3	3.6	3.1	3.1	7.4	7.4
16	9.3	38	23	8.6	6.3	3.6	3.6	3.1	7.4	7.4
17	12	10	23	7.4	6.3	3.6	3.6	3.1	7.4	7.4
18	14	12	22	7.4	6.3	3.6	3.1	3.1	7.4	7.4
19	16	20	22	7.4	6.0	3.1	3.1	3.1	7.4	7.4
20	20	23	20	7.4	5.6	3.1	3.1	3.1	7.4	7.4
21	26	32	20	7.4	5.6	3.1	3.1	3.1	7.4	7.4
22	30	34	20	7.4	5.6	3.1	3.1	3.1	7.4	7.4
23	32	42	20	7.4	5.6	3.6	4.3	3.1	7.4	7.4
24	32	48	20	7.4	5.6	3.6	4.3	3.6	6.3	7.4
25	28	50	20	7.4	5.6	3.6	4.3	3.6	6.3	7.4
26	22	53	18	7.4	5.6	3.6	4.3	3.6	6.3	7.4
27	22	56	18	7.4	5.6	3.6	4.3	3.6	6.3	7.4
28	15	57	18	7.4	5.6	3.6	4.3	3.6	6.3	6.3
29	15	59	18	6.3	5.6	3.6	3.6	3.6	6.3	6.3
30	12	62	18	6.3	5.6	3.6	3.6	4.3	6.3	6.3
31	12	.....	18	.....	5.1	3.6	.....	4.3	.....	6.3

NOTE.—These discharges are based on a well-defined rating curve below 30 second-feet.

Monthly discharge of Deadman Creek near Marysville, Mont., for 1910.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
January	.....	.....	[a] 4	246	
February	.....	.....	[a] 4	222	
March	32	4	[a] 13.7	842	C.
April	62	10	31.3	1,860	A.
May	74	18	39.0	2,400	A.
June	18	6.3	11.0	655	A.
July	6.3	5.1	6.00	369	A.
August	4.3	3.1	3.58	220	A.
September	4.3	2.4	3.36	200	A.
October	4.3	3.1	3.37	207	A.
November	7.4	4.3	6.35	378	A.
December	7.4	6.3	6.79	418	A.
The year	.....	.....	11.0	8,020	

[a] Discharge estimated Jan. 1 to Mar. 13.

NOTE.—Means for January and February are only approximate.

LOST HORSE CREEK NEAR MARYSVILLE, MONT.

Lost Horse Creek is a small stream, fed by springs and melting snow in the mountains. It is tributary to Deadman Creek.

The gaging station, which was established April 2, 1909, is at the ranch of Charles Johnson, one-fourth mile above the junction of Lost Horse with Deadman Creek, and about 6 miles from Marysville.

One ditch receives its water from Lost Horse Creek. There are no tributaries. Channel conditions are good in low and ordinary stages, but will shift in high water. A staff gage is used. Measurements are made by wading.

Discharge measurements of Lost Horse Creek near Marysville, Mont., in 1910.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 17	Raymond Richards	5	1.4	1.85	2.2
June 17	do	4	.8	1.78	.9
Aug. 3	C. S. Heidel	2.3	.3	1.62	.2
Sept. 9	do			1.50	*a* 0
Nov. 10	do			1.50	*a* 0

a Channel at gage dry, but there was about 2 second-feet flowing one-fourth mile below the gage. See description.

NOTE.—Measurements made by wading at various sections.

Daily gage height, in feet, of Lost Horse Creek near Marysville, Mont., for 1910.

[Charles Johnson, observer.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1		1.85	2.23	1.82	1.78	1.65	1.50
2		1.85	2.23	1.82	1.78	1.65	1.50
3		1.83	2.25	1.80	1.78	1.62	1.50
4		1.83	2.28	1.80	1.78	1.62	.....
5		1.78	2.28	1.82	1.78	1.62	.....
6		1.75	2.28	1.84	1.78	1.62	.....
7		1.78	2.28	1.85	1.78	1.62	.....
8		1.83	2.31	1.85	1.78	1.62	.....
9		1.88	2.30	1.85	1.78	1.62	.....
10		1.91	2.28	1.85	1.78	1.62	.....
11		1.98	2.23	1.85	1.78	1.60	.....
12		2.01	2.21	1.85	1.78	1.60	.....
13		2.03	2.15	1.85	1.78	1.60	.....
14	1.93	2.03	2.11	1.82	1.78	1.60	.....
15	1.93	2.03	2.08	1.82	1.78	1.60	.....
16	1.93	2.03	2.03	1.80	1.78	1.60	.....
17	2.00	1.93	1.90	1.80	1.78	1.60	.....
18	2.03	1.95	1.90	1.80	1.78	1.60	.....
19	2.06	1.98	1.88	1.80	1.78	1.58	.....
20	2.11	1.98	1.88	1.80	1.76	1.58	.....
21	1.98	1.98	1.85	1.80	1.75	1.58	.....
22	1.98	1.98	1.85	1.80	1.75	1.58	.....
23	1.93	1.98	1.82	1.80	1.75	1.58	.....
24	1.93	1.98	1.82	1.80	1.75	1.58	.....
25	1.93	2.08	1.80	1.80	1.75	1.58	.....
26	1.88	2.15	1.80	1.80	1.75	1.55	.....
27	1.88	2.18	1.82	1.80	1.75	1.55	.....
28	1.83	2.18	1.82	1.80	1.75	1.55	.....
29	1.83	2.23	1.82	1.80	1.75	1.55	.....
30	1.83	2.23	1.82	1.78	1.75	1.55	.....
31	1.83	.....	1.82	.....	1.70	1.55	.....

NOTE.—Probably slightly affected by ice during January, February, and first part of March.

Daily discharge, in second-feet, of Lost Horse Creek near Marysville, Mont., for 1910.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Day.	Mar.	Apr.	May.	June.	July.	Aug.
1	.....	1.9	6.6	1.6	1.3	0.4	16	2.8	4.0	4.0	1.4	1.3	0.2
2	.....	1.9	6.6	1.6	1.3	.4	17	3.6	2.8	2.4	1.4	1.3	.2
3	.....	1.7	6.8	1.4	1.3	.3	18	4.0	3.0	2.4	1.4	1.3	.2
4	.....	1.7	7.2	1.4	1.3	.3	19	4.4	3.4	2.2	1.4	1.3	.2
5	.....	1.3	7.2	1.6	1.3	.3	20	5.0	3.4	2.2	1.4	1.1	.2
6	.....	1.1	7.2	1.8	1.3	.3	21	3.4	3.4	1.9	1.4	1.1	.2
7	.....	1.3	7.2	1.9	1.3	.3	22	3.4	3.4	1.9	1.4	1.1	.2
8	.....	1.7	7.6	1.9	1.3	.3	23	2.8	3.4	1.6	1.4	1.1	.2
9	.....	2.2	7.5	1.9	1.3	.3	24	2.8	3.4	1.6	1.4	1.1	.2
10	.....	2.5	7.2	1.9	1.3	.3	25	2.8	4.6	1.4	1.4	1.0	.2
11	.....	3.4	6.6	1.9	1.3	.2	26	2.2	5.6	1.4	1.4	1.0	.1
12	.....	3.7	6.3	1.9	1.3	.2	27	2.2	5.6	1.6	1.4	1.0	.1
14	.....	4.0	5.5	1.9	1.3	.2	28	1.7	5.6	1.6	1.4	1.0	.1
14	2.8	4.0	5.0	1.6	1.3	.2	29	1.7	6.6	1.6	1.4	1.0	.1
15	2.8	4.0	4.6	1.6	1.3	.2	30	1.7	6.6	1.6	1.3	1.0	.1
							31	1.7	.....	1.6	.....	.7	.1

NOTE.—These discharges are based on a rating curve fairly well defined below 3 second-feet.

Monthly discharge of Lost Horse Creek near Marysville, Mont., for 1910.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
March	5.0	.....	[a] 2.26	139	C.
April	6.6	1.1	3.37	205	C.
May	7.6	1.4	4.20	258	C.
June	1.9	1.3	1.56	93	C.
July	1.3	.7	1.19	73	C.
August	.4	.1	.219	13	C.

[a] Discharge estimated; Mar. 1 to 13.

NOTE.—There was very litle flow during January, February, and September to December. Estimated total run-off in acre-feet for year, 828.

MARSH CREEK NEAR MARYSVILLE, MONT.

Marsh Creek, a small stream, without tributaries, rises in the mountains about 10 miles from Marysville. The station was established April 1, 1909, and is located at the Hartmiller ranch, about 1 mile above the junction of Marsh Creek with the Little Prickly Pear. The creek supplies no important ditches. Measurements are made by wading near the staff gage.

Discharge measurements of Marsh Creek near Marysville, Mont., in 1910.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec. ft.*
May 17	Raymond Richards	8	2.7	1.61	5.3
June 17	.....do	8	1.9	1.47	3.0
Aug. 4	C. S. Heidel	7	1.8	1.25	2.0
Sept. 9	.....do	5	2.2	1.30	1.7
Nov. 10	.....do	5	2.2	1.30	1.4

NOTE.—Discharge measurements are made by wading at various sections.

Daily gage height, in feet, of Marsh Creek near Marysville, Mont., for 1910.

[J. Hartmiller, jr., observer.]

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	1.62	1.5	1.45	1.25	1.3	1.3	1.25	1.25
2	.....	1.62	1.5	1.4	1.25	1.3	1.25	1.25	1.25
3	1.47	1.62	1.5	1.4	1.2	1.3	1.25	1.25	1.25
4	1.47	1.62	1.5	1.5	1.2	1.3	1.3	1.3	1.25
5	1.47	1.62	1.5	1.35	1.2	1.3	1.3	1.3	1.25
6	1.47	1.62	1.5	1.35	1.2	1.3	1.3	1.3	1.25
7	1.47	1.62	1.5	1.35	1.25	1.3	1.25	1.3	1.25
8	1.47	1.57	1.5	1.35	1.25	1.3	1.25	1.3	1.25
9	1.57	1.57	1.5	1.35	1.2	1.3	1.25	1.3	1.25
10	1.57	1.67	1.5	1.35	1.2	1.3	1.25	1.3	1.25
11	1.62	1.62	1.4	1.35	1.25	1.3	1.25	1.3	.....
12	1.62	1.62	1.4	1.35	1.2	1.3	1.25	1.33	.....
13	1.62	1.57	1.4	1.3	1.2	1.3	1.25	1.33	.....
14	1.62	1.57	1.4	1.3	1.25	1.3	1.25	1.30	.....
15	1.62	1.57	1.4	1.3	1.2	1.3	1.25	1.27	.....
16	1.62	1.67	1.45	1.3	1.25	1.3	1.25	1.27	.....
17	1.57	1.65	1.45	1.2	1.2	1.3	1.25	1.27	.....
18	1.57	1.6	1.45	1.2	1.2	1.3	1.25	1.27	.....
19	1.57	1.6	1.45	1.2	1.2	1.25	1.25	1.27	.....
20	1.57	1.6	1.5	1.25	1.2	1.25	1.25	1.27	.....
21	1.62	1.65	1.5	1.25	1.2	1.25	1.25	1.27	.....
22	1.62	1.6	1.5	1.25	1.2	1.25	1.25	1.29	.....
23	1.62	1.55	1.4	1.25	1.2	1.25	1.25	1.29	.....
24	1.62	1.55	1.4	1.25	1.25	1.3	1.25	1.29	.....
25	1.62	1.55	1.4	1.25	1.25	1.25	1.25	1.27	.....
26	1.62	1.55	1.4	1.25	1.25	1.25	1.3	1.25	.....
27	1.62	1.55	1.4	1.25	1.2	1.25	1.3	1.25	.....
28	1.62	1.5	1.4	1.3	1.2	1.25	1.3	1.25	.....
29	1.62	1.5	1.4	1.3	1.3	1.25	1.3	1.25	.....
30	1.62	1.5	1.5	1.3	1.3	1.25	1.3	1.25	.....
31	.....	1.5	.....	1.3	1.3	.....	1.25	.....	.....

NOTE.—Gage heights probably affected by ice during January and February. Little or no ice during March. Ice existed after Dec. 10.

Daily discharge, in second-feet, of Marsh Creek near Marysville, Mont., for 1910.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.4	5.0	3.6	3.2	2.0	1.7	1.5	1.3	1.3
2	3.4	5.0	3.6	2.8	2.0	1.7	1.5	1.3	1.3
3	3.4	5.0	3.6	2.8	1.8	1.7	1.5	1.3	1.3
4	3.4	5.0	3.6	3.6	1.8	1.7	1.6	1.4	1.3
5	3.4	5.0	3.6	2.5	1.8	1.7	1.6	1.4	1.3
6	3.4	5.0	3.6	2.5	1.8	1.7	1.6	1.4	1.3
7	3.4	5.0	3.6	2.5	2.0	1.7	1.5	1.4	1.3
8	3.4	4.4	3.6	2.5	1.9	1.7	1.5	1.4	1.3
9	4.4	4.4	3.6	2.5	1.8	1.7	1.5	1.4	1.3
10	4.4	5.8	3.6	2.5	1.8	1.7	1.5	1.4	1.3
11	5.0	5.0	2.8	2.5	1.9	1.7	1.5	1.4	.....
12	5.0	5.0	2.8	2.5	1.8	1.7	1.4	1.4	.....
13	5.0	4.4	2.8	2 2	1.8	1.7	1.4	1.4	.....
14	5.0	4.4	2.8	2.2	1.9	1.7	1.3	1.4	.....
15	5.0	4.4	2.8	2.2	1.8	1.7	1.3	1.4	.....
16	5.0	5.8	3.2	2.2	1.9	1.7	1.3	1.4	.....
17	4.4	5.4	3.2	1.8	1.7	1.7	1.3	1.4	.....
18	4.4	4.7	3.2	1.8	1.7	1.7	1.3	1.4	.....
19	4.4	4.7	3.2	1.8	1.7	1.6	1.3	1.4	.....
20	4.4	4.7	3.6	2.0	1.7	1.6	1.3	1.4	.....
21	5.0	5.4	3.6	2.0	1.7	1.6	1.3	1.3	.....
22	5.0	4.7	3.6	2.0	1.7	1.6	1.3	1.3	.....
23	5.0	4.2	2.8	2.0	1.7	1.5	1.3	1.3	.....
24	5.0	4.2	2.8	2.0	1.8	1.6	1.3	1.3	.....
25	5.0	4.2	2.8	2.0	1.8	1.5	1.3	1.3	.....
26	5.0	4.2	2.8	2.0	1.8	1.5	1.5	1.3	.....
27	5.0	4.2	2.8	2.0	1.7	1.5	1.4	1.3	.....
28	5.0	3.6	2.8	2.2	1.7	1.5	1.4	1.3	.....
29	5.0	3.6	2.8	2.2	1.8	1.5	1.4	1.3	.....
30	5.0	3.6	3.6	2.2	1.8	1.5	1.4	1.3	.....
31	.....	3.6	.....	2.2	1.8	.....	1.3	.....	.....

NOTE.—These discharges are based on a rating curve poorly defined. Discharges Apr. 1 and 2 estimated.

Monthly discharge of Marsh Creek near Marysville, Mont., for 1910.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
January	.....	.....	[a] 1.50	92	
February	.....	.....	[a] 1.50	83	
March	.....	.....	[a] 3.00	184	
April	5.0	3.4	4.45	265	C.
May	5.8	3.6	4.63	285	C.
June	3.6	2.8	3.23	192	C.
July	3.6	1.8	2.30	141	C.
August	2.0	1.7	1.80	111	C.
September	1.7	1.5	1.64	98	C.
October	1.6	1.3	1.41	87	C.
November	1.4	1.3	1.36	81	C.
December	.....	.....	[b] 1.30	80	
The year	.....	.....	2.34	1,700	

[a] Estimated. [b] Discharge Dec. 11 to 31 estimated.

NOTE.—The means for January, February, March, and December are only approximate.

DEARBORN RIVER BASIN.

DESCRIPTION.

Dearborn River rises on the eastern slope of the Rocky Mountains in Lewis and Clark County, Mont., and takes a general southeasterly course to its junction with the Missouri about 40 miles southwest of Great Falls.

The construction of a project under the Carey Act to reclaim about 30,000 acres of land was undertaken several years ago. The water supply for this project comes from the natural flow of the Dearborn at a point just below the mouth of Falls Creek.

DEARBORN RIVER NEAR CLEMONS, MONT.

This station, which was established May 4, 1908, to obtain information concerning the amount of water available for irrigation, is located 2 miles above Clemons, Mont., and half a mile above the head works of the reclamation project.

The only important tributary near the station is Falls Creek, which enters one-half mile below. The drainage area is 110 square miles.

Measurements at this station are made from cable located just above the gage and by wading. Owing to the fact that the gage is located some 2 miles from the observer's house observations were not made every day. Interpolations made are believed to be fairly accurate. The stream freezes over during the winter and no record of gage heights is kept. The datum of the staff gage was lowered 1.0 foot on October 21, 1910, and all gage heights for the year were consequently changed.

Discharge measurements of Dearborn River near Clemons, Mont., in 1910.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Apr. 27	Raymond Richards	.....	.....	2.08	427
May 27	....do	70	86	1.66	237
July 14	M. E. McChristie	60	42	1.06	68
Aug. 28	....do	43	44	.02	32
Oct. 11	Raymond Richards	57	37	.8	50
Nov. 22	J. C. Beebe	58	74	.96	42

NOTE.—Measurement Apr. 27 made at footbridge below mouth of Falls Creek. Measured discharge 576 second-feet. Discharge of Falls Creek Apr. 27, 149 second-feet subtracted to give flow past gaging station on Dearborn River. All other discharge measurements at this station were made by wading above mouth of Falls Creek.

Daily gage height, in feet, of Dearborn River near Clemons, Mont., for 1910.

[Dr. O. A. Kenck, observer,]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	.....	1.68	1.60	1.22	0.95	0.82	1.00	.....	0.94
2	.....	.....	.....	.....	1.22	.94	.....	.....	0.95	.....
3	.....	1.33	.....	1.54	1.19	.....	.84	1.00	.....	.90
4	.....	.....	1.72	.....	.....	.96	.84	.....	.95	.....
5	.....	.....	.....	1.47	1.18	.....	.84	.....	.....	.90
6	1.05	.....	2.20	1.46	.....	.99	.84	.....	.95	.....
7	.....	.....	.....	1.46	1.16	.80	.....	.99	.....	.87
8	.....	.....	1.90	.....	.....	.....	.86	.99	.95	.....
9	.....	.....	.....	1.45	1.14	.90	.....	.99	.....	.87
10	.....	1.54	2.00	1.45	.....	.....	.89	.97	.96	.....
11	.....	.....	.....	1.45	1.10	.88	.....	.97	.....	.85
12	.....	.....	1.80	.....	1.09	.....	.93	.....	.96	.....
13	1.18	.....	.....	1.43	.....	.....	1.00	.....	.....	.85
14	.....	.....	1.75	.....	1.06	.85	.....	.....	.98	.....
15	.....	.....	2.69	1.42	.....	.....	1.19	.....	.....	.85
16	.....	.....	.....	.....	1.06	.85	1.30	.95	.98	.....
17	.....	.....	1.56	1.44	1.05	.....	.....	.95	.98	.84
18	.....	.....	.....	.....	.....	.84	1.23	.....	.....	.....
19	.....	.....	.....	1.44	1.03	.....	.....	.....	.98	.84
20	.....	.....	1.57	.....	.....	.84	1.21	.....	.....	.....
21	1.21	.....	.....	1.47	1.02	.....	.....	.....	.98	.87
22	.....	.....	1.55	.....	.....	.83	1.20	.....	.....	.....
23	.....	.....	.....	1.35	1.00	.....	.....	.92	.96	.93
24	.....	.....	.....	.....	1.00	.83	1.18	.....	.....	1.10
25	.....	.....	1.60	1.31	.....	.....	.....	.92	.96	.....
26	.....	.....	.....	.....	.98	.83	1.15	.....	.....	1.48
27	1.25	2.10	1.66	1.27	.....	.....	.....	.92	.95	.....
28	.....	.....	.....	.....	.95	.82	1.15	.....	.....	1.61
29	.....	1.88	1.58	1.23	.....	.....	.....	.94	.95	.....
30	.....	.....	.....	.....	.97	.82	1.15	.....	.....	.....
31	.....	.....	1.63	.....	.....	.....	.....	.95	.....	1.63

NOTE.—Ice during January and February and after Dec. 20.

Daily discharge, in second-feet, of Dearborn River near Clemons, Mont., for 1910.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	119	235	205	97	50	31	58	50	49
2	.....	121	241	195	97	49	32	58	50	46
3	.....	123	247	185	91	50	34	58	50	43
4	.....	131	252	174	90	52	34	57	50	43
5	.....	139	372	162	89	54	34	56	50	43
6	66	147	492	159	86	56	34	56	50	40
7	69	155	412	159	84	28	36	56	50	38
8	72	163	333	158	83	36	37	56	50	38
9	75	174	358	156	82	43	40	56	51	38
10	78	185	383	156	78	42	42	53	52	37

Daily discharge, in second-feet, of Dearborn River near Clemons, Mont., for 1910—Contd.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
11	81	200	334	156	74	40	44	53	52	36
12	84	215	286	153	72	38	47	52	52	36
13	89	230	275	150	70	38	58	52	54	36
14	88	241	264	148	68	36	74	51	55	36
15	89	260	780	147	68	36	91	51	55	36
16	90	275	486	150	68	36	115	50	55	35
17	91	290	191	153	66	35	108	50	55	34
18	92	305	192	153	64	34	100	49	55	34
19	93	320	194	153	63	34	98	49	55	34
20	94	335	195	158	62	34	95	48	55	.....
21	95	350	192	162	61	33	94	48	55	.....
22	96	365	188	145	60	32	93	47	54	.....
23	97	380	194	128	58	32	91	46	52	.....
24	98	395	200	123	58	32	89	46	52	.....
25	100	410	205	118	56	32	86	46	52	.....
26	102	425	216	113	55	32	84	46	51	.....
27	104	436	228	108	52	32	84	46	50	.....
28	107	380	213	104	50	31	84	48	50	.....
29	110	324	198	100	52	31	84	49	50	.....
30	113	280	207	98	53	31	84	50	50	.....
31	116	.....	216	.....	52	31	.....	50	.....	.....

NOTE.—These discharges are based on a rating curve well defined between 20 and 520 second-feet. Discharges interpolated for days on which gage heights were not read.

Monthly discharge of Dearborn River near Clemons, Mont., for 1910.

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
January	.....	.....	[a]60	0.545	0.63	3,690	
February	.....	.....	[a]65	.591	.62	3,610	
March	116	.....	[a]87.6	.796	.92	5,380	C.
April	436	119	263	2.39	2.67	15,600	C.
May	492	188	283	2.57	2.96	17,400	A.
June	205	98	148	1.35	1.51	8,810	A.
July	97	52	69.6	.633	.73	4,280	A.
August	56	31	37.7	.343	.40	2,320	A.
September	115	31	68.6	.624	.70	4,080	A.
October	58	46	51.3	.466	.54	3,150	A.
November	55	50	52.1	.474	.53	3,100	A.
December	49	.....	[a]36.8	.335	.39	2,260	C.
The year	.....	.....	102	.926	12.60	73,700	

[a] Discharge estimated Jan. 1 to Mar. 5 and Dec. 20 to 30.

NOTE.—The means for January and February are only approximate.

FALLS CREEK NEAR CLEMONS, MONT.

This station, which is located 1½ miles above Clemons, Mont., and 500 feet above the mouth of the creek, was established May 4, 1908, to obtain data for use in connection with water-power and irrigation development.

Falls Creek has a large fall above the gaging station and affords opportunities for water-power development. No water is diverted from this stream, its entire flow reaching Dearborn River.

No records are kept during the winter, as the gage heights are affected by ice. The datum of the staff gage has remained unchanged.

Measurements are made by wading or from a recently constructed cable. Observations are fragmentary on account of the great distance the observer lives from the gage. Interpolations made are believed to be fairly accurate.

Discharge measurements of Falls Creek near Clemons, Mont., in 1910.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Apr. 27	Raymond Richards	45	49	1.69	149
May 27	do	33	37	1.38	91
July 14	M. E. McChristie	30	20	.91	31
Aug. 28	do	27	14	.73	18
Oct. 21	Raymond Richards	28	21	.90	25
Nov. 22	J. C. Beebe	26	16	.81	18

NOTE.—All measurements were made by wading.

Daily gage height, in feet, of Falls Creek near Clemons, Mont., for 1910.

[Dr. O. A. Kenck, observer.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1			1.42	1.30	1.01	0.81	0.75	0.98		0.80
2					1.01	.81			0.82	
3		1.47		1.27	1.00		.75	.98		.80
4			1.43			.80	.74		.83	
5				1.20	.99		.74			.79
6	0.89		1.77	1.20		.78	.74		.82	
7				1.18	.99	.77		.96		.77
8			1.52				.76	.96	.82	
9				1.18	.98	.77		.96		.77
10		1.22	1.72	1.18			.81	.96	.81	
11				1.20	.95	.77		.96	.81	.77
12			1.52		.95		.83		.81	
13	.97			1.18			.85		.80	.76
14			1.49		.91	.76			.80	
15			1.42	1.16			.87			.76
16					.90	.76	.91	.94	.80	
17			1.32	1.17	.89			.94	.80	.76
18						.75	.98			
19				1.16	.89				.80	.76
20			1.32			.75	.98			
21	1.03			1.18	.89				.80	.81
22			1.31			.73	1.00			
23				1.10	.88			.80	.81	.84
24					.88	.72	.99			.90
25			1.34	1.08				.80	.81	
26					.85	.72	1.02			1.52
27	1.12	1.72	1.40	1.05				.80	.81	
28					.82	.73	1.00			1.69
29		1.62	1.30	1.02				.80	.80	
30					.81	.73	.99			
31			1.32					.82		1.77

NOTE.—Ice during January, February, and Dec. 20 to 30.

Daily discharge, in second-feet, of Falls Creek near Clemons, Mont., for 1910.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	70	91	71	36	22	18	33	22	21
2	.....	85	91	69	36	22	18	33	22	21
3	.....	100	92	67	35	22	18	33	22	21
4	.....	90	92	62	34	21	18	33	23	20
5	.....	85	128	57	34	20	18	32	23	20
6	26	80	164	57	34	20	18	32	22	20
7	27	75	136	55	34	20	18	32	22	20
8	28	70	109	55	34	20	19	32	22	20
9	29	65	130	55	33	20	20	32	22	20
10	30	60	152	55	32	20	22	32	22	20
11	31	65	130	57	31	20	22	32	22	20
12	32	70	109	56	31	20	23	31	22	19
13	33	75	106	55	30	19	24	31	21	19
14	34	80	103	54	28	19	24	31	21	19
15	34	85	91	52	27	19	25	31	21	19
16	35	90	82	52	27	19	28	30	21	19
17	35	95	74	53	26	18	34	30	21	19
18	36	100	74	53	26	18	41	29	21	19
19	36	105	74	52	26	18	41	28	21	19
20	37	110	74	54	26	18	41	26	21	.....
21	38	115	74	55	26	18	38	24	21	.....
22	39	120	73	50	26	17	35	22	22	.....
23	40	130	74	45	26	17	38	21	22	.....
24	42	135	76	44	26	17	42	21	22	.....
25	44	140	77	43	25	17	40	21	22	.....
26	46	145	82	42	24	17	37	21	22	.....
27	47	152	87	40	23	17	36	21	22	.....
28	50	140	79	38	22	17	35	21	22	.....
29	55	129	71	37	22	17	34	21	21	.....
30	60	110	72	36	22	17	34	22	21	.....
31	65	.....	74	.....	22	17	.....	22	.....	.....

NOTE.—These discharges are based on a well-defined rating curve. Discharges interpolated on days when gage was not read.

Monthly discharge of Falls Creek near Clemons, Mont., for 1910.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
January	.....	.....	[a] 25	1,540	
February	.....	.....	[a] 25	1,390	
March	65	.....	[a] 36.6	2,250	C.
April	152	60	99.0	5,890	C.
May	164	71	94.9	5,840	B.
June	71	36	52.3	3,110	B.
July	36	22	28.5	1,750	B.
August	22	17	18.8	1,160	B.
September	41	18	28.6	1,700	B.
October	33	21	27.7	1,700	B.
November	23	21	21.7	1,290	B.
December	21	.....	[a] 19.5	1,200	C.
The year	.....	.....	39.8	28,800	

[a] Discharge estimated Jan. 1 to Mar. 5 and Dec. 20 to 31.

NOTE.—The means for January and February are only approximate.

SUN RIVER BASIN.

DESCRIPTION.

Sun River rises on the eastern slope of the Rocky Mountains in northwestern Montana, flows southward for about 60 miles, then, turning abruptly, flows eastward through a canyon, emerging on a level plain, through which it runs for 75 miles to its junction with

the Missouri at Great Falls. The area of the drainage basin is about 2,240 square miles.

South Fork and Willow Creek, its only important tributaries, rise in the mountains and are perennial streams. The others are small intermittent streams whose drainage areas lie entirely within the plains region.

The valley of Sun River proper is 1 to 3 miles wide and the river flows 5 to 25 feet below its general surface. Steeply sloping bluffs, about 300 feet high, border this valley, and between these bluffs and the adjoining river valley are comparatively smooth bench lands. The highest peak in the mountains stands about 8,900 feet above sea level; the altitude of the river at the canyon where it leaves the mountains is 4,450 feet; at its mouth it is 3,300 feet above sea level.

The mountainous part of the basin is included in the Lewis and Clark National Forest and is heavily timbered. The plains section is treeless except for a few willows and cottonwoods along the streams.

The mean annual rainfall ranges from 12 inches in the plains region to about 45 inches in the mountainous sections. The heaviest rainfall occurs during the month of June, but the regular June floods are caused by the melting snow in the mountains. During the greater part of the winter season all the streams are frozen over.

Much of the land in the valley has been irrigated, and the ordinary summer flow of the stream is practically all utilized. The United States Reclamation Service has started construction on an irrigation project that will store the flood water of Sun River and its tributaries and carry it to the higher bench lands at the north of the valley, where 260,000 acres of irrigable land can be reclaimed. A number of reservoir sites have been selected, the largest being the Warm Springs reservoir, with a capacity of 156,800 acre-feet. The other reservoirs are the Willow Creek, with a capacity of 84,320 acre-feet; the Pishkun, with a capacity of 45,747 acre-feet; and the Benton Lake, with a capacity of 140,200 acre-feet.

Natural power opportunities are good, as Sun River has a minimum flow at the point where it leaves the mountains of 150 second-feet and a fall of about 40 feet to the mile.

NORTH FORK OF SUN RIVER NEAR AUGUSTA, MONT.

This station, which is situated below the head of the Kilraven ditch, near Christian's ranch, 12 miles northwest of Augusta and 21 miles southwest of Chouteau, Mont., was established October 31, 1903, to determine the amount of water available for storage and irrigation.

The only important tributaries are Willow Creek and the South Fork of Sun River, both of which enter several miles below the gaging station. Very little water is diverted above the station, but below nearly all of the valley land is irrigated from this stream.

The datum of the chain gage has not been changed since the station was established. Conditions for obtaining accurate discharge data are excellent except during the winter months, when the discharge is affected by ice.

Measurements are made from a cable.

Discharge measurement of North Fork of Sun River near Augusta, Mont., in 1910.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Apr. 29	Raymond Richards	145	720	3.97	3,360
May 25	do	150	750	4.08	3,750
July 12	J. C. Beebe	149	340	1.44	749
Aug. 26[a]	M. E. McChristie	108	216	.64	270
Oct. 15	B. E. Jones	135	237	.85	325
Nov. 20[a]	J. C. Beebe	106	124	.95	354

[a] Made by wading.

Daily gage height, in feet, of North Fork of Sun River near Augusta, Mont., for 1910.

[J. R. King, jr., observer.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	1.2	3.2	3.7	2.2	1.0	0.7	0.6	0.8	0.8
2	.....	1.2	3.6	3.5	2.2	1.0	.7	.6	.8	.8
3	.....	1.1	3.8	3.2	2.2	1.0	.6	.7	.8	.8
4	.....	1.2	4.1	2.8	2.4	1.0	.6	.7	.8	.8
5	.....	1.2	4.4	3.1	2.4	1.0	.6	.7	.9	.8
6	.....	1.3	4.6	3.2	2.3	1.0	.7	.7	.9	.8
7	.....	1.6	4.9	3.1	2.3	1.0	.7	.7	.9	.8
8	.....	1.7	5.1	2.9	2.3	1.0	.7	.7	.9	.8
9	.....	1.9	4.8	2.7	2.3	.9	.7	.8	1.1	.8
10	.....	2.3	4.6	2.8	2.1	.9	.7	.8	.9	.8
11	.....	2.5	4.4	3.0	1.8	.8	.7	.8	.9	.....
12	.....	2.5	3.9	2.9	1.5	.8	.7	.8	1.0	.....
13	.9	2.5	3.6	2.9	1.5	.7	.6	.8	1.0	.....
14	.9	2.4	3.5	2.9	1.4	.7	.6	.8	.9	.7
15	.9	2.4	3.4	2.8	1.3	.7	.6	.8	.9	.....
16	1.0	2.4	3.1	2.8	1.3	.7	.6	.8	.9	.8
17	1.1	2.6	3.1	2.8	1.2	.7	.6	.8	.9	.....
18	1.1	2.8	3.2	2.8	1.2	.7	.6	.8	.9	.....
19	1.2	3.1	3.2	2.8	1.2	.7	.6	.8	.9	.7
20	1.6	3.2	3.1	2.6	1.2	.7	.6	.8	.9	.....
21	1.8	3.1	3.2	2.5	1.2	.7	.6	.8	.9	.8
22	2.1	3.1	3.2	2.5	1.2	.7	.6	.8	.9	.....
23	2.2	3.2	3.2	2.4	1.2	.7	.6	.8	.9	.9
24	1.8	3.4	3.4	2.3	1.2	.7	.6	.8	1.0	.....
25	1.7	3.6	4.1	2.3	1.2	.7	.6	.8	1.0	1.0
26	1.7	4.1	4.2	2.4	1.1	.7	.6	1.5	.9	.....
27	1.7	4.5	4.0	2.3	1.1	.7	.6	1.1	.8	1.1
28	1.6	4.6	3.4	2.3	1.1	.7	.6	.8	.8	.....
29	1.5	4.0	3.2	2.3	1.1	.7	.6	.8	.8	1.0
30	1.3	3.6	3.3	.....	1.1	.7	.6	.8	.8	.....
31	1.2	.....	3.4	.....	1.1	.7	.....	.8	.....	1.0

NOTE.—Ice January 1 to about March 12 and from about December 22 to 31.

Daily discharge, in second-feet, of North Fork of Sun River near Augusta, Mont., for 1910.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	510	2,470	3,110	1,350	400	275	240	315	315
2	.....	510	2,980	2,850	1,350	400	275	240	315	315
3	.....	450	3,240	2,470	1,350	400	240	275	315	315
4	.....	510	3,640	1,990	1,550	400	240	275	315	315
5	.....	510	4,060	2,350	1,550	400	240	275	355	315
6	.....	580	4,340	2,470	1,450	400	275	275	355	315
7	.....	815	4,760	2,350	1,450	400	275	275	355	315
8	.....	895	5,040	2,110	1,450	400	275	275	355	315
9	.....	1,070	4,620	1,880	1,450	355	275	315	450	315
10	.....	1,450	4,340	1,990	1,250	355	275	315	355	315
11	.....	1,660	4,060	2,230	980	315	275	315	355	305
12	.....	1,660	3,370	2,110	735	315	275	315	400	295
13	355	1,660	2,980	2,110	735	275	240	315	400	285
14	355	1,550	2,590	2,110	655	275	240	315	355	275
15	355	1,550	2,720	1,990	580	275	240	315	355	295
16	400	1,550	2,350	1,990	580	275	240	315	355	315
17	450	1,770	2,350	1,990	510	275	240	315	355	300
18	450	1,990	2,470	1,990	510	275	240	315	355	290
19	510	2,350	2,470	1,990	510	275	240	315	355	275
20	815	2,470	2,350	1,770	510	275	240	315	355	295
21	980	2,350	2,470	1,660	510	275	240	315	355	315
22	1,250	2,350	2,470	1,660	510	275	240	315	355	.....
23	1,350	2,470	2,470	1,550	510	275	240	315	355	.....
24	980	2,720	2,720	1,450	510	275	240	315	400	.....
25	895	2,980	3,640	1,450	510	275	240	315	400	.....
26	895	3,640	3,780	1,550	450	275	240	735	355	.....
27	895	4,200	3,500	1,450	450	275	240	450	315	.....
28	815	4,340	2,720	1,450	450	275	240	315	315	.....
29	735	3,500	2,470	1,450	450	275	240	315	315	.....
30	580	2,980	2,590	1,400	450	275	240	315	315	.....
31	510	.....	2,720	.....	450	275	.....	315	.....	.....

NOTE.—These discharges are based on a rating curve that is fairly well defined between 200 and 4,000 second-feet. Discharges interpolated on days in December with missing gage heights.

Monthly discharge of North Fork of Sun River near Augusta, Mont., for 1910.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
January	.....	.....	[a] 400	24,600	
February	.....	.....	[a] 375	20,800	
March	1,350	355	[a] 579	35,600	C.
April	4,340	450	1,900	113,000	A.
May	5,040	2,350	3,190	196,000	A.
June	3,110	1,400	1,960	116,000	A.
July	1,550	450	831	51,100	A.
August	400	275	315	19,400	B.
September	275	240	250	14,900	B.
October	735	240	320	19,700	B.
November	450	315	365	21,700	B.
December	.....	275	[a] 208	12,800	C.
The year	5,040	.....	901	646,000	

[a] Discharge estimated Jan. 1 to Mar. 12 and Dec. 22 to 31.

NOTE.—The means for January and February are only approximate.

SUN RIVER AT SUN RIVER, MONT.

This station, which is located at the highway bridge over Sun River, Mont., was established July 31, 1905, to obtain data for use in connection with irrigation projects. The records at this station do not show the total run-off from the drainage area above it, as

practically the entire valley above is irrigated from this stream. The greater part of the ordinary summer flow is utilized for irrigation. The principal tributaries are all above the station, South Fork of Sun River, Willow Creek, and Simms Creek being the most important.

The gage is a staff nailed securely to piling on the left bank just above the bridge.

The gage datum has not been changed since the station was established. The discharge is affected at times during the winter by ice. The gaging section at the bridge has been very poor since the high water of 1907, but good low-water measurements can be made by wading.

Discharge measurements of Sun River at Sun River, Mont., in 1910.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Apr. 30	Raymond Richards	205	963	6.27	3,450
June 6	W. A. Lamb	145	601	4.85	1,900
July 9	J. C. Beebe	112	582	3.49	1,020
Aug. 11	M. E. McChristie	23	175	1.80	194
Sept. 3[a]	....do	116	108	2.38	309
Nov. 26	C. S. Heidel	96	735	2.80	571

[a] Made by wading 200 feet above gage.

Daily gage height, in feet, of Sun River at Sun River, Mont., for 1910.

[R. A. Lange, observer.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	3.1	5.8	5.5	3.8	1.3	1.6	2.6	3.0	2.75
2	.....	3.15	5.5	5.4	4.0	1.0	1.8	2.45	3.1	2.8
3	.....	3.15	5.3	5.05	3.9	1.0	1.9	2.4	3.1	2.8
4	.....	3.1	5.0	5.0	4.2	1.0	2.4	2.5	3.0	2.8
5	.....	3.05	5.0	5.0	4.0	1.0	2.35	2.5	2.95	2.7
6	.....	3.1	5.5	5.0	3.9	1.0	2.3	2.6	2.9	2.7
7	.....	3.2	5.9	4.9	3.85	1.0	2.15	2.75	2.85	2.85
8	.....	3.3	6.9	4.9	3.75	1.0	2.1	2.7	2.8	2.8
9	.....	3.5	7.0	4.6	3.5	1.0	2.2	2.75	2.75	2.8
10	.....	3.8	7.0	4.5	3.3	1.5	2.15	2.75	2.75	2.8
11	.....	4.25	7.1	4.5	2.9	1.8	2.15	2.7	2.8	2.8
12	.....	4.3	6.6	4.5	2.7	1.3	2.3	2.75	3.0	2.8
13	3.65	5.0	6.5	4.95	2.8	1.2	2.4	2.75	3.0	2.8
14	3.6	5.0	6.2	4.8	2.85	1.05	2.25	2.75	3.1	2.8
15	3.6	4.75	6.2	4.9	2.8	1.0	2.15	2.7	3.1	2.8
16	3.8	4.35	6.15	4.9	2.8	1.0	2.4	2.8	3.0	2.8
17	3.8	4.1	6.0	4.6	2.8	.95	2.35	2.8	3.0	2.65
18	3.65	4.75	6.0	4.55	2.7	.9	2.4	2.8	3.05	2.6
19	3.6	5.0	6.0	4.55	2.65	1.0	2.3	2.8	2.8	2.6
20	3.65	5.05	5.5	4.5	2.5	1.5	2.4	2.85	2.8	2.7
21	3.65	5.7	5.2	4.5	2.0	1.0	2.4	2.85	2.8	2.65
22	3.9	5.55	5.2	4.5	2.0	1.0	2.55	2.95	2.75	2.6
23	4.0	5.45	5.6	4.5	2.0	1.0	2.55	2.7	2.65	2.65
24	4.2	5.45	5.8	4.3	2.0	1.0	2.5	2.65	3.0	2.75
25	3.9	6.2	6.2	4.7	2.0	1.2	2.5	2.65	2.85	2.8
26	3.5	6.8	6.5	4.7	1.9	1.15	2.55	2.85	2.8	2.85
27	3.3	6.8	7.0	4.0	1.9	1.15	2.55	3.0	2.8	2.85
28	3.3	6.9	6.75	3.9	1.8	1.15	2.55	3.0	2.8	2.8
29	3.25	6.7	6.2	3.8	1.8	1.1	2.6	2.45	2.8	2.9
30	3.2	6.3	6.0	.....	1.8	1.0	2.65	3.0	2.8	2.9
31	3.1	.....	5.8	.....	1.65	1.5	.....	3.1	.....	2.85

NOTE.—Ice probable during January, February, and first part of March.

Daily discharge, in second-feet, of Sun River at Sun River, Mont., for 1910.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	660	2,940	2,610	1,100	130	160	410	610	485
2	.....	690	2,610	2,500	1,240	100	180	355	660	510
3	.....	690	2,390	2,130	1,170	100	190	340	660	510
4	.....	660	2,080	2,080	1,380	100	340	370	610	510
5	.....	635	2,080	2,080	1,240	100	325	370	585	460
6	.....	660	2,610	2,080	1,170	100	310	410	560	460
7	.....	720	3,050	1,980	1,140	100	265	485	535	535
8	.....	780	4,320	1,980	1,060	100	250	460	510	510
9	.....	900	4,460	1,710	900	100	280	485	485	510
10	.....	1,100	4,460	1,620	780	150	265	485	485	510
11	.....	1,420	4,600	1,620	560	180	265	460	510	510
12	.....	1,460	3,920	1,620	460	130	310	485	610	510
13	995	2,080	3,790	2,030	510	120	340	485	610	510
14	960	2,080	3,410	1,890	535	115	295	485	660	510
15	960	1,840	3,410	1,980	510	100	265	460	660	510
16	1,100	1,500	3,350	1,980	510	100	340	510	610	510
17	1,100	1,310	3,170	1,710	510	105	325	510	610	435
18	995	1,840	3,170	1,660	460	100	340	510	635	410
19	960	2,080	3,170	1,660	435	100	310	510	510	410
20	995	2,130	2,610	1,620	370	150	340	535	510	460
21	995	2,830	2,280	1,620	220	110	340	535	510	435
22	1,170	2,660	2,280	1,620	220	110	390	585	485	410
23	1,240	2,560	2,720	1,620	220	110	390	460	435	435
24	1,380	2,560	2,940	1,460	220	110	370	435	610	485
25	1,170	3,410	3,410	1,800	220	120	370	435	535	510
26	900	4,180	3,790	1,800	200	115	390	535	510	535
27	780	4,180	4,460	1,240	200	115	390	610	510	535
28	780	4,320	4,120	1,170	180	115	390	610	510	510
29	750	4,050	3,410	1,100	180	110	410	355	510	560
30	720	3,530	3,170	1,100	180	110	435	610	510	560
31	660	.....	2,940	.....	165	150	.....	660	.....	535

NOTE.—These discharges are based on a rating curve that is well defined between 100 and 4,000 second-feet.

Monthly discharge of Sun River at Sun River, Mont., for 1910.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
January	.....	.....	[a] 600	37,000	
February	.....	.....	[a] 550	30,500	
March	1,380	660	[b] 979	60,200	C.
April	4,320	635	1,980	118,000	A.
May	4,600	2,080	3,260	200,000	A.
June	2,610	1,100	1,770	105,000	A.
July	1,380	165	589	36,200	B.
August	180	100	115	7,070	B.
September	435	160	319	19,000	B.
October	660	340	482	29,600	B.
November	660	435	558	33,200	B.
December	560	410	493	30,300	B.
The period	.....	.....	974	706,000	

[a] Discharge estimated, Jan. 1 to Feb. 28. [b] Mean of 19 days taken as mean for month.

NOTE.—The means for January and February are only approximate.

WILLOW CREEK NEAR AUGUSTA, MONT.

Willow Creek rises on the eastern slopes of the Rocky Mountains in the northwestern part of Lewis and Clark County, Mont., and flows in a general northeasterly direction to its junction with North Fork of Sun River.

The gaging station, which is located at Jordan's ranch, just below the mouth of Little Willow Creek, about 7 miles northwest of Augusta,

Mont., was established June 8, 1905, to obtain run-off data for use in connection with the Sun River irrigation project. Willow Creek dam, work on which has been begun, will provide a reservoir with a capacity of 84,320 acre-feet.

Much of the valley land above the station is irrigated, the water being taken from this stream.

Conditions for obtaining accurate discharge data are excellent. No ice forms at this station as a large spring enters the creek just above the gage. A standard chain gage is located on the right bank, near the observer's footbridge. Measurements are made by wading at any convenient section. The datum of the gage has not been changed.

Discharge measurements of Willow Creek near Augusta, Mont., in 1910.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec. ft.*
Apr. 29	Raymond Richards	22	31	1.73	41
May 26	....do	17	11	1.10	16
July 12	J. C. Beebe	8	1.6	.48	1.8
Aug. 26	M. E. McChristie	2.5	.4	.45	[a].8
Oct. 15	B. E. Jones	17	5.8	.74	4.8
Nov. 20	J. C. Beebe	12	8.1	.87	7.4

[a] Estimated.

NOTE.—Discharge measurements made by wading at various sections.

Daily gage height, in feet, of Willow Creek near Augusta, Mont., for 1910.

[Elizabeth Ireland, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.12	1.32	0.95	1.35	1.53	0.90	0.55	0.40	0.50	0.75	0.80	0.78
2	1.12	1.10	4.75	1.35	1.55	.90	.55	.40	.50	.75	.80	.78
3	1.10	1.10	5.80	1.35	1.55	.95	.55	.40	.50	.75	.80	.78
4	1.12	1.08	3.60	1.35	1.30	.95	.55	.40	.50	.75	.80	.78
5	1.05	1.08	2.70	1.30	1.30	.90	.50	.40	.50	.75	.80	.78
6	1.00	.98	2.05	1.30	1.30	.90	.50	.40	.50	.75	.80	.79
7	1.00	1.00	1.75	1.35	1.30	.90	.50	.40	.50	.75	.80	.79
8	1.00	1.00	1.60	1.35	1.30	.90	.50	.40	.50	.75	.80	.79
9	1.00	.98	1.45	1.35	1.25	.90	.50	.45	.50	.75	.80	.78
10	1.00	1.00	1.30	1.55	1.35	.85	.50	.45	.50	.75	.80	.78
11	1.00	1.00	1.45	1.55	1.30	.70	.50	.45	.50	.75	.80	.75
12	.98	1.00	1.65	1.55	1.30	.65	.50	.40	.50	.75	.80	.77
13	.95	1.00	1.45	1.65	1.25	.70	.50	.45	.55	.75	.80	.77
14	.95	.92	1.55	1.45	1.20	.70	.50	.45	.60	.75	.85	.80
15	.92	.92	1.45	1.45	1.20	.70	.50	.45	.60	.75	.85	.80
16	.92	.92	1.35	1.50	1.20	.70	.50	.45	.60	.75	.85	.80
17	.92	.95	1.30	1.50	1.20	.70	.25	.45	.60	.75	.85	.80
18	.92	.95	1.45	1.50	1.15	.65	.35	.40	.60	.85	.85	.80
19	.95	.95	1.45	1.55	1.15	.65	.35	.40	.60	.85	.85	.80
20	.98	.95	1.45	1.65	1.15	.65	.40	.45	.60	.85	.88	.80
21	.98	.92	1.55	1.70	1.15	.65	.40	.45	.60	.85	.90	.80
22	1.00	.90	1.65	1.55	1.15	.65	.40	.45	.70	.80	.85	.80
23	1.28	.90	1.65	1.55	1.15	.65	.40	.45	.70	.80	.90	.80
24	1.30	.90	1.55	1.65	1.10	.60	.40	.45	.70	.80	.90	.80
25	1.05	.90	1.25	1.65	1.05	.60	.35	.45	.70	.80	.85	.80
26	1.02	.90	1.4	1.60	1.10	.60	.40	.45	.70	.80	.82	.77
27	1.02	.90	1.35	1.70	1.10	.60	.40	.45	.70	.80	.78	.77
28	1.02	.90	1.25	1.72	1.05	.55	.40	.45	.75	.80	.78	.77
29	1.05	.....	1.35	1.60	1.05	.55	.40	.45	.75	.80	.78	.75
30	1.10	.....	1.35	1.55	1.05	.55	.40	.45	.75	.80	.78	.75
31	1.20	.....	1.30	.....	1.00	.....	.40	.45	.....	.80	.....	.72

Daily discharge, in second-feet, of Willow Creek near Augusta, Mont., for 1910.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	15	23	10	24	32	8.8	2.4	0.8	1.7	5.6	6.5	6.1
2	15	14	203	24	32	8.8	2.4	.8	1.7	5.6	6.5	6.1
3	14	14	275	24	32	10	2.4	.8	1.7	5.6	6.5	6.1
4	15	13	135	24	22	10	2.4	.8	1.7	5.6	6.5	6.1
5	13	13	86	22	22	8.8	1.7	.8	1.7	5.6	6.5	6.1
6	11	11	55	22	22	8.8	1.7	.8	1.7	5.6	6.5	6.3
7	11	11	42	24	22	8.8	1.7	.8	1.7	5.6	6.5	6.3
8	11	11	35	24	22	8.8	1.7	.8	1.7	5.6	6.5	6.3
9	11	11	28	24	20	8.8	1.7	1.2	1.7	5.6	6.5	6.1
10	11	11	22	32	24	7.7	1.7	1.2	1.7	5.6	6.5	6.1
11	11	11	28	32	22	4.6	1.7	1.2	1.7	5.6	6.5	5.6
12	11	11	38	32	22	3.8	1.7	.8	1.7	5.6	6.5	5.9
13	10	11	28	38	20	4.6	1.7	1.2	2.4	5.6	6.5	5.9
14	10	9.3	32	28	18	4.6	1.7	1.2	3	5.6	7.6	6.5
15	9.3	9.3	28	28	18	4.6	1.7	1.2	3	5.6	7.6	6.5
16	9.3	9.3	24	30	18	4.6	1.7	1.2	3	5.6	7.6	6.5
17	9.3	10	22	30	18	4.6	.0	1.2	3	5.6	7.6	6.5
18	9.3	10	28	30	16	3.8	.5	.8	3	7.6	7.6	6.5
19	10	10	28	32	16	3.8	.5	.8	3	7.6	7.6	6.5
20	11	10	28	38	16	3.8	.8	1.2	3	7.6	8.3	6.5
21	11	9.3	32	40	16	3.8	.8	1.2	3	7.6	8.8	6.5
22	11	8.8	38	32	16	3.8	.8	1.2	4.6	6.5	7.6	6.5
23	21	8.8	38	32	16	3.8	.8	1.2	4.6	6.5	8.8	6.5
24	22	8.8	32	38	14	3	.8	1.2	4.6	6.5	8.8	6.5
25	13	8.8	20	38	13	3	.5	1.2	4.6	6.5	7.6	6.5
26	12	8.8	26	35	14	3	.8	1.2	4.6	6.5	7.0	5.9
27	12	8.8	24	40	14	3	.8	1.2	4.6	6.5	6.1	5.9
28	12	8.8	20	41	13	2.4	.8	1.2	5.6	6.5	6.1	5.9
29	13	.....	24	35	13	2.4	.8	1.2	5.6	6.5	6.1	5.6
30	14	.....	24	32	13	2.4	.8	1.2	5.6	6.5	6.1	5.2
31	18	.....	22	.....	11	.....	.8	1.2	.....	6.5	.....	5.0

NOTE.—These discharges are based on a rating curve that is well defined below 42 second-feet.

Monthly discharge of Willow Creek near Augusta, Mont., for 1910.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
January	22	9.3	12.5	769	A.
February	23	8.8	10.8	600	A.
March	275	10	47.6	2,930	B.
April	41	22	30.8	1,830	A.
May	32	11	18.9	1,160	A.
June	10	2.4	5.42	323	A.
July	2.4	0	1.30	80	B.
August	1.2	.8	1.06	65	B.
September	5.6	1.7	3.04	181	B.
October	7.6	5.6	6.15	378	B.
November	8.8	6.1	7.05	420	B.
December	6.5	5.0	6.15	378	B.
The year	275	0	13.1	9,110	

SOUTH FORK OF SUN RIVER AT AUGUSTA, MONT.

This station, which is located at the highway bridge on the road from Augusta to Craig, Mont., about half a mile from Augusta, was established December 2, 1904, to obtain data for use in connection with the Sun River irrigation project.

Water is diverted to irrigate the valley lands, both above and below the stations. During dry seasons the entire summer flow is utilized.

The original gage was spiked to the cribwork of the right abutment on the downstream side of the bridge. On April 17, 1907, a new gage was established 100 yards above the bridge. This gage is spiked to a tree on the left bank and is set at a different datum. The new gage was used during 1907 and 1908. Records for 1909 and 1910 are referred to old gage. The gage heights are affected by ice during the winter.

Measurements in high water may be made from the highway bridge; in low water by wading.

Discharge measurements of South Fork of Sun River at Augusta, Mont., in 1910.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Apr. 26	Raymond Richards	35	24	1.07	58
May 24	....do	17	16	.99	46
July 12[a]	M. E. McChristie	16	13	.69	12
Aug. 25	....do	2.5	.6	.33	[b] 1
Oct. 16[a]	B. E. Jones	14	12	.90	29
Nov. 21[a]	J. C. Beebe	26	22	.92	36

[a] Made by wading below bridge. [b] Estimated.

Daily gage height, in feet, of South Fork of Sun River at Augusta, Mont., for 1910.

[Richard Auchard, observer.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	1.1	1.2	0.8	0.4	0.4	0.5	1.0	1.0	1.0
2	.....	1.1	1.15	.8	.5	.4	.5	1.0	1.0	1.0
3	.....	1.1	1.15	.8	.45	.4	.5	1.0	1.0	1.0
4	.....	1.1	1.15	.8	.45	.4	.5	1.0	1.0	1.0
5	.....	1.1	1.1	.8	.45	.3	.6	1.0	1.0	1.0
6	.....	1.1	1.1	.8	.5	.3	.6	1.0	1.0	.9
7	.....	1.1	1.1	.8	.5	.3	.6	1.0	1.0	.9
8	.....	1.15	1.1	.8	.5	.2	.6	1.0	1.0	.9
9	.....	1.15	1.1	.7	.5	.2	.6	.9	1.0	.9
10	.....	1.15	1.1	.7	.5	.3	.7	.9	1.0	.9
11	.....	1.2	1.1	.7	.6	.3	.7	.9	1.0	.9
12	.....	1.2	1.1	.7	.7	.3	.7	.9	1.0	1.0
13	1.2	1.2	1.1	.6	.5	.3	.7	.9	1.0	1.0
14	1.2	1.2	1.1	.5	.4	.3	.75	.9	1.0	1.0
15	1.15	1.2	1.1	.4	.4	.3	.75	.9	1.0	1.0
16	1.15	1.2	1.1	.4	.4	.3	.75	.9	1.0	1.0
17	1.15	1.2	1.1	.4	.4	.3	.75	.9	1.0	1.0
18	1.15	1.2	1.1	.4	.4	.3	.75	.9	1.0	1.0
19	1.15	1.2	1.1	.4	.3	.3	.75	.9	1.0	1.0
20	1.15	1.2	1.1	.4	.3	.3	.8	.9	1.0	1.0
21	1.2	1.15	1.1	.7	.3	.3	.8	.9	1.0	1.0
22	1.2	1.15	1.1	.7	.2	.3	.85	.9	1.0	1.0
23	1.2	1.15	1.1	.7	.2	.3	.9	.9	1.0	1.0
24	1.2	1.1	1.0	.7	.2	.3	.9	.9	.9	1.0
25	1.15	1.1	1.0	.7	.2	.3	.9	.9	.9	1.0
26	1.15	1.1	1.0	.7	.1	.3	.9	.9	.9	1.0
27	1.15	1.1	.9	.7	.1	.3	.9	1.0	1.0	1.0
28	1.15	1.1	.9	.7	−.2	.3	.9	1.0	1.0	1.4
29	1.1	1.1	.9	.6	.0	.3	.9	1.0	1.1	1.8
30	1.1	1.2	.8	.4	.0	.4	.9	1.0	2.0	2.1
31	1.1	.....	.8	.....	.5	.4	.....	1.0	.....	2.4

NOTE.—Ice, Jan. 1 to Mar. 12. The river was partly frozen over Nov. 29 and 30. Probably ice affected discharge to greater or less extent during December.

Daily discharge, in second-feet, of South Fork of Sun River at Augusta, Mont., for 1910.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	63	81	21	2	2	4.2	46	46	46
2	.....	63	72	21	4.2	2	4.2	46	46	46
3	.....	63	72	21	3.1	2	4.2	46	46	46
4	.....	63	72	21	3.1	2	4.2	46	46	46
5	.....	63	63	21	3.1	.8	7.7	46	46	46
6	.....	63	63	21	4.2	.8	7.7	46	46	32
7	.....	63	63	21	4.2	.8	7.7	46	46	32
8	.....	72	63	21	4.2	.3	7.7	46	46	32
9	.....	72	63	13	4.2	.3	7.7	32	46	32
10	.....	72	63	13	4.2	.8	13	32	46	32
11	.....	81	63	13	7.7	.8	13	32	46	32
12	.....	81	63	13	13	.8	13	32	46	46
13	81	81	63	7.7	4.2	.8	13	32	46	46
14	81	81	63	4.2	2	.8	17	32	46	46
15	72	81	63	2	2	.8	17	32	46	46
16	72	81	63	2	2	.8	17	32	46	46
17	72	81	63	2	2	.8	17	32	46	46
18	72	81	63	2	2	.8	17	32	46	46
19	72	81	63	2	.8	.8	17	32	46	46
20	72	81	63	2	.8	.8	21	32	46	46
21	81	72	63	13	.8	.8	21	32	46	46
22	81	72	63	13	.3	.8	26	32	46	46
23	81	72	63	13	.3	.8	32	32	46	46
24	81	63	46	13	.3	.8	32	32	32	46
25	72	63	46	13	.3	.8	32	32	32	46
26	72	63	46	13	.2	.8	32	32	32	46
27	72	63	32	13	.2	.8	32	46	46	46
28	72	63	32	13	0	.8	32	46	46	46
29	63	63	32	7.7	0	.8	32	46	46	46
30	63	81	21	2	0	2	32	46	46	46
31	63	.....	21	.....	4.2	2	.....	46	.....	46

NOTE.—These discharges are based on a curve that is well defined between 5 and 70 second-feet. Discharge estimated Nov. 29, 30, Dec. 28–31, because of ice conditions.

Monthly discharge of South Fork of Sun River at Augusta, Mont., for 1910.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
January	.....	.....	[a] 50	3,070	
February	.....	.....	[a] 50	2,780	
March	81	63	[a] 77.9	4,790	C.
April	81	63	71.4	4,250	A.
May	81	21	57.1	3,510	A.
June	21	2	11.9	708	B.
July	13	0	2.57	158	C.
August	2	.3	1.00	61	D.
September	32	4.2	17.8	1,060	A.
October	46	32	37.9	2,330	A.
November	46	32	44.6	2,650	B.
December	46	32	43.3	2,660	C.
The year	.....	.....	38.8	28,000	

[a] Discharge estimated Jan. 1 to Mar. 12 because of ice conditions.

NOTE.—The means for January and February are only approximate.

FORD CREEK NEAR AUGUSTA, MONT.

This station, which is located at the ranch of Joseph Ford, 16 miles west of Augusta, was established April 11, 1906, to obtain run-off data for use in connection with the Sun River irrigation project.

Ford and Smith creeks unite and form the South Fork of Sun River. Ford Creek has no tributaries. One small irrigation ditch diverts water from the creek above the gage.

The current is swift and the gage heights are but little affected by ice. Conditions of flow are changeable, requiring frequent measurements to properly define the rating curve.

The datum of the staff gage, located on the right bank of the stream near the observer's house, has remained unchanged. All measurements are made by wading.

Discharge measurements of Ford Creek near Augusta, Mont., in 1910.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Apr. 28	Raymond Richards	25	23.5	1.65	58
May 27	....do	24	20	1.49	37
July 14	J. C. Beebe	19	17	1.10	18
Aug. 27	M. E. McChristie	17	14	.98	13
Oct. 16	B. E. Jones	16	16	1.03	13
Nov. 21	J. C. Beebe	15	15	1.08	12
Do.	....do	15	15	1.06	10

Daily gage height, in feet, of Ford Creek near Augusta, Mont., for 1910.

[Joseph Ford, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.15	1.05	1.05	1.25	1.55	1.45	1.20	1.05	1.05	1.05	1.00	1.05
2	1.15	1.05	1.45	1.25	1.55	1.45	1.20	1.05	1.05	1.05	1.00	1.05
3	1.15	1.05	1.60	1.25	1.62	1.45	1.15	1.05	1.05	1.05	1.00	1.05
4	1.15	1.05	1.65	1.25	1.62	1.45	1.15	1.05	1.05	1.05	1.00	1.05
5	1.15	1.05	1.30	1.25	1.62	1.45	1.15	1.05	1.05	1.05	1.00	1.05
6	1.15	1.05	1.15	1.25	1.62	1.35	1.15	1.05	1.05	1.05	1.00	1.05
7	1.15	1.05	1.10	1.25	1.62	1.35	1.15	1.05	1.05	1.05	1.00	1.05
8	1.15	1.05	1.05	1.25	1.62	1.35	1.15	1.05	1.05	1.05	1.00	1.05
9	1.15	1.05	1.05	1.45	1.55	1.35	1.15	1.05	1.05	1.05	1.00	1.05
10	1.15	1.05	1.05	1.45	1.55	1.35	1.15	1.05	.95	1.05	1.00	1.05
11	1.15	1.05	1.05	1.52	1.55	1.35	1.13	.95	.95	1.05	1.00	1.05
12	1.15	1.05	1.05	1.45	1.55	1.35	1.10	.95	.95	1.05	1.00	1.05
13	1.15	1.05	1.25	1.45	1.55	1.35	1.10	.95	.95	1.05	1.00	1.05
14	1.15	1.05	1.25	1.45	1.55	1.35	1.10	.95	.95	1.05	1.00	1.04
15	1.15	1.05	1.25	1.45	1.55	1.35	1.10	.95	.95	1.05	1.00	1.04
16	1.15	1.05	1.25	1.45	1.55	1.35	1.05	.95	1.15	1.05	1.00	1.04
17	1.15	1.05	1.25	1.45	1.55	1.35	1.05	.95	1.20	1.00	1.00	1.04
18	1.10	1.05	1.25	1.45	1.55	1.35	1.05	.95	1.05	1.00	1.00	1.05
19	1.05	1.05	1.25	1.55	1.55	1.35	1.05	.95	1.05	1.00	1.00	1.04
20	1.05	1.75	1.30	1.55	1.55	1.35	1.05	.95	1.05	1.00	1.00	1.05
21	1.05	1.75	1.35	1.55	1.55	1.30	1.05	.95	1.15	1.00	1.01	1.04
22	1.05	1.75	1.45	1.55	1.55	1.25	1.05	.95	1.05	1.00	1.04	1.04
23	1.05	1.75	1.45	1.62	1.55	1.25	1.05	.95	1.05	1.00	1.05	1.04
24	1.05	1.75	1.40	1.65	1.52	1.25	1.05	.95	1.05	1.00	1.05	1.04
25	1.05	1.75	1.40	1.65	1.52	1.25	1.05	.95	1.05	1.00	1.05	1.04
26	1.05	1.75	1.40	1.65	1.45	1.25	1.05	.95	1.05	1.00	1.07	1.05
27	1.05	1.75	1.40	1.72	1.45	1.22	1.05	.95	1.05	1.00	1.06	1.04
28	1.05	1.75	1.35	1.62	1.45	1.20	1.05	.95	1.05	1.00	1.05	1.04
29	1.05	.....	1.25	1.65	1.45	1.20	1.05	.95	1.05	1.00	1.06	1.04
30	1.05	.....	1.25	1.55	1.45	1.20	1.05	.95	1.05	1.00	1.08	1.04
31	1.15	.....	.....	.....	1.45	.....	1.05	.95	.....	1.00	.....	1.04

NOTE.—Gage height distorted by ice Feb. 20 to 28 and Mar. 2 to 7.

Daily discharge, in second-feet, of Ford Creek near Augusta, Mont., for 1910.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	15	11	11	20	47	35	26	16	16	16	11	11
2	15	11	11	20	47	35	26	16	16	16	11	11
3	15	11	11	20	55	34	25	16	16	16	11	11
4	15	11	11	20	55	34	25	16	16	16	11	11
5	15	11	11	20	55	34	24	16	16	16	11	11
6	15	11	11	20	55	32	24	16	16	16	11	11
7	15	11	11	20	55	32	23	16	16	16	11	11
8	15	11	11	20	55	32	22	16	16	16	11	11
9	15	11	11	36	47	32	21	16	16	16	10	11
10	15	11	11	36	47	32	21	16	12	16	10	11
11	15	11	11	43	47	32	20	12	12	16	10	11
12	15	11	11	36	47	31	18	12	12	16	10	11
13	15	11	20	36	47	31	18	12	12	16	10	11
14	15	11	20	36	47	31	18	12	12	16	10	11
15	15	11	20	36	47	31	18	12	12	16	10	11
16	15	11	20	36	47	31	16	12	22	16	10	11
17	15	11	20	36	47	31	16	12	25	12	10	11
18	13	11	20	36	47	30	16	12	16	12	10	11
19	11	11	20	47	47	30	16	12	16	12	10	11
20	11	11	23	47	47	30	16	12	16	12	10	11
21	11	11	27	47	47	30	16	12	22	12	9.5	11
22	11	11	36	47	47	30	16	12	16	12	11	11
23	11	11	36	55	47	29	16	12	16	12	11	11
24	11	11	31	59	43	29	16	12	16	12	11	11
25	11	11	31	59	43	29	16	12	16	12	11	11
26	11	11	31	59	36	29	16	12	16	12	12	11
27	11	11	31	68	36	29	16	12	16	12	11	11
28	11	11	27	55	36	27	16	12	16	11	11	11
29	11	.....	20	59	36	27	16	12	16	11	11	11
30	11	.....	20	47	35	27	16	12	16	11	12	11
31	15	.....	20	.....	35	.....	16	12	.....	11	.....	11

NOTE.—These discharges are based on rating curves applicable as follows: Jan. 1 to May 27 and Nov. 21 to Dec. 31, well defined between 10 and 80 second-feet; May 28 to July 13 and Oct. 17 to Nov. 20, indirect method for shifting channels. July 14 to Oct. 16, fairly well defined between 12 and 20 second-feet. Discharges interpolated because of ice Feb. 20 to 28 and May 2 to 7.

Monthly discharge of Ford Creek near Augusta, Mont., for 1910.

[Drainage area, 18 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Run-off (total in acre-feet).	
January	15	11	13.4	0.744	0.86	824	B.
February	11	11	11.0	.611	.64	611	B.
March	36	11	19.5	1.08	1.24	1,200	B.
April	68	20	39.2	2.18	2.43	2,330	A.
May	55	35	46.1	2.56	2.95	2,830	A.
June	35	27	30.9	1.72	1.92	1,840	B.
July	26	16	18.9	1.05	1.21	1,160	B.
August	16	12	13.3	.739	.85	818	B.
September	25	12	15.9	.883	.99	946	B.
October	16	11	13.9	.772	.89	855	B.
November	12	9.5	10.6	.589	.66	631	B.
December	11	11	11.0	.611	.70	676	B.
The year	68	9.5	20.3	1.13	15.34	14,700	

SMITH CREEK NEAR AUGUSTA, MONT.

This station, which is located 1 mile above J. W. Nixon's ranch, 16 miles southwest of Augusta, Mont., was established April 14, 1906, to obtain run-off data for use in connection with the Sun River irrigation project.

The ordinary summer flow is practically all used for irrigation; but no water is diverted above the gaging station.

The gage is an inclined staff, fastened securely to a bowlder on the left bank just above the ford.

Discharge measurements are made by wading.

Discharge measurements of Smith Creek near Augusta, Mont., in 1910.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Apr. 28	Raymond Richards	33	29	0.86	56
May 27	do	28	22	.68	34
July 14	J. C. Beebe	20	12	.46	14
Aug. 27	M. E. McChristie	11	9	.38	10
Oct. 16	B. E. Jones	22	12	.48	14
Nov. 21	J. C. Beebe	18	13	.50	13
22	do	19	14	.49	14

NOTE.—These measurements are made by wading at various sections.

Daily gage height, in feet, of Smith Creek near Augusta, Mont., for 1910.

[Mrs. J. W. Nixon, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	0.4	0.4	0.7	0.6	0.8	0.65	0.5	0.4	0.5	0.5	0.5	0.5
2	.4	.4	.8	.6	.8	.65	.5	.4	.45	.5	.5	.5
3	.4	.4	.75	.6	.8	.65	.5	.4	.45	.55	.5	.5
4	.4	.4	.75	.6	.8	.65	.5	.4	.45	.55	.5	.5
5	.4	.4	.7	.6	.75	.65	.5	.4	.45	.55	.5	.5
6	.4	.4	.65	.65	.75	.65	.5	.4	.45	.55	.5	.5
7	.4	.4	.6	.65	.75	.65	.5	.4	.5	.55	.5	.5
8	.4	.35	.5	.7	.75	.65	.5	.4	.5	.55	.5	.5
9	.4	.4	.45	.7	.75	.65	.5	.4	.5	.5	.5	.5
10	.4	.4	.45	.7	.8	.65	.5	.4	.5	.5	.5	.5
11	.4	.4	.45	.75	.8	.65	.5	.4	.55	.5	.5	.5
12	.4	.4	.45	.8	.8	.65	.5	.4	.55	.5	.5	.5
13	.4	.4	.45	.8	.8	.6	.45	.4	.55	.5	.5	.5
14	.4	.4	.5	.75	.8	.6	.45	.4	.5	.5	.5	.5
15	.4	.4	.5	.8	.8	.6	.45	.4	.5	.5	.5	.5
16	.4	.4	.55	.8	.75	.6	.45	.4	.5	.5	.5	.45
17	.4	.4	.7	.8	.75	.55	.45	.4	.7	.5	.5	.45
18	.4	.4	.75	.8	.7	.55	.4	.4	.7	.5	.5	.45
19	.4	.4	.8	.8	.7	.55	.4	.4	.65	.5	.5	.45
20	.4	.4	.9	.8	.7	.55	.4	.4	.65	.5	.5	.45
21	.4	.4	.9	.85	.7	.55	.4	.4	.6	.5	.5	.45
22	.4	.4	.9	.85	.7	.55	.4	.4	.6	.5	.5	.45
23	.45	.4	.85	.85	.7	.55	.4	.4	.6	.5	.5	.45
24	.45	.4	.85	.9	.7	.5	.4	.45	.6	.5	.5	.45
25	.45	.4	.75	.9	.7	.5	.4	.45	.6	.5	.5	.45
26	.45	.4	.75	.9	.7	.5	.4	.4	.55	.5	.5	.45
27	.4	.4	.7	.9	.7	.5	.4	.4	.5	.5	.5	.45
28	.4	.4	.7	.85	.7	.5	.4	.4	.5	.5	.5	.45
29	.4	.....	.65	.85	.7	.5	.4	.4	.45	.5	.5	.45
30	.4	.....	.6	.85	.7	.5	.4	.4	.45	.5	.5	.45
31	.4	.....	.6	.....	.65	.....	.4	.5	.....	.5	.....	.45

Daily discharge, in second-feet, of Smith Creek near Augusta, Mont., for 1910.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	10	10	36	25	48	30	16	10	16	16	15	14
2	10	10	48	25	48	30	16	10	13	16	15	14
3	10	10	42	25	48	30	16	10	13	20	15	14
4	10	10	42	25	48	30	16	10	13	20	15	14
5	10	10	36	25	42	30	16	10	13	20	15	14
6	10	10	30	30	42	30	16	10	13	20	15	14
7	10	10	25	30	42	30	16	10	16	20	15	14
8	10	8	16	36	42	30	16	10	16	20	15	14
9	10	10	13	36	42	30	16	10	16	16	15	14
10	10	10	13	36	48	30	16	10	16	16	15	14
11	10	10	13	42	48	30	16	10	20	16	15	14
12	10	10	13	48	48	30	16	10	20	16	15	14
13	10	10	13	48	48	25	13	10	20	16	15	14
14	10	10	16	42	48	25	13	10	16	16	15	14
15	10	10	16	48	48	25	13	10	16	16	15	14
16	10	10	20	48	42	25	13	10	16	16	15	13
17	10	10	36	48	42	20	13	10	36	15	15	13
18	10	10	42	48	36	20	10	10	36	15	15	13
19	10	10	48	48	36	20	10	10	30	15	15	13
20	10	10	63	48	36	20	10	10	30	15	15	13
21	10	10	63	56	36	20	10	10	25	15	14	13
22	10	10	63	56	36	20	10	10	25	15	14	13
23	13	10	56	56	36	20	10	10	25	15	14	13
24	13	10	56	63	36	16	10	13	25	15	14	13
25	13	10	42	63	36	16	10	13	25	15	14	13
26	13	10	42	63	36	16	10	10	20	15	14	13
27	10	10	36	63	36	16	10	10	16	15	14	13
28	10	10	36	56	36	16	10	10	16	15	14	13
29	10	.....	30	56	36	16	10	10	13	15	14	13
30	10	.....	25	56	36	16	10	10	13	15	14	13
31	10	.....	25	.....	30	.....	10	16	.....	15	.....	13

NOTE.—These discharges are based on rating curves applicable as follows: Jan. 1 to Oct. 16, curve well defined; Oct. 17 to Nov. 20, indirect method for shifting channel; Nov. 21 to Dec. 31, rating curve poorly defined.

Monthly discharge of Smith Creek near Augusta, Mont., for 1910.

[Drainage area, 26 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
January	13	10	10.4	0.400	0.461	640	B.
February	10	8	9.93	.382	.398	551	B.
March	63	13	34.0	1.31	1.51	2,090	A.
April	63	25	45.0	1.73	1.93	2,680	A.
May	48	30	41.0	1.58	1.82	2,520	A.
June	30	16	23.7	.912	1.02	1,410	A.
July	16	10	12.8	.492	.567	787	A.
August	16	10	10.2	.392	.452	627	B.
September	36	13	19.6	.753	.840	1,170	A.
October	20	15	16.3	.627	.723	1,000	B.
November	15	14	14.7	.566	.632	875	B.
December	14	13	13.5	.519	.598	830	B.
The year	63	8	21	.805	10.95	15,200	

MARIAS RIVER BASIN.

DESCRIPTION.

The headwaters of Marias River rise on the eastern slope of the main divide of the Rocky Mountains, at an elevation of over 8,000 feet above sea level, and flow eastward through a region of elevated plains and prairies. Marias River proper is formed by the union of Cutbank and Two Medicine rivers, which meet at the eastern boundary of the Blackfeet Indian Reservation. From this junction to the Missouri, which it enters 14 miles below Fort Benton, its length is about 110 miles and its fall does not exceed 5 feet per mile. Its principal tributaries are Willow and Cottonwood creeks, which enter from the north, and Teton River, which comes in from the south.

The general altitude of this country is 3,000 to 4,000 feet above sea level, the plains rising by gentle terraces toward the mountains to elevations of about 5,000 feet. Grass is abundant and the region is devoted to grazing. Considerable spruce and pine timber is found at the headwaters in the mountains, but the remainder of the basin is bare except for fringes and small groves along the streams.

The mean annual rainfall ranges from about 60 inches in the mountains to 12 inches near the mouth of the river, the average for the plains section being about 16 inches. The streams are icebound from December until early in March, and this is the season of least flow.

Irrigation has been practiced to a slight extent for a number of years in the valleys of the tributaries, and three large irrigation projects are now under construction. One is being constructed by the United States Reclamation Service, and the other two under the Carey Act. Altogether about 450,000 acres will be reclaimed. The basin affords a number of excellent reservoir sites, which will be utilized in storing the flood waters of the upper tributaries from which the principal water supply for these projects will come.

The great fall and the abundant water supply of the upper tributaries of Marias River also afford favorable conditions for water-power development.

Run-off records in this basin extend back to 1902. The wettest year since that time was 1903 and the driest was 1905.

TWO MEDICINE RIVER AT FAMILY, MONT.

This station, which is located at the Holy Family Mission, 16 miles southeast of Browning, Mont, and about 6 miles above the mouth of Badger Creek, the nearest tributary, was established April, 1907, to determine the amount of water available for irrigation.

The United States Reclamation Service has under consideration a project which will use about 200 second-feet of water for irrigating

land north of the stream for the Blackfeet Indians. The water will be diverted near the mouth of Little Badger Creek, a small tributary entering from the south above the station. A storage reservoir will be built at Two Medicine Lake, near the headwaters of the stream, to augment the low-water flow. The only diversion from this stream at present is that made by a ditch which supplies water for about 100 acres of land on the farm at the Holy Family Mission. It heads about 2 miles above the gage.

A standard chain gage is located on the east bank of the stream directly back of the mission buildings. High-water measurements must be made from the old wagon bridge located about 3 miles above the bridge. Wading measurements are made in low water at a section near the gage.

The datum of the gage was lowered 0.95 foot July 21, 1908.

The results are good at this station, except during the winter months, when they are affected by ice.

Discharge measurements of Two Medicine River at Family, Mont., in 1910.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Apr. 23	W. A. Lamb	59	309	3.40	964
Apr. 25	M. E. McChristie	59	326	3.75	1,240
26	W. A. Lamb	59	344	3.92	1,490
May 18	do	59	210	3.12	812
June 16	M. E. McChristie	68	195	2.93	666
Aug. 4[a]	do	57	42	1.64	95
Sept. 10[a]	do	58	46	1.70	120
Nov. 22	W. A. Lamb	60	178	2.33	358

[a] Made by wading.

Daily gage height, in feet, of Two Medicine River at Family, Mont., for 1910.

[Otto Johnson, observer.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1		2.3	3.5	3.45	2.35	1.65	1.5	2.15	2.10
2		2.3	3.3	3.45	2.35	1.65	1.7	2.15	2.08
3		2.2	3.05	3.35	2.3	1.65	1.8	2.15	2.09
4		2.2	3.0	3.25	2.3	1.65	1.7	2.6	2.05
5		2.2	2.9	3.0	2.2	1.6	1.7	2.5	2.00
6		2.4	3.05	2.9	2.15	1.6	1.7	2.5	1.95
7		2.6	3.3	2.95	2.1	1.6	1.7	2.5	1.90
8		2.6	3.65	3.1	2.05	1.6	1.7	2.35	2.00
9		3.0	3.95	2.95	2.05	1.6	1.7	2.75	2.23
10		3.6	4.0	2.9	2.0	1.6	1.7	2.78	2.75
11		3.6	3.9	2.9	2.0	1.6	1.85	2.7	2.80
12		3.5	3.8	3.0	2.0	1.55	1.81	2.6	2.68
13		3.7	3.6	3.05	1.9	1.55	1.8	2.5	2.50
14		3.3	3.45	3.0	1.9	1.55	1.8	2.4	2.40
15		3.1	3.45	2.95	1.85	1.55	1.8	2.3	2.33
16		3.0	3.3	2.95	1.85	1.55	1.8	2.22	2.11
17		3.1	3.25	2.95	1.85	1.55	1.8	2.15	2.16
18		3.3	3.15	2.85	1.85	1.55	1.81	2.15	2.16
19		3.2	3.2	2.8	1.85	1.55	1.8	2.1	1.96
20	3.0	3.8	3.25	2.7	1.85	1.5	1.8	2.05	1.90

Daily gage height, in feet, of Two Medicine River at Family, Mont., for 1910—Contd.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
21	3.2	3.7	3.2	2.65	1.8	1.5	1.8	.....	2.00
22	3.6	3.6	3.1	2.6	1.8	1.5	1.85	.....	2.24
23	3.7	3.4	3.15	2.55	1.75	1.5	1.8	.....	2.15
24	3.0	3.6	3.3	2.45	1.7	1.6	1.8	.....	2.05
25	2.9	3.9	3.5	2.4	1.7	1.5	1.9	.....	2.15
26	2.8	3.9	3.7	2.35	1.7	1.5	1.9	.....	2.25
27	2.6	4.3	3.65	2.3	1.7	1.5	1.9	.....	.....
28	2.5	4.3	3.55	2.35	1.7	1.5	1.9	.....	.....
29	2.6	4.0	3.5	2.35	1.7	1.5	1.9	.....	.....
30	2.4	3.7	3.45	2.4	1.7	1.5	1.9	.....	.....
31	2.3	.....	3.45	.....	1.65	1.5	.....	.....	.....

NOTE.—Ice conditions Jan. 1 to about Mar. 19 and Nov. 27 to Dec. 31.

Daily discharge, in second-feet, of Two Medicine River at Family, Mont., for 1910.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	330	1,080	1,040	355	103	75	265	245
2	.....	330	920	1,040	355	103	114	265	237
3	.....	285	748	958	330	103	140	265	241
4	.....	285	715	885	330	103	114	485	225
5	.....	285	655	715	285	92	114	430	205
6	.....	380	748	655	265	92	114	430	188
7	.....	485	920	685	245	92	114	430	171
8	.....	485	1,200	780	225	92	114	625	205
9	.....	715	1,460	685	225	92	114	568	299
10	.....	1,160	1,500	655	205	92	114	584	568
11	.....	1,160	1,410	655	205	92	158	540	595
12	.....	1,080	1,320	715	205	84	143	485	529
13	.....	1,240	1,160	748	171	84	140	430	430
14	.....	920	1,040	715	171	84	140	380	380
15	.....	780	1,040	685	158	84	140	330	345
16	.....	715	920	685	158	84	140	294	249
17	.....	780	885	685	158	84	140	265	269
18	.....	920	815	625	158	84	143	265	269
19	.....	850	850	595	158	84	140	245	191
20	715	1,320	885	540	158	75	140	225	171
21	850	1,240	850	512	140	75	140	225	205
22	1,160	1,160	780	485	140	75	158	225	303
23	1,240	995	815	458	127	75	140	230	265
24	715	1,160	920	405	114	92	140	230	225
25	655	1,410	1,080	380	114	75	171	235	265
26	595	1,410	1,240	355	114	75	171	235	308
27	485	1,790	1,200	330	114	75	171	235	.....
28	430	1,790	1,120	355	114	75	171	240	.....
29	485	1,500	1,080	355	114	75	171	240	.....
30	380	1,240	1,040	380	114	75	171	245	.....
31	330	.....	1,040	.....	103	75	.....	245	.....

NOTE.—These discharges are based on a rating curve well defined between 140 and 1,600 second-feet. Discharges estimated Oct. 21 to 31.

Monthly discharge of Two Medicine River at Family, Mont., for 1910.

[Drainage area, 368 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
January	.....	.....	a 75	0.204	0.24	4,610	D.
February	.....	.....	a 75	.204	.21	4,170	D.
March	1,160	.....	a 275	.747	.86	16,900	D.
April	1,790	285	940	2.55	2.84	55,900	A.
May	1,500	655	1,010	2.74	3.16	62,100	A.
June	1,040	330	629	1.71	1.91	37,400	A.
July	355	103	188	.511	.59	11,600	A.
August	103	75	85.4	.232	.27	5,250	B.
September	158	75	138	.375	.42	8,210	A.
October	625	225	335	.910	1.05	20,600	B.
November	595	171	a 292	.793	.88	17,400	A.
December	.....	.....	a 100	.272	.31	6,150	D.
The year	1,790	.....	345	.938	12.74	250,000	

a Discharge estimated because of ice Jan. 1 to Mar. 19 and Nov. 27 to Dec. 31.

NOTE.—The means for January, February, March, and December are only approximate.

BADGER CREEK NEAR FAMILY, MONT.

Badger Creek is tributary to Two Medicine Creek.

This station, which is located near the road crossing 4 miles east of Family, Mont., was established April 20, 1907, to determine the amount of water available for irrigation. The United States Reclamation Service proposes to divert the natural flow of the stream to irrigate land in the eastern part of the Blackfeet Indian Reservation and north of Birch Creek.

The gage and bench marks were washed out in June, 1908, and a new gage was established July 22, 1908, about 400 feet farther upstream and at a different datum. As the bench mark was destroyed, the relation between the two gages could not be determined. The gage was again washed out May 25, 1909, and was reset at a different datum some 4 miles below the cable section and just below the old Piegan Mission crossing. High-water measurements are made from a cable. Low-water measurements can be made by wading at the cable section.

The stream at the gage flows in two channels at both medium and low stages. At high stages there are several channels. High-water measurements are, therefore, only fair. The low records, however, are good.

No records of gage heights were obtained during January, February, and first part of March, owing to lack of funds.

Discharge measurements of Badger Creek near Family, Mont., in 1910.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Apr. 23	W. A. Lamb	57	166	4.64	466
25	do	60	188	5.02	702
May 20	do	58	170	4.73	486
June 15	M. E. McChristie	57	151	4.43	319
Aug. 3[a]	do	73	115	3.80	142
Sept. 10[b]	do	90	83	3.88	154
Nov. 22[b]	W. A. Lamb	78	81	4.06	205

[a] Made by wading above cable. [b] Made by wading above gage.

Daily gage height, in feet, of Badger Creek near Family, Mont., for 1910.

[Oliver J. Racine, observer.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	3.80	4.62	4.85	.....	3.80	3.88	3.95	4.08	4.32
2	.....	3.90	4.65	4.72	.....	3.80	3.90	3.98	4.00	4.40
3	.....	3.80	4.60	4.65	4.10	3.80	3.92	3.98	4.00	4.28
4	.....	3.80	4.58	4.52	4.08	3.80	3.92	4.10	4.00	4.48
5	.....	3.88	4.75	4.52	4.15	3.80	3.90	4.15	4.00	4.48
6	.....	3.72	4.90	4.48	4.05	3.80	3.88	4.15	4.05	4.48
7	.....	3.92	4.90	4.50	4.05	3.78	3.88	4.18	4.08	4.50
8	.....	3.88	4.92	4.55	4.02	3.78	3.85	4.18	4.10	4.52
9	6.20	3.98	5.05	4.50	4.00	3.78	3.88	4.28	4.12	4.55
10	6.38	4.10	5.15	4.45	4.10	3.80	3.90	4.25	4.10	4.55
11	6.30	4.30	4.98	4.40	3.92	3.75	3.88	4.22	4.08	4.55
12	6.30	4.50	4.92	4.42	3.98	3.75	3.88	4.18	4.05	4.60
13	3.90	4.52	4.90	4.42	3.95	3.75	3.88	4.15	4.05	4.52
14	3.82	4.50	4.85	4.42	3.92	3.75	3.88	4.12	4.08	4.05
15	3.85	4.52	4.85	4.42	4.05	3.80	3.88	4.08	4.05	4.02
16	3.78	4.28	4.75	4.42	3.92	3.75	3.88	4.08	4.05	4.00
17	3.82	4.40	4.68	4.42	3.92	3.75	3.88	3.90	4.00	3.95
18	3.75	4.38	4.82	4.30	3.92	3.75	3.88	3.92	.....	3.92
19	3.80	4.58	4.80	4.28	3.88	3.75	3.88	3.92	.....	3.95
20	3.95	4.90	4.72	4.30	3.98	3.78	3.88	3.92	.....	3.98
21	3.90	4.70	4.60	4.22	3.88	3.72	3.92	3.92	4.05	3.98
22	4.15	4.70	4.62	4.25	3.85	3.72	3.95	3.92	4.00	4.00
23	4.10	4.58	4.70	4.18	3.85	3.75	3.98	3.98	4.05	4.00
24	4.05	4.70	4.88	4.15	3.85	3.75	3.95	4.02	4.08	4.05
25	4.05	5.00	5.00	4.18	3.95	3.82	3.95	4.38	4.10	4.08
26	3.92	5.00	4.95	.....	3.82	3.80	3.95	4.28	4.12	4.08
27	4.00	5.18	4.90	.....	3.85	3.75	3.95	4.22	4.18	4.10
28	3.85	5.15	4.78	.....	3.85	3.75	3.92	4.18	4.22	4.12
29	3.82	5.05	4.72	.....	3.82	3.75	3.98	4.15	4.25	4.10
30	3.90	4.90	4.85	.....	3.80	3.82	3.95	4.12	4.28	4.12
31	3.82	.....	4.82	.....	3.90	3.85	.....	4.10	.....	4.18

NOTE.—Probably affected by ice during part of period Jan. 1 to Mar. 12 and Nov. 26 to Dec. 31.

Daily discharge, in second-feet, of Badger Creek near Family, Mont., for 1910.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	141	429	577	210	141	156	171	203
2	.....	160	447	490	210	141	160	178	182
3	.....	141	417	447	208	141	164	178	182
4	.....	141	406	374	203	141	164	208	182
5	.....	156	510	374	224	141	160	224	182
6	.....	127	612	354	195	141	156	224	195
7	.....	164	612	363	195	138	156	233	203
8	.....	156	627	390	187	138	150	233	208
9	.....	178	727	363	182	138	156	268	214
10	.....	208	810	340	208	141	160	277	208

Daily discharge, in second-feet, of Badger Creek near Family, Mont., for 1910—Contd.

Day.	Mar.	Apr. .	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
11	.....	275	672	316	164	132	156	246	203
12	.....	363	627	325	178	132	156	233	195
13	160	374	612	325	171	132	156	224	195
14	145	363	575	325	164	132	156	214	203
15	150	374	575	325	195	141	156	203	195
16	138	268	410	325	164	132	156	203	195
17	145	316	465	325	164	132	156	160	182
18	132	308	556	275	164	132	156	164	187
19	141	406	542	268	156	132	156	164	188
20	172	612	490	275	178	138	156	164	190
21	160	477	417	246	156	127	164	164	195
22	224	477	429	277	150	127	171	164	182
23	208	406	477	233	150	132	178	178	195
24	195	477	598	224	150	132	171	187	203
25	195	687	687	233	171	145	171	308	208
26	164	687	650	230	145	141	171	268	.....
27	182	835	612	225	150	132	171	246	.....
28	150	810	527	220	150	132	164	233	.....
29	145	727	490	215	145	132	178	224	.....
30	160	612	577	215	141	145	171	214	.....
31	145	.....	556	.....	160	150	.....	208	.....

NOTE.—These discharges are based on a curve that is well defined between 100 and 850 second-feet. Discharges June 26 to July 2 and Nov. 18 to 20 interpolated.

Monthly discharge of Badger Creek near Family, Mont., for 1910.

[Drainage area, 224 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
January	.....	.....	[a]100	0.446	0.51	6,150	D.
February	.....	.....	[a]75	.335	.35	4,160	D.
March	224	132	[a]162	.723	.83	9,960	B.
April	835	127	381	1.70	1.90	22,700	A.
May	810	406	553	2.47	2.85	34,000	A.
June	577	[b]215	316	1.41	1.57	18,800	A.
July	224	141	174	.777	.90	10,700	A.
August	150	127	136	.607	.70	8,400	A.
September	178	150	162	.723	.81	9,640	A.
October	308	160	212	.946	1.09	13,000	A.
November	277	182	199	.888	.99	11,800	A.
December	.....	.....	[a]175	.781	.90	10,800	D.
The year	835	.....	220	.982	13.40	175,000	

[a] Discharge estimated Jan. 1 to Mar. 12 and Nov. 26 to Dec. 31. [b] Estimated value.

NOTE.—Means for January and February are only approximate.

CUTBANK CREEK AT CUTBANK, MONT.

This station, which is located half a mile southwest of Cutbank, one-fourth mile below the Great Northern Railway bridge, and 12 miles above the mouth of Two Medicine, was established August 4, 1905, to obtain data for use in connection with irrigation projects under consideration by the United States Reclamation Service.

The intake of the Great Northern Railway's pumping station is located a hundred yards above the gage. The average quantity pumped is about 14,000 gallons an hour for 18 hours a day—equivalent to a continuous flow of 0.4 second-foot.

The datum of the gage has not been changed since the station was established. The records during the winter months are somewhat affected by ice. The results taken as a whole can be considered as good.

Measurements in high water are made from a cable. The chain gage used at this station is located on the left bank about 100 yards above the cable.

Discharge measurements of Cutbank Creek at Cutbank, Mont., in 1910.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Apr. 26	W. A. Lamb	105	142	3.65	404
May 21	do	112	146	3.66	413
June 21	do	105	112	3.41	253
Aug. 11 [a]	C. S. Heidel	44	23	2.80	39
Sept. 25	M. E. McChristie	97	63	3.10	108
Nov. 28 [b]	B. E. Jones	58	80	3.00	28

[a] Made by wading below cable.
[b] Creek frozen over. Thickness of ice at measuring section ranged from 0.2 to 0.5 foot.

Daily gage height, in feet, of Cutbank Creek at Cutbank, Mont., for 1910.

[Conrad Peters, observer.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	3.2	3.7	3.8	3.3	2.9	2.8	3.05	3.25	3.2
2	.....	3.2	3.6	3.8	3.3	2.9	2.9	3.15	3.2	3.3
3	.....	3.2	3.6	3.75	3.3	2.9	2.9	3.35	3.2	3.4
4	.....	3.2	3.5	3.7	3.3	2.9	2.9	3.4	3.15	3.4
5	.....	3.2	3.5	3.6	3.3	2.9	2.9	3.4	3.15	3.3
6	.....	3.2	3.5	3.6	3.25	2.9	2.9	3.4	3.15	3.2
7	.....	3.2	3.5	3.6	3.2	2.8	2.9	3.4	3.1	3.2
8	3.9	3.2	3.65	3.75	3.2	2.8	2.9	3.4	3.1	3.2
9	3.9	3.3	3.75	3.8	3.15	2.8	2.9	3.45	3.15	3.2
10	3.8	3.4	3.9	3.7	3.1	2.8	2.9	3.5	3.2	3.2
11	3.75	3.4	3.9	3.6	3.1	2.8	2.9	3.5	3.2	3.2
12	3.7	3.45	3.8	3.6	3.1	2.8	2.9	3.45	3.1	3.2
13	3.75	3.5	3.8	3.6	3.1	2.8	2.9	3.45	3.25	3.2
14	3.95	3.5	3.75	3.6	3.1	2.8	2.9	3.45	3.4	3.2
15	4.0	3.45	3.7	3.6	3.1	2.8	2.9	3.3	3.3	3.2
16	3.95	3.4	3.7	3.6	3.1	2.8	2.9	3.3	3.3	3.2
17	3.9	3.4	3.7	3.6	3.1	2.8	2.9	3.3	3.2	3.25
18	3.8	3.4	3.6	3.6	3.1	2.8	3.0	3.25	3.2	3.2
19	3.5	3.45	3.6	3.6	3.1	2.8	3.0	3.25	3.15	3.2
20	3.4	3.55	3.6	3.5	3.1	2.8	3.0	3.2	3.2	3.1
21	3.4	3.6	3.6	3.5	3.0	2.8	3.0	3.2	3.2	3.1
22	3.4	3.6	3.7	3.5	3.0	2.8	3.1	3.2	3.2	3.05
23	3.4	3.6	3.7	3.5	3.0	2.8	3.1	3.2	3.2	3.0
24	3.4	3.5	3.7	3.5	3.0	2.8	3.1	3.15	3.2	2.9
25	3.4	3.5	3.75	3.5	3.0	2.8	3.1	3.1	3.2	2.95
26	3.4	3.65	3.8	3.4	3.0	2.8	3.1	3.15	3.1	3.0
27	3.3	3.75	3.8	3.35	2.9	2.8	3.1	3.5	3.1	3.1
28	3.3	3.9	3.8	3.3	2.9	2.8	3.1	3.4	3.05	3.1
29	3.2	3.85	3.7	3.4	2.9	2.8	3.1	3.35	3.1	3.2
30	3.2	3.8	3.7	3.4	2.9	2.8	3.1	3.3	3.2	3.2
31	3.2	.....	3.7	.....	2.9	2.8	.....	3.3	.....	3.2

NOTE.—Ice probably existed Jan. 1 to about Mar. 7 and after Nov. 20.

Daily discharge, in second-feet, of Cutbank Creek at Cutbank, Mont., for 1910.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	148	445	543	194	57	39	95	171
2	.....	148	367	543	194	57	57	129	148
3	.....	148	367	494	194	57	57	220	148
4	.....	148	303	445	194	57	57	246	129
5	.....	148	303	367	194	57	57	246	129
6	.....	148	303	367	171	57	57	246	129
7	.....	148	303	367	148	39	57	246	110
8	650	148	406	494	148	39	57	246	110
9	650	194	494	543	129	39	57	274	129
10	543	246	650	445	110	39	57	303	148
11	494	246	650	367	110	39	57	303	148
12	445	274	543	367	110	39	57	274	110
13	494	303	543	367	110	39	57	274	171
14	711	303	494	367	110	39	57	274	246
15	772	274	445	367	110	39	57	194	194
16	711	246	445	367	110	39	57	194	194
17	650	246	445	367	110	39	57	194	148
18	543	246	367	367	110	39	80	171	148
19	303	274	367	367	110	39	80	171	129
20	246	335	367	303	110	39	80	148	.....
21	246	367	367	303	80	39	80	148	.....
22	246	367	445	303	80	39	110	148	.....
23	246	367	445	303	80	39	110	148	.....
24	246	303	445	303	80	39	110	129	.....
25	246	303	494	303	80	39	110	110	.....
26	246	406	543	246	80	39	110	129	.....
27	194	494	543	220	57	39	110	303	.....
28	194	650	543	194	57	39	110	246	.....
29	148	596	445	246	57	39	110	220	.....
30	148	543	445	246	57	39	110	194	.....
31	148	.....	445	.....	57	39	.....	194	.....

NOTE.—These discharges are based on a well-defined curve between 30 and 1,400 second-feet.

Monthly discharge of Cutbank Creek at Cutbank, Mont., for 1910.

[Drainage area. 971 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
January	.....	.....	[a]150	0.154	0.18	9,220	
February	.....	.....	[a]150	.154	.16	8,330	
March	772	148	[a]355	.366	.42	21,800	B.
April	650	148	292	.301	.34	17,400	A.
May	650	303	444	.457	.53	27,300	A.
June	543	194	363	.374	.42	21,600	A.
July	194	57	114	.118	.14	7,010	A.
August	57	39	42.5	.044	.05	2,610	A.
September	110	39	75.4	.078	.09	4,490	A.
October	303	95	207	.213	.25	12,700	A.
November	246	.....	[a]117	.120	.13	6,960	C.
December	.....	.....	[a]35	.036	.04	2,150	
The year	.....	.....	196	.202	2.75	142,000	

[a] Discharge Jan. 1 to Mar. 7 and Nov. 20 to Dec. 31 estimated for ice effect.

NOTE.—The means for January, February, and December are only approximate.

BIRCH CREEK NEAR DUPUYER, MONT.

This station, which is located at Shields ranch, 12 miles northwest of Dupuyer, Mont., and about 25 miles from its junction with Two Medicine River, was established July 25, 1907, to determine the amount of water available for irrigation projects on the Blackfeet Indian Reservation.

No storage is used on this stream, but a number of ditches divert water for irrigation. The largest of these, owned by the Conrad Investment Co., diverts water about half a mile below the station.

The gage datum remained the same from the time the station was established until the high water of June, 1908, when the gage was washed away and the channel changed. A temporary staff gage was put in July 23, 1908, about 200 feet below the original gage. This gage was used until October 1, 1908, when a permanent chain gage was established one-fourth mile above. Measurements are made from a car and cable located three-fourths of a mile downstream from the gage. By wading just below the cable section better low-water results may be obtained.

Discharge measurements of Birch Creek near Dupuyer, Mont., in 1910.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Apr. 24	M. E. McChristie	73	101	5.35	279
May 19	W. A. Lamb	72	98	5.30	263
June 16	M. E. McChristie	70	80	5.00	195
Aug. 4[a]	....do	49	47	4.41	85
Sept. 16[b]	C. S. Heidel	43	47	4.70	125
Nov. 30[c]	....do	34	38	4.63	81

[a] Made by wading 125 feet below cable.
[b] Made by wading at gage.
[c] Ice. Gage read through hole cut in ice.

Daily gage height, in feet, of Birch Creek near Dupuyer, Mont., for 1910.

[Fred A. Nelson, observer.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	4.59	5.33	5.38	4.63	4.43	4.65	4.66	4.61
2	.....	4.59	5.25	5.36	4.61	4.42	4.58	4.68	4.62
3	.....	4.54	5.18	5.22	4.61	4.42	4.48	4.70	4.63
4	.....	4.52	5.15	5.13	4.60	4.42	4.45	4.74	4.61
5	.....	4.53	5.04	5.12	4.58	4.41	4.48	4.74	4.60
6	.....	4.56	5.04	5.13	4.55	4.41	4.49	4.76	4.58
7	.....	4.83	5.44	5.14	4.52	4.41	4.48	4.78	4.57
8	.....	4.87	5.67	5.12	4.50	4.40	4.48	4.80	4.58
9	.....	4.93	5.87	5.08	4.50	4.40	4.45	4.81	4.63
10	.....	4.98	5.82	5.02	4.50	4.39	4.62	4.76	4.68
11	.....	5.14	5.73	5.00	4.49	4.39	4.60	4.75	4.71
12	.....	5.17	5.62	5.06	4.49	4.39	4.58	4.70	4.73
13	4.45	5.18	5.48	5.10	4.48	4.38	4.56	4.71	4.72
14	4.47	5.02	5.44	5.00	4.48	4.38	4.55	4.68	4.68
15	4.50	5.00	5.42	5.12	4.47	4.37	4.65	4.66	4.66

Daily gage height, in feet, of Birch Creek near Dupuyer, Mont., for 1910—Continued.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
16	4.52	4.95	5.25	5.03	4.46	4.37	4.70	4.65	4.65
17	4.50	4.90	5.23	5.02	4.46	4.36	4.69	4.63	4.64
18	4.60	5.41	5.42	5.00	4.46	4.35	4.62	4.63	4.63
19	4.70	5.44	5.28	4.98	4.45	4.33	4.58	4.62	4.63
20	4.71	5.37	5.24	4.99	.....	4.31	4.60	4.62	4.62
21	4.90	5.34	5.21	4.92	.....	4.29	4.58	4.60	4.62
22	5.00	5.17	5.13	4.86	.....	4.28	4.55	4.58	4.62
23	5.01	5.37	5.12	4.87	.....	4.28	4.65	4.56	4.61
24	4.98	5.57	5.38	4.84	.....	4.40	4.73	4.54	4.61
25	4.93	5.76	5.56	4.83	.....	4.35	4.68	4.73	4.60
26	4.83	5.78	5.62	4.81	.....	4.34	4.65	4.76	4.58
27	4.73	5.80	5.41	4.80	4.44	4.33	4.63	4.70	4.68
28	4.67	5.75	5.28	4.78	4.44	4.33	4.68	4.68	4.75
29	4.66	5.67	5.24	4.72	4.44	4.33	4.70	4.66	4.75
30	4.65	5.40	5.42	4.67	4.43	4.33	4.68	4.67	4.63
31	4.58	.....	5.35	.....	4.43	4.32	.....	4.65	.....

NOTE.—Ice Jan. 1 to about Mar. 13, and Nov. 27 to Dec. 31.

Daily discharge, in second-feet, of Birch Creek near Dupuyer, Mont., for 1910.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	110	272	286	117	88	120	122	114
2	.....	110	251	284	114	87	109	125	115
3	.....	103	233	243	114	87	94	128	117
4	.....	100	226	221	112	87	90	136	114
5	.....	101	200	219	109	85	94	136	112
6	.....	106	200	221	104	85	96	139	109
7	.....	153	303	224	100	85	94	143	108
8	.....	161	370	219	97	84	94	147	109
9	.....	175	430	209	97	84	90	149	117
10	.....	163	415	196	97	83	115	139	125
11	.....	224	388	191	96	83	112	138	130
12	.....	231	355	205	96	83	109	128	134
13	90	233	314	214	94	82	106	130	132
14	93	196	303	191	94	82	104	125	125
15	97	191	298	219	93	81	120	122	122
16	100	180	251	198	92	81	128	120	120
17	97	168	246	196	92	80	126	117	118
18	112	295	298	191	92	78	115	117	117
19	128	303	259	186	90	76	109	115	117
20	130	384	248	189	90	74	112	115	115
21	168	275	241	173	90	72	109	112	115
22	191	231	221	160	90	71	104	109	115
23	193	384	219	162	90	71	120	106	114
24	186	340	286	155	89	84	134	103	114
25	175	397	337	153	89	78	125	134	112
26	153	403	355	149	89	77	120	139	109
27	134	409	295	147	89	76	117	128	.....
28	123	394	259	143	89	76	125	125	.....
29	122	370	248	132	89	76	128	122	.....
30	120	292	298	122	88	76	125	123	.....
31	109	.....	278	.....	88	75	.....	120	.....

NOTE.—These discharges are based on a curve that is well defined between 70 and 350 second-feet. Discharges estimated July 20 to 26.

Monthly discharge of Birch Creek near Dupuyer, Mont., for 1910.

[Drainage area, 155 square miles.]

Month.	Discharge in second-feet.				Run-off.		
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	Accuracy.
January	.....	.....	[a] 90	0.581	0.67	5,530	
February	.....	.....	[a] 90	.581	.60	5,000	
March	193	90	[a] 116	.748	.86	7,130	C.
April	409	100	239	1.54	1.72	14,200	A.
May	430	200	287	1.85	2.13	17,600	A.
June	286	122	193	1.25	1.40	11,500	A.
July	117	88	95.8	.618	.71	5,890	A.
August	88	71	80.2	.517	.60	4,930	A.
September	128	90	111	.716	.80	6,600	A.
October	149	103	126	.813	.94	7,750	A.
November	134	.....	[a] 114	.735	.82	6,780	A.
December	.....	.....	[a] 85	.548	.63	5,230	
The year	430	71	136	.875	11.88	98,100	

[a] Discharge estimated Jan. 1 to Mar. 12 and Nov. 27 to Dec. 31 because of ice.

NOTE.—The means for January, February, and December are only approximate.

DUPUYER CREEK AT DUPUYER, MONT.

Dupuyer Creek is tributary to Birch Creek.

This station, which was established April 15, 1908, is located at the highway bridge in the town of Dupuyer, Mont.

The original staff gage was nailed to the cribbing under the east end of the highway bridge. The gage was washed out July 28, 1909, and was replaced September 20, 1909, gage readings being reduced to the original datum.

In the spring of 1909 a breakwater was constructed on the left (west) bank which deflected the water to the opposite side. A new gage was installed April 25, 1910, at the same location and to the original datum, but owing to the changes in the channel the 1910 gage record is not directly comparable with that for earlier years.

High-water discharge measurements are made from the downstream side of the highway bridge. Low-water measurements are made by wading. Frequent measurements are necessary to insure good results at this station as conditions at the channel are unfavorable. Ice affects the results during the winter months.

Discharge measurements of Dupuyer Creek at Dupuyer, Mont., in 1910.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Apr. 25	M. E. McChristie	16	15	1.04	26
May 19	W. A. Lamb	18	19	1.15	40
June 17	M. E. McChristie	16	12	.79	12
Aug. 5	do	11	3.6	.50	1.8
Sept. 16	C. S. Heidel	20	13	.85	14
Nov. 30[a]	do	18	11	1.67	23

[a] Ice.

Daily gage height, in feet, of Dupuyer Creek at Dupuyer, Mont., for 1910.

[John Pfeiffer, observer.]

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1		1.0	1.0	0.75	0.5	0.5	1.1	1.1	1.6
2		1.0	1.0	.75	.5	.5	1.1	1.1	1.6
3		1.0	1.0	.75	.5	.5	1.1	1.1	1.6
4		1.0	1.0	.5	.5	.75	1.1	1.1	1.5
5		1.0	1.0	.5	.5	.75	1.1	1.1	1.5
6		1.0	1.0	.5	.5	.75	1.1	1.1	1.5
7		1.0	1.0	.5	.5	.75	1.1	1.1	1.4
8		1.0	1.0	.5	.5	.75	1.1	1.1	1.4
9		1.0	1.1	.5	.5	.75	1.1	1.1	1.4
10		1.0	1.1	.5	.5	.75	1.1	1.1	1.4
11		1.0	1.0	.5	5	.75	1.1	1.1	1.5
12		1.1	1.0	.5	.5	.75	1.1	1.1	1.5
13		1.1	1.1	.5	.5	.75	1.1	1.1	1.5
14		1.1	1.1	.5	.5	.75	1.1	1.1	1.5
15		1.1	1.0	.5	.5	.75	1.1	1.1	1.5
16		1.1	.9	.5	.5	.85	1.1	1.1	1.5
17		1.1	.8	.5	.5	1.1	1.1	1.1	1.5
18		1.15	.75	.5	.5	1.1	1.1	1.1	1.5
19		1.15	.75	.5	.5	1.1	1.1	1.1	1.5
20		1.15	.75	.5	.5	1.1	1.1	1.25	1.5
21		1.1	.75	.5	.5	1.1	1.1	1.25	1.5
22		1.1	.75	.5	.5	1.1	1.1	1.25	1.5
23		1.1	.75	.5	.5	1.25	1.1	1.25	1.5
24		1.1	.75	.5	.5	1.25	1.1	1.5	1.5
25	1.1	1.1	.75	.5	.5	1.25	1.1	1.5	1.5
26	1.1	1.1	.75	.5	.5	1.1	1.1	1.5	1.5
27	1.1	1.1	.75	.5	.5	1.1	1.1	1.5	1.5
28	1.0	1.1	.75	.5	.5	1.1	1.1	1.5	1.5
29	1.0	1.1	.75	.5	.5	1.1	1.1	1.5	1.5
30	1.0	1.0	.75	.5	.5	1.1	1.1	1.5	1.5
31		1.0		.5	.5		1.1		1.5

NOTE.—Discharge affected by ice after Nov. 19.

Daily discharge, in second-feet, of Dupuyer Creek at Dupuyer, Mont., for 1910.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1		24	24	9.8	1.8	1.8	33	33
2		24	24	9.8	1.8	1.8	33	33
3		24	24	9.8	1.8	1.8	33	33
4		24	24	1.8	1.8	9.8	33	33
5		24	24	1.8	1.8	9.8	33	33
6		24	24	1.8	1.8	9.8	33	33
7		24	24	1.8	1.8	9.8	33	33
8		24	24	1.8	1.8	9.8	33	33
9		24	33	1.8	1.8	9.8	33	33
10		24	33	1.8	1.8	9.8	33	33
11		24	24	1.8	1.8	9.8	33	33
12		33	24	1.8	1.8	9.8	33	33
13		33	33	1.8	1.8	9.8	33	33
14		33	33	1.8	1.8	9.8	33	33
15		33	24	1.8	1.8	9.8	33	33
16		33	17	1.8	1.8	14	33	33
17		33	12	1.8	1.8	33	33	33
18		38	9.8	1.8	1.8	33	33	33
19		38	9.8	1.8	1.8	33	33	33
20		38	9.8	1.8	1.8	33	33	
21		33	9.8	1.8	1.8	33	33	
22		33	9.8	1.8	1.8	33	33	
23		33	9.8	1.8	1.8	50	33	
24		33	9.8	1.8	1.8	50	33	
25	33	33	9.8	1.8	1.8	50	33	
26	33	33	9.8	1.8	1.8	33	33	
27	33	33	9.8	1.8	1.8	33	33	
28	24	33	9.8	1.8	1.8	33	33	
29	24	33	9.8	1.8	1.8	33	33	
30	24	24	9.8	1.8	1.8	33	33	
31		24		1.8	1.8		33	

NOTE.—These discharges are based on a rating curve fairly well defined below 45 second-feet.

Monthly discharge of Dupuyer Creek at Dupuyer, Mont., for 1910.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
January			a 18	1,110	
February			a 20	1,110	
March			a 25	1,540	
April			a 28.4	1,690	
May	38	24	29.7	1,830	A.
June	33	9 8	18.4	1,100	A.
July	9.8	1.8	2.57	158	C.
August	1.8	1 8	1.8	111	C.
September	50	1.8	21 7	1,290	B.
October	33	33	33.0	2,030	B.
November	33	23	a 31.5	1,870	C.
December			a 20	1,230	
The year			20.8	15,100	

a Discharge estimated Jan. 1 to Apr. 24 and Nov. 20 to Dec. 31.

NOTE.—The means for January, February, March, April, and December are only approximate.

TETON RIVER NEAR STRABANE,[1] MONT.

Teton River, the most important tributary of Marias River, rises in the Rocky Mountains and flows eastward in a course approximately parallel to that of Sun River, crossing and recrossing the sixth standard parallel north, and emptying into the Marias River about a mile above the point where the latter joins the Missouri.

This station, which is located 1 mile north of Peeble's ranch, 16 miles above Chouteau, Mont., was established November 26, 1904, to obtain data for use in connection with irrigation projects. In 1910 the post office was moved from Belleview to Strabane, Mont.

No important tributaries enter the stream near the station. Deep Creek and Muddy Creek join the Teton below the station. Practically no water is diverted above the station, but the ordinary flow below is appropriated and used for irrigation.

An irrigation project now being constructed under the Carey Act proposes to store the flood water of Teton River in a reservoir located about 5 miles north of the gaging station. The water will be diverted one-half mile above the gage. The capacity of the reservoir is 90,000 acre-feet and can be increased to 210,000 by raising the top of the dam 20 feet. It will serve 120,000 acres of land on the north side of the river.

The first gage was spiked to a post on the left bank about 40 feet above the bend of Kroff's irrigation ditch. March 9, 1905, it was moved by the observer 250 feet upstream to avoid the effect of the dam erected at the head of the ditch below. On May 8, 1905, the gage was referred to the bench marks, and it was found that the datum had been raised 0.78 foot in moving, while the difference between the level of the water surface at the old and new locations

[1] This station was known as "Teton River near Belleview, Mont.," in earlier years.

was but 0.10 foot. The gage datum was lowered on this date 0.20 foot. May 8, 1906, the gage was again moved 1½ miles upstream to Mr. Bjornstad's new ranch and set at an entirely different datum. The station was discontinued during 1907, but was reestablished again June 16, 1908, near the location of the gage that was used during 1906, but there is no connection between the gage readings.

A standard chain gage on the left bank is used at this new location. Measurements in flood are made from the cable about one-fourth mile above the gage. The current is swift at the gage and the river never freezes across. The conditions for obtaining accurate discharge data during high water are rather poor on account of the shifting channel.

Discharge measurements of Teton River near Strabane, Mont., in 1910.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Apr. 18	W. A. Lamb	34	75	5.08	131
May 25	R. Richards	28	63	5.57	408
June 21[a]	W. A. Lamb	61	79	4.80	205
Aug. 9[b]	C. S. Heidel	38	30	4.04	57
Sept. 14[c]	do	20	32	4.02	62
Nov. 29[d]	do	35	30	3.97	54

[a] Made by wading below cable.
[b] Made by wading at ford.
[c] Made by wading at cable.
[d] Made by wading below cable; discharge affected by ice.

Daily gage height, in feet, of Teton River near Strabane, Mont., for 1910.

[B. H. Peebles, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	4.5	4.5	4.4	4.7	6.1	5.4	4.3	4.15	4.1	3.95	3.95	4.05
2	4.5	4.5	4.5	4.7	6.3	5.45	4.4	4.2	4.2	4.05	4.0	4.05
3	4.7	4.6	4.65	4.8	6.15	5.3	4.3	4.1	4.0	4.1	4.1	4.1
4	4.6	4.5	4.6	4.7	6.25	5.4	4.5	4.1	4.1	4.15	4.05	3.95
5	4.6	4.55	4.7	4.7	6.15	5.2	4.35	4.0	4.2	4.2	4.1	4.0
6	4.8	4.7	4.8	4.8	5.75	5.2	4.35	3.95	4.2	4.25	4.15	3.95
7	4.7	4.6	4.6	4.8	5.7	5.1	4.2	3.75	4.2	4.3	4.2	3.9
8	4.7	4.6	4.6	4.8	5.75	5.3	4.3	3.95	4.3	4.35	4.25	3.9
9	4.7	4.5	4.6	4.8	5.8	5.25	4.15	3.9	4.3	4.25	4.25	3.9
10	4.8	4.6	4.65	4.9	5.9	5.45	4.4	4.15	4.45	4.4	4.3	4.0
11	4.7	4.45	4.5	4.7	5.7	5.45	4.3	4.0	4.15	4.35	4.25	3.95
12	4.8	4.4	4.5	4.75	5.75	5.4	4.4	4.2	4.2	4.25	4.25	3.95
13	4.9	4.5	4.6	4.95	5.55	5.2	4.2	4.0	3.95	4.2	4.4	4.0
14	4.8	4.4	4.5	4.9	5.5	5.2	4.3	4.05	4.0	4.15	4.35	4.05
15	4.75	4.35	4.5	5.05	5.5	5.0	4.1	4.0	4.0	4.1	4.4	4.1
16	4.8	4.4	4.65	5.2	5.4	5.0	4.2	4.0	3.9	4.05	4.3	4.05
17	4.7	4.4	4.6	5.1	5.5	4.9	4.0	4.0	3.75	4.05	4.35	4.05
18	4.7	4.35	4.6	5.1	5.4	4.95	4.2	4.1	3.85	4.1	4.3	4.1
19	4.7	4.3	4.7	5.25	5.5	4.8	4.15	3.9	3.8	4.05	4.25	4.05
20	4.8	4.4	4.8	5.45	5.65	4.85	4.4	4.05	4.05	4.15	4.25	4.0
21	4.65	4.25	4.7	5.35	5.5	4.65	4.2	3.8	3.9	4.15	4.15	3.95
22	4.6	4.2	4.7	5.35	5.55	4.7	4.2	3.85	4.1	4.15	4.15	3.95
23	4.7	4.4	4.8	5.5	5.4	4.55	4.1	3.7	4.1	4.3	4.15	4.0
24	4.6	4.3	4.8	5.45	5.4	4.6	4.1	3.8	4.25	4.25	4.05	4.0
25	4.6	4.35	4.8	5.65	5.6	4.4	4.0	3.75	4.3	4.3	4.1	4.1
26	4.65	4.5	4.9	5.85	5.5	4.4	4.1	3.9	4.2	4.2	4.05	4.05
27	4.5	4.4	4.8	6.0	5.45	4.35	4.0	3.8	4.1	4.15	4.05	4.05
28	4.5	4.4	4.8	6.1	5.4	4.5	4.15	4.0	4.1	4.25	4.0	4.05
29	4.45	.....	4.8	6.1	5.35	4.4	4.1	3.9	4.0	4.15	4.0	3.95
30	4.5	.....	4.9	6.1	5.4	4.5	4.3	4.1	4.1	4.1	4.1	3.9
31	4.4	.....	4.8	.....	5.3	.....	4.2	4.1	.....	4.05	.....	3.85

Daily discharge, in second-feet, of Teton River near Strabane, Mont., for 1910.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	85	72	52	65	446	360	99	74	67	50	50	61
2	85	72	57	65	490	374	117	82	82	61	55	61
3	118	86	62	72	500	333	99	67	55	67	67	67
4	100	70	66	65	508	360	137	67	67	74	61	50
5	100	77	71	64	440	306	108	55	82	82	67	55
6	136	100	102	63	375	306	108	50	82	90	74	50
7	117	83	62	70	363	280	82	36	82	99	82	46
8	117	83	63	77	370	333	99	50	99	108	90	46
9	117	69	64	85	390	320	74	46	99	90	90	46
10	133	83	67	102	392	374	117	74	127	117	99	55
11	117	62	57	103	395	374	99	55	74	108	90	50
12	132	57	58	104	405	360	117	82	82	90	90	50
13	150	68	66	107	350	306	82	55	50	82	117	55
14	130	57	62	98	325	306	99	61	55	74	108	61
15	120	52	63	125	318	254	67	55	55	67	117	67
16	129	56	63	170	317	254	82	55	46	61	99	61
17	110	56	67	131	320	229	55	55	36	61	108	61
18	110	51	68	131	327	242	82	67	42	67	99	67
19	110	48	78	170	355	205	74	46	38	61	90	61
20	126	55	93	220	408	217	117	61	61	74	90	55
21	98	44	70	200	370	170	82	38	46	74	74	50
22	88	42	71	207	388	181	82	42	67	74	74	50
23	105	55	71	248	352	148	67	33	67	99	74	55
24	88	47	72	238	355	158	67	38	90	90	61	55
25	88	51	72	280	416	117	55	36	99	99	67	67
26	96	64	103	352	388	117	67	46	82	82	61	61
27	73	53	74	397	374	108	55	38	67	74	61	61
28	73	53	75	405	360	137	74	55	67	90	55	61
29	67	.....	75	425	346	117	67	46	55	74	55	50
30	73	.....	105	450	360	137	99	67	67	67	67	46
31	60	.....	89	.....	333	.....	82	67	.....	61	.....	42

NOTE.—These discharges are based on rating curves applicable as follows: Jan. 1 to May 24, indirect method for shifting channels used; May 25 to Dec. 31, fairly well defined between 50 and 450 second-feet.

Monthly discharge of Teton River near Strabane, Mont., for 1910.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
January	150	60	105	6,460	C.
February	100	42	63.	3,500	C.
March	105	52	71.	4,400	C.
April	450	63	176	10,500	C.
May	508	317	382	23,500	C.
June	374	108	249	14,800	A.
July	137	55	87.5	5,380	B.
August	82	33	54.8	3,370	B.
September	127	36	69.6	4,140	B.
October	117	50	79.6	4,890	B.
November	117	50	79.7	4,740	B.
December	67	42	55.6	3,420	B.
The year	508	33	123	89,100	

JUDITH RIVER BASIN.

JUDITH RIVER NEAR LEWISTOWN, MONT.

Judith River rises in the southern part of Fergus County, Mont., and flows northward about 70 miles to its junction with Missouri River. Near its source it receives a number of small tributaries which rise in the Little Belt and Snowy mountains.

A portion of the drainage area near the headwaters is included in the Snowy Mountains and Little Belt national forests. The central portion of the drainage area contains large areas of excellent farming land.

Water is diverted from the main stream and its tributaries for irrigation. The lower portion of the drainage area is hilly and broken.

A gaging station was established September 9, 1910, near Lewistown, Mont., just below the mouth of Warm Spring Creek, a stream entering Judith River from the east about 30 miles from its mouth. The station was established to obtain data for power and irrigation projects in that vicinity.

The gage is an ordinary staff fastened to a post driven in the left bank of the stream. Measurements are made by wading. Gage datum has remained constant. The warm water discharged by Warm Spring Creek causes the section at the gage to remain open throughout the year.

The following discharge measurement was made by Raymond Richards:

September 9, 1910: Width, 87 feet; area, 121 square feet; gage height, 1.28 feet; discharge, 344 second-feet.

Daily gage height, in feet, of Judith River near Lewistown, Mont., for 1911.

[John S. Shields, observer.]

Day.	Sept.	Oct.	Nov.	Dec.
1	.....	1.3	1.3	1.3
2	.....	1.3	1.3	1.3
3	.....	1.3	1.3	1.3
4	.....	1.3	1.3	1.3
5	.....	1.3	1.3	1.3
6	.....	1.3	1.3	1.3
7	.....	1.3	1.3	1.3
8	.....	1.3	1.3	1.3
9	1.3	1.3	1.3	1.3
10	1.3	1.3	1.3	1.3
11	1.5	1.3	1.3	1.3
12	1.3	1.3	1.3	1.3
13	1.3	1.3	1.3	1.3
14	1.3	1.3	1.3	1.3
15	1.3	1.3	1.3	1.3
16	1.3	1.2	1.3	1.3
17	1.3	1.2	1.3	1.3
18	1.3	1.2	1.3	1.3
19	1.3	1.2	1.3	1.3
20	1.3	1.2	1.3	1.3
21	1.3	1.2	1.3	1.3
22	1.3	1.2	1.3	1 3
23	1.3	1.2	1.3	1.3
24	1.3	1.2	1.3	1.3
25	1.3	1.2	1.3	1.3
26	1.3	1.2	1.3	1.3
27	1.3	1.2	1.3	1.3
28	1.3	1.2	1.3	1.3
29	1.3	1.2	1.3	1.3
30	1.3	1.3	1.3	1.3
31	.....	1.3	.....	1.3

MUSSELSHELL RIVER BASIN.

DESCRIPTION.

Musselshell River is formed by two forks. The North Fork (or master stream) rises on the southern slopes of the Little Belt Mountains in the northern part of Meagher County, Mont., at an elevation of 8,000 feet above sea level, flows southeastward for 10 miles, emerging into an irrigable valley, one-half mile to 1 mile in width, and joining the South Fork near the town of Martinsdale, 30 miles below its source, at an elevation of 4,700 feet above sea level. The South Fork has its source in several small streams draining the northward slopes of Crazy Mountains, about 20 miles southwest of Martinsdale, at an elevation of 5,500 feet above sea level, and flows northeastward through a valley 1 mile to 3 miles wide. From Martinsdale the Musselshell flows almost due east for 130 miles to Melstone, where it turns abruptly to the north, and 60 miles farther on it enters the Missouri.

Below the forks the valley widens and is bordered by low rolling hills. The larger part of the basin is covered by glacial deposits. The soil is black loam, and when properly irrigated the land is suitable for agriculture. Forestation is scant. At the headwaters of the North Fork pines are found, but elsewhere the timber consists only of the few cottonwoods and willows that border the stream channels. The mean annual rainfall is about 25 inches in the upper areas of the basin, but near the mouth of the river it decreases to 12 inches.

The principal source of supply for the streams in this basin is the melting snow. Ice forms on the streams during the winter months.

The tributaries of the Musselshell are small intermittent streams, and the river exhibits wide variations in discharge. Much of the water is used for irrigation, the diversions all being small. During the irrigating season the Musselshell carries but little water.

A project now under way under the Carey Act will utilize a small but excellent reservoir site on the North Fork to store the flood waters of that stream and of Checkerboard Creek, which will be diverted into the reservoir. The dam will be 130 feet high and the reservoir will store 28,000 acre-feet of water. The dam site is 19½ miles from Martinsdale.

The Musselshell basin affords no opportunities for power development. The fall of greatest magnitude occurs on the upper North Fork, but the supply of water is insufficient to warrant an expenditure necessary to develop it.

The longest records of stream flow in the Musselshell basin have been kept at Shawmut and Harlowton. The wettest year recorded was 1908, while the driest was 1906.

NORTH FORK OF MUSSELSHELL RIVER NEAR DELPINE, MONT.

This station, which is located about 16 miles northeast of Martinsdale and 3 miles above Delpine at a proposed dam site, was established May 19, 1909, to determine the amount of water available for storage. The drainage area above the gaging station affords an excellent reservoir site, and with a 130-foot dam at the station 28,000 acre-feet of water may be stored. No important tributaries enter above the station. Several ditches take water for irrigation.

An ordinary staff gage is nailed securely to a foot log which spans the stream near the left bank. Measurements are made from this log or by wading.

The station is at a high altitude, and the stream freezes entirely over during cold weather. The gage datum has remained unchanged and records obtained are good. The gage at this station during 1909 has not been in the best condition and the records obtained are not as reliable as could be wished.

Discharge measurements of North Fork of Musselshell River near Delpine, Mont., in 1910.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Apr. 7	Raymond Richards	11	8.7	1.80	18
July 14 [a]	C. S. Heidel	10	5	1.40	5
Aug. 25 [a]	do	7	3.3	1.42	6.4
Oct. 14 [a]	do	8	3.3	1.40	5.0

[a] Made by wading.

Daily gage height, in feet, of North Fork of Musselshell River near Delpine, Mont., for 1910.

[Thos. Harbor, observer.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	1.80	1.85	1.60	1.45	1.45	1.40	.....	.....	1.70
2	.....	1.80	1.80	1.60	1.42	1.45	1.40	.....	.....	1.75
3	.....	1.81	1.80	1.60	1.42	1.45	1.40	.....	.....	1.70
4	.....	1.82	1.80	1.58	.....	1.43	1.40	.....	.....	.....
5	.....	1.90	1.80	1.60	1.43	1.43	1.40	.....	.....	.....
6	.....	1.87	1.75	1.60	1.45	1.40	1.40	.....	.....	.....
7	.....	1.85	1.75	1.65	1.45	1.40	1.40	.....	.....	.....
8	.....	1.90	1.75	2.00	1.45	1.45	1.40	.....	.....	.....
9	.....	1.90	1.80	1.80	1.45	1.43	1.40	.....	.....	.....
10	2.10	1.90	2.05	1.65	1.43	1.43	1.42	.....	1.50	.....
11	2.23	1.88	1.85	1.65	1.42	1.42	1.42	.....	1.50	.....
12	3.30	1.90	1.85	1.58	1.42	1.42	1.42	.....	1.50	.....
13	3.50	1.90	1.85	1.58	1.40	1.42	1.43	.....	.....	.....
14	3.05	1.85	1.85	1.58	1.40	1.42	1.45	1.40	.....	.....
15	3.10	1.80	1.85	1.58	1.40	1.42	1.45	.....	1.50	.....
16	2.70	1.90	1.90	1.58	1.40	1.42	1.43	.....	1.50	.....
17	2.45	1.90	1.85	1.57	1.40	1.42	1.43	.....	1.50	.....
18	2.90	1.70	1.85	1.55	1.40	1.42	1.43	.....	1.50	.....
19	2.25	1.73	1.83	1.53	.....	1.42	1.45	.....	1.50	.....
20	2.15	1.75	1.83	1.50	.....	1.42	1.45	.....	1.50	.....

Daily gage height, in feet, of North Fork of Musselshell River near Delpine, Mont., for 1910—Continued.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
21	2.30	1.80	1 80	1.50	.....	1.42	1.45	.....	1.50	.....
22	2 45	1.80	1.80	1 55	.....	1.42	1.43	.....	1.55	.....
23	2.05	1.80	1 75	1.50	.....	1.42	1.45	.....	1.60	.....
24	2 00	1.80	1.70	1.45	.....	1.42	1.45	.....	1.60	.....
25	1 95	1.80	1.75	1.45	1.38	1.42	1.45	.....	1.70	.....
26	1 95	1.80	1 90	1.45	1.38	1.42	1.45	.....	1.70	.....
27	1.90	1.75	1.88	1.42	1.38	1.42	1.45	.....	1.70	.....
28	1.85	1.80	1.80	1 42	1.38	1.42	1.45	.....	1.70	.....
29	1 80	1.83	1.75	1.42	1.40	1.40	1.45	.....	1.70	.....
30	1.80	1.85	1.75	1.45	1.45	1.40	.....	.....	1.70	.....
31	1.75	.....	1.70	.....	1.45	1.40	.....	.....	.....	.....

NOTE.—Ice probable Jan. 1 to about Mar. 9 and Nov. 22 to Dec. 31.

Daily discharge, in second-feet, of North Fork of Musselshell River near Delpine, Mont., for 1910.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	18	20	10	6.6	6 6	5.2	.....	.....	.....
2	.....	18	18	10	5.7	6.6	5.2	.....	.....	.....
3	.....	18	18	10	5.7	6.6	5.2	.....	.....	.....
4	.....	19	18	10	5.9	6.1	5.2	.....	.....	.....
5	.....	23	18	10	6.1	6.1	5.2	.....	.....	.....
6	.....	21	16	10	6.6	5.2	5.2	.....	.....	.....
7	.....	20	16	12	6.6	5.2	5.2	.....	.....	.....
8	.....	23	16	28	6.6	6.6	5.2	.....	.....	.....
9	.....	23	18	18	6.6	6.1	5.2	.....	.....	.....
10	35	23	31	12	6.1	6.1	5.7	.....	7.5	.....
11	44	22	20	12	5.7	5.7	5.7	.....	7.5	.....
12	156	23	20	10	5.7	5.7	5.7	.....	7.5	.....
13	178	23	20	10	5.2	5.7	6.1	.....	.....	.....
14	128	20	20	10	5.2	5.7	6.6	5.2	.....	.....
15	134	18	20	10	5.2	5.7	6.6	.....	7.5	.....
16	90	23	23	10	5.2	5.7	6.1	.....	7.5	.....
17	65	23	20	9.5	5.2	5.7	6.1	.....	7.5	.....
18	112	14	20	8.9	5.2	5.7	6.1	.....	7.5	.....
19	46	15	19	8.3	5.1	5.7	6.6	.....	7.5	.....
20	38	16	19	7.5	5.1	5.7	6.6	.....	7.5	.....
21	50	18	18	7.5	5.0	5.7	6.6	.....	7.5	.....
22	65	18	18	8.9	4.9	5.7	6.1	.....	.....	.....
23	32	18	16	7.5	4.8	5.7	6.6	.....	.....	.....
24	28	18	14	6.6	4.8	5.7	6.6	.....	.....	.....
25	25	18	16	6.6	4.8	5.7	6.6	.....	.....	.....
26	25	18	23	6.6	4.8	5.7	6.6	.....	.....	.....
27	23	16	22	5 7	4.8	5.7	6.6	.....	.....	.....
28	20	18	18	5.7	4.8	5.7	6.6	.....	.....	.....
29	18	19	16	5.7	5.2	5.2	6.6	.....	.....	.....
30	18	20	16.	6.6	6.6	5.2	6.6	.....	.....	.....
31	16	.....	14	.....	6.6	5.2	.....	.....	.....	7.5

NOTE.—These discharges are based on a poorly defined rating curve. Discharges interpolated for days on which gage was not read.

Monthly discharge of North Fork of Musselshell River near Delpine, Mont., for 1910.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
January	.....	.....	[a] 10	615	
February	.....	.....	[a] 10	555	
March	178	.....	[a] 49	3,010	
April	23	14	19.5	1,160	C.
May	31	14	18.7	1,150	C.
June	28	5.7	9.79	583	C.
July	6.6	4.8	5.56	342	C.
August	6.6	5.2	5.79	356	C.
September	6.6	5.2	6.01	358	C.
October	.....	.....	[b] 6.05	372	D.
November	.....	.....	[b] 7.5	446	D.
December	.....	.....	[a] 7.5	461	
The period	.....	.....	13.0	9,410	

[a] Discharge estimated Jan. 1 to Mar. 9 and Nov. 22 to Dec. 31 because of ice.
[b] Discharges Oct. 1 to 13, 15 to 31, Nov. 1 to 9 interpolated.

NOTE.—The means for January, February, and December are only approximate.

NORTH FORK OF MUSSELSHELL RIVER NEAR MARTINSDALE, MONT.

This station, which was established May 10, 1907, to determine the amount of water available for irrigation, is located at the ranch of Martin J. Settle, 4 miles north of Martinsdale and half a mile above the junction of the North and South forks.

All the tributaries to the North Fork enter the stream above the station, the principal ones being Checkerboard and Flagstaff creeks.

Under a Carey Act project the water of this fork, which is practically all appropriated, will be stored about 20 miles above the station and used to irrigate land between Martinsdale and Harlowton.

A chain gage on the left bank of the stream just above the observer's private wagon bridge is used. Its datum has remained the same. Measurements may be made from this bridge or by wading.

The bed of the stream is composed of gravel and may shift somewhat during high water, as the current is swift. Ice forms during the winter season, but records obtained during the open season are very good.

Discharge measurements of North Fork of Musselshell River near Martinsdale, Mont., in 1910.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Apr. 6	Raymond Richards	31	28	3.80	96
May 19	....do	28	25	3.50	46
July 14	C. S. Heidel	10	3.9	2.92	2.9
Aug. 25	....do	6	1.6	2.94	1.7
Oct. 13	....do	10	6	3.24	16

NOTE.—Measurements during 1910 made by wading about 200 feet downstream from the gage.

Daily gage height, in feet, of North Fork of Musselshell River near Martinsdale, Mont., for 1910.

[Martin J. Settle, observer.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	3.71	3.8	3.15	2.85	2.8	2.95	3.2	3.6	3.6
2	.....	3.76	3.75	3.15	2.9	2.8	3.1	3.3	3.6	3.6
3	.....	3.76	3.7	3.05	2.9	2.9	2.95	3.2	3.6	3.5
4	.....	3.56	3.7	3.05	2.9	2.75	2.9	3.25	3.4	3.4
5	.....	3.66	3.75	3.05	3.2	2.75	3.0	3.35	3.5	3.4
6	.....	3.8	3.7	3.05	3.0	2.85	2.95	3.25	3.5	3.5
7	5.66	3.8	3.65	3.05	2.95	2.8	3.2	3.3	3.65	3.3
8	5.46	3.8	3.6	3.4	2.9	2.8	3.2	3.2	3.4	3.4
9	5.26	3.85	3.6	3.3	2.9	2.8	3.15	3.2	3.4	3.4
10	5.06	3.9	3.75	3.3	3.0	2.9	3.2	3.3	3.4	3.3
11	4.96	3.9	3.8	3.15	2.9	2.8	3.2	3.2	3.4	.....
12	5.06	4.0	3.7	3.15	3.0	2.8	3.25	3.3	3.4	.....
13	5.06	4.0	3.7	3.1	2.9	2.95	3.15	3.25	3.4	.....
14	4.66	3.95	3.65	3.1	2.9	2.85	3.15	3.25	3.4	.....
15	4.26	3.85	3.65	3.0	3.0	2.85	3.25	3.25	3.4	.....
16	3.96	3.85	3.65	3.0	2.9	2.95	3.1	3.25	3.55	.....
17	3.96	3.85	3.65	3.0	2.85	2.8	3.2	3.25	3.6	.....
18	4.06	3.85	3.55	3.0	2.85	2.85	3.2	3.25	3.4	.....
19	4.06	3.8	3.5	3.0	2.9	2.85	3.15	3.25	3.4	.....
20	4.06	3.8	3.5	3.1	3.0	2.95	3.25	3.25	3.5	.....
21	4.26	3.8	3.5	2.9	2.9	2.8	3.2	3.25	3.4	.....
22	4.16	3.8	3.5	2.95	2.9	2.8	3.35	3.25	3.4	.....
23	4.16	3.75	3.45	2.95	2.85	2.9	3.25	3.25	3.4	.....
24	3.96	3.75	3.4	2.95	2.85	2.85	3.2	3.2	3.5	.....
25	3.86	3.75	3.5	2.95	2.95	2.9	3.4	3.2	3.5	.....
26	3.86	3.75	3.5	2.95	2.85	3.05	3.3	3.3	3.4	.....
27	3.76	3.7	3.4	2.9	2.8	2.85	3.35	3.3	3.4	.....
28	3.76	3.15	3.35	2.85	2.8	2.85	3.25	3.25	3.6	.....
29	3.66	3.9	3.3	2.85	2.8	2.9	3.2	3.3	3.6	.....
30	3.66	3.8	3.55	2.95	2.9	3.05	3.3	3.25	3.5	.....
31	3.71	.....	3.2	.....	2.8	2.9	.....	3.6	.....	.....

NOTE.—Gage heights probably affected by ice, Jan. 1 to about Mar. 6 and Nov. 17 to Dec. 31.

Daily discharge, in second-feet, of North Fork of Musselshell River near Martinsdale, Mont., for 1910.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	77	90	16	1.8	1.0	2	13	52
2	.....	84	83	16	2.5	1.0	7	21	52
3	.....	84	76	9.5	2.5	2.5	2	13	52
4	.....	58	76	9.5	2.5	.5	1	17	30
5	.....	71	83	9.5	20	.5	3	26	41
6	.....	90	76	9.5	6.5	1.8	2	17	41
7	410	90	70	9.5	4.5	1.0	13	21	58
8	376	90	63	40	2.5	1.0	13	13	30
9	335	97	63	30	2.5	1.0	10	13	30
10	297	104	83	30	6.5	2.5	13	21	30
11	280	104	90	16	2.5	1.0	13	13	30
12	297	119	76	16	6.5	1.0	17	21	30
13	297	119	76	12	2.5	4.5	10	17	30
14	228	112	70	12	2.5	1.8	10	17	30
15	160	97	70	6.5	6.5	1.8	17	17	30
16	113	97	70	6.5	2.5	4.5	7	17	.....
17	113	97	70	6.5	1.8	1.0	13	17	.....
18	128	97	57	6.5	1.8	1.8	13	17	.....
19	128	90	51	6.5	2.5	1.8	10	17	.....
20	128	90	51	12	6.5	4.5	17	17	.....
21	160	90	51	2.5	2.5	1.0	13	17	.....
22	144	90	51	4.5	2.5	1.0	26	17	.....
23	144	83	46	4.5	1.8	2.5	17	17	.....
24	113	83	40	4.5	1.8	1.8	13	13	.....
25	98	83	51	4.5	4.5	1.0	30	13	.....
26	98	83	51	4.5	1.8	5.0	21	21	.....
27	84	76	40	2.5	1.0	.5	26	21	.....
28	84	83	35	1.8	1.0	.5	17	17	.....
29	71	104	30	1.8	1.0	1.0	13	21	.....
30	71	90	57	4.5	2.5	5.0	21	17	.....
31	77	.....	20	.....	1.0	1.0	.....	52	.....

NOTE.—These discharges are based on rating curves applicable as follows: Jan. 1 to Aug. 24 fairly well defined; Aug. 25 to Dec. 31 not well defined.

Monthly discharge of North Fork of Musselshell River near Martinsdale, Mont., for 1910.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
January			a 25	1,540	
February			a 20	1,110	
March	410	20	a 174	10,700	B.
April	119	58	91	5,420	B.
May	90	20	61.8	3,800	B.
June	40	1.8	10.5	625	C.
July	20	1.0	3.51	216	C.
August	5	0.5	1.83	113	C.
September	30	1.0	13.0	774	C.
October	52	13	18.4	1,130	B.
November	58	30	a 33.9	2,020	C.
December	25	20	a 22.3	1,370	
The year			39.6	28,800	

a Discharge estimated Jan. 1 to Mar. 6 and Nov. 16 to Dec. 31, because of ice.

NOTE.—The means for January, February, and December are only approximate.

MUSSELSHELL RIVER AT HARLOWTON, MONT.

This station, which was established July 11, 1907, to take the place of the station formerly maintained at Shawmut, is located at the highway bridge 1 mile south of Harlowton. The records furnish information of value for irrigation development.

The tributaries above and below the station are all small streams. American Fork enters the stream between this station and Shawmut.

A large part of the valley is irrigated and many small ditches receive their water supply from the Musselshell. Practically the entire flow of the stream is appropriated. A minimum discharge of 2 second-feet is recorded during the irrigating season at this station.

During the high water of June, 1908, the approaches to the bridge were partly destroyed, but the gage was not disturbed. In October, 1908, the bridge caved in, destroying the gage.

On April 10, 1909, a temporary staff gage was installed which read 0.73 foot too high. On May 24, 1909, a standard chain gage was placed on the upstream side of the new public highway bridge with a datum 0.52 foot greater than the bench mark. The datum of the bench mark was raised 0.52 foot. All gage heights for 1909 were corrected to this new datum.

Measurements may be made from this bridge or by wading. The bed of the stream is composed of sand and gravel and will probably shift in flood.

Discharge measurements of Musselshell River at Harlowton, Mont., in 1910.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Apr. 6	Raymond Richards	57	67	1.31	211
May 20	do	62	83	1.53	262
July 15a	C. S. Heidel	25	17	.60	16
Aug. 26a	do	6	1.1	.33	.8
Oct. 12a	do	32	35	.78	67

a Measurements made by wading 100 feet below bridge.

Daily gage height, in feet, of Musselshell River at Harlowton, Mont., for 1910.

[W. G. Yamamota, observer.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	1.25	1.85	1.25	0.6	0.4	0.3	0.8	0.8	0.9
2	.....	1.2	1.7	1.2	.6	.35	.3	.8	.8	.9
3	.....	1.25	1.7	1.1	.6	.3	.35	.8	.8	.9
4	.....	1.2	1.6	1.1	.6	.2	.35	.8	.8	.8
5	.....	1.3	1.8	1.05	1.1	.2	.35	.8	.8	.8
6	2.0	1.45	1.9	1.0	.9	.1	.4	.8	.8	.7
7	1.8	1.4	1.9	1.0	.75	.1	.4	.8	.8	.7
8	1.75	1.4	1.8	1.85	.6	.15	.45	.8	.8	.7
9	1.55	1.4	1.8	1.5	.6	.2	.5	.8	.8	.7
10	1.5	1.4	1.9	1.3	.6	.2	.5	.8	.8	.7
11	1.6	1.55	2.15	1.1	.6	.2	.5	.8	.85	.7
12	1.7	1.55	2.1	1.05	.6	.3	.55	.8	.85	.7
13	1.65	1.65	2.0	1.0	.6	.3	.6	.8	.85	.75
14	1.65	1.7	1.95	1.0	.6	.3	.7	.75	.85	.75
15	1.85	1.75	1.85	1.0	.5	.3	.7	.75	.8	.75
16	1.8	1.7	1.8	1.0	.5	.3	.7	.75	.8	.75
17	1.75	1.65	1.7	1.0	.5	.3	.7	.75	.85	.75
18	1.65	1.6	1.6	1.0	.5	.3	.7	.75	.85	.75
19	1.8	1.5	1.6	1.0	.5	.3	.7	.75	.9	.7
20	1.75	1.55	1.5	.9	.5	.3	.7	.75	.9	.7
21	1.75	1.55	1.5	.9	.5	.3	.7	.75	.9	.7
22	1.9	1.7	1.4	.8	.5	.3	.8	.75	.9	.65
23	2.0	1.7	1.35	.8	.5	.3	.8	.75	.9	.65
24	1.9	1.7	1.3	.8	.5	.3	.8	.75	.9	.65
25	1.65	1.7	1.35	.8	.45	.3	.8	.7	.95	.....
26	1.6	1.7	1.55	.75	.4	.3	.8	.7	1.0	.....
27	1.5	1.8	1.65	.7	.4	.3	.8	.7	1.1	.....
28	1.5	1.95	1.65	.7	.4	.3	.8	.7	1.1	.....
29	1.4	2.1	1.55	.65	.4	.3	.8	.7	1.0	.....
30	1.35	2.1	1.4	.6	.4	.3	.8	.7	.9	.....
31	1.3	.....	1.3	.....	.4	.3	.....	.8	.....	.....

NOTE.—No observations until March 6. Discharge during January and February was probably affected by ice.

Daily discharge, in second-feet, of Musselshell River at Harlowton, Mont., for 1910.

[W. G. Yamamota, observer.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	100	169	460	169	16	2	0.4	66	66	92
2	100	151	375	151	16	1.2	.4	66	66	92
3	100	169	375	119	16	.4	1.5	66	66	92
4	100	151	322	119	16	0	2.5	66	66	66
5	100	187	430	105	119	0	4.8	66	66	66
6	550	250	490	91	67	0	7	66	66	44
7	430	227	490	91	38	0	9	66	66	44
8	402	227	430	460	16	0	11	66	66	44
9	297	227	430	272	16	0	15	66	66	44
10	272	227	490	187	16	0	15	66	66	44
11	322	297	648	119	16	0	15	66	79	44
12	375	297	615	105	16	.4	21	66	79	44
13	348	348	550	91	16	.4	27	66	79	55
14	348	375	520	91	16	.4	44	55	79	55
15	460	402	460	91	7	.4	44	55	66	55
16	430	375	430	91	7	.4	44	55	66	55
17	402	348	375	91	7	.4	44	55	79	55
18	348	322	322	91	7	.4	44	55	79	55
19	430	272	322	91	7	.4	44	55	92	44
20	402	297	272	67	7	.4	44	55	92	44
21	402	297	272	67	7	.4	44	55	92	44
22	490	375	227	46	7	.4	66	55	92	36
23	550	375	207	46	7	.4	66	55	92	36
24	490	375	187	46	7	.4	66	55	92	36
25	348	375	207	46	4.5	.4	66	44	107	36
26	322	375	297	38	2	.4	66	44	122	36
27	272	430	348	29	2	.4	66	44	156	36
28	272	520	348	29	2	.4	66	44	156	36
29	227	615	297	22	2	.4	66	44	122	36
30	207	615	227	16	2	.4	66	44	92	36
31	187	.....	187	.....	2	.4	.....	66	.....	36

NOTE.—These discharges are based on a rating curve fairly well defined. Discharges Mar. 1 to 5 and Dec. 25 to 31 estimated.

Monthly discharge of Musselshell River at Harlowton, Mont., for 1910.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
January	.....	.....	a45	2,770	D.
February	.....	.....	a45	2,500	D.
March	550	.....	325	20,000	C.
April	615	151	322	19,200	B.
May	615	187	375	23,100	B.
June	460	16	103	6,130	B.
July	119	2	15.7	965	B.
August	2	0	.37	23	B.
September	66	.4	35.9	2,140	C.
October	66	44	57.8	3,550	B.
November	156	66	85.8	5,110	B.
December	92	.....	49.6	3,050	B.
The year	615	.....	122	88,500	

a Estimated.

CHECKERBOARD CREEK NEAR DELPINE, MONT.

Checkerboard Creek, a small stream with no tributaries, rises in the Little Belt Mountains. The creek is about 12 miles long. It is proposed to carry the water from this creek over a small divide into the reservoir located on the North Fork of Musselshell River.

The gaging station, which is located 2½ miles above the junction of Checkerboard Creek with Musselshell, 21 miles from Martinsdale and 8 miles from Delpine post office, was established May 26, 1909, to determine the amount of water available for irrigation.

The gage is a staff nailed to a foot log and located near the right bank. All measurements are made from this foot log or by wading. As the station is located at a high altitude, ice is common. Since the station was established the gage datum has remained unchanged.

Discharge measurements of Checkerboard Creek near Delpine, Mont., in 1910.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Apr. 6	Raymond Richards	14	6.6	0.57	10
July 14	C. S. Heidel	12	4.6	.42	5.6
Aug. 25	.....do	11	3.4	.42	4.0
Oct. 14	.....do	12	3.6	.41	3.3

NOTE.—Measurements made by wading.

Daily gage height, in feet, of Checkerboard Creek near Delpine, Mont., for 1910.

[Thos. Harbor, observer.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Nov.	Dec.
1	.....	0.53	0.72	0.52	0.42	0.44	0.42	.....	0.42
2	.....	.53	.70	.52	.42	.44	.42	.....	.42
3	.....	.53	.67	.52	.42	.43	.42	.....	.42
4	.....	.53	.67	.52	.42	.....	.42	.....	.....
5	.....	.53	.62	.52	.42	.43	.42	.....	.42
6	.....	.57	.67	.52	.42	.43	.42	.....	.42
7	.....	.52	.62	.50	.42	.43	.42	.....	.42
8	.....	.62	.62	.57	.42	.43	.42	.....	.42
9	.....	.57	.67	.52	.42	.43	.42	.....	.42
10	.....	.62	.72	.52	.42	.43	.42	.40	.42

Daily gage height, in feet, of Checkerboard Creek near Delpine, Mont., for 1910—Contd.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Nov.	Dec.
11	0.56	0.62	0.67	0.52	0.42	0.43	0.42	0.40	0.42
12	.58	.72	.67	.52	.42	.43	.42	.40	.42
13	.63	.72	.67	.52	.42	.43	.42	.....	.42
14	.63	.67	.62	.52	.42	.43	.42	.....	.42
15	.63	.70	.62	.52	.42	.43	.....	.40	.42
16	.63	.67	.64	.52	.42	.43	.42	.40	.42
17	.63	.67	.62	.47	.42	.43	.42	.40	.42
18	.68	.67	.....	.47	.42	.42	.42	.42	.42
19	.63	.67	.57	.45	.....	.42	.42	.....	.....
20	.68	.72	.60	.45	.....	.42	.42	.42	.....
21	.63	.67	.60	.45	.....	.42	.42	.42	.....
22	.53	.72	.57	.45	.....	.42	.42	.42	.....
23	.53	.72	.57	.45	.....	.42	.42	.42	.....
24	.58	.70	.52	.44	.....	.42	.42	.42	.....
25	.55	.70	.57	.44	.44	.42	.40	.42	.....
26	.57	.72	.57	.44	.44	.42	.42	.42	.....
27	.58	.72	.57	.44	.44	.42	.42	.42	.....
28	.53	.72	.57	.43	.44	.42	.37	.42	.....
29	.53	.72	.57	.....	.44	.42	.....	.42	.....
30	.53	.72	.52	.42	.44	.42	.....	.42	.....
31	.53	.....	.52	.....	.44	.42	.....	.....	.....

NOTE.—Gage heights probably affected by ice during January, February, and first part of March. Observer absent Sept. 29 to Nov. 9.

Daily discharge, in second-feet, of Checkerboard Creek near Delpine, Mont., for 1910.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Nov.	Dec.
1	.....	8.4	17	8.2	5.3	5.2	4.1	.....	4.1
2	.....	8.4	16	8.2	5.3	5.2	4.1	.....	4.1
3	.....	8.4	15	8.2	5.3	5.0	4.1	.....	4.1
4	.....	8.4	15	8.2	5.3	5.0	4.1	.....	4.1
5	.....	8.4	12	8.2	5.3	4.9	4.1	.....	4.1
6	.....	9.6	15	8.2	5.3	4.9	4.1	.....	4.1
7	.....	8.2	12	7.6	5.3	4.8	4.1	.....	4.1
8	.....	12	12	9.6	5.3	4.8	4.1	.....	4.1
9	.....	9.6	15	8.2	5.3	4.7	4.1	.....	4.1
10	.....	12	17	8.2	5.3	4.7	4.1	3.3	4.1
11	9.3	12	15	8.2	5.3	4.6	4.1	3.3	4.1
12	9.8	17	15	8.2	5.3	4.6	4.1	3.3	4.1
13	13	17	15	8.2	5.3	4.5	4.1	3.3	4.1
14	13	15	12	8.2	5.6	4.5	4.1	3.3	4.1
15	13	16	12	8.2	5.5	4.4	4.1	3.3	4.1
16	13	15	13	8.2	5.5	4.3	4.1	3.3	4.1
17	13	15	12	6.8	5.4	4.3	4.1	3.3	4.1
18	15	15	10	6.8	5.4	4.2	4.1	4.1	4.1
19	13	15	9.6	6.2	5.4	4.2	4.1	4.1	.....
20	15	17	11	6.2	5.4	4.2	4.1	4.1	.....
21	13	15	11	6.2	5.4	4.1	4.1	4.1	.....
22	8.4	17	9.6	6.2	5.5	4.1	4.1	4.1	.....
23	8.4	17	9.6	6.2	5.5	4.0	4.1	4.1	.....
24	9.8	16	8.2	5.9	5.5	4.0	4.1	4.1	.....
25	9.5	16	9.6	5.9	5.5	4.0	3.3	4.1	.....
26	9.6	17	9.6	5.9	5.5	4.1	4.1	4.1	.....
27	9.8	17	9.6	5.9	5.4	4.1	4.1	4.1	.....
28	8.4	17	9.6	5.6	5.4	4.1	2.7	4.1	.....
29	8.4	17	9.6	5.4	5.3	4.1	2.7	4.1	.....
30	8.4	17	8.2	5.3	5.3	4.1	2.7	4.1	.....
31	8.4	.....	8.2	.....	5.2	4.1	.....	.....	.....

NOTE.—These discharges are based on rating curves applicable as follows: Mar. 11 to July 18, well defined; July 19 to Aug. 25, indirect method for shifting channels used; Aug. 26 to Dec. 31, poorly defined. Discharges interpolated on days on which gage was not read.

Monthly discharge of Checkerboard Creek near Delpine, Mont., for 1910.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
January			a 4.5	277	
February			a 5.0	278	
March			a 9.90	609	C.
April	17	8.2	13.8	821	B.
May	17	8.2	12.0	738	B.
June	9.6	5.3	7.22	430	B.
July	5.6	5.2	5.37	330	B.
August	5.2	4.0	4.45	274	B.
September	4.1	2.7	3.93	234	B.
October			a 3.3	203	C.
November			a 3.65	217	C.
December			a 4.06	250	C.
The year			6.43	4,660	

a Discharge estimated Jan. 1 to Mar. 10 and Oct. 1 to Nov. 9 and Dec. 19 to 31.

NOTE.—The means for January and February are only approximate. The discharge of the creek during October and Nov. 1 to 9 was constant.

SOUTH FORK OF MUSSELSHELL RIVER NEAR MARTINSDALE, MONT.

This station, which was established June 19, 1907, to determine the amount of water available for irrigation, was originally located near the ranch of Martin J. Settle. On April 28, 1908, it was moved upstream about 1½ miles, near the blacksmith shop of the Martinsdale Sheep Co., and near the public highway, 1¼ miles northeast of Martinsdale.

The South Fork has no important tributaries. Many small ditches take water from the creek, and during the irrigating season all the water is diverted.

When the new station was established a new datum was used, which has remained unchanged. The gage is an ordinary staff nailed to a tree on the right bank of the stream. Measurements may be made by wading near the gage or from a bridge 150 feet below.

The bed of the stream is chiefly gravel and is clean and nonshifting. Ice forms during the winter season, but records obtained during the open season are good.

Discharge measurements of South Fork of Musselshell River near Martinsdale, Mont., in 1910.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Apr. 6	Raymond Richards	44	61	2.48	113
May 14	do	47	78	2.88	165
July 14	C. S. Heidel				a 0
Aug. 25	do			.70	b .2
Oct. 13c	do	38	29	1.55	27

a Stream dry. b Discharge estimated. c Made by wading at gage.

Daily gage height, in feet, of South Fork of Musselshell River near Martinsdale, Mont., for 1910.

[J. G. Wallace, observer.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	2.2	4.0	2.5	0.9	0.7	0.7	1.55	1.5
2	.....	2.3	3.7	2.5	.9	.7	.7	1.55	1.5
3	.....	2.3	3.4	2.5	.9	.7	.7	1.55	1.5
4	.....	2.3	3 3	2.3	1.0	.7	.7	1.5	1.5
5	.....	2.35	3.25	2.2	1.5	.7	.7	1.5	1.5
6	.....	2.3	3.4	2.1	1.35	.7	.7	1.5	1.5
7	.....	2.45	3.4	2.1	1.2	.7	.7	1.5	1.5
8	.....	2.45	3.4	2.2	.8	.7	1.2	1.5	1.55
9	.....	2.6	3.5	2.5	.8	.7	1.25	1.5	1.55
10	.....	2.7	3.6	2.3	.8	.7	1.25	1.5	1.6
11	.....	3.0	4.2	2.3	.8	.7	1.25	1.5	1.6
12	.....	3.1	4.0	2.2	.75	.7	1.3	1.5	1.6
13	3.9	3.25	3.75	2.2	.75	.65	1.3	1.5	1.6
14	3.9	3.25	3.6	2.1	.75	.65	1.3	1.5	1.6
15	3.8	3.5	3.4	2.1	.7	.65	1.3	1.5	1.5
16	3.8	3.0	3.4	2.1	.7	.7	1.3	1.5	1.5
17	3.8	2.9	3.4	2.1	.75	.7	1.3	1.5	1.5
18	3.7	2.85	3.2	2.5	.8	.7	1.3	1.5	1.5
19	3.7	2.85	2.9	2.5	.8	.7	1.5	1.5	1.5
20	3.7	3.1	2.85	2.0	.8	.7	1.55	1.5	1.5
21	3.75	3.3	2.8	2.0	.8	.7	1.6	1.5	1.5
22	3.2	3.25	2.8	1.6	.75	.7	1.6	1.5	1.5
23	3.25	3.25	2.6	1.6	.75	.7	1.65	1.5	1.6
24	2.9	3.25	2.6	1.6	.75	.7	1.65	1.5	1.6
25	2.6	3.3	2.5	1.45	.75	.7	1.5	1.5	1.6
26	2.5	3.4	3.0	1.45	.75	.7	1.5	1.5	1.55
27	2.4	3.6	2.9	1.2	.75	.7	1.6	1.55	1.55
28	2.45	3.8	2.9	1.2	.7	.7	1.6	1.55	1.7
29	2.3	4.5	2.8	1.1	.7	.7	1.6	1.55	1.7
30	2.2	4.3	2.8	.9	.7	.7	1.55	1.55	1.7
31	2.3	.....	2.6	.....	.7	.7	.....	1.55	.....

NOTE.—Probably some ice during January and February, and during December.

Daily discharge, in second-feet, of South Fork of Musselshell River near Martinsdale, Mont., for 1910.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	81	390	116	3	0.5	0.5	27	24
2	.....	92	312	116	3	.5	.5	27	24
3	.....	92	249	116	3	.5	.5	27	24
4	.....	92	231	92	5	.5	.5	24	24
5	.....	98	222	81	24	.5	.5	24	24
6	.....	92	249	71	17	.5	.5	24	24
7	.....	110	249	71	11	.5	.5	24	24
8	.....	110	249	81	2	.5	11	24	27
9	.....	128	268	116	2	.5	13	24	27
10	.....	141	289	92	2	.5	13	24	30
11	.....	183	447	92	2	.5	13	24	30
12	.....	198	390	81	1.2	.5	15	24	30
13	363	222	324	81	1.2	.2	15	24	30
14	363	222	289	71	1.2	.2	15	24	30
15	337	268	249	71	.5	.2	15	24	24
16	337	183	249	71	.5	.5	15	24	24
17	337	168	249	71	1.2	.5	15	24	24
18	312	161	214	116	2	.5	15	24	24
19	312	161	168	116	2	.5	24	24	24
20	312	198	161	62	2	.5	27	24	24
21	324	231	154	62	2	.5	30	24	24
22	214	222	154	30	1.2	.5	30	24	24
23	222	222	128	30	1.2	.5	34	24	30
24	168	222	128	30	1.2	.5	34	24	30
25	128	231	116	22	1.2	.5	24	24	30
26	116	249	183	22	1.2	.5	24	24	27
27	104	289	168	11	1.2	.5	30	27	27
28	110	337	168	11	.5	.5	30	27	37
29	92	545	154	8	.5	.5	30	27	37
30	81	478	154	3	.5	.5	27	27	37
31	92	.....	128	.....	.5	.5	.....	27	.....

NOTE.—These discharges are based on a fairly well defined rating curve. For discharges above 275 second-feet, the 1909 rating was used.

Monthly discharge of South Fork of Musselshell River near Martinsdale, Mont., for 1910.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
January			a 20	1,230	
February			a 25	1,390	
March			a 251	15,400	C.
April	545	81	201	12,000	A.
May	447	116	228	14,000	A.
June	116	3	67.1	3,990	A.
July	24	.5	3.13	192	C.
August	.5	.2	.47	29	C.
September	30	.5	16.8	1,000	B.
October	27	24	24.8	1,530	B.
November	37	24	27.3	1,620	B.
December			a 20	1,230	
The year			73.7	53,600	

a Discharge estimated Jan. 1 to Mar. 12 and Dec. 1 to 31.

NOTE.—The means for January, February, and December are only approximate.

AMERICAN FORK NEAR HARLOWTON, MONT.

American Fork rises in the Crazy Mountains and flows northeastward to its junction with the Musselshell, a few miles below the gaging station, which was established July 28, 1907, at the Shaw & Elliott ranch, 5 miles southeast of Harlowton, Mont., to determine the amount of water available for irrigation and storage.

American Fork has no important tributaries except Lebo Creek, which enters the stream a short distance below the station, but receives its water supply from the melting snow on the mountains. The basin of this stream affords some good storage sites, and by holding back the spring flood waters much more land can be put under irrigation.

A chain gage is fastened to the upper bridge rail of a small wagon bridge. Its datum has remained constant. In flood, measurements may be made from this bridge.

Records obtained during the open season are good. The bed of the stream at the gaging station is composed of sand and clay, and shifts only under extreme conditions.

Discharge measurements of American Fork River near Harlowton, Mont., in 1910.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sq. ft.*
Apr. 5	Raymond Richards	7.0	3.0	1.29	3.7
May 20	do	13	6.0	1.52	14.2
July 15	C. S. Heidel				a 0
Aug. 26	do				a 0
Oct. 12	do	6	1.4	1.19	1.7

a Stream dry.

NOTE.—Gage height of zero flow, 1.05 feet.

Daily gage height, in feet, of American Fork near Harlowton, Mont., for 1910.

[Mrs. Neva Clark, observer.]

Day.	Apr.	May.	June.	July.	Sept.	Oct.	Nov.	Day.	Apr.	May.	June.	July.	Sept.	Oct.	Nov.
1	.....	1.95	1.2	0.55	.....	.....	1.25	16	1.25	1.95	1.2	.....	.....	1.2	1.25
2	.....	1.95	1.2	.55	.....	1.2	1.25	17	1.25	1.85	1.15	.....	.....	1.2	1.2
3	.....	1.85	1.2	.45	.....	1.2	1.25	18	1.25	1.7	1.15	.....	.....	1.2	1.2
4	.....	1.8	1.2	.45	.....	1.2	1.25	19	1.25	1.55	1.1	.....	.....	1.2	1.2
5	.....	1.85	1.15	.45	.....	1.2	1.25	20	1.25	1.5	1.0	.....	.....	1.2	1.2
6	.....	1.9	1.15	.4	.....	1.2	1.25	21	1.2	1.45	1.1	.....	.....	1.2	1.2
7	.....	1.95	1.1	.4	.....	1.2	1.25	22	1.2	1.35	1.0	.....	.....	1.2	1.2
8	.....	2.1	1.45	.35	.....	1.2	1.25	23	1.2	1.25	1.0	.....	.....	1.2	1.2
9	.....	2.1	1.35	.3	.....	1.2	1.25	24	1.2	1.25	1.0	.....	.....	1.2	1.2
10	1.3	2.25	1.25	.15	.....	1.2	1.25	25	1.2	1.2	.85	.....	.....	1.2	1.2
11	1.3	2.45	1.2	.2	.....	1.2	1.25	26	1.2	1.25	.95	.....	1.2	1.2	1.2
12	1.3	2.35	1.2	.2	.....	1.2	1.25	27	1.2	1.25	.8	.....	1.35	1.2	1.2
13	1.3	2.25	1.2	.....	.....	1.2	1.25	28	1.2	1.3	.75	.....	1.25	1.2	.....
14	1.3	2.1	1.2	.....	.....	1.2	1.2	29	1.65	1.35	.6	.....	1.3	1.2	.....
15	1.25	1.95	1.15	.....	.....	1.2	1.2	30	1.9	1.25	.5	.....	1.2	1.25	.....
								31	.....	1.25	.....	.....	.....	1.25	.....

NOTE.—There was probably some ice during January and February and December. Observations did not begin until Apr. 10. Stream dry June 19 to Sept. 25. Water probably standing in pools June 19 to July 12, and change in gage height due to evaporation.

Daily discharge, in second-feet, of American Fork near Harlowton, Mont., for 1910.

Day.	Apr.	May.	June.	Sept.	Oct.	Nov.	Day.	Apr.	May.	June.	Sept.	Oct.	Nov.
1	.....	48	2	.....	2	3	16	3	48	2	.....	2	3
2	.....	48	2	.....	2	3	17	3	38	1	.....	2	2
3	.....	38	2	.....	2	3	18	3	26	1	.....	2	2
4	.....	34	2	.....	2	3	19	3	16	0	.....	2	2
5	.....	38	1	.....	2	3	20	3	12	0	.....	2	2
6	.....	42	1	.....	2	3	21	2	10	0	.....	2	2
7	.....	48	0	.....	2	3	22	2	5.8	0	.....	2	2
8	.....	64	10	.....	2	3	23	2	3	0	.....	2	2
9	.....	64	5.8	.....	2	3	24	2	3	0	.....	2	2
10	.....	82	3	.....	2	3	25	2	2	0	.....	2	2
11	4	109	2	.....	2	3	26	2	3	0	2	2	2
12	4	95	2	.....	2	3	27	2	3	0	5.8	2	2
13	4	82	2	.....	2	3	28	2	4	0	3	2	.....
14	4	64	2	.....	2	2	29	22	5.8	0	4	2	.....
15	3	48	1	.....	2	2	30	42	3	0	2	3	.....
							31	.....	3	.....	.....	3	.....

Monthly discharge of American Fork near Harlowton, Mont., for 1910.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
January	.....	.....	[a] 1.5	92	
February	.....	.....	[a] 2.0	111	
March	.....	.....	[a] 6.0	369	
April	.....	.....	5.13	305	C.
May	109	2	35.1	2,160	C.
June	10	0	1.39	83	D.
July	.....	.....	0	0	
August	.....	.....	0	0	
September	5.8	0	.56	33	
October	3	2	2.07	127	C.
November	3	2	2.47	147	C.
December	.....	.....	[a] 1.5	92	
The year	.....	.....	4.81	3,520	

[a] Discharge estimated Jan. 1 to Apr. 9 and Nov. 28 to Dec. 31. Stream dry.

NOTE.—Stream dry June 19 to Sept. 25. The means for January, February, March, and December are only approximate.

LEBO CREEK NEAR HARLOWTON, MONT.

Lebo Creek rises at an elevation of 5,600 feet, flows northeastward, and enters American Fork half a mile below the gaging station. It is about 20 miles long, is fed by springs, and its flow is nearly uniform. Its water is used for irrigation.

The gaging station, which was established July 28, 1907, to determine the amount of water available for irrigation, is located near the Shaw & Elliott ranch, 5 miles southeast of Harlowton.

A staff gage is nailed to a pile of the small wagon bridge on the right bank. It has the same datum as American Fork. Measurements are made by wading.

Records obtained are fair. The flow is affected by grass in the stream bed.

Discharge measurements of Lebo Creek near Harlowton, Mont., in 1910.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Apr. 5	Raymond Richards	13	6	1.03	13
May 20[a]	do	14	7.9	1.24	19
July 13	C. S. Heidel	8	3.1	.63	2.7
Aug. 26	do	10	5.5	.88	8.8
Oct. 12	do	10	5.8	.98	10.3

[a] Meter not working well.

Daily gage height, in feet, of Lebo Creek near Harlowton, Mont., for 1910.

[Mrs. Neva Clark, observer.]

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	1.05	0.90	0.73	0.68	0.93	.....	0.98
2	.....	1.00	.90	.73	.68	.98	0.98	.98
3	.....	1.05	.90	.68	.73	.98	.98	.98
4	1.03	1.10	.85	.68	.73	.98	.98	.98
5	.....	1.35	.90	.73	.63	.93	.98	.98
6	.....	1.35	.90	.78	.63	.98	.98	.98
7	.....	1.30	.85	.78	.63	1.03	.98	.98
8	.....	1.10	1.45	.78	.68	1.23	.98	.98
9	.....	1.10	1.30	.73	.68	1.13	.98	.98
10	1.00	1.20	1.05	.73	.68	1.33	.98	1.03
11	1.05	1.35	.85	.73	.68	1.33	.98	1.03
12	1.10	1.20	.90	.68	.73	1.33	.98	1.03
13	1.05	1.25	1.30	.68	.73	1.43	.98	1.03
14	1.05	1.25	.95	.63	.73	1.33	.98	1.03
15	1.00	1.45	.95	.58	.73	1.33	.98	1.08
16	1.05	1.50	.85	.68	.73	1.43	.98	1.08
17	1.05	1.25	1.08	.53	.73	1.23	.98	1.13
18	.95	1.25	.98	.53	.73	1.23	.98	1.13
19	.90	1.25	.93	.53	.73	1.23	.98	1.13
20	.95	1.25	.88	.48	.73	1.23	.98	1.13
21	.80	1.30	.88	.48	.73	1.28	.98	1.23
22	.80	1.25	.83	.48	.73	1.28	.98	1.23
23	.85	1.25	.78	.43	.73	1.28	.98	1.28
24	.75	1.30	.78	.43	.83	1.28	.98	1.33
25	.80	1.25	.78	.43	.88	1.28	.93	1.43
26	.95	1.25	.73	.48	.88	1.23	.98	1.53
27	.90	1.20	.73	.53	.88	1.23	1.03	1.53
28	.90	1.05	.68	.58	.88	1.13	.98	.....
29	1.05	1.05	.58	.58	.88	1.13	.98	.....
30	1.15	1.05	.58	.58	.93	1.03	.98	.....
31	.....	1.25	.....	.58	.93	.....	.98	.....

NOTE.—There was probably some ice during January and February and after Nov. 20. Observations did not begin until Apr. 10.

Daily discharge, in second-feet, of Lebo Creek near Harlowton, Mont., for 1910.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	13	8.8	4.8	3.7	9.6	a 12	11
2	.....	12	8.8	4.8	3.7	11	11	11
3	.....	13	8.8	3.7	4.8	11	11	11
4	12	15	7.5	3.7	4.8	11	11	11
5	.....	23	8.8	4.8	2.8	9.6	11	11
6	.....	23	8.8	5.9	2.8	11	11	11
7	.....	21	7.5	5.9	2.8	12	11	11
8	.....	15	27	5.9	3.7	19	11	11
9	.....	15	21	4.8	3.7	16	11	11
10	12	18	13	4.8	3.7	22	11	12
11	13	23	7.5	4.8	3.7	22	11	12
12	15	18	8.8	3.7	4.8	22	11	12
13	13	20	21	3.7	4.8	26	11	12
14	13	20	10	2.8	4.8	22	11	12
15	12	27	10	1.9	4.8	22	11	14
16	13	29	7.5	3.7	4.8	26	11	14
17	13	20	14	1.2	4.8	19	11	16
18	10	20	11	1.2	4.8	19	11	16
19	8.8	20	9.6	1.2	4.8	19	11	16
20	10	20	8.3	.7	4.8	19	11	16
21	6.3	21	8.3	.7	4.8	21	11	.....
22	6.3	20	7.0	.7	4.8	21	11	.....
23	7.5	20	5.9	.4	4.8	21	11	.....
24	5.2	21	5.9	.4	7.0	21	11	.....
25	6.3	20	5.9	.4	8.3	21	9.6	.....
26	10	20	4.8	.7	8.3	19	11	.....
27	8.8	18	4.8	1.2	8.3	19	12	.....
28	8.8	13	3.7	1.9	8.3	16	11	.....
29	13	13	1.9	1.9	8.3	16	11	.....
30	16	13	1.9	1.9	9.6	12	11	.....
31	.....	20	.....	1.9	9.6	.....	11	.....

a Estimated.

NOTE.—These discharges are based on a fairly well defined rating curve.

Monthly discharge of Lebo Creek near Harlowton, Mont., for 1910.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
January	.....	.....	a 12	738	
February	.....	.....	a 12	666	
March	.....	.....	a 13	799	
April	.....	.....	11	655	A.
May	29	12	18.8	1,160	A.
June	27	1.9	9.26	551	B.
July	5.9	.4	2.78	171	C.
August	9.6	2.8	5.34	328	B.
September	26	9.6	17.8	1,060	B.
October	12	9.6	11	676	B.
November	.....	.....	12.2	726	B.
December	.....	.....	a 10	615	
The year	.....	.....	11.3	8,140	

a Discharge estimated Jan. 1 to Apr. 9; and Nov. 21 to Dec. 31.

NOTE.—Means for January, February, March, and December only approximate.

MILK RIVER BASIN.

DESCRIPTION.

Milk River is formed in the southern part of the Canadian Province of Alberta [1] by the union of two streams, the North Fork and the South Fork, that rise in the undulating foothills of the Rocky Mountains in northeastern Montana, near the international boundary line. For about 100 miles from this junction the Milk flows eastward parallel to and on the northeastern side of the boundary. It then turns to the southeast, passes across the northern part of Montana, and discharges into the Missouri east of Glasgow.

The tributaries of Milk River, except Clear Creek near Yantic, and North Fork at Chinook, are for the most part intermittent streams, but the drainage ways that carry them contain local water pockets which are used as watering places for stock.

From the point at which it leaves Canada and enters Montana to Yantic, 10 miles east of Havre, the Milk is bounded on both sides by high cliffs that rise 200 feet or more above the stream. At Yantic the cliffs recede and become less abrupt and the valley spreads out, and it maintains a width from 3 to 4 miles to its lower end, where it narrows to a mile near Hinsdale. This wider part of the valley was probably the preglacial channel of the Missouri before it was turned aside by the ice sheet and forced to seek a new outlet eastward along the southern face of the glacier.

From the top of the cliffs the country has a rolling aspect, exhibiting no abrupt changes except where tributaries to the main river have eroded deep channels in passing from higher or bench lands to the valley. The general slope of the country is toward the east.

A deposit of glacial drift, varying from a layer so thin as to be unnoticeable to a bed 70 feet thick, covers the greater part of the drainage basin except along the streams, and many small ponds that dry up in summer time are scattered over the area. Most of these ponds occupy shallow depressions with no outlet, and their waters, as a rule, contain salts leached from the soil, and are therefore alkaline. Highly alkaline water was also obtained by a number of wells that have been sunk in the vicinity of Havre and Chinook.

The entire drainage basin lies within the plains section, and is treeless except for a few willows and cottonwoods along the stream.

The mean annual rainfall, which is about 14 inches at Havre, is 19 inches at the extreme western edge of the basin. As a rule, most of this rainfall occurs during the months of May and June. As might be expected in this northern latitude, the streams and lakes are icebound from the last part of November to the first of April.

[1] Beginning July 1, 1909, the Canadian Government maintained stations in the Milk River basin in the Province of Alberta. The data are published in the report of progress of stream measurements for 1909, issued by the department of the interior, Dominion of Canada.

As the rainfall is so scanty, irrigation is necessary for successful cultivation of crops. The United States Reclamation Service has begun construction on an irrigation project that will store the flood water of Milk River, reenforce the discharge by water from St. Mary River, and ultimately reclaim 250,000 acres of land in the lower valley.

Reservoirs for the storage of flood waters are possible at a number of places in the basin, as at Chain Lakes, 30 miles northwest of Havre, and Mud Lake, in Tps. 31 and 32 N., Rs. 31 and 32 E., and at Lake Bowdoin and Lonesome Lake.

Natural power opportunities are wholly lacking in this basin, for the fall of none of the streams is large, and Milk River itself is apt to cease to flow in the late summer and autumn.

The longest run-off record extends back to 1898. The wettest year since that time was 1899 and the driest was 1905. The total flow of the river in the driest year was only one-thirtieth of that of the wettest.

SOUTH FORK OF MILK RIVER NEAR BROWNING, MONT.

This station, which is located at Richard Croff's ranch, about 40 miles northeast of Browning, Mont., and about 6 miles south of the Canadian boundary line, was established April 28, 1905, to obtain data for use in connection with irrigation projects in Milk River Valley.

No storage is used above this station. A number of small ditches divert water to irrigate meadow lands in the river bottom, a considerable amount of this water returning to the stream as seepage and waste water.

The river overflows its banks at a gage height of 12 feet. During the high water of June, 1908, the gage was washed out and was not replaced until July 31, 1908. From high-water marks the stage was found to be 15.4 feet. The flood width was 850 feet and the flood cross section about 2,600 square feet.

On July 31, 1908, a new chain gage and cable were put in at their original locations. The datum of the gage remains the same.

The results are excellent, except during the winter months, when they are affected by ice.

Discharge measurements of South Fork of Milk River near Browning, Mont., in 1910.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Apr. 21	W. A. Lamb	73	88	3.35	143
Sept. 16	M. E. McChristie	18	13.5	2.48	17.5

Daily gage height in feet of South Fork of Milk River near Browning, Mont., for 1910.

[R. J. Croff, observer.]

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	3.10	3.15	2.92	2.50	2.25	2.50	2.60	2.58
2	3.10	3.12	2.92	2.55	2.25	2.55	2.60	2.55
3	3.10	3.05	2.90	2.50	2.20	2.60	2.65	2.55
4	3.00	3.00	2.95	2.55	2.20	2.60	2.65	2.58
5	2.90	3.05	2.97	2.55	2.30	2.70	2.60	2.45
6	3.00	2.98	2.88	2.50	2.28	2.70	2.60	2.60
7	3.28	2.98	2.88	2.55	2.35	2.68	2.60	2.58
8	3.42	3.08	3.50	2.55	2.30	2.75	2.60	2.55
9	3.48	3.15	3.80	2.52	2.32	2.68	2.55	2.58
10	3.52	3.20	3.30	2.55	2.35	2.65	2.55	2.50
11	3.60	3.38	3.10	2.50	2.25	2.70	2.55	2.65
12	3.55	3.35	3.02	2.55	2.30	2.60	2.55	2.65
13	3.55	3.25	2.92	2.50	2.25	2.60	2.55	2.55
14	3.48	3.18	2.85	2.45	2.25	2.55	2.55	2.50
15	3.25	3.35	2.85	2.50	2.30	2.55	2.55	2.50
16	3.20	3.30	2.80	2.40	2.30	2.55	2.55	2.52
17	3.18	3.65	2.82	2.35	2.40	2.50	2.55	2.55
18	3.28	3.55	2.78	2.30	2.35	2.50	2.60	2.68
19	3.30	3.40	2.72	2.30	2.30	2.50	2.65	2.55
20	3.40	3.65	2.75	2.35	2.30	2.45	2.65	2.58
21	3.38	3.50	2.70	2.30	2.25	2.42	2.60	2.65
22	3.28	3.30	2.70	2.35	2.30	2.55	2.55	2.40
23	3.18	3.18	2.75	2.28	2.25	2.60	2.58	2.65
24	3.20	3.10	2.80	2.25	2.30	2.65	2.55	2.80
25	3.32	3.10	2.83	2.30	2.40	2.62	2.60	2.55
26	3.35	3.10	2.70	2.25	2.35	2.75	2.60	2.50
27	3.35	3.08	2.62	2.30	2.35	2.75	2.52	2.50
28	3.30	3.00	2.60	2.22	2.30	2.70	2.58	2.50
29	3.28	3.00	2.58	2.25	2.35	2.68	2.70	2.50
30	3.18	3.03	2.57	2.30	2.40	2.60	2.70	2.50
31	.....	2.95	.....	2.25	2.35	.....	2.60	.....

NOTE.—Ice probably existed during January, February, and December.

Daily discharge, in second-feet, of South Fork of Milk River near Browning, Mont., for 1910.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	94	102	68	23	9	23	32	30
2	94	97	68	28	9	28	32	28
3	94	86	65	23	8	32	37	28
4	79	79	72	28	8	32	37	30
5	65	86	75	28	10	42	32	20
6	79	76	62	23	9.6	42	32	32
7	126	76	62	28	13	40	32	30
8	154	91	172	28	10	47	32	28
9	168	102	246	25	11	40	28	30
10	177	111	130	28	13	37	28	23
11	195	146	94	23	9	42	28	37
12	184	140	82	28	10	32	28	37
13	184	120	68	23	9	32	28	28
14	168	108	58	20	9	28	28	25
15	120	140	58	23	10	28	28	23
16	111	130	52	16	10	28	28	25
17	108	206	55	13	16	23	28	28
18	126	184	50	10	13	23	32	40
19	130	150	44	10	10	23	37	28
20	150	208	47	13	10	20	37	30
21	146	172	42	10	9	17	32	37
22	126	130	42	13	10	28	28	16
23	108	108	47	9.6	9	32	30	37
24	111	94	52	9	10	37	28	52
25	134	94	56	10	16	34	32	28
26	140	94	42	9	13	47	32	23
27	140	91	34	10	13	47	25	23
28	130	79	32	8.4	10	42	30	23
29	126	79	30	9	13	40	42	23
30	108	84	29	10	16	32	42	23
31	.....	72	.....	9	13	.....	32	.....

NOTE.—These discharges are based on a well-defined rating curve.

Monthly discharge of South Fork of Milk River near Browning, Mont., for 1910.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
January	.....	.....	a 25	1,540	
February	.....	.....	a 25	1,390	
March	.....	.....	a 65	4,000	
April	195	65	129	7,680	A.
May	208	72	114	7,010	A.
June	246	29	67.8	4,030	A.
July	28	8.4	17.7	1,090	B.
August	16	8	10.9	670	B.
September	47	17	33.3	1,980	B.
October	42	28	31.5	1,940	B.
November	52	16	28.4	1,690	B.
December	.....	.....	a 25	1,540	
The year	.....	.....	47.7	34,600	

a Discharge estimated January, February, March, and December, and the means are therefore only approximate.

MILK RIVER AT HAVRE, MONT.

This station, which is located at the highway bridge over Milk River at Havre, Mont., was established May 15, 1898, to obtain data for use in connection with a storage project for irrigation in Milk River valley. The nearest important tributaries enter about 20 miles east of the station.

The drainage area above Havre is about 7,300 miles, but the entire run-off from this area does not pass Havre, as an elaborate canal system in southern Alberta is supplied by Milk River. The theoretical discharge of the main canal of this system is about 330 second-feet. The Canadian minister of the interior has granted the canal company 500 second-feet of the low-water flow and 1,500 second-feet of the high-water discharge. As the system has not been wholly in operation, the full effect of the diversions on the flow of Milk River has not yet been felt at Havre.

There are no other important irrigation rights above Havre, but farther downstream are five large canal systems supplied directly from Milk River and irrigating about 22,000 acres. The water rights of these various systems have not yet been adjudicated, although preliminary steps have been taken. A suit in behalf of the Fort Belknap Indians was decided in their favor, with the result that they were given a prior right over the other canals to 125 second-feet, the priority of the other rights not being touched upon. Although no provision for storage has been made by the above claimants, the entire unappropriated flow of the stream has been filed upon by the United States Reclamation Service in connection with its Milk River irrigation project, which is now under construction.

A chain gage fastened to the bridge rail on the downstream side is used; its datum has remained the same since the station was established. Measurements may be made from the bridge or by wading.

From the last part of November to the first part of April the river at Havre is frozen entirely over, and in portions of the cross sections it is usually frozen to the bottom.

Frequent discharge measurements are necessary at this station, and even with these the estimates are subject to considerable error. This characteristic is true of the entire river. In dry years the flow ceases entirely and the water stands in pools for several months.

Discharge measurements of Milk River at Havre, Mont., in 1910.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Mar. 30	Raymond Richards	122	169	6.25	333
Apr. 30	M. E. McChristie	114	124	5.73	180
May 7	do	124	123	5.70	170
June 20	do	87	72	5.29	72
July 18	W. A. Lamb	21	6.8	4.48	5.2

Daily gage height, in feet, of Milk River at Havre, Mont., for 1910.

[U. S. Weather Bureau, observer.]

Day.	Mar.	Apr.	May.	June.	July.	Sept.	Oct.	Nov.
1	.....	6.1	5.7	5.7	5.0	.....	4.7	4.9
2	8.2	6.1	5.7	5.6	4.9	.....	4.7	4.9
3	8.5	6.0	5.7	5.6	4.9	.....	4.7	4.9
4	8.9	6.0	5.7	5.6	4.9	.....	4.7	4.9
5	8.9	5.9	5.7	5.6	4.9	.....	4.7	4.9
6	8.7	5.9	5.7	5.6	4.9	.....	4.7	4.9
7	8.4	5.8	5.7	5.6	5.0	.....	4.6	4.9
8	8.0	5.8	5.6	5.5	5.0	.....	4.7	4.9
9	7.9	5.8	5.6	5.5	4.9	.....	4.7	4.9
10	7.4	5.8	5.6	5.5	4.9	.....	4.7	4.9
11	7.7	5.6	5.7	5.5	4.9	.....	4.8	5.1
12	7.9	5.6	5.7	5.5	4.9	.....	4.8	5.1
13	7.5	5.5	5.6	5.4	4.9	.....	4.8	5.0
14	7.4	5.5	5.6	5.4	4.9	.....	4.9	5.0
15	7.9	5.7	5.6	5.4	4.8	4.6	4.9	5.0
16	7.6	5.7	5.6	5.3	4.7	4.6	4.9	5.0
17	8.4	5.7	5.6	5.7	4.6	4.7	4.9	5.0
18	8.1	5.9	5.7	5.7	4.5	4.8	4.9	.....
19	7.6	5.9	5.8	5.5	4.5	4.8	4.9	.....
20	7.3	5.8	5.8	5.4	4.4	4.8	4.9	.....
21	7.4	5.8	5.8	5.3	4.3	4.8	4.9	.....
22	7.2	5.8	5.8	5.3	4.3	4.8	4.9	.....
23	7.1	5.7	5.8	5.3	4.3	4.8	4.9	5.0
24	6.9	5.7	5.7	5.3	4.3	4.8	4.9	5.0
25	7.8	6.2	5.9	5.2	4.3	4.9	4.9	5.0
26	6.8	6.2	5.9	5.1	4.2	4.8	4.9	.....
27	6.7	5.8	5.9	5.0	4.2	4.9	4.9	.....
28	6.8	5.8	5.8	5.0	.....	4.8	4.9	.....
29	6.8	5.7	5.8	5.0	.....	4.8	4.9	.....
30	6.6	5.7	5.7	5.0	.....	4.7	4.9	.....
31	6.4	.....	5.7	.....	.....	.....	4.9	.....

NOTE.—Ice Jan. 1 to Mar. 1 and after Nov. 25. River dry from July 28 to Sept. 14.

Daily discharge, in second-feet, of Milk River at Havre, Mont., for 1910.

Day.	Mar.	Apr.	May.	June.	July.	Sept.	Oct.	Nov.
1	.....	283	161	161	38	.....	11	27
2	1,400	283	161	138	27	.....	11	27
3	1,600	249	161	138	27	.....	11	27
4	1,860	249	161	138	27	.....	11	27
5	1,860	217	161	138	27	.....	11	27
6	1,720	217	161	138	27	.....	11	27
7	1,530	188	161	138	38	.....	7	27
8	1,280	188	138	117	38	.....	11	27
9	1,220	188	138	117	27	.....	11	27
10	920	188	138	117	27	.....	11	27
11	1,100	138	161	117	27	.....	18	51
12	1,220	138	161	117	27	.....	18	51
13	980	117	138	98	27	.....	18	38
14	920	117	138	98	27	.....	27	38
15	1,220	161	138	98	18	7	27	38
16	1,040	161	138	81	11	7	27	38
17	1,530	161	138	161	7	11	27	38
18	1,340	217	161	161	6	18	27	38
19	1,040	217	188	117	6	18	27	38
20	860	188	188	98	4	18	27	38
21	920	188	188	81	2	18	27	38
22	800	188	188	81	2	18	27	38
23	740	161	188	81	2	18	27	38
24	630	161	161	81	2	18	27	38
25	1,160	319	217	65	2	27	27	38
26	575	319	217	51	1	18	27	.....
27	525	188	217	38	1	27	27	.....
28	575	188	188	38	0	18	27	.....
29	575	161	188	38	.....	18	27	.....
30	480	161	161	38	.....	11	27	.....
31	396	.....	161	.....	.....	.....	27	.....

NOTE.—These discharges are based on a well-defined rating curve below 400 second-feet. Above this the curve is an extension. Stream dry July 28 to Sept. 14. Discharge interpolated Nov. 18 to 22.

Monthly discharge of Milk River at Havre, Mont., for 1910.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Ma'mum.	Minimum.	Mean.		
January	.....	.....	*a* 40	2,460	
February	.....	.....	*a* 50	2,780	
March	1,860	396	1,060	65,200	C.
April	319	117	197	11,700	A.
May	217	138	167	10,300	A.
June	161	38	103	6,130	A.
July	38	0	15.3	940	B.
August	0	0	0	0	
September	27	0	9.0	536	C.
October	27	7	20.8	1,280	B.
November	51	27	*a* 34.2	2,040	B.
December	.....	.....	*a* 25	1,540	
The year	.....	.....	143	105,000	

a Discharge estimated Jan. 1 to Mar. 1 and Nov. 26 to Dec. 31.

NOTE.—Stream dry July 28 to Sept. 14.

MILK RIVER AT MALTA, MONT.

This station, which is located at the highway bridge at Malta, Mont., was established July 31, 1902, to obtain data for irrigation projects in Milk River valley. The nearest tributaries above the station are West and North forks of Milk River, which enter about 60 miles west of Malta.

The drainage area above is about 14,000 square miles, but the entire run-off does not pass this station, for between Havre and Malta seven irrigation canals, which irrigate about 25,000 acres of land, divert water from Milk River and its tributaries. The United States Reclamation Service has under construction a diversion dam at Dodson, about 17 miles above the station, which diverts water for the irrigation of about 108,000 acres of land in Milk River valley east of Malta. There are two canals, one on each side, with a total discharge of 1,000 second-feet.

The chain gage is fastened to the foot rail on the down side of the bridge. The gage datum has not been changed since the station was established. Measurements are made from the bridge or by wading. From November until April the gage heights are affected by ice, so that estimates of run-off are only approximate. The channel is sandy and shifts during floods.

Discharge measurements of Milk River at Malta, Mont., in 1910.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Mar. 29	Raymond Richards	122	297	3.65	1,050
Apr. 27[a]	W. A. Lamb	40	41	1.32	54
May 12[a]	M. E. McChristie	32	20	1.10	39
17[a]	do.	34	25	1.22	52
21[a]	do.	34	24	1.23	50
24[a]	do.	26	38	1.18	47
July 8[a]	do.	6	1.2	.50	.9

[a] Made by wading.

Daily gage height, in feet, of Milk River at Malta, Mont., for 1910.

[R. H. Thomas, observer.]

Day.	Apr.	May.	June.	July.	Dec.	Day.	Apr.	May.	June.	July.	Dec.
1	.....	1.1	1.6	*0.5	.....	16	1.45	1.2	0.6	0.4	0.5
2	2.65	1.0	1.4	.5	.....	17	1.45	1.3	.6	.4	.5
3	2.65	1.1	1.4	.5	.....	18	1.35	1.1	.6	.4	.....
4	2.45	1.1	1.4	.5	0.2	19	1.25	1.1	.6	.4	.....
5	2.05	1.1	1.3	.5	.2	20	1.05	1.2	.6	.35	.....
6	2.05	1.1	1.3	.5	.2	21	1.05	1.3	.5	.3	.....
7	2.25	1.1	1.3	.5	.2	22	1.05	1.2	.5	.3	.....
8	2.45	1.1	1.1	.5	.3	23	1.25	1.1	.5	.35	.....
9	2.35	1.1	1.0	.5	.5	24	1.25	1.2	.5	.3	.....
10	1.95	1.1	1.0	.5	.6	25	1.25	1.2	.5	.25	.....
11	1.65	1.1	.9	.55	.6	26	1.25	1.2	.5	.25	.....
12	1.45	1.1	.8	.5	.5	27	1.3	1.3	.5	.2	.....
13	1.55	1.1	.8	.5	.5	28	1.3	1.3	.5	.2	.....
14	1.65	1.1	.7	.5	.5	29	1.2	1.4	.5	.15	.....
15	1.55	1.1	.7	.45	.5	30	1.1	1.4	.5	.1	.....
						31	.....	1.6	.....	.05	.....

NOTE.—Ice probably existed to greater or less extent during January, February, and December.

Daily discharge, in second-feet, of Milk River at Malta, Mont., for 1910.

Day.	Apr.	May.	June.	July.	Dec.	Day.	Apr.	May.	June.	July.	Dec.
1	.....	40	116	1	.....	16	88	52	4	0	1
2	472	29	80	1	.....	17	88	65	4	0	1
3	472	40	80	1	.....	18	72	40	4	0	.....
4	382	40	80	1	.....	19	58	40	4	0	.....
5	231	40	65	1	.....	20	34	52	4	0	.....
6	231	40	65	1	.....	21	34	65	1	0	.....
7	301	40	65	1	.....	22	34	52	1	0	.....
8	382	40	40	1	.....	23	58	40	1	0	.....
9	340	40	29	1	1	24	58	52	1	0	.....
10	200	40	29	1	4	25	58	52	1	0	.....
11	126	40	21	2.5	4	26	58	52	1	0	.....
12	88	40	14	1	1	27	65	65	1	0	.....
13	106	40	14	1	1	28	65	65	1	0	.....
14	126	40	8	1	1	29	52	80	1	0	.....
15	106	40	8	0.5	1	30	40	80	1	0	.....
						31	.....	116	.....	0	.....

NOTE.—These discharges are based on a well-defined rating curve. Above 52 second-feet it is the same as the 1909 curve. Stream dry July 16 to Dec. 8.

Monthly discharge of Milk River at Malta, Mont., for 1910.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
January	.....	.....	[a] 50	3,070	
February	.....	.....	[a] 55	3,050	
March	.....	.....	[a] 1,706	105,000	
April	570	34	166	9,880	A.
May	116	29	50 2	3,090	B.
June	116	1	24 8	1,480	B.
July	2.5	0	.52	32	C.
August	.....	.....	0	0	
September	.....	.....	0	0	
October	.....	.....	0	0	
November	.....	.....	0	0	
December	.....	.....	5	31	
The year	.....	.....	171	126,000	

[a] Discharge estimated Jan. 1 to Apr. 1 and Dec. 1 to 31.

NOTE.—The means for January, February, March, and December are only approximate. Stream dry July 16 to Dec. 8.

MILK RIVER AT HINSDALE, MONT.

This station, which is located at the highway bridge over Milk River about 1 mile from Hinsdale, Mont., a point 46 miles from its junction with Missouri River, was established May 13, 1908, to obtain data for use in connection with irrigation projects in Milk River valley.

Three tributaries enter between Malta and Hinsdale—Beaver Creek from the south and Frenchman and Rock creeks from the north. These streams discharge large volumes of water during the rainy weather in the spring and summer, but they are low or even dry during the fall and winter months.

No diversions are made between Malta and Hinsdale. The United States Reclamation Service has appropriated the flow of the stream

in connection with the Milk River project and will divert it at a point 9 miles east of Hinsdale to irrigate land in lower Milk River valley.

From late in November until the 1st of April the stream is frozen entirely across and to a considerable depth. It is impracticable to keep gage records here during this period.

A chain gage is located on the upstream side of the highway bridge. The datum has remained unchanged. Measurements are made from the bridge or by wading. Channel is gravel and nonshifting.

Discharge measurements of Milk River at Hinsdale, Mont., in 1910.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq.-ft.*	*Feet.*	*Sec.-ft.*
Mar. 28	Raymond Richards	136	1,290	6.57	2,830
Apr. 28	W. A. Lamb	64	151	2.08	158
May 18	M. E. McChristie	65	131	1.71	86
28	.....do	63	130	1.68	81
July 8	.....do	18	7.7	.89	9
25	.....do	.....	.....	.65	*a* 3.5

a Discharge estimated.

Daily gage height, in feet, of Milk River at Hinsdale, Mont., for 1910.

[Goldie Wooldridge, observer.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	4.6	1.8	1.7	1.0	0.5	1.4	0.5	0.65
2	.....	4.3	1.8	1.8	1.0	.5	1.2	.5	.65
3	.....	4.3	1.8	1.7	1.0	.5	1.1	.5	.6
4	.....	4.75	1.8	1.7	1.0	.5	1.1	.45	.65
5	.....	4.3	1.8	1.8	1.0	.45	1.0	.5	.65
6	.....	4.15	1.8	1.8	1.0	.5	.8	.5	.65
7	.....	3.7	1.8	1.7	1.0	.45	.7	.5	.6
8	.....	3.55	1.8	1.7	1.0	.45	.75	.5	.6
9	.....	3.4	1.8	1.8	1.0	.4	.7	.5	.6
10	.....	3.1	1.7	1.8	.9	.4	.7	.55	.6
11	.....	4.1	1.65	1.7	.9	.4	.7	.6	.6
12	.....	3.6	1.6	1.6	.8	.4	.65	.6	.6
13	.....	3.1	1.65	1.5	.8	.4	.65	.6	.....
14	.....	3.0	1.5	1.5	.8	.45	.6	.55	.....
15	.....	2.7	1.5	1.5	.8	.45	.6	.5	.....
16	.....	2.4	1.45	1.5	.8	2.15	.6	.5	.....
17	.....	4.3	1.5	1.5	.7	2.25	.6	.5	.....
18	.....	3.2	1.7	1.7	.7	1.8	.6	.55	.....
19	.....	2.3	1.45	1.6	.7	1.6	.6	.6	.....
20	.....	2.3	1.45	1.5	.7	1.4	.6	.6	.....
21	.....	2.3	1.4	1.5	.7	1.4	.6	.55	.....
22	.....	2.2	1.4	1.4	.7	1.35	.55	.55	.....
23	.....	2.1	1.4	1.3	.7	1.3	.5	.55	.....
24	.....	2.0	1.3	1.2	.65	1.1	.5	.6	.....
25	.....	2.0	1.3	1.1	.65	.9	.5	.6	.....
26	.....	1.9	1.5	1.1	.55	.9	.5	.6	.....
27	.....	1.85	1.4	1.1	.55	.8	.5	.6	.....
28	6.6	2.1	1.7	1.0	.55	.85	.55	.6	.....
29	6.6	1.8	1.7	1.0	.5	.8	.55	.6	.....
30	5.6	1.7	1.7	1.5	.55	.8	.5	.6	.....
31	4.75	.....	1.7	.....	.45	.75	.....	.65	.....

NOTE.—Ice probably existed during January and February and after Nov. 12. There was a slight freeze Oct. 28. Gage heights Oct. 28 to Nov. 12 are probably slightly affected.

Daily discharge, in second-feet, of Milk River at Hinsdale, Mont., for 1910.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	1,380	103	86	13	1.3	44	1.3	3.6
2	.....	1,180	103	103	13	1.3	26	1.3	3.6
3	.....	1,180	103	86	13	1.3	19	1.3	2.8
4	.....	1,490	103	86	13	1.3	19	.6	3.6
5	.....	1,180	103	103	13	.6	13	1.3	3.6
6	.....	1,090	103	103	13	1.3	6.5	1.3	3.6
7	.....	830	103	86	13	.6	4.5	1.3	2.8
8	.....	750	103	86	13	.6	5.5	1.3	2.8
9	.....	675	103	103	13	0	4.5	1.3	2.8
10	.....	535	86	103	9	0	4.5	2.0	2.8
11	.....	1,060	78	86	9	0	4.5	2.8	2.8
12	.....	775	70	70	6.5	0	3.6	2.8	2.8
13	.....	535	78	56	6.5	0	3.6	2.8	.....
14	.....	490	56	56	6.5	.6	2.8	2.0	.....
15	.....	370	56	56	6.5	.6	2.8	1.3	.....
16	.....	256	50	56	6.5	179	2.8	1.3	.....
17	.....	1,180	56	56	4.5	207	2.8	1.3	.....
18	.....	580	86	86	4.5	103	2.8	2.0	.....
19	.....	222	50	70	4.5	70	2.8	2.8	.....
20	.....	222	50	56	4.5	44	2.8	2.8	.....
21	.....	222	44	56	4.5	44	2.8	2.0	.....
22	.....	192	44	44	4.5	39	2.0	2.0	.....
23	.....	166	44	34	4.5	34	1.3	2.0	.....
24	.....	143	34	26	3.6	19	1.3	2.8	.....
25	.....	143	34	19	3.6	9	1.3	2.8	.....
26	.....	122	56	19	2.0	9	1.3	2.8	.....
27	.....	112	44	19	2.0	6.5	1.3	2.8	.....
28	2,850	166	86	13	2.0	7.7	2.0	2.8	.....
29	2,850	103	86	13	1.3	6.5	2.0	2.8	.....
30	2,100	86	86	56	2.0	6.5	1.3	2.8	.....
31	1,490	.....	86	.....	.6	5.5	.....	3.6	.....

NOTE.—These discharges are based on a well-defined curve, the 1909 rating table being used above 295 second-feet.

Monthly discharge of Milk River at Hinsdale, Mont., for 1910.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
January	.....	.....	[a] 55	3,380	
February	.....	.....	[a] 60	3,330	
March	.....	.....	[a] 2,500	154,000	
April	1,380	86	581	34,600	B.
May	103	34	73.8	4,540	A.
June	103	13	63.1	3,750	A.
July	13	.6	6.97	429	B.
August	207	0	25.8	1,590	B.
September	44	1.3	6.48	386	B.
October	3.6	.6	2.07	127	B.
November	3.6	.....	[a] 2.76	164	C.
December	.....	.....	[a] 3.0	184	
The year	.....	.....	281	207,000	

[a] Discharge estimated by comparison with other Milk River stations Jan. 1 to Mar. 27 and Nov. 13 to Dec. 31.

NOTE.—The means for January, February, March, and December are only approximate.

NORTH FORK OF MILK RIVER NEAR CHINOOK, MONT.

This station, which is located about 4½ miles north of Chinook, Mont., and about 7 miles above the junction of North Fork with Milk River, was established April 22, 1905, to obtain data for use in connection with irrigation projects in Milk River valley.

No storage is used on this stream. Three canals, which divert an aggregate of about 20 second-feet, take out above the station. Several small pumping plants, which supply water for irrigating the bottom land along the river valley, also operate above the station. Below the station the Matheson and Cook canals divert water for irrigating land in Milk River valley near the mouth of North Fork. The aggregate appropriation of these canals is 78 second-feet.

The results at this station may be considered reliable, as a fair rating curve has been obtained. Ice during the winter months makes gage readings impracticable. A chain gage is located on the left bank near the house of the observer. The datum of the gage has remained the same since the station was established in 1905. Measurements may be made by wading or at the cable near the gage.

The greater part of the run-off occurs during floods caused by heavy rains in the spring and early summer. The stream often goes dry in the fall. Channel sandy and shifting.

Discharge measurements of North Fork of Milk River near Chinook, Mont., in 1910.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Mar. 30	Raymond Richards	44	72	1.64	127
May 3[a]	M. E. McChristie	36	28	.63	25
7[a]	do	16	24	.48	14
13[a]	do	16	24	.43	11
June 20[a]	do	6	1.1	.05	.4

[a] Made by wading.

Daily gage height, in feet, and discharge, in second-feet, of North Fork of Milk River near Chinook, Mont., for 1910.

Day.	Mar.		Apr.		May.		June.	
	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
1			1.34	87	0.76	31	0.30	7.0
2			1.28	79	.68	26		6.7
3			1.32	84	.64	23		6.4
4			1.28	79	.61	22	.27	6.1
5			1.23	74	.55	18		5.6
6			1.18	69	.52	17		5.1
7	2.07	209	1.12	63	.50	16	.22	4.6
8	2.35	275	1.20	71	.48	15		4.2
9	2.12	221	1.27	79	.46	14		3.8
10	2.04	203	1.14	65	.43	12	.17	3.4
11	2.04	203	1.30	82	.44	13		3.0
12	3.32	570	1.22	73	.44	13		2.7
13	4.37	954	1.21	72	.44	13	.12	2.4
14	4.47	991	1.18	69	.42	12		2.0
15	3.72	713	1.10	61	.44	13		1.7
16	4.07	843	1.02	53	.52	17	.07	1.4
17	3.62	677	1.00	51	.52	17		1.1
18	3.09	491	.98	49	.50	16		.8
19	2.41	291	.94	46	.47	14		.6
20	2.27	256	.92	44	.46	14	.02	.4

Daily gage height, in feet, and discharge in second-feet, of North Fork of Milk River near Chinook, Mont., for 1910—Continued.

Day.	Mar.		Apr.		May.		June.	
	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
21	2.64	352	0.92	44	0.43	12	.....	.....
22	2.54	325	.90	42	.43	12	.....	.....
23	2.37	280	.89	41	.50	16	.....	.....
24	2.27	256	.92	44	.48	15	.....	.....
25	2.22	244	.90	42	.46	14	.....	.....
26	2.04	203	.86	39	.43	12	.....	.....
27	1.87	168	.81	35	.41	12	.....	.....
28	1.78	151	.80	34	.38	10	.....	.....
29	1.64	127	.80	34	.33	8.2	.....	.....
30	1.52	110	.78	40	.32	7.8	.....	.....
31	1.40	94	.....	.....	.32	7.8	.....	.....

NOTE.—There was probably ice during January and February. These discharges are based on the 1910 rating curve up to 194 second-feet, which is well defined. Above 194 second-feet 1909 rating is used. Discharges interpolated in June for days having no gage record. Stream dry June 21 to Dec. 31.

Monthly discharge of North Fork of Milk River near Chinook, Mont., for 1910.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
January	.....	.....	[a]10	614	
February	.....	.....	[a]12	666	
March	991	.....	[a]332	20,400	B.
April	87	34	58.2	3,460	B.
May	31	7.8	14.9	916	B.
June	7	0	2.3	137	C.
July	.....	.....	0	0	
August	.....	.....	0	0	
September	.....	.....	0	0	
October	.....	.....	0	0	
November	.....	.....	0	0	
December	.....	.....	0	0	
The year	.....	.....	37.5	26,200	

[a] Discharge estimated Jan. 1 to Mar. 6.

NOTE.—The stream was dry from June 21 to the end of the year. The means for January and February are only approximate.

BEAVER CREEK NEAR SACO, MONT.[1]

Beaver Creek rises in the Little Rocky Mountains, flows northeastward, and enters Milk River near Hinsdale, Mont.

The gaging station, which was established December 31, 1903, to obtain data for use in connection with irrigation projects in Milk River Valley, is located at Craig's ranch, about 18 miles from Malta, 3 miles south of Ashfield, Mont., and near Saco, Mont., the nearest post office.

The only diversion is that for the irrigation of land bordering the stream. The water is diverted by small ditches leading from the stream and by small pumping plants near the banks.

[1] This station was called "Beaver Creek near Ashfield, Mont.," in earlier reports.

The entire run-off from this area does not pass the station. At medium and high stages a second channel, known as Beaver Creek Overflow, leaves the stream above the station, follows a depression to the west of the main channel, and reenters at a point some distance below the gage. Records are kept of the flow of this channel.

A staff gage was first established at Bridge No. 455 of the Great Northern Railway, half a mile west of Ashfield, Mont. It was moved to its present location 2½ miles upstream December 31, 1903. Measurements are made from a cable or by wading. The stream carries but little water except at the times of the spring floods or heavy rains. During the summer months the channel is obstructed by a dense growth of weeds and willows, which have to be cleared out occasionally, thus making it a difficult matter to procure a permanent rating. The results therefore are only fair.

The following estimate of discharge was made by W. A. Lamb:

April 27, 1910: Gage height, −0.35 foot; discharge, 1.0 second-foot.

Daily gage height, in feet, and discharge, in second-feet, of Beaver Creek near Saco, Mont., for 1910.

[Mrs. W. P. Craig, observer.]

Day.	Mar.		Apr.		May.	
	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
1			1.35	34	−0.4	0.5
2			1.35	34	−.4	.5
3			1.35	34	−.4	.5
4			1.25	30	−.5	0
5			1.25	30	−.5	0
6			1.65	42	−.5	0
7			2.1	56	−.5	0
8			2.15	58		
9			1.95	52		
10			1.25	30		
11			1.0	23		
12			.55	13		
13	3.75	130	.35	9		
14	3.65	124	.05	3.5		
15	3.5	116	.05	3.5		
16	3.35	108	.05	3.5		
17	3.3	106		3.5		
18	2.85	86		3.5		
19	2.65	78		3.5		
20	2.25	62		3.0		
21	2.15	58		3.0		
22	1.85	48	0	3.0		
23	1.85	48		2.5		
24	1.85	48		2.0		
25	1.7	44		1.5		
26	1.6	41		1.0		
27	1.5	38		.9		
28	1.4	35	−.35	.8		
29	1.35	34	−.4	.5		
30	1.35	34	−.4	.5		
31	1.35	34				

NOTE.—There probably was ice during January and February. The stream began to flow Mar. 5, but no gage heights were kept until Mar. 13. The stream was dry from May 4 to the end of the year with the exception of Aug. 13 to 16, when a little flow occurred. Gage heights for these days were: Aug. 13, 1.0 foot; Aug. 14, 0.7 foot; Aug. 15, 0.4 foot; Aug. 16, 0.15 foot. The discharges were obtained from a well-defined rating curve. Discharges interpolated Apr. 17 to 21 and 23 to 27. Discharge Aug. 13, 23 second-feet; Aug. 14, 16 second-feet; Aug. 15, 10 second-feet; Aug. 16, 5 second-feet.

Monthly discharge of Beaver Creek near Saco, Mont., for 1910.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
March	.....	0	[a]170	10,500	C.
April	34	.5	15.1	898	B.
May	.5	0	.05	3	D.
June	0	0	0	0	
July	0	0	0	0	
August	23	0	1.74	107	D.

[a] Mar. 1-12 estimated on basis of high-water marks noted by the observer.

BEAVER CREEK OVERFLOW NEAR BOWDOIN, MONT.

This station which was established June 29, 1903, discontinued August 30, 1906, and reestablished May 2, 1908, is located at John Turmell's ranch, 14 miles from Malta, Mont.

The flow of this channel must be added to that at the Beaver Creek station to get the total flow from the drainage area. Water flows into this channel only when Beaver Creek is high; the remainder of the season water is standing in pools, and fluctuations in water level are due wholly to local rains and evaporation.

The datum of the staff gage has remained unchanged. Flood measurements are made at a bridge half a mile below the gage. Low-water measurements are made near the gage by wading.

The following observation was made by W. A. Lamb:

April 27, 1910: Gage height, 3.12 feet; discharge, 0 second-feet (stream dry).

Daily gage height, in feet, of Beaver Creek overflow near Bowdoin, Mont., for 1910.

[John Turmell, observer.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	.....	3.15	3.0	2.2	1.7	1.2	2.9
2	.....	3.15	3.0	2.2	1.7	1.2	2.9
3	.....	3.15	2.9	2.2	1.7	1.2	2.9
4	.....	3.15	2.9	2.2	1.7	1.2	2.9
5	.....	3.05	2.8	2.2	1.7	1.2	2.9
6	.....	3.05	2.8	2.2	1.6	1.1	2.8
7	.....	4.55	2.8	2.1	1.6	1.1	2.8
8	.....	4.35	2.8	2.1	1.6	1.1	2.8
9	.....	4.15	2.7	2.1	1.6	1.1	2.8
10	.....	4.05	2.7	2.1	1.6	1.1	2.7
11	.....	3.95	2.7	2.1	1.6	1.0	2.7
12	.....	3.85	2.7	2.1	1.5	1.0	2.7
13	6.45	3.75	2.6	2.1	1.5	1.75	2.7
14	6.05	3.65	2.6	2.0	1.5	3.1	2.7
15	5.55	3.55	2.6	2.0	1.5	3.1	2.6
16	5.05	3.45	2.6	2.0	1.5	3.1	2.6
17	4.55	3.45	2.6	2.0	1.5	3.1	2.6
18	4.15	3.45	2.5	2.0	1.5	3.0	2.6
19	3.85	3.35	2.5	2.0	1.4	3.0	2.6
20	3.75	3.35	2.5	2.0	1.4	2.9	2.6
21	3.75	3.35	2.4	1.9	1.4	2.9	2.5
22	3.65	3.25	2.4	1.9	1.4	2.8	2.5
23	3.55	3.25	2.4	1.9	1.4	2.8	2.5
24	3.45	3.25	2.4	1.9	1.4	2.8	2.5
25	3.35	3.15	2.4	1.8	1.3	2.7	2.5
26	3.25	3.15	2.4	.....	1.3	2.7	2.4
27	3.25	3.2	2.3	.....	1.3	2.7	2.4
28	3.25	3.2	2.3	.....	1.3	2.7	2.4
29	3.25	3.1	2.3	.....	1.3	3.0	2.4
30	3.25	3.1	2.3	.....	1.3	3.0	2.4
31	3.15	.....	2.3	.....	1.2	3.0	.....

NOTE.—This stream began to flow about Mar. 5. No gage heights were kept during the period Mar. 5 to 12. There was no flow after Mar. 20, excepting Apr. 7 to 12, as the water was standing in pools. Fluctuation of water surface due to local rains and evaporation.

Daily discharge, in second-feet, of Beaver Creek overflow near Bowdoin, Mont., for 1910.

Day.	Mar.	Apr.	Day.	Mar.	Apr.	Day.	Mar.	Apr.
1		0	11		0.6	21	0	
2		0	12		.1	22	0	
3		0	13	140	0	23	0	
4		0	14	100		24	0	
5		0	15	60		25	0	
6		0	16	30		26	0	
7		10	17	10		27	0	
8		6.1	18	2.9		28	0	
9		2.9	19	.1		29	0	
10		1.6	20	0		30	0	
						31	0	

NOTE.—These discharges are based on a fairly well defined rating curve.

Monthly discharge of Beaver Creek overflow near Bowdoin, Mont., for 1910.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
March		0	75.6	4,650
April	10	0	.70	42

NOTE—Mar. 5-12 estimated on basis of high water marks and statements made by observer. There was practically no flow during balance of year. These estimates are approximate. Total acre-feet for year, 4,692.

PORCUPINE CREEK AT NASHUA, MONT.

Porcupine Creek rises in the northern part of Valley County, Mont., flows southward, forming the west boundary of the Fort Peck Indian Reservation, and enters Milk River at Nashua, a point about 5 miles from the junction of Milk River with the Missouri.

The drainage area comprises a strip of rolling prairie about 40 miles long, extending but a short distance back from the narrow valley formed by the stream. Forests, except for willows and cottonwoods along the banks of the stream, are lacking.

The greater part of the run-off comes from the melting snow in the early spring and from heavy rains during the summer. In the late summer and winter the stream is dry. The annual rainfall is about 13 inches. The water of this stream is neither diverted nor stored.

The only gaging station is at the road crossing at Nashua. It was established July 11, 1908, to obtain data for an irrigation project under construction by the United States Reclamation Service for the Fort Peck Indians.

Measurements are made by wading near the staff gage, which is nailed securely to a tree on the right bank of the stream at the road crossing.

Discharge measurements of Porcupine Creek at Nashua, Mont., in 1910.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Mar. 27	Raymond Richards	39	258	10.15	490
May 9	M. E. McChristie	14	5.3	2.1	6.8

Daily gage height, in feet, of Porcupine Creek at Nashua, Mont., for 1910.

[Rosella Duncan, observer.]

Day.	Mar.	Apr.	May.	June.	July.	Day.	Mar.	Apr.	May.	June.	July.
1	.....	5.0	2.2	1.3	1.9	16	9.3	3.2	2.0	2.2	1.4
2	.....	4.2	2.1	1.2	1.9	17	9.4	3.2	2.0	2.2	1.4
3	.....	4.3	2.1	1.2	1.9	18	9.5	3.2	2.0	2.2	1.3
4	.....	5.0	2.1	1.2	1.8	19	9.5	3.1	1.9	2.2	1.3
5	.....	7.0	2.0	1.2	1.8	20	8.7	3.0	1.9	2.2	1.2
6	.....	7.0	2.0	1.3	1.8	21	7.7	3.0	1.9	2.2	1.1
7	.....	6.8	2.0	1.5	1.8	22	7.7	2.9	1.8	2.2	1.0
8	.....	6.5	2.0	1.7	1.7	23	8.7	2.8	1.8	2.2	1.0
9	.....	5.8	2.0	1.9	1.7	24	11.0	2.8	1.8	2.2	1.0
10	.....	5.7	2.0	2.0	1.7	25	9.4	2.6	1.7	2.2	1.0
11	.....	5.2	2.0	2.0	1.7	26	9.2	2.4	1.7	2.1	1.0
12	.....	4.8	2.0	2.0	1.6	27	10.3	2.4	1.6	2.0	.8
13	8.9	4.3	1.9	2.0	1.5	28	10.2	2.3	1.6	2.0	.4
14	9.0	3.8	1.9	2.2	1.5	29	10.0	2.3	1.6	1.9	.....
15	9.1	3.4	1.9	2.2	1.4	30	9.0	2.2	1.4	1.9	.....
						31	7.0	.....	1.3	.....	.....

NOTE.—Water was standing in pools from about July 12 to 28. Stream dry July 29. Ice probably existed during January and February.

Daily discharge, in second-feet, of Porcupine Creek at Nashua, Mont., for 1910.

Day.	Mar.	Apr.	May.	June.	July.	Day.	Mar.	Apr.	May.	June.	July.
1	.....	116	10	0	2.8	16	425	40	4.2	10	0
2	.....	80	7	0	2.8	17	435	40	4.2	10	0
3	.....	84	7	0	2.8	18	445	40	4.2	10	0
4	.....	116	7	0	.6	19	445	37	2.8	10	0
5	.....	240	4.2	0	.6	20	371	34	2.8	10	0
6	.....	240	4.2	0	.6	21	292	34	2.8	10	0
7	.....	226	4.2	0	.6	22	292	31	.6	10	0
8	.....	205	4.2	.1	.1	23	371	28	.6	10	0
9	.....	161	4.2	2.8	.1	24	610	28	.6	10	0
10	.....	155	4.2	4.2	.1	25	435	22	.1	10	0
11	.....	126	4.2	4.2	.1	26	415	16	.1	7	0
12	.....	106	4.2	4.2	0	27	531	16	0	4.2	0
13	387	84	2.8	4.2	0	28	520	13	0	4.2	0
14	396	64	2.8	10	0	29	498	13	0	2.8	0
15	405	58	2.8	10	0	30	396	10	0	2.8	0
						31	292	.....	0	.....	0

NOTE.—These discharges are based on a fairly well-defined rating curve. Water standing in pools July 12 to 28, no flow; dry July 29.

Monthly discharge of Porcupine Creek at Nashua, Mont., for 1910.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
March	610	0	a 296	18,200	B.
April	240	10	82.1	4,890	B.
May	10	0	31.0	1,910	B.
June	10	0	5.36	319	B.
July	2.8	0	.36	22	C.
The year				25,300	

a Discharge estimated Mar. 1 to 12.

NOTE.—There was little or no flow the rest of the year, water standing in pools or creek dry.

PRIVATE CANALS IN MILK RIVER VALLEY.

DESCRIPTION.

Since 1905 a number of stations have been maintained on private canals in Milk River valley for the purpose of ascertaining the extent of private water rights. With the exception of Rock Creek Canal, which is near Hinsdale, in Valley County, these canals are located in Chouteau County and are used to irrigate lands in the vicinity of Harlem and Chinook.

The canals are all built on small grades and in soil which is easily eroded. In many of them silt has been deposited, and nearly all of them contain a growth of weeds and moss. At low stages the water is uniformly sluggish. In order to divert water into the laterals checks are erected in the main canals, and these checks often produce back-water effects for long distances above. They were put up under a great variety of conditions, and as a result velocities are found to differ widely at the same gage height during the season. In order to establish the correct relation between gage height and discharge it is necessary to make several rating curves for the same canal station. Frequent discharge measurements are necessary to obtain reliable results. Staff gages are located on all canals and most measurements are made by wading.

COOK CANAL NEAR CHINOOK, MONT.

This station, which was established April 10, 1905, is located about one-half mile above a small wooden highway bridge on the road running parallel to the Great Northern Railway, about 3 miles east of Chinook.

Discharge measurements are made from the highway bridge.

Discharge measurements of Cook canal near Chinook, Mont., in 1910.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Feet.*	*Sec.-ft.*
Apr. 29[a]	M. E. McChristie	13	34	3.11	21
May 6[a]	do	13	27	2.60	13
16	do	14	27	2.45	9.7
20	do	16	34	2.57	15
25	do	14	27	2.54	9.7
June 4	do	8	13	1.95	3.5

[a] Made from south side of footbridge.

Daily gage height, in feet, and discharge, in second-feet, of Cook canal near Chinook, Mont., for 1910.

[Berto Snedecar, observer.]

Day.	Apr.		May.		June.	
	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
1				18.5	2.05	4.4
2			2.95	18.5	2.0	4.0
3			2.9	17.7	1.95	3.5
4			2.8	16.1	1.95	3.5
5			2.7	14.6	1.5	.7
6			2.6	13.0	1.45	.5
7			2.5	11.3	1.3	.2
8			2.4	9.6	1.3	.2
9			2.3	7.8	1.2	
10			2.3	7.8	1.15	
11			2.35	8.4	1.1	
12			2.3	7.8	1.05	
13			2.3	7.8	1.0	
14			2.3	7.8		
15		21	2.35	8.4		
16		21	2.5	9.8		
17		21	2.5	9.8		
18		21	2.6	15.4		
19		21	2.6	15.4		
20		21	2.6	15.4		
21		21	2.5	9.8		
22		21	2.45	9.0		
23		21	2.4	8.2		
24		21	2.4	8.2		
25		21	2.5	9.7		
26		21	2.45	8.7		
27		21	2.4	8.1		
28		21	2.3	7.0		
29		21	2.25	6.5		
30		21	2.15	5.4		
31			2.1	4.9		

NOTE.—Canal not running Jan. 1 to Apr. 14, nor June 9 to Dec. 31. The discharges were obtained by the indirect method for shifting channels. Discharges April 15 to May 1 were estimated from known condition of canal regulation.

Monthly discharge of Cook canal near Chinook, Mont., for 1910.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
Apr. 15–30	21	21	[a]21	666
May	18.5	4.9	10.5	646
June 1–8	4.4	.2	2.12	34

[a] Estimated.

MATHESON CANAL NEAR CHINOOK, MONT.

This station, which was established April 10, 1905, is located at a footbridge 200 feet below the head gate near the main road, 3½ miles east of Chinook.

Discharge measurements of Matheson canal near Chinook, Mont., in 1910.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Apr. 29	M. E. McChristie	9	7.9	2.18	4.3
May 6	do	7.5	5.3	2.00	2.5
16	do	5	4.8	1.90	1.9
20	do	2.5	2.4	1.84	1.0
25	do	4	4.1	1.88	1.2

NOTE.—All measurements were made from footbridge.

Daily gage height, in feet, and discharge, in second-feet, of Matheson canal near Chinook, Mont., for 1910.

[Mrs. Winnie Sisson, observer.]

Day.	Apr.		May.		June.	
	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
1			2.25	5.2	1.75	0.7
2			2.00	2.5	1.7	.5
3			1.9	1.6	1.7	.5
4			1.9	1.6	1.7	.5
5			1.9	1.6	2.3	5.8
6			2.0	2.5	2.3	5.8
7			1.9	1.6	2.3	5.8
8			1.8	.9	2.3	5.8
9			2.0	2.5	2.0	2.5
10			2.0	2.5	2.0	2.5
11			2.0	2.5	2.0	2.5
12			2.0	2.5	2.0	2.5
13			2.0	2.5	1.9	1.6
14			2.0	2.5	1.85	1.2
15			2.0	2.5	1.7	.5
16			1.9	1.6	1.7	.5
17			1.9	1.6	1.3	
18		3	1.9	1.6	1.3	
19		3	1.9	1.6	1.3	
20		3	1.8	.9	1.3	
21		3	1.8	.9	1.3	
22		4	1.8	.9	1.3	
23		4	1.8	.9		
24		4	1.8	.9		
25		4	1.9	1.6		
26		4	1.9	1.6		
27		5	1.8	.9		
28		5	1.8	.9		
29		5	1.8	.9		
30		5	1.8	.9		
31			1.8	.9		

NOTE.—Canal not running Jan. 1 to Apr. 17 nor June 17 to Dec. 31. Water standing in canal June 17 to 22. Discharges based on a fairly well defined rating curve. Discharges Apr. 18 to 30 were estimated from known conditions of regulation.

Monthly discharge of Matheson canal near Chinook, Mont., for 1910.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
Apr. 18–30	5.0	3.0	[a]4.0	103
May	5.2	.9	1.73	106
June 1–16	5.8	.5	2.45	78

[a] Estimated.

HARLEM CANAL NEAR ZURICH, MONT.

This station, which was established in June, 1903, is located about 500 feet below the head gates of the canal, 1½ miles southeast of the Great Northern Railway section house at Zurich. It is reached by driving from Chinook.

Discharge measurements of Harlem canal near Zurich, Mont., in 1910.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Apr. 29[a]	M. E. McChristie	19	39	2.65	52
May 6	do	19	37	2.60	52
16	do	19	42	2.95	60
20	do	20	47	3.10	62
20	do	20	47	3.10	65
25	do	18	46	3.09	60
25	do	18	46	3.09	63
June 4	do	18	32	1.83	38

[a] Made from highway bridge 2 miles below gage.

NOTE.—All measurements after Apr. 29 were made at one section between gage and head gates.

Daily gage height, in feet, and discharge, in second-feet, of Harlem canal near Zurich, Mont., for 1910.

[Joel Lean, observer.]

Day.	Mar.		Apr.		May.		June.	
	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
1	.....	.....	3.0	62	2.7	54	2.6	51
2	.....	.....	3.0	62	2.6	51	2.6	51
3	.....	.....	2.9	59	2.7	54	2.6	51
4	.....	.....	2.9	59	2.7	54	2.2	44
5	.....	.....	2.8	56	2.7	54	2.1	42
6	.....	.....	2.9	59	2.7	54	2.1	42
7	.....	.....	2.9	59	2.8	56	2.2	44
8	.....	.....	2.9	59	2.8	56	2.2	44
9	.....	.....	2.7	54	2.8	56	2.2	44
10	2.9	59	2.7	54	2.7	54	2.1	42
11	3.0	62	2.6	51	2.6	51	.....	.....
12	3.0	62	2.8	56	2.6	51	.....	.....
13	3.1	65	3.0	62	2.8	56	.....	.....
14	3.0	62	3.1	65	3.0	62	.....	.....
15	3.1	65	3.1	65	3.0	62	.....	.....
16	3.2	67	3.2	67	2.95	60	.....	.....
17	3.1	65	3.2	67	3.0	62	.....	.....
18	3.1	65	3.2	67	3.2	67	.....	.....
19	3.0	62	3.1	65	3.1	65	.....	.....
20	3.0	62	3.1	65	3.1	65	.....	.....

Daily gage height, in feet, and discharge, in second-feet, of Harlem canal near Zurich, Mont., for 1910—Continued.

Day.	Mar.		Apr.		May.		June.	
	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
21	2.9	59	3.1	65	3.25	69	.....	.....
22	2.9	59	3.1	65	3.1	65	.....	.....
23	2.8	56	3.0	62	3.0	62	.....	.....
24	2.8	56	3.0	62	3.1	65	.....	.....
25	2.9	59	3.0	62	3.05	63	.....	.....
26	2.8	56	2.9	59	3.2	67	.....	.....
27	2.9	59	2.9	59	3.0	62	.....	.....
28	3.0	62	2.8	56	3.0	62	.....	.....
29	3.0	62	2.7	54	2.9	59	.....	.....
30	3.0	62	2.7	54	2.85	57	.....	.....
31	3.1	65	.....	.....	2.8	56	.....	.....

NOTE.—Canal not running Jan. 1 to Mar. 9, nor from June 11 to Dec. 31. These discharges are based on a fairly well defined rating curve.

Monthly discharge of Harlem canal near Zurich, Mont., for 1910.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
Mar. 10–31	67	56	61.4	2,680	B.
April	67	51	60.4	3,590	B.
May	69	51	59.1	3,630	B.
June 1–10	51	42	45.5	903	B.

AGENCY DITCH NEAR HARLEM, MONT.

This station, which was established July 14, 1905, is located at the highway bridge, about one-fourth mile below the head gate. It is reached by driving south from Harlem, Mont.

No gage heights were observed regularly during 1910.

Discharge measurements of Agency ditch near Harlem, Mont., in 1910.

Date.	Hydrographer.	Width.	Area of section.	Gage. height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 4	M. E. McChristie	21	57	4.45	60
May 14	....do	16	18	2.05	26
June 6	....do	19	49	3.75	40
22	....do	22	78	5.15	48
July 9	....do	22	77	5.20	29
18	W. A. Lamb	20	56	4.95	15

Daily discharge, in second-feet, of Agency ditch near Harlem, Mont., for 1910.

Day.	Apr.	May.	June.	July.	Day.	Apr.	May.	June.	July.
1	.....	60	.....	40	16	60	.....	40	18
2	.....	60	40	40	17	60	.....	40	18
3	.....	60	40	40	18	60	.....	40	16
4	.....	60	40	40	19	60	.....	40	16
5	.....	60	40	40	20	60	.....	40	16
6	.....	60	40	35	21	60	.....	40	16
7	.....	60	40	35	23	60	.....	48	16
8	60	60	40	31	23	60	.....	48	16
9	60	60	40	29	24	60	.....	48	16
10	60	.....	10	29	25	60	.....	48	16
11	60	.....	10	29	26	60	.....	48	16
12	60	.....	10	25	27	60	.....	48	16
13	60	.....	10	25	28	60	.....	45	.....
14	60	.....	10	22	29	60	.....	45	.....
15	60	.....	40	20	30	60	.....	45	.....

NOTE.—These discharges are based on actual measurements and the following note, which was obtained from the irrigation engineer at the agency: "Canal was opened Apr. 8, and remained constant until May 10, when it was shut down for repairs. Water turned on June 2 and was constant until June 9, when the gates were partly closed. June 10 to 14, discharge estimated. Gates opened June 15; same discharge as before being closed. June 22 gates raised, also flush boards on waste gate. Since June 30 discharge decreased on account of river falling. Gates closed July 27."

Monthly discharge of Agency ditch near Harlem, Mont., for 1910.

Month.	Discharge in second-feet (mean).	Run-off (total in acre-feet).
Apr. 8–30	60	2,740
May 1–9	60	1,070
June 2–30	37	2,130
July 1–27	25	1,340

FORT BELKNAP CANAL NEAR CHINOOK, MONT.

This station, which was established June 21, 1903, is located at the highway bridge, about 500 feet below the head gates of the canal, 8 miles east of Chinook.

The high water of June, 1908, washed out both the bridge and the gage. A new gage was installed on June 27, 1908, at a different datum, within a few feet of the site of the old gage.

A new bridge was built about one-fourth mile upstream from the site of the old one. Measurements can be made from this bridge only when the canal is running full. Wading measurements are made at a section about 300 feet downstream from the gage at the bridge.

Discharge measurements of Fort Belknap canal near Chinook, Mont., in 1910.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 30	M. E. McChristie	48	65	2.56	66
May 5	....do	48	69	2.62	68
13	....do	48	69	2.65	69
19	....do	42	61	2.64	62
26	....do	49	75	2.75	81
June 7	....do	49	75	2.70	72

Daily gage height, in feet, and discharge, in second-feet, of Fort Belknap canal near Chinook, Mont., for 1910.

[Bruce Glenn, observer.]

Day.	May.		June.		Day.	May.		June.	
	Gage height.	Discharge.	Gage height.	Discharge.		Gage height.	Discharge.	Gage height.	Discharge.
1	2.60	67	2.70	75	16	2.65	62	.....	.....
2	2.60	67	2.65	72	17	2.70	62	.....	.....
3	2.60	67	2.65	72	18	2.68	62	.....	.....
4	2.60	67	2.65	72	19	2.65	62	.....	.....
5	2.60	67	2.65	72	20	2.65	62	.....	.....
6	2.60	67	2.65	72	21	2.65	62	2.40	56
7	2.65	70	2.65	72	22	2.65	62	2.45	59
8	2.65	70	2.65	72	23	2.70	73	2.45	59
9	2.60	67	2.60	67	24	2.70	73	2.45	59
10	2.60	67	2.60	67	25	2.75	81	2.45	59
11	2.60	67	2.60	67	26	2.75	81	.....	.....
12	2.60	67	.....	.....	27	2.75	81	.....	.....
13	2.60	67	.....	.....	28	2.75	81	.....	.....
14	2.60	67	.....	.....	29	2.70	75	.....	.....
15	2.60	67	.....	.....	30	2.70	75	.....	.....
					31	2.60	67	.....	.....

NOTE.—Canal gates closed June 12 to 20, and on June 26 for rest of the year.

Monthly discharge of Fort Belknap canal near Chinook, Mont., for 1910.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
Mar. 19–31	.....	.....	32.8	845
April	.....	.....	63.0	3,750
May	81	67	68.8	4,240
June, 16 days	75	56	67.0	2,130

NOTE.—Discharge for period Mar. 19 to Apr. 30, estimated from statements of observer before regular observations began.

LITTLE PORCUPINE CREEK BASIN.

LITTLE PORCUPINE CREEK NEAR FRAZER, MONT.

Little Porcupine Creek rises near the central-western part of the Fort Peck Indian Reservation, flows southward, and enters Missouri River near Frazer, Mont.

The drainage area comprises a strip of land about 25 miles long, extending but a short distance back from the narrow valley bordering the stream. Except for a growth of cottonwoods and willows, the basin is without forestation.

The run-off comes from the melting snow in the spring and from heavy rains during the summer. During the greater part of the year the channel is dry, except for about one-half second-foot of water derived from springs near the mouth of the stream. The annual rainfall is about 13 inches. The stream is not used for diversion.

The only gaging station in this basin is about 2 miles south of Frazer, Mont. A staff gage is located on the stream near the house of the observer. Measurements are made by wading. The station was established July 13, 1908, to obtain data for use in connection with an irrigation project being constructed by the United States Reclamation Service for the Fort Peck Indians.

This station was discontinued September 30, 1910.

The following discharge measurement was made by Raymond Richards:

March 26, 1910: Width, 29 feet; area, 20 square feet; gage height, 2.43 feet; discharge, 51 second-feet.

Daily gage height, in feet, of Little Porcupine Creek near Frazer, Mont., for 1910.

[T. C. Flynn, observer.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1		2.4	1.4	1.25	1.25	1.2	1.35
2		2.25	1.45	1.2	1.2	1.25	1.3
3		2.2	1.4	1.25	1.25	1.2	1.35
4		2.25	1.35	1.25	1.25	1.25	1.35
5		2.25	1.35	1.2	1.2	1.25	1.3
6		2.0	1.3	1.25	1.25	1.2	1.35
7		2.05	1.35	1.2	1.2	1.25	1.3
8		1.9	1.3	1.25	1.25	1.2	1.35
9		1.95	1.35	1.35	1.25	1.25	1.35
10		2.05	1.35	1.3	1.2	1.25	1.3
11	2.55	2.1	1.3	1.35	1.25	1.2	1.35
12	3.0	2.15	1.35	1.3	1.2	1.35	1.3
13	4.05	2.0	1.3	1.35	1.25	1.3	1.35
14	4.0	2.25	1.35	1.35	1.25	1.35	1.35
15	3.05	2.25	1.35	2.65	1.2	1.35	1.3
16	4.05	2.1	1.3	2.05	1.25	1.3	1.35
17	3.5	2.05	1.35	1.7	1.3	1.35	1.3
18	3.05	1.9	1.2	1.35	1.35	1.3	1.35
19	2.9	1.75	1.25	1.35	1.35	1.35	1.35
20	2.95	1.75	1.25	1.35	1.2	1.35	1.3
21	2.95	1.6	1.2	1.35	1.25	1.2	1.35
22	2.5	1.65	1.25	1.3	1.2	1.25	1.3
23	2.55	1.5	1.2	1.35	1.25	1.2	1.35
24	2.9	1.55	1.25	1.35	1.25	1.25	1.35
25	2.95	1.45	1.35	1.25	1.2	1.25	1.3
26	3.05	1.4	1.3	1.25	1.25	1.2	1.35
27	2.4	1.45	1.35	1.2	1.3	1.25	1.3
28	3.55	1.5	1.3	1.25	1.25	1.2	1.35
29	3.6	1.55	1.35	1.25	1.25	1.35	1.35
30	3.25	1.45	1.35	1.2	1.2	1.35	1.3
31	3.05	.....	1.2	.....	1.25	1.3	.....

Daily discharge, in second-feet, of Little Porcupine Creek near Frazer, Mont., for 1910.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	.....	50	0	0	.....	.....	.....
2	.....	40	1.5	0	.....	.....	.....
3	.....	36	0	0	.....	.....	.....
4	.....	40	0	0	.....	.....	.....
5	.....	40	0	0	.....	.....	.....
6	.....	25	0	0	.....	.....	.....
7	.....	28	0	0	.....	.....	.....
8	.....	20	0	0	.....	.....	.....
9	.....	22	0	0	.....	.....	.....
10	.....	28	0	0	.....	.....	.....

Daily discharge, in second-feet, of Little Porcupine Creek near Frazer, Mont., for 1910—Continued.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
11	61	30	0	0	.....	.....	.....
12	97	33	0	0	.....	.....	.....
13	204	25	0	0	.....	.....	.....
14	198	40	0	0	.....	.....	.....
15	102	40	0	69	.....	.....	.....
16	204	30	0	28	.....	.....	.....
17	145	28	0	11	.....	.....	.....
18	102	20	0	0	.....	.....	.....
19	89	13	0	.....	.....	.....	.....
20	93	13	0	.....	.....	.....	.....
21	93	7	0	.....	.....	.....	.....
22	57	9	0	.....	.....	.....	.....
23	61	3	0	.....	.....	.....	.....
24	89	5	0	.....	.....	.....	.....
25	93	1.5	0	.....	.....	.....	.....
26	102	0	0	.....	.....	.....	.....
27	50	1.5	0	.....	.....	.....	.....
28	150	3	0	.....	.....	.....	.....
29	155	5	0	.....	.....	.....	.....
30	120	1.5	0	.....	.....	.....	.....
31	102	.....	0	.....	.....	.....	.....

NOTE.—These discharges are based on a rating curve that is fairly well defined.

Monthly discharge of Little Porcupine Creek near Frazer, Mont., for 1910.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
March	204	0	[a]83.8	5,150	C.
April	50	0	21.2	1,260	C.
May	1.5	0	.05	3	D.
June	69	0	3.60	214	D.

[a] Discharge estimated Mar. 1 to 10.

NOTE.—The creek was dry, or water standing pools, Jan. 1 to about Mar. 1, May 3 to June 14, and from June 18 to the end of the season. Total run-off in acre-feet for year, 6630.

WOLF CREEK BASIN.

WOLF CREEK NEAR WOLF POINT, MONT.

Wolf Creek rises near the center of the Fort Peck Indian reservation, flows southward, and enters Missouri River near the Wolf Point agency. The drainage area comprises the central part of the Fort Peck Indian reservation. The entire area, with the exception of a narrow valley along the stream, is a rolling prairie. The only forestation is the growth of willows and cottonwoods along the banks of the streams.

The run-off comes from the melting snow in the spring and heavy rains during the summer. The upper part of the channel is dry during the late summer and winter, but near the mouth the flow is kept up by springs. The annual rainfall is about 13 inches. The stream is not used for storage and the only diversion is that made

by the Indian agency ditch at Wolf Point, which takes the entire flow during the low period.

The gaging station, which was established August 15, 1908, to determine the amount of water available for an irrigation project under consideration by the United States Reclamation Service for the Fort Peck Indians, is located at William Smith's ranch, 2½ miles northwest of Wolf Point.

Measurements are made by wading near the staff gage, which is located close to the house of the observer.

The Wolf Point ditch heads above the gage and practically the entire low-water flow of the creek is diverted through it.

Discharge measurements of Wolf Creek near Wolf Point, Mont., in 1910.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Mar. 27	Raymond Richards	20	38	3.51	80
May 10	M. E. McChristie	.5	2	1.73	[a] 1.2

[a] Does not include flow in Wolf Point ditch.

Daily gage height, in feet, of Wolf Creek near Wolf Point, Mont., for 1910.

[W. H. Smith, observer.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	.....	2.8	1.85	1.95	1.9	1.45	1.45
2	.....	2.8	1.9	1.95	1.85	1.45	1.45
3	.....	2.8	1.85	1.95	1.55	1.45	1.45
4	.....	2.8	1.9	2.0	1.55	1.45	1.5
5	.....	2.6	1.85	1.85	1.55	1.5	1.45
6	.....	2.6	1.85	1.85	1.6	1.45	1.45
7	.....	2.6	1.85	1.85	1.55	1.45	1.45
8	.....	2.7	1.95	1.85	1.55	1.45	1.45
9	.....	2.7	2.0	1.85	1.55	1.45	1.5
10	.....	2.7	1.95	1.9	1.5	1.5	1.45
11	.....	2.65	2.0	1.85	1.6	1.45	1.45
12	.....	2.5	1.95	1.85	1.55	1.45	1.45
13	3.9	2.5	1.95	1.85	1.55	1.45	1.45
14	3.9	2.5	1.95	1.85	1.55	1.45	1.5
15	3.9	2.45	1.85	1.9	1.5	1.5	1.45
16	3.6	2.5	1.9	1.85	1.6	1.45	1.45
17	3.6	2.35	1.85	1.85	1.45	1.45	1.45
18	3.2	2.4	1.85	1.85	1.45	1.45	1.45
19	3.2	2.3	1.85	1.85	1.45	1.45	1.5
20	3.2	2.25	1.95	1.9	1.45	1.5	1.45
21	3.1	2.1	2.0	1.85	1.5	1.45	1.45
22	3.1	2.05	1.85	1.85	1.45	1.45	1.45
23	3.1	2.1	1.85	1.85	1.45	1.45	1.45
24	2.5	2.05	1.85	1.85	1.45	1.45	1.5
25	2.5	2.05	1.85	1.85	1.45	1.5	1.45
26	2.75	2.2	1.9	1.9	1.5	1.45	1.45
27	3.05	2.15	1.85	1.85	1.45	1.45	1.45
28	2.8	2.1	1.85	1.85	1.45	1.45	1.45
29	2.7	2.05	1.95	1.85	1.45	1.45	1.5
30	2.7	2.05	1.95	1.85	1.45	1.5	1.45
31	2.7	.....	2.0	.....	1.5	1.45	.....

Daily discharge, in second-feet, of Wolf Creek near Wolf Point, Mont., for 1910.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	.....	29	2.3	3.2	2.7	0.1	0.1
2	.....	29	2.7	3.2	2.3	.1	.1
3	.....	29	2.3	3.2	.4	.1	.1
4	.....	29	2.7	3.7	.4	.1	.2
5	.....	18	2.3	2.3	.4	.2	.1
6	.....	18	2.3	2.3	.6	.1	.1
7	.....	18	2.3	2.3	.4	.1	.1
8	.....	23	3.2	2.3	.4	.1	.1
9	.....	23	3.7	2.3	.4	.1	.2
10	.....	23	3.2	2.7	.2	.2	.1
11	.....	21	3.7	2.3	.6	.1	.1
12	.....	15	3.2	2.3	.4	.1	.1
13	110	15	3.2	2.3	.4	.1	.1
14	110	15	3.2	2.3	.4	.1	.2
15	110	13	2.3	2.7	.2	.2	.1
16	87	15	2.7	2.3	.6	.1	.1
17	87	10	2.3	2.3	.1	.1	.1
18	56	11	2.3	2.3	.1	.1	.1
19	56	8.8	2.3	2.3	.1	.1	.2
20	56	7.7	3.2	2.7	.1	.2	.1
21	49	5.0	3.7	2.3	.2	.1	.1
22	49	4.4	2.3	2.3	.1	.1	.1
23	49	5.0	2.3	2.3	.1	.1	.1
24	15	4.4	2.3	2.3	.1	.1	.2
25	15	4.4	2.3	2.3	.1	.2	.1
26	26	6.7	2.7	2.7	.2	.1	.1
27	45	5.8	2.3	2.3	.1	.1	.1
28	29	5.0	2.3	2.3	.1	.1	.1
29	23	4.4	3.2	2.3	.1	.1	.2
30	23	4.4	3.2	2.3	.1	.2	.1
31	23	.....	3.7	.....	.2	.1	.....

NOTE.—These discharges are based on a fairly well defined rating curve.

Monthly discharge of Wolf Creek near Wolf Point, Mont., for 1910.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
January	.....	.....	0	0	
February	.....	.....	0	0	
March	.....	.....	[a] 54.1	3,330	B.
April	29	4.4	14.0	833	B.
May	3.7	2.3	2.76	170	C.
June	3.7	2.3	2.49	148	C.
July	2.7	.1	.41	25	D.
August	.2	.1	.12	7	D.
September	.2	.1	.12	7	D.
October	.....	.....	0	0	
November	.....	.....	0	0	
December	.....	.....	0	0	
The year	.....	.....	6.17	4,520	

[a] Discharge estimated Mar. 1 to 12.

NOTE.—The creek was practically dry, or water standing in pools, Jan. 1 to about Mar. 1, and Oct. 1 to Dec. 31.

POPLAR CREEK BASIN.

POPLAR CREEK NEAR POPLAR, MONT.

Poplar Creek rises in the southern part of the Canadian Province of Saskatchewan, flows southeastward through the northern part of Valley County, Mont., thence through the Fort Peck Indian reservation, and unites with Missouri River near Poplar, Mont. The largest

tributary is the West Branch, which enters near the north boundary of the Fort Peck reservation. The greater part of the drainage area is a rolling prairie cut by a number of small coulees and the valley of the creek. The only forestation is a growth of willows and cottonwoods along the banks of the stream.

The run-off comes from melting snow in the spring and heavy rains during the summer. The dry-season flow is considerable. The annual rainfall at Poplar is about 13 inches.

The gaging station was established August 15, 1908, at Buershia's ranch, 6 miles north of Poplar, Mont.

A staff gage fastened to a tree is located on the right bank of the stream and across the creek from the house of the observer. The gage datum has not been changed. All measurements are made by wading.

Discharge measurements of Poplar Creek near Poplar, Mont., in 1910.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Mar. 26	Raymond Richards	95	204	4.77	449
May 11	M. E. McChristie	63	56	2.93	70
July 1	.....do	20	24	2.53	18
28	.....do	30	21	2.34	6.1

NOTE.—Zero flow is at 2 feet.

Daily gage height, in feet, of Poplar Creek near Poplar, Mont., for 1910.

[Louis Obershaw, observer.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	4.6	3.1	2.7	2.5	2.2	2.5	2.5	2.5
2	.....	4.4	3.1	2.7	2.5	2.2	2.5	2.5	2.5
3	.....	4.4	3.1	2.7	2.5	2.2	2.5	2.5	2.5
4	.....	4.3	3.1	2.7	2.5	2.2	2.5	2.5	2.5
5	.....	4.3	3.1	2.7	2.5	2.2	2.5	2.5	2.5
6	.....	4.3	3.1	2.6	2.5	2.2	2.5	2.5	2.5
7	.....	4.4	3.1	2.6	2.5	2.2	2.5	2.3	2.7
8	.....	4.5	3.0	2.6	2.5	2.2	2.5	2.3	2.6
9	.....	4.4	3.0	2.6	2.5	2.2	2.5	2.3	2.7
10	.....	4.3	3.0	2.6	2.5	2.2	2.5	2.3	2.7
11	.....	4.2	2.9	2.6	2.5	2.2	2.5	2.4	2.7
12	.....	4.1	2.8	2.6	2.5	2.2	2.5	2.4	2.6
13	.....	4.0	2.8	2.6	2.5	2.2	2.5	2.5	2.6
14	.....	3.9	2.8	2.7	2.5	2.2	2.5	2.5	2.7
15	.....	3.8	2.8	2.7	2.5	2.3	2.5	2.5	.....
16	.....	3.7	2.8	2.7	2.5	2.4	2.5	2.5	.....
17	.....	3.6	2.8	2.7	2.5	2.5	2.5	2.5	.....
18	.....	3.4	2.8	2.7	2.5	2.5	2.5	2.5	.....
19	.....	3.4	2.8	2.6	2.4	2.5	2.5	2.5	.....
20	.....	3.4	2.7	2.6	2.4	2.4	2.5	2.5	.....
21	.....	3.4	2.7	2.6	2.4	2.4	2.5	2.5	.....
22	.....	3.2	2.7	2.5	2.4	2.4	2.5	2.5	.....
23	.....	3.2	2.7	2.5	2.3	2.4	2.5	2.5	.....
24	.....	3.2	2.7	2.5	2.3	2.4	2.5	2.5	.....
25	.....	3.2	2.7	2.5	2.3	2.5	2.5	2.5	.....
26	4.8	3.2	2.7	2.5	2.3	2.5	2.5	2.5	.....
27	4.8	3.2	2.6	2.5	2.3	2.5	2.5	2.5	.....
28	5.0	3.2	2.6	2.5	2.3	2.5	2.5	2.5	.....
29	5.2	3.2	2.6	2.5	2.2	2.5	2.5	2.5	.....
30	5.1	3.2	2.7	2.5	2.2	2.5	2.5	2.5	.....
31	4.9	.....	2.7	.....	2.2	2.5	.....	2.5	.....

NOTE.—Ice probably existed during January and February, and after Nov. 14.

Daily discharge, in second-feet, of Poplar Creek near Poplar, Mont., for 1910.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	418	94	36	15	2	15	15	15
2	.....	360	94	36	15	2	15	15	15
3	.....	360	94	36	15	2	15	15	15
4	.....	336	94	36	15	2	15	15	15
5	.....	336	94	36	15	2	15	15	15
6	.....	336	94	29	15	2	15	15	15
7	.....	360	94	29	15	2	15	5	30
8	.....	384	79	28	15	2	15	5	22
9	.....	360	79	27	15	2	15	5	30
10	.....	336	79	27	15	2	15	5	30
11	.....	312	66	26	15	2	15	9.5	30
12	.....	289	52	25	15	2	15	9.5	22
13	.....	267	52	25	15	2	15	15	22
14	.....	245	52	34	15	2	15	15	30
15	.....	223	52	34	15	5	15	15	.....
16	.....	202	52	34	15	9.5	15	15	.....
17	.....	182	51	33	15	15	15	15	.....
18	.....	145	51	33	15	15	15	15	.....
19	.....	145	51	25	9.5	15	15	15	.....
20	.....	145	39	24	9.5	9.5	15	15	.....
21	.....	145	39	24	9.5	9.5	15	15	.....
22	.....	110	39	17	9.5	9.5	15	15	.....
23	.....	110	39	17	5	9.5	15	15	.....
24	.....	110	38	17	5	9.5	15	15	.....
25	.....	110	38	16	5	15	15	15	.....
26	457	110	38	16	5	15	15	15	.....
27	457	110	28	16	5	15	15	15	.....
28	507	110	28	15	5	15	15	15	.....
29	557	110	28	15	2	15	15	15	.....
30	532	110	37	15	2	15	15	15	.....
31	482	.....	37	.....	2	15	.....	15	.....

NOTE.—These discharges are based on rating curves applicable as follows: Mar. 26 to May 11, poorly defined; May 12 to June 30, indirect method for shifting channels; July 1 to Nov. 14, well defined. This is the same as the 1909 curves.

Monthly discharge of Poplar Creek near Poplar, Mont., for 1910.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
January	.....	.....	[a] 15.0	922	
February	.....	.....	[a] 15.0	833	
March	.....	.....	[a] 600	36,900	
April	418	110	229	13,600	B.
May	94	28	58.1	3,570	B.
June	36	15	26.0	1,550	C.
July	15	2	11.1	682	B.
August	15	2	7.74	476	B.
September	15	15	15.0	893	C.
October	15	9.5	13.4	824	C.
November	.....	.....	[b] 18.7	1,110	
December	.....	.....	[a] 15.0	922	
The year	.....	.....	85.3	62,300	

[a] Discharge estimated by comparison with Big Muddy River near Culbertson.
[b] Nov. 15 to 30 estimated because of ice.

NOTE.—Means for January, February, March, and December are only approximate.

BIG MUDDY RIVER BASIN.

BIG MUDDY RIVER NEAR CULBERTSON, MONT.

Big Muddy River rises in the Province of Saskatchewan, Canada, flows southward into Montana, forms the eastern boundary of the Fort Peck Indian reservation, and unites with Missouri River near Blair, Mont. It drains a rolling prairie cut by many small coulees. The greater part of the run-off comes from the melting snow in the spring months.

The gaging station, which was established July 14, 1908, to determine the amount of water available for irrigation projects under consideration by the United States Reclamation Service for the Fort Peck Indians, is located about 3 miles above the mouth of the stream.

Because of backwater from the Missouri River, this station was discontinued July 19, 1909, and a new station was established at Gustave Sholtz's ranch, 8 miles above.

The results obtained at the new station are considered good.

The gage is of the inclined-rod type and is located on the left bank of the stream, near the residence of the observer. The gage datum has remained the same. All measurements are made by wading.

The following discharge measurement was made by R. Richards:

March 25, 1910: Width, 71 feet; area, 182 square feet; gage height, 4.76 feet; discharge, 156 second-feet.

Daily gage height, in feet, of Big Muddy River near Culbertson, Mont., for 1910.

[Gustave Sholtz, observer.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	.....	4.5	2.65	2.4	2.75	1.7	1.75
2	.....	4.5	2.6	2.4	2.6	1.75	1.7
3	.....	4.5	2.5	2.45	2.65	1.7	1.7
4	.....	4.5	2.55	2.3	2.5	1.7	1.75
5	.....	4.15	2.5	2.3	2.5	1.75	1.7
6	7.1	4.2	2.55	2.45	2.45	1.7	1.75
7	7.1	3.8	2.4	2.4	2.4	1.75	1.7
8	7.05	3.8	2.4	2.45	2.45	1.7	1.7
9	7.1	3.8	2.45	2.4	2.4	1.7	1.75
10	7.2	3.75	2.4	2.5	2.3	1.75	1.7
11	7.2	3.8	2.45	2.55	2.35	1.7	1.7
12	7.25	3.8	2.4	3.5	2.3	1.75	1.75
13	7.3	3.7	2.4	3.75	2.35	1.7	1.7
14	7.3	3.7	2.45	3.5	2.3	1.7	1.75
15	7.15	3.65	2.4	3.2	2.3	1.75	1.6
16	7.1	3.7	2.45	3.05	2.25	1.7	1.6
17	7.1	3.2	2.4	2.7	2.1	1.75	1.65
18	6.95	3.2	2.4	2.75	2.15	1.7	1.6
19	7.0	3.25	2.45	2.7	2.1	1.7	1.65
20	6.8	3.1	2.5	2.7	2.1	1.75	1.6
21	6.8	2.85	2.45	2.75	2.05	1.7	1.6
22	6.45	2.8	2.4	2.7	2.0	1.75	1.65
23	6.5	2.8	2.3	2.75	1.95	1.7	1.6
24	6.2	2.85	2.35	2.7	1.9	1.7	1.65
25	5.45	2.8	2.3	2.7	1.8	1.75	1.6
26	4.8	2.75	2.35	2.75	1.85	1.7	1.6
27	4.6	2.7	2.4	2.7	1.8	1.75	1.65
28	4.6	2.7	2.4	2.75	1.85	1.7	1.6
29	4.5	2.75	2.55	2.7	1.8	1.7	1.65
30	4.4	2.7	2.6	2.8	1.7	1.75	1.7
31	4.4	.....	2.55	.....	1.75	1.7	.....

Daily discharge, in second-feet, of Big Muddy River near Culbertson, Mont., for 1910.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	.....	129	5.8	3.2	7.3	0.5	0.6
2	.....	129	5.2	3.2	5.2	.6	.5
3	.....	129	4.1	3.6	5.8	.5	.5
4	.....	129	4.6	2.5	4.1	.5	.6
5	.....	92	4.1	2.5	4.1	.6	.5
6	436	97	4.6	3.6	3.6	.5	.6
7	436	59	3.2	3.2	3.2	.6	.5
8	430	59	3.2	3.6	3.6	.5	.5
9	436	59	3.6	3.2	3.2	.5	.6
10	448	55	3.2	4.1	2.5	.6	.5
11	448	59	3.6	4.6	2.8	.5	.5
12	454	59	3.2	36	2.5	.6	.6
13	460	51	3.2	55	2.8	.5	.5
14	460	51	3.6	36	2.5	.5	.6
15	442	47	3.2	19	2.5	.6	.3
16	436	51	3.6	14	2.2	.5	.3
17	436	19	3.2	6.5	1.6	.6	.4
18	418	19	3.2	7.3	1.8	.5	.3
19	424	21	3.6	6.5	1.6	.5	.4
20	400	15	4.1	6.5	1.6	.6	.3
21	400	9.1	3.6	7.3	1.4	.5	.3
22	358	8.1	3.2	6.5	1.3	.6	.4
23	364	8.1	2.5	7.3	1.2	.5	.3
24	328	9.1	2.8	6.5	1.0	.5	.4
25	238	8.1	2.5	6.5	.7	.6	.3
26	162	7.3	2.8	7.3	.8	.5	.3
27	140	6.5	3.2	6.5	.7	.6	.4
28	140	6.5	3.2	7.3	.8	.5	.3
29	129	7.3	4.6	6.5	.7	.5	.4
30	118	6.5	5.2	8.1	.5	.6	.5
31	118	.....	4.6	.....	.6	.5	.....

NOTE.—These discharges are based on a rating curve fairly well defined below 160 second-feet. Below 8.1 second-feet the 1909 rating was used.

Monthly discharge of Big Muddy River near Culbertson, Mont., for 1910.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
January	.....	.....	0	0	
February	.....	.....	0	0	
March	460	.....	[a] 326	20,000	C.
April	129	6.5	46.9	2,790	B.
May	5.8	2.5	3.69	227	C.
June	55	2.5	9.80	583	C.
July	7.3	.5	2.39	147	C.
August	.6	.5	.54	33	C.
September	.6	.3	.44	26	C.
October	.....	.....	0	0	
November	.....	.....	0	0	
December	.....	.....	0	0	
The year	.....	.....	32.5	23,800	

[a] Discharge estimated Mar. 1 to 5.

NOTE.—There was little or no flow during months of January, February, October, November, and December.

YELLOWSTONE RIVER BASIN.

DESCRIPTION.

The upper Yellowstone rises in the Shoshone Mountains, in northwestern Wyoming, near the southeast corner of the Yellowstone National Park, flows northwestward for 40 or 50 miles, and then enters Yellowstone Lake, which may be considered the great source of the main river. This lake is about 15 miles long by 20 miles wide, lies at an elevation of 7,778 feet above the sea, and is hemmed in on every side by lofty mountains, from whose snow-covered slopes its chief supply of water must come, since it receives no important streams. Issuing from the lake at the north end, the river flows northwestward for 10 to 15 miles, plunges over the Great Falls of the Yellowstone, and for the next 20 miles runs through its "Grand Canyon," which is impassable throughout. About 80 miles from the lake it emerges from the Snow Mountains, and thence runs eastward and northeastward until it joins the Missouri at Fort Buford, N. Dak. At this point it has an elevation of about 1,900 feet.

As it leaves the mountains the river is about 600 feet wide; thence to Clark Fork, which enters from the south about 15 miles above Billings, Mont., it is characterized by bold, sweeping curves and many islands. Between Clark Fork and the mouth of the Bighorn it is from 1,500 to 1,800 feet wide, is free from rapids, and has a current from 3 to 4 miles an hour. Between the Bighorn and the Powder the main stream increases in width from 2,400 to 2,700 feet and becomes turbid, like the Missouri. Below the mouth of the Powder the banks are low and caving, and the stream contains some rapids and shoals and numerous densely timbered islands.

The Yellowstone is about 500 miles long; the area of its basin is approximately 67,500 square miles.

Of the tributaries of the Yellowstone the most important is the Bighorn,[1] which has its source in the many small streams draining the slopes of the Wind River Range. Other important tributaries of the Yellowstone are the Shields, Boulder, Big Timber, Sweetgrass, Stillwater, Clark Fork, Tongue, and Powder rivers. Shields, Big Timber, and Sweetgrass rivers have their sources in the Crazy Mountains, rising to an elevation of 10,000 feet; the Boulder, Stillwater, and Clark Fork rise on the southeastern slope of the Shoshone Mountains, at an elevation of 10,500 feet. Powder and Tongue rivers have their source in the high plains region and Bighorn Mountains of Wyoming, flowing parallel and in a northeasterly direction until they join the Yellowstone.

[1] See description of Bighorn basin on pp. 173-175.

The headwaters of the Yellowstone and many of its tributaries drain portions of heavily timbered areas. The Yellowstone, Crazy Mountain, Bighorn, and Otter national forests are thus drained. However, the greater part of the drainage basin lies within the plains section and is treeless except for a few willows and cottonwoods along the stream channels.

The mean annual rainfall in Yellowstone Park is approximately 17 inches; at Billings, 15 inches; Glendive, 10 inches; and at Buford, 12½ inches. A greater portion of the rainfall occurs in June. Snow lies in the mountains from November to June. The streams are partly frozen during the colder months.

The great areas of irrigable land and the abundant water supply afford wonderful opportunities for irrigation in the Yellowstone basin. The United States Reclamation Service has practically completed irrigation projects diverting water from the Yellowstone and reclaiming 100,000 acres of arid land. The Shoshone project, reclaiming 132,000 acres, is partly finished. Several private irrigation projects are completed and more are under construction.

Many possible reservoir sites for the storage of flood water are found on the upper portion of the Yellowstone and its tributaries. Shoshone dam, 325 feet high, on the Shoshone River, stores 456,000 acre-feet.

The Yellowstone basin contains many natural power sites. The abundance of water and the magnitude of fall in the higher altitudes make the development of hydroelectric power most feasible. Power for municipal purposes is now generated at Livingston, Big Timber, and Billings.

The run-off record extends back to 1889, although a few stream measurements were made on the Yellowstone River in the national park as early as 1878. The wettest year recorded at Livingston from 1897 to 1908 was 1899; the driest was 1905.

YELLOWSTONE RIVER AT CORWIN SPRINGS, MONT.

This station was established September 2, 1910, in the canyon at Corwin Springs, Mont., 8 miles below Gardiner, one of the entrances to Yellowstone National Park. Gardiner River is the most important tributary between the station and Yellowstone Lake.

A staff gage is nailed to the right-bank wooden pier on lower side of highway bridge. Discharge measurements are made from the downstream side of highway bridge.

The bed of the stream is rocky and free from vegetation.

Practically no water is diverted from the Yellowstone near this station.

Sufficient measurements have not been made to develop a rating curve.

The following discharge measurement was made by Raymond Richards:

September 2, 1910: Width, 238 feet; area, 585 square feet; gage height, 1.80 feet; discharge, 1,710 second-feet.

Daily gage height, in feet, of Yellowstone River at Corwin Springs, Mont., for 1910.

[C. H. Wilks, observer.]

Day.	Sept.	Oct.	Nov.	Dec.	Day.	Sept.	Oct.	Nov.	Dec.
1	.....	1.4	1.2	1.1	16	1.6	1.4	1.0	.....
2	1.8	1.4	1.2	1.1	17	1.6	1.4	1.1	.....
3	1.7	1.4	1.2	1.1	18	1.6	1.4	1.1	.....
4	1.7	1.5	1.2	1.1	19	1.5	1.4	1.1	.....
5	1.7	1.5	1.1	1.0	20	1.5	1.3	1.0	.....
6	1.7	1.5	1.1	1.1	21	1.5	1.3	1.1	.....
7	1.7	1.4	1.1	1.0	22	1.6	1.3	1.1	.....
8	1.7	1.4	1.1	1.0	23	1.6	1.3	1.1	.....
9	1.6	1.4	1.2	1.0	24	1.5	1.3	1.1	.....
10	1.5	1.4	1.2	1.0	25	1.5	1.3	1.1	.....
11	1.6	1.4	1.2	1.0	26	1.5	1.3	1.2	.....
12	1.6	1.4	1.1	1.0	27	1.5	1.2	1.0	.....
13	1.6	1.5	1.2	.....	28	1.5	1.2	1.0	.....
14	1.6	1.4	1.1	.....	29	1.5	1.2	1.1	.....
15	1.6	1.4	1.0	.....	30	1.4	1.2	1.1	.....
					31	.....	1.2	.....	.....

NOTE.—Ice Dec. 13 to 31.

YELLOWSTONE RIVER AT HUNTLEY, MONT.

This station, which is located at the new steel highway bridge 1 mile below Huntley, Mont., and replaces that formerly maintained at Junction, was established October 1, 1907, to obtain data applicable to irrigation and power development.

The only tributary near the station is Pryor Creek, which enters the Yellowstone 1 mile above. The drainage area at Huntley is about 12,000 square miles.

The Huntley canal, built by the United States Reclamation Service, takes water from the river about 2 miles above the gaging station; its normal capacity is 400 second-feet, and it supplies water for 29,000 acres of land. Near Laurel are the head gates of the Billings Land & Irrigation Co.'s large canal, which carries about 305 second-feet and irrigates 28,000 acres. Many small ditches take water from the tributaries of the Yellowstone, but few from the stream itself, owing to the variation of the stages of the water surface and consequent difficulty in diversion.

This river freezes entirely over in places during the winter, but during the coldest seasons open channels with floating ice are not uncommonly seen. Conditions for obtaining accurate data at this station are only fair, as the channel is shifting and extra measurements are necessary to obtain a good rating curve.

Measurements are made from the downstream side of the bridge. The chain gage used at this station is fastened to the bridge rail. The gage datum has remained unchanged.

Discharge measurements of Yellowstone River at Huntley, Mont., in 1910.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 10	W. A. Lamb	230	2,510	5.68	18,400
June 3	Raymond Richards	535	4,640	8.08	30,600
July 18	....do	234	1,860	3.78	7,970
26	J. C. Beebe	240	1,820	3.62	8,030
Aug. 10	W. A. Lamb	216	1,590	2.82	4,090
24	....do	200	1,540	2.50	3,300
Nov. 13	....do	207	1,540	2.52	3,310

Daily gage height, in feet, of Yellowstone River at Huntley, Mont., for 1910:

[Arthur Foster, observer.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	2.50	5.70	7.75	5.10	.....	2.45	2.75	2.50	2.35
2	.....	2.50	5.70	8 40	5.10	.....	2.40	2.70	2.50	2.42
3	.....	2.50	5.40	8.10	4.90	.....	2.40	2.70	2.50	2.45
4	.....	2.50	5.30	7.00	4.80	.....	2.40	2.70	2.50	2.50
5	.....	2.50	5.10	6.40	4.60	.....	2.40	2.70	2.50	2.52
6	.....	2.50	5.10	6.10	4.60	.....	2.40	2.70	2.50	2.52
7	.....	2.50	5.00	6.10	4.50	.....	2.40	2.70	2.50	2.55
8	.....	2.40	5.10	6.00	4.30	.....	2.40	2.70	2.50	2.55
9	.....	2.40	5.50	6.00	4.20	.....	2.40	2.70	2.50	2.55
10	.....	2.50	5.70	5.90	4.10	2.85	2.40	2.75	2.52	2.57
11	5.20	2.60	6.70	6.00	4.00	2.85	2.40	2.70	2.50	2.50
12	5.00	2.60	6.50	6.10	4.00	2.65	2.60	2.70	2.50	2.45
13	3.50	3.00	6.30	6.10	4.00	2.75	2.50	2.60	2.50	2.38
14	3.00	3.05	6.20	6.10	3.90	2.40	2.50	2.60	2.47	2.35
15	2.60	3.10	6.20	6.20	3.80	2.90	2.50	2.60	2.47	2.35
16	2.50	3.10	6.00	6.20	3.80	2.80	2.40	2.60	2.45	2.35
17	2.60	3.10	5.70	6.30	3.80	2.75	2.40	2.75	2.45	2.35
18	2.60	3.30	5.40	6.50	3.90	2.70	2.40	2.75	2.45	2.35
19	2.60	3.30	5.20	6.40	3.90	2.70	2.40	2.75	2.55	2.35
20	2.60	3.40	5.00	6.40	3.90	2.60	2.40	2.65	2.47	2.35
21	2.65	3.50	5.00	6.20	3.80	2.60	2.60	2.65	2.47	2.35
22	2.70	3.50	4.90	6.20	3.80	2.50	2.70	2.60	2.48	2.35
23	2.90	3.60	5.00	6.00	4.40	2.50	3.00	2.60	2.48	2.35
24	2.90	3.80	5.40	5.70	4.50	2.50	3.00	2.60	2.48	2.35
25	2.90	4.00	6.00	5.40	4.00	2.50	3.10	2.65	2.48	2.35
26	2.80	4.30	6.80	5.20	3.60	2.45	3.15	2.65	2.48	2.32
27	2.80	4.60	6.80	5.20	3.50	2.45	3.00	2.65	2.45	2.32
28	2.70	4.90	6.90	5.20	3.40	2.45	2.90	2.60	2.40	2.32
29	2.60	5.40	6.60	5.10	3.35	2.45	2.90	2.60	2.35	2.30
30	2.60	5.90	6.50	5.10	3.30	2.45	2.85	2.55	2.35	2.30
31	2.60	.....	6.80	.....	3.20	2.45	.....	2.55	.....	2.28

NOTE.—Ice January and February. Water away from gage Aug. 1 to 9.

Daily discharge, in second-feet, of Yellowstone River at Huntley, Mont., for 1910.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	5,010	18,500	29,000	14,000	5,520	3,080	4,050	3,240	2,760
2	.....	5,010	18,500	31,600	14,000	5,390	2,920	3,880	3,240	2,980
3	.....	5,010	17,000	30,600	13,000	5,270	2,920	3,880	3,240	3,080
4	.....	5,010	16,500	24,300	12,500	5,140	2,920	3,880	3,240	3,240
5	.....	5,010	15,400	20,900	11,600	5,020	2,920	3,880	3,240	3,300
6	.....	5,010	15,400	19,200	11,600	4,890	2,920	3,880	3,240	3,300
7	.....	5,010	15,000	19,200	11,200	4,760	2,920	3,880	3,240	3,400
8	.....	4,730	15,400	18,700	10,300	4,630	2,920	3,880	3,240	3,400
9	.....	4,730	17,500	18,700	9,840	4,500	2,920	3,880	3,240	3,400
10	.....	5,010	18,500	18,200	9,400	4,390	2,920	4,050	3,300	3,460
11	16,000	5,300	23,900	18,700	8,960	4,390	2,920	3,880	3,240	3,240
12	15,000	5,300	22,600	19,200	8,960	3,720	3,560	3,880	3,240	3,080
13	8,230	6,520	21,600	19,200	8,960	4,050	3,240	3,560	3,240	2,860
14	6,520	6,680	21,000	19,200	8,520	2,920	3,240	3,560	3,140	2,760
15	5,300	6,840	20,900	19,800	8,080	4,560	3,240	3,560	3,140	2,760
16	5,010	6,840	20,000	19,800	8,080	4,220	2,920	3,560	3,080	2,760
17	5,300	6,840	18,400	20,300	8,080	4,050	2,920	4,050	3,080	2,760
18	5,300	7,500	17,000	21,400	8,520	3,880	2,920	4,050	3,080	2,760
19	5,300	7,500	15,900	20,900	8,520	3,880	2,920	4,050	3,400	2,760
20	5,300	7,860	15,200	20,900	8,520	3,560	2,920	3,720	3,140	2,760
21	5,450	8,230	15,200	19,800	8,080	3,560	3,560	3,720	3,140	2,760
22	5,600	8,230	15,000	19,800	8,080	3,240	3,880	3,560	3,180	2,760
23	6,200	8,610	15,600	18,700	10,700	3,240	4,910	3,560	3,180	2,760
24	6,200	9,400	17,200	17,100	11,200	3,240	4,910	3,560	3,180	2,760
25	6,200	10,200	19,900	15,500	8,960	3,240	5,270	3,720	3,180	2,760
26	5,900	11,600	24,000	14,500	7,220	3,080	5,460	3,720	3,180	2,670
27	5,900	13,000	24,000	14,500	6,810	3,080	4,910	3,720	3,080	2,670
28	5,600	14,500	24,600	14,500	6,410	3,080	4,560	3,560	2,920	2,670
29	5,300	17,000	23,200	14,000	6,220	3,080	4,560	3,560	2,760	2,600
30	5,300	19,600	22,800	14,000	6,020	3,080	4,390	3,400	2,760	2,600
31	5,300	.....	26,600	.....	5,640	3,080	.....	3,400	.....	2,540

NOTE.—These discharges are based on rating curves applicable as follows: Mar. 11 to May 10, fairly well defined; May 11 to June 3, indirect method for shifting channels used; June 4 to Dec. 31, fairly well defined. Discharges Aug. 1 to 9 interpolated.

Monthly discharge of Yellowstone River at Huntley, Mont., for 1910.

[Drainage area 12,000 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
January	.....	.....	[a] 3,000	0.250	0.29	184,000	
February	.....	.....	[a] 2,900	.242	.25	161,000	
March	.....	.....	[a] 8,330	.693	.80	512,000	B.
April	19,600	4,730	7,640	.637	.71	455,000	B.
May	26,600	15,000	19,100	1.59	1.83	1,170,000	B.
June	31,600	14,000	19,700	1.64	1.83	1,170,000	B.
July	14,000	5,640	9,290	.774	.89	571,000	B.
August	5,520	3,080	3,980	.332	.38	245,000	B.
September	5,460	2,920	3,550	.296	.33	211,000	B.
October	4,050	3,400	3,870	.322	.37	238,000	B.
November	3,300	2,760	3,160	.263	.29	188,000	B.
December	3,460	2,540	2,920	.243	.28	180,000	C.
The year	26,600	2,540	7,280	.607	8.25	5,280,000	

[a] Discharge estimated Jan. 1 to Mar. 10.

NOTE.—The means for January and February are only approximate.

YELLOWSTONE RIVER AT GLENDIVE, MONT.

This station, which was established in 1893 by the United States War Department, was transferred to the Department of Agriculture, which has kept daily records of river height. When a study of the lower Yellowstone Valley was begun in 1903 the station was taken up by the United States Geological Survey, whose records began August 1, 1903. The station is located at the steel highway bridge leading northward from Glendive, about one-fourth mile from the post office. The records are used to determine the amount of water available for the lower Yellowstone project and other irrigation enterprises. The drainage area of Yellowstone River at Glendive is 66,100 square miles.

The only large diversion from the Yellowstone near Glendive is the lower Yellowstone canal, built by the United States Reclamation Service. It leaves the river 18 miles below Glendive and diverts water to irrigate 66,000 acres of land.

A standard chain gage fastened to a bridge rail is used, and since 1903 no change in gage datum has been made. All measurements are made from the bridge. The records obtained at this station are good during the open season, although in low water the old piling and cribwork of a former bridge somewhat obstruct the flow. Ice usually exists from December to April.

Discharge measurements of Yellowstone River at Glendive, Mont., in 1910.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
June 11	W. A. Lamb	857	6,230	6.56	33,500
Aug. 11	do	724	3,100	2.58	8,840

Daily gage height, in feet, of Yellowstone River at Glendive, Mont., for 1910.

[E. C. Andrews, observer.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	2.3	5.9	6.65	5.3	3.1	1.4	2.6	1.3	1.5
2	4.7	2.15	6.1	6.9	5.25	3.05	1.4	2.2	1.3	3.5
3	5.7	2.1	5.95	7.4	5.1	3.0	1.35	1.75	1.3	3.6
4	.....	2.0	5.55	7.55	5.0	2.95	1.3	1.6	1.3	3.6
5	.....	2.0	5.2	7.85	4.95	2.85	1.3	1.5	1.3	3.6
6	.....	2.0	4.95	7.4	4.85	2.8	1.3	1.5	1.3	3.7
7	.....	1.95	4.65	7.1	4.8	2.7	1.3	1.4	1.3	3.7
8	7.85	1.9	5.05	7.05	4.7	2.7	1.3	1.4	1.3	3.9
9	7.35	1.8	5.45	7.85	4.55	2.6	1.2	1.4	1.3	3.9
10	6.35	1.8	5.05	7.0	4.45	2.6	1.2	1.4	1.3	3.9
11	5.9	1.8	5.2	6.5	4.25	2.6	1.3	1.3	1.3	3.9
12	5.5	1.8	5.35	5.95	3.95	2.5	1.3	1.3	1.3	3.9
13	5.3	1.85	5.8	5.65	3.8	2.5	1.3	1.3	1.3	4.0
14	4.85	2.15	6.8	5.9	3.7	2.4	1.3	1.3	1.3	4.0
15	4.15	2.6	6.8	5.75	3.6	2.4	1.4	1.2	1.2	4.1

Daily gage height, in feet, of Yellowstone River at Glendive, Mont., for 1910—Contd.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
16	4.0	2.75	6.85	5.85	3.5	2.4	1.4	1.2	1.2	4.2
17	3.6	2.95	7.0	5.85	3.4	2.25	1.3	1.2	1.2	4.2
18	3.35	3.0	6.95	5.8	3.35	2.15	1.3	1.2	1.2	4.2
19	3.1	2.9	6.55	6.05	3.3	2.0	1.3	1.3	1.3	4.2
20	2.95	2.75	6.1	6.15	3.3	2.0	1.3	1.3	1.3	4.2
21	2.8	2.6	5.95	6.4	3.35	1.9	1.3	1.3	1.3	4.2
22	2.7	2.65	5.65	6.3	3.4	1.8	1.45	1.3	1.3	4.2
23	2.7	2.9	5.6	6.15	3.75	1.7	1.8	1.3	1.3	4.2
24	2.8	3.5	5.6	6.0	4.1	1.6	2.25	1.3	1.3	4.2
25	2.85	3.65	5.4	5.8	4.25	1.6	2.7	1.3	1.3	4.2
26	2.95	3.6	5.35	5.75	4.05	1.6	3.6	1.3	1.3	4.2
27	3.3	3.75	5.8	5.75	3.8	1.5	4.15	1.3	1.3	4.2
28	2.95	4.15	6.6	5.6	3.4	1.5	4.05	1.3	1.3	4.2
29	.....	4.65	6.9	5.5	3.2	1.5	3.9	1.3	1.3	4.2
30	2.5	5.15	7.0	5.3	3.2	1.5	3.3	1.3	1.3	4.2
31	2.4	.....	7.1	.....	3.1	1.5	.....	1.3	.....	4.2

NOTE.—River frozen January, February, Mar. 1 to 4. Ice breaking up Mar. 4. River clear Mar. 8. River frozen again Dec. 2.

Daily discharge, in second-feet, of Yellowstone River at Glendive, Mont., for 1910.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	8,160	27,700	34,500	23,100	10,900	5,760	9,120	5,540
2	.....	7,720	29,400	37,000	22,700	10,700	5,760	7,860	5,540
3	.....	7,570	28,200	42,400	21,700	10,500	5,650	6,610	5,540
4	.....	7,290	24,900	44,000	21,100	10,400	5,540	6,230	5,540
5	.....	7,290	22,400	47,600	20,700	9,990	5,540	5,990	5,540
6	.....	7,290	20,700	42,400	20,100	9,810	5,540	5,990	5,540
7	.....	7,150	18,800	39,100	19,800	9,460	5,540	5,760	5,540
8	47,600	7,010	21,400	38,600	19,200	9,460	5,540	5,760	5,540
9	41,800	6,740	24,200	47,600	18,200	9,120	5,330	5,760	5,540
10	31,700	6,740	21,400	38,000	17,600	9,120	5,330	5,760	5,540
11	27,700	6,740	22,400	33,000	16,500	9,120	5,540	5,540	5,540
12	24,600	6,740	23,400	28,200	14,900	8,790	5,540	5,540	5,540
13	23,100	6,880	26,900	25,700	14,100	8,790	5,540	5,540	5,540
14	20,100	7,720	36,000	27,700	13,600	8,470	5,540	5,540	5,540
15	15,900	9,120	36,000	26,500	13,100	8,470	5,760	5,330	5,330
16	15,100	9,640	36,400	27,300	12,600	8,470	5,760	5,330	5,330
17	13,100	10,400	38,000	27,300	12,200	8,010	5,540	5,330	5,330
18	12,000	10,500	37,500	26,900	12,000	7,720	5,540	5,330	5,330
19	10,900	10,200	33,500	29,000	11,700	7,290	5,540	5,540	5,540
20	10,400	9,640	29,400	29,900	11,700	7,290	5,540	5,540	5,540
21	9,810	9,120	28,200	32,100	12,000	7,010	5,540	5,540	5,540
22	9,460	9,290	25,700	31,200	12,200	6,740	5,880	5,540	5,540
23	9,460	10,200	25,300	29,900	13,800	6,480	6,740	5,540	5,540
24	9,810	12,600	25,300	28,600	15,600	6,230	8,010	5,540	5,540
25	9,990	13,400	23,800	26,900	16,500	6,230	9,460	5,540	5,540
26	10,400	13,100	23,400	26,500	15,400	6,230	13,100	5,540	5,540
27	11,700	13,800	26,900	26,500	14,100	5,990	15,900	5,540	5,540
28	10,400	15,900	34,000	25,300	12,200	5,990	15,400	5,540	5,540
29	[a] 9,600	18,800	37,000	24,600	11,300	5,990	14,600	5,540	5,540
30	8,790	22,100	38,000	23,100	11,300	5,990	11,700	5,540	5,540
31	8,470	.....	39,100	.....	10,900	5,990	.....	5,540	.....

[a] Interpolated.

NOTE.—These discharges are based on a rating curve that is well defined. All measurements made at this station were considered in developing the rating curve.

Monthly discharge of Yellowstone River at Glendive, Mont., for 1910.

[Drainage area, 66,100 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
January	.....	.....	[a]5,500	0.083	0.01	338,000	
February	.....	.....	[a]5,000	.076	.08	278,000	
March	.....	.....	[a]18,800	.284	.33	1,160,000	C.
April	22,100	6,740	9,960	.151	.17	593,000	A.
May	39,100	18,800	28,600	.433	.50	1,760,000	A.
June	47,600	23,100	32,200	.487	.54	1,920,000	A.
July	23,100	10,900	15,500	.234	.27	953,000	A.
August	10,900	5,990	8,090	.122	.14	497,000	A.
September	15,900	5,330	7,260	.110	.12	432,000	A.
October	9,120	5,330	5,820	.088	.10	358,000	B.
November	5,540	5,330	5,510	.083	.09	328,000	B.
December	.....	.....	[a]4,500	.068	.08	277,000	
The year	.....	.....	12,300	.186	2.52	8,890,000	

[a] Discharge estimated Jan. 1 to Mar. 7 and Dec. 1 to 31.

NOTE.—The means for January, February, and December are only approximate.

BIG TIMBER CREEK BASIN.

NORTH FORK OF BIG TIMBER CREEK NEAR BIG TIMBER, MONT.

This station, which was established May 6, 1907, is located 1 mile above the Tintinger ranch, 15 miles northwest of Big Timber, just above the junction with the South Fork.

The source of North Fork is two lakes in the Crazy Mountains. These lakes form excellent reservoir sites. It is proposed to utilize the flow of the North Fork in connection with a project under the Carey Act. The drainage area above the station is only 40 square miles.

Several ditches above the station divert water to irrigate approximately 300 acres of land. A large ditch appropriating 50,000 inches of water has its head gate just below the gage. This appropriation includes both forks. The water rights on Big Timber Creek have never been adjudicated.

A staff gage is located on the left bank of the stream. Its datum has remained constant. Measurements are made by wading.

At the gaging station the bed of the stream is composed of bowlders and coarse gravel, and is probably permanent. Results obtained during the open season are good.

Discharge measurements of North Fork of Big Timber Creek near Big Timber, Mont., in 1910.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Apr. 8	W. A. Lamb	17	12	1.03	22
May 8	Raymond Richards	38	37	1.84	98
June 8	do	35	30	1.58	67
July 9	do	19	14	.99	19
Aug. 18	C. S. Heidel	17	8.9	.73	7.7
Oct. 5	do	18	13	.97	17
Dec. 14[a]	do	18	14	1.02	16

[a] Ice.

NOTE.—All measurements made by wading near gage.

Daily gage height, in feet, of North Fork of Big Timber Creek near Big Timber, Mont., for 1910.

[N. J. Tintinger, observer.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1	.....	1.18	1.63	.....	0.75	0.90	1.00	0.95
2	.....	1.18	1.63	.....	.75	.90	1.00	1.00
3	.....	1.23	1.73	.....	.75	1.10	.90	.95
4	.....	1.18	1.88	.....	.80	1.10	.90	1.00
5	.....	1.08	1.78	.....	.75	.95	.80	.97
6	.....	1.08	1.93	.....	.75	1.00	.70	.....
7	.....	1.03	1.93	.....	.75	1.00	.75	.....
8	0.93	1.03	1.98	1.20	.75	1.00	.75	.....
9	.98	1.03	2.00	1.20	1.00	1.10	.75	.....
10	.98	1.13	2.00	1.30	.95	.95	.65	.....
11	1.08	1.13	2.00	1.30	.95	1.00	.75	.....
12	.98	1.23	.....	1.30	.80	1.00	.80	.....
13	1.03	1.23	.....	1.30	.75	1.20	.70	.....
14	1.03	1.33	.....	1.25	.75	1.10	1.20	.....
15	1.08	1.33	.....	1.30	1.05	.95	1.20	.....
16	1.08	1.43	.....	1.30	1.10	1.00	1.15	.....
17	1.08	1.53	.....	1.25	1.00	.85	1.25	.....
18	1.13	1.53	.....	1.20	1.00	.73	1.25	.....
19	1.13	1.53	.....	1.20	1.00	.85	1.25	.....
20	1.13	1.53	.....	1.20	.95	.75	1.20	.....
21	1.08	1.53	.....	1.00	1.00	.85	1.20	.....
22	1.23	1.53	.....	1.00	1.00	.85	1.15	.....
23	1.23	1.53	.....	1.00	.95	.85	1.05	.....
24	1.18	1.53	.....	.90	.95	1.10	1.20	.....
25	1.18	1.63	.....	.80	.90	1.00	1.25	.....
26	1.13	1.63	.....	.80	.95	1.10	.....	.....
27	1.08	1.68	.....	.80	.95	1.00	.....	.....
28	1.08	1.93	.....	.75	.95	.80	.....	.....
29	1.08	1.93	.....	.75	.95	.80	.....	.....
30	1.08	1.88	.....	.75	.85	.75	.....	.....
31	1.13	.....	.....	.....	.90	.90	.....	.....

NOTE.—Ice probably existed January, February. The gage was destroyed May 12. Replaced at same location and datum June 8.

Daily discharge, in second-feet, of North Fork of Big Timber Creek near Big Timber, Mont., for 1910.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1	15	29	78	.....	7.8	14	18	16
2	15	29	78	.....	7.8	14	18	18
3	15	32	96	.....	7.8	24	14	16
4	15	29	128	.....	9.5	24	14	18
5	15	21	106	.....	7.8	16	9.5	17
6	15	23	140	.....	7.8	18	6.2	.....
7	15	20	140	.....	7.8	18	7.8	.....
8	15	20	153	30	7.8	18	7.8	.....
9	17	20	158	30	18	24	7.8	.....
10	17	26	158	37	16	16	5.0	.....
11	23	26	158	37	16	18	7.8	.....
12	17	32	.....	37	9.5	18	9.5	.....
13	20	32	.....	37	7.8	30	6.2	.....
14	20	40	.....	34	7.8	24	30	.....
15	23	40	.....	37	21	16	30	.....
16	23	50	.....	37	24	18	27	.....
17	23	62	.....	34	18	12	34	.....
18	26	62	.....	30	18	7.2	34	.....
19	26	62	.....	30	18	12	34	.....
20	26	62	.....	30	16	7.8	30	.....
21	23	62	.....	18	18	12	30	.....
22	32	62	.....	18	18	12	27	.....
23	32	62	.....	18	16	12	21	.....
24	29	62	.....	14	16	24	30	.....
25	29	78	.....	9.5	14	18	34	.....
26	26	78	.....	9.5	16	24	.....	.....
27	23	87	.....	9.5	16	18	.....	.....
28	23	140	.....	7.8	16	9.5	.....	.....
29	23	140	.....	7.8	16	9.5	.....	.....
30	23	128	.....	7.8	12	7.8	.....	.....
31	26	.....	.....	.....	14	14	.....	.....

NOTE.—These discharges are based on a curve that is well defined below 110 second-feet. Above 24 second-feet it is the same as the 1909 curve.

Monthly discharge of North Fork of Big Timber Creek near Big Timber, Mont., for 1910.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
March	32	15	[a] 20.8	1,280	B.
April	140	20	53.9	3,210	B.
May	158	30	[a] 75.1	4,620	C.
June	37	7.8	[a] 25.7	1,530	B.
July	24	7.8	13.7	842	B.
August	30	7.2	16.4	1,010	B.
September	34	5.0	[a] 20.3	1,210	B.
The period	.....	.....	.....	13,700	

[a] Discharge estimated Mar. 1 to 7, May 12 to June 7, and Sept. 26 to 30.

SOUTH FORK OF BIG TIMBER CREEK NEAR BIG TIMBER, MONT.

This station, which was established May 6, 1907, to determine the amount of water available for irrigation in connection with a Carey Act project, is located 1 mile above Tintinger's ranch, 15 miles northwest of Big Timber. The station is just above the junction with the North Fork.

The drainage area above the station is about 10 square miles. A few diversions are made, and practically all the water is appropriated.

A staff gage is used on the South Fork of Big Timber Creek. Its datum has remained constant. All measurements are made by wading near the gage.

Ice forms at this station during the winter months. The channel is practically permanent and fairly good results have been obtained during the open season.

Discharge measurements of South Fork of Big Timber Creek near Big Timber, Mont., in 1910.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Apr. 8	W. A. Lamb	19	8.6	0.55	9.7
May 8	Raymond Richards	23	19	.95	44
June 8	W. A. Lamb	13	8.7	.66	16.7
July 9	Raymond Richards	13	8.2	.56	8.4
Aug. 18	C. S. Heidel	13	6.5	.48	6.1
Oct. 5	do	17	10.2	.61	14.1
Dec. 14[a]	do	11	5.7	.56	7.6

[a] Ice.

NOTE.—All measurements made by wading near gage.

Daily gage height, in feet, of South Fork of Big Timber Creek near Big Timber, Mont., for 1910.

[N. J. Tintinger, observer.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1	.....	0.64	0.84	0.64	0.60	0.40	0.60	0.55
2	.....	.64	.89	.64	.60	.55	.65	.50
3	.....	.64	.94	.59	.60	.55	.50	.50
4	.....	.59	.96	.59	.55	.55	.60	.45
5	.....	.59	1.04	.64	.55	.40	.60	.61
6	.....	.59	1.04	.64	.55	.50	.50	.....
7	.....	.56	1.04	.64	.55	.50	.60	.....
8	0.54	.56	1.04	.59	.55	.55	.60	.....
9	.54	.56	1.04	.55	.55	.60	.60	.....
10	.54	.56	1.04	.60	.45	.48	.50	.....
11	.56	.59	1.04	.60	.55	.55	.60	.....
12	.56	.64	1.04	.60	.55	.55	.60	.....
13	.59	.69	1.04	.55	.55	.70	.50	.....
14	.59	.69	.64	.55	.55	.65	.70	.....
15	.59	.69	.59	.55	.55	.50	.75	.....
16	.59	.69	.59	.60	.55	.55	.65	.....
17	.59	.74	.64	.60	.55	.55	.75	.....
18	.59	.74	.64	.60	.45	.55	.75	.....
19	.64	.74	.64	.60	.45	.55	.70	.....
20	.66	.74	.59	.55	.35	.45	.60	.....
21	.64	.74	.54	.55	.45	.55	.65	.....
22	.69	.74	.79	.50	.45	.55	.65	.....
23	.69	.74	.74	.45	.45	.55	.50	.....
24	.66	.74	.64	.45	.40	.60	.65	.....
25	.66	.74	.74	.45	.40	.50	.70	.....
26	.64	.74	.64	.45	.40	.55	.....	.....
27	.64	.84	.64	.45	.40	.55	.....	.....
28	.64	1.04	.64	.50	.40	.55	.....	.....
29	.59	1.04	.64	.50	.40	.55	.....	.....
30	.59	.94	.64	.60	.30	.45	.....	.....
31	.64	.....	.74	.....	.40	.60	.....	.....

Daily discharge, in second-feet, of South Fork of Big Timber Creek near Big Timber, Mont., for 1910.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1	9	15	33	15	12	3.5	12	9.6
2	9	15	38	15	12	9.6	16	6.9
3	9	15	43	12	12	9.6	6.9	6.9
4	9	12	45	12	9.6	9.6	12	5.2
5	9	12	54	15	9.6	3.5	12	13
6	9	12	54	15	9.6	6.9	6.9	.....
7	9	10	54	15	9.6	6.9	12	.....
8	9	10	54	12	9.6	9.6	12	.....
9	9	10	54	9.6	9.6	12	12	.....
10	9	10	54	12	5.2	6.2	6.9	.....
11	10	12	54	12	9.6	9.6	12	.....
12	10	15	54	12	9.6	9.6	12	.....
13	12	19	54	9.6	9.6	20	6.9	.....
14	12	19	15	9.6	9.6	16	20	.....
15	12	19	12	9.6	9.6	6.9	24	.....
16	12	19	12	12	9.6	9.6	16	.....
17	12	23	15	12	9.6	9.6	24	.....
18	12	23	15	12	5.2	9.6	24	.....
19	15	23	15	12	5.2	9.6	20	.....
20	17	23	12	9.6	2.8	5.2	12	.....
21	15	23	9	9.6	5.2	9.6	16	.....
22	19	23	27	6.9	5.2	9.6	16	.....
23	19	23	23	5.2	5.2	9.6	6.9	.....
24	17	23	15	5.2	3.5	12	16	.....
25	17	23	23	5.2	3.5	6.9	20	.....
26	15	23	15	5.2	3.5	9.6	18	.....
27	15	33	15	5.2	3.5	9.6	16	.....
28	15	54	15	6.9	3.5	9.6	14	.....
29	12	54	15	6.9	3.5	9.6	12	.....
30	12	43	15	12	2.0	5.2	10	.....
31	15	.....	23	.....	3.5	12	.....	.....

NOTE.—These discharges are based on a curve that is well defined between 5 and 50 second-feet.

Monthly discharge of South Fork of Big Timber Creek near Big Timber, Mont., for 1910.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
March	19	9	12.4	762	B.
April[a]	54	10	21.3	1,270	A.
May	54	9.0	30.2	1,860	A.
June	15	5.2	10.4	619	A.
July	12	2.0	7.14	439	A.
August	20	3.5	9.24	568	A.
September[a]	24	6.9	14.2	845	A.
The period	.....	.....	.....	6,360	

[a] Discharge estimated Mar. 1 to 7 and Sept. 26 to 30.

BOULDER RIVER BASIN.

BOULDER RIVER NEAR CONTACT, MONT.

Boulder River rises in the rugged mountains bordering Yellowstone Park. Below the station it traverses a narrow but well-irrigated country.

Because of its abundant water and rapid fall, this stream possesses many opportunities for water-power development as well as for irrigation.

The gaging station was established May 1, 1910, at the ranch of G. W. Baker, about 8 miles above McLeod post office, and 4 miles from Contact, Mont., and 2½ miles below Boulder Falls.

The gage is fastened to the left bank abutment of the private wagon bridge near the ranch buildings. Discharge measurements in low water may be made by wading just above the footbridge, which is some 400 yards above the gage. Ice is common.

Discharge measurements of Boulder River near Contact, Mont., in 1910.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Apr. 10[a]	W. A. Lamb	56	87	2.60	132
10	do	72	96	2.60	140
June 10	Raymond Richards	120	236	4.25	1,000
July 7	do	75	145	3.52	540
27	C. S. Heidel	72	118	3.05	335
Sept. 3	do	65	70	2.36	105
Oct. 7	do	62	65	2.40	109
Dec. 16	do	58	56	2.03	33

[a] Made from bridge at Baker's ranch. Channel conditions poor.

Daily gage height, in feet, of Boulder River near Contact, Mont., for 1910.

[G. W. Baker, observer.]

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.2	6.4	4.1	3.05	2.3	2.5	2.38	2.2
2	3.15	6.25	4.0	3.05	2.3	2.5	2.38	2.2
3	3.2	5.35	3.9	3.0	2.4	2.5	2.38	2.2
4	3.0	4.85	3.7	2.85	2.45	2.5	2.38	2.2
5	3.4	4.6	3.6	2.75	2.5	2.5	2.38	2.2
6	3.65	4.85	3.9	2.75	2.5	2.5	2.35	2.2
7	4.0	5.0	3.4	2.65	2.52	2.4	2.35	2.2
8	4.6	4.1	3.4	2.65	2.55	2.5	2.35	2.2
9	5.3	4.0	3.3	2.6	2.58	2.5	2.35	2.2
10	5.55	4.9	3.4	2.5	2.58	2.5	2.35	2.2
11	5.75	6.2	3.25	2.5	2.55	2.4	2.35	2.0
12	4.3	5.9	3.2	2.4	2.55	2.4	2.35	2.0
13	4.3	5.3	3.2	2.4	2.55	2.4	2.32	2.0
14	4.1	5.2	3.1	2.4	2.55	2.4	2.32	2.0
15	3.4	5.0	3.1	2.4	2.5	2.4	2.32	2.0
16	3.9	5.1	3.2	2.4	2.5	2.4	2.32	2.0
17	3.65	5.2	3.25	2.3	2.55	2.4	2.3	.....
18	3.9	5.0	3.3	2.3	2.6	2.4	2.3	.....
19	4.1	4.8	3.25	2.3	2.6	2.4	2.3	.....
20	4.05	5.15	3.2	2.3	2.6	2.4	2.3	.....
21	4.1	5.2	3.15	2.3	2.6	2.4	2.3	.....
22	4.05	4.8	3.2	2.25	2.6	2.4	2.3	.....
23	3.9	4.3	3.25	2.2	2.6	2.35	2.3	.....
24	4.25	4.2	3.25	2.15	2.6	2.35	2.3	.....
25	5.3	4.0	3.15	2.15	2.6	2.35	2.3	.....
26	5.4	3.8	3.15	2.1	2.6	2.35	2.3	.....
27	4.9	3.7	3.25	2.05	2.55	2.35	2.2	.....
28	4.4	3.6	3.15	2.1	2.55	2.35	2.2	.....
29	5.2	3.5	3.2	2.15	2.55	2.35	2.2	.....
30	5.4	3.5	3.15	2.2	2.55	2.35	2.2	.....
31	.....	.....	3.05	2.25	.....	.....	.....	.....

NOTE.—Ice after Dec. 16.

Daily discharge, in second-feet, of Boulder River near Contact, Mont., for 1910.

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	396	2,440	904	331	86	139	106	64
2	374	2,380	840	331	86	139	106	64
3	396	1,760	778	310	111	139	106	64
4	310	1,410	659	256	125	139	106	64
5	493	1,240	601	221	139	139	106	64
6	630	1,410	778	221	139	139	98	64
7	840	1,510	493	186	145	111	98	64
8	1,240	904	493	186	154	139	98	64
9	1,720	840	443	170	164	139	98	64
10	1,900	1,440	493	139	164	139	98	64
11	2,040	2,350	420	139	154	111	98	32
12	1,040	2,140	396	111	154	111	98	32
13	1,040	1,720	396	111	154	111	91	32
14	904	1,650	352	111	154	111	91	32
15	493	1,510	352	111	139	111	91	32
16	778	1,580	396	111	139	111	91	32
17	630	1,650	420	86	154	111	86	.....
18	778	1,510	443	86	170	111	86	.....
19	904	1,370	420	86	170	111	86	.....
20	872	1,620	396	86	170	111	86	.....
21	904	1,650	374	86	170	111	86	.....
22	872	1,370	396	75	170	111	86	.....
23	778	1,040	420	64	170	98	86	.....
24	1,000	969	420	55	170	98	86	.....
25	1,720	840	374	55	170	98	86	.....
26	1,790	718	374	46	170	98	86	.....
27	1,440	659	420	39	154	98	64	.....
28	1,100	601	374	46	154	98	64	.....
29	1,650	545	396	55	154	98	64	.....
30	1,790	545	374	64	154	98	64	.....
31	2,120	.....	331	75	.....	102	.....	.....

NOTE.—These discharges are based on a rating curve that is fairly well defined below 1,170 second-feet. Discharges estimated Dec. 17 to 31.

Monthly discharge of Boulder River near Contact, Mont., for 1910.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
May	2,120	310	1,060	65,200	B.
June	2,440	545	1,380	82,100	B.
July	904	331	475	29,200	A.
August	331	39	131	8,060	A.
September	170	86	150	8,930	A.
October	139	98	115	7,070	A.
November	106	64	89.9	5,350	C.
December	64	.....	[a] 42.3	2,600	C.
The period	.....	.....	.....	209,000	

[a] Discharge estimated for ice effect Dec. 17 to 31.

WEST FORK OF BOULDER RIVER NEAR BRUFFEYS, MONT.

This station, which is located at the highway bridge on the Livingston road about 7 miles from Bruffeys and 30 miles from Big Timber, was established May 7, 1904, by the State engineer of Montana, for the purpose of obtaining data in connection with irrigation projects. On May 4, 1907, it was transferred to the United States Geological Survey.

West Fork receives numerous small tributaries which enter from both sides above the station, the largest being Davis Creek, which

comes in from the west 1½ miles upstream. One small irrigation ditch above the station diverts 3 or 4 second-feet of water. The drainage area is 94 square miles.

The channel is composed of small bowlders and coarse gravel and is reasonably permanent. The gage datum has remained unchanged since the station was established and the results obtained are excellent for the entire open season. At times during the winter this stream is open, but during the greater part of this period the gage heights are affected by ice.

A staff gage is located on the bridge from which flood measurements are made. For low and medium stages better results may be obtained by wading.

Discharge measurements of West Fork of Boulder River near Bruffeys, Mont., in 1910.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Apr. 9	W. A. Lamb	62	65	1.48	78
June 9	Raymond Richards	69	129	2.35	400
July 6	do	68	90	1.93	206
26	C. S. Heidel	63	68	1.62	119
Sept. 2	do	60	48	1.35	64
Oct. 6	do	60	51	1.40	68
Dec. 15[a]	do	60	44	1.30	42

[a] Ice.

Daily gage height, in feet, of West Fork of Boulder River near Bruffeys, Mont., for 1910.

[E. W. Gregory, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.
1	1.55	1.30	1.17	1.27	2.08	3.50	2.30	1.60
2	1.55	1.30	1.17	1.22	1.88	3.70	2.10	1.60
3	1.60	1.35	1.17	1.22	1.88	2.65	2.00	1.55
4	1.60	1.40	1.17	1.27	1.98	2.40	1.80	1.55
5	1.65	1.35	1.17	1.27	2.38	2.50	2.10	1.50
6	1.65	1.30	1.17	1.37	2.18	.....	1.93	1.50
7	1.70	1.40	1.17	1.37	2.43	2.80	.....	1.50
8	1.70	1.50	1.17	1.37	2.53	2.80	1.90	1.50
9	1.70	1.50	1.17	1.48	2.68	2.35	1.80	1.60
10	1.70	1.50	1.17	1.52	2.83	2.30	2.00	.....
11	1.70	1.50	1.17	1.67	2.88	2.80	1.90	.....
12	1.70	1.50	1.17	1.77	2.48	3.20	1.80	1.45
13	1.75	1.30	1.17	1.82	2.48	2.80	1.80	1.45
14	1.75	1.30	1.17	1.72	2.43	2.80	1.80	.....
15	1.75	1.20	1.17	1.52	2.38	2.70	1.80	1.40
16	1.75	1.40	1.17	1.57	2.28	2.90	1.80	1.40
17	1.75	1.60	1.17	1.67	.....	2.80	1.80	1.40
18	1.75	1.60	1.17	1.67	2.18	2.65	1.80	1.40
19	1.70	1.70	1.17	1.77	2.48	2.70	2.20	1.40
20	1.70	1.60	1.27	1.97	2.28	2.70	2.20	1.35
21	1.70	1.70	1.47	1.97	2.18	2.75	2.20	1.35
22	1.70	1.80	1.57	1.87	2.18	2.50	2.20	1.35
23	1.60	1.70	1.57	1.87	2.28	2.20	1.80	1.35
24	1.30	1.70	1.52	2.02	2.73	2.50	1.60	1.35
25	1.20	1.80	1.47	2.17	3.08	2.50	1.70	1.30
26	1.30	1.60	1.47	2.37	3.08	2.50	1.62	1.30
27	1.30	1.60	1.37	2.42	2.78	2.50	.....	1.30
28	1.30	1.50	1.37	2.72	2.68	2.40	1.70	.....
29	1.20	.....	1.27	2.57	2.58	2.35	1.70	.....
30	1.20	.....	1.17	2.27	2.88	2.35	1.70	.....
31	1.30	.....	1.37	.....	3.08	.....	1.60	.....

NOTE.—Gage heights Jan. 1 to Feb. 28 affected by ice. No observer after Aug. 27.

Daily discharge, in second-feet, of West Fork of Boulder River near Bruffeys, Mont., for 1910.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Day.	Mar.	Apr.	May.	June.	July.	Aug.
1	35	49	269	1,230	373	110	16	35	103	363	758	164	69
2	35	42	190	1,400	277	110	17	35	128	338	686	164	69
3	35	42	190	582	235	99	18	35	128	314	582	164	69
4	35	49	227	427	164	99	19	35	155	473	616	323	69
5	35	49	416	485	277	88	20	49	224	363	616	323	61
6	35	63	314	586	208	88	21	82	224	314	651	323	61
7	35	63	444	686	202	88	22	103	187	314	485	323	61
8	35	63	504	686	197	88	23	103	187	363	323	164	61
9	35	84	603	400	164	110	24	92	243	637	485	110	61
10	35	92	708	373	235	99	25	82	309	890	485	135	53
11	35	128	744	686	197	88	26	82	411	890	485	115	53
12	35	155	473	985	164	78	27	63	439	672	485	125	53
13	35	171	473	686	164	78	28	63	630	603	427	135	.....
14	35	141	444	686	164	74	29	49	530	536	400	135	.....
15	35	92	416	616	164	69	30	35	358	744	400	135	.....
							31	63	.....	890	.....	110	.....

NOTE.—These discharges are based on a curve that is well defined below 830 second-feet. Discharges interpolated on dates with missing gage heights.

Monthly discharge of West Fork of Boulder River near Bruffeys, Mont., for 1910.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
March	103	35	49.4	3,040	B.
April	630	42	185	11,000	A.
May	890	190	488	30,000	A.
June	1,400	323	613	36,500	A.
July	373	110	198	12,200	A.
August	110	53	[a] 75.3	4,630	A.
The period				97,400	

[a] Discharge Aug. 28 to 31 estimated.

WEST FORK OF BOULDER RIVER AT McLEOD, MONT.

This station was established May 4, 1907, at Koozer's private bridge, several hundred yards upstream from the highway bridge at McLeod post office, to determine the value of the stream for irrigation and power.

The West Fork has no important tributaries, deriving the greater part of its water from melting snow. It joins the main Boulder about one mile below the gaging station. The drainage area above the station is 137 square miles.

Water to irrigate about 800 acres of land is diverted above this station. A Carey Act project reclaiming 12,000 to 15,000 acres is now under investigation, the water to be diverted from the West Fork about 12 miles above the station.

The staff gage is fastened securely to a piling of the bridge near the right bank. The gage datum has remained unchanged. Measurements are made from this bridge or by wading. The bed of the stream is composed of bowlders and is rough but permanent. Ice forms during the winter months, but results obtained are good during the open season.

Discharge measurements of West Fork of Boulder River at McLeod, Mont., in 1910.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Apr. 9	W. A. Lamb	40	50	0.70	86
11	do	54	74	.90	124
June 10	Raymond Richards	55	113	1.65	408
July 6	do	63	98	1.21	227
26	C. S. Heidel	54	80	.75	110
Sept. 3	do	48	62	.46	50
Oct. 7	do	51	65	.66	73
Dec. 16[a]	do	28	26	.....	33

[a] Ice conditions.

Daily gage height, in feet, of West Fork of Boulder River at McLeod, Mont., for 1910.

[Clyde Curtis, observer.]

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	2.9	1.6	0.5	0.5	0.6	0.6	0.55
2	.....	3.0	1.5	.5	.5	.7	.6	.55
3	.....	2.1	1.4	.5	.45	.7	.6	.5
4	.....	1.8	1.4	.4	.45	.7	.55	.5
5	.....	2.0	1.4	.4	.6	.6	.55	.5
6	.....	2.0	1.3	.4	.65	.6	.55	.5
7	.....	2.2	1.3	.4	.65	.6	.55	.5
8	.....	2.4	1.2	.4	.55	.6	.55	.55
9	.....	1.8	1.2	.4	.55	.6	.6	.6
10	.....	1.7	1.2	.4	.55	.6	.6	.55
11	.....	2.1	1.1	.4	.55	.6	.55	.....
12	.....	2.7	1.1	.3	.6	.6	.55	.....
13	.....	2.1	1.0	.3	.6	.6	.55	.....
14	.....	2.3	1.0	.25	.7	.6	.55	.....
15	.....	2.2	1.0	.2	.6	.6	.55	.....
16	.....	2.3	1.0	.2	.6	.6	.5	.....
17	.....	2.2	.9	.2	.6	.6	.5	.....
18	.....	2.3	.9	.2	.6	.65	.5	.....
19	.....	2.2	1.0	.2	.6	.65	.5	.....
20	.....	2.4	1.0	.25	.7	.65	.5	.....
21	.....	2.2	1.3	.25	.7	.6	.5	.....
22	.....	1.9	1.1	.3	.7	.6	.5	.....
23	.....	1.7	.9	.3	.75	.6	.5	.....
24	.....	1.7	.8	.3	.8	.6	.5	.....
25	.....	1.7	.8	.5	.8	.6	.5	.....
26	.....	1.7	.7	.4	.7	.6	.5	.....
27	.....	1.7	.7	.4	.7	.6	.5	.....
28	.....	1.7	.7	.4	.65	.6	.5	.....
29	2.0	1.7	.7	.4	.65	.6	.5	.....
30	2.3	1.7	.6	.5	.6	.6	.55	.....
31	2.7	.....	.6	.6	.....	.6	.....	.....

NOTE.—Ice after Dec. 10.

Daily discharge, in second-feet, of West Fork of Boulder River at McLeod, Mont., for 1910.

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	1,280	390	56	56	69	69	62
2	.....	1,370	345	56	56	85	69	62
3	.....	660	305	56	50	85	69	56
4	.....	490	305	45	50	85	62	56
5	.....	600	305	45	69	69	62	56
6	.....	600	265	45	76	69	62	56
7	.....	725	265	45	76	69	62	56
8	.....	860	230	45	62	69	62	62
9	.....	490	230	45	62	69	69	69
10	.....	440	230	45	62	69	69	62

Daily discharge, in second-feet, of West Fork of Boulder River, at McLeod, Mont., for 1910—Continued.

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov	Dec.
11	.....	660	195	45	62	69	62	.....
12	.....	1,100	195	36	69	69	62	.....
13	.....	660	160	36	69	69	62	.....
14	.....	790	160	32	85	69	62	.....
15	.....	725	160	28	69	69	62	.....
16	.....	790	160	28	69	69	56	.....
17	.....	725	130	28	69	69	56	.....
18	.....	790	130	28	69	77	56	.....
19	.....	725	160	28	69	77	56	.....
20	.....	860	160	32	85	77	56	.....
21	.....	725	265	32	85	69	56	.....
22	.....	545	195	36	85	69	56	.....
23	.....	440	130	36	95	69	56	.....
24	.....	440	105	36	105	69	56	.....
25	.....	440	105	56	105	69	56	.....
26	.....	440	85	45	85	69	56	.....
27	.....	440	85	45	85	69	56	.....
28	.....	440	85	45	76	69	56	.....
29	600	440	85	45	76	69	56	.....
30	790	440	69	56	69	69	62	.....
31	1,100	.....	69	69	.....	69	.....	.....

NOTE.—These discharges are based on a well-defined rating curve. Discharges estimated Dec. 11 to 15 and 17 to 31.

Monthly discharge of West Fork of Boulder River at McLeod, Mont., for 1910.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
June	1,370	440	671	39,900	A.
July	390	69	186	11,400	A.
August	69	28	42.1	2,590	A.
September	105	50	73.3	4,360	A.
October	85	69	71.3	4,380	A.
November	69	56	60.4	3,590	A.
December[a]	69	33	43.5	2,670	C.
The period	.....	.....	.....	67,600	

[a] Discharge estimated Dec. 11 to 31 on basis of measurement made Dec. 16.

SWEETGRASS CREEK BASIN.

SWEETGRASS CREEK ABOVE MELVILLE, MONT.

Sweetgrass Creek rises in the Crazy Mountains and flows southeastward to the Yellowstone, which it joins a short distance below Big Timber. It has no important tributaries. The drainage area is about 47 square miles.

The gaging station, which was established May 5, 1907, to determine the amount of water available for irrigation, storage, and power, is located at C. M. Rein's ranch, 16 miles northwest of Melville and 35 miles from Big Timber, on the site of a reservoir proposed under the Carey Act.

A few small ditches divert water above the station. The stream freezes over during the winter months.

When the station was established, a secondary staff gage, to be used during extreme high water, was installed at a different datum about 300 feet below the regular gage. During the high water of June and July, 1908, the regular gage was undermined and after August 19 readings were discontinued. Beginning October 1, 1908, all gage heights refer to the secondary gage, which is nailed to lower side (right bank) of the footbridge directly behind ranch buildings of observer. The new gage heights are not comparable with the old ones. Discharge measurements are made by wading near the gage at ordinary stages; at high stages a footbridge is used.

The stream bed is composed of rough gravel.

Discharge measurements of Sweetgrass Creek above Melville, Mont., in 1910.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Apr. 8	W. A. Lamb	24	17	1.40	14
May 7	Raymond Richards	54	85	2.52	281
July 9	C. S. Heidel	38	62	2.03	105
Aug. 18	....do	30	42	1.72	41
Oct. 5	....do	36	45	1.97	83
Dec. 14	....do	31	34	1.62	25

Daily gage height, in feet, of Sweetgrass Creek above Melville, Mont., for 1910.

[C. M. Rein, observer.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	1.43	2.26	2.78	2.15	1.85	1.66	1.96	1.82	1.63
2	.....	1.43	2.20	2.83	2.15	1.85	1.66	1.96	1.82	1.63
3	.....	1.43	2.17	2.41	2.12	1.85	1.63	1.96	1.80	1.63
4	.....	1.43	2.14	2.28	2.10	1.85	1.63	.....	1.80	1.61
5	.....	1.43	2.31	2.24	2.08	1.83	1.63	1.97	1.78	1.61
6	.....	.....	2.38	2.21	2.07	1.83	1.63	.....	.....	.....
7	.....	1.41	2.56	2.41	2.05	1.82	1.66	1.96	1.76	.....
8	.....	1.41	2.86	2.44	2.05	1.82	1.68	1.96	1.76	1.61
9	.....	1.43	2.96	2.28	2.02	1.80	1.66	1.96	1.76	1.61
10	.....	1.44	2.96	2.30	2.02	1.80	1.65	1.96	1.76	1.61
11	.....	1.45	2.78	2.42	2.00	1.77	1.65	1.96	.....	1.61
12	.....	1.45	2.50	2.56	1.99	1.77	.....	1.96	1.73	.....
13	1.49	1.46	2.42	2.54	1.97	1.75	1.65	1.96	1.73	.....
14	1.48	1.48	2.41	2.51	1.97	1.75	1.65	1.96	1.73	1.62
15	.....	1.51	2.34	2.52	1.95	1.75	1.65	1.95	1.73	1.62
16	1.46	1.51	2.25	2.66	1.95	1.72	1.65	1.95	1.73	1.62
17	1.46	1.53	2.20	2.61	1.93	1.72	1.65	1.95	1.73	1.62
18	.....	1.53	2.20	2.54	1.93	1.72	1.65	1.93	1.72	1.62
19	1.43	1.54	2.22	2.51	1.92	1.72	1.65	1.93	1.72	1.62
20	1.43	1.57	2.27	2.48	1.92	.....	1.65	1.93	.....	1.61
21	1.43	1.57	2.28	2.61	1.92	.....	1.65	1.91	.....	1.61
22	1.43	1.61	2.28	2.52	1.91	1.70	1.80	1.91	1.68	.....
23	1.43	1.61	2.48	2.25	1.89	1.70	1.90	1.90	1.68	.....
24	1.43	1.63	2.47	2.23	1.89	1.70	1.96	1.90	.....	1.60
25	1.43	1.65	2.71	2.21	1.89	1.69	1.90	1.90	1.68	1.59
26	1.43	1.88	2.74	2.20	1.87	1.69	1.95	1.88	1.68	.....
27	1.43	2.38	2.62	2.18	1.87	1.69	1.96	1.88	.....	.....
28	.....	2.77	2.49	2.16	1.87	1.67	1.96	1.88	.....	.....
29	1.43	2.80	2.41	2.14	1.86	1.67	1.96	1.86	.....	.....
30	1.43	2.42	2.56	2.15	1.85	1.67	1.96	1.84	1.63	.....
31	1.43	.....	2.78	.....	.....	1.65	.....	1.84	.....	.....

NOTE.—Ice in January and February and after Dec. 25.

Daily discharge, in second-feet, of Sweetgrass Creek above Melville, Mont., for 1910.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	18	178	392	142	62	30	88	56	26
2	.....	18	158	415	142	62	30	88	56	26
3	.....	18	149	233	133	62	26	88	52	26
4	.....	18	139	185	127	62	26	89	52	23
5	.....	18	196	172	121	58	26	90	49	23
6	.....	17	222	161	118	58	26	89	47	23
7	.....	16	294	233	112	56	30	88	45	23
8	.....	16	430	245	112	56	32	88	45	23
9	.....	18	477	185	104	52	30	88	45	23
10	.....	18	477	192	104	52	28	88	45	23
11	.....	18	392	237	98	47	28	88	42	23
12	.....	18	269	294	95	47	28	88	40	24
13	20	18	237	286	90	44	28	88	40	24
14	20	20	233	273	90	44	28	88	40	25
15	20	22	207	277	86	44	28	86	40	25
16	19	22	175	337	86	38	28	86	40	25
17	19	24	158	315	80	38	28	86	40	25
18	18	24	158	286	80	38	28	80	38	25
19	18	25	165	273	78	38	28	80	38	25
20	18	27	172	261	78	37	28	80	36	23
21	18	27	185	315	78	36	28	76	34	23
22	18	31	185	277	76	35	52	76	32	23
23	18	31	261	175	71	35	73	73	32	22
24	18	34	257	168	71	35	88	73	32	22
25	18	36	360	161	71	34	73	73	32	21
26	18	77	369	158	67	34	86	69	32	.....
27	18	239	320	152	67	34	88	69	31	.....
28	18	387	265	146	67	31	88	69	30	.....
29	18	401	233	139	65	31	88	65	28	.....
30	18	237	294	142	62	31	88	60	26	.....
31	18	.....	392	.....	62	28	.....	60	.....	.....

NOTE.—These discharges are based on rating curves applicable as follows: Mar. 13 to Apr. 27, fairly well defined; Apr. 28 to Dec. 25, well defined above 20 second-feet. Discharge interpolated for days having no gage heights.

Monthly discharge of Sweetgrass Creek above Melville, Mont., for 1910.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
January	.....	.....	[1] 22	1,350	
February	.....	.....	[1] 19	1,060	
March	20	18	[1] 19.0	1,170	C.
April	401	16	63.1	3,750	B.
May	477	139	258	15,900	A.
June	415	139	236	14,000	A.
July	142	62	91.4	5,620	A.
August	62	28	43.8	2,690	A.
September	88	26	43.9	2,610	A.
October	90	60	80.5	4,950	A.
November	56	26	39.8	2,370	A.
December	26	20	[1] 23.0	1,410	B.
The year	.....	.....	78.3	56,900	

[1] Discharge estimated Jan. 1 to Mar. 12 and Dec. 26 to 31.

NOTE.—The means for January and February are only approximate.

SWEETGRASS CREEK BELOW MELVILLE, MONT.

This station, which was established May 4, 1907, to determine the amount of water available for irrigation, was located at Adams ranch, 9 miles below Melville, 20 miles from Big Timber, and 2½ miles below the head gate of the Glass-Lindsay Land Co.'s canal, a Carey Act

project. It was discontinued April 1, 1909, and a new station was established at McAllister's ranch, about 3 miles above the Adams ranch and just above the head gate of the canal owned by the Glass-Lindsay Land Co.

Many diversions are made on this stream, with a total appropriation of 550 second-feet of adjudicated rights. The Glass-Lindsay canal, partly completed, will carry 575 second-feet and irrigate 30,000 acres. This canal will divert water into two storage reservoirs, with capacities of 12,000 and 6,000 acre-feet, respectively, which will be filled from the spring run-off, the low-water flow being all appropriated.

The staff gage is located on the left bank of the stream, near the observer's house. Measurements are best made by wading at this section.

The stream bed is composed of clean gravel and is nonshifting. Ice forms at this station during the winter season. Records obtained are good.

Discharge measurements of Sweetgrass Creek below Melville, Mont., in 1910.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Apr. 7	W. A. Lamb	34	26	1.09	30
May 7	Raymond Richards	63	77	1.85	172
July 8	C. S. Heidel	18	12	1.03	27
Aug. 17	do	18	13	1.08	28
Oct. 4	do	47	56	1.50	85
Dec. 13[a]	J. C. Beebe	46	33	1.59	54
13[a]	C. S. Heidel	45	32	1.59	57

[a] Ice.

NOTE.—All measurements were made by wading.

Daily gage height, in feet, of Sweetgrass Creek below Melville, Mont., for 1910.

[William Allen, observer.]

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1		2.01	2.08	1.40	1.20	1.00	1.40	1.32
2		1.91	2.10	1.40	1.20	1.00	1.40	1.30
3		1.85	2.02	1.40	1.20	1.00	1.45	1.35
4		1.83	1.92	1.32	1.15	1.05	1.50	1.35
5		1.75	1.88	1.30	1.15	1.08	1.50	1.30
6		1.91	1.78	1.18	1.15	1.10	1.50	1.30
7	1.09	1.84	1.68	1.12	1.10	1.10	1.50	1.30
8		2.05	2.08	1.10	1.05	1.15	1.50	1.30
9		2.08	1.68	1.00	1.02	1.20	1.50	1.32
10	1.44	2.18	1.58	1.00	1.00	1.20	1.50	1.32
11	1.49	2.35	1.52	1.00	1.10	1.20	1.50	1.30
12	1.41	2.08	1.75	1.00	1.15	1.20	1.50	1.32
13	1.44	2.10	1.90	1.10	1.00	1.15	1.50	1.28
14	1.37	1.80	1.95	1.08	1.00	1.15	1.50	1.25
15	1.44	1.98	1.85	1.00	1.10	1.20	1.50	1.20
16	1.38	1.92	2.10	.90	1.10	1.20	1.50	1.20
17	1.42	1.82	2.05	.90	1.10	1.20	1.50	1.20
18	1.42	1.72	2.05	.95	1.00	1.20	1.60	1.20
19	1.42	1.62	1.85	.98	1.00	1.20	1.60	1.25
20	1.38	1.58	1.78	1.00	1.00	1.20	1.52	1.22

Daily gage height, in feet, of Sweetgrass Creek below Melville, Mont., in 1910—Contd.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
21	1.33	1.52	1.68	1.10	1.00	1.50	1.40	1.20
22	1.33	1.58	1.62	1.00	1.00	1.55	1.45	1.20
23	1.36	1.55	1.60	1.20	1.00	1.45	1.42	1.20
24	1.43	1.58	1.58	1.20	1.00	1.30	1.40	1.35
25	1.41	1.72	1.52	1.20	1.00	1.30	1.30	1.45
26	1.40	2.00	1.50	1.20	1.00	1.30	.....	.....
27	1.87	2.15	1.50	1.20	1.00	1.35	.....	.....
28	2.07	2.12	1.50	1.20	1.00	1.40	.....	.....
29	2.27	1.78	1.45	1.20	1.00	1.40	.....	.....
30	2.32	1.78	1.40	1.20	1.00	1.40	1.30	.....
31	.....	2.02	.....	1.20	1.00	.....	1.35	.....

NOTE.—Ice after Nov. 25.

Daily discharge, in second-feet, of Sweetgrass Creek below Melville, Mont., for 1910.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	229	259	67	40	23	67	55
2	.....	194	267	67	40	23	67	52
3	.....	174	233	67	40	23	76	60
4	.....	168	197	55	36	27	85	60
5	.....	144	184	52	36	29	85	52
6	.....	194	152	38	36	31	85	52
7	30	173	124	33	31	31	85	52
8	44	246	259	31	27	36	85	52
9	59	259	124	23	25	40	85	55
10	74	301	101	23	23	40	85	55
11	83	386	89	23	31	40	85	52
12	69	259	144	23	36	40	85	55
13	74	267	190	31	23	36	85	50
14	62	158	208	29	23	36	85	46
15	74	218	174	23	31	40	85	40
16	64	197	267	16	31	40	85	40
17	71	164	246	16	31	40	85	40
18	71	135	246	20	23	40	105	40
19	71	110	174	22	23	40	105	46
20	64	101	152	23	23	40	89	42
21	56	89	124	31	23	85	67	40
22	56	101	110	23	23	95	76	40
23	61	95	105	40	23	76	71	40
24	72	101	101	40	23	52	67	60
25	69	135	89	40	23	52	52	76
26	67	225	85	40	23	52	52	.....
27	180	288	85	40	23	60	52	.....
28	254	276	85	40	23	67	52	.....
29	345	152	76	40	23	67	52	.....
30	371	152	67	40	23	67	52	.....
31	.....	233	.....	40	23	.....	60	.....

NOTE.—These discharges are based on a curve that is well defined. Discharges Apr. 8 and 9 and Oct. 26 to 29 interpolated.

Monthly discharge of Sweetgrass Creek below Melville, Mont., for 1910.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
April	371	30	87.4	5,200	A.
May	386	89	191	11,700	A.
June	267	67	157	9,340	A.
July	67	16	35.4	2,180	A.
August	40	23	27.8	1,710	A.
September	95	23	45.6	2,710	A.
October	105	52	75.9	4,670	A.
November	76	40	50.1	2,980	A.
December	.....	.....	[a] 56	3,440	C.
The year	.....	.....	65.4	43,900	

[a] Discharge estimated on basis of ice measurements of Dec. 13 and by comparison with upper station.

STILLWATER RIVER BASIN.

STILLWATER RIVER NEAR ABSAROKEE, MONT.

Stillwater River rises in the rugged mountains bordering Yellowstone Park, and flows northeastward to its junction with Yellowstone River near Columbus.

The territory bordering Stillwater is well irrigated. The river has a heavy fall and carries an abundance of water, and therefore affords excellent opportunity for the development of hydroelectric power.

The gaging station was established July 19, 1910, on the public highway bridge crossing the stream at the Riverside Road House, 13 miles southwest of Columbus, Mont. Rosebud Creek enters the river a mile above the station.

A staff gage is nailed to right abutment pier on upstream side of bridge. Discharge measurements are made from the lower side of the bridge.

The bed of the stream is composed of gravel and bowlders and is very rough but will not shift.

Ice is common at the gaging section in extreme cold weather.

Discharge measurements of Stillwater River near Absarokee, Mont., in 1910.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
July 19	Raymond Richards	147	469	2.68	2,060
Aug. 3	.....do	146	366	1.82	1,210
Aug. 31	J. C. Beebe	137	272	.80	553
Nov. 9	W. A. Lamb	124	196	.52	322

Daily gage height, in feet, and discharge, in second-feet, of Stillwater River near Absarokee, Mont., for 1910.

[James Bennet, observer.]

Day.	July.		Aug.		Sept.		Oct.		Nov.	
	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
1			1.8	1,180	0.8	465	0.9	520	0.7	415
2			1.8	1,180	.8	465	.9	520	.7	415
3			1.7	1,100	.8	465	.9	520	.7	415
4			1.6	1,020	.8	465	.9	520	.8	465
5			1.5	940	.8	465	.9	520	.8	465
6			1.5	940	.8	465	.8	465	.8	465
7			1.5	940	.7	415	.8	465	.8	465
8			1.4	965	.7	415	.8	465	.7	415
9			1.4	965	.7	415	.8	465	.5	330
10			1.3	890	.7	415	.8	465	.5	330
11			1.3	890	.8	465	.8	465	.55	350
12			1.3	890	.8	465	.8	465	.55	350
13			1.6	1,020	.8	465	.8	465	.55	350
14			1.5	940	.8	465	.7	415	.6	370
15			1.4	965	.7	415	.7	415	.6	370
16			1.3	890	.7	415	.7	415	.6	370
17			1.2	720	.8	465	.7	415	.6	370
18			1.2	720	.9	520	.8	465	.6	370
19	2.7	2,070	1.1	650	.9	520	.8	465	.6	370
20	2.75	2,120	1.1	650	.9	520	.8	465	.6	370
21	3.4	2,860	1.1	650	1.2	720	.8	465	.65	392
22	3.4	2,860	1.1	650	1.4	965	.7	415	.65	392
23	3.0	2,400	1.1	650	1.4	965	.7	415	.7	415
24	2.72	2,090	1.1	650	1.4	965	.7	415	.7	415
25	2.4	1,760	1.1	650	1.5	940	.7	415	.65	392
26	2.2	1,560	1.0	580	1.3	890	.8	465	.7	415
27	2.2	1,560	.....	555	1.2	720	.8	465	.75	440
28	2.05	1,420	.....	535	1.1	650	.7	415	.8	465
29	2.0	1,370	.....	510	1.1	650	.7	415	.8	465
30	1.9	1,280	.....	485	1.0	580	.7	415	.7	415
31	1.85	1,230	.8	465	.....	.....	.7	415	.....	.....

NOTE.—Ice during December. The discharges are based on a well-defined rating curve.

Monthly discharge of Stillwater River near Absarokee, Mont., for 1910.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
July 19–31	2,860	1,230	1,890	48,700	A.
August	1,180	465	801	49,300	A.
September	965	415	574	34,200	A.
October	520	415	455	28,000	B.
November	465	330	401	23,900	B.

ROSEBUD RIVER AT ABSAROKEE, MONT.

Rosebud River rises in several small lakes in the high mountains bordering Yellowstone Park, flows northwestward, and unites with Stillwater River near Absarokee.

The gaging station was established July 19, 1910, on the highway bridge just west of Absarokee, Mont., and 14 miles from Columbus, about 1 mile above the mouth of the stream. There are no important tributaries above the station other than the many forks of the stream itself.

A staff gage is fastened to the downstream side of left abutment pier of the bridge. Discharge measurements are made from the downstream side of the bridge.

The bed of stream is composed of gravel and bowlders, and is not likely to shift. The flow at this station is practically unaffected by ice.

Irrigation is practiced considerably above the station.

Discharge measurements of Rosebud River at Absarokee, Mont., in 1910.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
July 19	Raymond Richards	75	236	1.18	1,010
Aug. 3	do	74	204	.86	661
31	J. C. Beebe	69	156	.24	283
Nov. 10	W. A. Lamb	69	130	.00	178

Daily gage height, in feet, and discharge, in second-feet, of Rosebud River at Absarokee, Mont., for 1910.

[Chris Carstens, observer.]

Day.	July.		Aug.		Sept.		Oct.		Nov.		Dec.	
	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
1	.....	.....	1.1	910	0.3	299	.....	[1]532	0.1	209	0.2	252
2	.....	.....	1.1	910	.3	299	0.4	352	.1	209	.2	252
3	.....	.....	.9	715	.2	252	.4	352	.1	209	.2	252
4	.....	.....	.9	715	.1	219	.4	352	.1	209	.2	252
5	.....	.....	1.1	910	.1	219	.3	299	.1	209	.2	252
6	.....	.....	1.1	910	.25	276	.3	299	.1	209	.2	252
7	.....	.....	1.0	810	.1	209	.2	252	.1	209	.2	252
8	.....	.....	.9	715	.1	209	.2	252	.1	209	.25	276
9	.....	.....	.7	552	.15	230	.2	252	.1	209	.25	276
10	.....	.....	.5	412	.2	252	.2	252	.1	209	.25	276
11	.....	.....	.5	412	.2	252	.2	252	.1	209	.25	276
12	.....	.....	.5	412	.2	252	.1	209	.1	209	.25	276
13	.....	.....	.5	412	.2	252	.1	209	.1	209	.25	276
14	.....	.....	.5	412	.2	252	.1	209	.1	209	.25	276
15	.....	.....	.5	412	.1	209	.1	209	.1	209	.25	276
16	.....	.....	.5	412	.1	209	.1	209	.1	209	.25	276
17	.....	.....	.6	480	.1	209	.1	209	.1	209	.25	276
18	.....	.....	.5	412	.3	299	.2	252	.1	209	.....	260
19	1.2	1,020	.5	412	.3	299	.2	252	.1	209	.....	260
20	1.3	1,140	.5	412	.5	412	.2	252	.1	209	.....	260
21	1.5	1,390	.5	412	.7	552	.1	209	.1	209	.....	260
22	1.8	1,800	.5	412	.9	715	.1	209	.1	209	.....	260
23	1.7	1,660	.5	412	.9	715	.1	209	.2	252	.....	260
24	1.6	1,520	.6	480	.....	[a]762	.1	209	.2	252	.....	250
25	1.4	1,260	.6	480	1.0	810	.1	209	.2	252	.....	250
26	1.2	1,020	.5	412	1.2	1,020	.1	209	.2	252	.....	250
27	1.1	910	.5	412	1.4	1,260	.1	209	.2	252	.....	250
28	1.1	910	.4	352	1.5	1,390	.1	209	.2	252	.....	250
29	1.1	910	.4	352	1.0	810	.1	209	.2	252	.....	250
30	1.1	910	.3	299	.9	715	.1	209	.2	252	.....	250
31	1.1	910	.3	299	.....	.....	.1	209	.....	.....	.....	250

[a] Interpolated.

NOTE.—Discharge affected by ice after Dec. 17. The discharges are based on a curve that is fairly well defined.

Monthly discharge of Rosebud River at Absarokee, Mont., for 1910.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
July 19–31	1,800	910	1,180	30,400	B.
August	910	299	518	31,900	B.
September	1,390	209	462	27,500	B.
October	532	209	250	15,400	B.
November	252	209	220	13,100	B.
December	276	250	261	16,000	C.

CLARK FORK BASIN.

CLARK FORK AT FROMBERG, MONT.

Clark Fork enters Yellowstone River from the south about 15 miles southwest of Billings, Mont. The stream is bordered by irrigable land which is used for agriculture.

The gaging station, which was established June 3, 1905, to determine the amount of water available for irrigation, is located on the highway bridge one-half mile east of the Northern Pacific Railway station at Fromberg, Mont.

One small stream, Red Rock Creek, flows into the river between the gaging station and its mouth. The drainage area above the station is about 2,500 square miles. (See fig. 1, p. 166.)

As almost all the valley land is under irrigation, many diversions are made, but owing to the abundance of water only a small portion of the flow is used.

The ice period ranges from December to the middle of March, but frequently during this period the river breaks up and floating ice may be seen.

The original staff gage has been replaced by a standard chain gage fastened to the upstream side of the bridge, but no change in gage datum has occurred. Records obtained are excellent. The gaging section, which is from the bridge, would be ideal if it were not for the middle pier of the bridge, which divides the channel. The bed of the stream is composed of rock and gravel, is free from vegetation, and is permanent.

All estimates of discharge for this station have been revised in the light of recent measurements and are published herewith. Gage heights for years 1905 to 1909 may be found in Water-Supply Papers 172, page 102; 208, pages 92, 93; 246, pages 173, 174; and 266, page 166.

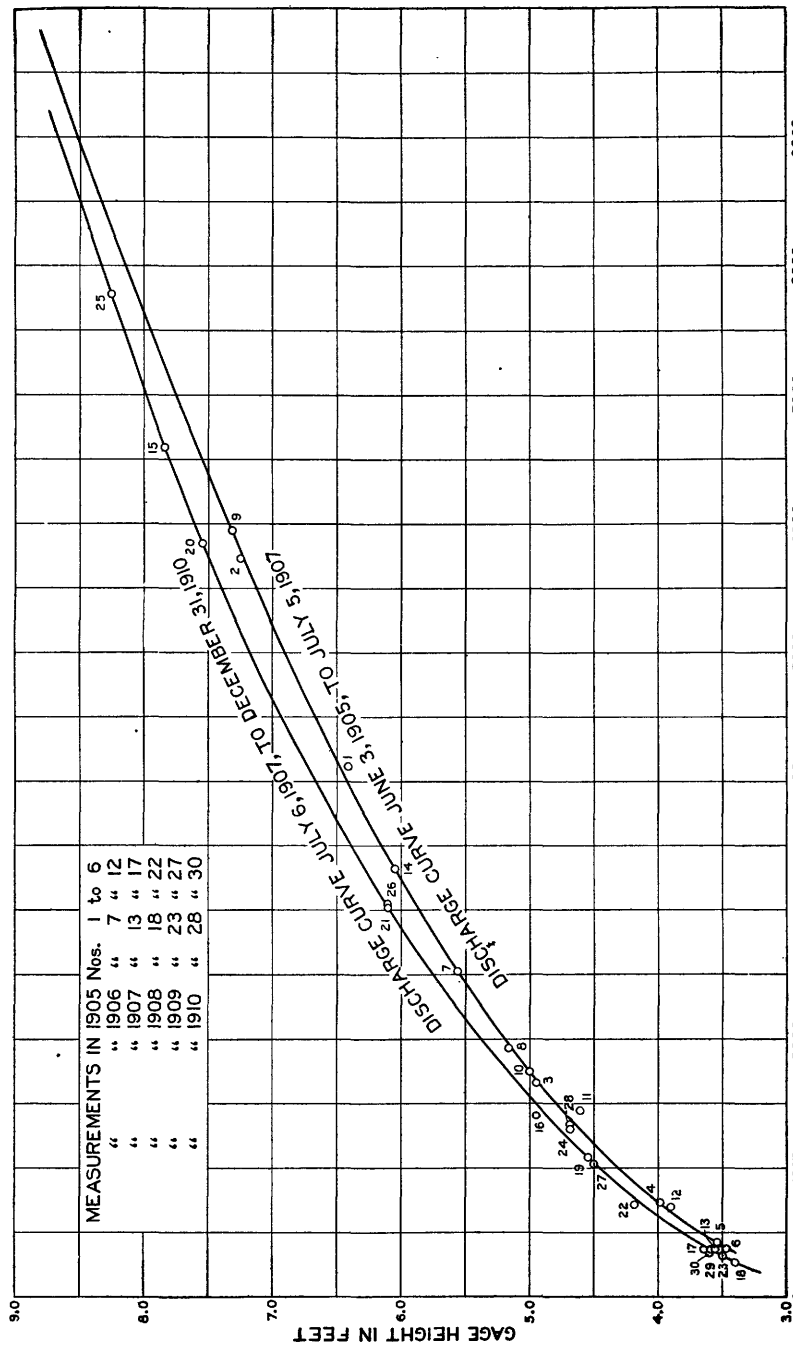

FIGURE 1.—Discharge curve for Clark Fork at Fromberg, Mont.

Discharge measurements of Clark Fork at Fromberg, Mont., in 1905–1910.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1905.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
June 3	J. H. Sloan	209	845	6.42	4,120
27	....do	185	578	4.95	1,660
July 25	....do	210	970	7.25	5,730
Aug. 19	....do	135	370	3.98	734
Sept. 16	....do	122	309	3.53	416
Oct. 17	....do	122	289	3.47	372
1906.					
May 12	H. M. Morse	190	637	5.57	2,530
June 2	Morse and Whinery	168	534	5.17	1,930
15	R. H. Whinery	209	1,010	7.32	5,950
26	....do	170	493	5.00	1,750
July 28	Richards and Whinery	165	479	4.62	1,450
Sept. 4	Raymond Richards	130	348	3.90	696
1907.					
Apr. 10	J. E. Stewart	120	288	3.56	374
June 1[a]	....do	207	733	6.04	3,320
July 12	....do	214	1,130	7.83	6,590
Aug. 17	....do	184	526	4.95	1,410
Nov. 12[b]	....do	125	310	3.64	370
1908.					
Mar. 30	J. E. Stewart	118	263	3.40	269
May 22	....do	158	438	4.54	1,080
June 13	Raymond Richards	211	1,090	7.55	5,850
July 20	....do	206	750	6.10	3,030
Oct. 10	J. E. Stewart	143	375	4.18	717
1909.					
Apr. 5	Raymond Richards	123	295	3.50	320
May 22	....do	183	470	4.68	1,300
June 24	....do	230	1,210	8.25	7,780
July 17	J. E. Stewart	210	780	6.11	3,050
Sept. 13	Raymond Richards	151	446	4.49	1,030
1910.					
July 16	Raymond Richards	165	505	4.68	1,330
Aug. 30	J. C. Beebe	126	330	3.58	368
Nov. 11	Wm. A. Lamb	105	275	3.60	346

[a] Measurement made without sufficient amount of lead. [b] Slight ice effect.

Daily gage height, in feet, of Clark Fork at Fromberg, Mont., for 1910.

[Mrs. E. V. Moran, observer.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	4.05	4.1	5.4	7.6	5.5	4.4	3.6	3.5	3.6	3.6
2	4.0	4.05	5.5	7.6	5.5	4.35	3.6	3.5	3.5	3.65
3	4.2	4.0	5.5	7.6	5.4	4.3	3.6	3.5	3.5	3.7
4	4.2	4.0	5.5	7.6	5.35	4.3	3.6	3.5	3.5	3.7
5	4.15	3.9	5.8	7.7	5.3	4.3	3.5	3.5	3.4	3.7
6	4.35	3.9	5.65	7.6	5.2	4.1	3.5	3.5	3.4	3.7
7	4.5	3.8	5.6	7.75	5.2	4.1	3.5	3.5	3.4	3.7
8	4.5	3.8	5.7	7.65	4.95	4.1	3.5	3.5	3.4	3.7
9	4.5	3.8	5.7	7.45	4.9	4.1	3.5	3.5	3.5	3.7
10	4.4	3.6	5.6	7.15	4.7	3.8	3.5	3.5	3.5	3.7
11	4.35	3.6	5.8	6.85	4.7	3.8	3.5	3.5	3.6	3.5
12	4.3	3.6	6.1	6.8	4.6	3.8	3.5	3.5	3.6	3.5
13	4.05	3.6	6.55	6.75	4.5	3.8	3.5	3.6	3.5	3.5
14	3.85	3.75	6.0	7.0	4.7	3.8	3.5	3.6	3.5	3.5
15	3.65	3.8	5.85	7.15	4.7	3.8	3.5	3.6	3.5	3.5
16	3.6	3.8	5.8	7.05	4.65	3.8	3.5	3.55	3.5	3.5
17	3.6	3.95	5.8	7.0	4.7	3.8	3.5	3.5	3.5	3.45
18	3.7	4.1	5.8	6.65	4.5	3.8	3.5	3.5	3.5	3.45
19	3.7	4.2	5.55	6.6	4.5	3.75	3.5	3.5	3.5	3.4
20	3.7	4.5	5.6	6.55	4.5	3.7	3.5	3.5	3.5	3.4

Daily gage height, in feet, of Clark Fork at Fromberg, Mont., for 1910—Continued.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
21	3.7	4.5	5.6	6.6	4.65	3.7	3.6	3.5	3.5	3.4
22	3.8	4.5	5.65	6.5	4.85	3.7	3.6	3.5	3.5	3.4
23	3.8	4.8	5.7	6.35	4.8	3.75	3.6	3.5	3.5	3.4
24	3.8	4.7	5.85	6.35	4.8	3.8	3.6	3.5	3.5	3.4
25	3.9	5.0	5.75	6.35	4.7	3.8	3.75	3.5	3.5	3.4
26	4.0	5.0	6.0	6.3	4.7	3.7	3.95	3.5	3.5	3.4
27	4.0	5.15	6.2	6.05	4.7	3.7	3.9	3.5	3.5	3.4
28	3.95	5.1	6.35	5.95	4.6	3.7	3.8	3.5	3.5	3.4
29	4.0	5.3	6.45	5.75	4.6	3.7	3.75	3.5	3.6	3.4
30	4.1	5.3	6.8	5.55	4.5	3.7	3.5	3.5	3.7	3.4
31	4.1	.....	6.9	.....	4.45	3.6	.....	3.5	.....	3.4

NOTE.—Ice during January and February.

Daily discharge, in second-feet, of Clark Fork at Fromberg, Mont., for 1905–1910.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1905.												
1	.....	.....	.....	.....	.....	.....	4,360	1,430	602	400	400	.....
2	.....	.....	.....	.....	.....	.....	4,260	1,380	554	400	400	.....
3	.....	.....	.....	.....	.....	4,160	3,740	1,690	533	400	400	.....
4	.....	.....	.....	.....	.....	5,100	3,580	1,880	507	323	446	.....
5	.....	.....	.....	.....	.....	5,780	3,500	1,520	489	323	458	.....
6	.....	.....	.....	.....	.....	4,260	3,060	1,300	458	346	429	.....
7	.....	.....	.....	.....	.....	3,320	3,140	1,190	458	346	429	.....
8	.....	.....	.....	.....	.....	3,680	3,230	1,190	429	346	429	.....
9	.....	.....	.....	.....	.....	6,260	3,230	1,080	429	346	400	.....
10	.....	.....	.....	.....	.....	5,440	3,230	980	429	346	400	.....
11	.....	.....	.....	.....	.....	3,860	3,260	1,050	429	321	400	.....
12	.....	.....	.....	.....	.....	4,160	3,060	999	429	321	400	.....
13	.....	.....	.....	.....	.....	5,780	3,060	999	429	373	400	.....
14	.....	.....	.....	.....	.....	5,900	2,930	926	429	458	400	.....
15	.....	.....	.....	.....	.....	5,210	2,900	891	400	400	400	.....
16	.....	.....	.....	.....	.....	4,260	2,820	838	400	373	400	.....
17	.....	.....	.....	.....	.....	3,770	2,500	804	400	373	400	.....
18	.....	.....	.....	.....	.....	3,500	2,010	738	384	357	400	.....
19	.....	.....	.....	.....	.....	2,500	2,010	660	373	346	400	.....
20	.....	.....	.....	.....	.....	2,290	1,760	624	373	357	400	.....
21	.....	.....	.....	.....	.....	2,740	1,760	587	373	389	400	.....
22	.....	.....	.....	.....	.....	3,960	1,630	587	346	400	400	.....
23	.....	.....	.....	.....	.....	3,960	1,820	587	346	417	400	.....
24	.....	.....	.....	.....	.....	3,960	1,760	554	331	429	400	.....
25	.....	.....	.....	.....	.....	3,960	1,760	554	321	429	400	.....
26	.....	.....	.....	.....	.....	4,320	1,610	520	321	400	400	.....
27	.....	.....	.....	.....	.....	5,210	1,760	624	321	400	400	.....
28	.....	.....	.....	.....	.....	5,580	1,580	624	321	400	.....	.....
29	.....	.....	.....	.....	.....	4,990	1,500	660	373	400	.....	.....
30	.....	.....	.....	.....	.....	4,560	1,500	645	554	400	.....	.....
31	.....	.....	.....	.....	.....	.....	1,430	624	.....	400	.....	.....
1906.												
1	.....	.....	.....	400	738	2,280	2,280	908	738	400	321	400
2	.....	.....	.....	458	520	1,880	2,820	821	738	373	321	400
3	.....	.....	.....	400	908	2,010	3,140	908	660	373	296	400
4	.....	.....	.....	346	908	2,010	3,230	908	660	400	296	400
5	.....	.....	.....	400	1,050	1,520	3,400	954	587	373	296	400
6	.....	.....	.....	373	999	2,900	3,680	1,140	587	373	321	400
7	.....	.....	.....	458	821	2,500	3,400	999	544	429	321	400
8	.....	.....	.....	458	660	2,360	3,400	908	458	373	321	400
9	.....	.....	.....	458	660	2,430	3,400	908	400	321	346	400
10	.....	.....	.....	520	1,150	2,580	3,140	954	400	321	346	400
11	.....	.....	.....	458	1,820	3,230	3,320	908	400	321	373	.....
12	.....	.....	.....	458	2,360	4,160	3,500	821	346	321	373	.....
13	.....	.....	.....	400	2,660	7,380	3,680	738	400	346	373	.....
14	.....	.....	.....	458	3,530	7,500	3,320	821	458	346	346	.....
15	.....	.....	.....	458	2,980	6,260	2,980	738	520	321	346	.....

Daily discharge, in second-feet, of Clark Fork at Fromberg, Mont., for 1905–1910—Contd.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1906.												
16	.....	.....	.....	520	2,540	5,100	2,360	738	520	321	346	.....
17	.....	.....	.....	458	2,280	4,560	2,080	660	520	296	346	.....
18	.....	.....	.....	520	1,720	3,580	2,220	660	458	296	321	.....
19	.....	.....	.....	520	1,520	2,900	2,360	660	458	296	321	.....
20	.....	.....	.....	554	1,460	2,140	2,220	755	429	273	321	.....
21	.....	.....	.....	602	2,100	2,010	2,080	2,070	400	273	321	.....
22	.....	.....	.....	821	2,430	2,140	1,690	1,190	400	273	373	.....
23	.....	.....	.....	1,240	2,740	2,010	1,630	2,900	400	273	373	.....
24	.....	.....	.....	1,090	3,320	1,880	1,760	3,230	400	296	373	.....
25	.....	.....	.....	926	2,900	1,760	1,580	2,900	400	296	373	.....
26	.....	.....	.....	821	3,400	2,010	1,580	1,520	520	321	346	.....
27	.....	.....	.....	738	2,900	2,010	1,350	954	520	321	346	.....
28	.....	.....	.....	738	2,900	2,140	1,300	954	458	321	321	.....
29	.....	.....	.....	821	2,580	2,140	999	864	458	346	400	.....
30	.....	.....	.....	738	2,740	2,140	1,090	908	400	321	400	.....
31	.....	.....	.....	.....	2,580	.....	954	738	.....	321	.....	.....
1907.												
1	.....	.....	429	400	738	3,400	7,260	3,610	1,340	945	402	375
2	.....	.....	400	446	1,090	5,210	10,000	3,440	1,340	1,040	402	375
3	.....	.....	400	489	1,190	4,880	8,950	3,180	1,180	780	402	375
4	.....	.....	400	489	1,250	3,680	10,300	3,180	1,130	625	402	350
5	.....	.....	400	489	660	4,160	10,700	3,180	1,040	625	402	350
6	.....	.....	373	489	587	5,100	8,660	2,940	1,040	625	375	350
7	.....	.....	373	489	660	6,140	7,620	2,640	1,040	625	375	325
8	.....	.....	373	400	660	6,630	7,180	2,560	1,080	555	375	325
9	.....	.....	373	357	660	5,780	7,330	2,420	1,040	555	375	325
10	.....	.....	346	429	864	5,100	6,890	2,290	1,040	555	375	325
11	.....	.....	346	429	1,190	4,360	6,360	2,040	1,040	555	350	325
12	.....	.....	346	458	1,180	4,260	6,620	2,040	1,040	555	325	325
13	.....	.....	321	520	1,520	4,560	6,100	1,740	1,040	555	325	325
14	.....	.....	321	520	1,410	4,060	5,620	1,560	945	555	325	325
15	.....	458	321	587	1,520	5,100	5,860	1,440	945	522	325	325
16	.....	458	321	660	2,500	5,560	5,620	1,440	860	522	325	325
17	.....	458	346	821	2,660	4,770	4,340	1,440	860	490	430	325
18	.....	458	346	821	3,230	4,460	3,610	1,560	780	490	430	325
19	.....	458	346	587	3,230	4,880	4,240	1,440	780	490	375	325
20	.....	458	346	554	3,680	5,440	4,440	1,380	780	490	375	325
21	.....	458	520	554	3,860	6,140	4,730	1,340	700	490	375	325
22	.....	489	520	520	4,360	6,500	5,160	1,340	700	460	375	325
23	.....	458	520	520	4,460	6,760	5,380	1,230	625	460	375	325
24	.....	458	458	520	3,770	4,990	4,940	1,180	625	460	375	325
25	.....	458	458	587	3,230	4,560	5,620	1,080	555	460	375	325
26	.....	458	458	587	2,820	4,360	5,740	1,130	555	430	375	325
27	.....	458	458	587	1,880	4,770	5,620	1,080	700	430	375	325
28	.....	412	458	587	1,940	5,670	4,340	1,040	700	430	375	325
29	.....	.....	489	554	2,010	8,020	3,880	1,440	1,080	430	375	325
30	.....	.....	489	554	2,140	7,260	3,700	1,380	990	430	375	325
31	.....	.....	489	.....	2,660	.....	3,520	1,340	.....	430	.....	325
1908.												
1	.....	.....	195	275	820	4,530	6,100	2,040	945	555	555	325
2	.....	.....	195	275	945	3,790	5,740	2,040	860	555	555	325
3	.....	.....	195	300	1,440	4,730	6,490	1,920	860	555	555	325
4	.....	.....	195	315	1,560	3,520	6,620	1,920	780	663	555	325
5	.....	.....	275	275	1,440	2,640	8,210	1,920	740	780	555	325
6	.....	.....	275	285	1,560	2,710	6,900	1,800	700	700	522	325
7	.....	.....	275	300	1,980	3,180	5,620	1,800	700	700	522	375
8	.....	.....	275	325	2,710	3,790	4,800	1,800	625	700	522	375
9	.....	.....	275	325	2,940	3,520	4,800	1,800	555	700	522	375
10	.....	.....	300	335	3,100	3,880	5,740	1,560	555	700	522	375
11	.....	.....	325	350	2,290	5,510	5,500	1,340	590	700	490	375
12	.....	.....	325	350	1,620	6,520	5,160	2,040	663	700	490	375
13	.....	.....	325	365	1,500	6,520	4,840	2,160	700	700	490	375
14	.....	.....	325	403	1,390	6,360	4,340	2,100	700	700	490	375
15	.....	.....	325	490	1,280	7,480	4,240	1,620	625	700	490	375
16	.....	.....	325	1,040	1,230	7,170	4,060	1,340	625	700	490	325
17	.....	195	325	1,040	1,130	5,980	3,880	1,340	625	700	490	.....
18	.....	195	325	740	1,080	5,390	3,520	1,340	663	700	490	.....
19	.....	195	325	1,040	1,130	3,700	3,520	1,340	663	700	430	.....
20	.....	195	325	990	1,140	4,150	3,270	1,620	625	700	430	.....
21	.....	195	325	1,680	2,040	4,940	2,780	1,340	625	625	430	.....
22	.....	195	325	1,500	1,150	3,270	2,640	1,230	625	625	430	.....
23	.....	195	325	1,620	1,340	3,520	2,640	1,230	625	625	403	.....
24	.....	195	325	1,340	1,620	3,360	2,420	1,230	625	625	403	.....
25	.....	195	300	1,560	1,280	3,360	2,420	1,130	625	555	375	.....

Daily discharge, in second-feet, of Clark Fork at Fromberg, Mont., for 1905–1910—Contd.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1908.												
26	.....	195	300	2,160	1,390	3,970	2,290	1,130	555	555	375	.....
27	.....	195	315	860	1,680	3,880	2,360	1,040	555	555	325	.....
28	.....	195	300	820	2,220	3,970	2,290	1,040	555	555	325	.....
29	.....	.....	300	700	2,360	4,150	2,290	860	555	555	325	.....
30	.....	.....	300	700	2,560	5,500	2,160	1,040	555	555	325	.....
31	.....	.....	300	.....	3,880	.....	2,100	945	.....	555	.....	.....
1909.												
1	.....	.....	430	325	350	7,480	1,150	1,560	780	522	300	.....
2	.....	.....	430	325	350	8,810	1,150	1,500	1,680	522	300	.....
3	.....	.....	430	325	490	9,410	12,100	1,560	1,680	522	300	.....
4	.....	.....	430	300	490	10,300	12,100	1,440	1,390	522	300	.....
5	.....	.....	430	275	625	9,710	11,800	1,500	1,080	522	300	.....
6	.....	.....	430	275	625	9,110	10,900	1,340	1,040	522	300	.....
7	.....	.....	430	275	625	8,210	9,860	1,340	1,040	522	300	.....
8	.....	.....	430	275	1,040	7,910	8,060	1,440	1,040	460	300	.....
9	.....	.....	430	300	1,040	7,030	6,900	1,340	990	460	300	.....
10	.....	.....	375	300	1,040	6,620	5,050	1,340	1,130	460	300	.....
11	.....	.....	375	325	625	6,360	4,530	1,340	1,230	460	300	.....
12	.....	.....	375	325	625	5,740	3,880	1,280	1,080	460	300	.....
13	.....	.....	375	325	820	6,230	3,300	1,230	990	460	300	.....
14	.....	.....	375	325	663	5,860	2,780	1,230	900	460	300	.....
15	.....	.....	375	350	740	6,100	2,560	1,340	860	403	300	.....
16	.....	.....	375	375	902	6,230	2,560	1,280	780	403	300	.....
17	.....	.....	375	350	700	7,760	2,500	1,340	740	403	300	.....
18	.....	.....	375	325	590	9,710	2,420	1,340	700	403	300	.....
19	.....	.....	375	325	625	11,200	2,420	1,340	700	403	300	.....
20	.....	.....	375	325	700	10,300	2,420	1,230	700	403	300	.....
21	.....	.....	375	325	945	9,860	2,420	1,230	700	403	300	.....
22	.....	.....	375	325	1,340	8,210	2,420	1,230	663	403	300	.....
23	.....	.....	375	325	2,160	8,210	2,290	1,230	555	403	300	.....
24	.....	.....	375	325	2,940	8,210	2,220	1,130	555	375	300	.....
25	.....	.....	375	325	2,860	8,210	2,100	1,130	555	350	300	.....
26	.....	.....	375	325	3,700	9,110	2,040	1,080	555	350	300	.....
27	.....	.....	375	325	4,440	9,410	1,920	990	555	350	300	.....
28	.....	.....	375	325	4,440	9,860	1,920	945	555	350	300	.....
29	.....	.....	375	325	6,100	10,500	1,620	945	555	350	300	.....
30	.....	.....	325	325	6,760	11,200	1,620	900	555	350	300	.....
31	.....	.....	325	.....	6,760	.....	1,560	820	.....	350	.....	.....
1910.												
1	.....	.....	663	700	1,940	5,980	2,160	945	370	320	370	370
2	.....	.....	625	663	2,160	5,980	2,160	900	370	320	320	400
3	.....	.....	780	625	2,160	5,980	1,940	860	370	320	320	430
4	.....	.....	780	625	2,160	5,980	1,880	860	370	320	320	430
5	.....	.....	740	555	2,560	6,230	1,820	860	320	320	270	430
6	.....	.....	902	555	2,360	5,980	1,800	700	320	320	270	430
7	.....	.....	1,040	490	2,290	6,360	1,800	700	320	320	270	430
8	.....	.....	1,040	490	2,420	6,100	1,500	700	320	320	270	430
9	.....	.....	1,040	490	2,420	5,620	1,440	700	320	320	320	430
10	.....	.....	945	370	2,290	4,940	1,230	490	320	320	320	430
11	.....	.....	900	370	2,560	4,340	1,230	490	320	320	370	320
12	.....	.....	860	370	3,020	4,240	1,130	490	320	320	370	320
13	.....	.....	663	370	3,790	4,150	1,040	490	320	370	320	320
14	.....	.....	520	460	2,860	4,630	1,230	490	320	370	320	320
15	.....	.....	398	490	2,640	4,940	1,230	490	320	370	320	320
16	.....	.....	370	490	2,560	4,730	1,180	490	320	345	320	320
17	.....	.....	370	590	2,560	4,630	1,230	490	320	320	320	295
18	.....	.....	430	700	2,560	3,970	1,040	490	320	320	320	295
19	.....	.....	430	780	2,220	3,880	1,040	460	320	320	320	270
20	.....	.....	430	1,040	2,290	3,790	1,040	430	320	320	320	270
21	.....	.....	430	1,040	2,290	3,880	1,180	430	370	320	320	270
22	.....	.....	490	1,040	2,360	3,700	1,390	430	370	320	320	270
23	.....	.....	490	1,340	2,420	3,440	1,340	460	370	320	320	270
24	.....	.....	490	1,230	2,640	3,440	1,340	490	370	320	320	270
25	.....	.....	555	1,560	2,500	3,440	1,230	490	460	320	320	270
26	.....	.....	625	1,560	2,860	3,360	1,230	430	590	320	320	270
27	.....	.....	625	1,740	3,180	2,940	1,230	430	555	320	320	270
28	.....	.....	590	1,680	3,440	2,780	1,130	430	490	320	320	270
29	.....	.....	625	1,820	3,610	2,500	1,130	430	460	320	370	270
30	.....	.....	700	1,820	4,240	2,220	1,040	430	320	320	430	270
31	.....	.....	700	.....	4,430	.....	990	370	.....	320	.....	270

NOTE.—The daily discharge for 1905 to 1910 are based on rating curves applicable as follows, except as noted: June 3, 1905, to July 5, 1907, well defined between 350 and 6,500 second-feet; July 6, 1907, to Dec. 31, 1910, well defined between 200 and 8,000 second-feet. Ice periods Nov. 28, 1905, to Mar. 31, 1906, Dec. 11, 1906, to Feb. 14, 1907, Jan. 1 to Feb. 16, 1908, Dec. 17, 1908, to Feb. 28, 1909, Dec. 1, 1909, to Feb. 28, 1910.

Monthly discharge of Clark Fork at Fromberg, Mont., for 1905–1910.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
1905.					
June 3–30	6,260	2,290	4,370	243,000	A.
July	4,360	1,430	2,570	158,000	A.
August	1,880	554	927	57,000	A.
September	602	321	418	24,900	A.
October	458	321	378	23,200	A.
Nov. 1–27	458	400	407	21,800	B.
The period				528,000	
1906.					
April	1,240	346	587	54,900	A.
May	3,530	520	1,990	122,000	A.
June	6,260	1,760	2,980	177,000	A.
July	3,680	954	2,450	151,000	A.
August	3,230	660	1,110	68,200	A.
September	738	346	488	29,000	A.
October	429	273	330	20,300	A.
November	400	296	343	20,400	A.
Dec. 1–10			400	7,930	A.
The period				651,000	
1907.					
Feb. 15–28	458	412	455	13,500	C.
March	520	321	405	24,900	C.
April	821	357	533	31,700	B.
May	4,460	587	2,070	127,000	A.
June	8,020	3,400	5,220	311,000	A.
July	10,700	3,520	6,140	378,000	A.
August	3,610	1,040	1,910	117,000	A.
September	1,340	555	919	54,700	A.
October	1,040	430	550	33,800	A.
November	430	325	371	22,100	B.
December	375	325	332	20,400	C.
The period				1,134,000	
1908.					
Feb. 17–28	195	195	195	4,640	C.
March	325	195	294	18,100	B.
April	2,160	275	758	45,100	A.
May	3,880	820	1,730	106,000	A.
June	7,480	2,640	4,500	268,000	A.
July	8,210	2,100	4,180	257,000	A.
August	2,160	860	1,520	93,500	A.
September	945	555	656	39,000	A.
October	780	555	645	39,700	A.
November	555	325	462	27,500	B.
Dec. 1–16	375	325	353	11,200	C.
The period				909,740	
1909.					
March	430	325	359	22,100	A.
April	375	275	319	19,000	A.
May	6,760	350	1,810	111,000	A.
June	11,200	5,740	8,430	502,000	A.
July	12,100	1,560	4,880	300,000	A.
August	1,560	820	1,260	77,500	A.
September	1,680	555	878	52,200	A.
October	522	350	430	26,400	A.
November	300	300	300	17,900	B.
The period				1,130,000	
1910.					
January			[a] 300	18,400	
February			[a] 350	19,400	
March	1,040	370	653	40,200	B.
April	1,820	370	868	51,600	A.
May	4,430	1,940	2,700	166,000	A.
June	6,360	2,220	4,470	266,000	A.
July	2,160	990	1,370	84,200	B.
August	945	370	560	34,400	A.
September	590	320	365	21,700	A.
October	370	320	326	20,000	A.
November	430	270	324	19,300	A.
December	430	270	330	20,300	B.
The year			1,050	762,000	

[a] Discharge estimated Jan. 1 to Feb. 28. The means are approximate.

PRYOR CREEK BASIN.

PRYOR CREEK AT HUNTLEY, MONT.

Pryor Creek rises in the Pryor Mountains in southern Carbon County, Mont., flows northeastward, and enters Yellowstone River from the south about 15 miles northeast of Billings.

The gaging station was originally established August 6, 1904, to determine the amount of water available for irrigation. On June 15–16, 1906, the creek was turned into a new channel by the United States Reclamation Service, and a station was established on the steel highway bridge crossing this channel one-half mile from the railroad station at Huntley. Since then the chain-gage datum has not been changed. Measurements are made from this bridge.

The channel is straight with uniform slope for 800 feet above and below the station. The banks are steep and uniformly graded, are clean, and will not overflow. The current is moderate. The bed is composed of clay and gravel and may change somewhat. On the upper portion of the stream some water is diverted for irrigation.

The stream freezes over during the winter months. Results obtained are good.

Discharge measurements of Pryor Creek at Huntley, Mont., in 1910.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 10	W. A. Lamb	30	56	1.72	74
June 3	Raymond Richards	29	56	1.63	57
July 18	do	27	44	1.13	16
Aug. 10[a]	W. A. Lamb	8	3.5	1.05	7.7
24	do	30	15	1.13	13
Nov. 13	do	28	50	1.43	41

[a] Made by wading below canal crossing.

Daily gage height, in feet, of Pryor Creek at Huntley, Mont., for 1910.

[Arthur Foster, observer.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	1.6	1.5	1.8	1.5	1.0	1.2	1.7	1.4	1.45
2	.....	1.6	1.5	1.7	1.3	1.05	1.8	1.6	1.4	1.5
3	.....	1.6	1.5	1.65	1.3	1.0	2.4	1.6	1.45	1.5
4	.....	1.6	1.5	1.65	1.3	1.0	1.7	1.5	1.45	1.5
5	.....	1.6	1.5	1.6	1.3	1.0	1.2	1.45	1.4	1.5
6	.....	1.6	1.6	1.5	1.3	1.0	1.2	1.45	1.5	1.5
7	.....	1.6	1.65	1.5	1.2	1.0	1.2	1.4	1.5	1.5
8	.....	1.6	2.4	1.5	1.2	1.0	1.2	1.4	1.5	1.5
9	.....	1.6	1.5	1.5	1.3	.....	1.2	1.4	1.5	1.5
10	.....	1.6	1.8	1.5	1.2	1.05	1.2	1.4	1.5	1.5
11	2.05	1.6	1.6	1.5	1.2	1.05	1.2	1.4	1.5	1.5
12	2.05	1.6	1.6	1.5	1.15	1.0	1.35	1.4	1.5	1.5
13	2.0	1.65	1.6	1.5	1.15	1.0	1.3	1.4	1.42	1.6
14	1.95	1.8	1.7	1.5	1.15	1.0	1.2	1.4	1.42	1.5
15	1.9	1.8	1.7	1.7	1.15	1.2	1.2	1.4	1.4	1.5

Daily gage height, in feet, of Pryor Creek at Huntley, Mont., for 1910—Continued.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
16	1.9	1.7	2.4	1.4	1.15	1.1	1.2	1.4	1.4	1.5
17	1.8	1.7	3.0	1.4	1.15	1.1	1.1	1.6	1.4	1.5
18	1.8	1.7	3.5	1.3	1.1	1.1	1.1	1.7	1.5	1.5
19	1.8	1.6	2.9	1.3	1.1	1.1	1.2	1.4	1.7	1.5
20	1.8	1.6	2.6	1.3	1.1	1.1	1.2	1.4	1.5	1.5
21	1.8	1.6	2.1	1.3	1.1	1.1	1.3	1.4	1.45	1.5
22	1.8	1.6	2.1	1.3	1.1	1.1	1.3	1.4	1.45	1.5
23	1.9	1.6	2.0	1.25	1.1	1.1	1.3	1.4	1.48	1.5
24	1.9	1.6	2.0	1.2	1.1	1.1	1.4	1.4	1.48	1.5
25	1.9	1.5	2.0	1.2	1.05	1.1	1.45	1.35	1.5	1.5
26	1.9	1.5	2.0	1.2	1.05	1.0	1.5	1.45	1.5	1.48
27	1.9	1.5	2.0	1.2	1.0	1.0	3.1	1.4	1.48	1.48
28	1.75	1.5	1.95	1.2	.9	1.0	2.7	1.4	1.45	1.45
29	1.7	1.5	1.9	1.6	.9	1.0	2.4	1.4	1.4	1.45
30	1.7	1.5	1.9	1.5	.9	1.25	2.4	1.4	1.42	1.45
31	1.7	.....	1.85	.....	.9	1.2	.....	1.4	.....	1.4

NOTE.—Probably affected by ice during greater part of January and February.

Daily discharge, in second-feet, of Pryor Creek at Huntley, Mont., for 1910.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	58	48	79	48	5	20	68	38	43
2	.....	58	48	68	29	8.5	79	58	38	48
3	.....	58	48	63	29	5	156	58	43	48
4	.....	58	48	63	29	5	68	48	43	48
5	.....	58	48	58	29	5	20	43	38	48
6	.....	58	58	48	29	5	20	43	48	48
7	.....	58	63	48	20	5	20	38	48	48
8	.....	58	156	48	20	5	20	38	48	48
9	.....	58	48	48	29	a 6.8	20	38	48	48
10	.....	58	79	48	20	8.5	20	38	48	48
11	109	58	58	48	20	8.5	20	38	48	48
12	109	58	58	48	16	5	34	38	48	48
13	103	63	58	48	16	5	29	38	40	58
14	97	79	68	48	16	5	20	38	40	48
15	91	79	68	68	16	20	20	38	38	48
16	91	68	156	38	16	12	20	38	38	48
17	79	68	240	38	16	12	12	58	38	48
18	79	68	318	29	12	12	12	68	48	48
19	79	58	226	29	12	12	20	38	68	48
20	79	58	184	29	12	12	20	38	48	48
21	79	58	115	29	12	12	29	38	43	48
22	79	58	115	29	12	12	29	38	43	48
23	91	58	103	24	12	12	29	38	46	48
24	91	58	103	20	12	12	38	38	46	48
25	91	48	103	20	8.5	12	43	34	48	48
26	91	48	103	20	8.5	5	48	43	48	46
27	91	48	103	20	5	5	254	38	46	46
28	74	48	97	20	1	5	198	38	43	43
29	68	48	91	58	1	5	156	38	38	43
30	68	48	91	48	1	24	156	38	40	43
31	68	.....	85	.....	1	20	.....	38	.....	38

a Discharge interpolated.

NOTE.—These discharges are based on a rating curve that is fairly well defined.

Monthly discharge of Pryor Creek at Huntley, Mont., for 1910.

[Drainage area, 800 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
January	.....	.....	[a] 25	0.031	0.04	1,540	
February	.....	.....	[a] 30	.038	.04	1,670	
March	109	40	[a] 84 1	.105	.12	5,170	C.
April	79	48	58.6	.073	.08	3,490	A.
May	318	48	103	.129	.15	6,330	A.
June	79	20	42.7	.053	.06	2,540	A.
July	48	1	16.4	.020	.02	1,010	B.
August	24	5	9.24	.012	.01	568	B
September	254	12	54 3	.068	.08	3,230	A.
October	68	34	42.5	.053	.06	2,610	A.
November	68	38	44.5	.055	.06	2,650	A.
December	58	38	47.2	.059	.07	2,900	B.
The year	318	1	42.1	.058	.79	33,100	

[a] Discharge estimated Jan. 1 to Mar. 10.

NOTE.—The means for January and February are only approximate.

BIGHORN RIVER BASIN.

DESCRIPTION.

Bighorn River is formed by the junction of Big and Little Wind rivers near Riverton, Wyo.

Big Wind River rises some 50 miles southeast of the Yellowstone National Park in the mountains of the Shoshone and Wind River ranges, whose highest peaks attain altitudes of more than 12,000 feet, and flows in a general southeasterly direction for about 100 miles to its mouth, where the elevation is 5,100 feet. The upper part of its basin is hilly and mountainous except along the river and its tributaries, where the bottom lands average a mile or so in width. About 40 miles above Riverton the valley broadens out and includes stretches of land several miles in width excellently adapted to agriculture. The most important tributary of Big Wind River is Bull Lake Creek; among other tributaries may be mentioned Red, Dinwoody, Dry, Willow, and Meadow creeks.

Little Wind River rises on the eastern side of the Wind River Range and flows eastward for about 50 miles to its confluence with Big Wind River. At the junction of the North and South forks of the Little Wind, near Fort Washakie, the valleys of these streams widen out into an excellent agricultural section. Above Fort Washakie the drainage area is generally hilly and mountainous in character.

The principal tributary of Little Wind River is the Popo Agie, which rises in the high mountains and flows northeastward to its confluence with the Little Wind River at Arapahoe, Wyo., and which emerges from the mountains about 8 miles above Lander, Wyo.

This stream at its mouth is considerably larger than Little Wind River. Important tributaries of the Popo Agie are the North Fork, which enters just below Lander, and the Little Popo Agie, which comes in at Hudson, about 10 miles below Lander. The valleys of the Popo Agie and its tributaries are comparatively wide and form one of the oldest irrigated sections of Wyoming. Among the other tributaries of Little Wind River are St. Lawrence, Sage, and Trout creeks.

From Riverton, Wyo., to its junction with the Yellowstone near Bighorn, Mont., a distance of about 250 miles, the Bighorn flows northward. At Thermopolis, 55 miles below Riverton, the elevation is about 4,200 feet; at the mouth of the Shoshone, 90 miles below Thermopolis, it is 3,800 feet; and at the mouth of the Bighorn it is about 2,700 feet.

Owl Creek, No Wood River, Greybull River, Shell Creek, Shoshone River, and Little Bighorn River are important tributaries of the Bighorn. The drainage area of Bighorn River above the mouth of the Shoshone is about 15,500 square miles.

The mountainous area drained by the Bighorn and its tributaries contains several hundred square miles of timber land, a great part of which is included in national forests. The remainder of the area, with the exception of occasional strips of land under cultivation, may be classed as range and sagebrush land.

The rainfall seems to range from 20 inches or more above an altitude of 9,000 feet to an average of 12 to 15 inches at elevations from 4,000 to 7,000 feet. Below an altitude of 4,000 feet the rainfall is locally less than 12 inches.

The winters on the upper Bighorn above an altitude of 4,500 feet are severe. Snowfall is abundant in the high mountains, and heavy snowstorms also take place in the more open country, but in the plains section the snow does not usually remain for long periods. As compared with those in the upper basin, the winters in what is called the Bighorn Basin are mild. This basin begins where the river emerges from the canyon above Thermopolis and extends nearly to the mouth of the river. Most of the lower drainage area of Shoshone River is included in this basin. This belt is subject to the influence of the so-called chinook winds. Nearer the mouth of the stream the winters are more severe.

Irrigation along Bighorn River is developing very rapidly. For a number of years irrigation has been practiced in comparatively restricted tracts at various points along the stream and its tributaries, as in the Lander and Thermopolis districts in Wyoming, and in the Crow Reservation in Montana, as well as on the No Wood, Greybull, Shoshone, and other tributaries; but such irrigation has used only a small part of the total flow of these streams. Extensive

irrigation works now being constructed by the Indian Office on the Shoshone Reservation in Wyoming and the Crow Reservation in Montana will eventually serve probably 225,000 acres; the Shoshone project of the United States Reclamation Service will provide for the irrigation of more than 125,000 acres along Shoshone River; by using some of the storage sites on Big Wind River the Wyoming Central Irrigation Co. will irrigate several hundred thousand acres of land near Riverton, and other private enterprises will irrigate considerable land near Basin. Many opportunities for additional projects are to be found on the tributary streams.

As a large part of the drainage area of Bighorn River has never been carefully surveyed, the amount of practicable storage is not well known, but undoubtedly many excellent reservoir sites exist at the headwaters of Big Wind and Little Wind rivers. Among others may be mentioned the site on Bull Lake Creek, which is situated at a natural lake on this stream, and many similar lakes are to be found in that locality. It is believed that good sites can be found for storing the flood waters of Paint Rock, Owl Creek, Shell Creek, and Greybull River. Many of these streams have a large annual run-off, but some of them are intermittent in character.

Probably the best reservoir site in the area is the one which the Reclamation Service is now developing on Shoshone River 8 miles above Cody, Wyo. With a dam 310 feet high above foundation the reservoir will have a capacity of 456,000 acre-feet.

The value of the land along the Bighorn River and its tributaries for agriculture will probably restrict water-power development to streams of the headwater regions. The fall of many of these streams exceeds 300 feet to the mile. Popo Agie and Little Wind rivers probably afford the best opportunities. In the canyon of the Bighorn above Thermopolis, where the Big Horn Company is now constructing a plant with a capacity of about 5,000 horsepower, at least 25,000 horsepower can be developed. Of the 100,000 horsepower or more which might easily be developed, probably less than 1,000 horsepower are now being utilized.

BIGHORN RIVER NEAR THERMOPOLIS, WYO.

This station, which is located on the county highway bridge between Thermopolis and the Thermopolis Hot Springs, was established May 28, 1900, discontinued December 31, 1905, and reestablished June 30, 1910. The principal tributaries above the station are Wind, Little Wind, Popo Agie, and Badwater rivers. Below the station No Wood, Greybull, Shoshone, and Little Bighorn rivers are the important tributaries.

The drainage area above the station is 8,180 square miles.

A staff gage is fastened securely to the downstream side of the middle pier of the bridge. The gage datum has remained constant. Discharge measurements are made from the highway bridge.

The bed of the stream is composed of rock and gravel and is practically permanent. The discharge at this station is little affected by ice.

Irrigation is carried on extensively on the tributaries of Bighorn, but not from the river itself.

Discharge measurements of Bighorn River near Thermopolis, Wyo., in 1910.

Date	Hydrographer	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
July 30	J. C. Beebe.	240	744	2.44	2,320
Aug. 23	do	216	557	1.70	1,240
Sept. 25	do	219	585	1.95	1,600

Daily gage height, in feet, and discharge, in second-feet, of Bighorn River near Thermopolis, Wyo., for 1910.

[Victor T Johnson, observer.]

Day.	July.		Aug.		Sept.		Oct.		Nov.		Dec.	
	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge
1	.....	.....	3.0	3,300	1.5	1,020	1.3	830	1.3	830	1.0	580
2	.....	.....	2.6	2,580	1.5	1,020	1.42	940	1.3	830	1.1	660
3	.....	.....	2.3	2,080	.....	995	1.4	920	1.3	830	1.1	660
4	.....	.....	2.4	2,240	.....	970	1.3	830	1.3	830	1.1	660
5	.....	.....	2.5	2,410	.....	945	1.3	830	1.3	830	1.1	660
6	.....	.....	2.4	2,240	1.4	920	1.2	740	1.2	740	1.1	660
7	.....	.....	2.3	2,080	1.3	830	1.2	740	1.2	740	1.1	660
8	.....	.....	2.2	1,930	1.3	830	1.2	740	1.2	740	1.1	660
9	.....	.....	2.3	2,080	1.2	740	1.2	740	1.1	660	1.1	660
10	.....	.....	2.0	1,650	1.2	740	1.2	740	1.1	660	1.1	660
11	.....	.....	2.1	1,790	1.2	740	1.2	740	1.1	660	1.1	660
12	.....	.....	2.1	1,790	1.2	740	1.2	740	1.1	660	1.1	660
13	.....	.....	2.0	1,650	1.2	740	1.2	740	1.1	660	1.1	660
14	.....	.....	2.0	1,650	1.2	740	1.2	740	1.1	660	1.1	660
15	.....	.....	2.0	1,650	1.2	740	1.2	740	1.1	660	1.1	660
16	.....	.....	1.7	1,250	1.2	740	1.2	740	1.1	660	1.1	660
17	.....	.....	1.8	1,380	1.2	740	1.3	830	1.1	660	1.0	580
18	.....	.....	1.8	1,380	1.2	740	1.3	830	1.0	580	1.0	580
19	.....	.....	1.8	1,380	1.2	740	1.3	830	1.0	580	1.0	580
20	.....	.....	1.7	1,250	1.2	740	1.3	830	1.0	580	1.0	580
21	.....	.....	1.7	1,250	1.2	740	1.3	830	1.0	580	.9	510
22	.....	.....	1.7	1,250	1.6	1,130	1.3	830	1.0	580	.9	510
23	.....	.....	1.7	1,250	2.1	1,790	1.3	830	1.0	580	.9	510
24	.....	.....	1.7	1,250	2.0	1,650	1.3	830	1.1	660	.9	510
25	.....	.....	1.7	1,250	1.9	1,510	1.3	830	1.1	660	.9	510
26	.....	.....	1.7	1,250	1.7	1,250	1.3	830	1.1	660	.9	510
27	.....	.....	1.7	1,250	1.6	1,130	1.3	830	1.1	660	.9	510
28	.....	.....	1.7	1,250	1.5	1,020	1.3	830	1.0	580	.9	510
29	.....	.....	1.6	1,130	1.5	1,020	1.3	830	1.0	580	.9	510
30	2.45	2,320	1.5	1,020	1.4	920	1.3	830	1.0	580	.9	510
31	2.6	2,580	1.5	1,020	.....	.....	1.3	830	.....	.....	.9	510

NOTE.—These discharges are based on a rating curve that is well defined between 920 and 3,300 second-feet. Discharges interpolated Sept. 3 to 5.

Monthly discharge of Bighorn River near Thermopolis, Wyo., for 1910.

[Drainage area, 8,180 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
August	3,300	1,020	1,640	0.200	0.23	101,000	A.
September	1,790	740	952	.116	.13	56,600	A.
October	940	740	805	.098	.11	49,500	B.
November	830	580	672	.082	.09	40,000	B.
December	660	510	594	.073	.08	36,500	B.

BIGHORN RIVER NEAR HARDIN, MONT.[1]

This station, which was established June 16, 1904, to determine the amount of water available for irrigation, is located at the bridge of the Burlington & Missouri River Railroad about half a mile above the junction of Bighorn and Little Bighorn rivers, and 2 miles from Hardin. Water is diverted a few miles above the station by a private irrigation company to irrigate land on the west side of the river.

The river freezes over during the winter months.

The present gage datum is 3 feet higher than that of the original chain gage; but on August 10, 1905, the gage was moved to the west span of the bridge and the datum lowered 2 feet. Gaging conditions at this station are good. The bed of the stream is of gravel, and is free from vegetation. All measurements are made from this railroad bridge.

Discharge measurements of Bighorn River near Hardin, Mont., for 1910.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
July 17	Raymond Richards	437	2,260	4.22	4,890
Aug. 28	J. C. Beebe	427	1,870	3.33	2,480
Nov. 12	W. A. Lamb	288	1,460	3.03	1,510

Daily gage height, in feet, of Bighorn River near Hardin, Mont., for 1910.

[E. P. Sweeney, observer.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	3.3	5.5	5.5	5.0	.....	3.2	3.05	2.9	3.1
2	.....	3.3	5.3	5.7	4.9	.....	3.2	3.05	2.9	3.1
3	.....	3.3	5.0	6.0	4.9	.....	3.2	3.05	2.9	3.1
4	.....	3.3	4.8	6.0	4.8	.....	3.2	3.05	2.9	3.1
5	.....	3.3	4.8	6.0	4.7	.....	3.2	3.25	2.9	3.1
6	.....	3.3	5.0	5.9	4.6	.....	3.4	3.15	2.9	3.0
7	.....	3.3	5.5	5.7	4.5	.....	3.3	3.15	2.9	3.0
8	4.9	3.3	5.5	5.5	4.5	.....	3.2	3.05	3.0	3.0
9	4.9	3.3	5.4	5.4	4.5	.....	3.1	3.05	3.0	3.0
10	4.8	3.4	5.3	5.3	4.5	.....	3.1	3.05	3.1	3.0

[1] Referred to as at "Fort Custer" in Water-Supply Paper, No. 208, p. 96.

Daily gage height, in feet, of Bighorn River near Hardin, Mont., for 1910—Continued.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
11	4.7	3.5	5.5	5.2	4.5	.....	3.1	2.95	3.1	.....
12	4.6	3.6	5.9	5.2	4.4	.....	3.0	2.95	3.0	.....
13	4.3	3.7	6.0	5.1	4.4	.....	3.0	2.85	3.0	.....
14	4.0	3.8	6.1	5.0	4.3	3.8	2.9	2.85	3.0	.....
15	3.9	3.9	6.0	5.5	4.3	3.8	2.9	2.85	3.0	.....
16	3.8	4.0	5.9	5.6	4.2	3.8	2.9	2.85	3.0	.....
17	3.7	4.0	5.6	5.4	4.2	3.8	2.75	2.8	2.9	.....
18	3.6	3.9	5.4	5.6	4.2	3.7	2.75	2.8	2.9	.....
19	3.5	3.8	5.3	5.5	4.2	3.7	2.75	2.8	2.9	.....
20	3.6	4.0	5.2	5.4	4.3	3.6	2.85	2.8	2.9	.....
21	3.65	4.1	5.1	5.2	4.4	3.6	2.85	2.8	2.9	.....
22	3.6	4.2	5.1	5.1	4.5	3.5	2.95	2.8	3.05	.....
23	3.6	4.2	5.1	5.0	4.6	3.5	3.25	2.8	3.05	.....
24	3.6	4.5	5.1	5.2	4.6	3.4	3.55	2.8	3.0	.....
25	3.6	4.6	5.1	5.0	4.5	3.3	3.55	2.8	3.0	.....
26	3.6	4.8	5.1	5.0	4.4	3.2	3.55	2.9	3.0	.....
27	3.6	4.9	5.4	4.9	4.4	3.1	3.35	2.9	3.15	.....
28	3.5	5.0	5.7	4.8	4.3	3.2	3.25	2.9	3.0	.....
29	3.5	5.2	5.5	4.7	4.2	3.3	3.15	2.9	3.0	.....
30	3.4	5.7	5.4	4.7	4.2	3.3	3.05	2.9	3.0	.....
31	3.4	.....	5.3	.....	.....	3.2	.....	2.9	.....	.....

Daily discharge, in second-feet, of Bighorn River near Hardin, Mont., for 1910.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	2,440	9,360	9,360	7,410	.....	2,220	1,910	1,620	2,010
2	.....	2,440	8,550	10,200	7,050	.....	2,220	1,910	1,620	2,010
3	.....	2,440	7,410	11,600	7,050	.....	2,220	1,910	1,620	2,010
4	.....	2 440	6,700	11,600	6,700	.....	2,220	1,910	1,620	2,010
5	.....	2,440	6,700	11,600	6,360	.....	2.220	2,330	1,620	2,010
6	.....	2,440	7,410	11,100	6,030	.....	2,670	2,110	1,620	1,810
7	.....	2,440	9,360	10,200	5,710	.....	2,440	2,110	1,620	1,810
8	7,050	2,440	9,360	9,360	5,710	.....	2,220	1.910	1,810	1,810
9	7,050	2,440	8,950	8,950	5,710	.....	2,010	1,910	1,810	1,810
10	6,700	2,670	8,550	8,550	5,710	.....	2,010	1,910	2,010	1,810
11	6,360	2,910	9,360	8 160	5,710	.....	2,010	1,720	2,010	.....
12	6,030	3,160	11,100	8,160	5,400	.....	1,810	1,720	1,810	.....
13	5,100	3,420	11,600	7,780	5,400	.....	1,810	1,530	1,810	.....
14	4,230	3,680	12,000	7,410	5,100	3,680	1,600	1,530	1,810	.....
15	3,950	3,950	11,600	9,360	5,100	3.680	1,620	1,530	1,810	.....
16	3,680	4,230	11,100	9,780	4,800	3,680	1,620	1,530	1,810	.....
17	3,420	4,230	9,780	8,950	4,800	3,680	1,350	1,440	1,620	.....
18	3,160	3,950	8,950	9,780	4,800	3,420	1,350	1,440	1,620	.....
19	2,910	3,680	8,550	9,360	4,800	3,420	1,350	1,440	1,620	.....
20	3,160	4,230	8,160	8,950	5,100	3,160	1,530	1,440	1,620	.....
21	3,290	4,510	7,780	8,160	5,400	3,160	1,530	1,440	1,620	.....
22	3,160	4,800	7,780	7,780	5,710	2,910	1,720	1,440	1,910	.....
23	3,160	4,800	7,780	7,410	6,030	2,910	2,330	1,440	1,910	.....
24	3,160	5,710	7,780	8,160	6,030	2,670	3,040	1,440	1,810	.....
25	3,160	6,030	7,780	7,410	5,710	2,440	3,040	1,440	1,810	.....
26	3,160	6,700	7,780	7,410	5,400	2,220	3,040	1,620	1,810	.....
27	3,160	7,050	8,950	7,050	5,400	2,010	2,560	1,620	2,110	.....
28	2,910	7.410	10,200	6,700	5,100	2,220	2,330	1,620	1.810	.....
29	2,910	8,160	9,360	6,360	4,800	2,440	2,110	1,620	1,810	.....
30	2,670	10,200	8,950	6,360	4,800	2,440	1,910	1,620	1,810	.....
31	2,670	.....	8,550	.....	.....	2,220	.....	1,620	.....	.....

NOTE.—These discharges are based on a fairly well defined rating curve.

Monthly discharge of Bighorn River near Hardin, Mont., for 1910.

[Drainage area, 20,700 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
January			1,700	0.082	0.09	104,000	D.
February			1,800	.087	.09	100,000	D.
March			4,200	.203	.24	258,000	C.
April	10,200	2,440	4,250	.205	.23	253,000	B.
May	12,000	6,700	8,940	.432	.50	550,000	B.
June	11,600	6,360	8,770	.424	.47	522,000	B.
July	7,410	4,800	5,630	.272	.31	346,000	B.
August			3,450	.167	.19	212,000	C.
September	3,040	1,350	2,070	.100	.11	123,000	B.
October	2,330	1,440	1,680	.081	.09	103,000	B.
November	2,110	1,620	1,760	.085	.10	105,000	B.
December			1,650	.080	.09	101,000	D.
The year			3,820	.185	2.51	2,780,000	

NOTE.—Means for January and February estimated; mean for period Mar. 1–7 estimated at 4,860 second-feet; mean for period Aug. 1–13 estimated at 4,210 second-feet; mean for period Dec. 11–31 estimated at 1,530 second-feet.

OWL CREEK NEAR THERMOPOLIS, WYO.

Owl Creek rises in the Owl Creek Mountains in western Wyoming, and flows eastward to its union with Bighorn River just below Thermopolis. Below the junction of its north and south forks it receives several small tributaries.

Irrigation is practiced quite extensively on this stream and the low-water flow is practically all appropriated. On the upper portions of the stream some good reservoir sites exist.

The gaging station was established July 30, 1910, on a newly constructed highway bridge, about 5 miles northwest of Thermopolis, Wyo., near the ranch buildings of the observer, C. H. McCumber.

The gage is an ordinary staff fastened to the upstream side of the bridge. Discharge measurements are made by wading. The channel will probably shift.

Discharge measurements of Owl Creek near Thermopolis, Wyo., in 1910.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
July 30	Raymond Richards	16	7	1.69	7.4
Aug. 23	J. C. Beebe	.....	.....	1.25	*a*.2
Sept. 27	.....do	13	11	1.81	8.9

a Estimated.

NOTE.—All measurements made by wading at various sections.

Daily gage height, in feet, and discharge, in second-feet, of Owl Creek near Thermopolis, Wyo., for 1910.

[C. H. McCumber, observer.]

Day.	July.		Aug.		Sept.		Oct.		Nov.		Dec.	
	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
1	.....	.....	1.8	9.3	1.4	1.7	1.6	4.9	1.7	7	1.7	7
2	.....	.....	1.5	3.1	1.4	1.7	1.7	7	1.7	7	1.7	7
3	.....	.....	1.5	3.1	1.4	1.7	1.7	7	1.7	7	1.7	7
4	.....	.....	1.4	1.7	1.4	1.7	1.7	7	1.7	7	1.7	7
5	.....	.....	1.4	1.7	1.4	1.7	1.7	7	1.7	7	1.7	7
6	.....	.....	1.4	1.7	1.5	3.1	1.7	7	1.7	7	.....	(a)
7	.....	.....	1.4	1.7	1.5	3.1	1.7	7	1.7	7	.....	.....
8	.....	.....	1.4	1.7	1.7	7	1.7	7	1.7	7	.....	.....
9	.....	.....	1.4	1.7	1.7	7	1.6	4.9	1.7	7	.....	.....
10	.....	.....	1.4	1.7	1.7	7	1.55	4.0	1.7	7	.....	.....
11	.....	.....	1.4	1.7	1.7	7	1.5	3.1	1.7	7	.....	.....
12	.....	.....	1.4	1.7	1.7	7	1.5	3.1	1.7	7	.....	.....
13	.....	.....	1.4	1.7	1.7	7	1.5	3.1	1.7	7	.....	.....
14	.....	.....	1.4	1.7	1.7	7	1.5	3.1	1.7	7	.....	.....
15	.....	.....	1.4	1.7	1.7	7	1.5	3.1	1.7	7	.....	.....
16	.....	.....	1.4	1.7	1.5	3.1	1.5	3.1	1.7	7	.....	.....
17	.....	.....	1.4	1.7	1.5	3.1	1.5	3.1	1.7	7	.....	.....
18	.....	.....	1.3	.6	1.5	3.1	1.5	3.1	1.7	7	.....	.....
19	.....	.....	1.3	.6	1.5	3.1	1.5	3.1	1.7	7	.....	.....
20	.....	.....	1.3	.6	1.5	3.1	1.5	3.1	1.7	7	.....	.....
21	.....	.....	1.3	.6	1.5	3.1	1.5	3.1	1.7	7	.....	.....
22	.....	.....	1.3	.6	2.75	34	1.5	3.1	1.7	7	.....	.....
23	.....	.....	1.3	.6	2.4	25	1.5	3.1	1.7	7	.....	.....
24	.....	.....	1.3	.6	3.0	40	1.5	3.1	1.7	7	.....	.....
25	.....	.....	1.3	.6	2.7	33	1.5	3.1	1.7	7	.....	.....
26	.....	.....	1.3	.6	1.8	9.3	1.5	3.1	1.7	7	.....	.....
27	.....	.....	1.3	.6	1.7	7	1.7	7	1.7	7	.....	.....
28	.....	.....	1.3	.6	1.7	7	1.7	7	1.7	7	.....	.....
29	.....	.....	1.3	.6	1.6	4.9	1.7	7	1.7	7	.....	.....
30	1.7	7	1.3	.6	1.6	4.9	1.7	7	1.7	7	.....	.....
31	2.1	17	1.3	.6	.....	.....	1.7	7	.....	.....	.....	.....

a Ice probably existed Dec. 6 to 31.

NOTE.—These discharges are based on a curve that is fairly well defined.

Monthly discharge of Owl Creek near Thermopolis, Wyo., for 1910.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
August	9.3	0.6	1.54	95	B.
September	40	1.7	8.48	505	B.
October	7	3.1	2.32	143	B.
November	7	7	7.0	417	C.
Dec. 1-5	.....	.....	7.0	69	D.

NO WOOD RIVER BASIN.

DESCRIPTION.

No Wood River rises in the Bighorn Mountains and flows northwestward to its junction with Bighorn River near Manderson, Wyo.

The principal tributaries of the No Wood are Otter Creek, Tensleep Creek, and Paint Rock Creek.

The irrigable land along the No Wood bottom is so narrow that irrigation can not be extensively practiced. Along the benches to

the north and west, however, there is considerable land which will eventually be irrigated. At present there is a project to take water from Tensleep Creek and irrigate the benches between that stream and Paint Rock Creek, and another project to carry water from the Paint Rock Creek to the benches between No Wood River and Shell Creek. In the mountains there are several good dam sites which will be used in storing the flood waters for these and other irrigation projects.

NO WOOD RIVER AT BONANZA, WYO.

This station was established July 29, 1910, near the ranch of J. W. Graves, one-fourth mile north of Bonanza post office, Wyo., in T. 49 N., R. 91 E. Discharge measurements are made by wading 50 feet below the gage. During floods, measurements are made from a highway bridge one-half mile below. The winter discharge is affected by ice. On August 29 a chain gage was installed on the left bank near the public highway, some 30 feet above the temporary staff gage at the same datum.

Paint Rock Creek enters the No Wood 1 mile above the station, Tensleep Creek about 20 miles above, and Otter Creek 35 miles above.

Irrigation is carried on to some extent and diversions are made both above and below the station.

Discharge measurements of No Wood River at Bonanza, Wyo., in 1910.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
July 29	Richards and Beebe	85	60	1.92	64
Aug. 26[a]	J. C. Beebe	108	180	1.91	72
Sept. 19	do	80	158	2.30	151
23	do	88	185	2.59	248
24	do	84	183	2.54	234

[a] Made from bridge about one-half mile below gage.

NOTE.—All measurements except that of Aug. 26 were made by wading.

Daily gage height, in feet, and discharge, in second-feet, of No Wood River at Bonanza, Wyo., for 1910.

[J. W. Graves, observer.]

Day.	July.		Aug.		Sept.		Oct.		Nov.		Dec.	
	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
1	.....	.....	2.20	125	1.90	63	2.45	198	2.48	208	2.38	.....
2	.....	.....	2.10	101	1.95	72	2.45	198	.....	207	2.38	.....
3	.....	.....	2.10	101	1.95	72	2.45	198	.....	206	2.40	.....
4	.....	.....	2.10	101	2.00	80	2.75	302	.....	205	2.38	.....
5	.....	.....	2.10	101	2.20	125	2.69	280	.....	204	2.38	.....
6	.....	.....	2.10	101	2.15	113	2.58	241	.....	203	1.98	.....
7	.....	.....	2.00	80	2.05	90	2.56	234	.....	202	2.80	.....
8	.....	.....	1.90	63	2.10	101	2.55	231	.....	200	.....	.....
9	.....	.....	1.90	63	2.10	101	2.54	228	2.45	198	.....	.....
10	.....	.....	1.90	63	2.10	101	2.53	224	2.45	198	.....	.....

Daily gage height, in feet, and discharge, in second-feet, of No Wood River, at Bonanza, Wyo., for 1910—Continued.

Day.	July.		Aug.		Sept.		Oct.		Nov.		Dec.	
	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-ch'ge.
11			1.95	72	2.10	101	2.50	214	2.45	198		
12			1.95	72	2.15	113	2.50	214	2.44	195		
13			1.90	63	2.20	125	2.52	221	2.44	195		
14			1.90	63	2.20	125	2.50	214	2.44	195		
15			2.00	80	2.25	138	2.46	201	2.42	188		
16			1.95	72	2.25	138	2.45	198	2.40	182		
17			1.90	63	2.25	138	2.46	201	2.32	258		
18			1.90	63	2.30	152	2.50	214	2.30	152		
19			1.90	63	2.35	167	2.50	214	2.38	176		
20			1.90	63	2.30	152	2.50	214	2.48	208		
21			1.90	63	2.30	152	2.49	211	2.28	247		
22			1.90	63	2.65	266	2.48	207	2.44	195		
23			1.90	63	2.65	266	2.48	207	2.42	188		
24			1.85	56	2.60	248	2.46	201	2.42	188		
25			1.90	63	2.60	248	2.46	201	2.40	182		
26			1.90	63	2.57	238	2.45	198	2.40	182		
27			1.90	63	2.55	231	2.45	198	2.26	141		
28			1.90	63	2.52	221	2.45	198	2.51	140		
29	1.90	63	1.90	63	2.50	214	2.43	192	2.46	140		
30	1.90	63	1.90	63	2.46	201	2.42	288	2.34	140		
31	2.30	152	1.90	63			2.48	208				

NOTE.—These discharges are based on a rating curve fairly well defined. Ice conditions Nov. 27 to Dec. 31. Discharges interpolated Nov. 2 to 8.

Monthly discharge of No Wood River at Bonanza, Wyo., for 1910.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
August	125	63	73	4,490	B.
September	248	63	152	9,040	B.
October	302	192	218	13,400	B.
November	258	140	191	11,400	B.

TENSLEEP CREEK NEAR TENSLEEP, WYO.

This station was established September 21, 1910, on Burke's ranch, 5 miles from Tensleep post office. The gage is 800 feet east of the county bridge near a cliff 80 feet high on north side of creek. Canyon Fork, the principal tributary, enters the stream just above the station.

An inclined and upright staff gage is used. At low and ordinary stages discharge measurements are made by wading; at flood stages measurements are made from the bridges over Canyon Fork and Tensleep Creek.

The bed of the creek is a rocky ledge.

Ice will probably occur in extreme cold weather.

A small amount of irrigation is practiced on this stream.

Discharge measurements of Tensleep Creek near Tensleep, Wyo., in 1910.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Sept. 22[a]	J. C. Beebe	59	59	0.42	93
Do.[b]	do			.40	[c] 87
Sept. 23[b]	do			.61	[d] 111

[a] Measurement made in morning, at a rough section below the gage.
[b] Measurement made on Tensleep Creek above mouth of Canyon Creek, and on Canyon Creek at mouth, and discharges added.
[c] Discharge of Canyon Creek, 24 second-feet; Tensleep Creek above Canyon Creek, 63 second-feet.
[d] Discharge of Canyon Creek, 29 second-feet; Tensleep Creek above Canyon Creek, 82 second-feet.

NOTE.—All measurements made by wading.

Daily gage height, in feet, and discharge, in second-feet, of Tensleep Creek near Tensleep, Wyo., for 1910.

[Miss Bessie Burke, observer.]

Day.	Sept.		Oct.		Nov.		Dec.	
	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
1			0.32	78	0.22	70	0.10	61
2			.34	80	.21	69	.10	61
3			.35	81	.20	68	.09	60
4			.38	84	.19	67	.09	60
5			.37	83	.11	62	.08	60
6			.35	81	.17	66	.10	61
7			.34	80	.20	68	.09	60
8			.33	79	.19	67	.07	59
9			.32	78	.17	66	.09	60
10			.30	76	.15	64	.10	61
11			.28	74	.17	66	.11	62
12			.27	74	.16	65	.10	61
13			.26	73	.15	64	.11	62
14			.25	72	.13	63	.10	61
15			.25	72	.11	62	.09	60
16			.26	73	.10	61	.07	59
17			.25	72	.09	60	.08	60
18			.28	74	.07	59	.06	59
19			.29	75	.12	62	.07	59
20			.20	68	.11	62	.06	59
21	0.33	79	.22	70	.10	61	.06	59
22	.42	88	.24	71	.08	60	.05	58
23	.62	115	.25	72	.06	59	.06	59
24	.60	112	.23	70	.11	62	.04	57
25	.53	102	.22	70	.12	62	.05	58
26	.46	93	.23	70	.11	62	.04	57
27	.44	91	.16	65	.10	61	.03	57
28	.38	84	.18	67	.11	62	.02	56
29	.38	84	.21	69	.10	61	.01	56
30	.33	79	.20	68	.09	60	.02	56
31			.21	69			.01	56

NOTE.—These discharges are based on a fairly well defined rating curve.

Monthly discharge of Tensleep Creek near Tensleep, Wyo., for 1910.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
Sept. 21–30	115	79	93	1,840	B.
October	84	65	74	4,550	B.
November	70	59	63	3,750	B.
December	62	56	59	3,630	B.

PAINT ROCK CREEK NEAR BONANZA, WYO.

Paint Rock Creek rises in the Bighorn Mountains, flows southwestward, and joins No Wood River at Bonanza post office, Wyo. Its tributaries all enter above the station and all are small mountain streams.

The gaging station, which was established July 28, 1910, is located about 1½ miles from Bonanza post office and 12 miles from Manderson, Wyo., near the farmhouse of William Paumer.

The chain gage is located on the right bank of the stream, directly in front of the house of the observer. Discharge measurements are made by wading at the gage at low and ordinary stages, and from the highway bridge, one-fourth mile below, at flood stages.

The bed of the stream is rocky and clean, and probably nonshifting. The winter discharge is affected by ice.

Some water is diverted above the station for irrigation.

Discharge measurements of Paint Rock Creek near Bonanza, Wyo., in 1910.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
July 28	Raymond Richards	38	36	2.61	40
Aug. 26	J. C. Beebe	38	29	2.42	19
Sept. 18	.....do	38	35	2.69	40
Sept. 23	.....do	40	44	2.87	62

NOTE.—All measurements made by wading at same section, which is practically the same as the one of the chain gage.

Daily gage height, in feet, and discharge, in second-feet, of Paint Rock Creek near Bonanza, Wyo., for 1910.

[W. Paumer, observer.]

Day.	July.		Aug.		Sept.		Oct.		Nov.		Dec.	
	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
1	.....	.....	2.50	25	2.40	18	2.91	66	2.92	67	2.83	57
2	.....	.....	2.50	25	2.40	18	2.91	66	2.92	67	2.83	57
3	.....	.....	2.50	25	2.45	22	3.00	77	2.92	67	2.83	57
4	.....	.....	2.50	25	2.40	18	3.04	82	2.92	67	2.82	56
5	.....	.....	2.50	25	2.35	16	3.10	89	2.93	69	2.82	56
6	.....	.....	2.40	18	2.40	18	3.10	89	2.94	70	2.82	56
7	.....	.....	2.40	18	2.35	16	3.10	89	2.92	67	2.81	55
8	.....	.....	2.40	18	2.40	18	3.03	80	2.92	67	(a)	.....
9	.....	.....	2.40	18	2.35	16	3.03	80	3.00	77	.....	.....
10	.....	.....	2.40	18	2.40	18	3.03	80	3.00	77	.....	.....
11	.....	.....	2.40	18	2.50	25	3.01	78	2.92	67	.....	.....
12	.....	.....	2.40	18	2.45	22	3.01	78	2.91	66	.....	.....
13	.....	.....	2.40	18	2.50	25	3.01	78	2.91	66	.....	.....
14	.....	.....	2.40	18	2.55	28	3.00	77	2.91	66	.....	.....
15	.....	.....	2.45	22	2.55	28	3.00	77	2.90	65	.....	.....
16	.....	.....	2.40	18	2.65	39	3.00	77	2.90	65	.....	.....
17	.....	.....	2.40	18	2.65	39	3.00	77	2.80	54	.....	.....
18	.....	.....	2.40	18	2.70	44	3.00	77	2.80	54	.....	.....
19	.....	.....	2.40	18	2.65	39	2.94	70	2.92	67	.....	.....
20	.....	.....	2.45	22	2.70	44	2.94	70	2.92	67	.....	.....

a Ice from about Dec. 8 to 31.

Daily gage height, in feet, and discharge, in second-feet, of Paint Rock Creek near Bonanza, Wyo., for 1910—Continued.

Day.	July.		Aug.		Sept.		Oct.		Nov.		Dec.	
	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
21			2.35	16	2.70	44	3.02	79	2.92	67		
22			2.40	18	2.70	44	3.02	79	2.92	67		
23			2.35	16	2.86	61	2.94	70	2.92	67		
24			2.35	16	2.85	60	2.94	70	2.92	67		
25			2.45	22	2.93	69	2.94	70	2.92	67		
26			2.40	18	3.01	78	3.00	77	2.92	67		
27			2.45	22	3.02	79	3.00	77	2.92	67		
28	2.60	34	2.40	18	3.02	79	3.00	77	2.92	67		
29		[a] 30	2.40	18	3.02	79	3.00	77	2.92	67		
30	2.50	25	2.45	22	2.92	67	2.92	67	2.84	58		
31	2.50	25	2.40	18			2.92	67				

[a] Interpolated.

NOTE.—These discharges are based on a curve that is fairly well defined.

Monthly discharge of Paint Rock Creek near Bonanza, Wyo., for 1910.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
August	25	16	19.6	1,210	B.
September	79	16	39.0	2,320	B.
October	89	66	76.4	4,700	B.
November	77	54	66.4	3,950	B.
Dec. 1-7	57	55	56.3	808	B.

GREYBULL RIVER BASIN.

DESCRIPTION.

Greybull River rises in the Shoshone Range of the Rockies and flows northeastward to its junction with Bighorn River just below Basin, Wyo.

Greybull River has numerous tributaries, many of them small intermittent streams. Wood River, the largest tributary, rises in the mountains to the south of the Greybull and joins the main stream about 9 miles above Meeteetse, Wyo.

Irrigation is carried on quite extensively on the Greybull and its branches. A project to divert water from Wood River and discharge it into a reservoir on Grass Creek is now under way.

GREYBULL RIVER NEAR MEETEETSE, WYO.

This station, which is about 5 miles from Meeteetse, Wyo., on the road to Sunshine and Wilson's mine, 300 feet from Wilson's house, was established September 14, 1910. The principal tributary above the station is Wood River.

A staff gage is fastened to south span of the middle pier on the upstream side of the bridge. Gage datum has remained constant. At flood stages discharge measurements are made from the upstream side of the bridge. Low-water measurements are made by wading either above or below the bridge.

The bed of the stream is rocky.

The following discharge measurement was made by J. C. Beebe:

September 15, 1910: Width, 56 feet; area, 70 square feet; gage height, 0.68 feet; discharge, 127 second-feet. Made by wading about 100 feet above the gage.

Daily gage height, in feet, of Greybull River near Meeteetse, Wyo., for 1910.

Day.	Sept.	Oct.	Nov.	Dec.	Day.	Sept.	Oct.	Nov.	Dec.
1		0.98	0.98	0.85	16	0.81	0.96	0.70	0.96
2		1.01	.96	.85	17	1.30	1.01	.78	1.04
3		1.02	.94	.83	18	.86	.99	.85	1.65
4		.98	.86	.82	19	.98	.97	.88	1.78
5		.97	.78	.79	20	.85	.78	.69	.98
6		1.06	.96	.75	21	.88	.89	.75	.98
7		1.03	.91	.76	22	2.34	.86	.70	3.00
8		.99	.86	.82	23	1.27	.90	.88	3.00
9		.97	.79	.85	24	1.06	.88	.85	2.68
10		.97	.89	.88	25	.98	.89	.80	3.00
11		.97	.87	.85	26	1.07	.99	.85	
12		.97	.84	.86	27	1.07	.92	.65	
13		.96	.82	.88	28	1.04	.98	.68	
14	0.68	.97	.74	.90	29	.98	1.02	.85	
15	.68	.97	.72	.94	30	.98	1.00	.88	
					31		.96		

NOTE.—Ice from about Dec. 17 to 31.

WOOD RIVER NEAR MEETEETSE, WYO.

This station, which is on the highway bridge 800 feet above the junction of Wood and Meeteetse rivers, 9 miles from Meeteetse post office, on the road running west to the Pitchfork ranch, was maintained from September 15 to December 10, 1910.

Cascade and Indian creeks, the principal tributaries of Wood River, enter the stream above the station. Some water is diverted above the station for irrigation.

A staff gage is fastened to the wind brace on the north side of the bridge. Discharge measurements are made from the downstream side of bridge and, at low water, by wading.

The bed of the stream is of gravel. The winter discharge is affected by ice.

The following discharge measurement was made by J. C. Beebe:

September 15, 1910: Width, 29 feet; area, 30 square feet; gage height, 0.77 feet; discharge, 62 second-feet.

Daily gage height, in feet, of Wood River near Meeteetse, Wyo., for 1910.

Day.	Sept.	Oct.	Nov.	Dec.	Day.	Sept.	Oct.	Nov.	Dec.
1	.....	0.80	0.75	0.72	16	0.82	0.72	0.71	.....
2	.....	.85	.75	.70	17	.85	.71	.71	.....
3	.....	.82	.75	.70	18	.84	.73	.71	.....
4	.....	.81	.74	.70	19	.84	.72	.72	.....
5	.....	.80	.74	.70	20	.85	.70	.73	.....
6	.....	.81	.73	.70	21	.84	.70	.71	.....
7	.....	.81	.73	.70	22	.95	.70	.72	.....
8	.....	.78	.73	.70	23	.90	.68	.72	.....
9	.....	.75	.72	.70	24	.85	.67	.70	.....
10	.....	.75	.72	.70	25	.85	.69	.70	.....
11	.....	.75	.73	.....	26	.84	.72	.71	.....
12	.....	.74	.72	.....	27	.80	.77	.71	.....
13	.....	.74	.72	.....	28	.78	.80	.75	.....
14	.....	.73	.71	.....	29	.80	.77	.75	.....
15	0.78	.73	.71	.....	30	.78	.75	.75	.....
					31	.....	.77	.....	.....

NOTE.—Gage heights probably affected by ice Dec. 11 to 31.

SHOSHONE RIVER BASIN.

SHOSHONE RIVER AT CODY, WYO.

This station, which is located at the highway bridge 1 mile northeast of Cody, Wyo., was established April 26, 1902, to obtain data to be used in connection with the Shoshone reclamation project.

The principal tributaries are the North and South forks, which unite 8 miles above Cody to form the Shoshone. The drainage area above the gaging station is 1,400 square miles, but the entire run-off from this area does not pass the section, as a number of private irrigation canals, serving about 35,000 acres of land, divert water above the station. Below Cody irrigation has been carried on extensively by means of private canal systems that serve about 45,000 acres.

A staff gage, the datum of which has not changed, is spiked to a crib pier of the bridge. Measurements are made from the bridge.

The conditions for obtaining accurate discharge data are good. Ice does not affect the flow at this station as the river is kept open by springs which enter the river a short distance above the gage.

No gage heights were obtained in 1910.

The following discharge measurement was made by Raymond Richards:

March 16, 1910: Width, 128 feet; area, 352 square feet; gage height, 3.48 feet; discharge, 672 second-feet.

SHOSHONE RIVER AT CORBETT DAM, WYO.

This station, which is located 8 miles below Cody, Wyo., at the Corbett diversion dam built by the United States Reclamation Service, was established April 20, 1908.

The dam is a reenforced concrete structure of the buttressed type, having on the upstream side a deck 2½ feet thick, sloping 1 to 1, and supported by buttresses 2 feet thick, spaced 14 feet on centers. It raises the low-water elevation of the river 10.2 feet. The length between abutments is 400 feet. The estimates of discharge are com-

puted by considering the dam as a weir and the sluice and tunnel gates as submerged orifices.

Sage Creek, the only important tributary that enters between this station and that at Cody, drains only about 25 square miles.

The gage is situated 40 feet above the crest of the dam, and reads the height of the water above the crest.

Daily gage height, in feet, of Shoshone River at Corbett dam, Wyo., for 1910.

[J. A. Fleming, observer.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1		0.52	1.35	1.20	1.60	1.44	0.81	0.30	0.46	0.46
2		.54	1.17	1.30	1.60	1.44	.83	.32	.50	.45
3		.54	1.07	1.33	1.61	1.42	.80	.31	.48	.47
4		.54	1.04	1.34	1.61	1.40	.80	.31	.48	.46
5		.56	1.65	1.38	1.61	1.40	.79	.35	44	.47
6		.63	1.35	1.43	1.61	1.40	.77	.36	.45	.45
7		.65	1.35	1.43	1.61	1.39	.75	.38	.45	.43
8		.58	1.40	1.44	1.60	1.35	.70	.00	.45	.44
9		.72	1.53	1.44	1.62	1.32	.60	.40	56	.45
10		.80	1.68	1.42	1.60	1.30	.31	.40	.49	.46
11		.88	1.70	1.44	1.60	1.28	.30	.31	.50	.45
12		.96	1.90	1.50	1.58	1.25	.33	.30	.50	.45
13	0.54	1.05	1.92	1.48	1.58	1.23	.35	.30	.51	.43
14	.54	1.06	1.92	1.50	1.58	1.23	.34	.31	.51	.43
15	.58	.98	1.88	1.51	1.57	1.23	.33	.30	.46	.45
16	.60	.80	1.84	1.51	1.57	1.18	.32	.27	.44	.40
17	.65	.70	1.70	1.51	1.55	1.14	.31	.27	.42	.42
18	.74	.82	1.46	1.51	1.55	1.11	.38	.27	.37	.41
19	.90	1.14	1.22	1.52	1.57	1.07	.46	.33	.47	.43
20	.93	1.32	1.27	1.54	1.56	1.01	.34	.31	.45	.42
21	.95	1.38	1.30	1.55	1.55	.96	.32	23	.48	.42
22	.95	1.14	1.25	1.55	1.54	.92	.46	.33	.47	.43
23	.90	1.21	1.30	1.56	1.54	.92	.46	.40	.45	.38
24	.72	1.28	1.32	1.56	1.54	.91	.39	.40	.48	.43
25	.67	1.44	1.33	1.56	1.52	.89	.37	.39	.48	.42
26	.64	1.44	1.37	1.56	1.51	.86	.34	.42	.48	.40
27	.60	1.54	1.37	1.56	1.51	.85	.33	.46	.46	.40
28	.58	1.64	1.38	1.58	1.52	.84	.31	.43	.36	.40
29	.57	1.71	.90	1.59	1.50	.84	.31	.44	.46	.39
30	.49	1.52	.91	1.59	1.49	.83	.29	.43	.46	.39
31	.50		1.10		1.45	.81		.43		.40

NOTE.—The zero of the gage is the crest of the dam.

Daily discharge, in second-feet, of Shoshone River at Corbett dam, Wyo., for 1910.

[Shoshone River and sluices.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1		502	2,420	2,040	3,110	2,660	1,160	368	414	414
2		534	1,970	2,290	3,110	2,660	1,200	392	470	400
3		534	1,730	2,370	3,140	2,600	1,140	380	442	428
4		534	1,660	2,390	3,140	2,560	1,140	380	442	414
5		566	3,250	2,500	3,140	2,560	1,120	428	386	428
6		681	2,420	2,640	3,140	2,560	1,090	440	400	400
7		715	2,420	2,640	3,140	2,520	1,050	962	400	372
8		598	2,560	2,660	3,110	2,420	960	894	400	386
9		836	2,910	2,660	3,170	2,340	790	528	566	400
10		980	3,340	2,600	3,110	2,290	380	330	456	414
11		1,140	3,400	2,660	3,110	2,240	368	222	470	400
12		1,310	4,020	2,820	2,950	2,160	404	210	470	400
13	534	1,520	4,090	2,780	2,950	2,120	428	210	486	372
14	534	1,540	4,090	2,820	2,950	2,120	416	222	486	372
15	598	1,360	3,960	2,860	3,030	2,120	404	210	414	400
16	630	980	3,830	2,860	3,030	1,990	392	182	386	330
17	715	800	3,400	2,860	2,970	1,900	380	182	358	358
18	872	1,020	2,720	2,860	2,970	1,820	464	182	294	344
19	1,180	1,740	2,090	2,880	3,030	1,730	573	246	428	372
20	1,250	2,180	2,220	2,940	3,000	1,580	416	222	400	358

Daily discharge, in second-feet, of Shoshone River at Corbett dam, Wyo., for 1910— Continued.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
21	1,290	2,500	2,290	2,970	2,970	1,470	392	144	442	358
22	1,290	1,900	2,160	2,970	2,940	1,380	573	894	428	372
23	1,180	2,060	2,290	3,000	2,940	1,380	573	1,020	400	306
24	836	2,240	2,340	3,000	2,940	1,360	476	330	442	372
25	749	2,660	2,370	3,000	2,880	1,320	452	318	442	358
26	698	2,660	2,480	3,000	2,860	1,260	416	358	442	330
27	630	2,940	2,480	3,000	2,860	1,240	404	414	414	330
28	598	3,230	2,500	3,050	2,880	1,220	380	372	282	330
29	582	3,430	1,340	3,080	2,820	1,220	380	386	414	318
30	456	2,880	1,360	3,080	2,800	1,200	358	372	414	318
31	470	.....	1,800	.....	2,680	1,160	.....	372	.....	330

Monthly discharge of Shoshone River and sluices at Corbett dam, Wyo., for 1910.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
March 13-31	1,290	456	794	29,900
April	3,430	502	1,550	92,200
May	4,090	1,340	2,640	162,000
June	3,080	2,040	2,780	165,000
July	3,170	2,680	3,000	184,000
August	2,660	1,160	1,910	117,000
September	1,200	358	623	37,100
October	1,020	144	393	24,200
November	566	282	423	25,200
December	428	306	370	22,800
The period	.....	.....	.....	859,000

Daily discharge, in second-feet, of Corbett tunnel at Corbett dam, Wyo., for 1910.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	73	258	188	262	276	172	127	34
2	.....	74	258	221	215	276	172	127	39
3	.....	74	257	249	187	276	164	127	39
4	.....	74	257	260	200	276	155	127	39
5	.....	74	184	261	231	276	155	127	39
6	.....	74	42	262	231	248	155	127	10
7	.....	74	68	275	231	230	155	127	.....
8	.....	74	101	282	250	230	154	126	.....
9	.....	74	122	282	262	230	153	147	.....
10	.....	74	122	282	262	230	142	219	.....
11	.....	75	122	282	262	230	135	274	.....
12	.....	75	124	282	272	230	135	274	.....
13	46	56	124	282	277	230	135	274	.....
14	74	44	124	282	277	230	135	279	.....
15	74	44	124	282	277	206	135	284	.....
16	74	44	79	282	277	191	135	284	.....
17	74	43	52	282	277	170	135	284	.....
18	74	111	52	289	277	159	135	284	.....
19	75	154	52	293	277	142	144	284	.....
20	75	180	52	293	277	132	149	284	.....
21	75	196	68	293	277	145	149	284	.....
22	75	194	78	293	277	177	149	191	.....
23	75	195	78	293	277	188	149	184	.....
24	74	195	78	293	277	199	149	128	.....
25	74	196	114	293	277	199	149	101	.....
26	74	245	138	293	276	198	149	54	.....
27	74	276	147	283	276	198	149	26	.....
28	74	267	156	262	276	198	137	26	.....
29	74	262	156	262	276	198	127	26	.....
30	73	261	156	262	276	198	127	26	.....
31	73	.....	156	.....	276	190	.....	26	.....

NOTE.—These discharges were computed considering the gate openings as submerged orifices.

Monthly discharge of Corbett tunnel at Corbett dam, Wyo., for 1910.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
March 13-31	75	46	72.7	2,740
April	276	43	128	7,620
May	258	42	126	7,750
June	293	188	275	16,400
July	277	187	262	16,100
August	276	132	211	13,000
September	172	127	146	8,690
October	284	26	170	10,500
November 1-6	39	10	33.3	396
The period				83,200

NOTE.—Considering the uncertainties involved in the method of computation, the accuracy of the above monthly mean is not better than "C."

KNIFE RIVER BASIN.

DESCRIPTION.

Knife River rises in the northeast portion of Billings County, N. Dak., and flows eastward to Missouri River at Stanton, N. Dak., 90 miles in a direct line. It drains a basin whose greatest width is 40 miles and whose area comprises about 2,500 square miles. One-fifth of this basin is drained by the chief tributary, Spring Creek, which enters the Knife about 20 miles above its mouth.

Altitudes range from 1,700 to 2,500 feet above sea level. The mean annual rainfall ranges from 15 to 17 inches. There are no forests and only a few scattered trees along the streams.

Through most of the year the flow is small, but owing to the steep slopes of the sides of the valley there are occasional sudden floods after heavy rains.

The land in the lower portion of the valley is very favorably located for irrigation if the flood waters can be stored, but no really economical localities for storage have yet been found.

KNIFE RIVER NEAR BRONCHO, N. DAK.

This station, which is located at C. D. Smith's ranch, in the SE. $\frac{1}{4}$ sec. 4, T. 142 N., R. 90 W., the former site of the post office of Broncho, N. Dak., was established on May 29, 1903, to determine the amount of water available for irrigation. The present post office is some 6 miles away from the old site.

Spring Creek enters about 15 miles below the station and Elm Creek one-half mile above. The drainage area is 1,260 square miles.

The station was originally 2 miles farther down the river, but it was moved to its present location March 23, 1905, and since that time the gage datum has been unchanged. The drainage areas at the two locations are practically identical, the area at the lowest point being perhaps about 5 square miles greater.

No discharge measurements were made in 1910.

The channel at this point does not change perceptibly. Sufficient discharge measurements at high stages have not yet been made to check the rating curve satisfactorily, but it is approximately defined.

The chain gage is located on the left bank of the stream just below the observer's house. Measurements are made from a car and cable in flood just below the gage. Low-water measurements are made by wading.

Daily gage height, in feet, of Knife River near Broncho, N. Dak., for 1910.

[C. D. Smith, observer.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	4.3	3.7	3.7	3.6	3.5	3.6	3.6	3.6
2	.....	4.4	3.7	3.7	3.6	3.5	3.6	3.6	3.6
3	.....	4.4	3.7	3.7	3.6	3.4	3.6	3.6	3.6
4	.....	4.3	3.7	3.7	3.55	3.4	3.6	3.6	3.6
5	8.15	4.3	3.7	3.6	3.55	3.4	3.6	3.6	3.6
6	15.65	4.2	3.7	3.6	3.5	3.4	3.6	3.6	3.6
7	16 0	4.2	3.7	3.6	3.5	3.4	3.6	3.6	3.6
8	14.25	4.1	3.7	3.6	3.5	3.5	3.6	3.6	3.6
9	12.2	4.0	3.7	3.7	3.5	3.5	3.6	3.6	3.6
10	10.6	4.0	3.7	6.0	3.5	3.5	3.6	3.6	3.6
11	13.4	4.0	3.7	6.8	3.5	3.6	3.6	3.6	3.6
12	17.6	3.8	3.7	5.2	3.5	3.6	3.6	3.6	3.6
13	16.4	3.8	3.7	5.0	3.5	3.6	3.7	3.6	3.7
14	13.0	3.8	3.7	4.6	3.5	3.6	3.7	3.6	3.7
15	10.2	3.8	3.7	4.2	3.5	3.6	3.7	3.6	3.7
16	8.2	3.9	3.7	4.0	3.5	3.6	3.7	3.6	3.7
17	6.7	3.9	3.8	3.9	3.4	3.6	3.7	3.6	3.7
18	6.2	3.9	3.8	3.9	3.4	3.6	3.7	3.6	3.7
19	5.85	3.9	3.8	3.8	3.4	3.6	3.7	3.6	3.7
20	5.45	3.9	3.8	3.7	3.4	3.6	3.7	3.6	3.7
21	5.15	3.9	3.8	3.7	3.4	3.6	3.7	3.6	3.7
22	4.95	3.9	3.8	3.7	3.4	3.6	3.7	3.6	3.7
23	4.85	3.9	3.7	3.7	3.4	3.6	3.7	3.6	3.7
24	4.55	3.9	3.7	3.7	3.5	3.6	3.7	3.6	3.7
25	4.4	3.9	3.7	3.7	3.6	3.6	3.6	3.6	3.7
26	4.3	3.8	3.7	3.7	3.8	3.6	3.6	3.6	3.7
27	4.4	3.8	3.7	3.7	3.8	3.6	3.6	3.6	.....
28	4.4	3.8	3.7	3.7	3.8	3.6	3.6	3.6	.....
29	4.4	3.8	3.7	3.7	3.7	3.6	3.6	3.6	.....
30	4.3	3.8	3.7	3.7	3.7	3.6	3.6	3.6	.....
31	4.3	.....	3.7	.....	3.6	3.6	.....	3.6	.....

NOTE.—Ice probably existed during January, February, and Mar. 1 to 4, and after Nov. 27.

Daily discharge, in second-feet, of Knife River near Broncho, N. Dak., for 1910.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	59	14	14	10	7	10	10	10
2	.....	70	14	14	10	7	10	10	10
3	.....	70	14	14	10	4	10	10	10
4	.....	59	14	14	8	4	10	10	10
5	764	59	14	10	8	4	10	10	10
6	2,730	49	14	10	7	4	10	10	10
7	2,810	49	14	10	7	4	10	10	10
8	2,410	40	14	10	7	7	10	10	10
9	1,760	32	14	14	7	7	10	10	10
10	1,360	32	14	318	7	7	10	10	10
11	2,160	32	14	471	7	10	10	10	10
12	3,210	19	14	181	7	10	10	10	10
13	2,910	19	14	151	7	10	14	10	14
14	2,060	19	14	95	7	10	14	10	14
15	1,260	19	14	49	7	10	14	10	14

Daily discharge, in second-feet, of Knife River near Broncho, N. Dak., for 1910—Contd.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
16	775	25	14	32	7	10	14	10	14
17	451	25	19	25	4	10	14	10	14
18	354	25	19	25	4	10	14	10	14
19	292	25	19	19	4	10	14	10	14
20	224	25	19	14	4	10	14	10	14
21	174	25	19	14	4	10	14	10	14
22	144	25	19	14	4	10	14	10	14
23	129	25	14	14	4	10	14	10	14
24	88	25	14	14	7	10	14	10	14
25	70	25	14	14	10	10	10	10	14
26	59	19	14	14	19	10	10	10	14
27	70	19	14	14	19	10	10	10	.....
28	70	19	14	14	19	10	10	10	.....
29	70	19	14	14	14	10	10	10	.....
30	59	19	14	14	14	10	10	10	.....
31	59	.....	14	.....	10	10	.....	10	.....

NOTE.—These discharges are based on a rating curve well defined below 82 second-feet.

Monthly discharge of Knife River near Broncho, N. Dak., for 1910.

[Drainage area, 1,260 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
January	.....	.....	[a] 5	.....	.....	307	
February	.....	.....	[a] 6	.....	.....	333	
March	3,210	.....	[a] 859	0.682	0.79	52,800	D.
April	70	19	32.4	.026	.03	1,930	C.
May	19	14	15.0	.012	.01	922	C.
June	471	10	54.3	.043	.05	3,230	B.
July	19	4	8.5	.0067	.01	521	C.
August	10	4	8.5	.0067	.01	526	C.
September	14	10	11.6	.0092	.01	690	C.
October	10	10	10.0	.0079	.01	615	C.
November	14	10	12.4	.0098	.01	738	C.
December	.....	.....	[1] 6	.....	.....	369	
The year	.....	.....	85.7	.....	.....	63,000	

[a] Discharge estimated Jan. 1 to Mar. 4 and Nov. 27 to Dec. 31 because of probable effect of ice.

NOTE.—The means for January, February, and December are only approximate.

PAINTED WOODS CREEK BASIN.

DESCRIPTION.

This drainage basin, comprising an area of about 900 square miles in McLean, Sheridan, and Burleigh counties, N. Dak., is drained by Painted Woods and Turtle creeks. Painted Woods Creek flows west and Turtle Creek south to their confluence in section 4, T. 143 N., R. 91 W., about 4 miles southeast of Washburn. Thence, by a 5-mile course, most of which is through a shallow lake known as Painted Woods Lake, the united stream flows to Missouri River.

Altitudes in this basin range from 1,700 to 2,400 feet above sea level. The region is a rolling prairie, treeless but covered by rank prairie grass or cultivated fields. The mean annual rainfall is about 16 inches.

PAINTED WOODS CREEK NEAR WASHBURN, N. DAK.

This station, which is located at the north side of sec. 34, T. 144 N., R. 81 W., about 6 miles southeast of Washburn, N. Dak., was maintained from March 10, 1909, to November 11, 1910, under the supervision of T. R. Atkinson, State engineer of North Dakota.

The drainage area above the station comprises about 390 square miles.

The equipment consists of a staff gage attached to a stake. Discharge measurements are made by wading or from a cable about 500 feet downstream, except at very high stages, when a highway bridge in section 33, 2 miles below the gage, can be used.

In 1910 the spring flood came unexpectedly early and was unusually small and brief.

Sufficient discharge measurements covering all stages have not been made at this station to properly define a rating curve.

Discharge measurements of Painted Woods Creek near Washburn, N. Dak., in 1909–10.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1909.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Mar. 21[a]	J. W. Bliss	19	27	4.20	55
25[b]	do	37	75	4.00	180
June 16	T. Dickinson	6.6	8.9	1.10	5.4
July 9	do	5.3	2.9	.70	1.3
1910.					
Mar. 29	J. W. Bliss	4.5	5.7	1.10	2.0

[a] Ice. [b] A little ice in the channel.

Daily gage height, in feet, of Painted Woods Creek near Washburn, N. Dak., for 1909–10.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1909.										
1		3.5	1.0	1.3	0.9	0.5	0.5	0.6	0.6	0.5
2		3.1	1.0	1.4	.9	.5	.7	.6	.6	.5
3		2.7	.9	1.3	.8	.5	.6	.6	.6	.5
4		2.5	.9	1.3	.8	.5	.5	.6	.6	.5
5		2.3	.9	1.3	.7	.9	.6	.6	.6	.5
6		2.2	.9	1.3	.7	1.1	.5	.6	.6	.6
7		2.1	.9	1.2	.7	.9	.5	.7	.6	.6
8		1.8	.8	1.2	.8	.7	.5	.6	.6	.7
9		1.7	.8	1.3	.7	.6	.5	.6	.6	.7
10	4.2	2.0	.8	1.2	.7	.7	.5	.6	.6	.7
11	4.2	1.5	.8	1.2	.7	.7	.4	.6	.6	.7
12	4.2	1.5	.8	1.2	.7	.6	.5	.6	.6	.7
13	4.2	2.4	.8	1.2	.7	.6	.6	.6	.6	1.5
14	4.2	1.5	.8	1.2	.7	.6	.5	.6	.6	.8
15	4.2	1.5	.7	1.2	.6	.6	.4	.6	.6	.8

Daily gage height, in feet, of Painted Woods Creek near Washburn, N. Dak., for 1909–10—Continued.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1909.										
16	4.2	1.4	0.7	1.1	0.6	0.6	0.5	0.6	0.6	1.3
17	4.2	1.4	.7	1.1	.6	.6	.5	.6	.6	1.2
18	4.4	1.3	.7	1.0	.6	.6	.5	.6	.6	1.2
19	4.4	1.3	.8	1.0	.6	.6	.5	.6	.6	1.2
20	4.5	1.3	.8	1.0	.6	.5	.6	.6	.6	1.2
21	4.4	1.3	.7	1.0	.6	.5	.6	.6	.6	1.2
22	4.4	1.2	.8	1.0	.6	.5	.6	.6	.6	1.2
23	4.4	1.1	.8	.9	.6	.5	.5	.6	.6	1.2
24	4.3	1.1	.7	.9	.6	.6	.5	.6	.6	1.2
25	4.2	1.1	1.0	.9	.7	.6	.5	.6	.6	1.2
26	3.8	1.0	1.1	.9	.7	.5	.6	.6	.6	1.2
27	3.7	1.0	1.2	.9	.6	.5	.6	.6	.6	1.2
28	3.7	.9	1.2	.9	.6	.5	.6	.6	.6	1.2
29	3.5	.9	1.2	.9	.6	.4	.6	.6	.6	1.2
30	3.5	1.0	1.2	1.1	.6	.4	.6	.6	.5	1.2
31	3.5	.....	1.2	.....	.6	.4	.....	.6	.....	1.2
1910.										
1	.....	1.1	.8	.5	1.0	.6	.6	.6	.6	.....
2	.....	1.1	.8	.5	.9	.6	.6	.6	.6	.....
3	.....	1.0	.8	.5	.9	.6	.6	.6	.6	.....
4	.....	1.0	.8	.5	.8	.6	.6	.6	.6	.....
5	.....	1.0	.8	.5	.8	.6	.6	.6	.6	.....
6	.....	1.0	.8	.6	.8	.6	.6	.6	.6	.....
7	.....	1.0	.8	.6	.7	.6	.6	.6	.6	.....
8	.....	.9	.7	.7	.7	.6	.6	.6	.6	.....
9	.....	.9	.7	.7	.7	.6	.6	.6	.6	.....
10	.....	.9	.7	.8	.7	.6	.6	.6	.6	.....
11	.....	.9	.7	.8	.8	.6	.6	.6	.6	.....
12	.....	.9	.7	.8	.8	.6	.6	.6	.....	.....
13	2.6	.9	.7	.7	.8	.6	.6	.6	.....	.....
14	2.6	.9	.7	.7	.8	.6	.6	.6	.....	.....
15	2.4	.9	.7	.7	.7	.6	.6	.6	.....	.....
16	1.9	.9	.7	.6	.7	.6	.6	.6	.....	.....
17	2.1	1.0	.7	1.65	.7	.6	.6	.6	.....	.....
18	2.1	1.0	.7	1.0	.6	.6	.6	.6	.....	.....
19	1.9	1.0	.7	1.0	.6	.6	.6	.7	.....	.....
20	1.7	.9	.7	1.0	.6	.6	.6	.7	.....	.....
21	1.6	.9	.7	1.0	.5	.6	.6	.7	.....	.....
22	1.5	.8	.7	.9	.5	.6	.6	.7	.....	.....
23	1.4	.8	.7	.9	.9	.6	.6	.6	.....	.....
24	1.3	.8	.7	.8	.9	.6	.6	.6	.....	.....
25	1.2	.8	.6	.8	.8	.6	.6	.6	.....	.....
26	1.1	.8	.6	.8	.8	.6	.6	.6	.....	.....
27	1.1	.8	.6	.7	.7	.6	.6	.6	.....	.....
28	1.0	.8	.6	.7	.6	.6	.6	.6	.....	.....
29	1.0	.8	.6	.7	.6	.6	.6	.6	.....	.....
30	1.1	.8	.6	1.4	.6	.6	.6	.6	.....	.....
31	1.1	.....	.5	.....	.6	.6	.....	.6	.....	.....

NOTE.—Ice probably in January, February, greater part of March, December, 1909, January, February, and first part of March, 1910, and after Nov. 11, 1910.

TURTLE CREEK NEAR WASHBURN, N. DAK.

This station, which is located at the highway bridge near the northwest corner of sec. 15, T. 144 N., R. 81 W., about 4 miles northeast of Washburn, N. Dak., was maintained from March 10, 1909, to November 16, 1910, under the supervision of T. R. Atkinson, State engineer of North Dakota.

The drainage area above the station is about 440 square miles.

A staff gage is attached to bridge from which discharge measurements are made.

Sufficient discharge measurements covering all stages have not been made at this station to properly define a rating curve.

In 1910 the spring breakup was unexpectedly and unprecedentedly early and the spring flood unusually small and brief.

Discharge measurements of Turtle Creek near Washburn, N. Dak., in 1909–10.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1909.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Mar. 26[a]	J. W. Bliss	28	42	5.50	94
June 16	T. Dickinson	8	12	2.20	18
1910					
Mar. 30	J. W. Bliss	3.5	5.1	2.50	2.4

[a] Water running over ice.

Daily gage height, in feet, of Turtle Creek near Washburn, N. Dak., for 1909–10.

[Erick Larson, observer.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1909.										
1	.....	3.8	2.3	2.7	2.1	1.7	1.4	1.7	1.9	1.8
2	.....	3.7	2.3	2.8	2.0	1.7	1.7	1.7	1.9	1.8
3	.....	3.8	2.3	3.1	2.0	1.7	1.7	1.7	1.9	1.8
4	.....	4.0	2.3	3.0	2.0	1.7	1.7	1.7	1.9	1.8
5	.....	3.7	2.3	2.8	2.0	1.7	1.7	1.7	1.9	1.8
6	.....	3.4	2.3	2.6	2.0	1.7	1.6	1.7	1.9	1.8
7	.....	3.2	2.2	2.5	2.0	1.7	1.6	1.7	1.9	1.8
8	.....	3.1	2.2	2.4	2.1	1.7	1.6	2.0	1.9	1.8
9	.....	2.8	2.2	2.5	2.0	1.7	1.6	2.0	1.9	1.8
10	4.1	2.4	2.1	2.5	2.0	1.8	1.5	1.9	1.9	1.8
11	4.1	2.9	2.1	2.4	2.0	1.8	1.5	1.9	1.9	1.8
12	4.0	2.6	2.1	2.4	1.9	1.8	1.4	1.9	1.9	1.8
13	4.0	2.4	2.1	2.7	1.9	1.8	1.9	1.8	1.8	1.8
14	4.0	2.5	2.1	2.6	1.9	1.8	1.8	1.8	1.8	1.8
15	4.0	2.5	2.1	2.5	1.9	1.8	1.7	1.8	1.8	1.8
16	4.0	2.5	2.1	2.2	1.9	1.7	1.6	1.8	1.8	1.8
17	4.0	2.5	2.1	2.2	1.9	1.7	1.5	1.9	1.8	1.8
18	4.0	2.5	2.1	2.1	1.9	1.6	1.4	1.9	1.8	1.8
19	4.0	2.4	2.1	2.1	1.8	1.6	1.7	1.9	1.8	1.8
20	4.2	2.4	2.1	2.1	1.8	1.6	1.7	1.9	1.8	1.8
21	4.2	2.3	2.1	2.1	1.8	1.6	1.7	1.9	1.8	1.8
22	4.8	2.3	2.1	2.1	1.8	1.5	1.7	1.9	1.8	1.8
23	5.0	2.2	2.1	2.0	1.8	1.5	1.7	1.9	1.8	1.8
24	4.7	2.2	2.1	2.0	1.8	1.5	1.7	1.9	1.8	1.8
25	5.3	2.2	2.5	2.0	2.0	1.5	1.7	1.9	1.8	1.7
26	5.6	2.3	2.4	2.1	1.9	1.5	1.7	1.9	1.8	1.7
27	5.3	2.2	2.5	2.0	1.8	1.5	1.7	1.9	1.8	1.7
28	4.4	2.2	2.5	2.0	1.8	1.5	1.7	1.9	1.8	1.7
29	4.2	2.2	2.5	2.0	1.8	1.5	1.7	1.9	1.8	1.7
30	4.0	2.2	2.7	2.3	1.7	1.4	1.7	1.9	1.8	1.7
31	4.0	.....	2.7	.....	1.7	1.4	.....	1.9	.....	1.7
1910.										
1	.....	2.3	2.2	1.9	2.0	2.1	1.7	1.7	1.8	.....
2	.....	2.3	2.2	1.9	2.0	2.1	1.7	1.7	1.8	.....
3	.....	2.3	2.2	1.9	1.8	2.0	1.7	1.7	1.8	.....
4	.....	2.3	2.2	1.9	1.8	2.0	1.7	1.7	1.8	.....
5	.....	2.3	2.2	1.9	1.7	1.9	1.7	1.7	1.8	.....
6	.....	2.3	2.1	1.9	1.7	1.9	1.7	1.7	1.8	.....
7	.....	2.3	2.1	1.9	1.6	1.9	1.7	1.7	1.8	.....
8	.....	2.3	2.1	1.9	1.6	1.9	1.7	1.7	1.8	.....
9	.....	2.3	2.1	2.5	1.6	1.8	1.7	1.7	1.8	.....
10	.....	2.3	2.1	2.5	1.6	1.8	1.7	1.7	1.8	.....

Daily gage height, in feet, of Turtle Creek near Washburn, N. Dak., for 1909–10—Contd.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1910.										
11	.....	2.3	2.1	2.0	1.7	1.8	1.7	1.7	1.8	.....
12	.....	2.3	2.1	2.0	1.7	1.7	1.7	1.7	1.8	.....
13	5.3	2.2	2.1	2.0	1.7	1.7	1.7	1.7	1.8	.....
14	4.8	2.2	2.1	2.0	1.7	1.7	1.7	1.7	1.8	.....
15	4.0	2.3	2.1	2.0	1.6	1.8	1.7	1.7	1.8	.....
16	3.8	2.3	2.2	2.0	1.6	1.8	1.7	1.7	1.8	.....
17	3.5	2.3	2.2	2.0	1.6	1.8	1.7	1.7	.....	.....
18	3.2	2.3	2.2	3.5	1.5	1.8	1.7	1.7	.....	.....
19	2.8	2.3	2.2	2.5	1.5	1.7	1.7	2.0	.....	.....
20	2.6	2.3	2.2	2.2	1.4	1.7	1.7	2.0	.....	.....
21	2.6	2.3	2.2	2.2	1.3	1.7	1.7	2.0	.....	.....
22	2.6	2.3	2.1	2.1	1.3	1.7	1.7	2.0	.....	.....
23	2.5	2.3	2.1	2.0	2.9	1.7	1.7	1.9	.....	.....
24	2.5	2.3	2.0	2.0	2.7	1.7	1.7	1.9	.....	.....
25	2.5	2.3	2.0	2.0	2.7	1.7	1.7	1.8	.....	.....
26	2.3	2.3	2.0	2.0	2.7	1.7	1.7	1.8	.....	.....
27	2.3	2.3	2.0	1.9	2.5	1.7	1.7	1.8	.....	.....
28	2.3	2.2	2.0	1.8	2.3	1.7	1.7	1.8	.....	.....
29	2.3	2.2	2.0	1.7	2.3	1.7	1.7	1.8	.....	.....
30	2.5	2.2	2.0	1.7	2.3	1.7	1.7	1.8	.....	.....
31	2.3	.....	2.0	.....	2.2	1.7	.....	1.8	.....	.....

NOTE.—Ice probably affected flow in January, February, and greater part of March, 1909, January, February, and first part of March, 1910, and after Nov. 16, 1910.

HEART RIVER BASIN.

DESCRIPTION.

Heart River rises in eastern Billings County, N. Dak., flows eastward and southeastward for about 100 miles by general course, then turns abruptly to the north and northeast for 30 miles, and enters Missouri River at Mandan, N. Dak. The entire drainage area is 3,350 square miles.

The largest tributaries are Big Muddy Creek, which enters from the north a few miles above the big bend and drains 480 square miles, and Green River, which is one of the headwaters and drains 340 square miles.

Altitudes range from 1,640 feet above sea level at Mandan to about 2,700 feet at the western boundary of the basin. The mean annual rainfall is from 13 to 17 inches, of which about half falls in the three months of May, June, and July. There is no forestation, merely scattering fringes and groves along the streams.

HEART RIVER NEAR RICHARDTON, N. DAK.

This station, which is located at the steel highway bridge 10 miles south of Richardton, N. Dak., in or near sec. 21, T. 138, R. 92, and half a mile below the mouth of Blacktail Creek, was established May 18, 1903, to determine the amount of water available for irrigation. The drainage area above this point is 1,250 square miles.

The datum of the gage has been unchanged, but the channel bottom is not permanent, and occasional small changes in the rating curve are required. No extreme high-stage measurements have yet been obtained, and not enough medium high-stage measurements to properly define the upper portion of the rating curve; hence the estimates of the extreme floods are only approximate. A standard chain gage is fastened securely to the downstream side of the highway bridge. Flood measurements are made from this bridge.

No discharge measurements were made in 1910.

Daily gage height, in feet, of Heart River near Richardton, N. Dak., for 1910.

[W. F. Church, observer.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	5.4	4.4	4.1	4.3	4.0	3.9	3.9	4.0
2	.....	5.3	4.4	4.1	4.3	4.0	3.9	3.9	4.0
3	.....	5.2	4.4	4.1	4.3	4.0	3.9	3.9	4.0
4	.....	5.1	4.4	4.1	4.3	3.9	3.9	3.9	4.0
5	5.3	5.0	4.3	4.1	4.3	3.9	3.9	3.9	4.0
6	6.0	4.9	4.3	4.1	4.3	3.9	3.9	4.0	4.0
7	9.8	4.9	4.3	4.1	4.3	3.9	3.9	4.0	4.0
8	11.6	4.8	4.3	4.1	4.9	3.9	3.9	4.0	4.0
9	13.1	4.8	4.3	4.2	4.8	3.9	3.9	4.0	4.0
10	14.2	4.7	4.3	4.6	4.7	4.0	3.9	4.0	4.1
11	15.5	4.7	4.2	5.0	4.6	4.0	3.9	4.0	4.2
12	16.7	4.6	4.2	5.2	4.5	4.0	4.0	4.0	4.2
13	18.0	4.6	4.2	5.4	4.4	4.2	4.0	4.0	4.2
14	19.4	4.5	4.3	5.5	4.3	4.2	4.0	4.0	4.2
15	17.1	4.5	4.3	5.3	4.2	4.1	4.0	4.0	4.2
16	15.9	4.4	4.4	5.1	4.1	4.1	4.0	4.0	4.2
17	14.2	4.4	4.4	4.9	4.0	4.1	4.0	4.0	4.2
18	12.3	4.3	4.4	4.8	4.0	4.0	4.0	4.0	4.2
19	10.1	4.2	4.3	4.7	4.0	4.0	4.0	4.0	4.2
20	8.3	4.3	4.3	4.6	4.0	4.0	3.9	4.0	4.2
21	7.7	4.5	4.3	4.6	4.0	4.0	3.9	4.0	4.2
22	7.4	4.6	4.2	4.5	4.1	4.0	3.9	4.0	4.2
23	6.0	4.8	4.2	4.5	4.0	4.0	3.9	4.0	4.2
24	6.3	4.6	4.2	4.5	4.1	3.9	3.9	4.0	4.2
25	6.1	4.5	4.2	4.5	4.1	3.9	3.9	4.0	4.2
26	5.9	4.4	4.2	4.4	4.0	3.9	3.9	4.0	4.2
27	5.7	4.4	4.2	4.4	4.0	3.9	3.9	4.0	.....
28	5.6	4.4	4.2	4.4	4.0	3.9	3.9	4.0	.....
29	5.6	4.4	4.2	4.3	4.1	3.9	3.9	4.0	.....
30	5.5	4.4	4.2	4.3	4.1	3.9	3.9	4.0	.....
31	5.4	.....	4.2	.....	4.0	3.9	.....	4.0	.....

NOTE.—Ice probably prevailed Jan. 1 to Mar. 4 and after Nov. 26.

Daily discharge, in second-feet, of Heart River near Richardton, N. Dak., for 1910.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	86	11	2	7	1	0.3	0.3	1
2	.....	75	11	2	7	1	.3	.3	1
3	.....	65	11	2	7	1	.3	.3	1
4	.....	56	11	2	7	.3	.3	.3	1
5	75	48	7	2	7	.3	.3	.3	1
6	167	40	7	2	7	.3	.3	1	1
7	935	40	7	2	7	.3	.3	1	1
8	1,450	33	7	2	40	.3	.3	1	1
9	1,960	33	7	4	33	.3	.3	1	1
10	2,350	27	7	21	27	1	.3	1	2
11	2,870	27	4	48	21	1	0.3	1	4
12	3,350	21	4	65	16	1	1	1	4
13	3,920	21	4	86	11	4	1	1	4
14	4,570	16	7	98	7	4	1	1	4
15	3,520	16	7	75	4	2	1	1	4

Daily discharge, in second-feet, of Heart River near Richardton, N. Dak., for 1910—Contd.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
16	3,030	11	11	56	2	2	1	1	4
17	2,350	11	11	40	1	2	1	1	4
18	1,680	7	11	33	1	1	1	1	4
19	1,020	4	7	27	1	1	1	1	4
20	586	7	7	21	1	1	.3	1	4
21	462	16	7	21	1	1	.3	1	4
22	403	21	4	16	2	1	.3	1	4
23	167	33	4	16	1	1	.3	1	4
24	212	21	4	16	2	.3	.3	1	4
25	182	16	4	16	2	.3	.3	1	4
26	152	11	4	11	1	.3	.3	1	4
27	124	11	4	11	1	.3	.3	1	.....
28	111	11	4	11	1	.3	.3	1	.....
29	111	11	4	7	2	.3	.3	1	.....
30	98	11	4	7	2	.3	.3	1	.....
31	86	.....	4	.....	1	.3	.....	1	.....

NOTE.—These discharges are based on a rating curve that is fairly well defined below 520 second-feet.

Monthly discharge of Heart River near Richardton, N. Dak., for 1910.

[Drainage area, 1,250 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
January	.....	.....	[a] 3	.....	.....	184	
February	.....	.....	[a] 3	.....	.....	167	
March	4,570	.....	[a]1,160	0.928	1.07	71,300	D.
April	86	4	26.9	.022	.02	1,600	B.
May	11	4	6.6	.0053	.01	406	C.
June	98	2	24.1	.019	.02	1,430	B.
July	40	1	7.4	.0059	.01	455	C.
August	4	.3	.97	.00078	.001	60	D.
September	1	.3	.49	.00039	.0004	29	D.
October	1	.3	.89	.00071	.0008	55	D.
November	4	1	[a] 3.0	.0024	.003	179	D.
December	.....	.....	[a] 2	.....	.....	123	
The year	.....	.....	103	.....	.....	76,000	

[a] Discharge estimated Jan. 1 to Mar. 4 and Nov. 27 to Dec. 31.

NOTE.—The means for January, February, and December are only approximate.

GRAND RIVER BASIN.

NORTH FORK OF GRAND RIVER AT HALEY, N. DAK.

The North Fork of Grand River unites with the South Fork to form the Grand in the northeastern part of Butte County, S. Dak., the main stream flowing from this junction eastward across the Standing Rock Indian reservation to the Missouri.

This station, which is located about 20 rods south of the post office at Haley, N. Dak., near the northeast corner of sec. 36, T. 129, R. 100, was established May 17, 1908, to obtain data for the reclamation project under survey at that point. Two hundred feet below the staff gage is a standard car and cable outfit from which high-water

measurements may be made. Low-water measurements are made by wading.

The drainage area above the station includes only the North Fork of the Grand and comprises about 500 square miles.

The following discharge measurement was made by J. W. Bliss:

March 21, 1910: Width, 60 feet; area, 137 square feet; gage height, 2.60 feet; discharge, 90 second-feet.

Daily gage height, in feet, of North Fork of Grand River at Haley, N. Dak., for 1910.

[H. N. Lungwitz, observer.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	1.6	1.2	1.1	1.0	0.9	0.9	0.9	0.9
2	.....	1.6	1.2	1.1	1.0	.9	.9	.9	.9
3	6.5	1.6	1.2	1.1	1.0	.9	.9	.9	.9
4	5.8	1.5	1.2	1.1	1.0	.9	.9	.9	.9
5	6.85	1.5	1.2	1.1	1.0	.9	.9	.9	.9
6	7.8	1.5	1.2	1.1	1.0	.9	.9	.9	.9
7	5.8	1.5	1.2	1.1	1.0	.9	.9	.9	.9
8	6.2	1.5	1.2	1.1	1.0	.9	.9	.9	.9
9	5.7	1.4	1.2	1.1	1.0	.9	.9	.9	.9
10	5.45	1.4	1.2	2.2	.9	.9	.9	.9	.9
11	6.4	1.4	1.2	2.05	.9	.9	.9	.9	.9
12	.....	1.4	1.2	1.85	.9	.9	.9	.9	.9
13	.....	1.4	1.2	1.35	.9	.9	.9	.9	.9
14	.....	1.4	1.2	1.3	.9	.9	.9	.9	.9
15	.....	1.4	1.2	1.3	.9	.9	.9	.9	.9
16	.....	3.0	1.2	1.3	.9	.9	.9	.9	.9
17	.....	3.5	1.2	1.3	.9	.9	.9	.9	.9
18	.....	1.95	1.2	1.2	.9	.9	.9	.9	.9
19	.....	1.8	1.2	1.2	.9	.9	.9	.9	.9
20	.....	1.7	1.2	1.2	.9	.9	.9	.9	.9
21	2.5	1.6	1.2	1.2	.9	.9	.9	.9	.9
22	2.35	1.5	1.2	1.2	.9	.9	.9	.9	.9
23	2.1	1.5	1.2	1.2	.9	.9	.9	.9	.9
24	2.0	1.4	1.1	1.7	.9	.9	.9	.9	.9
25	2.0	1.4	1.1	2.15	.9	.9	.9	.9	.9
26	1.9	1.4	1.1	1.55	.9	.9	.92	.9	.9
27	1.9	1.4	1.1	1.3	.9	.9	1.00	.9	.....
28	1.8	1.4	1.1	1.15	.9	.9	.95	.9	.....
29	1.8	1.35	1.1	1.1	.9	.9	.92	.9	.....
30	1.8	1.35	1.1	1.1	.9	.9	.90	.9	.....
31	1.7	.....	1.1	.....	.9	.9	.....	.9	.....

NOTE.—Gage heights probably affected by ice from Jan. 1 to Mar. 2 and after Nov. 27.

Daily discharge, in second-feet, of North Fork of Grand River at Haley, N. Dak., for 1908–1910.

Day.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1908.											
1	.....	.....	.....	.....	38	36	8	0.5	0.5	0.5	0.5
2	.....	.....	.....	.....	54	18	7	.5	.5	.5	.5
3	.....	.....	.....	.....	84	8	6	.5	.5	.5	.5
4	.....	.....	.....	.....	102	8	5	.5	.5	.5	.5
5	.....	.....	.....	.....	43	3.5	4	.5	.5	.5	.5
6	.....	.....	.....	.....	13	23	3	.5	.5	.5	.5
7	.....	.....	.....	.....	43	18	2	.5	.5	.5	.5
8	.....	.....	.....	.....	38	18	1	.5	.5	.5	.5
9	.....	.....	.....	.....	36	33	0	.5	.5	.5	.5
10	.....	.....	.....	.....	28	18	0	.5	.5	.5	.5
11	.....	.....	.....	2.0	23	3.5	0	5	.5	.5	.5
12	.....	.....	.....	2.5	26	.5	0	.5	.5	.5	.5
13	.....	.....	.....	2.5	18	.5	0	.5	.5	.5	.5
14	.....	.....	.....	2.5	102	.5	0	.5	.5	.5	.5
15	.....	.....	.....	3.0	227	.5	0	.5	.5	.5	.5

Daily discharge, in second-feet, of North Fork of Grand River at Haley, N. Dak., for 1908–1910—Continued.

Day.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1908.											
16				3.0	114	0.5	0.3	0.5	0.5	0.5	0.5
17				3.5	114	.2	.3	.5	.8	.5	.5
18				3.5	57	3	.3	1.1	.8	.5	.5
19				3.5	13	8	.3	1.1	4	.5	.5
20				164	48	8	.3	.5	4	.5	.5
21				234	23	8	.4	.5	2.6	.5	.5
22				288	43	8	.4	.5	.8	.5	.5
23				296	18	8	.4	.5	.8	.5	.5
24				164	8	8	.4	.5	.5	.5	.5
25				164	13	8	.4	.5	.5	.5	.5
26				126	23	8	.4	.5	.5	.5	.5
27				99	48	8	.4	.5	.5	.5	.5
28				54	23	8	.4	.5	.5	.5	.5
29				43	3.5	8	.5	.5	.5	.5	.5
30				43	38	8	.5	.5	.5	.5	.5
31				43		8	.5		.5		.5
1909.											
1		356	20	8	394	9	3.5	2	2	2	2
2		351	20	3.5	367	10	3.5	2	2	2	2
3		288	18	2.9	206	8	3.5	2	2	2	2
4		227	13	2.0	105	10	3.5	2	2	2	2
5		178	10	2.0	69	13	3.5	2	2	2	2
6		141	10	2.0	54	19	3.5	2	2	2	2
7	0.5	126	13	2.0	43	23	3.5	2	3.5	2	2
8	.5	123	10	3.5	44	23	3.5	2	3.5	2	2
9	.5	87	10	3.5	396	18	3.5	2	3.5	2	2
10	.5	102	5.8	3.5	199	18	3.5	2	2	2	2
11	.5	102	8	2.9	123	28	3.5	2	2	2	2
12	.5	102	8	.5	135	24	149	2	2	2	2
13	.5	102	8	.5	241	20	46	2	2	2	2
14	.5	102	7.1	.5	133	23	26	2	2	2	2
15	.5	72	5.8	.5	84	20	16	2	2	2	2
16	.5	43	5.8	.5	84	19	8	2	2	2	2
17	.5	33	3.5	3.5	46	13	8	2	2	2	2
18	.5	30	3.5	2.9	36	8	8	2	2	2	2
19	.5	40	3.5	2.9	27	5.8	7.1	2	2	2	2
20	.5	57	3.5	.5	26	5.8	5.8	2	2	2	2
21	20	57	3.5	.5	20	8	5.8	2	2	2	2
22	40	87	.5	.5	18	5.8	3.5	2	2	2	2
23	50	78	.5	3.5	18	5.8	3.5	2	2	2	2
24	60	60	.5	3.5	18	5.8	3.5	2	2	2	2
25	150	46	2.0	3.5	13	5.8	3.5	2	2	2	2
26	188	38	2.0	3.5	13	3.5	3.5	2	2	2	2
27	252	38	2.0	3.5	13	3.5	3.5	2	2	2	2
28	324	38	2.0	3.5	13	3.5	2	2	2	2	2
29		36	3.5	26	13	3.5	2	2	2	2	2
30		23	8	33	10	3.5	2	2	2	2	2
31		20		500		3.5	2		2		2
1910.											
1				33	13	8	3.5	.5	.5	.5	.5	
2				33	13	8	3.5	.5	.5	.5	.5	
3		374		33	13	8	3.5	.5	.5	.5	.5	
4		312		28	13	8	3.5	.5	.5	.5	.5	
5		405		28	13	8	3.5	.5	.5	.5	.5	
6		500		28	13	8	3.5	.5	.5	.5	.5	
7		312		28	13	8	3.5	.5	.5	.5	.5	
8		347		28	13	8	3.5	.5	.5	.5	.5	
9		304		23	13	8	3.5	.5	.5	.5	.5	
10		284		23	13	66	.5	.5	.5	.5	.5	
11		365		23	13	57	.5	.5	.5	.5	.5	
12		350		23	13	46	.5	.5	.5	.5	.5	
13		300		23	13	20	.5	.5	.5	.5	.5	
14		250		23	13	18	.5	.5	.5	.5	.5	
15		200		23	13	18	.5	.5	.5	.5	.5	
16		175		114	13	18	.5	.5	.5	.5	.5	
17		150		144	13	18	.5	.5	.5	.5	.5	
18		125		50	13	13	.5	.5	.5	.5	.5	
19		100		43	13	13	.5	5	.5	.5	.5	
20		92		38	13	13	.5	.5	.5	.5	.5	

Daily discharge, in second-feet, of North Fork of Grand River at Haley, N. Dak., for 1908–1910—Continued.

Day.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1910.											
21	.....	84	33	13	13	0.5	0.5	0.5	0.5	0.5	.....
22	.....	75	28	13	13	.5	.5	.5	.5	.5	.....
23	.....	60	28	13	13	.5	.5	.5	.5	.5	.....
24	.....	54	23	8	38	.5	.5	.5	.5	.5	.....
25	.....	54	23	8	63	.5	.5	.5	.5	.5	.....
26	.....	48	23	8	30	.5	.5	1.1	.5	.5	.....
27	.....	48	23	8	18	.5	.5	3.5	.5	.....	.....
28	.....	43	23	8	20	.5	.5	2.0	.5	.....	.....
29	.....	43	20	8	8	.5	.5	1.1	.5	.....	.....
30	.....	43	20	8	8	.5	.5	.5	.5	.....	.....
31	.....	38	.....	8	.....	.5	.5	.....	.5	.....	.....

NOTE.—These daily discharges for 1908–1910 are based on a rating curve that is well defined below 90 second-feet. Above this the curve is an extension and is approximate. * Discharge interpolated or estimated May 12 to 16, July 18, Aug. 2 to 8, 1908; Feb. 20 to 24, 1909; Mar. 12 to 19, 1910.

Monthly discharge of North Fork of Grand River at Haley, N. Dak., for 1908–1910.

[Drainage area, 420 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1908.							
May	296	1.0	a 56.7	0.135	0.16	3,490	C.
June	227	3.5	48.7	.116	.13	2,900	B.
July	36	.2	9.57	.023	.03	588	C.
August	8	.0	1.36	.0032	.004	84	C.
September	1.1	.5	.54	.0013	.001	32	C.
October	4	.5	.83	.0020	.002	51	C.
November	.5	.5	.50	.0012	.001	30	D.
December	.5	.5	.50	.0012	.001	31	D.
The period	.....	.....	14.8	.035	.329	7,210	
1909.							
January	.....	.....	a 0	.0	.00	0	
February	324	.5	a 39	.093	.10	2,170	D.
March	356	20	103	.245	.28	6,330	C.
April	20	.5	7.03	.017	.02	418	B.
May	500	.5	20.3	.048	.06	1,250	C.
June	396	10	98.7	.235	.26	5,870	C.
July	28	3.5	11.9	.028	.03	732	C.
August	149	2	11.2	.027	.03	689	C.
September	2	2	2.0	.0048	.005	119	D.
October	3.5	2	2.15	.0051	.006	132	D.
November	2	2	2.0	.0048	.005	119	D.
December	2	2	2.0	.0048	.006	123	D.
The year	.....	.....	24.9	.059	.82	18,000	
1910.							
January	.....	.....	a 1.0	.0024	.003	61	
February	.....	.....	a 1.0	.0024	.002	56	
March	.....	.....	a 186	.443	.51	11,400	D.
April	144	20	34.4	.082	.09	2,050	B.
May	13	8	11.7	.028	.03	719	B.
June	66	8	19.9	.047	.05	1,180	B.
July	3.5	.5	1.37	.0033	.004	84	C.
August	.5	.5	.50	.0012	.001	31	D.
September	3.5	.5	.69	.0016	.002	41	D.
October	.5	.5	.50	.0012	.001	31	D.
November	.5	.5	a .50	.0012	.001	30	D.
December	.....	.....	a .5	.0012	.001	31	
The year	.....	.....	21.5	.051	.695	15,700	

a Discharge estimated May 1 to 10, 1908; Jan. 1 to Feb. 6, 1909; Jan. 1 to Mar. 2 and Nov. 27 to Dec. 31, 1910.

NOTE.—The means for January, 1909, January, February, and December, 1910, are only approximate.

NIOBRARA RIVER BASIN.[1]

DESCRIPTION.

Niobrara River rises in the mountains of eastern Wyoming, flows eastward through the northern portion of Nebraska, and empties into the Missouri in Knox County at the city of Niobrara. Its drainage basin is narrow in the upper portion but broadens considerably near the mouth; it comprises about 9,000 square miles.

Precipitation within the basin ranges from 15 to 18 inches in the upper portion, from 18 to 21 inches in the middle portion, and from 21 to 24 inches in the lower portion. Evaporation is 6, 5, and 4½ feet in the upper, middle, and lower portions, respectively. Sixty-nine per cent of the precipitation falls during April, May, June, July, and August, and about one-half of the remainder is snowfall.

The river is not subject to periodic rises of any importance, owing to the fact that the sand hills which form so large a portion of its drainage area act as storage reservoirs for the rain and snow, which are afterwards fed to the stream in the form of spring water, thus equalizing the flow and making the constancy of the discharge almost phenomenal.

The principal tributaries are Verdigris, Keyapaha, and Snake rivers and Minnechaduza Creek. The drainage area of the Snake is similar in nearly all respects to that of the western part of the Niobrara.

The water resources of the Niobrara are at present almost wholly undeveloped, irrigation being limited to the low, narrow flood plains in the bottoms of the canyons. On Minnechaduza Creek at Valentine an artificial lake has been formed by a dam, and a power plant has been installed for lighting and for furnishing the city with water. On the lower course of the Niobrara a number of mills are in operation, receiving their power from small tributaries. On Snake River opportunities for power development are phenomenal, but long transmission lines would be required to make it of practical value.

NIOBRARA RIVER AT NIOBRARA, NEBR.

This station, which is located at the Government wagon bridge spanning the main channel in the SE. ¼ sec. 18, T. 32 N., R. 6 W., half a mile south and half a mile west of the depot at Niobrara and 1½ miles above the junction of Niobrara and Missouri rivers, was established May 11, 1902, discontinued October 25, 1902, and reestablished August 19, 1910. The station is below all tributaries.

[1] See report on Niobrara River basin, by Stevens, J. C., Surface waters of Nebraska: Water-Supply Paper U. S. Geol. Survey No. 230, 1909, pp. 220–238.

A rod gage is fastened to a pile at the southwest end of the Government bridge in the main channel. The location and datum of this gage bear no relation to those of the wire gage used in 1902.

Measurements are made from the Government wagon bridge and from the highway bridge which crosses the west channel three-fourths of a mile west of the gage. The west channel is separated from the main channel by an island for a mile above and below the gage.

The bed of the stream is sandy and shifting, making frequent discharge measurements necessary. There are two channels at high stages and numerous small ones at low stages.

During the winter months gage heights are from time to time affected by ice.

This station is located very near the mouth of the river, and as the fall between the gaging section and Missouri River is small, records will probably be affected by backwater from the Missouri.

Discharge measurements of Niobrara River at Niobrara, Nebr., in 1910.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Aug. 26	D. D. Price	330	335	2.10	1,040
Oct. 9	A. A. Dobson	230	302	1.80	1,000
Nov. 26	do	590	457	1.50	1,650

Daily gage height, in feet, of Niobrara River at Niobrara, Nebr., for 1910.

Day.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	1.8	1.5	1.8	1.7	16	.....	1.6	1.8	1.7	2.8
2	.....	1.9	1.4	1.8	1.8	17	.....	1.6	1.8	1.7	3.1
3	.....	1.8	1.4	1.7	1.7	18	.....	1.6	1.8	1.7	3.4
4	.....	1.8	1.6	1.7	1.6	19	2.1	1.65	1.8	1.7	3.6
5	.....	1.7	1.8	1.7	1.6	20	2.1	1.6	1.8	1.7	3.2
6	.....	1.7	1.7	1.6	1.7	21	2.2	1.8	1.8	1.7	3.4
7	.....	1.7	1.8	1.6	1.7	22	2.2	1.9	1.9	1.7	3.6
8	.....	1.7	1.8	1.7	1.8	23	2.1	1.9	1.9	1.7	3.8
9	.....	1.7	1.8	1.7	1.8	24	2.1	1.9	1.8	1.6	2.2
10	.....	1.7	1.8	1.6	1.8	25	2.1	1.9	1.8	1.6	.....
11	.....	1.6	1.8	1.7	1.7	26	2.0	1.7	1.8	1.5	.....
12	.....	1.6	1.8	1.7	1.8	27	2.0	1.7	1.8	1.6	.....
13	.....	1.6	1.7	1.8	1.8	28	1.9	1.7	1.8	1.7	.....
14	.....	1.6	1.7	1.8	2.2	29	1.9	1.6	1.8	1.7	.....
15	.....	1.6	1.8	1.7	2.6	30	1.8	1.6	1.7	1.8	.....
						31	1.8	.....	1.8	.....	.....

NOTE.—River frozen Dec. 25.

PLATTE RIVER BASIN.

GENERAL FEATURES.

Considered only with regard to extent of the area drained, the Platte is the most important tributary of the Missouri. It is formed by two forks, North Platte and South Platte, which rise, respectively, in northern and in central Colorado and unite a little southwest of

the center of Nebraska. Its entire drainage basin comprises about 84,000 square miles, of which 28,500 square miles belong to the North Platte and 24,000 to the South Platte. The lower course of the river is fairly well settled, but farther west the population is more scattered.

NORTH PLATTE RIVER AND PLATTE RIVER PROPER.

DESCRIPTION.

The source of North Platte River, here considered the continuation of the main stream, is in North Park, Colo., or rather in the mountains which, rising to elevations from 4,000 to 5,000 feet above its general level, hem it in on all sides. The park is just east of the continental divide, some of the peaks of which in that locality exceed 12,000 feet in altitude. From the steep slopes of the mountains numerous small streams descend, unite below into large creeks, and flow outward to the center of the basin. The two which may be said to form the real head of the North Platte are Grizzly and Little Grizzly creeks, but within the park the river is joined by four large tributaries, Roaring Fork and North Fork from the west and Michigan and Canadian creeks from the east. Leaving the park, the river makes a bold curve northward into Wyoming, but near Casper, on the north side of the Casper Range, it turns abruptly to the east and southeast, maintaining the latter course to its point of junction with the South Platte in central Nebraska.

Within North Park the topographic features are diversified, including every degree of roughness from the snow-capped peaks of the Park and Medicine Bow ranges to the level prairie mesas along the lower portion of the stream. Dense forests cover the mountain tracts, the heaviest being those on the east slope of the Park and the west slope of the Medicine Bow ranges. At an elevation of 8,500 feet above sea level the forests give way to the open prairie country, which, with the exception of the dense growth of willows along the river bottoms, is entirely free from forests of any description.

The soil, composed principally of sandy and gravelly loam on the mesas and of sandy and black loam along the river bottoms, is in general fertile, but climatic conditions are such that the agricultural products are limited to wild hay, roots, and a few of the hardier grains.

In its northward course through Wyoming the stream receives many tributaries, the Snowy Range on the east contributing its drainage through Douglas, French, and Brush creeks, while the northeast slope of the Sierra Madre is drained by Beaver, Big Cow, and Spring creeks and Grand Encampment River. Medicine Bow and Sweetwater rivers are added to the North Platte between Saratoga and Casper,

beyond which the only important tributary is the Laramie, which enters at old Fort Laramie.

The greater part of the region below Saratoga is a rolling, undulating prairie. The soil throughout Wyoming is a sandy loam of sufficient depth to produce meadows of rich grasses, even up to elevations of 7,000 feet. At lower elevations the soil becomes more friable and deeper.

Throughout its course in western Nebraska the valley of the North Platte is 10 to 15 miles wide. The present floor, consisting of sediments deposited in a former greater valley, is bordered by terraces and table-lands scarred by numerous tributaries and arroyos. The stream is broad and shallow, with a flood plain from 1 mile to 4 miles wide.

The character of the river bed at the Big Bend and at the Seminole Mountains, in Wyoming, seems to indicate a considerable underflow. A part of this is collected at the Big Bend, and probably the entire amount is brought to the surface as the river passes through the Seminole Range. In its lower course the bed of the stream is of fine quicksand underlain at a depth of 15 to 20 feet by a hard layer which seems to be clay.

The total length of the river from source to mouth is nearly 650 miles. At Pinkhampton, Colo., it is about 8,000 feet above sea level; at Fort Steele, Wyo., about 500 miles above its mouth, it is 6,500 feet; and at Fort Laramie it is 4,200 feet, and at North Platte, Nebr., 2,800 feet.

The drainage area includes about 28,800 square miles, of which 1,800 square miles are in Colorado, 20,000 in Wyoming, and nearly 7,000 in Nebraska.

In the mountain districts precipitation, usually in the form of snow during the winter and spring months, ranges from 7 to 15 inches, the average being about 11 inches; in the high mountains it is 20 inches and upward. Throughout the lower portion of the basin the precipitation is from 15 to 18 inches, and the evaporation from the water surface is 5 to 6 feet annually.

The stream is subject to periodic floods, which reach the maximum at the mouth some time during the latter part of June and are caused by the melting snow on the high ranges. The river runs lowest in winter and is usually covered with thick ice. High water prevails from the middle of April until the middle of July, during which period the river is frequently bank full.

The winters are quite severe thoughout the basin of this stream, and particularly so above an altitude of 4,000 feet. On the plains areas, although there is considerable snowfall, the snow does not lie for more than a few days at a time.

Agriculture in the basin of the North Platte has been confined largely to the valleys of the tributaries, and most of the available agricultural lands on these tributaries are now occupied. At present irrigation is most extensively practiced on Laramie and Little Laramie rivers in the vicinity of Laramie; on the Laramie in the vicinity of Wheatland, and on the North Platte itself for a considerable distance on both sides of the Wyoming-Nebraska line.

The Laramie-Poudre project will divert a considerable portion of the flow of Laramie River in Colorado across the divide by means of a tunnel into the headwaters of the Cache la Poudre, where the waters will be used to irrigate land in the South Platte drainage. Construction is well along on this project. The nearly completed North Platte project of the Reclamation Service will provide for the irrigation of about 100,000 acres of land along the North Platte in Nebraska and Wyoming. Numerous other irrigation projects are contemplated or are in course of construction, and many additional opportunities for development by storage of flood waters still remain.

The basin contains many excellent reservoir sites, a few of which have been developed. The most notable is the Pathfinder reservoir of the United States Reclamation Service. This reservoir, with a dam 215 feet high, has a capacity of over 1,000,000 acre-feet. Another excellent site is at what is usually known as the "Devils Gate" on Sweetwater River a few miles above its mouth. It has a capacity of over 300,000 acre-feet, but has never been developed on account of the inadequacy of the water supply; and as the Pathfinder reservoir will store the flood waters of the Sweetwater it is not likely that the Devils Gate reservoir will ever be built. On the North Platte and its tributaries in Colorado are several fairly good reservoir sites, the largest being on the North Platte near Pinkhampton, which would have a capacity of nearly 100,000 acre-feet with a dam 100 feet high. The reservoir site on Laramie River near Glendevey, Colo., has a capacity of about 15,000 acre-feet.

Power development on the North Platte will be limited largely to the upper river and its tributaries and probably never will be in excess of 50,000 horsepower. Present development amounts to only a few hundred horsepower.

The more recent records of the United States Geological Survey indicate 1902 as the driest and 1909 as the wettest year.

From the point of junction of North and South Platte rivers the main stream winds eastward across Nebraska for over 200 miles, uniting with the Missouri at Plattsmouth, about 10 miles south of Omaha. Its course lies chiefly through broad, level bottom lands, rather sandy in places, but for the most part fertile, bordered by bluffs ranging in height from 50 to 400 feet. To a point near

Ashland, Saunders County, it is a broad, shallow stream, flowing in many places as a network of interlacing channels among numerous islands and sand bars, but farther east it is confined between heavily wooded limestone bluffs. The average fall is about 6 feet per mile.

The average annual precipitation is about 23 inches, of which 69 per cent falls during the five months of the growing season, from April to August; about one-half of the remainder is snowfall. The evaporation averages about 4½ feet. The stream is subject to periodic floods caused by melting of snows in the headwaters regions of North and South Platte rivers. These floods reach a maximum in June and July and often do considerable damage to property on the lower portions of the stream. In the western part of the drainage area the waters of the stream are extensively used for irrigation.

The records of the Survey indicate 1905 and 1909 as years of high water, and 1902 and 1908 as low-water years.

The following special reports contain information regarding the hydrography of Colorado and Nebraska:

Water resources of Colorado by A. L. Fellows, 1902: Water-Supply Paper U. S. Geol. Survey No. 74. Surface waters of Nebraska, by J. C. Stevens, 1909: Water-Supply Paper U. S. Geol. Survey No. 230.

NORTH PLATTE RIVER AT PATHFINDER, WYO.

This station, which is located one-half mile south of Pathfinder post office and 500 feet below the mouth of the canyon, in sec. 24, T. 29 N., R. 84 W., sixth principal meridian, Wyoming, was established May 9, 1905, and has been maintained by the United States Reclamation Service to show the amount of water available for storage in connection with the North Platte project.

The Pathfinder reservoir is about one-fourth mile above the station, which is at an elevation of nearly 5,700 feet, and Sweetwater River enters the North Platte about 3 miles above. The drainage area is about 12,000 square miles.

Very little water is diverted above the station. Some land is irrigated on the North Platte and its tributaries, but opportunities for much additional development can be found.

The datum of the gage has remained constant during the maintenance of the station. The flow is affected by ice for several months during the winter season. The results obtained at this station have been on the whole very satisfactory.

Discharge measurements of North Platte River at Pathfinder, Wyo., in 1910.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Jan. 11[a]	L. V. Branch	165	595	2.00	448
Apr. 21	Comstock and Ralston	185	665	2.12	655
May 31	.....do	193	755	2.66	958
June 23	.....do	198	1,150	4.06	2,380

[a] Ice.

Daily gage height, in feet, of North Platte River at Pathfinder, Wyo., for 1910.

[J. C. Ralston, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.85	1.8	1.8	3.3	2.4	3.3	4.15	3.75	3.7	1.6	2.0	1.35
2	1.85	1.85	2.1	3.2	2.35	3.8	4.1	3.75	3.8	1.25	1.9	1.35
3	2.0	1.8	2.4	3.25	2.4	3.8	4.05	3.75	3.5	.85	1.9	1.35
4	2.0	1.8	2.7	3.15	2.4	3.55	4.05	3.75	3.55	1.4	1.9	3.1
5	2.0	1.75	3.0	3.3	2.4	3.9	4.05	3.75	3.6	1.45	1.9	1.2
6	2.0	1.8	3.0	3.3	2.4	3.9	4.0	3.75	3.7	1.4	1.8	1.25
7	1.95	1.75	3.25	3.25	2.45	4.9	4.0	3.7	3.7	1.45	1.85	1.25
8	2.0	1.7	3.4	3.2	2.45	4.4	4.15	3.7	3.7	1.4	1.85	1.25
9	1.95	1.7	3.55	2.95	2.45	4.5	4.1	3.7	3.55	1.35	1.8	1.25
10	1.95	1.65	3.75	2.9	2.45	4.5	3.95	3.7	3.55	1.0	1.75	1.25
11	2.0	1.65	3.6	3.1	2.45	4.4	3.85	3.7	3.55	1.1	1.7	1.3
12	2.0	1.65	3.9	3.2	2.45	4.4	3.8	3.7	3.7	1.15	1.7	1.3
13	2.0	1.6	3.95	3.55	2.5	4.45	3.8	3.7	3.7	1.15	1.75	1.3
14	1.95	1.6	4.05	4.1	2.5	4.45	3.8	3.7	3.7	1.2	1.75	1.3
15	1.9	1.6	3.7	1.8	2.5	4.4	3.7	3.7	3.65	1.4	1.7	2.9
16	1.9	1.8	3.5	4.3	2.5	4.3	3.7	3.7	3.75	1.45	1.65	2.9
17	2.0	1.8	3.5	1.9	2.5	4.35	3.7	3.7	3.7	1.45	1.65	1.25
18	1.9	1.8	3.5	2.0	2.5	4.05	3.7	3.7	3.7	1.5	1.3	1.3
19	2.0	1.8	3.5	2.0	2.5	4.05	3.7	3.65	3.65	1.6	1.2	1.3
20	1.9	1.7	3.6	2.1	2.5	4.05	3.7	3.65	3.65	1.8	1.15	1.3
21	1.9	1.75	3.7	2.1	2.55	4.05	3.7	3.7	3.7	2.0	1.15	1.3
22	1.9	1.95	3.85	2.1	2.6	4.05	3.85	3.7	3.65	3.3	1.2	1.3
23	1.9	1.7	3.95	2.15	2.6	4.05	3.85	3.7	3.6	2.2	1.3	1.3
24	1.85	1.65	4.05	2.2	2.6	4.0	3.85	3.8	3.6	2.6	1.3	1.3
25	1.85	1.6	4.2	2.2	2.6	4.05	3.85	3.8	3.55	2.2	1.35	1.3
26	1.8	1.7	4.25	2.2	2.55	4.1	3.8	3.8	3.45	2.25	1.3	1.3
27	1.8	1.7	4.15	2.2	2.55	4.1	3.8	3.75	3.45	1.7	1.3	1.3
28	1.8	1.75	4.05	2.3	2.55	4.1	3.8	3.75	3.45	1.85	1.35	1.3
29	1.7	.....	3.9	2.3	2.6	4.0	3.8	3.7	1.7	1.9	1.3	1.3
30	2.0	.....	3.7	2.3	2.65	4.05	3.75	3.7	1.65	1.85	1.3	1.3
31	1.8	.....	3.55	.....	.....	.....	3.75	3.7	.....	1.95	.....	1.3

NOTE.—Ice Jan. 1 to Mar. 5. Ice 15 inches thick at gage Feb. 10, 14 inches thick Feb. 26, some water on top of ice Mar. 1, ice gone out at station Mar. 6. The gage heights are affected by gate regulation at Pathfinder dam. Known dates when gage heights were so affected are: Jan. 29–31, July 21, Aug. 24, Sept. 5, Oct. 2, 4, 22–25, Nov. 17, Dec. 4, 5, 16, and 17.

Daily discharge, in second-feet, of North Platte River at Pathfinder, Wyo., for 1910.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	403	388	388	1,520	820	1,520	2,420	1,980	1,920	438	615	334
2	403	403	480	1,440	790	2,030	2,360	1,980	2,030	294	569	334
3	448	388	610	1,480	820	2,030	2,300	1,980	1,720	185	569	334
4	448	388	760	1,390	820	1,760	2,300	1,980	1,760	354	569	1,340
5	448	373	960	1,520	820	2,140	2,300	1,980	1,820	375	569	276
6	448	388	1,260	1,520	820	2,140	2,250	1,980	1,920	354	525	294
7	433	373	1,480	1,480	850	3,330	2,250	1,920	1,920	375	547	294
8	448	359	1,620	1,440	850	2,700	2,420	1,920	1,920	354	547	294
9	433	359	1,760	1,220	850	2,820	2,360	1,920	1,760	334	525	294
10	433	344	1,980	1,180	850	2,820	2,200	1,920	1,760	214	503	294

Daily discharge, in second-feet, of North Platte River at Pathfinder, Wyo., for 1910—Con.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
11	448	344	1,820	1,340	850	2,700	2,080	1,920	1,760	243	481	313
12	448	344	2,140	1,440	850	2,700	2,030	1,920	1,920	260	481	313
13	448	330	2,200	1,760	880	2,760	2,030	1,920	1,920	260	503	313
14	433	330	2,300	2,360	880	2,760	2,030	1,920	1,920	276	503	313
15	418	330	1,920	525	880	2,700	1,920	1,920	1,870	354	481	1,180
16	418	388	1,720	2,580	880	2,580	1,920	1,920	1,980	375	460	1,180
17	448	388	1,720	569	880	2,640	1,920	1,920	1,920	375	460	294
18	418	388	1,720	615	880	2,300	1,920	1,920	1,920	396	313	313
19	448	388	1,720	615	880	2,300	1,920	1,870	1,870	438	276	313
20	418	359	1,820	661	880	2,300	1,920	1,870	1,870	525	260	313
21	418	373	1,920	661	915	2,300	1,920	1,920	1,920	615	260	313
22	418	433	2,080	661	950	2,300	2,080	1,920	1,870	1,520	276	313
23	418	359	2,200	686	950	2,300	2,080	1,920	1,820	710	313	313
24	403	344	2,300	710	950	2,200	2,080	2,030	1,820	950	313	313
25	403	330	2,470	710	950	2,300	2,080	2,030	1,760	710	334	313
26	388	359	2,520	710	915	2,360	2,030	2,030	1,660	735	313	313
27	388	359	2,420	710	915	2,360	2,030	1,980	1,660	481	313	313
28	388	373	2,300	760	915	2,360	2,030	1,980	1,660	547	334	313
29	359	.....	2,140	760	950	2,250	2,030	1,920	481	569	313	313
30	448	.....	1,920	760	985	2,300	1,980	1,920	460	547	313	313
31	388	.....	1,760	.....	1,000	.....	1,980	1,920	.....	592	.....	313

NOTE.—These discharges are based on rating curves applicable as follows: Jan. 1 to Mar. 5, ice curve defined by measurement of Jan. 11, 1910, Mar. 6 to Dec. 31 (computations for this period made by U. S. Reclamation Service), well defined.

Monthly discharge of North Platte River at Pathfinder, Wyo., for 1910.

[Drainage area, 12,000 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
January	448	350	423	0.035	0.04	26,000	D.
February	433	330	367	.031	.03	20,400	D.
March	2,520	388	1,760	.147	.17	108,000	B.
April	2,580	525	1,130	.094	.10	67,200	A.
May	[a] 1,000	790	885	.074	.09	54,400	A.
June	3,330	1,520	2,400	.200	.22	143,000	A.
July	2,420	1,920	2,100	.175	.20	129,000	A.
August	2,030	1,870	1,940	.162	.19	119,000	A.
September	2,030	460	1,750	.146	.16	104,000	A.
October	1,520	185	476	.040	.05	29,300	B.
November	615	260	428	.036	.04	25,500	B.
December	1,340	276	399	.033	.04	24,500	C.
The year	3,330	260	1,180	.098	1.33	850,000	

[a] Estimated.

Inflow, in second-feet, into Pathfinder reservoir at Pathfinder, Wyo., for 1910.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	388	1,440	4,500	5,310	836	423	247
2	480	1,410	5,500	8,140	430	423	252
3	610	1,550	3,810	6,940	368	387	287
4	760	1,370	4,610	6,790	414	387	287
5	960	1,440	3,680	6,940	464	380	388
6	1,300	1,700	3,260	5,820	363	368	444
7	1,500	1,500	3,450	5,000	414	363	444
8	1,630	1,400	3,650	5,210	580	363	439
9	1,920	1,210	3,550	4,910	525	262	434
10	1,800	1,440	3,300	4,000	404	262	434

Inflow, in second-feet, into Pathfinder reservoir at Pathfinder, Wyo., for 1910—Continued.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
11	2,010	1,330	3,190	2,280	297	262	434
12	1,840	1,510	3,960	2,280	293	257	439
13	2,500	1,610	3,490	3,150	293	257	283
14	2,350	2,300	3,740	3,150	293	257	333
15	1,600	2,210	5,100	3,140	276	257	328
16	1,620	2,000	5,150	3,000	276	207	338
17	1,720	2,470	5,800	2,640	400	207	378
18	1,720	2,380	5,560	2,790	400	207	378
19	1,770	2,020	4,600	2,340	400	353	368
20	1,860	1,980	4,100	2,340	400	353	368
21	2,050	2,640	4,490	1,890	345	353	424
22	2,150	2,440	3,660	1,480	405	353	414
23	2,250	2,570	3,610	1,530	350	202	414
24	2,450	2,310	3,610	1,430	400	207	414
25	2,550	3,360	3,410	1,070	450	207	409
26	2,650	3,480	3,690	1,230	445	106	409
27	2,150	2,920	3,650	720	450	100	343
28	2,000	3,130	4,200	1,020	450	101	343
29	1,800	3,240	3,900	1,070	475	100	328
30	1,800	3,440	4,220	720	475	139	459
31	1,610	.....	4,920	.....	475	200	.....

NOTE.—These daily discharges were computed by the United States Reclamation Service and are published without change.

Monthly inflow into Pathfinder reservoir at Pathfinder, Wyo., for 1910.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
March	2,650	388	1,740	107,000
April	3,480	1,210	2,130	127,000
May	5,800	3,190	4,110	253,000
June	8,140	720	3,280	195,000
July	836	276	414	25,500
August	423	100	268	16,500
September	459	247	375	22,300
The period	.....	.....	.....	746,000

NOTE.—These estimates were furnished by the United States Reclamation Service. They have been slightly changed to conform to the computation rules of the United States Geological Survey.

NORTH PLATTE RIVER AND INTERSTATE CANAL AT WHALEN, WYO.

This station, which is located at the head of the Interstate canal at Whalen, Wyo., about 7 miles below Guernsey, was established May 1, 1909, by the United States Reclamation Service at the recently completed Whalen weir, to obtain data on stream flow for use in connection with the North Platte project and to replace the station on the North Platte at Guernsey.

No important tributaries enter the river for several miles above; Laramie River comes in about 6 miles below the station.

The zero of the weir gage is the level of the weir crest, which is 300 feet wide. The discharges given in the table for the river station include the flow over the weir, the flow through the four scour gates in the weir, which are $5\frac{3}{4}$ feet wide and 6 feet high when fully opened, and the discharge through the nine diversion gates of the Interstate canal, which are the same size as the sluiceway gates.

Another river gage is fastened to the retaining wall 75 feet downstream from the weir crest. The zero of the gage is 10 feet below the zero of the weir gage.

The canal gage is painted on the retaining wall about 1,000 feet below the diversion gate; its zero is on a level with canal bottom.

The readings of the river and canal gages have been used only when it has been necessary to compute the discharges through the gates when the gate openings are submerged.

The weir and discharge coefficients have been rather uncertain, and it is the intention eventually to check them up by a series of meter measurements of the canal and the river. During the spring of 1910 a gage and cable were installed at a point about 1 mile downstream from the weir, and several meter measurements were taken during the season, but the record is not complete enough to furnish convincing evidence as to the coefficients.

The seven diversion gates of the proposed Fort Laramie canal are the same size as those of the Interstate canal, and are situated at the south end of the Whalen weir. This canal has not yet been constructed.

The 1910 data for these stations are published as furnished by the United States Reclamation Service.

Discharge measurements of North Platte River at Whalen, Wyo., in 1910.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 27	W. T. Ferguson	286	745	1.90	571
31	....do	280	620	1.50	361
June 5	Freeman and Pyle	295	895	2.45	913
10	W. T. Ferguson	300	1,090	3.10	1,770
July 15	.....do	292	811	2.18	783
Aug. 15	.....do	285	723	1.97	597
Sept. 5		284	685	1.72	438

Daily discharge, in second-feet, of North Platte River at Whalen, Wyo., for 1910.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	703	642	740	2,666	1,409	1,044	2,111	1,895	1,716	1,711	765	418
2	643	578	908	2,558	1,409	970	2,141	1,831	1,716	1,654	765	418
3	650	578	1,223	2,451	1,344	1,086	2,174	1,773	1,716	1,056	765	470
4	635	642	1,489	2,344	1,286	1,418	2,128	1,773	1,721	893	765	521
5	620	642	3,056	2,241	1,333	1,860	2,296	1,773	1,530	700	765	521
6	615	642	2,384	2,138	1,268	1,835	2,181	1,773	1,530	636	765	330
7	590	642	1,577	2,040	1,268	1,732	2,104	1,773	1,530	636	765	374
8	590	578	1,668	2,040	1,275	1,835	2,158	1,826	1,530	578	765	906
9	590	578	1,760	2,040	1,261	2,187	2,127	1,801	1,618	521	765	765
10	590	642	1,854	2,040	1,225	2,172	1,990	1,801	1,669	521	700	418
11	590	642	1,854	1,941	1,143	2,225	2,045	1,748	1,669	469	700	418
12	590	642	1,947	2,138	1,105	2,491	2,023	1,763	1,618	469	700	469
13	590	578	2,144	1,941	1,054	2,521	1,951	1,763	1,618	469	700	374
14	590	578	2,045	2,138	1,044	2,531	1,891	1,763	1,618	418	700	259
15	590	578	2,144	2,666	1,070	2,576	1,836	1,768	1,669	418	700	330
16	590	642	2,350	2,774	1,084	2,611	1,836	1,711	1,721	418	700	294
17	590	642	2,457	2,843	1,119	2,554	1,846	1,711	1,778	418	636	259
18	645	642	2,247	2,588	1,160	2,467	1,782	1,716	1,721	636	636	259
19	674	642	2,144	3,191	1,238	2,379	1,628	1,716	1,965	579	636	330
20	622	642	2,045	2,364	1,258	2,313	2,593	1,716	1,778	1,305	636	374

Daily discharge, in second-feet, of North Platte River at Whalen, Wyo., for 1910—Contd.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
21	710	642	2,045	2,091	1,331	2,158	2,131	1,664	1,778	1,865	765	765
22	776	642	2,144	2,091	1,263	2,026	2,290	1,664	1,778	1,061	765	521
23	850	531	2,247	2,091	1,263	1,970	2,054	1,664	1,836	835	636	418
24	850	554	2,475	2,091	1,216	1,980	2,036	1,664	1,836	765	578	374
25	707	590	2,780	2,008	1,183	1,980	1,895	1,664	1,778	765	521	294
26	707	590	2,780	1,832	1,183	1,980	1,830	1,664	1,721	1,398	521	294
27	707	643	2,889	1,832	1,183	1,965	1,766	1,716	1,669	1,142	521	294
28	707	669	3,001	1,754	1,183	1,968	1,766	1,773	1,669	1,061	470	234
29	642	.....	3,114	1,820	1,183	1,919	1,806	1,773	1,652	906	418	259
30	642	.....	3,114	1,521	1,184	1,928	1,773	1,773	1,615	835	418	374
31	642	.....	2,774	.....	1,104	.....	2,423	1,716	.....	765	.....	418

NOTE.—These discharges were computed by the United States Reclamation Service and are published herewith unchanged. They have not been verified by engineers of the United States Geological Survey. The discharges in this table include the discharge of the Interstate canal and the flow over the river weir and sluices.

Monthly discharge of North Platte River at Whalen, Wyo., for 1910.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
January	850	590	653	40,200
February	669	531	616	34,200
March	3,110	740	2,170	133,000
April	3,190	1,520	2,210	132,000
May	1,410	1,040	1,210	74,400
June	2,610	970	2,020	120,000
July	2,590	1,630	2,020	124,000
August	1,900	1,660	1,750	108,000
September	1,960	1,530	1,690	101,000
October	1,860	418	836	51,400
November	765	418	665	39,600
December	906	234	411	25,200
The year	3,190	234	1,360	983,000

NOTE.—These estimates were computed by the United States Geological Survey from data furnished by the United States Reclamation Service, published herewith, and include the total flow in the river and Interstate canal.

Daily discharge, in second-feet, of Interstate canal at Whalen, Wyo., for 1910.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1	.....	528	788	1,205	1,195	1,195	1,711
2	.....	528	714	1,080	1,195	1,195	430
3	.....	528	759	0	1,195	1,195	420
4	.....	470	780	57	1,195	1,200	315
5	.....	452	875	420	1,195	1,200	.....
6	.....	452	850	690	1,195	1,200	.....
7	.....	452	895	960	1,195	1,200	.....
8	.....	459	850	1,095	1,190	1,200	.....
9	.....	503	960	727	1,165	1,200	.....
10	.....	524	945	1,005	1,165	1,200	.....
11	.....	548	1,080	1,060	1,170	1,200	.....
12	.....	554	1,090	1,115	1,185	1,200	.....
13	.....	550	1,120	1,115	1,185	1,200	.....
14	.....	575	1,130	1,125	1,185	1,200	.....
15	.....	601	1,175	1,136	1,190	1,200	.....
16	.....	615	1,210	1,136	1,190	1,200	.....
17	177	615	1,240	1,146	1,190	1,200	.....
18	341	612	1,240	1,146	1,195	1,200	.....
19	417	643	1,235	1,030	1,195	1,200	.....
20	420	313	1,250	1,008	1,195	1,200	.....

Daily discharge, in second-feet, of Interstate canal at Whalen, Wyo., for 1910—Contd.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
21	422	630	1,250	1,146	1,195	1,200	.....
22	422	668	1,260	1,146	1,195	1,200	.....
23	422	712	1,270	1,146	1,195	1,200	.....
24	422	712	1,280	1,130	1,195	1,200	.....
25	427	714	1,280	1,130	1,195	1,200	.....
26	425	714	1,280	1,130	1,195	1,200	.....
27	425	714	1,200	1,130	1,195	1,200	.....
28	425	714	0	1,130	1,195	1,200	.....
29	491	714	150	1,170	1,195	1,074	.....
30	473	751	702	1,195	1,195	780	.....
31	.....	797	.....	1,195	1,195	.....	.....

NOTE.—These discharges were computed by the United States Reclamation Service from their weir and canal gage readings and are published herewith unchanged. They have not been verified by engineers of the United States Geological Survey. There was no flow Jan. 1 to Apr. 16, and Oct. 6 to Dec. 31.

Monthly discharge of Interstate canal at Whalen, Wyo., for 1910.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
January	.....	.....	0	0
February	.....	.....	0	0
March	.....	.....	0	0
April	491	0	190	11,300
May	797	313	592	36,400
June	1,280	0	995	59,200
July	1,200	0	997	61,300
August	1,200	1,160	1,190	73,200
September	1,200	780	1,180	70,200
October	1,710	0	92.8	5,710
November	.....	.....	0	0
December	.....	.....	0	0
The year	1,710	0	439	317,000

NOTE.—These estimates were computed by the United States Geological Survey from data furnished by the United States Reclamation Service published herewith.

NORTH PLATTE RIVER NEAR MITCHELL, NEBR.

This station, which was established June 3, 1901, to replace the station at Gering, is located at a highway bridge 1 mile south of Mitchell, Nebr., in sec. 27, T. 23 N., R. 56 W. The records at this point show the amount of water passing the Wyoming-Nebraska State line, and are of especial value in connection with interstate questions concerning the distribution of water. Laramie River and Rawhide Creek enter the river in Wyoming below the Guernsey station, and Horse Creek comes in just below the State line. No important tributaries enter below the station. Important diversions for irrigation are made both above and below the station.

The chain gage is fastened to the upstream handrail of the pile bridge from which discharge measurements are usually made. The datum of the gage was lowered 1 foot May 3, 1902, to obviate negative readings. As the river sometimes freezes solid, few records have been obtained during the winter.

As the bed of the river is of shifting sand, and the measurements are insufficient in number to indicate all changes, the results obtained are unsatisfactory.

This station was discontinued October 6, 1910.

Discharge measurements of North Platte River near Mitchell, Nebr., in 1910.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Mar. 20	D. D. Price	980	1,150	3.10	2,640
Apr. 29	do	860	732	2.80	1,530
June 1	R. H. Willis	497	186	1.90	215
23	E. C. Simmons	728	316	2.20	409
July 28	R. H. Willis	263	93	1.65	120
Nov. 29	do	679	371	2.35	687

Daily gage height, in feet, of North Platte River near Mitchell, Nebr., for 1910.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1	3.0	3.2	.....	2.2	2.3	1.8	1.4	2.1
2	2.7	3.2	2.8	2.1	2.4	2.3	1.4	.....
3	2.7	.....	2.8	2.1	.....	2.0	1.4	2.4
4	2.7	3.4	2.7	2.1	2.8	1.8	.....	2.4
5	2.7	3.3	2.7	.....	2.7	1.7	1.4	2.3
6	.....	3.1	2.7	2.1	2.7	1.7	1.4	.....
7	3.2	3.3	2.7	2.1	2.5	.....	1.4	.....
8	3.0	3.3	.....	1.9	2.4	1.7	1.4	.....
9	3.0	3.3	2.5	1.9	2.3	1.7	1.4	.....
10	2.9	.....	2.4	2.0	.....	1.6	1.6	.....
11	2.9	3.0	2.4	2.2	2.3	1.6	.....	.....
12	3.0	3.0	2.4	.....	2.3	1.6	1.6	.....
13	.....	3.1	2.3	2.3	2.2	1.6	1.6	.....
14	3.2	3.1	2.3	2.5	2.0	.....	2.0	.....
15	3.1	3.1	.....	2.6	1.8	1.6	2.0	.....
16	3.0	3.2	2.3	2.6	1.8	1.6	1.7	.....
17	3.0	.....	2.3	2.5	.....	1.5	1.7	.....
18	3.1	3.2	2.3	2.5	1.7	1.5	.....	.....
19	3.1	3.1	2.3	.....	1.7	1.5	1.7	.....
20	.....	3.2	2.3	2.4	2.0	1.5	1.7	.....
21	3.1	3.1	2.3	2.4	2.1	.....	1.8	.....
22	3.1	3.0	.....	2.4	2.3	1.5	1.8	.....
23	3.1	3.0	2.3	2.4	1.9	1.5	1.9	.....
24	3.1	.....	2.3	2.2	.....	1.4	2.0	.....
25	3.0	2.9	2.3	2.2	1.7	1.4	.....	.....
26	3.1	3.0	2.3	.....	1.7	1.4	2.0	.....
27	.....	3.0	2.3	1.9	1.7	1.4	2.0	.....
28	3.2	2.9	2.2	1.9	1.7	.....	1.9	.....
29	3.3	2.9	.....	1.9	1.8	1.5	2.0	.....
30	3.3	2.7	2.2	2.6	1.8	1.4	2.0	.....
31	3.2	.....	2.2	.....	.....	1.4	.....	.....

NOTE.—Ice probably existed during January and February.

Daily discharge, in second-feet, of North Platte River near Mitchell, Nebr., for 1910.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1	2,230	2,930	1,480	440	580	170	85	340
2	1,360	2,930	1,620	340	740	580	85	540
3	1,360	3,320	1,620	340	1,180	265	85	740
4	1,360	3,700	1,360	340	1,620	170	85	740
5	1,360	3,310	1,360	340	1,360	135	85	580
6	2,140	2,570	1,360	340	1,360	135	85	.....
7	2,930	3,310	1,360	340	920	135	85	.....
8	2,230	3,310	1,140	215	740	135	85	.....
9	2,230	3,310	920	215	580	135	85	.....
10	1,910	2,770	740	265	580	110	110	.....

Daily discharge, in second-feet, of North Platte River near Mitchell, Nebr., for 1910— Continued.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
11	1,910	2,230	740	440	580	110	110	.....
12	2,230	2,230	740	510	580	110	110	.....
13	2,580	2,570	580	580	440	110	110	.....
14	2,930	2,570	580	920	265	110	265	.....
15	2,570	2,570	580	1,140	170	110	265	.....
16	2,230	2,930	580	1,140	170	110	135	.....
17	2,230	2,930	580	920	152	95	135	.....
18	2,570	2,930	580	920	135	95	135	.....
19	2,570	2,570	580	830	135	95	135	.....
20	2,570	2,930	580	740	265	95	135	.....
21	2,570	2,570	580	740	340	95	170	.....
22	2,570	2,230	580	740	580	95	170	.....
23	2,570	2,230	580	740	215	95	215	.....
24	2,570	2,070	580	440	175	85	265	.....
25	2,230	1,910	580	440	135	85	265	.....
26	2,570	2,230	580	328	135	85	265	.....
27	2,750	2,230	580	215	135	85	265	.....
28	2,930	1,910	440	215	135	90	215	.....
29	3,310	1,910	440	215	170	95	265	.....
30	3,310	1,360	440	1,140	170	85	265	.....
31	2,930	.....	440	.....	170	85	.....	.....

NOTE.—These discharges are based on a well-defined rating curve below 4,000 second-feet. Discharges interpolated for days on which gage was not read.

Monthly discharge of North Platte River near Mitchell, Nebr., for 1910.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
March	3,310	1,360	2,380	146,000	A.
April	3,700	1,360	2,620	156,000	A.
May	1,620	440	803	49,400	A,
June	1,140	215	551	32,800	A.
July	1,620	135	481	29,600	B.
August	580	80	129	7,930	B.
September	265	80	159	9,460	B.
The period	.....	.....	.....	431,000	

NORTH PLATTE RIVER AT NORTH PLATTE, NEBR.

This station was originally established October 5, 1894, at the Union Pacific Railroad bridge 2 miles east of North Platte, Nebr., and above the junction of North and South Platte rivers. On April 10, 1910, it was moved to the highway bridge 3½ miles above the confluence of the two forks, about one-half mile north of North Platte, Nebr., in sec. 28, T. 14 N., R. 30 W.

Many diversions are made between the station near Mitchell and the measuring station. One small tributary, Birchwood Creek, maintains a small flow of water at the measuring section at times when the river itself would otherwise be dry.

From October 5, 1894, to May 31, 1910, a vertical gage was used, attached to a cofferdam surrounding the east pier of the Union Pacific Railroad bridge. Because of the stony eddies around

the gage that vitiated the accuracy of the readings, a chain gage was installed March 25, 1910, at a different datum at the highway bridge 2 miles above, and on April 10, 1910, gage readings were commenced. This gage was stolen and the gage record interrupted from July 1 to October 1; on October 15, 1910, a new staff gage was set at the highway bridge at a different datum.

All discharge measurements have been made at the highway bridge.

The datum of the gage at the railroad bridge remained unchanged during the time it was in use.

During the winter the river often freezes solid, as it is very shallow.

Records at this station show the amount of water contributed by the North Platte to the Platte below all diversions. They are subject to the same limitations of shifting channel and poor measuring conditions as other stations on the river, though to a somewhat less degree.

Discharge measurements of North Platte River at North Platte, Nebr., in 1910.

Date.	Hydrographer.	Width.	Area of section.	Gauge height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Mar. 25	D. D. Price	2,210	1,300	[a] 3.60	3,010
Apr. 26	do	1,180	1,230	[a] 3.40	2,600
May 26	R. H. Willis	774	523	[a] 3.00	749
Oct. 15	A. A. Dobson	370	176	[b] 2.60	228
Nov. 19	do	576	533	[b] 3.14	963
Dec. 10	do	415	309	[b] 3.45	595

[a] These measurements were taken at the highway bridge 2 miles above the Union Pacific Railroad bridge. The gage heights are the observer's readings at the railroad bridge, as the hydrographer read only the gage at the highway bridge.

[b] These gage heights are from a new gage established Oct. 15, 1910, at highway bridge at a different datum.

Daily gage height, in feet, of North Platte River at North Platte, Nebr., for 1910 (highway bridge gage).

Day.	Apr.	May.	June.	Oct.	Nov.	Dec.	Day.	Apr.	May.	June.	Oct.	Nov.	Dec.
1	.....	3.6	2.9	.....	3.0	3.3	16	3.6	3.0	2.0	.....	3.1	3.5
2	.....	3.6	2.6	.....	3.1	3.25	17	.....	2.9	2.4	2.6	3.2	3.6
3	.....	3.7	2.6	.....	3.15	3.2	18	3.6	3.0	2.2	2.65	3.2	.....
4	.....	3.6	2.6	.....	3.2	.....	19	3.5	2.9	.....	2.6	3.2	3.7
5	.....	3.5	.....	.....	3.2	3.15	20	3.6	2.9	2.1	2.6	.....	3.7
6	.....	3.6	2.5	.....	.....	3.2	21	3.6	2.7	2.0	2.6	3.2	3.6
7	.....	3.6	2.6	.....	3.15	3.25	22	3.7	.....	2.0	2.6	3.2	3.6
8	.....	3.5	2.7	.....	3.1	3.2	23	3.6	2.9	2.0	2.6	3.3	3.5
9	.....	3.4	2.4	.....	3.1	3.15	24	.....	2.9	2.0	2.6	3.3	3.5
10	3.8	3.2	2.4	.....	3.1	3.1	25	3.6	2.9	2.6	2.6	3.3	.....
11	3.7	3.2	2.4	.....	3.1	.....	26	3.4	2.95	.....	2.6	3.4	3.4
12	3.6	3.1	2.0	.....	3.1	3.3	27	3.4	3.1	2.4	2.6	.....	3.4
13	3.7	3.0	2.3	.....	.....	3.3	28	3.4	3.2	2.4	2.65	3.3	3.4
14	3.7	3.0	2.2	.....	3.1	3.4	29	3.4	.....	2.1	2.9	3.25	3.3
15	3.8	.....	2.1	2.6	3.1	3.4	30	3.3	2.8	2.1	.....	3.2	.....
							31	.....	.....	.....	2.95	.....	.....

NOTE.—Gage readings from Apr. 10 to June 30 observed from gage at highway bridge, 2 miles above Union Pacific Railroad bridge. New gage established Oct. 15 at highway bridge, but at different datum. River frozen over Dec. 30.

Daily gage height, in feet, of North Platte River near North Platte, Nebr., for 1910 (railroad bridge gage).

Day.	Mar.	Apr.	May.	Day.	Mar.	Apr.	May.	Day.	Mar.	Apr.	May.
1	3.3	2.5	2.35	11	1.9	2.4	2.4	21	2.0	2.5	2.25
2	3.3	2.5	2.4	12	1.8	2.4	2.4	22	2.0	2.5	2.3
3	3.0	2.5	2.45	13	2.0	2.5	2.35	23	2.0	2.45	2.3
4	3.25	2.5	2.45	14	2.0	2.5	2.35	24	2.0	2.5	2.3
5	3.5	2.5	2.55	15	2.0	2.5	2.3	25	2.1	2.5	2.3
6	2.5	2.5	2.6	16	2.0	2.4	2.3	26	2.1	2.45	2.25
7	2.0	2.5	2.6	17	2.1	2.4	2.25	27	2.2	2.45	2.25
8	2.0	2.5	2.5	18	2.0	2.45	2.25	28	2.2	2.4	2.25
9	1.95	2.5	2.5	19	2.0	2.4	2.25	29	2.3	2.4	2.3
10	1.9	2.5	2.4	20	2.0	2.4	2.25	30	2.3	2.4	2.3
								31	2.3	.....	2.3

NOTE.—Ice January, February, Mar. 1 to about Mar. 6. Ice breaking up Mar. 3.

PLATTE RIVER NEAR COLUMBUS, NEBR.

This station, which was established June 4, 1895, and has been kept continuously since that date except during the winter months, is located above the mouth of Loup River, at Meridian Bridge, about 3 miles south of Columbus, in sec. 31, T. 17 N., R. 1 E. No important tributaries enter the river between the junction of the North Platte and the South Platte and this station, and Loup River and Elkhorn River are the only large tributaries below. The drainage area is 56,900 square miles.

In the late summer practically all the water of the river disappears, either from diversion or evaporation from the wide shallow channels. No records have been obtained during the ice period of the winter.

The bed of the river is of shifting sand and at low water the stream flows in many shallow channels, so that determination of discharge is largely a matter of estimate. Poor measuring conditions, combined with shifting channel, render the records liable to considerable error. The gage datum has remained the same throughout.[1]

The river at this point flows in three channels, known as the main, middle, and south channels, respectively, each of which is spanned by a pile bridge from the upstream side of which discharge measurements are made. The chain gage is fastened to the upstream side of the main channel bridge, which is called the Meridian Bridge, and has a span of nearly 2,000 feet. The middle channel bridge is over 300 feet long, and the south channel bridge is about 80 feet long.

The gage was destroyed with the bridge early in season of 1910. On July 25, 1910, it was reestablished in the same place, but possibly at a slightly different datum.

[1] Data collected at this station prior to 1908 have been compiled in Water-Supply Paper 230 : Surface water supply of Nebraska.

Discharge measurements of Platte River at Columbus, Nebr., in 1910.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
July 25	A. A. Dobson				[a] 0
Oct. 1	do			0.55	[b] 10
Nov. 19	do				[c] 0
25	do			.48	[b] 28

[a] River dry. [b] Estimated. [c] Water standing in pools which were frozen over.

Daily gage height, in feet, of Platte River at Columbus, Nebr., for 1910.

Day.	Sept.	Oct	Nov.	Day.	Sept.	Oct.	Nov.	Day.	Sept.	Oct.	Nov.
1	1.55	0.55		11				21			
2	1.0	.55		12				22			
3	1.0	1.1		13				23	0.2		
4	.95	1.15		14				24	.4		
5	.7	1.1		15				25	.9		0.48
6	6			16				26	.85		
7				17				27	.7		
8		8		18				28	.65		
9				19				29			
10				20				30			
								31			

NOTE.—The observer records that there was no flow Sept. 7 to 22, 29, 30, Oct. 9 to Nov. 24. The hydrographer stated that the river at this point was practically dry all the season.

LARAMIE RIVER BASIN.

DESCRIPTION.[1]

Laramie River has its source in the mountains of northern Colorado, its headwaters adjoining those of the Cache la Poudre on the west. Irrigation is practiced in the basin of this river on a small scale in Colorado, but principally for hay ranches, the elevation being too great for diversified farming. After crossing the Wyoming line Laramie River soon leaves its canyon and enters the Laramie Plains, which are extensively irrigated from the main stream and its various tributaries, notably Little Laramie River, the low-water flow of which is now entirely used. Farther down the river passes through another canyon, and finally enters the plain of lower Laramie River, which extends from the eastern edge of Laramie Hills to the mouth of the river. It enters the North Platte at Fort Laramie, Wyo.

The highest point of diversion on Laramie River is the canal of the Water Supply & Storage Co. of Colorado, called the Sky Line canal, which takes water into Cache la Poudre River. This canal is at an elevation of about 10,000 feet above sea level, is 5 miles long, and was built principally through solid rock at a cost of about $90,000. Its maximum capacity is 100 second-feet. On account of its altitude this canal is not practically available until late in June. The taking

[1] For a more detailed description of this basin see the annual reports of the U. S. Geol. Survey, listed in Water-Supply Paper 119, 1905, p. 121.

of this water from Laramie River is a source of loss to irrigators in Wyoming, as none of the water returns to the stream through seepage or percolation.

LARAMIE RIVER AT GLENDEVEY, COLO.

This station is located at highway bridge one-eighth mile west of Glendevey post office, on the State road between Fort Collins and Waldon, Colo., in the NW. ¼ sec. 36, T. 10 N., R. 76 W., just below the mouth of Nunn Creek, which enters from the east, and some distance below the confluence of Spring Creek with the Laramie and some distance above McIntyre Creek, both of which streams enter from the west. It was established June 24, 1904, discontinued October 31, 1905, and reestablished August 18, 1910.

The drainage area at this station is 221 square miles. Some water is diverted above the station for irrigation.

A 2 by 4 vertical staff gage, graduated to feet and tenths, fastened to northwest corner of wooden pier near east end of wagon bridge, was used from June 24, 1904, to October 31, 1905. A new staff gage fastened to the northwest corner of first pier from right bank on August 18, 1910, was established at same datum as gage used in 1904 and 1905.

November 17, 1910, a Bristol automatic gage was established at this station, with datum same as that of vertical staff gage. (See Pl. IV, *B*, p. 270.)

The channel is straight for about 200 feet above the station.

At low stages measurements are made by wading; during high water measurements are made with cable from the lower side of bridge. The section is rather rough, consisting of gravel and bowlders. Gage heights are very much affected by ice during the winter.

Results should be fair.

This station is maintained by the State engineer of Colorado, who has furnished the data for publication. They have not been verified by engineers of the United States Geological Survey.

Discharge measurements of Laramie River at Glendevey, Colo., in 1910.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Aug. 19	C. C. Hezmalhalch	38	42.7	1.90	30
Sept. 28	do	38	40.2	1.90	26
Nov. 7	W. B. Freeman	33	30	1.86	28
8[a]	do	31	24.4	1.69	14

[a] Some slush ice.

NOTE.—All measurements made by wading.

Daily gage height, in feet, and discharge, in second-feet, of Laramie River at Glendevey, Colo., for 1910.

[A. L. Fairhurst, observer.]

Day.	Aug.		Sept.		Oct.		Nov.		Dec.	
	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
1	.....	.....	1.9	31	1.90	31	1.9	31	1.7	15
2	.....	.....	1.95	36	1.9	31	1.9	31	1.75	18
3	.....	.....	2.1	56	1.8	22	1.9	31	1.85	26
4	.....	.....	2.2	76	2.0	42	1.9	31	1.85	26
5	.....	.....	2.2	76	2.0	42	1.9	31	1.8	22
6	.....	.....	2.0	42	2.0	42	1.9	31	1.8	22
7	.....	.....	1.9	31	2.0	42	1.8	22	1.8	22
8	.....	.....	1.9	31	1.95	36	1.85	26	1.75	18
9	.....	.....	1.9	31	1.9	31	1.75	18	1.80	22
10	.....	.....	2.1	56	1.9	31	1.8	22	1.75	18
11	.....	.....	1.95	36	1.9	31	1.8	22	1.8	22
12	.....	.....	1.90	31	1.9	31	1.8	22	1.7	15
13	.....	.....	1.95	36	1.9	31	1.8	22	1.75	18
14	.....	.....	2.1	56	1.9	31	1.75	18	1.9	31
15	.....	.....	1.95	36	1.9	31	1.8	22	1.75	18
16	.....	.....	1.9	31	1.9	31	1.8	22	1.75	18
17	.....	.....	2.0	42	1.95	36	1.85	26	1.75	18
18	1.9	31	2.05	49	2.05	49	1.7	15	1.70	15
19	1.9	31	2.1	56	2.05	49	1.75	18	1.65	13
20	1.9	31	2.05	49	2.0	42	1.7	15	1.65	13
21	1.95	36	2.0	42	2.05	49	1.7	15	1.65	13
22	1.9	31	2.0	42	2.1	56	1.75	18	1.7	15
23	1.9	31	2.0	42	2.0	42	2.0	42	1.75	18
24	1.9	31	2.0	42	2.0	42	2.0	42	1.85	26
25	1.85	26	2.0	42	1.95	36	2.0	42	1.8	22
26	1.9	31	2.0	42	1.9	31	1.95	36	1.75	18
27	1.9	31	1.9	31	1.9	31	1.85	26	1.85	26
28	1.9	31	1.9	31	1.9	31	2.0	42	1.8	22
29	1.9	31	1.9	31	1.95	36	2.0	42	1.7	15
30	1.9	31	1.9	31	1.9	31	2.0	42	1.8	22
31	1.9	31	.....	.....	1.9	31	.....	.....	1.95	36

NOTE.—These data are published as furnished by the State engineer of Colorado. They have not been verified by the engineers of the United States Geological Survey.

Monthly discharge of Laramie River at Glendevey, Colo., for 1910.

[Drainage area, 102 square miles.]

Month.	Discharge in second-feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.
Aug. 18-31	36	26	31.0	0.304	0.16	861
September	76	31	42.1	.413	.46	2,510
October	56	31	36.4	.357	.41	2,240
November	42	15	27.4	.269	.30	1,630
December	31	13	20.1	.197	.23	1,240

NOTE.—These estimates were computed by the United States Geological Survey from data furnished by the State engineer of Colorado.

SOUTH PLATTE RIVER BASIN.

DESCRIPTION.

The South Platte rises in the mountainous region surrounding the large basin near the center of the State of Colorado, known as South Park, and in the long eastern slopes of the high mountains forming the Continental Divide. The river might properly be said

to be formed at South Platte, Colo., by the junction of the North and South forks. The drainage area of the South fork comprises about 2,150 square miles and that of the North Fork only about 450 square miles, but there is little difference in the mean annual flow of the two branches. The North Fork is about 50 miles long and the South Fork a little over 100 miles. Geneva Creek, with a drainage area of 50 square miles, is the most important tributary of the North Fork, other tributaries being Deer Park, Elk, and Buffalo creeks. Tarryall Creek and Goose Creek are the principal tributaries of the South Fork.

South Fork, usually considered the main branch of the river, flows in an easterly direction to Lake George, then northward to its junction with the North Fork, and on to the mouth of the Cache la Poudre near Greeley. From Greeley its general course is eastward until it joins the North Platte at the town of North Platte, Nebr.

At the mouth of the South Platte its elevation is 2,800 feet above sea level; 100 miles above the mouth it is 3,600 feet; at Denver, 288 miles above the mouth, it is 5,170 feet; and at South Platte, 30 miles above Denver, it is about 6,100 feet. Lake George, about 50 miles up the South Fork, is 8,000 feet above sea level, and Cheesman reservoir, 23 miles up from South Platte, is 6,850 feet. At the mouth of Geneva Creek, at Grant, Colo., 40 miles up the North Fork from South Platte, the elevation is about 8,500 feet.

The drainage basin, which comprises about 20,000 square miles above Julesburg, Colo., is bisected in an irregular way by the channel of the South Platte. To the north and west lies the mountainous portion, which consists of a long, narrow strip, extending in a north-south direction from a point a short distance above the south boundary of Wyoming to Palmer Lake, Colo. This area furnishes at least 90 per cent of the total run-off of the basin. South and east of the river the basin lies entirely within the plains region.

The mountainous region consists of peaks and jagged masses of granite, with sedimentary rocks cut and gashed by stream channels along the foothills. The stream gradients are steep, and many of the streams consist of series of cascades and rapids. The soil cover as a whole is light, and except during spring freshets or heavy storms the streams are remarkably free from sediment in suspension.

The lower basin, somewhat scarred and broken along the foothills, gradually merges farther east into the undulating prairies so characteristic of the Great Plains east of the Rocky Mountains. The soils of the plains are the product of the disintegration of shales and sandstones, and range from adobe clays to sandy loams. The controlling vegetation is largely native grasses, the only timber being a few bunches of scraggly cottonwoods along the stream channels and small patches of pine, cedar, and piñon along the higher portions.

The forest cover of the mountains, consisting originally of coniferous trees, is rapidly disappearing, but, through the occurrence of fires, a foothold has been furnished for the deciduous aspen, which is gradually increasing its dominion. Most of the timberland in this drainage is included in the Pike and Medicine Bow national forests; in all there are probably 1,000 square miles of merchantable timberlands.

The tributaries of the South Platte comprise, first, the small streams that rise on the eastern slope of the Rocky Mountains and, second, the plains streams. The mountain streams furnish a perennial supply of water, the amount of which, however, varies with the snowfall, being light during the latter part of the summer and in the fall and winter, and large during the spring floods. This water is almost entirely diverted for irrigation and does not reach the South Platte except in times of heavy floods. The principal streams of this class are Bear, Clear, St. Vrain, Boulder, and Big Thompson creeks, and Cache la Poudre River. The plains streams are all intermittent and furnish water only during storms or in the season of melting snow. The chief streams of this class are Cherry, Lone Tree, Crow, Kiowa, Boxelder, Bijou, Beaver, and Pawnee creeks.

In the mountainous regions the flow of the South Platte is perennial, but in the plains area the volume is greatly diminished by the numerous irrigation diversions. At North Platte, Nebr., just above the mouth of the river, the stream channel is dry for the greater part of the year, or consists of several small channels carrying a few second-feet of water.

The river is subject to periodic floods that occur in May and June, the magnitude varying from year to year with seasonal precipitation and temperature. At Julesburg, Colo., the stream flow varies from nothing up to 12,000 second-feet.

The rainfall is 25 inches or more in the highest mountains; 15 to 20 inches between altitudes of 5,500 and 9,000 feet; 10 to 15 inches between 4,000 and 5,000 feet; and in the lower basin, below an elevation of 4,000 feet, from 15 to 20 inches annually.

The winters are very severe, especially above the points where the mountain streams emerge into the more open country. In the mountain sections the snowfall is heavy, and snowstorms are common on the plains areas, but here the snow usually disappears within a few days after each storm. During the winter months the river and its tributaries are frequently frozen over throughout their courses. The length of the ice period ranges from about two months in the vicinity of Julesburg, Colo., to about five months in the high mountains, where the streams are frozen almost to the bottom.

The South Platte basin contains the oldest cultivated and irrigated areas in Colorado. At present nearly 1,000,000 acres are under irri-

gation in Colorado from the South Platte and its tributaries. In fact, the entire normal flow is being used for this purpose, and additional irrigation will necessitate the construction of storage reservoirs or the diversion of water from other drainage areas. The North Grand ditch, which has been in operation for several years, diverts water from the North Fork of Grand River across the divide into the Cache la Poudre River. The Laramie-Poudre project, which is under construction will divert water from the headwaters of Laramie River, in the basin of the North Platte, into the Cache la Poudre, in the basin of the South Platte; and the Denver Reservoir & Irrigation Co. proposes to divert the headwaters of Fraser River, a tributary of the Grand, into the headwaters of South Boulder, a tributary of the South Platte. Other similar projects are under consideration. The storage of the flood waters of the intermittent streams in the lower basin offer opportunities for considerable irrigation development. Very little is known as to the flow of these streams, but it is certainly very large at times, and many excellent storage sites are available.

About half a million acre-feet of the annual flow from the mountain section of this basin is now being stored for irrigation in many small reservoirs, and a large part of the mountain flow is still available for irrigation by proper conservation and storage.

Conditions on the upper South Platte and its tributaries are unusually favorable for storage. Some of the many good sites are natural depressions or are situated on small tributaries, so that the reservoirs will have to be supplied by feeder canals. Of this type is the Standley reservoir of the Denver Reservoir & Irrigation Co. This reservoir, which has been practically completed at a height considerably less than shown on the original plans and has a capacity of about 50,000 acre-feet. It will undoubtedly be enlarged in the future.

The largest reservoir which has been constructed in the South Platte basin is the Cheesman Lake of the Denver Union Water Co. This reservoir, which was completed in 1904, has a maximum capacity of 79,000 acre-feet. Among other proposed reservoirs may be mentioned the Antero, Tarryall, Lake George, Lost Park, Eagle Rock, and Geneva. Opportunities for storage are also found on Clear Creek, Boulder, St. Vrain, Big Thompson, and the Cache la Poudre. Some excellent reservoir sites have been surveyed on the last-named stream. The reservoirs on the upper portions of these streams will be used primarily for power development, but the stored waters can also be used for irrigation in the valleys below.

Water-power development is necessarily limited to the mountainous parts of the drainage area. Many favorable opportunities for such development are presented on Geneva Creek, the South Fork, Clear Creek, Boulder Creek, Big Thompson Creek, and Cache la Poudre

River. Many power sites have been filed upon. The ultimate power development in this drainage basin will probably amount to nearly 200,000 horsepower, but present development is limited to numerous small plants with a total capacity of less than 5,000 horsepower. Most of these plants are on Clear Creek and Boulder Creek. The plant of the Eastern Colorado Power Co., on Boulder Creek, a few miles above Boulder, Colo., is now under construction, and when completed will have a capacity of probably 20,000 horsepower.

The following special reports contain information regarding the hydrography of Colorado and Nebraska:

Water resources of Colorado, by A. L. Fellows: Water-Supply Paper U. S. Geol. Survey No. 74, 1902.

Surface waters of Nebraska, by J. C. Stevens: Water-Supply Paper U. S. Geol. Survey No. 230, 1909.

SOUTH FORK OF SOUTH PLATTE AT FAIRPLAY, COLO.

This station, which is located at the steel highway bridge in Fairplay, Colo., was established October 17, 1910.

A temporary staff gage was installed at upstream side of bridge. Measurements are made from bridge during high stages and by wading at various sections during low stages.

The bed of the stream is rocky and fairly permanent. The stream is frozen over from three to four months.

This station is maintained in cooperation with the United States Forest Service.

The following discharge measurement was made by S. T. Harding:

October 17, 1910: Width, 17 feet; area, 14 square feet; gage height, 1 foot; discharge, 25 second-feet.

Daily gage height, in feet, of South Fork of South Platte River at Fairplay, Colo., for 1910.

[E. W. Brown, observer.]

Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.
1	.....	0.9	0.7	11	.....	0.9	.....	21	0.8	0.9	.....
2	.....	.9	.7	12	.....	.8	.....	22	1.1	.9	.....
3	.....	.9	.9	13	.....	1.1	.....	23	1.0	.8	.....
4	.....	.9	.....	14	.....	.9	.....	24	1.0	.9	.....
5	.....	.9	.8	15	.....	.9	0.7	25	1.0	.....	.....
6	.....	.8	.9	16	.....	.9	.7	26	1.0	.....	.....
7	.....	.9	.9	17	1.0	.7	.7	27	1.0	.9	.....
8	.....	.9	.9	18	1.0	.7	.8	28	1.0	.7	.....
9	.....	1.1	.9	19	1.0	.9	.8	29	.....	.7	.....
10	.....	1.0	.....	20	.9	.9	1.0	30	1.0	.....	.....
								31	1.0	.....	0.6

NOTE.—Observer away on days when gage was not read. Ice during greater part of December.

SOUTH FORK OF SOUTH PLATTE RIVER NEAR LAKE GEORGE, COLO.

This station was established October 22, 1910, by the United States Geological Survey, in cooperation with the United States Forest Service. It is located one-fourth mile below Lake George, Colo., on highway bridge, near Hayman (Lake George) post office.

A vertical staff gage is attached to the bridge on left downstream side of center pier.

Measurements are made from bridge or by wading. Section is rather poor.

The channel is of gravel and cobbles and liable to shift.

Gage heights are affected by ice during winter months, and measurements are somewhat affected by a 2-foot dam 50 feet below the gage.

Discharge measurements of South Fork of South Platte River near Lake George, Colo., in 1910.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Oct. 22	S. T. Harding	22.5	24.5	1.78	58
Nov. 18[a]	G. H. Russell	29	48	1.43	22

[a] Thin ice along edges. Made by wading 200 feet below gage.

Daily gage height, in feet, of South Fork of South Platte River near Lake George, Colo., for 1910.

[By F. C. Parrett, observer.]

Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.
1	.....	.....	1.3	11	.....	1.7	.....	21	.....	1.65	1.0
2	.....	.....	.....	12	.....	1.7	1.3	22	1.8	1.65	.9
3	.....	1.55	.....	13	.....	1.7	1.3	23	1.8	1.7	.9
4	.....	1.6	1.35	14	.....	1.6	1.3	24	1.8	1.65	.85
5	.....	1.65	1.3	15	.....	1.65	1.35	25	1.8	.....	.8
6	.....	.....	1.2	16	.....	1.65	.....	26	1.8	.....	.8
7	.....	1.6	1.2	17	.....	.....	1.2	27	1.75	1.6	.7
8	.....	1.65	1.3	18	.....	1.45	.....	28	1.8	1.55	.....
9	.....	1.7	1.2	19	.....	.....	1.2	29	1.7	1.5	.75
10	.....	1.65	.....	20	.....	.....	1.1	30	1.7	1.45	.7
								31	1.7	1.3	.7

NOTE.—No ice notes reported.

SOUTH FORK OF SOUTH PLATTE RIVER AT SOUTH PLATTE, COLO.

This station, which was established May 8, 1905, to determine the amount of water available on this branch of the South Platte for power and irrigation, is located at South Platte, Colo., in T. 7 S., R. 70 W.

The North and South forks of the South Platte unite about 600 feet below the station, and the Cheesman reservoir, which intercepts the flow of Tarryall and Goose creeks in addition to that of the main branch, is about 20 miles above. No very important tributaries

enter below Cheesman Lake. The drainage area above the station is 2,160 square miles, of which probably less than 20 per cent can be classed as timbered land.

No water is diverted above this point except for the irrigation of hay lands in South Park, but the flow is regulated by the Cheesman reservoir, which has a capacity of 79,000 acre-feet. So many filings for power development have been made on this stream that it is doubtful whether additional filings can be made except near the headwaters.

The flow of the river at this station is affected by ice for about three months in the winter season.

No change has been made in the inclined rod gage since it was first established, and the datum remains the same. Discharge measurements are made from a cable near the gage and by wading.

Fair results should be obtained at this station, but as the bed is shifting, frequent measurements are necessary. The gage heights are apt to show fluctuation at certain times of the year owing to storage or release of water in the Cheesman reservoir.

Discharge measurements of South Fork of South Platte River at South Platte, Colo., in 1910.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Jan. 24[a]	G. H. Russell	45	44	2.30	135
Feb. 15	do	26	30	1.90	74
Mar. 7	Thos. Grieve	61	84	2.78	303
Apr. 2	G. H. Russell	65	90	2.65	272
27	do	64	92	2.85	315
May 9	W. B. Freeman	69	106	2.80	335
June 4	R. C. Miles	64	88	2.70	320
20	G. H. Russell	61	83	2.75	285
July 19	do	43	39	1.90	82
24	Grieve and Christiansen	42	42	2.05	95
28	Lyon and Johnson	.....	85	2.80	341
Aug. 9	Hezmalhalch and Ferguson	63.5	83	2.83	306
11	G. H. Russell	65	135	3.33	582
25	Russell and Padgett	63	54	2.00	124
Sept. 24	Padgett and Miles	37	61	2.10	136
Oct. 31	G. H. Russell	39	60	2.05	114
Nov. 22	H. D. Padgett	36	36	1.8	62
Dec. 15[b]	R. C. Miles	23	33	1.55	42

[a] Open channel conditions. [b] Channel full of floating ice.

NOTE.—All measurements excepting those of Apr. 27, June 4, and Aug. 10, made by wading.

Daily gage height, in feet, of South Fork of South Platte River at South Platte, Colo., for 1910.

[E. H. Jardin, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.25	2.2	2.0	2.6	3.1	2.7	2.45	2.25	2.05	2.0	1.9	1.7
2	2.3	2.15	2.1	2.6	3.1	2.7	2.7	3.15	2.05	2.0	1.85	1.7
3	2.2	2.1	2.2	2.65	3.1	2.7	2.9	3.4	2.0	2.0	1.8	1.7
4	2.2	2.0	2.2	2.6	3.2	2.7	2.8	3.3	2.0	1.95	1.85	1.7
5	2.2	2.0	2.5	2.6	3.25	2.7	2.8	3.1	2.0	1.9	1.95	1.6
6	2.4	2.0	2.7	2.6	3.05	2.7	2.8	3.05	1.9	1.9	2.0	1.65
7	2.5	1.9	2.7	2.0	3.0	2.95	2.8	3.0	1.85	1.9	2.0	1.7
8	2.5	1.7	2.7	2.0	2.9	2.85	2.8	2.9	1.85	1.9	2.0	1.7
9	2.6	1.7	2.75	2.0	2.8	2.8	2.35	2.85	1.95	1.95	2.05	1.75
10	2.6	1.7	3.6	2.6	2.8	2.75	1.9	3.3	1.85	1.95	2.1	1.7

Daily gage height, in feet, of South Fork of South Platte River at South Platte, Colo., for 1910—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
11	2.3	1.75	3.55	2.65	2.8	2.8	1.9	3.5	1.9	1.95	2.1	1.7
12	2.3	1.65	3.4	2.65	2.9	2.7	1.9	3.5	1.9	1.95	2.05	1.7
13	2.3	1.7	3.3	2.7	2.9	2.75	1.9	3.5	1.9	1.9	2.0	1.65
14	2.25	1.75	3.2	2.85	2.8	2.65	1.9	3.5	1.9	1.95	2.05	1.65
15	2.3	1.9	3.2	2.8	3.0	2.75	1.9	3.1	1.9	1.95	2.05	1.65
16	2.3	1.9	3.1	2.6	2.95	2.8	1.9	2.0	1.9	1.95	2.05	1.65
17	2.4	1.95	3.15	2.65	3.05	2.8	2.0	2.55	2.0	2.0	2.0	1.65
18	2.4	1.95	3.2	2.65	3.25	2.9	2.05	2.55	1.95	2.0	2.0	1.8
19	2.5	2.0	3.2	2.65	3.15	2.9	2.0	2.55	1.9	2.0	1.95	1.8
20	2.45	2.1	3.2	2.7	2.95	2.7	2.1	2.8	1.9	2.0	1.9	1.7
21	2.5	2.25	3.2	2.8	2.95	2.5	2.1	2.9	2.05	2.0	1.9	1.8
22	2.5	2.2	3.2	2.85	3.0	2.6	2.15	2.9	2.1	2.15	1.8	1.9
23	2.45	2.2	2.9	2.85	3.1	2.6	2.1	2.9	2.25	2.15	1.85	1.85
24	2.3	2.1	2.9	2.85	3.2	2.6	2.1	2.9	2.15	2.15	1.8	1.85
25	2.25	2.0	2.9	2.9	3.2	2.2	2.75	2.0	2.15	2.15	1.75	1.9
26	2.15	2.0	2.8	2.9	3.1	2.2	2.75	2.05	2.15	2.15	1.85	1.9
27	2.2	2.0	2.8	2.9	2.9	2.1	2.75	2.1	2.15	2.1	1.85	1.9
28	2.2	2.0	2.7	2.9	3.0	2.15	2.8	2.05	2.15	2.1	1.7	2.1
29	2.15	.....	2.7	3.0	2.85	2.2	3.6	2.05	2.15	2.1	1.8	2.0
30	2.2	.....	2.6	3.0	2.7	2.2	2.8	2.0	2.15	2.1	1.8	2.0
31	2.2	.....	2.6	.....	2.7	.....	2.75	2.1	.....	2.1	.....	2.05

NOTE.—Ice Jan. 1 to 10, and Dec. 18 to 31.

Daily discharge, in second-feet, of South Fork of South Platte River at South Platte, Colo., for 1910.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	120	98	250	414	280	205	152	108	98	80	48
2	.....	110	118	250	414	280	280	431	108	98	71	48
3	.....	100	140	265	414	280	343	528	98	98	62	48
4	.....	80	140	250	450	280	310	488	98	89	71	48
5	.....	80	220	250	469	280	310	414	98	80	89	38
6	.....	80	280	250	396	280	310	396	80	80	98	43
7	.....	70	280	98	378	360	310	378	71	80	98	48
8	.....	40	280	98	343	326	310	343	71	80	98	48
9	.....	40	295	98	310	310	178	326	89	89	108	55
10	.....	40	608	250	310	295	80	488	71	89	118	48
11	135	50	588	265	310	310	80	568	80	89	118	48
12	135	40	528	265	343	280	80	568	80	89	108	48
13	135	45	488	280	343	295	80	568	80	80	98	43
14	122	55	450	326	310	265	80	568	80	89	108	43
15	135	80	450	310	378	295	80	414	80	89	108	43
16	135	80	414	250	360	310	80	98	80	89	108	43
17	160	89	432	265	396	310	98	235	98	98	98	43
18	160	89	450	265	469	343	108	235	89	98	98	.....
19	185	98	450	265	432	343	98	235	80	98	89	.....
20	172	118	450	280	360	280	118	310	80	98	80	.....
21	185	152	450	310	360	220	118	343	108	98	80	.....
22	185	140	450	326	378	250	129	343	118	129	62	.....
23	172	140	343	326	414	250	118	343	152	129	71	.....
24	135	118	343	326	450	250	118	343	129	129	62	.....
25	122	98	343	343	450	140	295	98	129	129	55	.....
26	100	98	310	343	414	140	295	108	129	129	71	.....
27	110	98	310	343	343	118	295	118	129	118	71	.....
28	110	98	280	343	378	129	310	108	129	118	48	.....
29	100	.....	280	378	326	140	608	108	129	118	62	.....
30	110	.....	250	378	280	140	310	98	129	118	62	.....
31	110	.....	250	.....	280	.....	295	118	.....	118	.....	.....

NOTE.—These discharges are based on rating tables applicable as follows: Jan. 11 to 31, not well defined; Feb. 1 to 14, indirect method for shifting channels used; Feb. 15 to Dec. 17, fairly well defined between 62 and 380 second-feet.

Monthly discharge of South Fork of South Platte River at South Platte, Colo., for 1910.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
January	.....	.....	[a] 129	7,930	D.
February	152	40	87.4	4,850	C.
March	608	98	347	21,300	B.
April	378	98	275	16,400	B.
May	469	280	377	23,200	B.
June	360	118	259	15,400	B.
July	608	80	207	12,700	B.
August	568	98	318	19,600	C.
September	152	71	100	5,950	C.
October	129	80	101	6,210	C.
November	118	48	85.0	5,060	C.
December	.....	.....	[1] 45.6	2,800	C.
The period	.....	.....	195	141,000	

[a] Discharge estimated because of ice Jan. 1 to 10 and Dec. 18 to 31.

SOUTH PLATTE RIVER AT SOUTH PLATTE, COLO.

This station, which was established March 28, 1902, furnishes valuable data for use in connection with storage, irrigation, and water-power development. It is located on the Colorado & Southern Railway in T. 7 S., R. 7 W., about 9 miles above the mouth of the canyon and just below the junction of the North and South forks. Records at Platte Canyon and at Deansbury, a few miles below, extend back to 1887, with the exception of the years 1893 and 1894, and records at Platte Canyon are still being taken by the Denver Union Water Co. The earlier records, 1887–1892, were taken by the State engineer, and the records from 1895 to 1898 were taken under the direction of the Denver Power & Irrigation Co.

The station is especially important because of its location above the head gates of all irrigation systems and also above the intake of the Denver Union Water Co. The location of the Cheesman storage reservoir on the South Fork, 20 miles above this station, and the proposed installation of several power plants on both forks of the river above add to the importance of the station.

A great many filings for power development have been made on the tributaries of the river above this point, but doubtless opportunities for additional filings still exist.

The flow of the South Fork of the South Platte is regulated by storage in Cheesman reservoir. The flow of the North Fork is natural, except for slight variations due to the many ice and fishponds for 30 miles above its mouth.

The river and its tributaries are usually frozen over from two to four months during the winter time.

On May 7, 1905, the gage was moved from the county bridge to a point 150 feet downstream, which no doubt caused some change in the relation of gage readings. This gage, was an inclined rod. Since

March 14, 1910, a Bristol automatic gage established by the state engineer has been used. It is at the same location as the rod gage and is referred to the same datum. Discharge measurements are made from a cable near the gage and by wading.

The stream bed is more or less shifting, and frequent discharge measurements are necessary to obtain the best results. The gage readings are apt to show considerable fluctuation owing to the regulation of the flow from the Cheesman reservoir. The records from 1895 to 1898 were bought by the Denver Union Water Co. from J. E. Rhodes, representing the Denver Power & Irrigation Co.

Discharge measurements of South Platte River at South Platte, Colo., in 1910.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Jan. 24[a]	G. H. Russell	42	64	2.18	203
Feb. 15[a]	do	42	59	1.90	152
Mar. 7	Thos. Grieve	76	116	2.62	356
Apr. 2[a]	G. H. Russell	57	118	2.68	392
27	do	77	154	3.16	555
May 9	W. B. Freeman	78.5	154	3.18	536
June 5	R. C. Miles	75	146	3.28	556
20	G. H. Russell	77	135	2.90	423
July 19[a]	do	40	64	1.95	154
24[a]	Grieve and Christiansen	74	80	2.05	192
28	Lyon and Johnson		119	2.60	411
Aug. 9	Hezmalhalch and Ferguson	80	125	2.82	388
11	G. H. Russell	76	160	3.40	648
25	Russell and Padgett	75	82	2.10	196
Sept. 24[a]	Miles and Padgett	65	71	2.05	199
Oct. 31	G. H. Russell	48.5	73	2.00	161
Nov. 22[a]	H. D. Padgett	55	57	1.80	112
Dec. 15[b]	Miles and Arnold	36	41	1.68	62

[a] Wading measurement; very little ice. [b] Made by wading. River full of floating ice.

Daily gage height, in feet, of South Platte River at South Platte, Colo., for 1910.

[E. H. Jardin and A. Vermillion, observers.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.6	2.0	1.9	2.6	3.3	3.25	2.8	2.6	1.9	1.8	1.85	1.5
2	2.4	2.1	2.0	2.65	3.3	3.25	2.8	3.2	1.95	1.8	1.8	1.5
3	2.5	2.0	2.2	2.65	3.3	3.25	2.9	3.35	1.9	1.8	1.8	1.6
4	2.3	1.9	2.2	2.5	3.4	3.25	2.85	3.2	1.95	1.8	1.8	1.6
5	2.3	1.9	2.5	2.5	3.4	3.1	2.85	3.05	1.9	1.75	1.9	1.4
6	2.5	1.9	2.6	2.45	3.25	3.1	2.8	3.1	1.8	1.75	1.85	1.35
7	2.6	1.7	2.55	2.5	3.2	3.2	2.75	3.0	1.75	1.75	1.85	1.4
8	2.7	1.7	2.65	2.5	3.15	3.15	2.65	2.8	1.75	1.8	1.95	1.55
9	2.7	1.7	2.7	2.5	3.15	3.1	2.55	2.65	1.85	1.75	1.95	1.65
10	2.5	1.65	3.55	2.5	3.15	3.05	2.1	3.25	1.85	1.75	1.95	1.55
11	2.5	1.7	3.55	2.55	3.15	3.05	2.05	3.2	1.75	1.8	1.95	1.5
12	2.6	1.7	3.4	2.6	3.2	3.1	2.0	3.3	1.75	1.75	1.95	1.45
13	2.6	1.75	3.3	2.7	3.3	3.0	2.0	3.25	1.8	1.65	1.9	1.4
14	2.45	1.8	3.3	2.85	3.4	3.1	2.0	3.1	1.8	1.7	1.85	1.25
15	2.5	1.9	3.3	2.8	3.4	3.0	2.05	2.2	1.8	1.8	1.9	1.45
16	2.3	2.0	3.3	2.65	3.35	3.1	2.05	2.1	1.8	1.9	1.9	1.75
17	2.4	1.9	3.25	2.7	3.3	3.15	2.05	2.25	1.8	1.95	1.8	1.8
18	2.5	1.95	3.3	2.7	3.5	3.1	2.05	2.35	1.8	1.85	1.85	1.9
19	2.5	2.0	3.25	2.75	3.4	3.05	1.9	2.35	1.8	1.85	1.85	2.0
20	2.6	2.1	3.3	2.8	3.2	2.9	1.95	2.35	1.8	1.9	1.75	1.9
21	2.6	2.2	3.25	2.95	3.15	2.7	2.1	2.55	1.85	1.9	1.75	2.0
22	2.55	2.25	3.2	2.9	3.25	2.75	2.2	2.6	1.95	1.95	1.8	2.0
23	2.6	2.2	3.25	2.95	3.45	2.7	2.25	2.6	1.95	1.95	1.75	1.9
24	2.2	2.2	3.2	3.0	3.5	2.65	2.2	2.6	1.95	1.9	1.85	2.05
25	2.2	2.0	3.05	3.05	3.45	2.65	2.6	2.15	1.9	1.9	1.85	2.1

Daily gage height, in feet, of South Platte River at South Platte, Colo., for 1910—Con.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
26	2.2	2.1	3.0	3.05	3.3	2.5	2.55	1.95	1.9	1.85	1.75	.....
27	2.0	2.1	2.85	3.1	3.3	2.45	2.55	1.95	1.9	1.8	1.7	.....
28	2.1	2.0	2.75	3.15	3.3	2.4	2.6	1.95	1.9	1.8	1.55	.....
29	2.2	.....	2.75	3.25	3.3	2.4	3.25	2.0	1.9	1.85	1.6	.....
30	2.1	.....	2.6	3.3	3.25	2.75	3.2	1.9	1.9	1.8	1.55	.....
31	2.15	.....	2.55	.....	3.25	.....	3.35	1.9	.....	1.95	.....	.....

NOTE.—Gage heights affected by ice Jan. 1 to 23 and Dec. 16 to 31.

Daily discharge, in second-feet, of South Platte River at South Platte, Colo., for 1910.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	170	146	343	590	571	408	395	146	124	135	65
2	.....	196	170	359	590	571	408	610	158	124	124	65
3	.....	170	224	359	590	571	443	660	146	124	124	80
4	.....	146	224	312	630	571	426	605	158	124	124	80
5	.....	146	312	312	630	515	426	535	146	114	146	50
6	.....	146	343	297	571	515	408	545	124	114	135	45
7	.....	104	328	312	552	552	392	500	114	114	135	50
8	.....	104	359	312	534	534	359	420	114	124	158	60
9	.....	104	375	312	534	515	328	359	135	114	158	70
10	.....	95	690	312	534	496	196	571	135	114	158	60
11	.....	104	690	328	534	496	183	552	114	124	158	50
12	.....	104	630	343	552	515	170	590	114	114	158	50
13	.....	114	590	375	590	478	170	571	124	95	146	50
14	.....	124	590	416	630	515	170	515	124	104	135	35
15	.....	146	590	408	630	478	183	224	124	124	146	55
16	.....	170	590	359	610	515	183	196	124	146	146	.....
17	.....	146	571	375	590	534	183	238	124	158	124	.....
18	.....	158	590	375	670	515	183	267	124	135	135	.....
19	.....	170	571	392	630	496	146	267	124	135	135	.....
20	.....	196	590	408	552	443	158	267	124	146	114	.....
21	.....	224	571	460	534	375	196	328	135	146	114	.....
22	.....	238	552	443	571	392	224	343	158	158	124	.....
23	.....	224	571	460	650	375	238	343	158	158	110	.....
24	224	224	552	478	670	359	224	343	158	146	130	.....
25	224	170	496	496	650	359	360	210	146	146	125	.....
26	224	196	478	496	590	312	360	158	146	135	105	.....
27	170	196	426	515	590	297	380	158	146	124	95	.....
28	196	170	392	534	590	282	410	158	146	124	75	.....
29	224	.....	392	571	590	282	645	170	146	135	80	.....
30	196	.....	343	590	571	392	625	146	146	124	70	.....
31	210	.....	328	.....	571	.....	675	146	.....	158	.....	.....

NOTE.—These discharges are based on rating curves applicable as follows: Jan. 24 to July 24 and Aug. 9 to Nov. 22, fairly well defined between 124 and 670 second-feet; July 25 to Aug. 8, indirect method for shifting channels used.

Monthly discharge of South Platte River at South Platte, Colo., for 1910.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
January	.....	.....	199	12,200	D.
February	238	95	159	8,830	C.
March	690	146	460	28,300	B.
April	590	297	402	23,900	B.
May	670	534	591	36,300	B.
June	571	282	461	27,400	B.
July	675	146	318	19,600	B.
August	660	146	367	22,600	B.
September	158	114	136	8,090	C.
October	158	95	130	7,990	B.
November	158	70	127	7,560	C.
December	.....	.....	58.9	3,620	D.
The year	.....	.....	285	206,000	

NOTE.—Mean discharge estimated on account of ice for Jan. 1–23 at 195 second-feet and for Dec. 16–31 at 60 second-feet.

SOUTH PLATTE RIVER AT DENVER, COLO.

This station, which is located a short distance below the mouth of Cherry Creek, was maintained under the direction of the United States Geological Survey from 1895 to 1906, and since that time more or less intermittent records have been taken by the State engineer's office.[1] The station affords data concerning the amount of water available for irrigation.

The rod gage used from 1906 to August 11, 1909, inclusive, is located on the right bank about 100 feet above the Sixteenth Street viaduct. Beginning August 12, 1909, a Bristol automatic gage, at practically the same datum, fastened to a pier of the Sixteenth Street viaduct, has been used.

Discharge measurements are made from the Fifteenth Street Bridge and by wading.

The flow of the stream at this point is seldom affected by ice.

This station is maintained by the State engineer of Colorado, who has furnished the data for publication.

Discharge measurements of South Platte River at Denver, Colo., in 1910.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Jan. 12[a]	Grieve and Chatfield	91	120	1.30	256
Feb. 14[b]	Thomas Grieve	102	85	1.22	165
Mar. 10[a]	....do	134	269	2.35	711
Apr. 8[b]	F. Cogswell	.....	145	1.62	361
23[b]	....do	.....	162	1.63	386
May 5[b]	....do	.....	197	1.80	524
17[b]	....do	.....	195	1.87	526
June 4[c]	Chatfield and Hezmalhalch	.....	174	1.95	512
17[d]	F. Cogswell	.....	124	1.49	331
July 7[e]	....do	.....	74	.90	119
26[e]	Grieve and Christiansen	53	77	1.20	183
30[f]	....do	173	324	3.18	1,280
Aug. 22[g]	F. Cogswell	.....	82	1.10	168
31[g]	....do	.....	53	.80	86
Sept. 17[g]	....do	.....	59	.95	101
Oct. 5[g]	....do	.....	64	1.00	117
6[g]	Grieve and Hezmalhalch	45	53	.90	87
Nov. 11[b]	Christiansen and Hezmalhalch	46	57	.89	78

[a] From foot plank at Sixteenth Street viaduct.
[b] Wading measurement below Sixteenth Street.
[c] Made from bridge.
[d] Wading measurement at bridge.
[e] Wading measurement above gage.
[f] Made from Fifteenth Street Bridge.
[g] Wading measurement above Sixteenth Street viaduct.

Daily gage height, in feet, of South Platte River at Denver, Colo., for 1910.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.25	1.45	1.35	1.7	1.8	1.65	1.45	1.75	0.9	1.05	0.8	0.9
2	1.85	1.4	1.3	1.65	2.15	1.85	1.4	1.25	.9	1.0	.8	.9
3	1.75	1.25	1.35	1.65	2.0	1.85	1.4	1.75	.95	1.0	.8	.9
4	1.5	1.2	1.45	1.7	1.8	1.95	1.4	2.0	1.0	1.0	.8	.9
5	1.2	1.25	1.45	1.65	1.8	1.85	1.35	1.9	1.05	.95	.8	.95
6	1.1	1.2	1.45	1.6	1.75	1.8	1.3	1.9	1.0	.95	.8	.85
7	1.25	1.2	1.55	1.55	1.55	1.85	1.1	1.9	.9	.95	.8	.85
8	1.35	1.15	1.95	1.5	1.45	1.8	.95	1.8	.85	.95	.8	.8
9	1.25	1.05	2.15	1.5	1.4	1.75	.8	1.75	.85	.95	.8	.85
10	1.25	1.0	2.25	1.45	1.4	1.55	.85	1.75	.85	.95	.85	.95

[1] This station is fully described in Water-Supply Paper U. S. Geol. Survey No. 208, p. 154.

Daily gage height, in feet, of South Platte River at Denver, Colo., for 1910—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
11	1.25	1.05	2.4	1.4	1.65	1.35	0.9	2.1	1.0	0.9	0.85	0.95
12	1.25	1.05	2.35	1.55	1.65	1.25	.8	2.15	.8	.9	.85	.95
13	1.2	1.05	2.15	1.8	1.75	1.3	.8	2.15	.85	.9	.85	1.0
14	1.25	1.2	2.05	1.95	2.05	1.4	.8	2.25	.95	.9	.85	.95
15	1.25	1.15	2.0	1.95	2.15	1.4	.8	2.0	.85	.95	.85	.8
16	1.3	1.05	2.0	1.8	2.25	1.35	.8	1.4	.9	1.0	.85	.85
17	1.35	.85	2.0	1.55	1.85	1.45	.75	1.4	.9	1.0	.9	.85
18	1.35	.85	2.05	1.4	1.65	1.45	.75	1.7	.9	1.0	.95	.85
19	1.4	1.05	2.1	1.5	1.7	1.45	.75	1.65	1.3	1.05	.9	.9
20	1.4	1.1	2.05	1.4	1.85	1.4	.8	1.55	1.0	1.1	.9	.95
21	1.35	1.1	2.1	1.5	1.9	1.25	.8	1.5	1.0	1.2	.85	.9
22	1.4	1.1	2.05	1.75	1.8	.95	.8	1.3	1.2	1.15	.95	.9
23	1.45	1.1	2.05	1.6	1.8	1.0	.8	1.3	1.45	1.15	1.05	.9
24	1.5	1.2	2.1	1.5	1.9	.9	.85	1.25	1.2	.95	1.05	.
25	1.6	1.25	2.05	1.6	1.9	1.0	1.1	1.15	1.2	1.0	1.15	.95
26	1.35	1.2	1.95	1.65	1.75	1.25	1.0	1.2	1.15	.95	1.15	.95
27	1.3	1.25	1.85	1.6	1.6	1.25	.85	1.4	1.1	.9	1.0	.95
28	1.4	1.35	1.8	1.55	1.5	1.25	1.1	1.55	1.15	.95	1.05	.9
29	1.45	.....	1.8	1.55	1.55	1.15	1.7	1.0	1.1	.9	.95	.9
30	1.35	.....	1.85	1.55	1.7	1.25	2.65	1.1	1.1	.9	.95	.9
31	1.35	.....	1.75	.....	1.7	.....	1.9	1.0	.....	.85	.....	.9

Daily discharge, in second-feet, of South Platte River at Denver, Colo., for 1910.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	678	295	258	400	500	408	295	422	90	128	65	90
2	102	275	240	378	768	535	275	222	90	115	65	90
3	422	222	258	378	645	535	275	422	102	115	65	90
4	315	205	295	400	500	520	275	545	115	115	65	90
5	205	222	295	378	500	470	258	495	128	102	65	102
6	175	205	295	355	468	445	240	495	115	102	65	78
7	222	205	335	335	358	470	175	495	90	102	65	78
8	258	190	520	315	312	445	130	445	78	102	65	65
9	222	160	622	315	290	422	90	422	78	102	65	65
10	222	145	678	295	290	335	102	422	78	102	78	102
11	222	160	765	275	408	258	115	595	115	90	78	102
12	222	160	735	335	408	222	90	622	65	90	78	102
13	205	160	622	445	468	240	90	622	78	90	78	115
14	222	205	570	520	685	275	90	678	102	90	78	102
15	222	190	545	520	768	275	90	545	78	102	78	65
16	240	160	545	500	855	258	90	275	90	115	78	78
17	258	102	545	358	535	295	82	275	90	115	90	78
18	258	102	570	290	408	295	82	400	90	115	102	78
19	275	160	595	335	435	295	82	378	200	128	90	90
20	275	175	570	290	535	275	90	335	115	140	90	102
21	258	175	595	335	570	222	90	315	115	170	78	90
22	275	175	570	468	500	130	90	240	170	155	102	90
23	295	175	570	380	500	145	90	240	245	155	128	90
24	315	205	595	335	570	115	102	222	170	102	128	90
25	355	222	570	380	570	145	175	190	170	115	155	102
26	258	205	520	408	468	222	145	205	155	102	155	102
27	240	222	470	380	380	222	102	275	140	90	115	102
28	275	258	445	368	335	222	175	335	155	102	128	90
29	295	.....	445	358	358	190	400	145	140	90	102	90
30	258	.....	470	358	435	222	918	175	140	90	102	90
31	258	.....	422	.....	435	.....	495	145	.....	78	.....	90

NOTE.—These discharges were computed by the State engineer department of Colorado and are published herewith without change. They have not been verified by engineers of the United States Geological Survey. The discharges are based on rating curves applicable as follows: Jan. 1 to Apr. 15 and June 4 to Aug. 31; Apr. 16 to June 3; Sept. 1 to Dec. 31.

Monthly discharge of South Platte River at Denver, Colo., for 1910.

[Drainage area, 3,840 square miles.]

Month.	Discharge in second-feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.
January	678	102	268	0.070	0.08	16,500
February	295	102	191	.050	.05	10,600
March	765	240	501	.130	.15	30,800
April	520	275	373	.097	.11	22,200
May	855	290	492	.128	.15	30,300
June	535	115	304	.079	.09	18,100
July	918	82	187	.049	.06	11,500
August	678	145	374	.097	.11	23,000
September	245	65	120	.031	.03	7,140
October	170	78	110	.029	.03	6,760
November	155	65	89.9	.023	.03	5,350
December	115	65	89.9	.023	.03	5,530
The year	918	65	259	.067	.92	188,000

NOTE.—These estimates were computed by the United States Geological Survey from the daily discharge table furnished by the State engineer of Colorado published herewith.

SOUTH PLATTE RIVER NEAR KERSEY, COLO.

This station, which was established April 27, 1901, is located at a pile bridge about 1½ miles north of Kersey, on the Union Pacific Railroad about 6 miles east of Greeley, in T. 5 N., R. 64 W. The station was discontinued during the fall of 1903, but was reestablished March 5, 1905.

The station is below all the important tributaries of the South Platte that derive their supply from the mountain region, and the records are therefore particularly important as showing the amount of water available for storage reservoirs in northeastern Colorado.

Cache la Poudre River, a very important tributary of the South Platte, enters 2 or 3 miles above the station. Crow Creek and Box-elder Creek, two intermittent streams, come in from the north and south sides, 4 or 5 miles below. The drainage area at Kersey is 9,500 square miles.

Above Kersey are numerous irrigation and canal systems serving one of the most extensively irrigated areas in Colorado. Nearly 790,000 acres were irrigated above this station in 1907, about 380,000 acre-feet of water were stored, and about half of it used during the season. In 1908 about 300,000 acre-feet were stored, all of which was used for irrigation.

No important water-power plants are operated on the South Platte or its tributaries above the station, but one or two are now under construction and several are contemplated. In order to secure additional water rights for irrigation it will be necessary to construct storage works on some of the tributaries, as filings greatly in excess of the natural flow of the stream have been on record for a number of years.

The river is generally frozen over from the middle of December to the first of March.

In the fall of 1906 a chain gage was established on each of the two channels into which the river is divided at ordinary stages. Gage No. 1 is 30 feet from the right bank; gage No. 2 is 325 feet from the right bank. Formerly one rod gage was used, but it was found that the elevation of the water surface in the two channels differed considerably. Owing to the shifting character of the stream bed, a slight change in the datum of the gage is not apt to seriously affect the value of the results, as marked changes occur in the rating curve from one season to the next and often during a single season.

Measurements should be taken at this station on an average at least once every three weeks, except when the river is at a constant stage. Accurate results are rather difficult to obtain on account of the piles of the bridge and the fact that the bridge is not at right angles to the direction of the current. Whenever possible measurements should be taken by wading. At high stages the river flows in three channels and during extreme floods overflows into one or two channels on the left bank.

Discharge measurements of South Platte River near Kersey, Colo., in 1910.

[Gage No. 1.]

Date.	Hydrographer.	Width.	Area of section.	Gage. height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Feb. 10	G. H. Russell	69	123	3.30	298
Mar. 21	do	83	179	3.75	442
Apr. 25	do	45	42	2.37	73
May 16	do	65	45	2.40	80
June 9	do	45	30	2.10	49
29	Turner and Miles	44	66	2.15	61
July 14	G. H. Russell	47	37	2.21	60
Aug. 9	do	39	38	2.26	57
Sept. 12	do	35	33	2.18	53
Oct. 8	Padgett and Miles	35	32	2.30	74
27	G. H. Russell	67	85	2.88	157
Nov. 26	Miles and Padgett	48	48	2.60	103
Dec. 29[a]	E. O. Christiansen	67	86	2.79	146

[a] Thin ice on edge and slush ice in channel.

NOTE.—All measurements excepting that of Dec. 29 made by wading at various sections.

Daily gage height, in feet, of South Platte River near Kersey, Colo., for 1910.

[Gage No. 1. Mrs. J. C. Maisner, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.8	3.65	3.45	3.4	2.35	2.2	2.15	2.2	2.2	2.2	2.85	2.75
2	3.85	3.65	3.5	3.25	2.5	2.15	2.15	2.2	2.2	2.2	2.85	2.7
3	4.3	3.65	3.45	3.25	2.75	2.1	2.15	2.2	2.2	2.25	2.8	2.6
4	4.05	3.5	3.45	3.15	2.9	2.1	2.15	2.25	2.2	2.3	2.75	2.6
5	3.7	3.4	3.45	3.3	2.85	2.1	2.15	2.25	2.2	2.3	2.75	2.55
6	3.55	3.45	3.5	2.95	2.7	2.1	2.15	2.3	2.15	2.3	2.75	2.6
7	3.6	3.4	3.45	3.0	2.5	2.1	2.15	2.3	2.15	2.3	2.8	2.75
8	3.5	3.4	3.5	2.85	2.4	2.1	2.2	2.3	2.15	2.3	2.85	2.8
9	3.55	3.45	3.45	2.8	2.3	2.1	2.2	2.25	2.15	2.3	2.9	2.8
10	3.65	3.4	3.7	2.65	2.2	2.05	2.25	2.2	2.2	2.3	2.8	2.8

Daily gage height, in feet, of South Platte River near Kersey, Colo., for 1910—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
11	3.6	3.35	3.75	2.7	2.1	2.05	2.3	2.25	2.2	2.3	2.75	2.8
12	3.55	3.4	3.9	2.65	2.1	2.05	2.3	2.25	2.2	2.5	2.8	2.8
13	3.6	3.35	3.8	2.8	2.2	2.1	2.25	.....	2.2	2.45	2.85	2.8
14	3.55	3.4	3.9	2.85	2.3	2.1	2.2	2.25	2.2	2.5	2.85	2.7
15	3.6	3.35	3.8	2.95	2.5	2.1	2.2	2.25	2.2	2.55	2.85	2.6
16	3.55	3.4	3.8	3.2	2.4	2.1	2.2	2.25	2.2	2.6	2.8	2.55
17	3.65	3.45	3.7	3.15	2.4	2.1	2.2	2.3	2.2	2.75	2.8	2.55
18	3.65	3.5	3.75	3.05	2.55	2.1	2.2	2.3	2.2	2.9	2.8	2.55
19	3.7	3.4	3.7	2.9	2.3	2.1	2.25	2.3	2.2	3.0	2.8	2.55
20	3.65	3.5	3.7	2.75	2.2	2.1	2.2	2.2	2.2	3.0	2.75	2.5
21	3.7	3.45	3.7	2.6	2.2	2.1	2.2	2.2	2.2	3.0	2.8	2.5
22	3.65	3.45	3.75	2.5	2.45	2.1	2.2	2.2	2.2	3.0	2.8	2.5
23	3.8	3.45	3.65	2.5	2.4	2.1	2.2	2.2	2.3	3.1	2.7	2.6
24	3.85	3.5	3.7	2.45	2.7	2.1	2.2	2.2	2.3	3.1	2.7	2.65
25	4.0	3.5	3.65	2.4	2.5	2.1	2.2	2.2	2.25	3.05	2.6	2.7
26	3.85	3.6	3.7	2.2	2.45	2.1	2.2	2.2	2.25	3.0	2.6	2.7
27	3.85	3.45	3.55	2.2	2.25	2.1	2.2	2.2	2.25	2.95	2.7	2.7
28	3.75	3.5	3.5	2.2	2.15	2.1	2.25	2.2	2.25	2.85	2.75	2.75
29	3.8	.....	.....	2.2	2.2	2.15	2.25	2.2	2.25	2.85	2.8	2.7
30	3.65	.....	3.3	2.3	2.2	2.15	2.25	2.2	2.2	2.85	2.75	2.7
31	3.7	.....	3.35	.....	2.15	.....	2.2	2.2	.....	2.8	.....	2.8

NOTE.—Ice Jan. 1 to 5.

Daily discharge, in second-feet, of South Platte River near Kersey, Colo., for 1910.

[Gage No. 1.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	410	338	320	72	59	56	59	59	59	157	133
2	.....	410	355	273	89	56	56	59	59	59	157	122
3	.....	410	338	273	133	53	56	59	59	63	144	104
4	.....	355	338	243	170	53	56	63	59	67	133	104
5	.....	320	338	288	157	53	56	63	59	67	133	96
6	373	338	355	184	122	53	56	67	56	67	133	104
7	390	320	338	198	89	53	56	67	56	67	144	133
8	355	320	355	157	77	53	59	67	56	67	157	144
9	373	338	338	144	67	53	59	63	56	67	170	144
10	410	320	430	113	59	50	63	59	59	67	144	144
11	390	304	450	122	53	50	67	63	59	67	133	144
12	373	320	510	113	53	50	67	63	59	89	144	144
13	390	304	470	144	59	53	63	[a] 63	59	83	157	144
14	373	320	510	157	67	53	59	63	59	89	157	122
15	390	304	470	184	89	53	59	63	59	96	157	104
16	373	320	470	258	77	53	59	63	59	104	144	96
17	410	338	430	243	77	53	59	67	59	133	144	96
18	410	355	450	213	96	53	59	67	59	170	144	96
19	430	320	430	170	67	53	63	67	59	198	144	96
20	410	355	430	133	59	53	59	59	59	198	133	89
21	430	338	430	104	59	53	59	59	59	198	144	89
22	410	338	450	89	83	53	59	59	59	198	144	89
23	470	338	410	89	77	53	59	59	67	228	122	104
24	490	355	430	83	122	53	59	59	67	228	122	113
25	550	355	410	77	89	53	59	59	63	213	104	122
26	490	390	430	59	83	53	59	59	63	198	104	122
27	490	338	373	59	63	53	59	59	63	184	122	122
28	450	355	355	59	56	53	63	59	63	157	133	133
29	470	.....	[a] 320	59	59	56	63	59	63	157	144	122
30	410	.....	288	67	59	56	63	59	59	157	133	122
31	430	.....	304	.....	56	.....	59	59	.....	144	.....	144

[a] Interpolated.

NOTE.—These discharges were obtained from a fairly well defined rating curve.

Discharge measurements of South Platte River near Kersey, Colo., in 1910.

[Gage No. 2.]

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Feb. 10	G. H. Russell	70	193	3.40	522
Mar. 21	do	150	203	3.60	550
Apr. 25	do	47	52	2.20	131
May 16	do	54.5	56	2.30	130
June 9	do	31	22	1.56	38
June 29	Turner and Miles	46	32	.....	48
July 14	G. H. Russell	27	28	1.78	47
Aug. 9	do	38	30	1.90	53
Sept. 12	do	38.5	25	1.89	40
Oct. 8	Padgett and Miles	41	39	2.10	69
Oct. 27	G. H. Russell	56	130	2.87	269
Nov. 26	Miles and Padgett	45	65	2.70	183
Dec. 29[a]	E. O. Christiansen	75	169	2.84	258

[a] Slush ice in channel.

NOTE.—All above measurements excepting that of Dec. 29 made by wading at various sections.

Daily gage height, in feet, of South Platte River near Kersey, Colo., for 1910.

[Gage No. 2. Mrs. J. C. Maisner, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.7	3.7	3.5	3.35	2.1	1.85	1.7	1.7	1.85	1.9	3.3	2.85
2	3.9	3.65	3.5	3.3	2.2	1.85	1.7	1.7	1.85	1.9	3.3	2.9
3	4.2	3.6	3.5	3.2	2.6	1.6	1.7	1.7	1.85	2.25	3.3	2.7
4	4.0	3.5	3.5	3.1	3.25	1.6	1.7	1.7	1.85	2.15	3.3	2.6
5	3.8	3.5	3.5	3.25	2.8	1.55	1.7	1.75	1.85	2.15	3.3	2.6
6	3.65	3.5	3.5	2.9	2.4	1.6	1.7	1.9	1.8	2.15	2.85	2.6
7	3.7	3.45	3.5	2.9	2.3	1.6	1.7	1.8	1.8	2.15	2.9	2.7
8	3.7	3.45	3.5	2.9	2.3	1.6	1.75	1.8	1.8	2.15	3.0	2.9
9	3.7	3.4	3.55	2.8	2.2	1.55	1.7	1.7	1.85	2.25	3.0	2.9
10	3.7	3.4	3.7	2.6	2.05	1.55	1.9	1.8	1.9	2.2	3.0	2.9
11	3.7	3.4	3.75	2.6	1.8	1.55	2.0	1.8	1.9	2.2	3.0	2.9
12	3.65	3.45	3.8	2.6	1.7	1.55	2.0	1.8	1.9	2.25	3.0	2.9
13	3.65	3.45	3.8	2.8	1.9	1.6	1.95	1.85	1.9	2.4	3.0	2.9
14	3.6	3.45	3.8	2.85	2.2	1.6	1.6	1.8	1.9	2.45	3.0	2.8
15	3.6	3.45	3.75	2.9	2.35	1.6	1.6	1.8	1.9	2.55	3.0	2.75
16	3.5	3.4	3.7	3.0	2.35	1.6	1.6	1.8	1.9	2.7	3.0	2.65
17	3.6	3.45	3.65	3.1	2.35	1.6	1.6	1.8	1.95	2.9	2.9	2.7
18	3.65	3.4	3.6	3.15	2.65	1.6	1.6	1.8	1.9	3.25	2.9	2.65
19	3.7	3.4	3.6	2.9	2.2	1.6	1.7	1.8	1.9	3.2	2.9	2.65
20	3.7	3.4	3.6	2.8	2.15	1.6	1.7	1.7	1.9	3.2	2.85	2.6
21	3.65	3.4	3.6	.....	2.1	1.6	1.7	1.7	2.0	3.15	2.85	2.6
22	3.6	3.3	3.6	.....	2.55	1.6	1.7	1.7	2.0	3.15	2.9	.....
23	3.7	3.2	3.6	.....	2.75	1.6	1.7	1.75	2.1	3.2	2.8	.....
24	3.8	3.35	3.6	.....	2.75	1.6	1.7	1.85	2.1	3.2	2.75	.....
25	3.9	3.45	3.55	2.1	2.5	1.6	1.7	1.85	1.85	3.2	2.7	2.8
26	3.8	3.5	3.6	2.0	2.4	1.6	1.7	1.85	1.8	3.15	2.7	2.8
27	3.7	3.5	3.5	1.9	2.3	1.6	1.7	1.85	1.8	3.2	2.8	2.8
28	3.7	3.5	3.4	1.9	2.2	1.6	1.7	1.85	2.0	3.4	2.9	2.8
29	3.7	.....	.....	1.85	2.3	1.6	1.7	1.85	2.05	3.4	2.85	2.8
30	3.6	.....	3.3	2.0	2.0	1.6	1.7	1.85	1.85	3.4	2.85	2.8
31	3.7	.....	3.5	.....	1.9	.....	1.7	1.85	.....	3.4	.....	2.8

NOTE.—Ice Jan. 1 to 5.

Daily discharge, in second-feet, of South Platte River near Kersey, Colo., for 1910.

[Gauge No. 2.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	615	535	477	103	67	39	39	49	53	390	245
2	.....	595	535	458	121	67	39	39	49	53	390	260
3	.....	575	535	420	220	43	39	39	49	98	390	200
4	.....	535	535	385	439	43	39	39	49	82	390	173
5	.....	535	535	439	282	40	39	42	49	82	390	173
6	595	535	535	315	166	43	39	53	45	82	245	173
7	615	515	535	315	142	43	39	45	45	82	260	200
8	615	515	535	315	142	43	42	45	45	82	290	260
9	615	496	555	282	121	40	39	39	49	98	290	260
10	615	496	615	220	95	40	53	45	53	89	290	260
11	615	496	635	220	61	40	63	45	53	89	290	260
12	595	515	655	220	51	40	63	45	53	98	290	260
13	595	515	655	282	73	43	58	49	53	126	290	260
14	575	515	655	298	121	43	34	45	53	137	290	230
15	575	515	635	315	154	43	34	45	53	160	290	215
16	535	496	615	350	154	43	34	45	53	200	290	186
17	575	515	595	385	154	43	34	45	58	260	260	200
18	595	496	575	402	235	43	34	45	53	372	260	186
19	615	496	575	315	121	43	39	45	53	355	260	186
20	615	496	575	282	112	43	39	39	53	355	245	173
21	595	496	575	250	103	43	39	39	63	338	245	173
22	575	458	575	192	206	43	39	39	63	338	260	173
23	615	420	575	142	266	43	39	42	75	355	230	200
24	655	477	575	121	266	43	39	49	75	355	215	230
25	697	515	555	103	192	43	39	49	49	355	200	230
26	655	535	575	87	166	43	39	49	45	338	200	230
27	615	535	535	73	142	43	39	49	45	355	230	230
28	615	535	496	73	121	43	39	49	63	428	260	230
29	615	.....	477	67	142	43	39	49	69	428	245	230
30	575	.....	458	87	87	43	39	49	49	428	245	230
31	615	.....	535	.....	73	.....	39	49	.....	428	.....	230

NOTE.—These discharges were obtained from rating curves applicable as follows: Jan. 6 to June 30, not well defined; July 1 to Dec. 31, poorly defined. Discharge interpolated for days when gage was not read.

Monthly discharge of South Platte River near Kersey, Colo., for 1910.

[Drainage area, 9,470 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
January	.....	.....	[a] 1,020	0.108	0.12	62,700	C.
February	1,020	758	858	.091	.09	47,700	C.
March	1,160	746	964	.102	.12	59,300	C.
April	797	126	419	.042	.05	24,900	C.
May	609	104	237	.025	.03	14,600	C.
June	126	90	97.3	.010	.01	5,790	C.
July	130	93	100	.011	.01	6,150	C.
August	120	98	106	.011	.01	6,520	C.
September	142	101	114	.012	.01	6,780	C.
October	585	112	356	.038	.04	21,900	C.
November	547	304	421	.044	.05	25,100	C.
December	.....	.....	335	.035	.04	20,600	C.
The year	.....	.....	419	.044	.58	302,000	

[a] Discharge for Jan. 1 to 5 channel No. 1 estimated as 373 second-feet; channel No. 2 estimated as 595 second-feet, because of ice conditions.

NOTE.—These estimates are for the combined flow in the two channels.

SOUTH PLATTE RIVER AT JULESBURG, COLO.

This station, which is located 1 mile south of Julesburg, Colo., in T. 12 N., R. 44 W., below all irrigation ditches taking water from the South Platte in Colorado except one, was established April 2, 1902, but was not in operation during 1907. It was reestablished on May 2, 1908, at a new pile bridge about 2,000 feet upstream from the old location.

The greatest value of this station lies in the fact that it is situated less than a mile from the Colorado-Nebraska line, and its records, therefore, show the amount of water passing into Nebraska. It has also some importance in obtaining data on the flow of return waters.

All the tributaries for 100 miles or more above the station are intermittent streams and none are of any importance. The same may be said of the tributaries between Julesburg and North Platte, where the river joins North Platte River to form the Platte. The drainage area at Julesburg is 20,600 square miles. Numerous irrigation systems and reservoirs are located on the South Platte and tributaries above Julesburg for a distance of 250 miles. In 1907 more than 900,000 acres were irrigated in this valley. Nearly 450,000 acre-feet were stored in reservoirs, and over half of this quantity was used for irrigation in that year. Additional rights can not be provided for in the South Platte Valley without constructing reservoirs to store surplus flood waters.

The flow of the river at Julesburg during the irrigation season depends on the amount of water diverted above and is likely to be small except when the river is in flood. During the nonirrigating season considerable water is diverted by feeder canals to storage reservoirs from the main river or its tributaries or is intercepted by reservoirs on the tributaries.

The river is usually frozen over wholly or in part for two or three months during the winter.

A chain and a rod are fastened to the upstream side of the bridge. These gages are in no way referred to the old gage. No change has been made in datum of gage since 1908. However, the recorded gage heights give no indication of the discharge of the river from one season to the next because of the sandy and extremely shifting character of the stream bed. In low water the river consists of a number of small rivulets flowing between sand bars. In order to procure reliable results measurements should be taken as often as once every two weeks throughout the year. They are made from the bridge at high stages and by wading when the river is low.

Discharge measurements of South Platte River at Julesburg, Colo., in 1910.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Feb. 11[a]	G. H. Russell	466	525	[b] 2.95	1,031
Mar. 22	do	431	334	2.23	670
Apr. 26	do	229	109	1.80	169
May 17	do	98	30	1.40	33
June 10	do	73	21	1.30	22
July 15	do	34	6	1.20	5
Aug. 10	do	50	13	1.31	11
Sept. 13	do	52.5	11	1.30	13
Sept. 30	do	76	20	1.41	22
Oct. 28[c]	do	69	21	1.55	21
Nov. 25	Padgett and Miles	43.5	17	1.40	22
Dec. 28[d]	E. O. Christiansen	181	143	2.04	234

[a] Measurement made through ice and by wading.
[b] Gage probably taken to bottom of ice.
[c] Some thin ice in measuring section.
[d] Made 1½ miles below bridge by wading. Slush ice in channels.

NOTE.—All measurements in 1910 were made by wading at various sections.

Daily gage height, in feet, of South Platte River at Julesburg, Colo., for 1910.

[J. G. McSparran and Elva McSparran, observers.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	3.7	3.2	2.25	1.6	1.25	1.1	1.4	1.35	.....	1.4	1.4
2	3.7	3.7	3.2	2.2	1.6	1.25	1.1	1.45	1.35	1.4	1.4	1.5
3	3.8	3.7	3.0	2.0	1.55	1.2	1.1	1.4	1.35	1.4	1.4	1.5
4	3.8	3.7	2.5	2.1	1.55	1.2	1.1	1.4	.....	1.4	1.4	1.5
5	3.8	3.7	2.4	2.2	1.6	1.2	1.1	1.35	1.35	1.4	1.4	1.5
6	3.8	3.6	2.4	2.1	1.6	1.25	1.1	1.4	1.35	1.4	1.4	1.6
7	3.8	3.55	2.4	2.05	1.6	1.25	1.1	1.35	1.4	1.4	1.4	1.7
8	3.8	3.55	2.5	2.0	1.6	1.2	1.1	1.35	1.35	1.4	1.4	1.7
9	3.8	.....	2.3	2.0	1.55	1.2	1.1	1.35	1.35	1.4	1.4	1.7
10	3.8	.....	2.3	2.0	1.55	1.25	1.1	1.35	1.35	1.4	1.4	1.7
11	3.8	3.4	[a] 4.75	2.0	1.5	1.2	1.1	1.35	1.35	1.4	1.4	2.0
12	3.8	3.4	2.7	1.95	1.45	1.2	1.1	1.3	1.35	1.4	1.4	2.0
13	3.8	.....	2.4	1.9	1.45	1.2	1.15	1.35	1.3	1.4	1.4	2.1
14	3.8	.....	2.5	1.95	1.4	1.2	1.15	1.35	1.3	1.4	1.4	2.1
15	3.8	.....	2.4	2.0	1.4	1.25	1.1	1.35	1.3	1.4	1.3	2.1
16	3.8	.....	2.3	2.0	1.4	1.2	1.1	1.35	1.3	1.4	1.3	2.2
17	3.8	3.4	2.3	1.9	1.3	1.2	1.1	1.35	1.3	1.4	1.3	2.2
18	3.8	3.45	2.3	1.8	1.3	1.2	1.1	1.35	1.3	1.4	1.3	2.2
19	3.8	3.4	2.2	1.8	1.35	1.1	1.1	1.35	1.3	1.4	1.3	2.1
20	3.8	3.4	2.2	1.75	1.35	1.1	1.1	1.35	1.3	1.4	1.3	2.1
21	3.8	3.5	2.2	1.7	1.3	1.1	1.1	1.35	1.3	1.4	1.3	2.2
22	3.8	3.6	2.2	1.75	1.3	1.1	1.25	1.35	1.3	1.4	1.3	2.2
23	3.8	3.55	2.2	1.75	1.3	1.1	1.3	1.35	1.4	1.4	1.3	2.2
24	3.8	3.6	2.2	1.75	1.3	1.1	1.3	1.35	1.4	1.4	1.3	2.2
25	3.8	3.6	2.1	1.65	1.35	1.1	1.3	1.4	1.4	1.4	1.3	2.2
26	3.8	3.5	2.0	1.6	1.35	1.1	1.3	1.35	1.4	1.4	1.3	2.2
27	3.75	3.4	2.1	1.6	1.3	1.1	1.3	1.35	1.4	1.4	1.3	2.2
28	3.75	3.3	2.2	1.65	1.3	1.1	1.35	1.4	1.35	1.4	1.3	2.1
29	3.75	.....	2.15	1.6	1.3	1.1	1.4	1.35	1.4	1.4	1.4	2.1
30	3.75	.....	2.2	1.6	1.3	1.1	1.4	1.35	1.4	1.4	1.4	2.2
31	3.7	.....	2.25	.....	1.25	.....	1.4	1.35	.....	1.4	.....	2.2

[a] High gage height due to bursting of Julesburg Reservoir. Maximum recorded gage height was 5.70 feet at 11 a. m.

NOTE.—Ice probably lasted from Jan. 1 to about Feb. 16. The gage heights Feb. 17 to Mar. 3 are abnormally high, and may be affected by backwater. Probable ice conditions from about Dec. 11 to 31. Gage heights Nov. 15 to 28 believed to be about 0.1 foot too small, owing to water being away from gage.

Daily discharge, in second-feet, of South Platte River at Julesburg, Colo., for 1910.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	682	87	16	1	23	18	23	23	23
2	.....	606	87	16	1	32	18	23	23	40
3	.....	358	72	11	1	23	18	23	23	40
4	1,150	472	72	11	1	23	a 18	23	23	40
5	938	605	87	11	1	18	18	23	23	40
6	938	472	87	16	1	23	18	23	23	65
7	938	415	87	16	1	18	23	23	23	100
8	1,150	358	87	11	1	18	18	23	23	100
9	758	358	72	11	1	18	18	23	23	100
10	758	358	72	16	1	18	18	23	23	100
11	12,900	358	57	11	1	18	18	23	23	.....
12	1,660	310	46	11	1	12	18	23	23	.....
13	938	263	46	11	2	18	12	23	23	.....
14	1,150	310	36	11	2	18	12	23	23	.....
15	938	358	36	10	1	18	12	23	23	.....
16	758	358	36	10	1	18	12	23	23	.....
17	758	263	21	10	1	18	12	23	23	.....
18	758	187	21	10	1	18	12	23	23	.....
19	605	187	28	3	1	18	12	23	23	.....
20	605	158	28	3	1	18	12	23	23	.....
21	605	129	21	3	1	18	12	23	23	.....
22	605	158	21	3	8	18	12	23	23	.....
23	605	158	21	3	12	18	23	23	23	.....
24	605	158	21	3	12	18	23	23	23	.....
25	472	108	28	3	12	23	23	23	23	.....
26	358	87	28	2	12	18	23	23	23	.....
27	472	87	21	2	12	18	23	23	23	.....
28	605	108	21	2	18	23	18	23	23	.....
29	538	87	21	2	23	18	23	23	23	.....
30	605	87	21	2	23	18	23	23	23	.....
31	682	.....	16	.....	23	18	.....	23	.....	.....

a Interpolated.

NOTE.—These discharges are based on rating tables applicable as follows: Mar. 4 to June 10, fairly well defined between 30 and 5,000 second-feet; June 11 to July 15, indirect method for shifting channels used; July 16 to Dec. 31, fairly well defined. Discharge Nov. 15 to 28 interpolated.

Monthly discharge of South Platte River at Julesburg, Colo., for 1910.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
Mar. 4-31	12,900	358	1,210	67,200	C.
April	682	87	287	17,100	B.
May	87	16	45.3	2,790	B.
June	16	2	8.33	500	C.
July	23	1	5.74	353	D.
August	32	12	19.2	1,180	C.
September	23	12	17.3	1,030	C.
October	23	23	23.0	1,410	C.
November	23	12	23.0	1,370	C.
December a	.....	23	151.	9,280	D.
The period	.....	.....	.....	102,000	

a Estimated mean discharge. Dec. 11 to 15, 140 second-feet; Dec. 16 to 20, 180 second-feet; Dec. 21 to 25, 210 second-feet; Dec. 26 to 31, 230 second-feet.

TARRYALL CREEK BASIN.

DESCRIPTION.

Tarryall Creek rises in the Rocky Mountain Front Range near Breckenridge Pass, above Como, Colo., at an elevation of almost 11,000 feet above sea level, and flows in a general southeasterly

direction to its junction with South Platte River, about 5 miles above the upper end of Lake Cheesman, at an elevation of 7,500 feet above sea level. The important tributaries from the north are Michigan, Jefferson, and Rock creeks; those from the south are Park Gulch and Early Gulch. The creek flows in Park County except for 3 or 4 miles at the mouth, which is in Jefferson County. Its drainage area comprises approximately 550 square miles.

The upper half of the valley of Tarryall Creek is fairly broad and of gentle slope; the lower end of the valley, between the Tarryall Mountains on the north and the Puma Hills on the south, is comparatively narrow and its slopes are steeper.

Some irrigation is carried on in the upper end of the basin, but only a small quantity of water is diverted from the stream. Hay is the principal crop raised.

At the end of the basin near the Continental Divide are forests composed chiefly of Douglas fir and pine; the lower end of the basin is only slightly covered with forest. The drainage basin is in the dry belt, the average annual run-off ranging from 10 to 15 inches over the entire area.

TARRYALL CREEK NEAR JEFFERSON, COLO.

This station, which is located at the L. W. Robbins ranch, 10 miles below Jefferson, a station on the Colorado & Southern Railway, was established October 23, 1910. The station is just above the mouth of Rock Creek and 1 mile below mouth of Jefferson Creek.

A vertical rod gage is attached to L. W. Robbins's private bridge in his field one-fourth mile from road.

Measurements are made from bridge to which gage is attached and by wading at various sections.

The bed of stream is of gravel and sand with shifting tendency.

This is not a regular station as there is no daily gage observer.

This station was maintained in cooperation with the United States Forest Service.

The following discharge measurement was made by S. T. Harding:

October 18, 1910: Width, 15 feet, area 11 square feet; gage height, 0.85 foot; discharge, 11 second-feet.

The following additional gage heights were observed by R. M. Truman:

November 1, 0.9 foot; November 10, 0.8 foot.

TARRYALL CREEK NEAR HAYMAN, COLO.

This station was established October 23, 1910, by the United States Geological Survey in cooperation with the United States Forest Service and is being maintained as a cooperative station. It is located in T. 11 S., R. 72 W., on a private bridge 20 feet inside of

field at gate, at McLaughlin's ranch, three-eighths mile downstream from sawmill and one-quarter mile up from ranch house, 8 miles from Lake George, Colo.

A vertical staff gage is attached on right downstream abutment, just under bridge floor.

Measurements are made by wading or from bridge. The measuring section is fair.

The channel is of sand and gravel and only slightly shifting.

Gage heights are affected by ice during the winter months.

Discharge measurements of Tarryall Creek near Hayman, Colo., in 1910.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Oct. 23.	S. T. Harding	22	18	0.80	9.3
Nov. 18.	G. H. Russell	20	13	.9	13.3

NOTE.—The following additional gage heights, in feet, were observed by F. C. Parrett.

Date.	Gage height.	Date.	Gage height.	Date.	Gage height.	Date.	Gage height.
Oct. 27	0.8	Nov. 13	0.9	Nov. 29	1.0	Dec. 15	0.8
Oct. 30	.75	Nov. 22	.85	Dec. 6	1.1	Dec. 22	.7
Nov. 5	1.0	Nov. 23	.8	Dec. 7	1.0	Dec. 29	.6
Nov. 12	.9						

JEFFERSON CREEK AT JEFFERSON, COLO.

This station, which is located at Jefferson, just below the Colorado & Southern Railway bridge, was established October 17, 1910.

A rod gage is located on the left bank 100 feet below the highway bridge. Measurements are made by wading at different sections.

The bed of the stream is sandy and shifting. The creek is frozen over from three to four months each year.

This station is maintained in cooperation with the United States Forest Service.

The following discharge measurement was made by S. T. Harding:

October 17, 1910: Width, 6 feet; area, 1.4 square feet; gage height, 0.4 foot; discharge, 1.2 second-feet.

The following additional gage heights were observed by R. M. Truman:

October 17, 0.35 foot; October 30, 0.4 foot; November 10, 0.4 foot; November 28, 0.3 foot; December 19, 1.3 feet.

MICHIGAN CREEK NEAR JEFFERSON, COLO.

Michigan Creek is tributary to Jefferson Creek.

This gaging station, which is located 3 miles southwest of Jefferson, was established October 17, 1910.

A vertical gage is attached to the highway bridge. Measurements are made from bridge and by wading at various sections.

The bed of the stream is sandy and shifting. The stream is frozen from three to four months each year.

The following discharge measurement was made by S. T. Harding:

October 17, 1910: Width, 8 feet; area, 6.2 square feet; gage height, 0.70 foot; discharge, 5.9 second-feet.

The following additional gage heights were observed by R. M. Truman:

October 31, 0.8 foot; November 11, 0.85 foot; November 26, 0.7 foot.

BASIN OF NORTH FORK OF SOUTH PLATTE RIVER.

NORTH FORK OF SOUTH PLATTE RIVER AT GRANT, COLO.

This station, which is located at Grant, about 250 feet above the junction of Geneva Creek with the North Fork of South Platte River, was established July 18, 1910.

A vertical gage is located on left bank, 20 feet above foot log. Measurements are made from foot log and by wading at various sections.

The bed of the stream is of small bowlders and is liable to shift during high stages.

The stream is affected by ice for about three months each year.

This station is maintained in cooperation with the United States Forest Service.

Discharge measurements of North Fork of South Platte River at Grant, Colo., in 1910.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
July 18[a]	J. B. Stewart	16.7	11.9	1.51	16.0
Aug. 29	W. B. Freeman	14	7.9	1.35	8.9
Sept. 19	do	14	8.6	1.42	11.0
Nov. 19[a]	do	12	8.4	1.43	8.5
Dec. 15[a]	J. B. Stewart	8	5.1	[b] 1.50	6.6

[a] Measurements made by wading. [b] Gage height distorted by ice.

Daily gage height, in feet, of North Fork of South Platte River at Grant, Colo., for 1910.

[Edmund Couch, observer.]

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1		1.55				1.5	16		1.4				1.6
2							17						
3		1.5			1.25		18	1.5	1.4			1.4	
4							19			1.42		1.43	
5							20		1.4	1.45			1.65
6		1.5					21				1.45		
7							22						
8			1.35				23	1.5	1.4				
9							24						
10						1.6	25				1.35	1.45	
11			1.35	1.45	1.25		26		1.35				
12		1.45					27	1.45			1.25		
13							28		1.35				
14							29		1.35	1.4			
15					1.45	1.5	30						
							31						

NOTE.—Gage heights after Nov. 19 somewhat distorted by ice.

Daily discharge, in second-feet, of North Fork of South Platte River at Grant, Colo., for 1910.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Day.	July.	Aug.	Sept.	Oct.	Nov.
1		19	8.7	10	6.6	16		10	10	12.5	12.5
2		15	8.7	10	6.6	17		10	10	12.5	10
3		15	8.7	10	6.6	18	15	10	10	12.5	10
4		15	8.7	10	6.6	19	15	10	11	12.5	8.5
5		15	8.7	10	6.6	20	15	10	12.5	12.5	
6		15	8.7	12.5	6.6	21	15	10	12.5	12.5	
7		15	8.7	12.5	6.6	22	15	10	12.5	12.5	
8		15	8.7	12.5	6.6	23	15	10	12.5	10	
9		15	8.7	12.5	6.6	24	15	10	12.5	8.7	
10		12.5	8.7	12.5	6.6	25	15	10	12.5	8.7	
11		12.5	8.7	12.5	6.6	26	12.5	8.7	12.5	7.4	
12		12.5	8.7	12.5	7.4	27	12.5	8.7	12.5	6.6	
13		12.5	8.7	12.5	8.7	28	12.5	8.7	10	6.6	
14		10	8.7	12.5	10	29	15	8.7	10	6.6	
15		10	10	12.5	12.5	30	19	8.7	10	6.6	
						31	23	8.7		6.6	

NOTE.—These discharges are based on a fairly well defined rating curve. Discharges interpolated for days on which gage was not read.

Monthly discharge of North Fork of South Platte River at Grant, Colo., for 1910.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
July 18–31	23	12.5	15.3	424
August	19	8.7	11.7	719
September	12.5	8.7	10.1	601
October	12.5	6.6	10.6	652
November	12.5		[a] 8.08	481
December			[a] 6.8	418

[a] Discharges Nov. 20 to Dec. 31, estimated because of ice.

NOTE.—These estimates are approximate.

NORTH FORK OF SOUTH PLATTE RIVER AT CASSELLS, COLO.

This station, which is located at a private highway bridge at Cassells, Colo., was established July 4, 1908, to determine the value of the stream for power development.

Geneva Creek, one of the most important tributaries, comes in about 2 miles above, and supplies a large part of the water passing the station.

The drainage area above the basin comprises 100 square miles, a considerable part of which is timbered. No diversions of any importance are made above this point on the main stream or any of its tributaries, but many filings have been made for power sites, especially on Geneva Creek. Additional power sites are, however, probably available.

The stream is liable to freeze over from the middle of November to the 1st of April.

No change has been made in the datum of the gage since it was first established. The vertical rod gage originally installed was replaced in December, 1908, by a chain gage on the bridge.

Very good results should be obtained except in extremely high water. Measurements can be taken by wading the greater part of the year, those at the higher stages being taken from the bridge. Frequent measurements are necessary to determine the winter flow accurately.

Discharge measurements of North Fork of South Platte River at Cassells, Colo., in 1910.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Jan 30	W. B. Freeman	15.3	27.9	[1] 1.90	34.1
Feb. 1	do	14.5	21.4	[1] 1.50	27.2
1	do	13.5	22.6	[1] 1.55	30
25	do	13	19.1	[1] 1.50	22.8
25	do	14	20.5	[1] 1.65	23.2
Mar. 28	do	36.3	30	[1] 1.20	61
30	do	22	16.6	[1] 1.00	24.4
30	do	30.5	31.2	[1] 1.45	71
May 11	do	48	46	1.56	126
11	do	48	45	1.57	116
30	do	29	66	1.75	176
July 18	do	18.5	24	1.41	60
Aug. 27	do	23.5	20.1	1.17	36.2
28	do	27.7	43	1.17	30.4
Sept. 18	do	23.5	21.6	1.21	35.8
18	do	15.1	12.2	1.21	32.5
Nov. 18	do	26	18.3	[a] 1.25	28.8
Dec. 14	J. B. Stewart	16	10.9	[a] 1.27	19.5

[a] Gage heights more or less affected by ice.

NOTE.—All measurements made by wading at various sections except those on May 30 and Aug. 28, when they were made from the bridge.

Daily gage height, in feet, of North Fork of South Platte River at Cassells, Colo., for 1910.

[Lulu Cassell, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.25	1.5	1.4	1.1	1.55	1.9	1.45	1.5	1.1	1.2	1.1	1.25
2	1.25	1.25	1.4	1.15	1.3	1.9	1.45	1.4	1.1	1.2	1.1	1.2
3	1.25	1.3	1.6	1.15	1.4	1.9	1.45	.....	1.1	1.15	1.1	1.3
4	1.3	1.25	1.55	1.0	1.6	1.9	1.45	.....	1.15	1.15	1.1	1.1
5	1.2	1.25	1.6	1.1	1.55	1.9	1.4	.....	1.1	1.2	1.05	1.15
6	1.2	1.25	1.6	1.15	1.4	1.9	1.4	.....	1.1	1.15	1.05	1.1
7	1.2	1.25	1.55	1.15	1.5	1.9	1.4	.....	1.1	1.2	1.15	1.2
8	1.2	1.25	1.5	1.1	1.5	1.85	1.4	.....	1.05	1.2	1.15	1.2
9	1.3	1.25	1.4	1.1	1.55	1.75	1.4	.....	1.1	1.2	1.1	1.2
10	1.45	1.25	1.1	1.3	1.55	1.75	1.45	.....	1.1	1.15	1.15	1.2
11	1.55	1.2	1.2	1.2	1.6	1.7	1.4	1.2	1.1	1.15	1.1	1.25
12	1.45	1.25	1.1	1.2	1.5	1.7	1.4	.....	1.15	1.15	1.1	1.2
13	1.55	1.25	1.1	1.25	1.6	1.75	1.4	.....	1.2	1.2	1.05	1.15
14	1.5	1.25	1.1	1.0	1.6	1.65	1.35	.....	1.35	1.2	1.1	1.15
15	1.75	1.2	1.05	1.1	1.6	1.7	1.35	.....	1.2	1.2	1.0	1.2
16	1.75	1.1	1.1	1.05	1.65	1.6	1.35	.....	1.15	1.2	1.1	1.2
17	1.75	1.2	1.1	1.1	1.6	1.65	1.35	.....	1.2	1.35	1.0	1.25
18	1.6	1.25	1.15	1.2	1.5	1.65	1.35	.....	1.2	1.2	1.15	1.3
19	1.6	1.25	1.1	1.15	1.55	1.55	1.35	.....	1.3	1.2	1.2	1.2
20	1.55	1.25	1.05	1.15	1.5	1.6	1.25	.....	1.3	1.2	1.1	1.2
21	1.6	1.25	1.15	1.1	1.65	1.6	1.3	.....	1.3	1.2	1.25	1.2
22	1.6	1.4	1.2	1.2	1.55	1.5	1.2	.....	1.25	1.25	1.25	1.2
23	1.55	1.5	1.15	1.25	1.5	1.55	1.3	.....	1.25	1.2	1.2	1.2
24	1.55	1.6	1.15	1.3	1.55	1.65	1.25	.....	1.2	1.2	1.15	1.3
25	1.55	1.55	1.1	1.4	1.6	1.6	1.25	1.2	1.2	1.15	1.2	1.4
26	1.25	1.5	1.2	1.55	1.65	1.6	1.2	.....	1.2	1.05	1.15	1.35
27	1.3	1.55	1.2	1.6	1.65	1.55	1.2	1.15	1.2	1.1	1.1	1.4
28	1.5	1.45	1.15	1.6	1.65	1.55	1.4	1.15	1.15	1.0	1.1	1.45
29	1.4	.....	1.1	1.7	1.85	1.55	1.6	1.15	1.2	1.05	1.1	1.5
30	1.65	.....	1.25	1.6	1.75	1.5	1.75	1.1	1.15	1.1	1.15	1.5
31	1.65	.....	1.1	.....	1.85	.....	1.5	1.1	.....	1.1	.....	1.6

NOTE.—Ice Jan. 1 to about Mar. 14, and about Nov. 18 to Dec. 31. Thickness of ice Jan. 30, 1.5 feet; Feb. 16, 2 feet; ice breaking up Mar. 3; ice all gone from gage Mar. 15.

Daily discharge, in second-feet, of North Fork of South Platte River at Cassells, Colo., for 1910.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	46	119	214	78	72	25	35	25
2	.....	53	74	214	78	58	25	35	25
3	.....	53	90	214	78	58	25	30	25
4	.....	34	130	214	75	58	30	30	25
5	.....	46	119	214	67	58	25	35	20
6	.....	53	90	214	67	46	25	30	20
7	.....	53	108	214	67	46	25	35	30
8	.....	46	108	198	63	46	20	35	30
9	.....	46	119	168	63	35	25	35	25
10	.....	74	119	168	70	35	25	30	30
11	.....	60	130	154	63	35	25	30	25
12	.....	60	108	154	60	35	30	30	25
13	.....	67	130	168	60	35	35	35	20
14	.....	34	130	138	54	35	52	35	25
15	40	46	130	150	54	35	35	35	16
16	46	40	142	126	52	35	30	35	25
17	46	46	130	138	52	35	35	52	16
18	53	60	108	132	52	35	35	35	.....
19	46	53	119	110	52	35	46	35	.....
20	40	53	108	120	40	35	46	35	.....
21	53	46	142	120	46	35	46	35	.....
22	60	60	119	96	35	35	40	40	.....
23	53	67	108	105	46	35	40	35	.....
24	53	74	119	126	40	35	35	35	.....
25	46	90	130	115	40	35	35	30	.....

Daily discharge, in second-feet, of North Fork of South Platte River at Cassells, Colo., for 1910—Continued.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
26	60	119	142	110	35	35	35	20	.....
27	60	130	142	100	35	30	35	25	.....
28	53	130	142	100	58	30	30	16	.....
29	46	154	198	100	88	30	35	20	.....
30	67	130	168	86	118	25	30	25	.....
31	46	.....	198	.....	72	25	.....	25	.....

NOTE.—These discharges are based on rating curves applicable as follows: Mar 15 to June 10, poorly defined; June 11 to July 17, indirect method for shifting channels used; July 18 to Nov. 17, poorly defined. Discharges estimated Aug. 3 to 10, 12 to 24, and 26.

Monthly discharge of North Fork of South Platte River at Cassells, Colo., for 1910.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
January	.....	.....	a 37.4	2,300	D.
February	.....	.....	a 26.8	1,490	D.
March	.....	.....	a 46.1	2,830	D.
April	154	34	67.4	4,010	D.
May	198	74	126	7,750	C.
June	214	86	149	8,870	C.
July	118	35	60.0	3,690	C.
August	.....	.....	39.1	2,400	C.
September	52	20	32.7	1,950	B.
October	52	16	32.0	1,970	B.
November	.....	.....	a 25.7	1,530	C.
December	.....	.....	a 20.8	1,280	D.
The year	214	.....	55.4	40,100	

a Discharge estimated because of ice conditions Jan. 1 to Mar. 14 and Nov. 18 to Dec. 31 on the basis of discharge measurements made during these periods.

NORTH FORK OF SOUTH PLATTE RIVER AT SOUTH PLATTE, COLO.

This station, which was established January 4, 1909, to show the total run-off of the creek available for power and storage and, in connection with the records at the station on the South Fork of the South Platte, to serve as a check on the South Platte station below the forks, is located about one-third mile from the mouth of the stream. The station is maintained in cooperation with the Denver Power & Irrigation Co.

Many ice and fish ponds divert water for a distance of 30 miles above the station.

The drainage area above the station is about 450 square miles.

Measurements are made from a cable 100 yards upstream from the inclined rod gage and by wading. The channel is quite shifting in character and the results obtained have not been very satisfactory. Ice affects the gage heights for several months during the winter. The datum has remained constant since the station was established.

The station was discontinued September 30, 1910.

Discharge measurements of North Fork of South Platte River at South Platte, Colo., in 1910.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Jan. 24[a]	G. H. Russell	19	22	3.50	85
Feb. 15[a]	do	23	20	2.95	56
Apr. 2	do	34	35	2.15	104
Apr. 27	do	61	71	2.84	217
May 9	W. B. Freeman	61	71	2.81	223
June 4	R. C. Miles	61	97	2.95	364
June 20	G. H. Russell	59	65	2.45	160
July 19	do	34	36	1.88	83
July 24	Christiansen and Grieve	44	42	1.87	96
Aug. 11	G. H. Russell	40.5	36	1.80	84
Aug. 25	Russell and Padgett	38	33	1.63	65
Sept. 24	Miles and Padgett	38	30	1.55	69
Oct. 31	G. H. Russell	28.5	24	1.40	41
Nov. 22	H. D. Padgett	.....	.....	1.45	(b)

[a] Ice conditions. [b] No measurement made.

NOTE.—All measurements by wading at various sections except Apr. 27, June 4, and Oct. 31.

Daily gage height, in feet, of North Fork of South Platte River at South Platte, Colo., for 1910.

[E. H. Jardine, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	2.65	2.7	2.6	2.1	2.7	3.05	2.25	2.3	1.6
2	2.7	2.6	2.65	2.1	2.7	2.95	2.2	2.25	1.6
3	2.75	2.5	2.6	2.1	2.6	2.95	2.2	2.15	1.6
4	2.65	2.55	2.5	2.05	2.8	2.85	2.1	2.05	1.6
5	2.7	2.7	2.4	2.0	2.7	2.8	2.1	2.1	1.65
6	2.7	2.55	1.95	2.05	2.6	2.8	2.1	2.05	1.5
7	2.8	2.5	1.9	2.05	2.6	2.75	2.1	1.9	1.5
8	2.6	2.5	1.8	2.05	2.6	2.7	2.05	1.85	1.5
9	3.0	2.6	2.0	2.3	2.75	2.5	2.0	1.8	1.45
10	3.1	2.55	2.0	2.3	2.8	2.5	2.05	1.8	1.45
11	3.1	2.5	2.05	2.4	2.7	2.5	2.0	1.75	1.45
12	3.2	2.4	2.1	2.45	2.7	2.5	2.0	1.75	1.5
13	3.2	2.5	2.1	2.45	2.8	2.6	1.95	1.75	1.6
14	2.9	2.6	2.1	2.5	2.7	2.6	1.95	1.75	1.6
15	3.1	2.95	2.05	2.5	2.8	2.6	1.95	1.75	1.55
16	2.0	2.8	2.0	2.45	2.75	2.5	1.95	1.7	1.6
17	3.0	2.75	2.0	2.45	2.8	2.65	1.85	1.65	1.6
18	2.9	2.7	2.0	2.45	2.9	2.5	1.95	1.65	1.6
19	2.9	2.7	2.1	2.45	2.7	2.5	1.9	1.65	1.7
20	3.1	2.6	2.1	2.5	2.7	2.45	1.9	1.65	1.65
21	3.05	2.5	2.0	2.7	2.7	2.35	2.0	1.65	1.6
22	3.05	2.4	2.0	2.55	2.7	2.3	2.15	1.65	1.6
23	3.5	2.4	2.0	2.5	2.95	2.4	1.95	1.65	1.6
24	3.5	2.5	2.05	2.5	2.9	2.4	1.95	1.65	1.55
25	2.8	2.4	1.95	2.7	2.8	2.6	1.85	1.65	1.55
26	2.7	2.4	1.95	2.7	3.0	2.55	1.85	1.65	1.55
27	2.65	2.6	1.95	2.75	2.9	2.65	1.8	1.65	1.55
28	2.7	2.55	1.9	2.7	2.8	2.3	1.85	1.65	1.55
29	2.6	.....	1.9	2.8	3.1	2.2	3.95	1.65	1.55
30	2.75	.....	1.9	2.7	3.2	2.2	2.8	1.6	1.55
31	2.7	.....	2.1	.....	2.95	.....	2.65	1.6	.....

NOTE.—Ice Jan. 1 to Mar. 5.

Daily discharge, in second-feet, of North Fork of South Platte River at South Platte, Colo., for 1910.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	.....	95	190	380	130	165	60
2	.....	95	190	350	125	155	60
3	.....	95	170	350	125	136	60
4	.....	87	215	325	110	120	60
5	.....	80	190	305	110	127	66
6	78	85	170	305	110	120	50
7	72	85	170	280	110	98	50
8	60	85	170	265	105	92	50
9	85	120	202	210	98	85	45
10	85	120	220	210	105	85	45
11	92	140	200	200	98	78	45
12	98	145	205	200	98	78	50
13	98	145	230	220	90	78	60
14	98	155	210	220	90	78	60
15	92	155	235	220	90	78	55
16	85	140	220	180	92	72	60
17	85	140	240	220	80	66	60
18	85	140	270	180	92	66	60
19	98	140	225	175	90	66	72
20	98	150	225	160	98	66	66
21	85	190	230	145	112	66	60
22	85	160	230	140	136	66	60
23	85	150	310	155	105	66	60
24	92	145	295	155	105	66	55
25	78	190	265	200	92	66	55
26	78	190	340	190	92	66	55
27	78	202	305	210	85	66	55
28	72	190	280	140	92	66	55
29	72	215	380	125	790	66	55
30	72	190	430	125	295	60	55
31	98	.....	340	.....	250	60	.....

NOTE.—These discharges are based on rating tables applicable as follows: Mar. 6 to 31, not well defined; Apr. 1 to 25, and May 10 to July 19, indirect method for shifting channels used; Apr. 26 to May 9, not well defined; July 20 to Sept. 30, fairly well defined between 30 and 150 second-feet.

Monthly discharge of North Fork of South Platte River at South Platte, Colo., for 1910.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
January	.....	.....	[a] 80.2	4,930	D.
February	.....	.....	[a] 60.4	3,350	D.
March	98	.....	[a] 80.0	4,920	C.
April	215	80	141	8,390	C.
May	430	170	244	15,000	C.
June	380	125	218	13,000	C.
July	790	80	135	8,300	C.
August	165	60	84.6	5,200	B.
September	72	45	56.6	3,370	C.
The period	.....	.....	.....	66,500	

[a] Discharge estimated because of ice Jan. 1 to Mar. 5 on basis of discharge measurements made during this period.

GENEVA CREEK BASIN.

Geneva Creek above Jackwhacker Creek, near Grant, Colo.

A temporary station was established on Geneva Creek, August 17, 1909, to obtain run-off and power data. It is located 100 feet above the mouth of Jackwhacker Creek, 12 miles above Grant, Colo.

The vertical staff gage has remained unchanged in datum and location since the station was established. Discharge measurements are made by wading.

The bed of the stream is made up of small rocks and gravel and is fairly permanent.

The stream is frozen over about four months each year.

This is not a regular station, as there is no daily gage observer.

The following discharge measurement was made by J. B. Stewart:

July 18, 1910: Width, 8 feet; area, 3.1 square feet; gage height, 0.55 foot; discharge, 6.4 second-feet.

The following additional gage heights were observed by Edmund Couch:

July 27, 0.50 foot; August 18, 0.45 foot.

Geneva Creek at Old Geneva smelter, near Grant, Colo.

This is a temporary station, established August 17, 1909, to determine the amount of water available for storage and power development, and is located in T. 6 S., R. 75 W., 10 miles above Grant, Colo.

A vertical rod gage is located on left bank at old slaughterhouse one-fourth mile below the Old Geneva smelter and the same distance below the mouth of Smelter Creek.

Its datum has not been changed since the establishment of the station. Discharge measurements are made by wading.

The bed of the stream is composed of small bowlders and is fairly permanent.

The creek is frozen for three to four months each year.

This is not a regular station, as there is no daily gage observer.

Discharge measurements of Geneva Creek at Old Geneva smelter, near Grant, Colo., in 1910.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
July 18	W. B. Freeman	16	7.4	1.24	12
Aug. 29	do	16	6.5	1.23	6.3

NOTE.—These measurements made by wading at different sections. The following gage heights were observed by Edmund Couch: July 27, 1.20 feet; August 18, 1.15 feet.

Geneva Creek at Sullivan's ranch, near Grant, Colo.

This station, which is located at Sullivan's ranch, 3½ miles above Grant, Colo., in T. 6 S., R. 74 W., was established July 5, 1908, to obtain data concerning the run-off from a small mountain drainage area and also to determine the flow available for power development.

The station is about 3½ miles above the confluence of Geneva Creek with the North Fork of the South Platte, about 50 feet below the mouth of Gold Run, or Threemile Creek, and about a mile below the mouth of Scott Gomer Gulch, which is called on some of the old

maps the North Fork of the South Platte. The drainage area, which is very mountainous and part of which area is heavily timbered, comprises 49 square miles above the station.

No water is diverted above the station. Several power sites have been filed on, but the stage of construction at none of these has yet been reached. The creek has a fall of 900 feet in the last 4 miles and a very much greater fall above. With proper storage it will be possible to develop 10,000 horsepower during a six months' period. The development of the Continental reservoir site, about 3 miles above the station, is under consideration.

The creek is frozen wholly or in part for four or five months during the year.

The datum or position of the vertical rod gage has not been changed since the station was established.

Very good results should be obtained except at very high stages, when the current is likely to be swift. Measurements can be made by wading at most seasons of the year, but for flood measurements a cable must be installed. Such high-water measurements as there are have been made from the highway bridge at Grant, 3½ miles downstream.

Discharge measurements of Geneva Creek at Sullivan's ranch, near Grant, Colo., in 1910.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Jan. 31[a]	W. B. Freeman	16.5	17.4	0.52	15.9
Feb. 25[b]	do	12.3	14	.50	13
Mar. 29	do	20.5	15.8	.50	19.7
May 10	do	41	31	1.00	73
29	do	42	35	1.10	97
July 18	do	30	23.6	.71	35.2
Aug. 29	do	27	17.4	.57	21.4
Sept. 19	do	23.5	23.4	.65	25
Nov. 19[a]	do	19.8	20.2	.62	15.3
Dec. 15	J. B. Stewart	8.0	10.3	[c] 1.08	10.6

[a] Slightly affected by ice. [b] Partly frozen. [c] Gage height distorted by ice.

NOTE.—All measurements made by wading at various sections.

Daily gage height, in feet, of Geneva Creek at Sullivan's ranch, near Grant, Colo., for 1910.

[M. A. Sullivan, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	0.70	0.55	.....	.....	.....	1.3	0.9	0.95	0.55	0.55	.....
2	.65	.55	.....	.....	.....	1.3	.9	.9	.55	.55	.....
3	.65	.5	.....	.....	.....	1.3	.9	.85	.6	.55	.....
4	.65	.5	0.45	.....	.....	1.3	.9	.8	.55	.55	.....
5	.6	.5	.45	.....	.....	1.2	.9	.8	.55	.55	.....
6	.6	.55	.5	.....	.....	1.2	.85	.8	.55	.55	.....
7	.6	.6	.5	0.55	.....	1.1	.85	.75	.55	.5	0.5
8	.6	.....	.8	.55	.....	1.1	.8	.7	.5	.5	.5
9	.6	.....	.....	.6	.....	1.1	.8	.75	.5	.5	.45
10	.6	.....	.....	.6	1.0	1.1	.85	.75	.5	.52	.45

Daily gage height, in feet, of Geneva Creek at Sullivan's ranch, near Grant, Colo., for 1910—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
11				0.65	1.1	1.05	0.8	0.7	0.5	0.55	
12					1.1	1.1	.8	.7	.55	.55	
13					1.1	1.1	.75	.7	.55	.55	
14					1.15	1.1	.7	.7	.65	.55	
15			0.6		1.1	1.1	.7	.7	.65	.55	
16			.6		1.1	1.05	.7	.65	.6		
17					.9	1.0	.7	.6	.55		
18					1.0	1.0	.7	.6	.55		
19					1.0	1.0	.7	.6	.65		
20				.7	.95	1.0	.75	.6	.6		
21				.75	.9	1.0	.7	.65	.6		
22					.9	.95	.75	.65	.6		
23				.7	.95	.95	.7	.65	.6		
24					1.0	.95	.65	.6	.6		
25		0.5			.9	1.0	.65	.6	.6		
26				.8	.95	1.05	.65	.6	.6		
27				.95	1.0	1.0	.65	.6	.6		
28				1.0	1.1	.95	.7	.6	.6		
29			.5	1.0	1.1	.95	.65	.6	.55		
30					1.3	.9	.85	.55	.55		
31	0.5				1.25		1.0	.55			

NOTE.—Probably only slightly affected by ice during January, February, and March, last part of November, and December.

Daily discharge, in second-feet, of Geneva Creek at Sullivan's ranch, near Grant, Colo., for 1910.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	20	75	134	59	67	19	19	
2	20	75	134	59	59	19	19	
3	24	75	134	59	52	23	19	
4	24	75	134	59	45	19	19	
5	23	75	114	59	45	19	19	
6	23	75	114	52	45	19	19	
7	23	75	94	52	39	19	15	15
8	23	75	94	45	33	15	15	15
9	28	75	94	45	39	15	15	12
10	28	75	94	52	39	15	17	12
11	31	94	84	45	33	15	19	
12	31	94	94	45	33	19	19	
13	31	94	94	39	33	19	19	
14	31	104	94	33	33	28	19	
15	31	94	94	33	33	28	19	
16	37	94	84	33	28	23		
17	35	59	75	33	23	19		
18	35	75	75	33	23	19		
19	35	75	75	33	23	28		
20	35	67	75	39	23	23		
21	41	59	75	33	28	23		
22	41	59	67	39	28	23		
23	34	67	67	33	28	23		
24	39	75	67	28	23	23		
25	39	59	75	28	23	23		
26	46	67	84	28	23	23		
27	68	75	75	28	23	23		
28	76	94	67	33	23	23		
29	75	94	67	28	23	19		
30	75	134	59	52	19	19		
31		124		75	19			

NOTE.—These discharges are based on rating curves applicable as follows: Apr. 1 to May 9, indirect method for shifting channels; May 10 to Nov. 10, fairly well defined. Discharges estimated Apr. 1 to 6, 12 to 19, 22, 24, 25, 30, May 1 to 9.

Monthly discharge of Geneva Creek at Sullivan's ranch, near Grant, Colo., for 1910.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
January			[a] 20.0	1,230	D.
February			[a] 15.0	833	D.
March			[a] 18.0	1,110	C.
April			37.5	2,230	B.
May			80.9	4,970	B.
June	134	59	89.6	5,330	B.
July	75	28	42.3	2,600	B.
August	67	19	32.5	2,000	B.
September	28	15	20.8	1,240	B.
October			[b] 18.5	1,140	C.
November			[a] 15.0	893	C.
December			[a] 11.0	676	D.
The year			33.4	24,300	

[a] Estimated from discharge measurements and observer's notes.
[b] Oct. 16 to 31, estimated as 19 second-feet.

Smelter Creek near Grant, Colo.

A temporary station on Smelter Creek, in T. 6 S., R. 75 W., about one-fourth mile above its confluence with Geneva Creek, at the old Geneva smelter, 10 miles above Grant, Colo., was established August 17, 1909.

None of the water in this stream has been diverted for any purpose, but some opportunity is presented for power development on account of the precipitous slope of the stream bed.

There has been no change in the location of the vertical staff gage since the station was established. Discharge measurements are made by wading.

The stream is covered with ice and snow for several months during the winter season.

Discharge measurements of Smelter Creek near Grant, Colo., in 1910.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
July 18	W. B. Freeman	8	2.8	0.63	2.2
Aug. 29	do	2.4	1.6	.57	1.8

NOTE.—These measurements made by wading above wagon bridge. The following additional gage heights were observed by Edmund Couch: July 27, 0.6 foot; August 18, 0.6 foot; August 28, 0.6 foot.

Duck Lake Creek near Grant, Colo.

Duck Lake Creek has a total drainage area of about 8 square miles, at an elevation varying between 9,700 and 13,000 feet.

It is proposed to make a storage reservoir out of Duck Lake, which is about 5 miles above the mouth of the stream, at an elevation of 11,000 feet.

A temporary station was established August 17, 1909, about 50 yards above the confluence of Duck Lake Creek with Geneva Creek, about 7 miles above Grant, Colo.

A vertical staff gage is fastened to the crib abutment of an old bridge, and measurements are taken from a foot log at the gage or by wading.

So far no water has been diverted from this creek, though filings have been made both for power and irrigation projects.

Discharge measurements of Duck Lake Creek near Grant, Colo., in 1910.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Jan. 31	W. B. Freeman	7	2.8	.....	1.0
Mar. 29	.....do	7.8	3.35	0.80	2.0
May 10	.....do	6.5	4.3	1.00	8.0
July 18	.....do	7.2	2.9	.82	2.1
Aug. 29	.....do	2.2	1.6	.71	1.4

NOTE.—The following additional gage heights, in feet, were observed by Edmund Couch:

Date.	Gage height.	Date.	Gage height.	Date.	Gage height.	Date.	Gage height.
July 27	0.75	Aug. 28	0.7	Oct. 25	0.7	Nov. 30	0.65
Aug. 18	.75	Sept. 2	.6	Nov. 18	.7	Dec. 1	.7

Scott Gomer Creek at Sullivan's ranch, near Grant, Colo.

Scott Gomer Creek, an important tributary of Geneva Creek, has a total drainage area of 21 square miles, at elevations ranging from 9,500 to 14,000 feet. As the fall of this creek is large it offers excellent opportunities for power development. At present no water is being diverted from the stream.

A temporary station, with a vertical staff gage, was established on Scott Gomer Creek, 3 miles above its mouth and three-eighths of a mile above the Geneva Power Co.'s dam site, August 16, 1909, to determine the amount of water available for power development.

As the location was very inaccessible, another vertical rod gage was established on September 4, 1909, at the highway bridge, one-fourth mile above the junction of the stream with Geneva Creek. Several small tributaries come in between the two stations, but there are none below the lower one.

The creek is covered with ice and snow for several months each winter. Discharge measurements are made by wading.

Discharge measurements of Scott Gomer Creek at Sullivan's ranch, near Grant, Colo., in 1910.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Jan. 31 [a]	W. B. Freeman	8.4	5.0	1.63	6.3
Mar. 29 [b]	do	7.9	4.4	1.23	7.3
May 10	do	18.5	12.8	1.83	19.1
July 18	do	6.8	4.1	1.25	7.2
Aug. 29	do	5.8	3.1	1.16	6.3
Sept. 19	do	6.5	4.9	1.42	7.7

[a] Partly frozen over. [b] Some ice.

NOTE.—The following additional gage heights, in feet, were observed by Edmund Couch:

Date.	Gage height.	Date.	Gage height.	Date.	Gage height.
May 19	1.90	Aug. 18	1.20	Nov. 19	1.42
July 23	1.15	Aug. 28	1.15	Nov. 30	1.25
July 27	1.15	Sept. 2	1.65	Dec. 11	1.30
Aug. 1	1.75	Oct. 25	1.45		
Aug. 6	1.55	Nov. 18	1.20		

NOTE.—On Nov. 19 there was considerable ice in the stream; thickness, 1½ inches.

CLEAR CREEK BASIN.

DESCRIPTION.[1]

Clear Creek is one of the largest tributaries of South Platte River, which it enters about 6 miles below Denver. Like the other streams of this region, it flows for a long distance through a mountainous territory and then passes out to the plains, where its water is used for irrigation, there being comparatively little surplus even during the flood stages.

CLEAR CREEK AT FORKSCREEK, COLO.

For 13 miles below Forkscreek station the creek flows in a deep canyon, falling in that distance 1,225 feet. It then emerges into a broad valley, where the entire normal flow is used for irrigation. The drainage area above Forkscreek station, 345 square miles in extent, comprises a narrow strip of very mountainous country, composed entirely of granitic rock, in many places barren of soil and studded with heavy patches of coniferous timber, remnants of a once extensive forest.

Two of the oldest mining districts in Colorado lie in this basin, and in these districts the waters of the upper tributaries of the stream have been used for mining. The stream now carries in suspension immense quantities of tailings and sediment.

The water is used to some extent for power, and 4,000 horsepower are at present developed by about a dozen small plants. Several other plants are planned or in the course of construction. By utilizing all the storage facilities on the stream above Forkscreek it will

[1] For full description of the basin see Hayden's report of 1875, p. 432; also Report on agriculture by irrigation, Eleventh Census, by F. H. Newell, p. 114.

be possible to develop about 30,000 horsepower for six months during the year and 20,000 more between that point and its mouth.

The natural flow of the stream is more or less affected by storage in various ponds and reservoirs above. The creek is frozen over for three or four months during the winter.

This station, which is located at Forkscreek, Colo., in T. 3 S., R. 71 W., was established May 29, 1899, to determine the amount of water available for irrigation and power development.

This station is at a footbridge a few hundred feet below the mouth of the North Fork. No other important tributaries enter between this fork and the mouth of the stream.

On July 19, 1905, the gage was moved 30 feet upstream from its original location, but it is not likely that the relation of gage heights was materially affected thereby. This last gage, which is a chain gage fastened to the footbridge, is still in use. Very good results should be obtained at this station except in times of high water, when it is very difficult to measure, on account of the swiftness of the current. As the channel is occasionally shifted by floods, new rating curves must from time to time be constructed.

The creek is subject to disastrous floods, due to the heavy rains in summer months, which frequently wash out the tracks of the Colorado & Southern Railway in the bottom of the canyon.

Discharge measurements of Clear Creek at Forkscreek, Colo., in 1910.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Jan. 20[a]	G. H. Russell	24	25	4.42	40
Feb. 14[a]	do	15	38	4.90	48
Mar. 26	do	22.5	49	4.28	71
May 21	do	20	82	4.85	285
21	do	20	82	4.85	277
June 13	do	40	107	5.45	495
25	Miles and Turner	39	102	5.2	399
July 23	Miles and Padgett	27	72	4.65	181
Aug. 12	G. H. Russell	21	50	5.10	161
12	do	22	55	5.10	165
Sept. 5	H. D. Padgett	19	44	5.00	135
Oct. 1	do	22	34	5.81	90
29	G. H. Russell	18	29	5.65	68
Dec. 8[a]	R. C. Miles	19	23	6.35	31

[a] Made by wading. Ice conditions.

Daily gage height, in feet, of Clear Creek at Forkscreek, Colo., for 1910.

[C. W. Hoisington, observer.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1		4.05	4.7	5.85	5.1	5.5	4.85	5.75	5.65	6.25
2		4.15	4.65	5.95	5.1	5.5	4.85	5.75	5.65	6.25
3		4.2	4.65	5.75	5.0	5.4	4.85	5.75	5.65	6.3
4		3.8	4.75	5.85	5.0	5.95	4.95	5.75	5.65	6.25
5		3.85	4.65	5.75	5.0	5.4	5.0	5.75	5.6	6.25
6	3.8	3.9	4.7	5.65	4.9	5.3	5.0	5.75	5.6	6.15
7	3.75	4.05	4.65	5.55	4.85	5.2	5.0	5.75	5.6	6.3
8	3.85	4.1	4.7	5.45	4.8	5.2	4.9	5.75	5.6	6.35
9	3.75	4.2	4.75	5.45	4.8	5.15	4.9	5.75	5.6	6.45
10	3.7	4.15	5.05	5.4	4.75	5.1	4.9	5.75	5.6	6.45

Daily gage height, in feet, of Clear Creek at Forkscreek, Colo., for 1910—Continued.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
11	3.6	4.2	5.15	5.45	4.75	5.1	4.9	5.75	5.6	6.45
12	3.65	4.25	5.15	5.45	4.8	5.05	4.8	5.75	5.7	6.5
13	4.3	4.3	5.05	5.5	4.75	5.0	4.8	5.75	5.8	6.5
14	4.15	4.2	5.05	5.5	4.7	5.0	4.8	5.7	5.9	6.55
15	3.95	4.3	4.95	5.55	4.7	5.0	4.75	5.7	6.0	6.55
16	3.85	3.85	4.95	5.5	4.6	5.0	4.75	5.7	6.0	6.55
17	4.0	4.2	4.85	5.4	4.8	4.9	4.75	5.65	6.0	6.6
18	4.15	4.15	4.95	5.4	4.75	4.9	5.55	5.65	6.1	6.6
19	4.05	4.15	4.85	5.3	4.7	4.9	6.2	5.6	6.1	6.65
20	4.2	4.3	4.85	5.3	4.9	4.9	6.0	5.75	6.1	6.75
21	4.2	4.4	4.85	5.3	4.75	4.9	5.9	5.75	6.2	6.75
22	4.25	4.35	4.95	5.3	4.7	4.9	5.9	5.7	6.2	6.75
23	4.2	4.4	4.9	5.2	4.6	4.9	5.85	5.7	6.2	6.75
24	4.3	4.4	4.9	5.3	4.5	4.85	5.8	5.65	6.2	6.8
25	4.25	4.5	4.9	5.25	4.5	4.85	5.8	5.65	6.2	6.85
26	4.3	4.55	4.9	5.25	4.5	4.85	5.75	5.6	6.2	6.85
27	4.1	4.8	4.9	5.25	4.45	4.85	5.75	5.6	6.2	6.9
28	4.15	4.8	5.1	5.2	5.15	4.85	5.7	5.6	6.2	6.95
29	4.15	4.9	5.35	5.3	5.25	4.85	5.75	5.65	6.2	7.0
30	4.1	4.95	5.75	5.25	5.35	4.85	5.75	5.65	6.2	7.0
31	4.05	.....	5.8	.....	5.3	4.85	.....	5.65	.....	7.05

NOTE.—Ice Jan. 1 to about Mar. 5, and Nov. 12 to Dec. 31.

Daily discharge, in second-feet, of Clear Creek at Forkscreek, Colo., for 1910.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	48	199	700	351	515	92	80	62
2	.....	58	182	748	351	500	92	80	62
3	.....	63	182	652	310	435	92	80	62
4	.....	29	216	700	310	675	118	80	62
5	.....	32	182	652	310	395	132	80	55
6	29	36	199	604	271	340	132	80	55
7	26	48	182	556	252	280	132	80	55
8	32	52	199	508	234	270	104	80	55
9	26	63	216	508	234	235	104	80	55
10	23	58	330	485	216	205	104	80	55
11	18	63	372	508	216	190	104	80	55
12	20	72	372	508	234	148	80	80	.....
13	80	80	330	532	216	132	80	80	.....
14	58	63	330	532	199	132	80	70	.....
15	40	80	290	556	199	132	72	70	.....
16	32	32	290	532	165	132	72	70	.....
17	43	63	252	485	234	104	72	62	.....
18	58	58	290	485	216	104	300	62	.....
19	48	58	252	439	199	104	555	55	.....
20	63	80	252	439	271	104	430	80	.....
21	63	103	252	439	216	104	350	80	.....
22	72	92	290	439	199	104	320	70	.....
23	63	103	271	394	165	104	270	70	.....
24	80	103	271	439	133	92	225	62	.....
25	72	133	271	416	133	92	200	62	.....
26	80	149	271	416	133	92	155	55	.....
27	52	234	271	416	118	92	130	55	.....
28	58	234	351	394	372	92	95	55	.....
29	58	271	462	439	416	92	100	62	.....
30	52	290	652	416	462	92	90	62	.....
31	48	.....	676	.....	439	92	.....	62	.....

NOTE.—These discharges are based on rating curves applicable as follows: Mar. 6 to July 31 fairly well defined between 50 and 550 second-feet; Aug. 12 to Sept. 17 fairly well defined between 100 and 200 second-feet; Oct. 1 to Nov. 11, fairly well defined between 50 and 150 second-feet.

Monthly discharge of Clear Creek at Forkscreek, Colo., for 1910.

[Drainage area, 345 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
January			a 40	0.116	0.13	2,460	
February			a 45	.130	.14	2,500	
March			a 46.6	.135	.16	2,870	C.
April	290	29	94.9	.275	.31	5,650	B.
May	676	182	295	.855	.99	18,100	B.
June	748	394	511	1.48	1.65	30,400	A.
July	462	118	251	.728	.84	15,400	B.
August	675	92	199	.577	.67	12,200	B.
September	555	72	163	.472	.53	9,700	C.
October	80	55	71.1	.206	.24	4,370	B.
November			52.8	.153	.17	3,140	
December			29.4	.085	.10	1,810	
The year			150.0	.434	5.93	109,000	

a Discharge estimated for ice conditions Jan. 1 to Mar. 5, and Nov. 12 to 31. The means for January, February, November, and December are only approximate.

CLEAR CREEK AT IDAHO SPRINGS, COLO.

This station, which is located at Idaho Springs, half a block above Miner Street, was established October 8, 1910.

A vertical rod gage is fastened to the right bank, 50 feet above 8-inch sewer outlet on left bank. Measurements are made by wading at various sections.

The bed of the stream is sandy and shifting. The creek is frozen for three or four months each year.

This is not a regular station, as daily gage heights are not recorded.

Discharge measurements of Clear Creek at Idaho Springs, Colo., in 1910.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Oct. 8	S. T. Harding	34	48	0.45	95
Dec. 28	R. C. Miles	33	32	.32	53

NOTE.—The following additional gage heights, in feet, were observed by W. B. Kelso:

Date.	Gage height.	Date.	Gage height.	Date.	Gage height.	Date.	Gage height.
Oct. 10	0.45	Oct. 22	0.40	Nov. 8	0.30	Dec. 1	0.30
Oct. 13	.40	Oct. 23	.40	Nov. 21	.25	Dec. 4	.45
Oct. 15	.40	Oct. 29	.35	Nov. 26	.25	Dec. 10	.25
Oct. 17	.45	Nov. 5	.30	Nov. 28	.45	Dec. 31	.30
Oct. 20	.40						

ST. VRAIN CREEK BASIN.

DESCRIPTION.[1]

St. Vrain Creek and its tributaries receive their supply of water from the eastern slope of that portion of the Front Range lying between Longs Peak and James Peak, a distance of about 30 miles. The general trend of the drainage is northeastward, the St. Vrain flowing at last into South Platte River about 6 miles below the town of Platteville.

The principal tributaries of the St. Vrain are the North and South forks and the Boulder, the South Boulder being an important branch of the latter. The areas drained by the upper portions of these streams are mountainous, the streams flowing through deep and rugged canyons, where the water can be used only for placer mining; leaving the foothills, however, each emerges into a broad and nearly level valley where farming by irrigation is extensively practiced.

ST. VRAIN CREEK AT LYONS, COLO.

This station, which is located one-half mile below Lyons and 300 feet below the junction of the North and South forks of St. Vrain Creek, was maintained under the direction of the United States Geological Survey from 1895 to 1903.[2] Since 1903 it has been maintained more or less continually under the direction of the State engineer's office.

A number of ditches take water above the station for irrigation, besides the water supply of Lyons and Longmont.[3]

The drainage area above this station is about 200 square miles.

The location and datum of the gage are probably the same as for the station used in 1903. On August 9, 1909, a new slope gage was put in, which is practically at the same datum as the old gage. The old bench mark could not be found.

The flow of the stream is affected by ice for several months during the winter.

These records were taken under the direction of the State engineer of Colorado and are published as furnished by him. They have not been verified by engineers of the United States Geological Survey.

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[1] For a full description of this basin see Hayden's report of 1875, p. 436. Also Report on agriculture by irrigation, Eleventh Census, by F. H. Newell, p. 103.

[2] This station is fully described in Water-Supply Paper U. S. Geol. Survey No. 99, p. 193.

[3] Idem, p. 195.

Discharge measurements of St. Vrain Creek at Lyons, Colo., in 1910.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Feb. 2[a]	C. L. Chatfield	21	17	1.84	15
Mar. 21[a]	do	35	46	2.10	38
Mar. 22[b]	do	35	49	2.12	39
Mar. 23[c]	do	35	50	2.17	45
June 11[b]	Grieve and Hezmalhalch	39	81	3.10	230
June 28[b]	C. C. Hezmalhalch	36	66	2.75	145
Aug. 15[a]	do	39	57	2.33	70
Sept. 29[b]	C. L. Chatfield	38	51	2.18	49

[a] Made by wading. [b] Made from cable. [c] Made by wading under cable.

NOTE.—The channel was open when measurements were made in February and March.

Daily gage height, in feet, of St. Vrain Creek at Lyons, Colo., for 1910.

[Wm. Siglinger, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.9	1.8	1.75	2.0	2.6	3.4	3.2	2.65	2.15	2.1	1.9	1.7
2	1.9	1.75	1.65	2.0	2.5	3.5	3.0	2.7	2.15	2.1	1.95	1.75
3	1.9	1.75	1.65	2.0	2.4	3.65	2.95	2.55	2.25	2.1	1.95	1.8
4	1.9	1.85	1.8	2.05	2.55	3.45	2.95	2.55	2.45	2.1	1.85	1.8
5	1.9	1.75	1.85	2.1	2.65	3.4	2.95	2.55	2.55	2.0	1.9	1.7
6	1.85	1.75	1.9	2.25	2.5	3.3	2.85	2.45	2.5	1.95	1.9	1.65
7	1.9	1.75	1.85	2.2	2.4	3.4	2.8	2.45	2.4	2.0	1.9	1.65
8	1.9	1.75	1.9	2.15	2.45	3.25	2.75	2.45	2.4	2.0	1.9	1.7
9	1.85	1.75	1.85	2.0	2.5	3.15	2.7	2.45	2.4	1.9	1.85	1.9
10	1.85	1.7	1.7	2.0	2.75	3.05	2.7	2.35	2.3	1.95	1.85	1.9
11	1.8	1.8	1.7	2.1	2.85	3.05	2.7	2.3	2.3	1.95	1.8	1.85
12	1.85	1.75	1.8	2.05	2.9	3.05	2.65	2.3	2.3	1.9	1.85	1.9
13	1.9	1.75	1.85	2.1	2.85	3.1	2.7	2.35	2.3	1.9	1.85	1.85
14	1.9	1.75	1.85	2.05	2.85	3.1	2.7	2.4	2.4	1.9	1.85	1.65
15	1.9	1.65	2.0	2.05	2.8	3.1	2.6	2.3	2.35	1.95	1.85	1.7
16	1.9	1.8	2.0	2.0	2.7	3.1	2.6	2.25	2.3	1.95	1.8	1.8
17	1.95	1.8	2.0	2.0	2.65	3.2	2.6	2.25	2.3	2.05	1.75	1.9
18	1.9	1.8	2.0	1.95	2.6	3.05	2.6	2.35	2.35	2.00	1.8	1.8
19	1.9	1.8	2.0	1.95	2.6	3.1	2.65	2.35	2.4	2.05	1.85	1.85
20	1.9	1.7	2.05	2.0	2.65	3.1	2.95	2.35	2.4	2.1	1.75	1.85
21	1.85	1.7	2.05	2.05	2.8	3.1	2.9	2.35	2.45	2.0	1.7	1.85
22	1.9	1.8	2.15	2.0	2.65	3.0	2.75	2.4	2.4	2.05	1.85	1.8
23	1.9	1.8	2.1	1.95	2.8	3.0	2.65	2.4	2.4	2.1	1.8	1.8
24	1.9	1.85	2.1	2.0	2.8	2.95	2.55	2.35	2.3	2.0	1.85	1.85
25	1.85	1.85	2.1	2.05	2.85	2.9	2.55	2.3	2.25	2.0	1.8	1.9
26	1.8	1.8	2.1	2.15	2.9	2.95	2.55	2.25	2.25	2.0	1.8	1.8
27	1.85	1.85	2.1	2.3	2.9	2.75	2.5	2.2	2.2	2.0	1.75	1.75
28	1.8	1.85	2.1	2.4	3.1	2.75	2.6	2.25	2.15	1.85	1.7	1.8
29	1.8	.....	2.1	2.6	3.2	2.95	2.8	2.25	2.15	2.0	1.75	1.75
30	1.8	.....	1.95	2.65	3.3	3.00	2.95	2.2	2.1	1.95	1.85	1.75
31	1.8	.....	2.0	.....	3.3	.....	2.75	2.2	.....	1.9	.....	1.7

Daily discharge, in second-feet, of St. Vrain Creek at Lyons, Colo., for 1910.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	18	13	12	26	114	318	258	124	42	36	18	11
2	18	12	10	26	96	353	202	134	42	36	22	12
3	18	12	10	26	80	406	190	105	56	36	22	13
4	18	16	13	31	105	336	190	105	88	36	16	13
5	18	12	16	36	124	318	190	105	105	26	18	11
6	16	12	18	56	96	288	166	88	96	22	18	10
7	18	12	16	48	80	318	154	88	80	26	18	10
8	18	12	18	42	88	273	144	88	80	26	18	11
9	16	12	16	26	96	244	134	88	80	18	16	18
10	16	11	11	26	144	216	134	72	64	22	16	18

Daily discharge, in second-feet, of St. Vrain Creek at Lyons, Colo., for 1910—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
11	13	13	11	36	166	216	134	64	64	22	13	16
12	16	12	13	31	178	216	124	64	64	18	16	18
13	18	12	16	36	166	230	134	72	64	18	16	16
14	18	12	16	31	166	230	134	80	80	18	16	10
15	18	10	26	31	154	230	114	64	72	22	16	11
16	18	13	26	26	134	230	114	56	64	22	13	13
17	22	13	26	26	124	258	114	56	64	31	12	18
18	18	13	26	22	114	216	114	72	72	26	13	13
19	18	13	26	22	114	230	124	72	80	31	16	16
20	18	11	31	26	124	230	190	72	80	36	12	16
21	16	11	31	31	154	230	178	72	88	26	11	16
22	18	13	42	26	124	202	144	80	80	31	16	13
23	18	13	36	22	154	202	124	80	80	36	16	13
24	18	16	36	26	154	190	105	72	64	26	16	16
25	16	16	36	31	166	178	105	64	56	26	13	18
26	13	13	36	42	178	190	105	56	56	26	13	13
27	16	16	36	64	178	144	96	48	48	26	12	12
28	13	16	36	80	230	144	114	56	42	16	11	13
29	13	.....	36	114	258	190	154	56	42	26	12	12
30	13	.....	22	124	288	202	190	48	36	22	16	12
31	13	.....	26	.....	288	.....	144	48	.....	18	.....	11

NOTE.—These discharges are based on one rating curve. These values are published as furnished by the State engineer of Colorado.

Monthly discharge of St. Vrain Creek at Lyons, Colo., for 1910.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
January	22	13	16.7	1,030
February	16	10	12.9	716
March	42	10	23.5	1,440
April	124	22	39.7	2,360
May	288	80	150	9,220
June	406	144	241	14,300
July	258	96	146	8,980
August	134	48	75.8	4,660
September	105	36	67.6	4,020
October	36	16	26.0	1,600
November	22	11	15.0	893
December	18	10	13.6	836
The year	406	10	69.1	50,100

NOTE.—These estimates were computed by the United States Geological Survey from data furnished by the State engineer of Colorado, published herewith.

BOULDER CREEK AT ORODELL, COLO.

This station, which was established March 18, 1907, is located just above the mouth of Fourmile Creek, at Orodell, Colo., about 4 miles above Boulder, Colo. The records are valuable chiefly in connection with power development. Boulder Creek has an immense amount of fall, and the distance from the Continental Divide at its headwaters to the plains at Boulder is only 20 miles.

No diversions are made above the station. The first canal has its intake a short distance below.

The creek is frozen four or five months of the year and discharges for such periods have been estimated by interpolation between discharge measurements and weir records.

The records at this station since May 20, 1907, have been kept and furnished by the Central Colorado Power Co.

The data for 1910 are published as received and have not been verified by engineers of the United States Geological Survey.

Discharge measurements of Boulder Creek at Orodell, Colo., in 1910.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Jan. 11[a]	C. L. Chatfield	7	4.51	0.30	7.36
Feb. 1[a]	do	7.5	4.4	.30	6.50
Feb. 21[a]	do	7.7	4.1	.25	6.10
Mar. 12[b]	Chatfield and Elliott	18.5	10.72	1.60	8.27
Apr. 21[c]	Thomas Grieve	34	29.1	2.25	65.4
June 13[c]	do	48	61.8	2.85	184
July 9[c]	do	34	46.0	2.50	113
July 16[c]	do	33.5	35.7	2.30	76.6
July 27[c]	C. C. Hezmalhalch	36.0	37.65	2.30	74.0
Aug. 13[c]	do	34	29.2	2.15	50.0
Sept. 13[c]	Thomas Grieve	28	18.3	1.93	26.1
Sept. 30[d]	C. L. Chatfield	27	19	1.89	25.6
Nov. 8[c]	Thomas Grieve	23.5	12.6	1.68	4.7
Nov. 30[c]	do	15	4.7	1.30	2.4

[a] Measurement made at temporary station at power house.
[b] Made at Orodell.
[c] Made by wading.
[d] Made from cable.

Daily gage height, in feet, of Boulder Creek at Orodell, Colo., for 1910.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Nov.	Nov.	Dec.
1	0.36	0.28	0.28	1.9	2.4	3.15	2.8	2.35	2.0	1.75	1.7	1.4
2	.30	.28	.25	1.9	2.35	3.2	2.9	2.35	1.9	1.75	1.6	1.45
3	.28	.34	.35	2.0	1.85	3.25	.....	2.35	1.9	1.75	1.6	1.6
4	.31	.34	.38	1.9	2.15	3.2	.....	2.35	1.9	1.75	1.65	1.5
5	.38	.29	.38	1.9	2.25	3.15	.....	2.5	2.05	1.75	1.6	1.6
6	.36	.30	.37	1.95	2.2	3.05	.....	2.45	2.05	1.75	1.6	1.55
7	.30	.30	1.65	1.95	2.3	3.05	.....	2.45	2.05	1.75	1.5	1.45
8	.30	.29	1.65	1.8	2.55	3.0	.....	2.35	2.05	1.75	1.7	1.45
9	.30	.28	1.70	1.55	2.55	2.85	2.5	2.35	2.1	1.8	1.75	1.45
10	.29	.29	1.60	1.55	2.7	2.85	2.45	2.25	2.05	1.75	1.6	1.55
11	.31	.29	1.60	1.65	2.85	2.8	2.45	2.2	1.95	1.7	1.6	1.55
12	.39	.28	1.60	1.8	2.85	2.8	2.45	2.25	1.95	1.7	1.65	1.55
13	.36	.29	1.65	1.8	2.8	2.8	2.45	2.2	1.95	1.7	1.65	1.5
14	.30	.29	1.65	2.15	2.8	2.8	2.35	2.2	2.0	1.7	1.45	1.65
15	.30	.32	1.65	2.15	2.75	2.75	2.25	2.15	2.0	1.6	1.5	1.65
16	.30	[a] .80	1.70	2.15	.....	2.75	2.25	2.15	2.0	1.65	1.55	1.65
17	.30	.65	1.70	2.1	.....	2.7	2.3	2.15	2.0	1.75	1.45	1.6
18	.29	.60	1.75	1.95	.....	2.7	2.35	2.1	2.0	1.9	1.5	.....
19	.28	.29	1.80	2.0	.....	2.7	2.5	2.1	1.9	1.65	1.5	.....
20	.28	.28	1.90	2.05	.....	2.7	2.5	2.15	1.9	1.6	1.5	.....
21	.24	.25	1.95	2.25	1.95	2.7	2.4	2.1	1.85	1.7	1.55	.....
22	.25	.24	2.00	2.15	1.95	2.7	2.4	2.05	1.9	1.75	1.6	.....
23	.25	.25	2.10	2.05	1.95	2.7	2.5	2.25	1.9	1.75	1.6	.....
24	.34	.25	2.05	2.1	1.9	2.7	2.4	2.2	1.8	1.75	1.65	.....
25	.35	.26	2.05	2.25	2.05	2.7	2.35	2.15	1.8	1.8	1.6	.....
26	.85	.28	2.00	2.05	2.15	2.7	2.35	2.05	1.75	1.8	1.5	.....
27	.58	.26	1.90	2.35	2.5	2.7	2.3	2.0	1.8	1.75	1.5	.....
28	.55	.28	1.90	2.25	2.75	2.65	2.4	1.9	1.8	1.75	1.45	.....
29	.40	.....	1.90	2.5	3.0	2.65	2.4	1.9	1.8	1.7	1.4	.....
30	.29	.....	1.75	2.65	3.1	2.75	2.4	1.9	1.8	1.7	1.4	.....
31	.28	.....	1.90	.....	3.15	.....	2.35	2.0	.....	1.75	.....	.....

[a] Probably caused by choking of channel below.

NOTE.—Ice, Jan. 1 to Mar. 7, and Dec. 18 to 31.

Daily discharge, in second-feet, of Boulder Creek at Orodell, Colo., for 1910.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	24	92	254	174	83	33	16	13	4
2	.....	24	83	266	196	83	24	16	9	5
3	.....	33	21	278	152	83	24	16	9	9
4	.....	24	51	266	152	83	24	16	11	6
5	.....	24	66	254	142	112	38	16	9	9
6	.....	28	58	230	132	102	38	16	9	8
7	.....	28	74	230	112	102	38	16	6	5
8	11	18	122	218	112	83	38	16	13	5
9	13	8	122	185	112	83	44	18	16	5
10	9	8	152	185	102	66	38	16	9	8
11	9	11	185	174	102	58	28	13	9	8
12	9	18	185	174	102	66	28	13	11	8
13	11	18	174	174	102	58	28	13	11	6
14	11	51	174	174	85	58	33	13	5	11
15	11	51	163	163	66	51	33	9	6	11
16	13	51	174	163	66	51	33	11	8	11
17	13	44	122	152	74	51	33	16	5	9
18	16	28	51	152	83	44	33	24	6	.....
19	18	33	40	152	112	44	24	11	6	.....
20	24	38	28	152	112	51	24	9	6	.....
21	28	66	28	152	92	44	21	13	8	.....
22	33	51	28	152	92	38	24	16	9	.....
23	44	38	28	152	112	66	24	16	9	.....
24	38	44	24	152	92	58	18	16	11	.....
25	38	66	38	152	83	51	18	18	9	.....
26	33	38	51	152	83	38	16	18	6	.....
27	24	83	112	152	74	33	18	16	6	.....
28	24	66	163	142	92	24	18	16	5	.....
29	24	112	218	142	92	24	18	13	4	.....
30	16	142	242	163	92	24	18	13	4	.....
31	24	.....	254	.....	83	33	.....	16	.....	.....

NOTE.—These discharges are based on one rating curve. They are published as computed by the Central Colorado Power Co. Discharges estimated May 16 to 20 and July 3 to 8.

Monthly discharge of Boulder Creek at Orodell, Colo., for 1910.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
January	.....	.....	[a] 7.3	449
February	.....	.....	[a] 6.5	361
March	44	.....	[a] 18.0	1,110
April	142	8	42.3	2,520
May	254	21	107	6,580
June	278	142	184	10,900
July	196	66	106	6,520
August	112	24	59.5	3,660
September	44	16	27.6	1,640
October	24	9	15.0	922
November	16	4	8.3	494
December	11	.....	[a] 7.3	449
The year	278	.....	49.2	35,600

[a] Discharges estimated Jan. 1 to Mar. 7 and Dec. 18 to 31 by the State engineer of Colorado because of ice conditions.

NOTE.—These estimates have been computed by the United States Geological Survey from data furnished by the Central Colorado Power Co., published herewith.

SOUTH BOULDER CREEK NEAR ROLLINSVILLE, COLO.

This station was established September 10, 1910, by the United States Geological Survey, in cooperation with the United States Forest Service, and is being maintained as a cooperative station.

It is located at highway bridge about 1¼ miles above Rollinsville, and about 3 miles below the mouth of Jenny Creek.

A vertical rod gage, graduated to feet and tenths, is fastened to the right crib abutment of bridge.

Low-water measurements are made by wading; high-water measurements can be made from the highway bridge.

The channel is composed mainly of bowlders and is fairly permanent, but is so rough that the measuring section is poor.

Gage heights are affected by ice during the winter months.

Discharge measurements of South Boulder Creek near Rollinsville, Colo., in 1910.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Sept. 10	W. B. Freeman	14	8.7	0.9	9.4
Sept. 24	S. T. Harding	21	8.9	.87	6.3

NOTE.—These measurements made by wading above the gage.

The following additional gage heights, in feet, were observed by F. D. Whitney:

Date.	Gage height.	Date.	Gage height.	Date.	Gage height.	Date.	Gage height.
Sept. 11	0.9	Sept. 18	0.9	Sept. 23	0.9	Oct. 3	0.8
Sept. 12	.95	Sept. 20	.9	Sept. 25	.8	Oct. 4	.85
Sept. 13	.95	Sept. 21	.95	Oct. 1	.8	Oct. 5	.9
Sept. 14	.95	Sept. 22	.9	Oct. 2	.8	Oct. 6	.9
Sept. 15	.95						

SOUTH BOULDER CREEK NEAR MARSHALL, COLO.

This station, which is located at the mouth of the canyon about 3 miles west of the Colorado & Southern Railway station at Marshall, was maintained under the direction of the United States Geological Survey from 1895 to 1901[1] and since then more or less intermittent records have been obtained under the direction of the State engineer of Colorado.

Two ditches, the more important being the Community ditch, divert water above the station.

The rod gage, which has the same datum as in 1901, is located a short distance below the Community canal.

The drainage area above this station is about 195 square miles.

[1] See Water-Supply Paper U. S. Geol. Survey No. 49, 1901, p. 287.

During 1909 the station was maintained both by the State engineer and by the Denver Reservoir & Irrigation Co., and they have used the same daily gage readings. The daily discharges have been computed from discharge measurements made by both parties and they have both agreed upon them. The Denver Reservoir & Irrigation Co. also obtained records of the flow of the Community ditch.

Ice prevails at this station for several months during the winter.

During 1910 this station was maintained by the State engineer of Colorado. The data are published as furnished by him. They have not been verified by engineers of the United States Geological Survey.

Discharge measurements of South Boulder Creek near Marshall, Colo., in 1910.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
June 13	C. C. Hezmalhalch	38	39.8	1.95	121
July 27	do	28	12.6	1.30	23.1
Aug. 14	do	24.5	17.4	1.40	33
Sept. 30	C. L. Chatfield	21.5	13.0	1.05	8.6
Feb. 1	do	21	9.24	1.10	10.4

NOTE.—All measurements were made by wading at various sections.

Daily gage height, in feet, of South Boulder Creek near Marshall, Colo., for 1910.

[B. E. Chesebro, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.15	1.1	1.1	1.3	1.8	2.2	1.7	1.5	1.1	1.05	1.1	1.0
2	1.2	1.1	1.1	1.3	1.75	2.2	1.7	1.5	1.1	1.05	1.1	1.0
3	1.2	1.1	1.1	1.3	1.75	2.25	1.7	1.4	1.1	1.05	1.1	1.05
4	1.15	1.1	1.1	1.25	1.75	2.2	1.7	1.5	1.1	1.0	1.1	1.1
5	1.1	1.05	1.1	1.25	1.8	2.1	1.65	1.45	1.2	1.1	1.05	.9
6	1.05	1.05	1.1	1.25	1.7	2.1	1.6	1.4	1.15	1.1	1.1	.9
7	1.0	1.05	1.1	1.3	1.7	2.1	1.6	1.35	1.1	1.1	1.1	.9
8	.95	1.0	1.2	1.25	1.7	2.1	1.55	1.35	1.1	1.1	1.1	1.0
9	.9	1.0	1.25	1.25	1.8	2.0	1.5	1.35	1.1	1.1	1.05	1.15
10	.9	1.0	1.15	1.3	1.9	2.0	1.55	1.35	1.1	1.1	1.1	1.15
11	.9	1.0	1.15	1.3	1.9	1.95	1.5	1.3	1.1	1.05	1.05	1.1
12	.95	1.0	1.1	1.3	2.0	2.0	1.5	1.25	1.1	1.05	1.1	1.15
13	.95	1.0	1.15	1.35	1.9	2.0	1.45	1.4	1.1	1.05	1.1	1.1
14	.9	1.1	1.2	1.25	1.95	2.0	1.45	1.4	1.2	1.05	1.05	.9
15	.95	1.0	1.25	1.25	1.9	1.95	1.4	1.3	1.1	1.1	1.1	1.0
16	1.0	1.0	1.25	1.15	1.9	1.9	1.4	1.3	1.1	1.1	1.1	1.05
17	1.0	1.0	1.25	1.15	1.9	1.9	1.6	1.3	1.1	1.1	1.1	1.05
18	1.05	1.0	1.25	1.2	1.9	1.9	1.6	1.3	1.2	1.1	1.1	1.0
19	1.1	1.0	1.3	1.3	1.8	1.85	1.6	1.25	1.2	1.2	1.05	1.0
20	1.1	1.0	1.3	1.4	1.8	1.8	1.55	1.25	1.1	1.15	1.0	1.0
21	1.1	1.05	1.4	1.6	1.9	1.8	1.5	1.2	1.1	1.1	.9	1.05
22	1.1	1.05	1.45	1.5	1.9	1.8	1.5	1.2	1.1	1.15	1.1	1.0
23	1.1	1.0	1.5	1.4	2.0	1.8	1.45	1.2	1.2	1.2	1.1	1.0
24	1.1	1.05	1.35	1.4	1.9	1.8	1.4	1.2	1.1	1.15	1.15	1.05
25	1.1	1.1	1.5	1.5	1.9	1.85	1.35	1.15	1.1	1.15	1.1	1.05
26	1.1	1.1	1.4	1.6	1.9	1.8	1.3	1.15	1.1	1.15	1.05	1.05
27	1.1	1.1	1.4	1.7	1.9	1.8	1.3	1.1	1.1	1.15	1.05	1.0
28	1.1	1.1	1.3	1.8	2.0	1.75	1.5	1.1	1.1	.95	.95	1.0
29	1.1	.....	1.15	1.8	2.05	1.8	1.6	1.1	1.05	1.15	.95	.95
30	1.1	.....	1.3	1.85	2.15	1.8	1.8	1.1	1.05	1.05	.95	.95
31	1.1	.....	1.3	.....	2.2	.....	1.6	1.1	.....	1.1	.....	.9

Daily discharge, in second-feet, of South Boulder Creek near Marshall, Colo., for 1910.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	14	11	11	24	88	173	72	43	11	8	11	6
2	17	11	11	24	80	173	72	43	11	8	11	6
3	17	11	11	24	80	188	72	33	11	8	11	8
4	14	11	11	20	80	173	72	43	11	6	11	11
5	11	8	11	20	88	148	64	38	17	11	8	3
6	8	8	11	20	72	148	57	33	14	11	11	3
7	6	8	11	24	72	148	57	28	11	11	11	3
8	4	6	17	20	72	148	50	28	11	11	11	6
9	3	6	20	20	88	126	43	28	11	11	8	14
10	3	6	14	24	106	126	50	28	11	11	11	14
11	3	6	14	24	106	116	43	24	11	8	8	11
12	4	6	11	24	126	126	43	20	11	8	11	14
13	4	6	14	28	106	126	38	33	11	8	11	11
14	3	11	17	20	116	126	38	33	17	8	8	3
15	4	6	20	20	106	116	33	24	11	11	11	6
16	6	6	20	14	106	106	33	24	11	11	11	8
17	6	6	20	14	106	106	57	24	11	11	11	8
18	8	6	20	17	106	106	57	24	17	11	11	6
19	11	6	24	24	88	97	57	20	17	17	8	6
20	11	6	24	33	88	88	50	20	11	14	6	6
21	11	8	33	57	106	88	43	17	11	11	3	8
22	11	8	38	43	106	88	43	17	11	14	11	6
23	11	6	43	33	126	88	38	17	17	17	11	6
24	11	8	28	33	106	88	33	17	11	14	14	8
25	11	11	43	43	106	97	28	14	11	14	11	8
26	11	11	33	57	106	88	24	14	11	14	8	8
27	11	11	33	72	106	88	24	11	11	14	8	6
28	11	11	24	88	126	80	43	11	11	4	4	6
29	11	.....	14	88	137	88	57	11	8	14	4	4
30	11	.....	24	97	160	88	88	11	8	8	4	4
31	11	.....	24	.....	173	.....	57	11	.....	11	.....	3

NOTE.—These discharges are based on one rating curve. They are published as computed by the State engineer of Colorado.

Monthly discharge of South Boulder Creek near Marshall, Colo., for 1910.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
January	17	3	9.0	553
February	11	6	8.0	444
March	43	11	20.9	1,290
April	97	14	35.0	2,080
May	173	72	104	6,400
June	188	88	118	7,020
July	88	24	49.5	3,040
August	43	11	23.9	1,470
September	17	8	11.9	708
October	17	6	11.4	701
November	14	3	9.3	553
December	14	3	7.1	437
The year	188	3	34.2	24,700

NOTE.—These estimates were computed by the United States Geological Survey from data furnished by the State engineer of Colorado, published herewith.

BIG THOMPSON CREEK BASIN.

DESCRIPTION.

Big Thompson Creek drains the country lying between St. Vrain Creek and Cache la Poudre River. It is one of the largest tributaries of the South Platte, into which it discharges about 4 miles above

the town of Evans. It is joined by Little Thompson Creek a short distance above the point where their combined waters enter the South Platte.

Nearly all the normal flow of Big and Little Thompson creeks is used for irrigation.

BIG THOMPSON CREEK AT ARKINS, COLO.

This station is located at a private wagon bridge 10 or 12 miles above Loveland, and about 400 feet below the Handy dam. Measurements of flow of Big Thompson Creek have been made at or near Arkins since 1888, the earlier records being kept by the State engineer. From 1895 to 1903 the station was maintained under the direction of the United States Geological Survey. Since that time it has been continued more or less intermittently under the direction of the State engineer, by whom all records are furnished.

A rod gage on the bridge pier was established in 1909 at a different datum from the 1903 gage, as the old bench mark could not be found. The Handy ditch diverts water for irrigation above the station. In 1903 this ditch used 17,000 acre-feet of water.

The flow of the creek is affected by ice for several months during the winter season.

Discharge measurements of Big Thompson Creek at Arkins, Colo., in 1910.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Feb. 4[a]	C. L. Chatfield	42	31	1.42	21
Mar. 17[b]	do	42.5	49	1.10	c 27
Apr. 20[b]	Thomas Grieve	36.5	38	1.10	34
June 10[d]	C. C. Hezmalhalch	57.5	124	2.20	310
June 25[d]	do	57.5	111	2.00	265
Aug. 16[b]	do	80	72	1.40	86
Sept. 27[b]	C. L. Chatfield	61	75	1.30	64
Dec. 5[e]	C. C. Hezmalhalch	.....	22.8	.86	6.0

[a] Measurement made through holes cut in ice.
[b] Wading measurement.
[c] No ice.
[d] Made from bridge.
[e] Ice.

Daily gage height, in feet, of Big Thompson Creek at Arkins, Colo., for 1910.

[Miss Minnie Gammon, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.6	1.5	1.15	1.1	1.7	2.75	2.25	1.9	1.3	1.3	0.85	1.15
2	1.65	1.5	1.1	1.0	1.6	2.85	2.1	1.8	1.25	1.3	1.15	1.2
3	1.6	1.3	1.1	.95	1.5	2.9	2.0	1.7	1.25	1.3	1.1	1.1
4	1.55	1.25	1.1	.95	1.65	2.85	2.0	1.5	1.7	1.25	1.1	1.1
5	1.4	1.3	1.1	1.0	1.8	2.55	2.05	1.55	1.85	1.2	1.1	.95
6	1.35	1.25	1.1	1.0	1.65	2.6	2.1	1.5	1.6	1.2	1.1	.85
7	1.3	1.4	1.15	1.0	1.55	2.65	1.9	1.4	1.55	1.2	1.1	1.0
8	1.35	1.45	1.15	1.05	1.5	2.6	2.0	1.35	1.5	1.2	1.15	1.1
9	1.4	1.5	1.15	1.05	1.7	2.3	2.0	1.3	1.45	1.2	1.15	1.2
10	1.35	1.5	1.15	1.1	1.9	2.15	1.75	1.3	1.4	1.2	1.15	1.2

Daily gage height, in feet, of Big Thompson Creek at Arkins, Colo., for 1910—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
11	1.35	1.5	1.1	1.1	2.1	2.2	1.7	1.3	1.35	1.15	1.1	1.2
12	1.35	1.5	1.1	1.15	2.15	2.45	1.6	1.4	1.5	1.15	1.1	1.15
13	1.3	1.4	1.1	1.2	2.1	2.4	1.7	1.5	1.55	1.15	1.1	1.05
14	1.2	1.4	1.1	1.15	2.05	2.5	1.7	1.6	1.55	1.2	1.1	1.1
15	1.35	1.3	1.1	1.1	2.0	2.4	1.7	1.5	1.55	1.2	1.1	1.15
16	1.4	1.3	1.1	1.1	1.9	2.45	1.65	1.4	1.5	1.2	1.1	1.1
17	1.3	1.4	1.1	1.2	1.8	2.4	1.8	1.4	1.6	1.25	1.05	1.1
18	1.3	1.4	1.1	1.1	1.7	2.3	1.8	1.35	1.6	1.25	1.05	1.0
19	1.3	1.4	1.1	1.1	1.75	2.4	1.8	1.3	1.65	1.2	1.05	.95
20	1.3	1.4	1.1	1.15	1.85	2.35	1.9	1.3	1.7	1.25	.95	1.05
21	1.4	1.45	1.2	1.25	2.0	2.2	1.9	1.3	1.7	1.2	1.0	.95
22	1.4	1.45	1.2	1.25	1.9	2.2	1.8	1.4	1.7	1.25	1.1	1.05
23	1.4	1.45	1.2	1.2	1.9	2.2	1.7	1.45	1.7	1.2	1.1	1.1
24	1.4	1.5	1.3	1.2	1.9	2.2	1.6	1.45	1.5	1.2	1.1	1.1
25	1.4	1.5	1.3	1.3	2.0	2.15	1.5	1.4	1.45	1.2	1.05	1.15
26	1.35	1.45	1.3	1.4	2.0	2.0	1.5	1.3	1.45	1.15	1.0	1.05
27	1.45	1.4	1.2	1.55	2.0	2.0	1.6	1.2	1.4	1.05	.95	1.0
28	1.5	1.35	1.2	1.65	2.2	2.0	2.0	1.2	1.4	.9	1.0	.9
29	1.5	.....	1.2	1.8	2.55	2.25	2.3	1.3	1.3	.9	1.1	.8
30	1.5	.....	1.05	1.8	2.75	2.5	2.45	1.3	1.3	.9	1.05	.8
31	1.5	.....	1.2	.....	2.8	.....	2.25	1.3	.....	.9	.....	.8

NOTE.—Ice from January 1 to about February 28.

Daily discharge, in second-feet, of Big Thompson Creek at Arkins, Colo., for 1910.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	.....	39	30	162	517	338	222	66	66	5	39
2	.....	.....	30	17	135	555	288	192	57	66	39	48
3	.....	.....	30	12	110	574	255	162	57	66	30	30
4	.....	.....	30	12	148	555	255	110	162	57	30	30
5	.....	.....	30	17	192	442	272	122	207	48	30	12
6	.....	.....	30	17	148	460	288	110	135	48	30	6
7	.....	.....	39	17	122	479	222	86	122	48	30	17
8	.....	.....	39	24	110	460	255	76	110	48	39	30
9	.....	.....	39	24	162	355	255	66	98	48	39	48
10	.....	.....	39	30	222	304	177	66	86	48	39	48
11	.....	.....	30	30	288	320	162	66	76	39	30	48
12	.....	.....	30	39	304	408	135	86	110	39	30	39
13	.....	.....	30	48	288	390	162	110	122	39	30	24
14	.....	.....	30	39	272	425	162	135	122	48	30	30
15	.....	.....	30	30	255	390	162	110	122	48	30	39
16	.....	.....	30	30	222	408	148	86	110	48	30	30
17	.....	.....	30	48	192	390	192	86	135	57	24	30
18	.....	.....	30	30	162	355	192	76	135	57	24	17
19	.....	.....	30	30	177	390	192	66	148	48	24	12
20	.....	.....	30	39	207	372	222	66	162	57	12	24
21	.....	.....	48	57	255	320	222	66	162	48	17	12
22	.....	.....	48	57	222	320	192	86	162	57	30	24
23	.....	.....	48	48	222	320	162	98	162	48	30	30
24	.....	.....	66	48	222	320	135	98	110	48	30	30
25	.....	.....	66	66	255	304	110	86	98	48	24	39
26	.....	.....	66	86	255	255	110	66	98	39	17	24
27	.....	.....	48	122	255	255	135	48	86	24	12	17
28	.....	.....	48	148	320	255	255	48	86	8	17	8
29	.....	.....	48	192	442	338	355	66	66	8	30	5
30	.....	.....	24	192	517	425	408	66	66	8	24	5
31	.....	.....	48	.....	536	.....	338	66	.....	8	.....	5

NOTE.—These discharges are based on one rating curve. They are published as computed by the State engineer of Colorado.

Monthly discharge of Big Thompson Creek at Arkins, Colo., for 1910.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
January	.....	.....	[a] 28.7	1,760
February	.....	.....	[a] 25.9	1,440
March	66	24	38.8	2,390
April	192	12	52.6	3,130
May	536	110	238	14,600
June	574	255	389	23,100
July	408	110	218	13,400
August	222	48	93.3	5,740
September	207	57	115	6,840
October	66	8	44.1	2,710
November	39	5	26.9	1,600
December	48	5	25.8	1,590
The year	574	.....	108	78,300

[a] Discharge Jan. 1 to Feb. 28 estimated by the State Engineer of Colorado.

NOTE.—These estimates have been computed by the United States Geological Survey from data furnished by the State engineer of Colorado, published herewith.

CACHE LA POUDRE RIVER BASIN.

DESCRIPTION.

Cache la Poudre River is the largest and the northernmost of the tributaries discharging from the east front of the Rocky Mountains into the South Platte. During the irrigation season its discharge is augmented by the supply diverted from the headwaters of Laramie River, which heads immediately west of the headwaters of the Cache la Poudre, the diversion being made through a canal known as the Sky Line canal. Measurements of the discharge of the Cache la Poudre basin therefore include some of the Laramie waters. As is the case with other streams of this region, the normal flow is almost entirely consumed for irrigation, and even the greater part of the flood waters is stored for late use. The earliest and most thorough irrigation of the State is carried on along this stream.[1]

CACHE LA POUDRE RIVER NEAR ELKHORN, COLO.

This station, which was established January 6, 1909, to determine the amount of water available for storage and power development, is located at the lower bridge at Fry's ranch, on the stage line, 50 miles above Fort Collins, 7 miles above Elkhorn post office, and 20 miles below Chambers Lake.

Sheep Gulch comes in about a mile above the station and Elkhorn Creek enters about 8 miles below. The drainage area is about 250 square miles, at elevations from 7,500 to 11,500 feet.

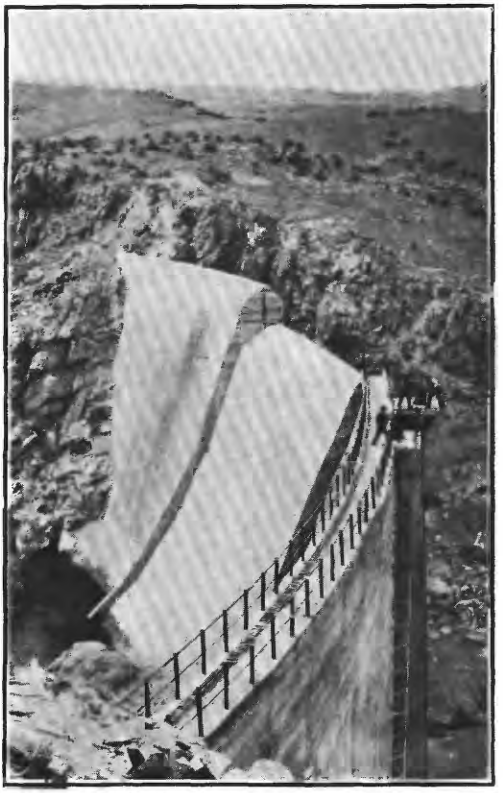
No water is diverted for irrigation above the station, but the North Grand ditch has been diverting water from the North Fork of Grand River into the Cache la Poudre, above the station, for a number of

[1] See Water-Supply Paper U. S. Geol. Survey No. 9, and Dept. of Agr. Office of Experiment Stations, Bull. No. 92.

A. ICE ON CACHE LA POUDRE RIVER NEAR HOME, COLO.

B. GAGING STATION ON CACHE LA POUDRE RIVER AT FRY'S RANCH, NEAR ELKHORN, COLO.

Showing method of making discharge measurement under ice.



A. HALLIGAN DAM, 72 FEET HIGH, ON NORTH FORK OF CACHE LA POUDRE RIVER NEAR LIVERMORE, COLO.

Looking across dam; spillway about 10 feet below crest.

B. BRISTOL AUTOMATIC GAGE USED AT GAGING STATION ON LARAMIE RIVER AT GLENDEVEY, COLO.

years, and the Chambers Lake reservoir has been used to regulate the flow for irrigation below. The proposed Roosevelt reservoir, which is to be used in connection with a power project, is located about 3 miles above the station and will have a capacity of 117,000 acre-feet, with a dam 231 feet high above the stream bed.

Discharge measurements at high and medium stages are made from the highway bridge, upon which the chain gage is located. Winter measurements are made through the ice. (See Pl. III.)

The stream flow is affected by ice for several months each winter.

During 1909 and 1910 frequent measurements were made by parties cooperating with the United States Geological Survey through George B. McFadden, an engineer of Denver, Colo. Computations of daily and monthly discharges have been made by engineers of the United States Geological Survey.

In developing rating curves for this station for 1909 the discharge measurements were considered in groups as the channel conditions are permanent, though rough. Owing to the erratic plotting of high-water measurements, the estimates for this period should be used with caution. For 1910 individual measurements were plotted, properly weighted, and rating curves developed.

A peculiarity has been noted in the rating for this station for 1909 and 1910. Above gage height 5.0 feet the measurements show that a second curve, parallel to the main curve and giving smaller discharges for the same gage heights, should be used for certain periods. This temporary change in the rating may be due to obstructions on the control below the gage or to insufficient channel capacity.

Discharge measurements of Cache la Poudre River near Elkhorn, Colo., in 1901.[a]

Date.	Width.	Area of section.	Gage height.	Discharge.	Date.	Width.	Area of section.	Gage height.	Discharge.
	Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Jan. 1	20	51	3.10	43	Feb. 7	20	40	2.50	27
2	20	43	2.74	32	8	20	40	2.54	26
3	20	43	2.74	34	9	20	42	2.62	25
12	20	45	2.77	26	10	20	46	2.78	23
13	20	61	3.58	32	11	20	44	2.66	22
14	20	51	3.14	32	13	20	42	2.60	27
15	20	41	2.60	30	14	20	40	2.50	22
16	20	39	2.54	33	19	20	40	2.48	29
17	20	39	2.53	30	22	20	40	2.47	14
18	20	43	2.68	25	23	20	40	2.53	21
19	20	39	2.54	24	24	20	42	2.64	23
20	20	37	2.43	21	25	20	44	2.68	24
21	20	39	2.51	23	26	20	44	2.69	26
22	20	37	2.43	24	27	20	46	2.80	27
23	20	39	2.47	29	28	20	40	2.53	21
24	20	39	2.53	31	Mar. 1	20	46	2.79	24
25	20	39	2.50	30	2	20	44	2.74	26
26	20	37	2.41	20	3	20	48	2.86	30
28	20	39	2.48	25	4	20	44	2.60	32
29	20	39	2.50	30	5	20	44	2.70	49
30	20	45	2.81	23	6	20	38	2.40	30
31	20	41	2.63	25	7	20	44	2.71	54
Feb. 1	20	41	2.63	28	8	20	44	2.74	59
3	20	41	2.64	30	9	20	42	2.62	45
4	20	44	2.70	29	10	20	36	2.29	24
5	20	42	2.60	29	11	20	42	2.58	48
6	20	40	2.52	26	12	20	34	2.22	21

[a] Measurements Jan. 1 to 24 by H. Mertens; Jan. 25 to Oct. 31 by N. W. Fry; Nov. 1 to 12 by H. Mertens (second measurement on Nov. 4 and first measurement on Nov. 5 made by W. B. Freeman); Nov. 13 to Dec. 31 by N. W. Fry. Ice Jan. 1 to Mar. 10 and Dec. 6 to 31.

Discharge measurements of Cache la Poudre River near Elkhorn, Colo., in 1901—Contd.

Date.	Width.	Area of section.	Gage height.	Discharge.
	Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Mar. 13	20	36	2.33	25
14	20	38	2.41	32
15	20	38	2.41	34
16	20	38	2.37	32
17	24	44	2.50	41
18	24	43	2.49	39
19	24	43	2.50	40
20	35	54	2.48	39
21	35	54	2.48	41
22	35	54	2.51	45
23	35	58	2.59	56
24	35	54	2.52	48
25	35	54	2.52	44
26	35	58	2.60	57
27	35	54	2.54	44
28	35	54	2.52	40
30	35	59	2.60	50
31	35	66	2.84	82
Apr. 1	35	58	2.58	46
2	35	54	2.50	41
3	35	54	2.54	44
4	35	54	2.54	44
5	35	58	2.61	50
6	35	54	2.48	39
7	35	54	2.53	45
8	35	58	2.57	47
9	35	58	2.64	51
10	35	61	2.74	62
11	35	65	2.79	73
12	35	65	2.82	76
13	35	65	2.81	74
14	35	65	2.81	77
15	35	61	2.73	61
16	35	65	2.78	73
17	35	58	2.63	53
18	35	66	2.76	70
19	35	68	2.87	82
20	39.6	78	3.07	113
21	39.6	93	3.34	155
22	39.6	77	3.13	117
23	39.6	77	3.08	116
24	39.6	85	3.30	154
25	39.6	109	3.56	176
26	39.6	110	3.60	191
27	39.6	117	3.83	264
28	39.6	131	4.18	366
29	39.6	147	4.56	492
30	39.6	153	4.48	454
May 3	39.6	115	3.80	287
4	39.6	119	3.90	303
5	39.6	135	4.26	428
6	39.6	127	4.08	353
7	39.6	125	3.96	326
8	39.6	120	3.89	291
9	39.6	139	4.38	443
10	39.6	158	4.90	616
11	39.6	162	4.98	716
12	39.6	167	5.10	807
13	39.6	166	5.06	754
14	39.6	162	4.98	684
15	39.6	144	5.02	669
16	39.6	143	4.50	518
17	39.6	135	4.32	421
18	39.6	140	4.42	472
19	39.6	139	4.44	529
20	39.6	147	4.58	582
21	39.6	143	4.50	570
22	39.6	140	4.39	437
23	39.6	140	4.44	496
24	39.6	150	4.66	591
25	39.6	154	4.82	607
26	39.6	158	4.90	632
27	39.6	158	4.94	623
28	39.6	170	5.56	1,004
29	39.6	198	5.88	1,237
30	39.6	206	6.08	1,531
31	39.6	198	5.94	1,439
June 1	39.6	202	5.99	1,480
2	39.6	201	6.20	1,593
June 4	39.6	206	6.15	1,461
5	39.6	206	6.00	1,210
6	39.6	195	5.71	1,085
7	39.6	191	5.60	1,021
8	39.6	188	5.54	956
9	39.6	187	5.50	885
10	39.6	177	5.28	832
11	39.6	175	5.22	819
12	39.6	170	5.28	856
13	39.6	177	5.27	838
14	39.6	183	5.45	918
15	39.6	179	5.29	922
16	39.6	175	5.20	837
17	39.6	175	5.22	812
18	39.6	172	5.12	751
19	39.6	179	4.98	668
20	39.6	167	5.02	668
21	39.6	168	4.99	655
22	39.6	160	4.77	595
23	39.6	158	4.76	588
24	39.6	152	4.56	561
25	39.6	144	4.43	455
26	39.6	149	4.48	517
27	39.6	144	4.43	448
28	39.6	144	4.40	452
29	39.6	149	4.52	532
30	39.6	152	4.61	586
July 1	39.6	148	4.48	502
2	39.6	144	4.37	455
3	39.6	141	4.26	393
4	39.6	138	4.25	400
5	39.6	144	4.38	464
6	39.6	136	4.16	354
7	39.6	131	4.06	323
8	39.6	129	4.00	301
9	39.6	124	3.94	288
10	39.6	124	3.92	280
11	39.6	120	3.83	261
12	39.6	120	3.76	242
13	39.6	116	3.69	228
14	39.6	116	3.67	225
15	39.6	112	3.60	203
16	39.6	112	3.60	195
17	39.6	112	3.63	214
18	39.6	120	3.82	246
19	39.6	116	3.69	229
20	39.6	120	3.77	254
21	39.6	116	3.71	235
22	39.6	112	3.64	206
23	39.6	112	3.56	202
24	39.6	108	3.47	181
25	39.6	104	3.37	162
26	39.6	100	3.30	144
27	39.6	96	3.24	134
28	39.6	116	3.68	226
30	39.6	132	4.12	336
31	39.6	116	3.66	215
Aug. 1	39.6	108	3.53	187
2	39.6	104	3.43	160
3	39.6	98	3.35	142
4	39.6	95	3.24	132
5	39.6	99	3.28	144
6	39.6	95	3.22	136
7	39.6	94	3.12	113
8	39.6	85	3.06	108
9	38	79	3.02	101
10	38	65	3.00	99
11	38	85	2.98	98
12	38	85	3.04	98
13	39.6	99	3.16	118
14	39.6	89	3.19	130
15	39.6	89	3.16	125
16	38	85	3.02	103
17	38	82	2.93	88
18	38	81	2.92	86
19	38	81	2.90	88
20	38	81	2.86	80
21	38	81	2.91	87
22	38	81	2.92	88

Discharge measurements of Cache la Poudre River near Elkhorn, Colo., 1901—Contd.

Date.	Width.	Area of section.	Gage height.	Discharge.	Date.	Width.	Area of section.	Gage height.	Discharge.
	Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Aug. 23	38	81	2.89	85	Oct. 25	38	73	2.72	57
24	38	77	2.84	74	26	38	77	2.77	60
25	38	77	2.81	72	27	38	73	2.74	60
26	38	74	2.74	62	28	38	73	2.66	52
27	38	81	2.90	83	29	38	73	2.71	61
28	38	89	3.10	108	30	38	72	2.64	52
29	38	85	2.97	93	31	38	73	2.68	55
30	38	81	2.90	85	Nov. 1	38	73	2.72	58
31	38	77	2.81	72	2	38	73	2.68	55
Sept. 1	38	77	2.82	71	3	38	72	2.66	50
2	38	73	2.74	63	4	38	76	2.80	65
3	38	77	2.78	68	4	38	69	[a] 2.71	54
4	39.6	112	3.60	201	5	36	62	[b] 2.60	40
5	39.6	96	3.31	143	5	38	68	2.53	39
6	39.6	97	3.32	138	6	38	66	2.51	35
7	38	87	2.98	88	7	38	70	2.60	50
8	38	79	2.84	73	8	38	70	2.61	48
9	38	87	2.96	92	9	38	70	2.60	48
10	38	87	2.98	99	10	38	70	2.64	51
11	38	83	2.88	80	11	38	72	2.59	45
12	38	94	3.19	134	12	38	70	2.64	51
13	38	94	3.21	127	13	38	59	2.58	49
14	39.6	110	3.57	190	13	38	59	2.58	48
15	39.6	96	3.33	140	14	38	59	2.58	46
16	38	94	3.21	129	16	38	59	2.62	48
17	39.6	98	3.44	163	17	37.5	57	2.52	36
18	39.6	114	3.70	205	18	38	59	2.2	49
19	39.6	110	3.61	196	19	37.5	56	2.54	41
20	39.6	101	3.37	153	20	36	45	2.16	15
21	39.6	106	3.49	170	21	38	67	2.80	74
22	38	103	3.36	157	22	38	59	2.59	40
23	38	102	3.32	135	23	38	63	2.69	56
24	38	86	3.22	116	24	38	59	2.60	45
25	38	89	3.12	109	25	37.5	54	2.53	39
26	38	93	3.20	118	26	37.5	56	2.51	40
27	38	89	3.10	101	28	38	70	2.92	68
28	38	85	3.03	91	29	38	59	2.61	45
29	38	89	2.98	86	30	38	63	2.66	53
30	38	85	2.96	90	Dec. 1	38	77	2.93	75
Oct. 1	38	81	2.91	81	2	37	49	2.28	24
2	38	81	2.90	76	3	38	59	2.58	42
3	38	81	2.90	79	6	37	67	2.84	26
4	38	74	2.69	61	8	36.5	66	2.69	37
5	38	74	2.66	55	9	38	69	2.76	61
6	38	74	2.66	56	10	37.5	65	2.71	56
7	38	77	2.83	72	11	38	58	2.68	43
8	38	77	2.80	70	12	38	55	2.67	46
9	38	77	2.76	63	13	38	39	2.26	19
10	38	74	2.73	57	14	38	36	2.20	15
11	38	73	2.70	56	15	38	77	3.38	42
12	38	70	2.58	45	16	38	65	3.22	46
13	38	70	2.60	47	17	38	70	3.24	40
14	38	70	2.62	48	18	38	50	2.84	34
15	38	70	2.64	52	19	38	58	3.02	43
16	38	73	2.69	51	20	38	50	2.79	37
17	38	77	2.78	63	22	58	47	2.71	38
18	38	81	2.91	76	24	38	70	3.27	50
20	38	74	2.70	55	25	38	52	2.89	39
21	38	81	2.92	83	26	38	46	2.76	35
22	38	78	2.76	63	27	38	62	3.34	43
23	38	77	2.80	67	30	38	41	2.76	26
24	38	75	2.71	56					

[a] Thin ice. [b] Thin ice and slush at edges; probably not enough to affect results.

Daily gage height, in feet, of Cache la Poudre River near Elkhorn, Colo., for 1910.

[Norman W. Fry, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.1	2.65	2.8	2.6	4.1	6.0	4.5	3.55	2.8	2.90	2.70	2.35
2	2.75	2.65	2.75	2.5	3.9	6.2	4.35	3.45	2.75	2.90	2.70	2.30
3	2.75	2.65	2.85	2.55	3.8	6.15	4.25	3.35	2.8	2.90	2.65	2.60
4	2.7	2.7	2.6	2.55	3.9	6.15	4.25	3.25	3.6	2.70	2.80	2.40
5	2.9	2.6	2.7	2.6	4.25	6.0	4.4	3.3	3.3	2.65	2.55	2.60

Daily gage height, in feet, of Cache la Poudre River near Elkhorn, Colo., for 1910—Contd.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
6	3.6	2.5	2.4	2.5	4.1	5.7	4.15	3.2	3.3	2.65	2.50	2.85
7	2.9	2.5	2.7	2.55	3.95	5.6	4.05	3.1	3.0	2.85	2.60	2.80
8	2.8	2.55	2.75	2.55	3.9	5.55	4.0	3.05	2.85	2.80	2.60	2.70
9	2.65	2.6	2.6	2.65	4.4	5.5	3.95	3.0	2.95	2.75	2.60	2.75
10	2.75	2.8	2.3	2.75	4.9	5.3	3.9	3.0	3.0	2.75	2.65	2.70
11	2.7	2.65	2.6	2.8	5.0	5.2	3.85	3.0	2.9	2.70	2.60	2.70
12	2.75	2.6	2.2	2.8	5.1	5.3	3.75	3.05	3.2	2.60	2.65	2.65
13	3.6	2.6	2.35	2.8	5.05	5.25	3.7	3.15	3.2	2.60	2.60	2.25
14	3.15	2.5	2.4	2.8	5.0	5.45	3.65	3.2	3.55	2.60	2.60	2.20
15	2.6	2.75	2.4	2.75	5.0	5.3	3.6	3.15	3.35	2.65	2.65	3.40
16	2.55	2.4	2.35	2.8	4.5	5.2	3.6	3.0	3.2	2.70	2.60	3.20
17	2.55	2.6	2.5	2.65	4.3	5.1	3.65	2.95	3.45	2.80	2.50	3.25
18	2.7	2.4	2.5	2.75	4.4	5.2	3.8	2.9	3.7	2.90	2.60	2.85
19	2.55	2.5	2.5	2.85	4.45	5.0	3.7	2.9	3.6	2.85	2.55	3.00
20	2.45	2.45	2.5	3.05	4.6	5.0	3.75	2.85	3.35	2.70	2.15	2.80
21	2.5	2.55	2.5	3.35	4.5	5.0	3.7	2.9	3.5	2.90	2.80	2.90
22	2.45	2.45	2.5	3.15	4.4	4.75	3.65	2.9	3.35	2.75	2.60	2.70
23	2.45	2.55	2.6	3.10	4.45	4.75	3.55	2.9	3.3	2.80	2.70	3.20
24	2.55	2.65	2.5	3.3	4.65	4.55	3.45	2.85	3.2	2.70	2.60	3.25
25	2.5	2.7	2.5	3.55	4.8	4.45	3.35	2.8	3.1	2.70	2.55	2.90
26	2.4	2.7	2.6	3.6	4.9	4.5	3.3	2.75	3.2	2.75	2.55	2.75
27	2.5	2.8	2.55	3.85	4.95	4.45	3.25	2.9	3.1	2.75	2.35	3.35
28	2.5	2.55	2.5	4.2	5.55	4.4	3.7	3.1	3.05	2.65	2.90	3.00
29	2.5	.....	2.4	4.55	5.9	4.5	3.7	2.95	3.0	2.70	2.60	2.80
30	2.8	.....	2.6	4.5	6.05	4.6	4.1	2.9	2.95	2.65	2.65	2.75
31	2.65	.....	2.85	.....	5.95	.....	3.65	2.8	.....	2.70	.....	2.85

NOTE.—Ice Jan. 1 to Mar. 10 and Dec. 6 to 31.

Daily discharge, in second-feet, of Cache la Poudre River near Elkhorn, Colo., for 1910.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	43	28	24	46	350	a1,480	510	195	68	80	56	27
2	32	29	26	38	288	a1,590	445	173	62	80	56	24
3	34	30	30	42	256	1,430	405	152	68	80	51	46
4	34	29	32	42	288	1,430	405	133	206	56	68	30
5	32	29	49	46	405	1,320	465	142	142	51	42	46
6	32	26	30	38	350	1,100	368	124	142	51	38	26
7	30	27	54	42	303	1,020	334	108	94	74	46	31
8	30	26	59	42	288	992	318	101	74	68	46	37
9	28	25	45	51	465	960	303	94	87	62	46	61
10	28	23	24	62	a 616	835	288	94	94	62	51	56
11	26	22	46	68	a 716	780	270	94	80	56	46	43
12	26	25	20	68	a 807	835	243	101	124	46	51	46
13	32	27	27	68	a 754	808	230	116	124	46	46	19
14	32	22	30	68	a 684	927	218	124	195	46	46	15
15	30	22	30	62	a 669	835	206	116	152	51	51	42
16	33	24	27	68	510	780	206	94	124	56	46	46
17	30	26	38	51	425	725	218	87	173	68	38	40
18	25	29	38	62	465	780	256	80	230	80	46	34
19	24	29	38	74	488	675	230	80	206	74	42	43
20	21	27	38	101	555	675	243	74	152	56	19	37
21	23	25	38	152	510	a 675	230	80	184	80	68	38
22	24	23	38	116	465	a 595	218	80	152	62	46	38
23	29	21	46	108	488	a 588	195	80	142	68	56	44
24	31	23	38	142	580	532	173	74	124	56	46	50
25	30	24	38	195	a 607	487	152	68	108	56	42	39
26	20	26	46	206	625	510	142	62	124	62	42	35
27	22	27	42	272	650	488	133	80	108	62	27	43
28	25	21	38	385	992	465	230	108	101	51	80	38
29	30	.....	30	532	a1,240	510	230	87	94	56	46	32
30	23	.....	46	510	a1,530	555	350	80	87	51	51	26
31	25	.....	74	.....	a1,440	.....	218	68	.....	56	.....	26

a Discharge measurement used.

NOTE.—These discharges are based on rating curves applicable as follows, except as indicated in footnote above: Mar. 11 to May 24 and June 24 to Dec. 5, well defined below 765 second-feet; May 26 to June 21, fairly well defined. Discharges estimated or interpolated Jan. 4 to 11, 27, Feb. 2, 12, 15 to 18, 20 to 22, Dec. 7, 21, 23, 28, 29, and 31. Discharges obtained from discharge measurements for other days, Jan. 1 to Mar. 11 and Dec. 6 to 31.

Monthly discharge of Cache la Poudre River near Elkhorn, Colo., for 1910.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
January	43	20	28.5	1,750	A.
February	30	21	25.5	1,420	A.
March	74	20	38.0	2,340	A.
April	532	38	125	7,440	A.
May	1,530	256	607	37,300	B.
June	1,590	465	846	50,300	B.
July	510	133	272	16,700	A.
August	195	62	102	6,270	A.
September	230	62	127	7,560	A.
October	80	46	61.4	3,780	A.
November	80	19	47.5	2,830	A.
December	61	15	37.4	2,300	A.
The year	1,590	15	193	140,000	

CACHE LA POUDRE RIVER NEAR FORT COLLINS, COLO.

This station, which was established January 8, 1909, to determine the amount of water available for storage, irrigation, and power development, is situated about 1,000 feet below the Fort Collins waterworks intake, 16 miles above Fort Collins, and 500 yards above the mouth of the North Fork of the Cache la Poudre.

The station is below all tributaries above the North Fork.

Practically no water is diverted from the main stream or its tributaries above the station, with the exception of that taken for the Fort Collins water supply.

Discharge measurements are taken from a cable about 120 yards downstream from the vertical rod gage, which is driftbolted to a cliff on the left bank, and which has remained constant. Winter and low-water measurements are made by wading.

Ice affects the gage heights for several months each winter.

All of the ordinary flow and a considerable proportion of the flood waters have been filed upon for irrigation below, but if the flood waters are stored opportunities for power development will be afforded.

The proposed Elkhorn reservoir, the dam for which is to be located 2 miles below the mouth of Elkhorn Creek, will have a capacity of 113,000 acre-feet with a dam 400 feet high, and the proposed Stove Prairie reservoir, located 8 miles above the gaging station, will have a capacity of 26,500 acre-feet with a dam 200 feet high.

During 1909 and 1910 frequent measurements were made by parties cooperating with the United States Geological Survey through George B. McFadden, an engineer of Denver, Colo. Computations of daily and monthly discharges have been made by engineers of the United States Geological Survey. In developing the rating table for this station for 1909 the discharge measurements were considered in groups, as the channel conditions are permanent, though rough. For 1910 individual measurements were plotted, properly weighted, and a rating curve developed.

Discharge measurements of Cache la Poudre River near Fort Collins, Colo., in 1910.

[By engineers of the United States Geological Survey.]

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Mar. 5[a]	G. J. Lyon	40	37	2.0	52
June 1[b]	Bolster and Freeman	75	342	5.75	1,910
28[a]	Freeman and Turner	73	167	3.72	561
Oct. 9[a]	Padgett and Miles	51	57	2.20	77

[a] Wading measurement. [b] From cable.

Discharge measurements of Cache la Poudre River near Fort Collins, Colo., in 1910.

[By Fred Stearley.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
Jan. 1	2.70	55	Mar. 12	2.00	65	Aug. 7	2.7	178
2	2.65	52	13	2.05	79	8	2.5	147
3	2.70	55	14	1.90	56	11	2.5	132
4	2.75	60	15	1.90	53	15	2.7	176
5	2.60	54	19	1.95	59	18	2.45	139
6	2.70	56	23	2.15	90	22	2.35	114
7	2.50	48	24	2.12	89	27	2.25	95
8	2.45	43	27	2.10	81	31	2.3	104
9	2.40	36	30	1.90	50	Sept. 2	2.2	92
10	2.60	52	31	2.20	100	5	2.8	182
11	2.60	54	Apr. 1	2.25	105	7	2.5	143
12	2.70	61	4	2.01	152	10	2.4	116
13	2.70	62	7	2.10	172	14	2.7	184
14	2.75	68	11	2.20	164	17	2.5	143
15	2.75	68	14	2.30	116	22	2.8	205
16	2.80	75	16	2.25	102	28	2.5	134
17	2.75	58	18	2.20	96	Oct. 3	2.35	108
18	2.70	54	22	2.75	182	6	2.2	88
19	2.62	53	23	2.60	159	8	2.3	97
20	2.60	53	24	2.50	153	11	2.15	86
21	2.65	44	27	3.25	409	15	2.10	82
22	2.65	43	28	3.65	515	18	2.3	102
23	2.65	58	29	4.0	654	21	2.2	93
24	2.65	54	May 2	3.4	354	25	2.15	86
25	2.65	53	5	3.7	466	27	2.15	88
26	2.50	42	7	3.3	348	29	2.2	95
27	2.50	43	10	4.25	789	Nov. 1	2.1	82
28	2.50	41	11	4.5	938	3	2.1	85
29	2.50	43	12	4.65	1,040	6	2.0	75
30	2.45	41	15	4.3	788	8	2.2	96
31	2.45	43	20	3.8	564	11	2.1	82
Feb. 1	2.49	42	25	4.4	882	13	2.05	73
2	2.42	41	29	5.2	1,274	16	2.05	74
3	2.45	43	June 6	5.2	1,260	19	2.1	83
4	2.30	38	9	4.7	1,090	21	1.9	56
5	2.40	38	12	4.6	988	24	1.9	58
6	2.40	38	15	4.6	1,040	27	2.1	63
7	2.30	38	18	4.2	722	30	2.4	70
8	2.40	38	22	4.1	697	Dec. 2	2.0	61
9	2.20	37	25	3.9	652	5	1.85	54
10	2.30	37	28	3.7	500	8	1.9	53
12	2.45	41	July 1	3.7	510	11	2.1	40
15	2.10	32	5	3.5	392	13	1.95	55
17	1.80	28	10	3.2	405	16	1.9	51
19	2.40	48	15	3.0	222	19	1.9	49
22	2.30	36	18	3.2	316	21	2.0	40
26	2.42	49	22	3.0	222	25	2.0	39
28	2.30	37	25	2.8	217	27	2.06	34
Mar. 1	2.25	52	30	3.45	437	29	1.9	48
4	1.95	60	Aug. 3	2.8	188	31	2.3	32
8	2.20	97						

NOTE.—Ice Jan. 1 to Mar. 1 and Nov. 27 to 31. Beginning Apr. 27 the hydrographer used 0.2 and 0.6 depth method instead of 0.2 and 0.8 depth method. Measurements Apr. 27 to July 22, July 30, Aug. 3, Sept 2, 14, and 22 have been corrected from the original current meter notes using the recorded velocities for the 0.6 points. These measurements, however, are not as reliable as other measurements made by the 0.2 and 0.8 depth method.

Daily gage height, in feet, of Cache la Poudre River near Fort Collins, Colo., for 1910.

[Fred Stearley, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.7	2.45	2.25	2.25	3.45	5.75	3.75	3.05	2.2	2.4	2.1	2.15
2	2.65	2.4	2.25	2.1	3.4	6.0	3.7	2.95	2.2	2.35	2.15	1.95
3	2.7	2.4	2.05	2.05	3.35	5.8	3.6	2.8	2.2	2.3	2.1	1.9
4	2.7	2.35	2.0	1.95	3.55	5.5	3.5	2.65	2.4	2.3	2.15	1.9
5	2.7	2.4	1.95	1.9	3.75	4.95	3.5	2.6	2.75	2.25	2.15	1.7
6	2.7	2.4	2.1	1.95	3.45	5.15	3.4	2.7	2.6	2.2	2.05	1.55
7	2.5	2.3	2.1	2.1	3.3	5.0	3.4	2.65	2.45	2.2	2.0	1.75
8	2.4	2.35	2.2	2.1	3.4	4.8	3.3	2.5	2.35	2.25	2.2	1.9
9	2.45	2.2	2.1	2.1	3.85	4.65	3.25	2.45	2.3	2.2	2.1	2.05
10	2.6	2.35	1.9	2.2	4.25	4.55	3.2	2.5	2.4	2.2	2.0	2.15
11	2.6	2.4	2.05	2.2	4.35	4.45	3.15	2.55	2.3	2.15	2.1	2.0
12	2.7	2.45	2.0	2.3	4.65	4.45	3.1	3.05	2.3	2.1	2.1	1.95
13	2.7	2.4	2.0	2.25	4.45	4.55	3.1	2.8	2.85	2.1	2.0	1.9
14	2.75	2.35	1.9	2.3	4.3	4.6	3.0	2.7	2.65	2.1	2.0	1.9
15	2.75	2.1	1.9	2.25	4.25	4.55	3.0	2.65	2.6	2.1	2.0	1.9
16	2.85	2.05	1.9	2.3	4.15	4.45	3.05	2.5	2.5	2.2	2.05	1.9
17	2.75	1.8	1.9	2.2	3.7	4.35	3.1	2.45	2.5	2.3	2.0	1.9
18	2.7	2.3	1.9	2.2	3.8	4.2	3.15	2.4	2.85	2.3	2.0	2.0
19	2.65	2.4	2.0	2.25	3.9	4.2	3.1	2.4	2.9	2.2	2.05	1.9
20	2.6	2.4	2.0	2.4	3.7	4.2	3.1	2.3	2.8	2.2	2.0	1.9
21	2.7	2.4	2.1	2.65	3.85	4.15	3.05	2.3	2.8	2.2	1.9	1.95
22	2.65	2.3	2.1	2.7	3.85	4.05	3.0	2.35	2.8	2.1	2.2	1.9
23	2.65	2.4	2.15	2.6	4.05	4.0	2.95	2.4	2.8	2.15	2.0	2.0
24	2.65	2.45	2.15	2.55	4.2	4.0	2.9	2.3	2.7	2.1	1.9	2.0
25	2.6	2.45	2.1	2.85	4.35	3.85	2.75	2.3	2.7	2.15	1.9	2.0
26	2.5	2.45	2.1	2.95	4.25	3.8	2.7	2.2	2.55	2.15	2.0	2.0
27	2.5	2.3	2.1	3.15	4.25	3.8	2.7	2.25	2.5	2.15	2.1	2.0
28	2.5	2.3	2.05	3.75	4.65	3.7	2.85	2.3	2.5	2.2	2.25	1.95
29	2.5	.....	1.95	3.9	5.0	3.7	3.15	2.3	2.5	2.2	2.4	1.9
30	2.45	.....	1.8	3.65	5.55	4.1	3.45	2.4	2.4	2.1	2.35	2.1
31	2.5	.....	2.15	.....	5.9	.....	3.15	2.3	.....	2.1	.....	2 25

NOTE.—Ice Jan. 1 to Mar. 1, Nov. 27 to Dec. 31.

Daily discharge, in second-feet, of Cache la Poudre River near Fort Collins, Colo., for 1910.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	55	42	52	93	405	1,910	532	269	86	116	74	65
2	52	41	52	74	386	2,150	510	240	86	108	80	61
3	55	43	57	68	368	1,960	465	200	86	100	74	59
4	60	38	62	56	445	1,680	424	165	116	100	80	56
5	54	38	56	50	532	1,250	424	154	188	93	80	54
6	56	38	74	56	405	1,400	386	176	154	86	68	54
7	48	38	74	74	350	1,290	386	165	125	86	62	53
8	43	38	86	74	386	1,140	350	134	108	93	86	53
9	36	37	74	74	580	1,040	333	125	100	86	74	49
10	52	37	50	86	795	978	316	134	116	86	62	44
11	54	39	68	86	855	915	300	144	100	80	74	40
12	61	41	62	100	1,040	915	284	269	100	74	74	48
13	62	38	62	93	915	978	284	200	213	74	62	55
14	68	35	50	100	825	1,010	254	176	165	74	62	53
15	68	32	50	93	795	978	254	165	154	74	62	52
16	75	30	50	100	738	915	269	134	134	86	68	51
17	58	28	50	86	510	855	284	125	134	100	62	50
18	54	38	50	86	555	765	300	116	213	100	62	50
19	53	48	62	93	605	765	284	116	226	86	68	49
20	53	44	62	116	510	765	284	100	200	86	62	45
21	44	40	74	165	580	738	269	100	200	86	50	40
22	43	36	74	176	580	682	254	108	200	74	86	40
23	58	40	80	154	682	655	240	116	200	80	62	40
24	54	43	80	144	765	655	226	100	176	74	50	39
25	53	46	74	213	855	580	188	100	176	80	50	39

Daily discharge, in second-feet, of Cache la Poudre River near Fort Collins, Colo., for 1910—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
26	42	49	74	240	795	555	176	86	144	80	62	36
27	43	43	74	300	795	555	176	93	134	80	63	34
28	41	37	68	532	1,040	510	213	100	134	86	65	41
29	43	.....	56	605	1,290	510	300	100	134	86	68	48
30	41	.....	40	488	1,730	710	405	116	116	74	70	40
31	43	.....	80	.....	2,060	.....	300	100	.....	74	.....	32

NOTE.—These discharges are based on a fairly well-defined rating curve between 50 and 2,150 second-feet, except as noted. Discharges Jan. 1 to Mar. 1 and Nov. 27 to Dec. 31, discharge measurements used, and discharges between measurements estimated. Discharge estimated Mar. 2 and 3.

Monthly discharge of Cache la Poudre River near Fort Collins, Colo., for 1910.

[Drainage area, 495 square miles.]

Month.	Discharge in second-feet.			Per square mile.	Depth in inches on drainage area.	Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.				
January	75	36	52.3	0.106	0.12	3,220	A.
February	49	28	39.2	.079	.08	2,180	A.
March	86	46	63.8	.129	.15	3,920	A.
April	605	50	156	.315	.35	9,280	A.
May	2,060	350	747	1.51	1.74	45,900	A.
June	2,150	510	994	2.01	2.24	59,100	A.
July	532	176	312	.630	.73	19,200	A.
August	269	86	143	.289	.33	8,790	A.
September	226	86	147	.297	.33	8,750	A.
October	116	74	85.9	.274	.20	5,280	A.
November	86	50	67.4	.136	.15	4,010	A.
December	65	32	47.4	.096	.11	2,910	A.
The year	2,150	28	238	.481	6.53	173,000	

CACHE LA POUDRE RIVER AT MOUTH OF CANYON, NEAR FORT COLLINS, COLO.

From 1884 to 1901 a careful study of the regimen of this stream at this point was carried on under the direction of Prof. L. G. Carpenter, of the Colorado State Agricultural College, and the results of his study were published in the reports of the United States Geological Survey.[1] On November 30, 1909, a Bristol automatic gage was installed about 2 miles below the intake of the Fort Collins waterworks, 12 miles from Fort Collins, about half a mile below the head gate of the Poudre Valley ditch, in the NE. ¼ sec. 15, T. 8 N., R. 70 W. An auxiliary sloping staff gage, used to set the automatic gage, was also installed. Continuous gage-height records did not commence until May 8, 1910.

The drainage area above the station comprises about 1,060 square miles.

The banks of stream are the remains of the wall of the old flume. The stream runs in one channel, not liable to shift.

Measurements are made from a car and cable at the gage.

The bed at the measuring section is composed of round bowlders and gravel and is fairly uniform. Results should be good.

[1] See Water-Supply Paper U. S. Geol. Survey No. 119, 1905, p. 42.

Considerable water is diverted for irrigation above this station.

Gage heights are somewhat affected by ice during the winter.

This station is now maintained by the State engineer of Colorado, who has furnished the data for publication.

Discharge measurements of Cache la Poudre River at mouth of canyon, near Fort Collins, Colo., in 1910.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Feb. 3[a]	C. L. Chatfield	90	97	1.69	60
Mar. 18[b]	do	94	160	1.11	98
25[b]	do	95	179	1.28	146
Apr. 19[b]	Thomas Grieve	94	175	1.28	148
May 11	do	98	305	2.65	936
June 9	C. C. Hezmalhalch	98	334	2.88	1,210
23	do	100	294	2.55	818
28	Freeman and Miles	97	247	2.02	496
July 15[b]	Thomas Grieve	99	210	1.60	268
Aug. 5[b]	C. C. Hezmalhalch	100	195	1.42	196
Sept 27[b]	C. L. Chatfield	95	185	1.35	167
Dec. 5[c]	C. C. Hezmalhalch	.....	131	.97	436

[a] Made through ice. [b] Made from cable. [c] Ice conditions.

Daily gage height, in feet, of Cache la Poudre River at mouth of canyon, near Fort Collins, Colo., for 1910.

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	3.4	2.0	1.5	1.05	1.3	1.1	0.95
2	.....	3.45	1.95	1.45	1.05	1.45	1.2	1.05
3	.....	3.45	1.85	1.4	1.1	1.4	1.25	1.05
4	.....	3.45	1.8	1.25	1.2	1.4	1.1	1.1
5	.....	2.95	1.85	1.3	1.4	1.2	1.1	.8
6	.....	2.85	1.85	1.35	1.25	1.15	1.15	.7
7	.....	2.9	1.7	1.3	1.2	1.2	1.15	.7
8	1.8	2.8	1.7	1.2	1.05	1.25	1.3	.8
9	2.05	2.75	1.55	1.15	1.1	1.3	1.2	1.0
10	2.25	2.7	1.65	1.2	1.2	1.35	1.1	.9
11	2.65	2.7	1.6	1.3	1.1	1.45	1.2	.95
12	2.7	2.65	1.55	1.3	1.2	1.45	1.25	.9
13	2.65	2.65	1.5	1.4	1.4	1.4	1.1	.8
14	2.55	2.7	1.5	1.35	1.45	1.3	1.05	.8
15	2.5	2.65	1.5	1.3	1.4	1.4	1.0	.7
16	2.4	2.55	1.5	1.25	1.35	1.55	1.0	.8
17	2.25	2.5	1.5	1.15	1.3	1.55	1.10	.8
18	2.3	2.5	1.65	1.15	1.45	1.4	1.1	.9
19	2.3	2.5	1.5	1.15	1.5	1.1	1.15	.85
20	2.3	2.5	1.6	1.1	1.55	1.15	1.05	.85
21	2.35	2.4	1.6	1.1	1.5	1.2	1.0	.9
22	2.3	2.35	1.55	1.15	1.45	1.2	1.05	.7
23	2.3	2.25	1.5	1.15	1.5	1.2	1.2	.7
24	2.35	2.2	1.45	1.05	1.5	1.2	1.0	1.0
25	2.55	2.15	1.4	1.05	1.35	1.35	1.15	.....
26	2.55	2.0	1.35	1.05	1.3	1.25	1.15	.....
27	2.6	1.9	1.25	1.05	1.25	1.1	1.05	.....
28	2.85	1.85	1.3	1.1	1.2	1.1	1.10	.....
29	3.1	1.95	1.55	1.15	1.2	1.15	.90	.....
30	3.15	2.1	1.8	1.1	1.2	1.2	.95	.....
31	3.3	.....	1.65	1.1	.....	1.2	.....	.....

NOTE.—Ice during December.

Daily discharge, in second-feet, of Cache la Poudre River at mouth of canyon, near Fort Collins, Colo., for 1910.

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	1,750	465	220	85	150	95	.....
2	.....	1,810	438	202	85	202	120	.....
3	.....	1,810	382	185	95	185	135	.....
4	.....	1,810	355	135	120	185	95	.....
5	.....	1,250	382	150	185	120	95	.....
6	.....	1,150	382	168	135	108	108	.....
7	.....	1,200	305	150	120	120	108	.....
8	355	1,100	305	120	85	135	150	.....
9	498	1,050	240	108	95	150	120	.....
10	632	1,000	282	120	120	168	95	.....
11	958	1,000	260	150	95	202	120	.....
12	1,000	958	240	150	120	202	135	.....
13	958	958	220	185	185	185	95	.....
14	872	1,000	220	168	202	150	85	.....
15	830	958	220	150	185	185	75	.....
16	745	872	220	135	168	240	75	.....
17	632	830	220	108	150	240	95	.....
18	670	830	282	108	202	185	95	.....
19	670	830	220	108	220	95	108	.....
20	670	830	260	95	240	108	85	.....
21	708	745	260	95	220	120	75	.....
22	670	708	240	108	202	120	85	.....
23	670	632	220	108	220	120	120	.....
24	708	595	202	85	220	120	75	.....
25	872	562	185	85	168	168	108	.....
26	872	465	168	85	150	135	108	.....
27	915	410	135	85	135	95	85	.....
28	1,150	382	150	95	120	95	95	.....
29	1,410	438	240	108	120	108	60	.....
30	1,465	530	355	95	120	120	68	.....
31	1,630	.....	282	95	.....	120	.....	.....

Monthly discharge of Cache la Poudre River at mouth of canyon, near Fort Collins, Colo., for 1910.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
May 8-31	1,630	355	857	40,800
June	1,810	382	949	56,500
July	465	135	269	16,500
August	220	85	128	7,870
September	220	85	152	9,040
October	240	95	154	9,470
November	150	60	98.9	5,890
December	.....	.....	[a] 45	2,770
The period	.....	.....	.....	149,000

[a] Estimated.

NOTE.—These values have been changed slightly to conform to the computation rules of the United States Geological Survey.

LOUP RIVER BASIN

DESCRIPTION

The Loup and its branches, which form the most important tributaries of the Platte below the forks, drain an area 13,540 square miles in extent, lying in the heart of Nebraska. The Loup proper is formed by the junction of North and Middle Loup rivers, which unite near the city of St. Paul, the middle Loup in turn receiving the South Loup in the southwestern part of Howard County. The principal

tributaries are Beaver, Cedar, Calamus, and Dismal creeks. A comparatively small amount of water is diverted for irrigation, the ditches generally being small and covering limited areas. A number of power plants are in operation and others of considerable extent have been proposed, particularly one near Columbus, by which it is believed that about 20,000 continuous horsepower may be developed.

On Loup River the flow was probably lowest in 1895.

The following special report contains information regarding the hydrography of this basin:

Surface waters of Nebraska, by J. C. Stevens: Water-Supply Paper U. S. Geol. Survey No. 230, 1909.

LOUP RIVER AT COLUMBUS, NEBR.

This station, which was established October 13, 1894, is located at the highway bridge in the outskirts of Columbus and about 3 miles above the mouth of the river, in sec. 25, T. 17 N., R. 1 W.

The records show the total discharge of the river at its mouth, and are valuable in connection with power development. They show also the remarkably uniform flow of the stream. A comparatively small amount of water is diverted for irrigation.

Records have usually been suspended during the winter months on account of the severe ice conditions.

Measurements at this station are rough at best, owing to the soft and constantly shifting bed and the high and uneven velocity. Gage heights are only an approximate index of discharge, as the swift current changes the channel very rapidly, and at least one measurement a week would be required to give even fairly good results.

No daily discharges have been computed for 1910, as any computation based on the data at hand would be misleading, and a fair idea of the discharge can be obtained from the discharge measurements. Two gages have been used at this station: A chain gage at the highway bridge has been used since 1904; and a staff gage at the former cable location, 1½ miles above, was used prior to that time. The datum of the staff gage is 8.56 feet above the present gage datum. Otherwise, no changes in datum have been made. Discharge measurements are made from the highway bridge to which the gage is attached.

Discharge measurements of Loup River at Columbus, Nebr., in 1910.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Apr. 20	D. D. Price	210	687	4.40	2,280
May 10	do	340	966	4.60	3,190
25	do	340	888	4.50	2,530
June 24	do	380	642	4.20	1,780
July 25	do	520	788	4.54	2,160
Aug. 31	do	410	1,010	5.40	3,590
Oct. 1	A. A. Dolson	350	753	4.45	2,120
Nov. 19	do	390	696	4.39	2,230
25	do	402	714	4.28	2,420

Daily gage height, in feet, of Loup River at Columbis, Nebr., for 1910.

[W. D. Benson, observer.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	4.35	4.3	4.5	4.55	4.35	5.55	4.4	4.55	4.2
2	.....	4.35	4.5	.....	4.35	4.4	4.1	4.3	4.6	4.35
3	.....	4.35	4.95	4.5	4.6	4.4	4.3	4.55	4.5	4.4
4	.....	4.45	4.95	4.5	4.6	4.4	4.3	4.55	4.3	4.35
5	.....	4.5	.....	4.5	4.75	4.45	4.25	4.5	4.1	.....
6	.....	4.55	.....	4.6	4.55	4.45	4.2	4.5	4.25	.....
7	.....	4.6	.....	4.75	4.85	4.5	4.2	.....	4.1	.....
8	.....	.....	.....	4.85	5.0	4.6	4.1	4.45	4.2	.....
9	.....	.....	.....	5.25	4.6	4.5	4.1	4.0	4.2	.....
10	.....	4.55	4.55	5.3	4.5	4.5	4.1	4.45	4.25	.....
11	.....	4.6	4.45	4.95	4.45	4.65	4.1	4.45	4.3	.....
12	4.65	4.6	4.5	4.8	4.4	4.65	4.1	4.45	4.25	.....
13	4.4	4.55	4.6	4.7	4.5	4.9	4.15	4.45	4.2	.....
14	4.3	4.7	4.65	4.5	4.4	5.65	4.2	4.45	4.25	.....
15	4.3	4.8	4.6	4.35	4.4	5.1	4.2	4.45	4.2	.....
16	4.45	4.85	4.55	4.3	4.4	5.3	4.3	4.5	4.15	.....
17	4.35	4.7	4.55	.....	4.4	5.4	4.25	4.55	4.1	.....
18	4.25	4.65	4.6	4.4	4.35	5.65	4.35	4.6	4.2	.....
19	4.3	4.3	4.65	4.4	4.3	5.2	4.3	4.6	4.4	.....
20	4.3	4.45	4.55	4.4	4.35	4.75	4.3	4.55	4.45	.....
21	4.3	4.4	4.65	4.4	4.35	4.4	.....	.....	4.4	.....
22	4.3	4.45	4.65	4.35	4.3	4.3	4.35	4.5	4.4	.....
23	4.45	4.4	4.75	4.3	4.4	4.25	4.4	4.3	4.3	.....
24	4.3	4.4	4.7	4.3	4.45	4.2	4.5	4.3	4.3	.....
25	4.35	4.35	4.65	4.5	4.5	4.1	4.5	4.3	4.25	.....
26	4.45	4.4	4.4	5.3	4.45	4.1	4.55	4.4	4.3	.....
27	4.45	4.4	4.55	5.05	4.4	4.05	4.6	4.5	4.35	.....
28	4.45	4.5	4.6	4.8	4.35	4.1	4.55	4.55	4.4	.....
29	4.5	4.55	4.6	4.5	4.25	5.0	4.5	4.7	4.25	.....
30	4.4	4.5	4.6	4.5	4.25	5.4	4.4	4.6	4.2	.....
31	4.35	4.55	4.5	.....	4.25	5.55	.....	4.6	.....	.....

NOTE.—Ice conditions Jan. 1 to Mar. 11 and Dec. 5 to 31.

KANSAS RIVER BASIN.

DESCRIPTION.

The drainage basin of Kansas River lies between the basins of the Platte and the Arkansas, entirely within the region of the Great Plains. The Kansas as such is a comparatively short stream, being formed by the union of Smoky Hill and Republican rivers in Geary County, Kans., whence it flows eastward, entering the Missouri at Kansas City, Mo.

The Smoky Hill rises near the boundary between Kansas and Colorado, pursues a winding but on the whole easterly course through Kansas, and near Junction unites with the Republican. Its length is 335 miles and the extreme width of its basin is about 100 miles. The river runs close to the northern border of the Arkansas basin, and its chief tributaries are from the north. Solomon and Saline rivers are the most important, the former draining the northern part of Kansas and the latter the territory between the Solomon and the Smoky Hill.

Republican River rises in the arid plains of eastern Colorado, flows northeastward into southwestern Nebraska, then eastward through

the southern tier of counties to Superior, where it turns to the southeast, enters Kansas, and finally joins the Smoky Hill. The length of the basin east and west is approximately 360 miles, its greatest width is 120 miles, and the total area drained is 25,840 square miles. The river is wide and rather shallow, with a rapid descent, and the bed is largely shifting quicksand of the most unstable character. In its upper course the Republican receives many tributaries, chiefly from the south. Nearly all of these flow through a region where the rainfall is less than 22 inches, but as this part of the basin is covered with buffalo grass, which sheds rain like a roof, the per cent of rainfall reaching the streams is great. Near the mouth the drainage area is very narrow and the tributaries are small and unimportant, but here the rainfall is 28 to 30 inches a year. Many small springs are found along the Republican and its branches, and the ground water generally lies at medium depth. The soil of the middle part of the basin is porous, sandy loam, and about 55 per cent of the land is under cultivation; along the lower course the soil is black loam and clay, and about 75 per cent of the land is cultivated. The rainfall in the lower basin is considered sufficient for all growing crops. The Republican is subject to sudden rises and falls and occasionally overflows its banks.

The most important feeder of the Kansas below the junction of Smoky Hill and Republican rivers is the Blue, which rises in southeastern Nebraska, flows to the southeast and south into Kansas, and joins Kansas River at Manhattan. The principal tributary of the Blue is the Little Blue, which rises in southern Nebraska, flows southeastward, and unites with the main stream near Blue Rapids.

The basin of the Kansas comprises the richest portion of the State of Kansas. The section is under a high state of cultivation and produces a great variety of crops. The river flows through a rich alluvial bottom land, and bottoms and rolling uplands are well timbered with oak, cottonwood, ash, elm, hickory, etc. The banks are sandy and easily cave in. In places the bed contains rock and bowlders, but in general it is composed of sand and at many places of quicksand. The channel as a rule hugs one bank or the other and is somewhat shifting. Islands are formed here and there by the deposit of sediment during high water, drift lodges upon them, and a thick growth of brush, mainly cottonwood, soon springs up. At Topeka the river is 900 feet wide between banks. At ordinary low water the channel occupies 150 to 200 feet of this width and has a depth of 8 to 9 feet; at mean high water the average depth is probably 10 feet for the entire distance between banks.

The following special report contains information regarding the hydrography of Kansas River basin:

Surface waters of Nebraska, by J. C. Stevens: Water-Supply Paper U. S. Geol. Survey No. 230, pp. 175–220, 1909.

REPUBLICAN RIVER AT BOSTWICK, NEBR.

This station, which is located at a highway bridge 1 mile north of Bostwick, Nebr., in Sec. 23, T. 1 N., R. 8 W., was established June 6, 1904, to replace the station at Superior, Nebr., which had been maintained from 1896 to 1903. Records at this point show the amount of water carried by the river at the Nebraska-Kansas State line, and are of value in connection with irrigation above and flood control below.

No records have been obtained during the winter period. No storage is used on the stream to reduce floods or to reenforce the low-water flow, so that the variation in discharge is great. Owing to the unstable condition of the stream bed the records are more or less unsatisfactory.

The chain gage has remained the same since the establishment of the station. It is fastened to the bridge from which discharge measurements are made.

Discharge measurements of Republican River at Bostwick, Nebr., in 1910.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Apr. 13	D. D. Price	270	227	1.70	345
May 18	E. C. Simmons	287	235	1.55	429
June 15	D. D. Price	265	159	1.40	238
July 12	A. A. Dobson	195	95	1.01	114
Aug. 13	do	225	100	1.10	110
Sept. 22	do	338	132	1.21	162
Nov. 5	do	275	150	1.34	215

Daily gage height, in feet, of Republican River at Bostwick, Nebr., for 1910.

[J. W. Keifer, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1			2.75	1.8	1.55	1.5	1.1	0.8	1.8	1.7	1.2	1.5
2		3.2	2.95	1.8	1.45	1.45	1.1	.7	1.7	1.6	1.3	1.5
3		3.2	2.45	1.75	1.45	1.55	1.0	.7	1.6	1.7	1.3	1.5
4		3.15	2.35	1.75	1.45	1.55	1.0	1.6	1.6	1.6	1.3	1.6
5		3.15	2.65	1.7	1.5	1.55	1.0	1.3	1.6	1.5	1.3	1.6
6		3.05	2.85	1.7	1.6	1.45	1.0	1.9	1.5	1.5	1.3	1.8
7		3.0	2.5	1.7	1.6	1.5	1.1	1.4	1.6	1.5	1.3	1.8
8		3.0	2.45	1.7	1.55	2.1	1.0	1.5	1.7	1.4	1.4	1.8
9		2.95	2.25	1.75	1.55	1.75	1.0	1.2	1.5	1.4	1.4	1.6
10		2.75	2.25	1.75	1.6	1.7	1.0	1.2	1.5	1.3	1.4	1.7
11		2.75	2.15	1.7	1.6	1.6	.9	1.1	1.5	1.3	1.4	1.9
12		2.7	2.2	1.7	1.65	1.55	1.0	1.2	1.5	1.3	1.4	1.9
13		2.7	2.2	1.7	1.65	1.55	1.0	1.1	1.5	1.2	1.4	1.8
14		2.75	2.15	1.7	1.6	1.45	1.0	1.5	1.4	1.2	1.4	1.8
15		3.0	2.1	1.7	1.6	1.4	1.0	1.4	1.3	1.2	1.4	1.8
16			2.05	1.7	1.6	1.4	1.0	1.2	1.3	1.2	1.4	1.7
17		2.9	2.05	1.7	1.6	1.4	1.6	4.8	1.3	1.1	1.4	1.7
18		2.9	2.0	1.7	1.55	1.3	1.4	5.2	1.2	1.2	1.4	1.6
19		3.1	2.0	1.7	1.5	1.2	1.2	5.2	1.2	1.2	1.4	1.6
20			2.0	1.7	1.5	1.2	1.1	5.5	1.2	1.2	1.5	1.6
21		2.8	2.0	1.7	1.55	1.2	1.4	4.0	1.3	1.2	1.5	1.6
22			1.95	1.7	1.55	1.1	1.0	3.3	1.2	1.2	1.5	1.7
23		2.75	1.95	1.65	1.5	1.1	1.1	2.9	1.5	1.2	1.5	1.9
24		2.75	1.9	1.65	1.45	1.1	1.0	2.6	4.0	1.1	1.5	2.4
25		2.75	1.9	1.6	1.45	1.2	1.0	2.4	2.9	1.1	1.5	2.7

Daily gage height, in feet, of Republican River at Bostwick, Nebr., for 1910—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
26	.....	2.7	1.9	1.6	1.4	1.8	0.9	2.4	3.1	1.2	1.5	2.9
27	2.5	2.7	1.9	1.6	1.95	1.7	.9	2.2	2.5	1.2	1.5	2.9
28	.....	2.7	1.85	1.6	1.8	1.5	.8	2.0	2.4	1.2	1.5	2.9
29	.....	.....	1.85	1.55	1.6	1.3	.8	2.3	2.0	1.2	1.5	2.3
30	.....	.....	1.8	1.5	1.6	1.1	.8	2.3	1.8	1.2	1.5	2.1
31	3.25	.....	1.8	.....	1.55	.....	.8	1.8	.....	1.2	.....	1.9

NOTE.—Ice Jan. 1 to Mar. 10 and Dec. 1 to 31. There was a little ice Nov. 28.

Daily discharge, in second-feet, of Republican River at Bostwick, Nebr., for 1910.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	400	345	275	125	60	440	380	160
2	.....	400	295	255	125	50	380	325	195
3	.....	375	295	300	100	50	325	380	195
4	.....	375	295	300	100	325	325	325	195
5	.....	345	345	300	100	195	325	275	195
6	.....	345	400	255	100	510	275	275	195
7	.....	345	400	275	125	235	325	275	195
8	.....	345	375	660	100	275	380	235	235
9	.....	375	375	410	100	160	275	235	235
10	.....	375	400	380	100	160	275	195	235
11	640	345	400	325	75	125	275	195	235
12	680	345	470	300	100	160	275	195	235
13	680	345	470	300	100	125	275	160	235
14	640	360	440	255	100	275	235	160	235
15	600	360	440	235	100	235	195	160	235
16	570	360	440	235	100	160	195	160	235
17	570	360	440	235	325	4,090	195	125	235
18	540	360	429	195	235	4,830	160	160	235
19	540	360	400	160	160	4,830	160	160	235
20	540	360	375	160	125	5,430	160	160	275
21	540	380	410	160	235	2,810	195	160	275
22	500	380	410	125	100	1,870	160	160	275
23	500	360	350	125	125	1,410	275	160	275
24	460	360	325	125	125	1,110	2,810	125	275
25	460	340	325	160	125	920	1,410	125	275
26	460	340	275	440	75	920	1,630	160	275
27	460	340	600	380	75	740	1,010	160	275
28	440	360	500	275	60	580	920	160	275
29	440	345	345	195	60	830	580	160	275
30	400	325	345	125	60	830	440	160	275
31	400	.....	310	.....	60	440	.....	160	.....

NOTE.—These discharges are based on rating curves applicable as follows: Mar. 10 to Apr. 13, not well defined; Apr. 14 to May 31, indirect method for shifting channels; June 1 to Nov. 30, fairly well defined between 100 and 200 second-feet.

Monthly discharge of Republican River at Botswick, Nebr., for 1910.

[Drainage area, 23,300 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
Mar. 11-31	680	400	527	0.023	0.02	22,000	C.
April	400	325	359	.015	.02	21,400	C.
May	600	275	388	.017	.02	23,900	C.
June	660	125	264	.011	.01	15,700	B.
July	325	60	116	.0050	.006	7,130	B.
August	5,430	50	1,120	.048	.06	68,900	B.
September	2,810	160	496	.021	.02	29,500	B.
October	380	125	201	.0086	.01	12,400	B.
November	275	160	239	.010	.01	14,200	B.
The period	.....	.....	.....	.....	.....	188,000	

BIG BLUE RIVER AT BEATRICE, NEBR.

This station, which is located at the highway bridge on Sixth Street, south of Beatrice, Nebr., on the section line between secs. 3 and 4, T. 3 N., R. 6 E. of the sixth principal meridian, 300 feet downstream from the railroad bridge and 1 mile downstream from a mill dam, was established October 15, 1910.

The chain gage used was installed by United States Weather Bureau on the upstream side of the highway bridge from which discharge measurements are made. Gage heights have also been obtained from this gage by the United States Weather Bureau for parts of years since 1905.

The constant angle between the bridge and the current renders it necessary to apply a correction coefficient of 0.8 to reduce the measured discharge to normal discharge past the cross section.

Miscellaneous discharge measurements were made at this location in 1908 and published in Water-Supply Paper 246, page 296.

No rating curve has yet been developed for this station.

Discharge measurements of Big Blue River at Beatrice, Nebr., in 1910.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
July 8[a]	D. D. Price	80	137	.....	321
13	A. A. Dobson	150	250	2.62	382
Aug. 13	.....do	150	204	1.18	246
Sept. 22	.....do	150	247	1.38	400
Oct. 29	.....do	150	228	1.28	328
Nov. 11	.....do	150	223	1.35	324

[a] Made about 3 miles below in SW. ¼ sec. 7, T. 3 N., R. 7 E.

Daily gage height, in feet, of Big Blue River at Beatrice, Nebr., for 1910.

[Herbert Palmer, observer.]

Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.
1	.....	1.3	1.4	11	.....	1.3	1.4	21	1.3	1.3	1.3
2	.....	1.3	1.3	12	.....	1.3	1.3	22	1.3	1.3	1.1
3	.....	1.3	1.3	13	.....	1.3	1.3	23	1.3	1.3	1.1
4	.....	1.2	1.3	14	.....	1.2	1.3	24	1.2	1.3	1.1
5	.....	1.2	1.3	15	1.4	1.2	1.4	25	1.3	1.3	1.2
6	.....	1.2	1.3	16	1.4	1.3	1.3	26	1.4	1.3	1.2
7	.....	1.2	1.2	17	1.4	1.4	1.3	27	1.4	1.3	1.2
8	.....	1.2	1.2	18	1.6	1.4	1.3	28	1.4	1.4	1.3
9	.....	1.3	1.2	19	1.5	1.3	1.1	29	1.4	1.4	1.3
10	.....	1.3	1.3	20	1.4	1.3	1.2	30	1.4	1.4	1.2
								31	1.4	.....	1.2

LITTLE BLUE RIVER NEAR FAIRBURY, NEBR.

This station, which is located at the highway bridge 1½ miles south of Fairbury and about 12 miles above the Nebraska-Kansas State line, was established May 23, 1908, to obtain data for use in studies of run-off and flood control and in power development. A chain gage, the datum of which has remained constant, is fastened to the bridge from which discharge measurements are made.

Sandy Creek, the principal tributary, enters about 10 miles above. Muddy Creek, a small stream, is the only tributary between the station and the Kansas line.

The dam of the Fairbury roller mill is about 2 miles above the station, and may possibly cause some daily fluctuations in stage.

Gage heights are apparently little affected by ice.

Records have been fairly satisfactory, though the channel shifts at high stages. The maximum discharges are somewhat uncertain, as the river overflows its banks at about 11 feet gage height. The amount of overflow has been estimated.

Discharge measurements of Little Blue River near Fairbury, Nebr., in 1910.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
Jan. 29	D. D. Price	80	291	4.9	724
Mar. 2	do	70	164	3.6	350
Apr. 3	do	75	97	2.9	203
16	do	70	92	3.0	190
May 21	do	70	101	3.0	201
June 9	do	335	2,320	12.1	[a] 7,320
15	do	90	153	3.9	333
July 14	do	105	229	3.7	355
Aug. 7	do	72	94	2.81	168
Sept. 17	A. A. Dobson	75	86	2.71	137
Oct. 25	do	75	90	2.82	153
Nov. 11	do	75	96	2.80	151
Dec. 4	do	80	109	3.11	165

[a] Includes overflow of 600 second-feet at north end of bridge.

Daily gage height, in feet, of Little Blue River near Fairbury, Nebr., for 1910.

[Clark Hulburt, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	4.3	3.6	2.9	2.7	6.0	3.4	2.5	3.0	3.4	2.9	2.9
2	.....	4.5	3.7	3.0	2.8	4.6	3.2	2.7	3.0	3.3	2.8	3.2
3	.....	4.2	3.8	2.9	2.9	4.0	3.1	4.2	3.0	3.3	2.8	3.0
4	.....	4.0	4.0	2.9	2.8	3.7	3.0	2.9	3.0	3.2	2.8	3.1
5	.....	4.0	4.0	3.0	3.0	3.5	3.0	2.9	3.0	3.1	2.9	3.0
6	.....	3.9	3.8	2.9	3.1	3.4	2.9	2.9	2.9	3.1	2.8	3.2
7	.....	3.8	3.6	2.9	3.1	3.5	3.0	2.8	2.9	3.1	2.8	3.2
8	.....	3.7	3.5	2.9	3.0	9.1	3.7	2.8	2.8	3.0	2.9	3.1
9	.....	3.7	3.3	2.9	2.9	11.6	3.4	3.9	2.8	3.0	2.9	3.0
10	.....	3.7	3.2	2.8	3.1	8.9	3.0	3.2	2.8	3.0	2.8	3.0
11	.....	3.4	3.2	2.9	2.9	6.8	2.9	3.0	2.7	3.0	2.8	3.1
12	.....	3.2	3.1	2.9	2.9	5.5	3.0	2.9	2.8	2.9	3.0	3.4
13	.....	3.2	3.1	2.9	2.8	5.1	4.1	2.8	2.8	3.0	3.0	3.1
14	.....	3.5	3.1	2.8	2.8	4.4	4.0	3.3	2.8	3.0	3.0	3.3
15	.....	3.6	3.1	2.9	2.8	4.0	3.5	4.0	2.7	2.9	3.0	3.3

Daily gage height, in feet, of Little Blue River near Fairbury, Nebr., in 1910—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
16	.....	3.4	3.0	2.9	2.9	3.7	3.2	3.2	2.8	2.8	2.9	3.4
17	.....	3.5	3.0	2.8	3.0	3.6	3.1	4.1	2.8	2.8	3.0	3.4
18	.....	3.7	3.0	3.0	2.8	3.5	3.0	8.2	2.7	2.9	3.0	3.3
19	.....	3.8	3.0	3.0	2.9	3.5	2.9	5.7	2.6	2.9	3.0	3.0
20	.....	3.3	3.0	2.9	2.9	3.3	2.9	4.5	2.7	2.8	3.0	3.1
21	.....	3.7	3.0	2.9	3.0	3.3	2.8	5.4	2.8	2.9	3.0	3.1
22	.....	3.6	3.0	3.0	3.6	3.2	2.7	5.8	2.8	2.9	3.1	3.1
23	.....	3.7	2.9	3.1	3.2	3.2	2.7	4.6	3.6	2.8	3.0	3.3
24	.....	3.8	2.9	3.2	3.0	3.1	2.7	3.9	7.35	2.8	2.9	2.9
25	3.2	3.4	2.9	3.0	2.9	3.1	2.8	3.6	4.7	2.8	3.0	2.8
26	3.7	3.2	3.0	2.9	2.9	3.0	2.7	3.3	5.0	2.8	3.1	3.3
27	4.7	3.6	3.0	2.8	3.1	3.1	2.7	3.2	5.3	2.8	2.9	3.5
28	5.1	3.4	2.9	2.6	3.0	3.8	2.6	3.2	4.3	2.8	3.0	3.3
29	4.9	.....	2.9	2.9	6.0	4.0	2.6	3.2	4.0	2.9	3.0	3.4
30	4.7	.....	3.0	2.7	6.95	3.6	2.6	3.1	3.6	2.8	3.0	3.5
31	4.3	.....	2.9	.....	10.6	.....	2.6	.....	.....	2.9	.....	3.3

NOTE.—Ice probably existed to greater or less extent Jan. 1 to Jan. 24 and Dec. 12 to 31.

Daily discharge, in second-feet, of Little Blue River near Fairbury, Nebr., for 1910.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	520	350	205	162	875	270	150	170	240	160	158
2	.....	580	375	210	172	390	240	160	170	230	151	220
3	.....	490	380	202	182	260	220	400	170	230	151	180
4	.....	440	440	200	172	210	210	180	170	220	151	165
5	.....	440	440	210	192	175	210	180	170	200	160	180
6	.....	400	380	197	204	160	210	180	160	200	151	220
7	.....	375	340	195	204	170	220	170	160	200	151	220
8	.....	355	320	194	194	2,800	330	170	150	180	160	165
9	.....	350	280	192	184	6,300	280	330	150	180	160	180
10	.....	345	260	180	204	2,740	220	210	150	180	151	180
11	.....	290	260	188	186	1,270	210	190	140	180	151	.....
12	.....	260	245	187	186	700	220	180	150	158	180	.....
13	.....	260	245	185	176	600	440	170	150	180	180	.....
14	.....	320	245	175	176	425	410	225	150	180	180	.....
15	.....	340	245	182	176	350	300	350	140	158	180	.....
16	.....	300	225	180	189	290	250	210	150	151	160	.....
17	.....	325	225	170	199	270	230	375	150	151	180	.....
18	.....	360	225	190	179	255	220	2,600	135	160	180	.....
19	.....	390	225	190	190	255	210	900	130	160	180	.....
20	.....	290	225	180	190	225	210	450	135	151	180	.....
21	.....	360	225	180	201	235	190	750	140	160	180	.....
22	.....	340	225	190	290	220	175	940	140	153	200	.....
23	.....	360	210	200	215	220	170	475	240	153	180	.....
24	.....	390	210	210	190	210	165	310	1,780	153	160	.....
25	260	300	210	190	175	210	190	260	470	153	180	.....
26	350	270	225	180	160	210	170	220	550	153	200	.....
27	640	340	210	170	190	225	170	210	660	153	160	.....
28	790	310	205	150	170	340	160	200	360	153	180	.....
29	724	.....	205	180	950	390	160	200	300	160	180	.....
30	650	.....	210	160	1,460	300	160	190	240	153	180	.....
31	520	.....	205	.....	5,050	.....	160	180	.....	160	.....	.....

NOTE.—These discharges were obtained by the indirect methods for shifting channels.

Monthly discharge of Little Blue River near Fairbury, Nebr., for 1910.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
January	.....	.....	[a] 320	19,200	D.
February	580	260	361	20,000	C.
March	440	205	267	16,400	C.
April	210	150	187	11,100	C.
May	5,050	160	412	25,300	D.
June	6,300	160	710	42,200	D.
July	440	160	225	13,800	C.
August	2,600	150	378	23,200	C.
September	1,780	130	264	15,700	C.
October	240	151	174	10,700	C.
November	200	151	170	10,100	C.
December	.....	.....	[a] 172	10,600	D.
The year	6,300	.....	303	219,000	

[a] Discharge estimated Jan. 1 to 24 and Dec. 11 to 31 because of ice conditions.

NOTE.—The mean for January is approximate.

MISCELLANEOUS MEASUREMENTS.

The miscellaneous measurements made in the Missouri River basin in 1910 are presented in the following pages. They have been listed under drainage basins in the same order as the regular stations:

Miscellaneous measurements in Missouri River basin.

Missouri River proper.

Date.	Stream.	Tributary to—	Locality.	Gage height.	Discharge.
				Feet.	*Sec.-ft.*
Nov. 22[a]	Missouri River	Mississippi River	Gaging station, Kansas City, Mo.	[b] 4.50	22,200

Upper Missouri River basin.

June 27	Red Rock River	Missouri	Lyons ranch, near Monida, Mont.	.....	66
July 6	.....do	.....do	.....do	.....	38
19	.....do	.....do	.....do	.....	38
30	.....do	.....do	.....do	.....	34
13	Sixteen Mile Creek	.....do	Lombard, Mont	.....	34
Oct. 1	Crow Creek	.....do	Townsend, Mont	.....	29
Sept. 9	Warm Spring Creek	Judith River	At mouth near Lewiston, Mont.	.....	142

Milk River basin.

Jan. 14	Milk River	Missouri River	Malta, Mont	.....	[c] 25
16	.....do	.....do	Exeter, Mont	.....	[c] 25
June 21	.....do	.....do	Chinook, Mont	.....	33
July 9	.....do	.....do	.....do	.....	35

[a] Made at Hannibal Railroad bridge near foot of Broadway, Kansas City, Mo. Measurement by G. L. Parker.

[b] Gage height referred to St. Louis directrix, which is 303.3 feet below the zero of the gage.

[c] Estimated.

Miscellaneous measurements in Missouri River basin—Continued.

Yellowstone River basin.

Date.	Stream.	Tributary to—	Locality.	Gage height.	Discharge.
				Feet.	*Sec.-ft.*
Sept. 10	Clark Fork	Yellowstone	Clark, Wyo.		244
10	Paint Creek	Clarke Fork	Near junction with Clark Fork, near Clark, Wyo.		7.8
10	Pat O'Hare Creek	do	Allison's Ranch, near Clark, Wyo.		5.2
22	Tensleep Creek	No Wood River	Above mouth of Canyon Creek near Tensleep, Wyo.		63
23	do	do	do		82
22	Canyon Creek	Tensleep Creek	At mouth, near Tensleep, Wyo.		24
23	do	do	do		29

Cheyenne River basin.

May 20[a]	Belle Fourche River	Cheyenne River	At cable station, 300 feet below diverting dam near Belle Fourche, S. Dak.	2.00	853
24[a]	do	do	do	1.06	321

Minor Missouri River basins in North Dakota.

July 21	White Earth River	Missouri River	At mouth, T. 153 N., R. 94 W.		[b] 2.5
Aug. 11	do	do	do		[b] 1.0
2	do	do	White Earth, N. Dak.		[b] 1.8
10	Shell Creek	do	Sec. 28, T. 151 N., R. 91 W.		[b] 2.5
10	Rising Water Creek	do	At mouth, T. 150 N., R. 90 W.		[b] 1.2
5	Little Missouri River	do	Sec. 5, T. 147 N., R. 92 W.		66
8	Douglas Creek	do	At mouth, T. 147 N., R. 85 W.		[b] 1.5

Niobrara River basin.

Aug. 30	Long Pine Creek	Niobrara River	2 miles west of Long Pine, Nebr.		50

Minor Missouri River drainage in Nebraska.

Oct. 26	Little Nemaha	Missouri River	Sec. 16, T. 6 N., R. 13 E., Brock, Nebr.		88

Platte River basin.

Sept. 1	North Platte River	Platte River	Keystone, Nebr.		52
Nov. 6	Laramie River	North Platte River	Laramie Poudre Co. Dam site near Glendevey, Colo.		[c] 3
Aug. 21	do	do	Boswell ranch near Jelm, Wyo.	1.00	42
Sept. 18	do	do	do	1.08	49
Nov. 8	do	do	do	1.00	41
9	East Fork of Lone Tree Creek.	Laramie River	2 miles west of Tie Siding, Wyo.		[c] 1

[a] Made by F. J. Barnes, U. S. Reclamation Service. [b] Made by floats. [c] Estimated.

Miscellaneous measurements in Missouri River basin—Continued.

Platte River basin—Continued.

Date.	Stream.	Tributary to—	Locality.	Gage height.	Discharge
				Feet.	*Sec.-ft.*
Nov. 9	Sand Creek	Laramie River	At highway bridge on road between Jelm and Tie Siding, Wyo.		a 2
8	McIntyre Creek	do	Measurement by wading 100 feet below old rod gage, Gleneyre, Colo.	1.15	4.5
7	Nun Creek	do	Just above mouth of Deadman Creek above Glendevey, Colo.		a 2.25
7	do	do	25 feet above mouth, Nun Creek, Glendevey, Colo.		4.9
8	do	do	do		5.2
7	Deadman Creek	Nun Creek	1 mile above Glendevey, Colo.		a 2.75

South Platte River basin.

Jan. 30	Buffalo Creek	North Fork of South Platte.	At Buffalo, Colo.		a 0.25
30	Elk Creek	do	Pine Grove, Colo.		a 2
Feb. 24	do	do	do		a 2
25	do	do	do		a 2
Mar. 27	do	do	do		a 4.5
30	do	do	do		a 7.5
Apr. 13	do	do	do		a 5.5
May 11	do	do	do		a 4
28	do	do	do		a 7
July 16	do	do	do		a 2
Nov. 19	do	do	do		a 3
Feb. 1	Deer Park Creek	do	Near Crossons, Colo.		a 4.5
25	do	do	do		a 3
Mar. 30	do	do	do		a 7
May 11	do	do	do		a 10
28	do	do	do		a 8
July 19	do	do	do		a 3
Aug. 30	do	do	do		a 4
Nov. 19	do	do	do		a 3
Feb. 1	Geneva Creek	do	At mouth Geneva Creek at Grant, Colo. Wading measurement.		15.0
Jan. 31	Three Mile Creek	Geneva Creek	Ice measurement just above mouth Three Mile Creek, near Sullivan's ranch, Grant, Colo.		1.9
Feb. 28	do	do	do		2.0
Mar. 29	do	do	Wading 100 feet above mouth. Near Sullivan's ranch, Grant, Colo.		1.65
May 10	do	do	do		2.4
29	do	do	do		3.0
July 18	do	do	Wading 100 feet above mouth Three Mile Creek, near Sullivan's ranch, Grant, Colo.		1.3
Aug. 29	do	do	Wading measurement 50 feet above mouth Three Mile Creek, near Sullivan's ranch, Grant, Colo.		1.9
Sept. 19	do	do	do		2.3
Nov. 19	do	do	Near Sullivan's ranch, Grant, Colo.		a 2
Oct. 7	Clear Creek	South Platte River	At bridge above mouth of South Clear Creek, Georgetown, Colo.		19.2
6	do	do	At highway bridge 4 miles above Silver Plume, Colo.		20.8

a Estimated.

Miscellaneous measurements in Missouri River basin—Continued.

South Platte River basin—Continued.

Date.	Stream.	Tributary to—	Locality.	Gage height.	Discharge.
				Feet.	*Sec.-ft.*
July 23	North Fork of Clear Creek.	Clear Creek	Measurement by wading 200 feet above mouth. At Forkscreek, Colo.	.....	3.7
Dec. 8	.....do.....	.....do.....	Measurement by wading 25 feet below C. & S. Ry. bridge, Forkscreek, Colo.	.....	2.5
Oct. 9	.....do.....	.....do.....	1 mile above Smith Hill, Colo.	.....	2.3
9	.....do.....	.....do.....	1 mile above Missouri Creek road and 4 miles above Blackhawk, Colo.	.....	1.2
8	Chicago Creek.....	.....do.....	Above mouth West Chicago Creek, and 8 miles above Idaho Springs, Colo.	.....	4
7	Fall River.....	.....do.....	2 miles above mouth Fall River, near Idaho Springs, Colo.	.....	6.9
7	West Clear Creek.....	.....do.....	Just below mouth Mud Creek and 1 mile above Empire, Colo.	.....	13.6
7	West Chicago Creek.....	Chicago Creek.....	At mouth West Chicago Creek, and 8 miles above Idaho Springs, Colo.	.....	1.6
7	Mud Creek.....	West Clear Creek.....	At mouth Mud Creek, and 1 mile above Empire, Colo.	.....	a 4
Nov. 6	Cache la Poudre River..	South Platte River.....	Just below Chambers Lake Outlet, Colo.	.....	14
9	Dale Creek.....	North Fork of Cache la Poudre River.	Near Virginia Dale, Colo.	.....	a 2
5	Roaring Creek.....	Cache la Poudre River..	Near mouth Roaring Creek, about 2½ miles above Home, Colo.	.....	a 2
5	Trap Creek.....	.....do.....	Just below Chambers Lake, Colo.	.....	b 1.0
5	Joe Wright Creek.....	.....do.....	Chambers Lake, Colo...	.....	b 4.0
5	Fall River.....	.....do.....	.....do.....	.....	b 1.5
5	Big South Creek	.....do	At mouth, 11 miles above Home, Colo.	.....	8.2

a Estimated. b Float measurement.

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