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DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY
CHARLES D. WALCOTT, DIRECTOR

REPORT

OF

PROGRESS OF STREAM MEASUREMENTS

FOR

THE CALENDAR YEAR 1904

PREPARED UNDER THE DIRECTION OF F. H. NEWELL
BY
D. W. ROSS, J. T. WHISTLER, and T. A. NOBLE

PART XII.—Columbia River and Puget Sound Drainage.

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1905

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DEPARTMENT OF THE INTERIOR,
UNITED STATES GEOLOGICAL SURVEY,
HYDROGRAPHIC BRANCH,
Washington, D. C., May 17, 1905.

SIR: I transmit herewith the manuscript of Part XII of a series of twelve papers which compose the Report of Progress of Stream Measurements for the Calendar Year 1904. Parts I to VI of this report contain the results of the data collected in the territory east of Mississippi River. Parts VII to XII are devoted to the data collected in the territory west of Mississippi River.

The data for this paper were collected under the direction of T. A. Noble, D. W. Ross, and J. T. Whistler. Mr. Noble had charge of the work in Washington, and was assisted by G. H. Bliss, G. F. Harley, and W. G. Steward. Mr. Ross had charge of the work in Idaho and was assisted by Robert Stockton and J. B. Bond. Mr. Whistler had charge of the work in Oregon and was assisted by W. C. Sawyer and J. H. Lewis.

The assembling of the data and the preparation for publication were done under the direction of John C. Hoyt, who has been assisted by R. H. Bolster, Robert Follansbee, Willis E. Hall, G. F. Harley, A. H. Horton, and H. D. Padget.

I request that this manuscript be published as one of the series of water-supply and irrigation papers.

Very respectfully,

F. H. NEWELL, *Chief Engineer.*

Hon. CHARLES D. WALCOTT,
Director United States Geological Survey.

PROGRESS REPORT OF STREAM MEASUREMENTS FOR THE CALENDAR YEAR 1904.

PART XII.

By D. W. Ross, J. T. Whistler, and T. A. Noble.

INTRODUCTION.

The hydrographic work of the United States Geological Survey includes the collection of facts concerning, and the study of conditions affecting, the behavior of water from the time it reaches the earth as rain or snow until it joins the oceans or great navigable rivers. These investigations became a distinct feature of the work of the Survey in the fall of 1888, when an instruction camp was established at Embudo. N. Mex. Since that date the work has been continually and gradually extended as larger funds became available. The first distinctive appropriation for gaging streams was made by the act of August 18, 1894, which contained an item of $12,500 "for gaging the streams and determining the water supply of the United States, including the investigation of underground currents and artesian wells in the arid and semiarid sections." (Digest of Appropriations for 1895, p. 270.)

Since that time a similar act has been passed each year and the appropriations have gradually increased, as shown in the following table:

Annual appropriations for hydrographic surveys.

Year ending June 30, 1895	$12,500
Year ending June 30, 1896	25,000
Year ending June 30, 1897	50,000
Year ending June 30, 1898	50,000
Year ending June 30, 1899	50,000
Year ending June 30, 1900	50,000
Year ending June 30, 1901	100,000
Year ending June 30, 1902	100,000
Year ending June 30, 1903	200,000
Year ending June 30, 1904	200,000
Year ending June 30, 1905	200,000
Year ending June 30, 1906	200,000

The chief feature of the work of the hydrographic division is the systematic study of the flow of the surface waters and the conditions affecting the same. In this connection other information that may be of use to the engineer or others in hydrographic studies, such as river profiles, duration and extent of damage by floods, water-power data, etc., is collected. Furthermore, the work has been so directed that the information collected will be of direct value in the commercial and agricultural development of the country.

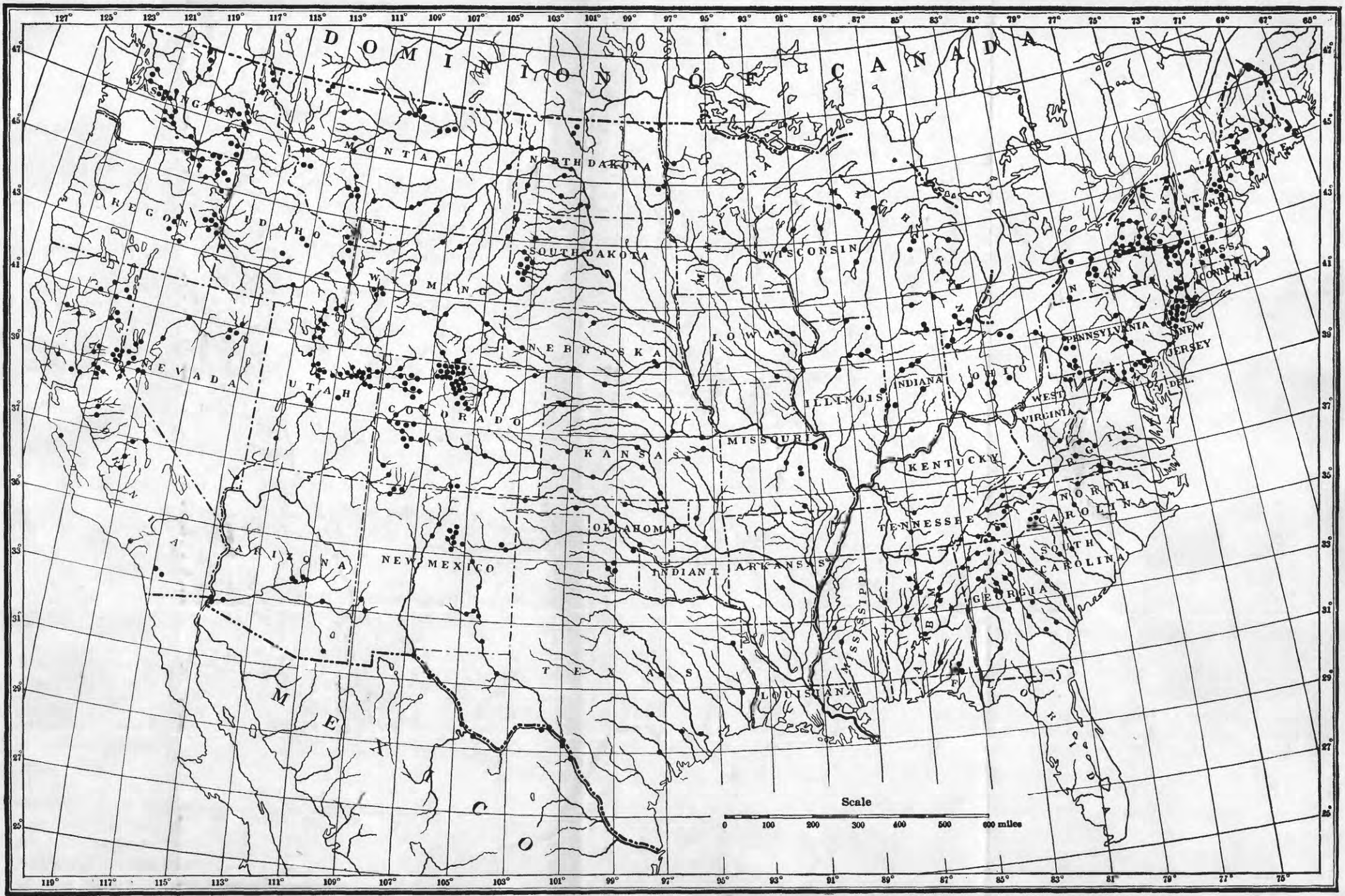
As a result of the increased appropriations since June 30, 1902, the work has been largely extended and thoroughly systemized. The various States have been grouped into districts, each of which is under the supervision of a district hydrographer who, with a corps of assistants, devotes his whole time to the study of the hydrographic resources of his district.

The methods used in the collection of these data and in their preparation for publication are given in detail in Water-Supply Paper No. 94. (Hydrographic Manual, U. S. Geol. Survey.)

The general plan of stream gaging which has been developed is to obtain eventually data in regard to the flow of all the important streams in the United States. With this in view, gaging stations are established at points where the data will be of greatest commercial value. At these stations discharge measurements are taken from time to time at typical river stages, and the daily surface fluctuation is obtained by means of gage readings. From these two factors it is possible to estimate both the total flow and its distribution through the period of observation.

The selection of the site for a gaging station and the length of time the station is maintained depend largely upon the needs of each locality. If the stream is to be used for water power, special efforts are made to obtain information concerning the low-water flow. If water is to be stored, the high waters are given special attention. In all sections certain permanent stations are maintained for general statistical purposes to show the conditions which exist through long periods. They also act as primary stations, and are used in connection with short series of measurements to determine the flow in particular portions of the drainage basin.

Gaging stations are divided into two general classes: First, current-meter stations, and second, weir stations. The former class is subdivided as to location into bridge, cable, boat, and wading stations. Fig. 1 shows a cable station with car, tag line, inclined gage, etc. In addition to the bridge, cable, or boat, the equipment of a current-meter gaging station consists in a gage for determining the daily fluctuations of the water surface, bench marks to which the zero of the gage is referred, and permanent marks on the bridge or a tagged line indicating the points of measurement. Where the current is swift



MAP OF THE UNITED STATES, SHOWING LOCATION OF PRINCIPAL RIVER STATIONS MAINTAINED DURING 1904.

MAP OF THE UNITED STATES, SHOWING LOCATIONS OF PRINCIPAL SIGNAL STATIONS MAINTAINED DURING 1864.

some appliance, generally a secondary cable, is necessary to hold the meter below the surface.

Gaging stations are generally located at bridges, if the channel conditions are satisfactory, as from them the meter can be easily manipulated and the cost of the equipment is comparatively small. The stations are located as far as possible at points where the channel is straight, both above and below the gaging section, and where there are no cross currents, backwater, or boils. The bed of the stream should be as clear as possible from large projections and of a permanent character. The banks should be high, and should overflow at high stages only. At stations with shifting beds more measurements are made, and special methods of computing daily discharges are employed. Great care is taken in the selection and equipment of gaging stations, in order that the data may have the required degree of accuracy.

On many of the larger rivers, where water power is developed by dams, estimates of flow are obtained by observing the head on the

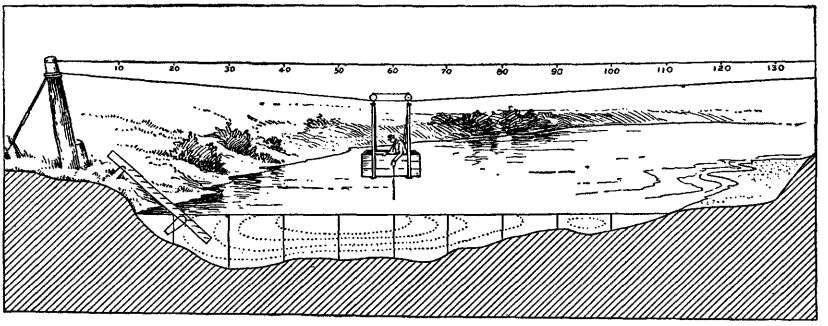


FIG. 1.—Cable station, showing section of river, car, gage, etc.

crest and using a weir formula. On the smaller streams sharp-crested weirs are in some cases erected.

The principal instrument used in stream-measurement work is the current meter, by which the velocity of the flow of water is determined. After years of experience the Survey has adopted the Price current meter for general work. This meter, as is shown on Pl. II, is made in two sizes, known as the large and small Price. The small Price has been largely developed by the officers of the Survey, using the Price acoustic meter as a basis.

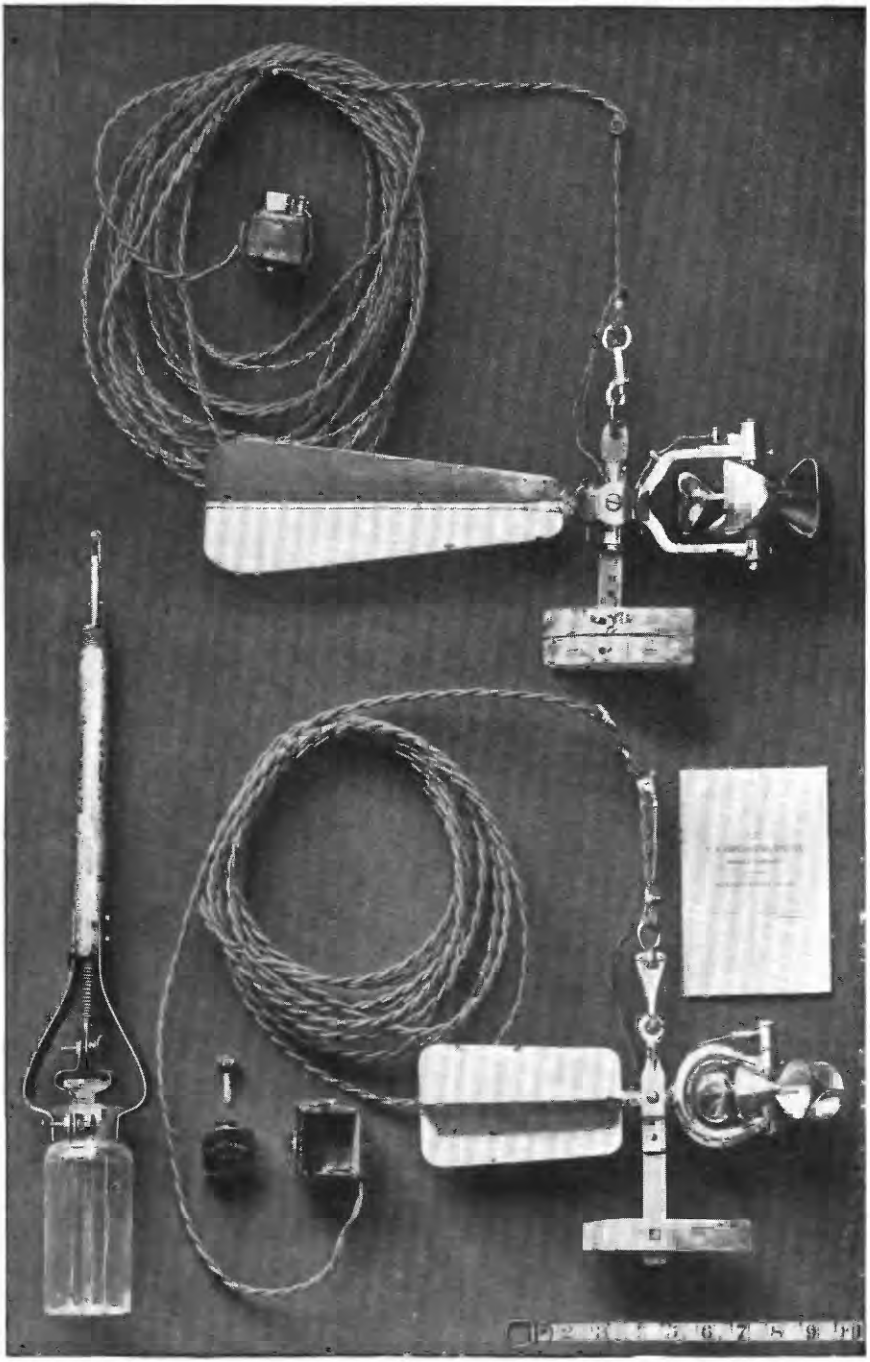
A discharge measurement is the determination of the quantity of water flowing past a certain point at a given time. This quantity is the product of two factors: (1) The mean velocity, which is the function of the cross section, surface slope, wetted perimeter, and roughness of bed; (2) the area, which depends upon the permanency of the bed and the fluctuations of the surface, which govern the depth.

In making the measurement an arbitrary number of points are laid off perpendicular to the thread of the stream (see fig. 1). These points are usually at regular intervals varying from 2 to 20 feet, depending upon the size and conditions of the stream. They are known as measuring points, and at them the observed data, the velocities and soundings, are taken. The perpendiculars dropped from the measuring points divide the gaging section into strips, and for each strip or pair of strips the mean velocity, area, and discharge are determined independently; thus conditions existing in one part of the stream are not distributed to parts where they do not apply.

The methods of obtaining velocity with the current meters which are in general use may be grouped into three classes: Single point, multiple point, and integration.

The single-point method consists in holding the meter either at the depth of the thread of mean velocity or at an arbitrary depth for which the coefficient for reducing to mean velocity has been determined. Extensive experiments by vertical velocity-curves show that the thread of mean velocity lies at from 0.5 to 0.7 of the total depth. In general practice the thread of mean velocity is considered to be at 0.6 depth, and it is at this depth that the meter is held in the majority of the measurements, this being known as the six-tenths depth method. It is found by a large number of vertical velocity-curve measurements, taken on various streams and under various conditions, that the coefficient for reducing the velocity obtained at six-tenths depth to mean velocity is practically unity, ranging, in a series of 910 measurements made at 39 gaging stations, between .94 and 1.04, with a mean for the 910 observations of 1.00. In the other principal single-point method the meter is held near the surface, usually 1 foot below, or low enough to be out of the action of the wind or other disturbing influences. This is known as the subsurface method. The coefficient for reducing the velocities taken at the subsurface has been found by repeated experiments with vertical velocity-curves to be from .85 to .95, depending upon the depth of the stream and velocity and channel conditions. This method is specially adapted for flood measurements or when the velocity is so great that the meter can not be kept at 0.6 depth.

The three principal multiple-point methods in general use are: The vertical velocity curve; top and bottom; and top, bottom, and mid depth. In the vertical velocity-curve method a series of velocity determinations are taken in the vertical at regular intervals, usually from 0.5 to 1 foot apart. By plotting these velocities as abscissas and their depths as ordinates, and drawing a smooth curve through these points, the vertical velocity-curve is produced, which shows the change in velocity from the surface to the bottom of the stream. The mean velocity in the vertical is then obtained by dividing the depth



PRICE CURRENT METERS, WITH BUZZERS.

into the area bounded by this mean velocity-curve and the initial line. Owing to the length of time it takes to make these measurements, they are seldom used except for determining coefficients for purposes of comparison and for measurements under ice.

In the second multiple-point method the meter is held from 0.5 to 1 foot below the surface and about 0.5 foot above the bottom, and the mean of the velocities at these two points is taken as the mean velocity for that vertical. This method is not well adapted for general work, as the roughness of the bottom disturbs the velocity at that point. For shallow streams with comparatively smooth beds good results are obtained by this method. In the third multiple-point method the meter is held at mid depth, 0.5 foot below the surface, and 0.5 foot above the bottom, and the mean velocity is determined by dividing the sum of the top velocity, twice the mid-depth velocity, and the bottom velocity by 4.

The vertical-integration method consists in moving the meter at a slow, uniform speed from the surface to the bottom and back again to the surface. The number of revolutions and the time taken in the operation is noted, and the mean velocity is found by dividing the number of revolutions by the number of seconds taken in the run. This method has the advantage in that the velocity at each point of the vertical is measured twice. It is well adapted for measurements under ice and as a check on the point methods.

The area, which is the other factor for determining the discharge of the stream, depends upon the stage of the river, which is taken on a gage, and the general contour of the bed of the stream, which is found by sounding. The soundings are usually taken at each measuring point at the time of the discharge measurement, either by using the meter and cable or by a special sounding line or rod. For stations with permanent beds standard cross sections are usually taken during low water. These sections serve to check the soundings which are taken at the time of the measurements, and from them any change which may have taken place in the bed of the stream can be detected. They are also used for obtaining the area for use in high-water measurement computations, as accurate soundings are hard to obtain at high stages.

In computing the discharge measurements from the observed velocities and depths at the various points of measurements the measuring section is divided into elementary strips, as shown in fig. 1, and the mean velocity, area, and discharge are determined separately for either a single or double strip. The total discharge and area are the sums of those for the various strips, and the mean velocity is obtained by dividing the total discharge by the total area.

The volume of water flowing in a stream is known as run-off. In expressing it various units are used, depending upon the kind of work

for which the data are needed. Those used in this report are "second-feet," "acre-feet," "run-off per square mile," and "run-off in depth in inches," and may be defined as follows:

"Second-foot" is an abbreviation for cubic foot per second, and is the body of water flowing in a stream 1 foot wide, 1 foot deep, at a rate of 1 foot per second.

The "acre-foot" is the unit of capacity used in connection with storage for irrigation work, and is equivalent to 43,560 cubic feet. It is the quantity required to cover an acre to a depth of 1 foot. There is a convenient relation between the second-foot and the acre-foot; 1 second-foot flowing for twenty-four hours will deliver 86,400 cubic feet, which equals 1.9835 acre-feet, or approximately 2 acre-feet.

The expression "second-feet per square mile" means the number of cubic feet of water flowing each second from every square mile of drainage area on the assumption that the run-off is uniformly distributed.

"Depth in inches" means the depth of water in inches that would have covered the drainage area, uniformly distributed, if all the water could have accumulated on the surface. This quantity is used for comparing run-off with rainfall, which quantity is usually given in depth in inches.

It should be noticed that "acre-feet" and "depth in inches" represent the actual quantities of water which are produced during the periods in question, while "second-feet," on the contrary, is merely a rate of flow, per second.

The base data for computing the daily discharge of a stream are the daily gage heights, and the various discharge measurements of which there should be sufficient number to cover the range of stage. The fundamental laws upon which these computations are based are the following:

(1) The discharge will remain constant so long as the conditions at or near the gaging station remain constant;

(2) Neglecting the change of slope due to the rise and fall of the stream, the discharge will be the same whenever the stream is at a given stage; and

(3) The discharge is both a function of, and increases gradually with, the gage heights. (2 and 3 depend on 1.)

As the beds of many streams are changeable, the problem divides itself into two classes: (1) Those of streams with permanent or practically permanent beds, and (2) those of streams with changeable beds. The base data and methods of obtaining them are the same for either class, and it is only in the computation of the mean daily flow that different methods are necessary.

In determining the daily discharge of streams with permanent beds the results of the discharge measurements are plotted on cross-section

paper, with gage heights as ordinates and discharges as abscissas. Through these points a smooth curve is drawn, which shows the discharge for any gage height, and from which a rating table is prepared. Aside from plotting the discharge, the mean velocity and area determined for each discharge measurement are plotted. Through these points the curves of mean velocity and of area are drawn, and the rating curve is largely determined by taking the product of the mean velocity and the area at various stages as determined by these curves. These curves of mean velocity and area are of special value to determine the location of the rating curve for stages at which actual discharge measurements are not available and for extending the discharge curve outside the limits of the measurements. In the preparation of the rating table the discharge for each tenth or half tenth on the gage is found from the curve. The first and second differences of these discharges are then taken and adjusted according to the law that they shall either be constant or increasing, never decreasing. The discharges in the table are then changed in accordance with these adjusted differences. In making up the station-rating curve the individual discharge measurements and the conditions under which they were taken are carefully studied in order that proper weight shall be given to each measurement. Rating curves in general take the form of a parabola, and as a rule the high-water portion of the curve approaches a straight line. For stations of permanent character the results of the measurements from year to year should be within 5 per cent of the curve, with the exception of those taken during high water, when the probable error may be as high as 10 per cent.

The determination of the daily discharge of streams with changeable beds is difficult, and unless frequent discharge measurements are made the results obtained are only roughly approximate. For streams with continually shifting beds, such as Colorado River and the Rio Grande, discharge measurements are made every two or three days, and the discharges for the intervening days are obtained by interpolation, modified by the gage heights for these days. For stations with beds which shift slowly, or are only materially changed during floods, station-rating curves and tables can be prepared for the periods between changes, and satisfactory results can be obtained with two or three measurements a month, providing measurements are taken soon after the changes take place.

In determining the flow for periods when the streams are frozen, special rating curves and tables have to be prepared from measurements taken under these conditions. The methods of constructing these curves and tables are the same as for open sections. The discharge measurements, however, are either taken by integration in

verticals or by the vertical velocity-curve method, as sufficient experiments have not been made on ice-covered streams to determine the laws which govern the position of the thread of mean velocity.

The Report of Progress of Stream Measurements for the Calendar Year 1904, of which this is Part XII, is published in a series of twelve Water-Supply Papers, Nos. 124–135, inclusive, under the following subtitles:

Part 1. Atlantic coast of New England drainage.
Part 2. Hudson, Passaic, Raritan, and Delaware River drainages.
Part 3. Susquehanna, Patapsco, Potomac, James, Roanoke, Cape Fear, and Yadkin River drainages
Part 4. Santee, Savannah, Ogeechee, Altamaha rivers, and Eastern Gulf of Mexico drainage.
Part 5. Eastern Mississippi River drainage.
Part 6. Great Lakes and St. Lawrence River drainage.
Part 7. Hudson Bay, Minnesota, Wapsipinicon, Iowa, Des Moines, and Missouri River drainages.
Part 8. Platte, Kansas, Meramec, Arkansas, and Red River drainages.
Part 9. Western Gulf of Mexico drainage.
Part 10. Colorado River and Great Basin drainage.
Part 11. The Great Basin and Pacific Ocean drainage in California.
Part 12. Columbia River and Puget Sound drainage.

The territory covered by each paper is given in the subtitle, and the larger drainages are, for convenience in arrangement, subdivided into smaller ones, under which the data are arranged, as far as practicable, geographically.

These papers contain the data that have been collected at the regular gaging stations, the results of the computations based upon the observations, and such other information that has been collected that has a direct bearing on these data, including, as far as practicable, descriptions of the drainage areas and the streams draining them.

For each regular station are given, as far as available, the following data:

1. Description of station.
2. List of discharge measurements.
3. Gage-height table.
4. Rating table.
5. Table of estimated monthly and yearly discharges and run-off.

The descriptions of stations give, as far as possible, such general facts about the locality and equipment as would enable the reader to find the station and use the same. They also give, as far as possible, a complete history of all the changes that have occurred since the establishment of the station that would be factors in using the data collected.

The discharge-measurement table gives the results of the discharge measurements made during the year. This includes the date, the

hydrographer's name, the gage height, and the discharge in second-feet.

The table of daily gage heights gives for each day the mean height of the surface of the river as found from the mean of the gage readings taken on that day. At most of the stations the gage is read in the morning and in the evening.

The rating table gives discharges in second-feet corresponding to each stage of the river as given by the gage heights.

In the table of estimated run-off the column headed "Maximum" gives the mean flow for the day when the mean gage height was the highest, and it is the flow as given in the rating table for that mean gage height. As the gage height is the mean for the day, there might have been short periods when the water was higher and the corresponding discharge larger than given in this 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" gives the average flow for each second during the month. Upon this mean the computations for the three remaining columns which are defined on page 16 are based.

In the computations for the tables of this report the following general and special rules have been used:

Fundamental rules for computation.

1. The highest degree of precision consistent with the rational use of time and money is imperative.

2. All items of computation should, in general, be expressed by at least two and by not more than four significant figures.

3. Any measurement in a vertical velocity, mean velocity, or discharge curve whose per cent of error is 5 times the average per cent error of all the other measurements should be rejected.

4. In reducing the number of significant figures, or the number of decimal places, by dropping the last figure, the following rules apply:

(a) When the figure in the place to be rejected is less than 5, drop it without changing the preceding figure. Example: 1,827.4 becomes 1,827.

(b) When the figure in the place to be rejected is greater than 5, drop it and increase the preceding figure by 1. Example: 1,827.6 becomes 1,828.

(c) When the figure in the place to be rejected is 5, and it is preceded by an even figure, drop the 5. Example: 1,828.5 becomes 1,828.

(d) When the figure in the place to be rejected is 5, and it is preceded by an odd figure, drop the 5 and increase the preceding figure by 1. Example: 1,827.5 becomes 1,828.

5. In constructing and applying rating tables a maximum limit of one-half per cent error should seldom be exceeded.

Special rules for computation.

1. Rating tables are to be constructed as close as the data upon which they are based will warrant. No decimals are to be used when the discharge is over 50 second-feet.

2. Daily discharges shall be applied directly to the gage heights as they are tabulated.

3. Monthly means are to be carried out to one decimal place when the quantities are below 100 second-feet. Between 100 and 10,000 second-feet, the last figure in the monthly mean shall be a significant figure. This also applies to the yearly mean.

4. Second-feet per square mile and depth in inches for the individual months shall be carried out at least to three significant figures, except in the case of decimals, where the first significant figure is preceded by one or more "0," when the quantity shall be carried out to two significant figures. Example: 1.25; .125; .012; .0012. The yearly means for these quantities are always to be expressed in three significant figures and at least two decimal places.

The results of the stream measurements made during previous years by the United States Geological Survey can be found in the following Survey publications. A detailed index of the reports for years previous to 1904 is given in Water-Supply Paper No. 119.

1888. Tenth Annual Report, Part II.
1889. Eleventh Annual Report, Part II.
1890. Twelfth Annual Report, Part II.
1891. Thirteenth Annual Report, Part III.
1892. Fourteenth Annual Report, Part II
1893. Bulletin No. 131.
1894. Bulletin No. 131; Sixteenth Annual Report, Part II.
1895. Bulletin No. 140.
1896. Water-Supply Paper No. 11; Eighteenth Annual Report, Part IV.
1897. Water-Supply Papers Nos. 15 and 16; Nineteenth Annual Report, Part IV.
1898. Water-Supply Papers Nos. 27 and 28; Twentieth Annual Report, Part IV.
1899. Water-Supply Papers Nos. 35 to 39, inclusive; Twenty-first Annual Report, Part IV.
1900. Water-Supply Papers Nos. 47 to 52, inclusive; Twenty-second Annual Report, Part IV.
1901. East of Mississippi River, Water-Supply Papers Nos. 65 and 75.
West of Mississippi River, Water-Supply Papers Nos. 66 and 75.
1902. East of Mississippi River, Water-Supply Papers Nos. 82 and 83.
West of Mississippi River, Water-Supply Papers Nos. 84 and 85.
1903. East of Mississippi River, Water-Supply Papers Nos. 97 and 98.
West of Mississippi River, Water-Supply Papers Nos. 99 and 100.
1904. East of Mississippi River, Water-Supply Papers Nos. 124 to 129, inclusive.
West of Mississippi River, Water-Supply Papers Nos. 130 to 135, inclusive.

A limited number of these are for free distribution, and as long as the supply lasts they may be obtained by application to the Director United States Geological Survey or to members of Congress. Other copies are filed with the Superintendent of Public Documents, Washington, D. C., from whom they may be had at prices little above cost. Copies of Government publications are, as a rule, furnished to the public libraries in our large cities, where they may be consulted by those interested.

COOPERATION AND ACKNOWLEDGMENTS.

Most of the measurements presented in this paper have been obtained through local hydrographers. Acknowledgment is extended to other persons and corporations who have assisted local hydrographers or have cooperated in any way, either by furnishing records of the height of water or by assisting in transportation.

The following list, arranged alphabetically by States, gives the names of the resident hydrographers and others who have assisted in furnishing and preparing the data contained in this report:

Idaho.—District engineer, D. W. Ross [a], assisted by Fred Stockton, William G. Davies, and J. B. Bond. Acknowledgments and thanks are due the Oregon Short Line Railroad Company for transportation furnished the district hydrographer and his assistants.

Montana.—District engineer, C. C. Babb [b], assisted by A. E. Place, L. R. Stockman, and Robert Follansbee, assistant engineers, and W. B. Freeman, engineering aid.

Oregon.—District engineer, J. T. Whistler [c], assisted by J. H. Lewis during the first quarter, and by Wilbur C. Sawyer, E. N. Smith, and Ivan Landes the remainder of the year. Acknowledgment and thanks are due the Oregon Railroad and Navigation Company, Southern Pacific Railway Company, Oregon Short Line Railroad Company, Sumpter Valley Railway, and the Columbia Southern Railway for transportation; to the Pacific Live Stock Company, through Mr. Gilchrist, superintendent, for gratuitous gage readings, to W. C. McDonald for the use of his ferry cable on John Day River as a gaging station, and to Mr. J. H. Cunningham, civil and hydraulic engineer, Portland, Oreg., for several miscellaneous current meter measurements.

Washington.—District engineer, T. A. Noble [d], assisted by George H. Bliss, W. G. Steward, and George F. Harley. Acknowledgments and thanks are due to the many owners and managers of irrigation canals in Yakima River Valley for assistance and information furnished in the prosecution of the work in that locality. Acknowledgments are also due to the Washington Irrigation Company, through Walter N. Granger, manager; Northern Pacific Irrigation Company, through O. L. Hanson, superintendent; Washington Water-Power Company, Northern Pacific Railway, Great Northern Railway, and Oregon Railroad and Navigation Company, for assistance and information.

Wyoming.—District hydrographer, M. C. Hinderlider [e], and resident hydrographer, A. J. Parshall. Acknowledgments are due for annual passes over all their lines in Wyoming to the Union Pacific Chicago, Burlington and Quincy; Colorado and Southern; Colorado and Wyoming; and Fremont, Elkhorn and Missouri River Valley Railroad Companies.

COLUMBIA RIVER DRAINAGE BASIN.

Next to the Colorado, Columbia River drains the largest area of all rivers in the arid region. Its drainage basin includes parts of Washington, Oregon, Idaho, Montana, and a large area in Canada. No extensive observations of its flow have been made, but the data obtained indicate that the discharge of Columbia River is much greater than that of the Colorado. The Columbia and its numerous tributaries are of great importance, offering good sites for water-power development and an abundance of water for irrigation, while the main river is navigable for a considerable distance.

A great part of the water of Columbia River and its tributaries flows to waste, not being utilized. This is due to the fact that the river has cut so deeply into the lava-covered plains that water can not be diverted except at points near the mountains, where the streams

[a] Office of district engineer, Boise, Idaho.
[b] Office of district engineer, Browning, Mont.
[c] Office of district engineer, Pendleton, Oreg.
[d] Office of district engineer, North Yakima, Wash.
[e] Office of district hydrographer, Chamber of Commerce Building, Denver, Colo

are of small size and have not yet entered the deeply incised canyon in the plateaus. The following rivers are tributary to the Columbia:

Umatilla River rises in the well-wooded country in northeastern Oregon and flows in a general westerly direction, entering Columbia River below the mouth of Walla Walla River. The country north of Umatilla is high and rolling. A number of canals divert water from the lower course of the stream to irrigate lands on either side.

Yakima River has its source in Keechelus Lake, on the eastern slope of the Cascade Mountains, in Kittitas County, Wash. Within a short distance it receives the waters of Kachess Lake, and 2½ miles above Clealum it receives the outlet of the last of the three large headwater lakes. It enters Columbia River 23 miles below Kiona, Wash.

Naches River has its source on the eastern slope of the Cascade Mountains, in Yakima County, Wash. It flows in a general southeasterly direction, entering Yakima River a short distance above North Yakima. Irrigation is practiced in the narrow valley along the lower course of the river, but its waters are of greater value for the irrigation of lands west of North Yakima. The river has considerable fall, and the water can easily be diverted by means of comparatively short canals.

Tieton River is the principal tributary of Naches River and discharges into the latter about 17 miles above its junction with the Yakima River, near North Yakima. Its source is in the Cascade Mountains in the vicinity of Cowlitz Pass. A peculiar feature of the stream is the turbid, milk-white appearance of the water, it being similar in this respect to White River, on the western slope of the Cascade Range. The water of the South Fork of the Tieton, 25 miles above the mouth, is, however, perfectly clear. The forks head in the glaciers of a peak of the Cascades known locally as Goat Rock.

Spokane River rises in the northern part of Idaho, being the outlet of Lake Coeur d'Alene. It passes into Washington, flows in a northerly direction, and enters Columbia River near latitude 47° 52′ north. It is about 120 miles long.

Missoula River has its source in Silverbow County, Mont., and flows northerly until it receives the waters of Little Blackfoot River, when it takes a more northwesterly course. The name Missoula is usually applied to that portion of the river between the junction of Blackfoot and Hellgate rivers and the mouth of Pend Oreille River. From that point to its junction with Columbia River it is called Clark Fork of Columbia.

The source of Bitterroot River is in the high mountains which form the boundary line between Montana and Idaho. It flows in a northerly direction, entering Missoula River a short distance below the city of Missoula. The tributaries on the east side drain comparatively

low hills and contribute little to the supply of the river. The west side branches, on the contrary, are numerous, draining a precipitous and heavily wooded area. Their discharges are regulated by many small lakes fed by banks of snow, which continue far into the summer before disappearing altogether. From Hamilton to Missoula, a distance of 48 miles, the fall of the river is 350 feet, or 7.3 feet to the mile.

Snake River, which is the largest affluent of the Columbia, rises on the southern slope of the Continental Divide in the Yellowstone National Park, draining the country west and southwest of Yellowstone Lake. From Shoshone, Lewis, and Hart lakes, near its head, the river flows in a southerly direction through a timbered and mountainous country, resulting in a long period of high water. After continuing through this area for about 20 miles it broadens into Jackson Lake, a deep body of water about 3 miles wide and 8 miles long. Below the lake the river flows through Jackson Hole Valley—about 40 miles long and 8 miles wide—and then enters a long canyon near the Idaho-Wyoming line. All of the large tributaries come from the east, receiving their waters from the Wind River Range. The west side of the valley is bounded by the high Teton Mountains, from which most of the drainage flows westward through Tieton River into North Fork of Snake River. It empties into Columbia River near Pasco Junction, in the State of Washington.

The headwater tributaries of Palouse River have their sources in western Idaho. After passing into Washington the streams unite to form Palouse River, which has a general southwesterly course, through a rolling country. Six miles below Hooper, Wash., Palouse River bends suddenly to the south and enters its canyon, through which it flows until its junction with Snake River. A short distance above the mouth of the river are the Palouse Falls, approximately 180 feet high.

Weiser River drains Washington County, in the extreme western part of Idaho, and flows into Snake River at Weiser, Idaho.

The Boise drains a mountainous and well-wooded country in Elmore County, Idaho. The effects of the forests are shown in the high flow that is maintained throughout the summer season, in contrast to the discharge of Weiser River, farther to the west, which drains a more barren country. Below the gaging station, which is located in the canyon, a large number of canals divert water to irrigate lands in Boise Valley. The diversion of the water is now so great that frequent complaints of scarcity are heard.

Bruneau River rises in northern Nevada and flows in a general northerly course through southern Idaho, emptying into Snake River at a point south of Boise. Fall River is one of the small tributaries of Snake River at its headwaters in eastern Idaho.

The following rivers in the Columbia drainage basin are also worthy of mention: The Walla Walla, the drainage of which is one of the best irrigated and most productive localities in either Washington or Oregon; Owyhee River, which rises in northwestern Nevada and flows southwest through Idaho; Malheur River, rising in the mountains of east-central Oregon and emptying into Snake River west of Boise; the Grande Ronde, which drains the northern slope of the Blue Mountains and empties into Snake River in southeastern Washington.

The following pages give the results of data collected in Columbia River drainage basin during 1904:

COLUMBIA RIVER NEAR PASCO, WASH.

This station was established October 15, 1904, by C. B. Cox. It is located 1.2 miles from Pasco, Wash., at the bridge of the Northern Pacific Railway Company. A staff gage, in two sections, graduated to feet and tenths, is bolted vertically to the third pier from the east end of the bridge. The lower section is graduated from zero to 10 feet. The upper section is graduated from zero to 20 feet, with its zero at the 10-foot mark of the lower section. Gage readings have been reduced to the zero of the lower section. The gage is read once each day by W. B. Sloan. Discharge measurements are made by means of a boat held from the bridge to which the gage is attached by means of a 400-foot, one-fourth inch rope cable. The meter is lowered 2 feet above the bow of the boat over a roller on a projecting plank and controlled by a windlass. The initial point for soundings is 400 feet below the railway bridge, opposite the center of the east pier. The channel is curved for about 800 feet above and straight for about one-fourth mile below the station. The water above the station is smooth. It becomes swift and rough on the west side of the channel 600 feet below the station. Both banks overflow during high water. The bed of the stream is composed of bowlders and is fairly permanent. There is one channel at high, and two at very low stages. The piers of the bridge, a bar 600 feet below the station, and the movement of the boat affect the measurements. A United States Geological Survey standard aluminum bench-mark tablet marked "350" is placed on the south side of the first pier from the east end of the bridge. Its elevation is 349.78 feet above sea level and 42.03 feet above the gage datum. A United States Coast and Geodetic Survey brass bench-mark tablet on the same pier has an elevation of 44.51 feet above the datum of the gage.

The observations at this station during 1904 have been made under the direction of T. A. Noble, district engineer.

Discharge measurement of Columbia River near Pasco, Wash., in 1904.

Date.	Hydrographer.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Sq. feet.	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
October 8	C. B. Cox	22,660	2.82	9.90	64,000

Mean daily gage height, in feet, of Columbia River near Pasco, Wash., for 1904.

Day.	Nov.	Dec.	Day.	Nov.	Dec.	Day.	Nov.	Dec.
1	8.6	8.7	12	8.4	8.1	23	8.4	8.1
2	8.6	8.6	13	8.3	8.2	24	8.4	8.1
3	8.6	8.5	14	8.3	8.1	25	8.5	8.0
4	8.5	8.5	15	8.3	8.1	26	8.5	7.9
5	8.5	8.4	16	8.3	8.0	27	8.5	7.8
6	8.5	8.4	17	8.3	8.0	28	8.6	7.7
7	8.5	8.3	18	8.3	8.1	29	8.6	7.7
8	8.4	8.2	19	8.3	8.1	30	8.7	7.7
9	8.4	8.1	20	8.3	8.1	31	.....	7.6
10	8.4	8.1	21	8.3	8.1			
11	8.4	8.1	22	8.4	8.1			

KOOTENAI RIVER NEAR BONNERS FERRY, IDAHO.

This station was established May 10, 1904, by W. W. Schlecht. It is located at the Great Northern Railway Company's bridge, three-fourths mile below Bonners Ferry, Idaho, 40 miles above Kootenai Lake, and 5 miles below the mouth of Moyie River. A standard chain gage is securely nailed to floor beams near the first bridge pier from the left bank. The length of the chain from the outer edge of the ring to the lower end of the weight is 43.10 feet. The datum of the gage is 1,727.53 feet above sea level, as determined from the datum of the Great Northern Railway at Bonners Ferry. The gage is read once each day by L. Christenson. Discharge measurements are made from the upstream side of the railroad bridge to which the gage is attached. This consists of three stationary and one draw span and a trestle approach at the left bank. The upstream guard timber along the bridge is marked every 5 feet and numbered every 10 feet; along the trestle the marks and numbers are 25 feet apart. A stay wire, 1,000 feet long, is stretched across the river above the bridge at the time of making each measurement. The stream is considered navigable, and the wire can not be left in position. It is stored with the observer. The initial point for soundings is the mean outer face of the northernmost pier, marked with a 10-penny nail and has zero painted in white on the upstream guard timber. The channel is straight for about 1,000 feet above and 350 feet below the station. About 500 feet below the station there is a sharp curve to the right. The current is sluggish. The right bank is high, wooded, and not

liable to overflow. The left bank is low, wooded, and liable to overflow to the railroad embankment which is about 1,200 feet from the bank proper. The bed of the stream is composed of sand, free from vegetation, and may shift during high water. There are five channels beneath the bridge, and during high water another channel under the trestle at sounding station No. 1750.

Bench mark No. 1 is a point on the sill of the bridge near the right bank at sounding station −52, marked "1770" (datum of the Great Northern Railway), established by a United States and Canadian Boundary Survey party. Its elevation is 42.47 feet above the datum of the gage. Bench mark No. 2 is the top of the head of a 20-penny nail driven horizontally into a signpost about 200 feet northwest of bench mark No. 1, and marked "1771.2." Its elevation is 43.637 feet above the datum of the gage. Bench mark No. 3 is an 8-penny nail driven into the diagonal brace of trestle bent below sounding station 614.3, marked "1761.4." The nail is 10.49 feet below the top of ties on the trestle. Its elevation is 33.87 feet above the datum of the gage. Bench mark No. 4 is on the cap of trestle bent, upstream side, at station 1,850 feet from the initial point for soundings. It was set by a United States and Canadian Boundary Survey party, and marked "1761." Its elevation is 33.74 feet above the datum of the gage.

On account of backwater from Lake Kootenai influencing the gage heights at the Bonners Ferry gage, a gage was set May 18, 1904, on the left bank of the river, about three-fourths mile above James Fitzpatrick's ranch, and 1 mile below the mouth of Moyie River, a large tributary from the north. This gage is about 1 mile above Crossport siding, and 5 miles above Bonners Ferry. The gage is set in two vertical sections connected by levels. The middle section is fastened to a small balm of Gilead tree, and gives the stage of the river between gage heights 20 and 30 feet. The upper section, which is fastened to a large pine stump, gives the stage of the river between gage heights 30 and 38 feet. The gage is read once each day by James Fitzpatrick. The bench mark is the top of a 20-penny nail driven into a telegraph pole near the gage. Its elevation is 37.92 feet above the datum of the gage. River heights from this gage are to be used in making estimates of flow and constructing rating table from the discharge measurements made at Bonners Ferry. At extreme high stages of the lake some backwater will probably influence the gage height, but by going farther up stream the fluctuations due to Moyie River would be omitted, and it is important to include the discharge of the latter.

In order to determine the slope of the river a gage was set May 19, 1904, at Porthill, Idaho, about 300 feet south of the United States-Canada boundary line. A staff gage is fastened vertically to a large cottonwood tree on the right bank. The gage was read once each day by Claude M. Danielson until July 25, 1904, when the gage was

discontinued. The bench mark was two 20-penny nails driven into a tree a few feet north of the depot at Porthill. Its elevation is 35.00 feet above the zero of the gage. The zero of the gage is 1,716.54 feet above sea level, as determined by a United States and Canadian Boundary Survey party from the datum of the Great Northern Railway at Bonners Ferry.

The observations at this station during 1904 have been made under the direction of T. A. Noble, district engineer.

Discharge measurements of Kootenai River near Bonners Ferry, Idaho, in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
May 13	W. W. Schlecht	497	13,880	2.09	17.29	28,950
June 23	C. M. Hurlburt	505	17,020	2.89	[a]24.00	48,580
September 15	O. Laurguard	447	7,960	1.02	[b]5.10	8,140

[a] Gage at Crossport 23.85. [b] Gage at Crossport 17.60.

Mean daily gage height, in feet, of Kootenai River near Bonners Ferry, Idaho, for 1904.

Day.	May.	June.	July.	Aug.	Sept.	Oct.
1	.....	22.90	20.80	12.10	6.30	3.30
2	.....	23.00	21.30	11.70	6.30	3.20
3	.....	22.90	21.60	11.30	6.30	3.20
4	.....	22.85	21.80	11.10	6.20	3.20
5	.....	22.80	21.75	10.90	6.10	3.10
6	.....	23.65	21.60	10.70	6.00	3.10
7	.....	24.65	21.50	10.40	5.90	3.10
8	.....	25.30	21.40	10.30	5.80	3.10
9	.....	25.20	21.30	10.20	5.70	3.00
10	17.80	24.90	21.10	10.10	5.70	3.00
11	17.60	24.20	20.70	9.90	5.70	2.90
12	17.40	23.60	20.30	9.70	5.60	2.90
13	17.25	22.80	20.00	9.50	5.50	2.80
14	17.33	22.20	19.60	9.20	5.30	2.80
15	17.80	21.90	19.10	9.00	5.10	2.70
16	17.15	22.20	18.50	8.70	5.00	.....
17	18.40	23.05	17.90	8.50	4.90	.....
18	19.10	23.80	17.30	8.40	4.80	.....
19	20.15	24.40	16.70	8.30	4.60	.....
20	21.25	24.80	16.10	8.20	4.40	.....
21	22.50	24.80	15.40	8.00	4.30	.....
22	24.25	24.40	14.70	7.80	4.20	.....
23	25.40	24.00	14.20	7.60	4.10	.....
24	25.85	23.60	14.00	7.40	4.00	.....
25	25.45	22.80	14.00	7.10	3.90	.....
26	24.50	21.80	13.90	6.90	3.80	.....
27	23.50	21.00	13.30	6.70	3.60	.....
28	23.00	20.50	12.80	6.50	3.50	.....
29	22.80	20.50	12.50	6.40	3.50	.....
30	22.80	20.50	12.50	6.30	3.40	.....
31	22.90	.....	12.50	6.30	.....	.....

Gage readings influenced by backwater.

Mean daily gage height, in feet, of Kootenai River at Crossport, Idaho, for 1904.

Day.	May.	June	July.	Aug.	Sept.	Oct.
1	.....	23.90	23.00	19.30	18.00	16.95
2	.....	23.85	23.60	19.50	18.10	16.92
3	.....	23.80	23.50	19.40	18.00	16.80
4	.....	23.75	.....	19.40	18.00	16.80
5	.....	24.40	23.30	19.50	18.00	16.80
6	.....	25.00	23.10	19.30	17.95	16.90
7	.....	25.70	23.00	19.20	17.95	16.95
8	.....	26.00	23.00	19.20	17.95	17.00
9	.....	25.00	22.80	19.30	17.95	16.90
10	.....	24.40	22.60	19.20	17.90	16.90
11	.....	23.80	22.40	19.10	17.80	16.80
12	.....	23.30	22.10	19.05	17.70	16.75
13	.....	22.90	22.00	19.00	17.70	.....
14	.....	22.80	21.90	18.90	17.65	.....
15	.....	23.00	21.60	18.70	17.60	.....
16	.....	23.60	21.20	18.70	17.50	.....
17	.....	24.00	21.10	18.70	17.50	.....
18	23.25	24.20	20.90	18.65	17.50	.....
19	23.85	25.00	20.70	18.60	17.50	.....
20	24.50	24.80	20.50	18.60	17.40	.....
21	25.30	24.30	20.10	18.50	17.30	.....
22	26.50	24.10	20.05	18.40	17.20	.....
23	27.20	23.85	20.00	18.30	17.15	.....
24	26.80	23.30	20.30	18.20	17.10	.....
25	25.50	22.60	20.20	18.20	17.05	.....
26	24.40	22.20	20.00	18.12	17.03	.....
27	23.60	22.00	19.80	18.10	17.00	.....
28	23.55	22.20	19.75	18.50	17.00	.....
29	23.70	22.40	19.80	18.50	17.00	.....
30	23.80	22.60	19.90	18.00	16.95	.....
31	23.90	.....	19.90	18.00	.....	.....

Mean daily gage height, in feet, of Kootenai River near Porthill, Idaho, for 1904.

Day.	May.	June.	July.	Day.	May.	June.	July.	Day.	May.	June.	July.
1	.....	27.6	26.7	12	.....	28.6	26.5	22	26.6	29.0	23.0
2	.....	27.7	27.0	13	.....	28.3	26.2	23	27.4	28.8	22.7
3	.....	27.6	27.1	14	.....	28.9	26.1	24	27.8	28.7	22.5
4	.....	27.7	27.1	15	.....	28.8	26.0	25	28.1	28.4	[a] 22.3
5	.....	27.8	27.1	16	.....	28.8	25.5	26	28.0	27.9	.....
6	.....	28.1	27.3	17	.....	28.0	25.3	27	27.8	27.5	.....
7	.....	28.6	27.2	18	.....	28.4	24.8	28	27.6	27.1	.....
8	.....	28.8	27.1	19	24.5	28.7	24.6	29	27.5	26.9	.....
9	.....	29.1	27.0	20	25.1	28.9	24.0	30	27.5	26.8	.....
10	.....	29.0	26.9	21	25.5	29.1	23.7	31	27.6	.....	.....
11	.....	28.9	26.7								

[a] Gage discontinued July 25. Gage used only to get the slope of the river.

MISSOULA RIVER AT MISSOULA, MONT.

The original station was established July 10, 1898, by C. C. Babb, and was located at Higgins Avenue Bridge, in Missoula. As the river at this point flows in two channels, originally two gage rods were

attached to the bridge piers, one at each channel, but as fluctuations were found to occur, this location was abandoned and a new one found May 27, 1899, some distance downstream at the bridge of the Bitterroot Valley Division of the Northern Pacific Railway. The river here is practically in one channel, except in times of flood, when some water passes through a slough 600 feet south of the bridge.

The measurements are made from the downstream side of the bridge, the initial point for soundings being over the northeast abutment opposite the center of the first angle block of the truss.

The riprapping around the crib piers of the bridge and remains of old cribs and piling in the channel under the bridge cause eddies which decrease the accuracy of measurements. At flood heights there is a visible difference in the elevation of the water surface above and below the station.

The gage is located on the right bank of the river some 400 feet above the station. It is of the standard chain type, and is attached to a horizontal timber bolted to a cottonwood tree. Timbers above and below and guy wires brace it securely. The length of chain from marker to bottom of weight is 21.89 feet. The elevation of the gage datum is 3,162.18 feet above sea level. The gage is read twice each day by Thomas E. Westby. The bench mark consists of a United States Geological Survey iron post on the north side of Front street, about 200 feet west of McCormick street, and has an elevation of 3,194.64 feet above sea level. The height of the river was read at the three rods during 1899, but all subsequent readings have been made from the new gage above.

The observations at this station during 1904 have been made under the direction of C. C. Babb, district engineer.

Discharge measurements of Missoula River at Missoula, Mont., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec. feet.*
April 28	A. E. Place	365	1,953	6.32	7.48	12,357
May 20	W. B. Freeman	329	1,833	6.25	7.25	11,457
June 22	do	297	1,441	4.54	5.97	6,544
July 10	do	190	952	3.23	4.59	3,071
July 21	do	175	912	2.58	4.04	2,353
August 25	W. B. Freeman and Robert Follansbee.	213	731	1.62	3.04	1.182
November 3	L. R. Stockman	.....	775	1.66	3.12	1,290

Mean daily gage height, in feet, of Missoula River at Missoula, Mont., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	(a)	.....	3.20	3.55	7.35	7.35	5.05	3.70	3.32	3.00	3.15	3.15
2	.....	.....	3.15	3.62	7.20	7.48	5.08	3.70	3.20	2.92	3.10	3.15
3	.....	.....	3.18	3.72	7.22	7.38	5.05	3.65	3.15	2.80	3.15	3.10
4	.....	.....	3.15	3.80	7.25	7.20	5.00	3.60	3.12	2.75	3.15	3.10
5	.....	b 3.25	3.15	3.88	7.20	7.00	4.98	3.58	3.10	2.75	3.10	3.05
6	.....	.....	3.15	4.02	7.08	7.00	4.85	3.50	3.05	2.82	3.10	3.03
7	.....	.....	3.18	4.22	7.00	7.02	4.78	3.42	3.10	3.00	3.15	3.00
8	.....	.....	3.20	4.38	6.88	7.00	4.72	3.40	3.10	3.10	3.13	2.85
9	.....	.....	3.22	4.50	6.62	6.92	4.58	3.40	3.08	3.15	3.10	2.93
10	.....	.....	3.20	4.68	6.68	6.90	4.55	3.40	3.00	3.15	3.10	3.12
11	.....	.....	3.18	5.35	6.60	6.80	4.55	3.35	3.00	3.10	3.08	3.08
12	.....	.....	3.10	6.32	6.63	6.48	4.45	3.32	2.98	3.10	3.05	3.10
13	.....	.....	3.12	6.52	6.73	6.38	4.40	3.30	2.97	3.10	3.05	3.12
14	.....	.....	3.15	6.45	6.75	6.28	4.38	3.25	2.98	3.10	3.05	3.00
15	.....	.....	3.18	6.35	6.85	6.20	4.35	3.22	3.00	3.05	3.05	3.05
16	b 3.20	.....	3.25	6.18	6.90	6.30	4.35	3.22	2.95	3.05	3.10	3.10
17	.....	.....	3.32	.....	6.92	6.48	4.32	3.20	2.95	3.10	3.12	3.05
18	.....	.....	3.40	6.28	6.98	6.50	4.35	3.18	2.95	3.15	3.15	3.05
19	.....	.....	3.45	6.45	7.10	6.40	4.28	3.15	2.95	3.35	3.15	3.05
20	.....	.....	3.42	6.58	7.38	6.30	4.20	3.15	2.95	3.28	3.13	3.10
21	.....	.....	3.45	6.70	7.45	6.18	4.08	3.15	2.95	3.18	3.10	3.05
22	.....	3.15	3.40	6.78	7.78	6.00	4.00	3.15	3.00	3.08	3.05	3.05
23	.....	3.18	3.40	6.70	8.60	5.92	3.95	3.15	3.02	3.10	3.05	3.00
24	.....	3.20	3.35	6.60	8.35	5.75	3.95	3.10	3.00	3.10	3.05	b 2.95
25	.....	3.20	(a)	6.50	8.25	5.60	3.90	3.08	2.95	3.12	3.05	(c)
26	.....	3.20	b 2.95	6.60	7.88	5.42	3.88	3.05	2.95	3.15	3.05	.....
27	.....	3.15	.....	6.85	7.50	5.30	3.80	3.02	2.95	3.15	3.05	.....
28	.....	3.15	.....	7.18	7.20	5.22	3.80	3.05	2.92	3.15	3.10	.....
29	.....	3.20	.....	7.42	7.20	5.15	3.80	3.10	2.95	3.15	3.12	.....
30	.....	.....	3.35	7.38	7.22	5.08	3.75	3.32	3.00	3.15	3.15	.....
31	.....	.....	3.48	.....	7.20	.....	3.75	3.40	.....	3.15	.....	b 3.40

a River frozen January 1 to February 22 and also March 25 to 30.
b Readings to top of ice.
c River frozen December 24 to 31.

Rating table for Missoula River at Missoula, Mont., from January 1 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
2.80	960	4.00	2,290	5.20	4,140	6.60	8,950
2.90	1,060	4.10	2,420	5.30	4,410	6.80	9,720
3.00	1,160	4.20	2,550	5.40	4,700	7.00	10,490
3.10	1,265	4.30	2,680	5.50	5,000	7.20	11,260
3.20	1,375	4.40	2,810	5.60	5,300	7.40	12,030
3.30	1,485	4.50	2,950	5.70	5,600	7.60	12,800
3.40	1,595	4.60	3,095	5.80	5,910	7.80	13,570
3.50	1,705	4.70	3,245	5.90	6,260	8.00	14,340
3.60	1,815	4.80	3,395	6.00	6,640	8.20	15,110
3.70	1,930	4.90	3,550	6.20	7,410	8.40	15,880
3.80	2,050	5.00	3,720	6.40	8,180	8.60	16,650
3.90	2,170	5.10	3,910				

The above table is applicable only for open-channel conditions. It is based upon 7 discharge measurements made during 1904. It is well defined between gage heights 4.00 feet and 7.50 feet. The table has been extended beyond these limits. Above gage height 6.00 feet the rating curve is a tangent, the difference being 385 per tenth.

Estimated monthly discharge of Missoula River at Missoula, Mont., for 1904.

[Drainage area, 5,960 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
January	.....	.....	[a] 1,300	79,934	0.218	0.251
February	.....	.....	[a] 1,300	74,777	.218	.235
March [b]	1,705	1,265	1,443	88,726	.242	.279
April	12,030	1,760	6,701	398,737	1.124	1.254
May	16,650	8,950	11,365	698,807	1.907	2.199
June	12,420	3,910	8,161	485,613	1.369	1.527
July	3,910	1,990	2,790	171,550	.468	.540
August	1,930	1,160	1,478	90,879	.248	.286
September	1,485	1,060	1,181	70,274	.198	.221
October	1,540	915	1,241	76,306	.208	.240
November	1,320	1,210	1,263	75,154	.212	.236
December	1,320	1,010	1,204	74,031	.202	.233
The year	.....	.....	3,286	2,384,788	.551	7.501

[a] Estimated.
[b] March 1 to 24 and 30 to 31, inclusive. Mean for 26 days taken as mean for month.

BIG BLACKFOOT RIVER NEAR BONNER, MONT.

This station was established for general information purposes in July, 1898, by C. C. Babb. It is situated a short distance above the junction of the Big Blackfoot with Hellgate River, at the county highway bridge one-half mile west of Bonner and 6 miles east of Missoula. The power dam of the Big Blackfoot Milling Company, about 1,000 yards above the station, interferes with the natural flow of the water, the opening and closing of the gates causing abrupt changes in the gage heights. The channel at the station is straight. Both banks are high and rocky. They are clothed with a vegetation of bushes and single trees. Neither bank is subject to inundation. The bed of the river is rocky and covered with cobbles and bowlders. It is not liable to change. The depth of water varies from 4 to 10 feet. The current is very swift and can seldom be gaged without guying the meter. The discharge measurements are made from the bridge, the distances being marked on the downstream hand rail. The initial point is a notch marked zero at the left end of the downstream hand rail. The gage is attached to the downstream guard rail. It is of the standard chain type and reads to feet and tenths. The marker is a brass-wire index near the handle. The distance from the bottom of the weight to the marker is 20.90 feet. The gage is read twice each day by Charles Anderson.

Bench mark No. 1 is a temporary bench mark of the topographic division of the United States Geological Survey, consisting of a cross cut in the northeast corner of the top of the northeast abutment of the Northern Pacific Railway bridge near Bonner. It has an elevation of 3,290.30 feet above sea level. Bench mark No. 2 is a standard United States Geological Survey iron post located in front of John McCormick's house, at the highway bridge. Its elevation is 3,246.04 feet above sea level. The elevation of the axle of an old gage pulley on the upstream side of the bridge, which serves as a temporary bench mark, is 3,251.68 feet above sea level.

The zero of the gage is 3,230.70 feet above sea level. All elevations refer to Missoula datum—25.34 feet above gage datum.

The observations at this station during 1904 have been made under the direction of C. C. Babb, district engineer.

Discharge measurements of Big Blackfoot River near Bonner, Mont., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Second feet.*
April 30	A. E. Place	134	1,031	6.48	5.10	6,755
May 19	W. B. Freeman	133	949	6.10	4.45	5,793
May 28	W. B. Freeman and E. C. Murphy.	134	950	5.72	4.48	5,431
June 20	W. B. Freeman	133	853	4.77	3.66	4,069
July 9	do	125	652	2.92	2.10	1,901
July 21	do	125	581	2.32	1.59	1,349
August 25	W. B. Freeman and Robert Follansbee.	122	465	1.31	.86	611
November 3	L. R. Stockman	120	465	1.11	.34	516

Mean daily gage height, in feet, of Big Blackfoot River near Bonner, Mont., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	0.65	0.50	0.40	0.70	5.07	4.51	2.40	1.29	0.83	0.57	0.36	0.31
2	.65	.50	.45	.85	4.97	4.86	2.55	1.29	.83	1.47	.36	.36
3	.70	.45	.60	.85	4.92	4.61	2.55	1.24	.83	.87	.36	.31
4	.75	.45	.55	.95	4.82	4.41	2.55	1.19	.73	.67	.41	.21
5	.75	.60	.55	1.10	4.77	4.36	2.40	1.14	.73	.45	.41	.56
6	.85	.55	.60	1.40	4.67	4.36	2.35	1.09	.73	.22	.36	.56
7	.80	.55	.65	1.65	4.62	4.41	2.25	1.09	.73	.32	.41	.31
8	.70	.50	.75	1.70	4.37	4.21	2.10	1.09	.73	.37	.46	.31
9	.60	.40	1.15	1.90	4.22	4.16	2.05	1.09	.68	.87	.46	.41
10	.60	.55	.90	2.40	4.07	4.21	2.05	1.09	.68	.47	.36	.36
11	.60	.50	.80	3.65	4.22	4.16	2.00	1.09	.....	.47	.21	.26
12	.55	.55	.70	3.65	4.17	3.86	1.95	.99	.63	.47	.31	.26
13	.60	.55	.55	3.70	3.82	3.76	1.85	.99	.63	.47	.31	.31
14	.60	.50	.55	3.85	3.97	3.51	1.85	.99	.63	.47	.31	.26
15	.60	.55	.70	4.05	4.02	3.51	1.75	.99	.58	.37	.41	.31
16	.65	.55	.65	3.80	4.12	3.58	1.72	.96	.60	39	.31	.21
17	.65	.55	.60	3.60	4.24	3.93	1.72	.96	.60	.39	41	.21
18	.65	.45	.60	3.55	4.39	3.83	1.72	.96	.60	.34	.41	.16
19	.55	.40	.60	3.85	4.59	3.83	1.72	.86	.65	.39	.41	.21
20	.65	.40	.65	4.05	4.64	3.63	1.72	.86	.60	.39	3.11	.26
21	.60	.50	.65	4.45	4.84	3.48	1.62	.86	.60	.24	.36	.26
22	.70	.55	.65	4.45	5.39	3.43	1.52	.86	.60	.54	.46	.21
23	.70	.55	.60	4.35	5.59	3.33	1.52	.86	.60	.54	.41	.21
24	.60	.45	.60	4.20	5.79	3.08	1.52	.86	.65	.39	.31	.21
25	.60	.40	.50	4.10	5.54	2.93	1.52	.86	.45	.44	.41	.16
26	.55	.45	.65	4.35	5.19	2.83	1.47	.81	.55	.44	.46	.16
27	.70	.50	.60	4.65	4.69	2.73	1.42	.76	60	.44	.36	(a)
28	.60	.40	.65	4.90	4.54	2.63	1.42	.76	.60	.44	.36	.....
29	.60	.45	.65	5.25	4.49	2.48	1.42	.76	.80	.44	.36	.....
30	.60	.....	.70	5.15	4.54	2.48	1.42	.76	.65	.44	.36	.....
31	.55	.....	.70	.....	4.64	.....	1.32	.81	.....	.44	.....	.....

(a) Ice river frozen at gage.

NOTE.—Variations in gage heights due to waste gates of dam above gage.

Rating table for Big Blackfoot River near Bonner, Mont., from January 1 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
0.20	440	1.70	1,470	3.20	3,290	4.70	6,180
0.30	480	1.80	1,560	3.30	3,440	4.80	6,420
0.40	525	1.90	1,660	3.40	3,590	4.90	6,660
0.50	575	2.00	1,770	3.50	3,740	5.00	6,900
0.60	635	2.10	1,880	3.60	3,900	5.20	7,380
0.70	705	2.20	1,990	3.70	4,070	5.40	7,860
0.80	775	2.30	2,100	3.80	4,250	5.60	8,340
0.90	845	2.40	2,210	3.90	4,430	5.80	8,820
1.00	915	2.50	2,330	4.00	4,620	6.00	9,300
1.10	985	2.60	2,460	4.10	4,820	6.20	9,780
1.20	1,060	2.70	2,590	4.20	5,030	6.40	10,260
1.30	1,140	2.80	2,730	4.30	5,250	6.60	10,740
1.40	1,220	2.90	2,870	4.40	5,480	6.80	11,220
1.50	1,300	3.00	3,010	4.50	5,710	7.00	11,700
1.60	1,380	3.10	3,150	4.60	5,940		

The above table is applicable only for open-channel conditions. It is based upon discharge measurements made during 1899, 1900, 1903, 1904. It is well defined between gage heights 1.00 foot and 5.00 feet. The table has been extended beyond these limits. Above gage height 5 feet the rating curve is a tangent, the difference being 240 per tenth.

Estimated monthly discharge of Big Blackfoot River near Bonner, Mont., for 1904.

[Drainage area, 2,465 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
January	810	605	666	40,951	0.270	0.311
February	635	525	574	33,017	.233	.251
March	1,020	525	668	41,074	.271	.312
April	7,500	705	3,785	225,223	1.535	1.713
May	8,820	4,250	6,066	372,984	2.461	2.837
June	6,540	2,330	4,217	250,929	1.711	1.909
July	2,395	1,140	1,638	100,717	.664	.766
August	1,140	740	898	55,216	.364	.420
September	810	550	684	40,701	.277	.309
October	1,260	440	581	35,724	.236	.272
November	550	440	509	30,288	.206	.230
December	610	420	472	29,022	.191	.220
The year	8,820	420	1,730	1,255,846	.702	9.550

BITTERROOT RIVER NEAR GRANTSDALE, MONT.

This station was established April 25, 1902, by H. B. Waters. It is located on the highway bridge 2 miles southwest of Grantsdale and 5 miles southwest of Hamilton, Mont. The gage was originally of the wire type and fastened to the downstream truss of the bridge. It was replaced May 2 by a standard chain gage. The gage is read daily by T. J. Holt, who lives about a quarter of a mile distant.

Two large ditches—the New Hedge and the Republican—are taken out of the river some distance above the station. They irrigate extensive farm lands and orchards in the vicinity of Hamilton.

The length of the chain from the end of the weight to the marker is 23.35 feet. Discharge measurements are made from the highway bridge on the downstream side by the aid of a stay wire. The initial point for sounding is a notch on the hand rail over the northeast bridge pier. The channel is straight both above and below the station.

The stream has a moderate velocity. The right bank has a gentle slope for about 100 feet, when it terminates in a high bank which is not liable to overflow. The left bank is high and is formed above the bridge by a railroad fill. The bed of the stream is composed of gravel and bowlders.

Bench mark No. 1 is a wire nail driven in the northeast side of a large pine stump and marked "B. M. 24.40." The stump is across the road from the west end of the bridge. The elevation above the gage datum is 24.40 feet. Bench mark No. 2 is the northwest bolt in the northwest abutment plate of the bridge. It is marked "B. M. 19.36." Its elevation above the gage datum is 19.36 feet.

The observations at this station during 1904 have been made under the direction of C. C. Babb, district engineer.

Discharge measurements of Bitterroot River near Grantsdale, Mont., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
May 3	A. E. Place	192	805	5.53	4.60	4,453
May 22	W. B. Freeman	205	1,215	7.69	6.44	9,340
June 21	do	193	891	5.49	4.77	4,894
July 8	do	188	680	3.80	3.66	2,584
July 22	do	180	486	2.55	2.75	1,241
August 26	W. B. Freeman and Robert Follansbee.	159	225	.37	1.37	84
November 4	L. R. Stockman	.....	307	.76	1.70	235

Mean daily gage height, in feet, of Bitterroot River near Grantsdale, Mont., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.00	1.70	1.80	2.10	4.40	5.50	3.95	2.25	1.45	1.20	1.60	1.60
2	2.00	1.70	1.80	2.10	4.50	5.40	3.95	2.15	1.45	1.20	1.60	1.60
3	2.00	1.70	1.80	2.10	4.60	5.30	4.05	2.15	1.35	1.20	1.60	1.60
4	1.90	1.80	1.80	2.20	4.50	5.20	4.05	2.05	1.35	1.20	1.60	1.60
5	1.90	1.80	1.80	2.40	4.50	5.10	3.95	1.95	1.35	1.30	1.60	1.60
6	1.90	1.70	2.00	2.60	4.40	5.40	3.95	1.95	1.35	1.30	1.60	1.60
7	1.80	1.80	2.00	2.60	4.30	5.00	3.85	1.95	1.25	1.40	1.60	1.60
8	1.80	2.10	2.40	2.90	4.30	5.10	3.65	1.85	1.25	1.50	1.50	1.60
9	1.80	2.00	2.50	2.90	4.20	5.20	3.75	1.85	1.25	1.60	1.50	1.60
10	1.80	1.90	2.40	3.50	4.20	5.10	3.65	1.85	1.25	1.60	1.50	1.60
11	1.80	1.90	2.20	3.70	4.30	5.00	3.65	1.75	1.25	1.50	1.50	1.60
12	1.80	1.80	2.10	3.90	4.40	4.60	3.55	1.75	1.25	1.50	1.50	1.60
13	1.80	1.80	2.10	4.20	4.50	4.60	3.35	1.75	1.35	1.50	1.50	1.70
14	1.80	1.80	2.10	4.50	4.60	4.50	3.15	1.75	1.25	1.50	1.50	1.70
15	1.80	1.80	2.10	4.90	4.80	4.90	3.05	1.65	1.25	1.50	1.60	1.70
16	1.80	1.80	2.10	4.60	5.00	5.30	2.95	1.65	1.25	1.50	1.60	1.70
17	1.70	1.90	2.00	4.20	5.10	5.70	2.85	1.55	1.25	1.50	1.60	1.70
18	1.70	1.80	2.00	4.00	5.20	5.40	2.75	1.55	1.25	1.50	1.60	1.70
19	1.70	1.80	2.00	4.00	5.30	5.40	2.75	1.55	1.25	1.50	1.60	1.60
20	1.70	1.70	2.00	4.10	5.40	5.00	2.65	1.45	1.25	1.50	1.60	1.60
21	1.70	1.80	2.10	4.00	5.90	4.80	2.75	1.45	1.25	1.50	1.70	1.60
22	1.70	2.10	2.10	4.00	6.30	4.80	2.75	1.45	1.25	1.50	1.70	1.60
23	1.70	2.00	2.10	3.90	7.00	4.70	2.75	1.35	1.25	1.50	1.70	1.60
24	1.80	1.90	2.00	3.80	7.30	4.40	2.75	1.35	1.35	1.50	1.70	1.60
25	1.80	1.90	2.00	3.70	6.40	4.10	2.65	1.35	1.35	1.50	1.70	1.60
26	1.80	1.90	2.00	3.70	5.80	4.00	2.55	1.35	1.25	1.50	1.70	a1.80
27	1.70	1.80	1.90	4.30	5.50	3.90	2.45	1.35	1.25	1.50	1.70	1.80
28	1.80	1.80	1.90	4.80	5.40	4.00	2.45	1.35	1.25	1.50	1.70	1.80
29	1.80	1.80	1.90	4.70	5.40	4.10	2.35	1.45	1.25	1.50	1.70	1.80
30	1.80	.....	2.10	4.70	5.30	4.10	2.35	1.55	1.25	1.50	1.70	1.80
31	1.80	.....	2.10	.....	5.40	.....	2.35	1.45	.....	1.50	.....	1.80

a Partial ice gorge below, December 26 to 31.

Rating table for Bitterroot River near Grantsdale, Mont., from January 1 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.30	75	2.40	820	3.50	2,400	5.20	6,050
1.40	100	2.50	930	3.60	2,560	5.40	6,600
1.50	130	2.60	1,050	3.70	2,720	5.60	7,150
1.60	170	2.70	1,180	3.80	2,890	5.80	7,700
1.70	225	2.80	1,320	3.90	3,060	6.00	8,250
1.80	290	2.90	1,470	4.00	3,240	6.20	8,800
1.90	365	3.00	1,620	4.20	3,620	6.40	9,350
2.00	450	3.10	1,770	4.40	4,030	6.60	9,900
2.10	540	3.20	1,925	4.60	4,480	6.80	10,450
2.20	630	3.30	2,080	4.80	4,970	7.00	11,000
2.30	720	3.40	2,240	5.00	5,500		

The preceding table is applicable only for open-channel conditions. It is based upon 7 discharge measurements made during 1904. It is well defined between gage heights 1.30 feet and 6.50 feet. The table has been extended beyond these limits. Above gage height 5.00 feet the rating curve is a tangent, the difference being 275 per tenth.

Estimated monthly discharge of Bitterroot River near Grantsdale, Mont., for 1904.

[Drainage area, 1,550 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
January	450	225	296	18,200	0.191	0.220
February	540	225	323	18,579	.208	.224
March	930	290	490	30,129	.316	.364
April	5,230	540	2,783	165,600	1.795	2.003
May	11,825	3,620	5,868	360,809	3.786	4.365
June	7,425	3,060	5,208	309,898	3.360	3.749
July	3,335	770	1,899	116,765	1.225	1.412
August	675	88	246	15,126	.159	.183
September	115	65	74	4,403	.048	.054
October	170	55	118	7,256	.076	.088
November	225	130	179	10,651	.115	.128
December[a]	225	170	181	11,129	.117	.135
The year	11,825	55	1,472	1,068,545	.950	12.925

[a] December 26 to 31 estimated on account of ice goge.

BITTERROOT RIVER NEAR MISSOULA, MONT.

This station was established July 6, 1898, by C. C. Babb. The station is located at the Buckhouse wagon bridge, on the main road, 7 miles southwest of Missoula, Mont. As it is not far above its junction with Missoula River, it will give the full discharge of the Bitterroot. The first gage established had a length of wire of 22.83 feet, and the center of the axle of the gage pulley was 3.801 feet below the bench mark. On April 8, 1901, the bridge was washed away, but was immediately replaced. The station was then reestablished with a gage wire of different length. Observations were discontinued November 1, 1901, but were begun again in 1903. The length of the gage wire on October 8, 1903, was found to be 30.40 feet, at which time the center of the gage pulley was 6.70 feet above the United States Geological Survey bench-mark post. The marker on the wire was taken as the end of the wire. April 29, 1904, a standard chain gage replaced the former wire gage. This has a chain length of 25.64 feet. The marker is a brass wire index near its handle. Observations were made during 1904 by Frank Mitchell, Don Buckhouse, and

Frances Coburn. Discharge measurements are made from the downstream guard rail of the wagon bridge to which the gage is attached. The initial point for soundings is a point marked zero over the center of the northeast bridge pier. All distances are marked on the hand rail. The channel is nearly straight above and below the station. The right bank is low and liable to overflow. The left bank is high and rocky and juts out into the river so that the channel is congested at the bridge during floods. The bed of the stream consists of gravel and is shifting. The depth varies from 3 to 6 feet.

The bench mark is a standard United States Geological Survey iron post, set 25 yards northwest of the bridge. Its elevation above gage datum is 19.50 feet, and above sea level (Missoula datum) is 3,140 feet. The center of the old gage pulley has an elevation of 26.20 feet above gage datum. On account of the shifting river bed, which makes accurate rating of the station impossible, this station was abandoned December 31, 1904.

The observations at this station during 1904 have been made under the direction of C. C. Babb, district engineer.

Discharge measurements of Bitterroot River near Missoula, Mont., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
April 28	A. E. Place	226	2,058	4.20	5.26	8,641
May 20	W. B. Freeman	230	2,082	4.75	6.98	9,883
May 28	Murphy and Freeman	230	2,163	4.81	7.18	10,394
June 20	W. B. Freeman	230	1,926	4.55	6.99	8,761
July 9	do	225	1,431	3.23	4.88	4,626
July 21	do	221	1,091	2.22	3.54	2,422
August 25	Freeman and Follansbee.	207	551	.88	1.32	484
November 3	L. R. Stockman	192	693	.97	1.50	674

Mean daily gage height, in feet, of Bitterroot River near Missoula, Mont., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.05	1.65	1.85	2.45	6.00	7.38	5.66	2.80	1.42	1.20	1.45	1.35
2	2.05	1.65	1.85	2.55	6.10	7.18	5.76	2.70	1.42	1.20	1.45	1.35
3	1.95	1.65	1.85	2.55	6.20	7.28	5.56	2.50	1.42	1.20	1.45	1.30
4	1.85	1.55	1.75	2.75	6.20	7.28	5.46	2.40	1.47	1.20	1.45	1.30
5	1.75	1.55	1.75	2.85	6.00	7.28	5.36	2.30	1.47	1.15	1.45	1.25
6	1.65	1.55	1.85	2.95	5.90	7.38	5.46	2.20	1.47	1.15	1.45	1.20
7	1.65	1.55	3.15	3.05	6.00	7.48	5.46	.....	1.47	1.15	1.40	1.20
8	1.65	1.55	3.55	3.05	5.70	.....	4.96	.....	1.32	1.20	1.40	1.20
9	1.65	1.45	3.95	3.05	5.30	.....	4.96	.....	1.32	1.30	1.40	1.25
10	1.55	1.35	3.25	3.65	5.40	.....	4.86	.....	1.32	1.35	1.40	1.30
11	1.55	1.35	2.95	3.85	5.50	.....	4.71	.....	1.32	1.40	1.40	1.35
12	1.65	1.45	2.75	4.75	5.60	.....	4.61	.....	1.32	1.40	1.40	1.35

Mean daily gage height, in feet, of Bitterroot River near Missoula, Mont., for 1904—Cont'd.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
13	1.75	1.55	2.65	5.25	5.60	.....	4.36	.....	1.22	1.40	1.40	1.35
14	1.85	1.55	2.45	5.65	5.60	.....	3.96	.....	1.22	1.40	1.40	1.40
15	1.85	1.55	2.45	6.35	6.00	.....	3.86	.....	1.22	1.40	1.40	1.40
16	1.85	1.65	2.45	6.35	6.30	.....	3.76	.....	1.12	1.40	1.40	1.40
17	1.75	1.75	2.35	5.85	6.40	.....	3.66	.....	1.12	1.40	1.45	1.35
18	1.75	1.65	2.35	5.55	6.60	.....	3.56	.....	1.12	1.45	1.45	1.35
19	1.65	1.65	2.35	5.55	6.80	.....	3.46	.....	1.12	1.45	1.45	1.35
20	1.65	1.65	2.45	5.55	7.10	6.99	3.46	.....	1.12	1.45	1.45	1.35
21	1.65	1.65	2.55	5.65	7.20	.....	3.46	.....	1.12	1.50	1.50	1.35
22	1.55	1.65	2.75	5.75	7.90	.....	3.46	.....	1.12	1.50	1.50	1.30
23	1.55	1.75	2.45	5.85	8.60	.....	3.46	.....	1.12	1.55	1.55	1.30
24	1.65	2.55	2.25	5.65	9.00	.....	3.40	.....	1.12	1.55	1.55	1.30
25	1.65	2.35	1.95	5.05	9.50	5.78	3.40	1.34	1.12	1.55	1.55	1.30
26	1.65	1.85	1.95	5.15	8.62	5.48	3.20	.....	1.12	1.50	1.50	1.30
27	1.65	1.95	1.95	5.35	7.60	5.18	3.20	.....	1.12	1.50	1.50	1.30
28	1.55	1.85	2.05	5.85	7.20	5.18	3.10	1.84	1.12	1.50	1.45	1.35
29	1.55	1.85	2.25	6.80	7.10	5.28	3.00	1.84	1.12	1.50	1.45	1.40
30	1.65	.....	2.45	6.60	7.30	5.48	2.90	1.89	1.17	1.50	1.40	1.45
31	1.65	.....	2.45	.....	7.50	.....	3.00	1.89	.....	1.45	.....	1.50

Rating table for Bitterroot River near Missoula, Mont., from January 1 to December 31, 1904.

Gage height.	Discharge	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.10	370	2.70	1,670	4.30	3,520	6.60	8,460
1.20	440	2.80	1,770	4.40	3,660	6.80	9,140
1.30	510	2.90	1,870	4.50	3,810	7.00	9,820
1.40	580	3.00	1,970	4.60	3,960	7.20	10,500
1.50	650	3.10	2,070	4.70	4,110	7.40	11,180
1.60	720	3.20	2,180	4.80	4,260	7.60	11,860
1.70	790	3.30	2,290	4.90	4,420	7.80	12,540
1.80	870	3.40	2,400	5.00	4,580	8.00	13,220
1.90	950	3.50	2,520	5.20	4,940	8.20	13,900
2.00	1,030	3.60	2,640	5.40	5,340	8.40	14,580
2.10	1,120	3.70	2,760	5.60	5,740	8.60	15,260
2.20	1,210	3.80	2,880	5.80	6,160	8.80	15,940
2.30	1,300	3.90	3,000	6.00	6,620	9.00	16,620
2.40	1,390	4.00	3,120	6.20	7,160	9.20	17,300
2.50	1,480	4.10	3,250	6.40	7,780	9.40	17,980
2.60	1,570	4.20	3,380				

The above table is applicable only for open-channel conditions. It is based upon 8 discharge measurements made during 1904. It is fairly defined between gage heights 1.30 feet and 7.20 feet. The table has been extended beyond these limits. Above gage height 6.40 feet the rating curve is a tangent, the difference being 340 per tenth. There is some uncertainty in the curve due to shifting channel.

Estimated monthly discharge of Bitterroot River near Missoula, Mont.

[Drainage area, 3,260 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
January	1,075	685	799	49,129	0.245	0.282
February	1,525	545	788	45,326	.242	.261
March	3,060	830	1,434	88,173	.440	.507
April	9,140	1,435	4,592	273,243	1.409	1.572
May	18,320	5,140	9,031	555,294	2.770	3.194
June, 13 days [a]	11,520	4,940	8,397	216,518	2.576	1.245
July	6,050	1,870	3,469	213,300	1.064	1.227
August, 11 days [b]	1,770	545	1,190	25,964	.365	.149
September	615	370	455	27,074	.140	.156
October	685	405	568	34,925	.174	.201
November	685	580	614	36,536	.188	.210
December	650	440	530	32,588	.163	.188
The period				1,598,070		

[a] June 1 to 7 and 25 to 30 inclusive.
[b] August 1 to 6 and 25 and 28 to 31 inclusive.

CLARK FORK [a] AT PRIEST RIVER, IDAHO.

This station was established in June, 1903, by T. A. Noble, assisted by George H. Bliss. It is located about 1,000 feet west of Priest River railroad station and south of the railroad track, on the right bank. It is about 100 feet west of a sawmill. The stream at this point flows parallel to the railroad track, and both the platform to which the gage is attached and the ferry cable from which measurements are made are at right angles to the track and stream. The gage is of the wire and weight type, with horizontal scale board, fastened to the railing of the platform, which is built between two cottonwood and two black pine trees. The gage is adjusted to read the height of the water surface above sea level. Discharge measurements are made from a ferry cable about 400 feet downstream from the gage. The initial point for soundings is a stake on the left bank of the stream and the west side of the driveway. Its elevation is 2,062.11 feet above sea level. On the right bank 1,020 feet from the initial point is another stake, with a tack in its head. Its elevation above sea level is 2,076.31 feet. The channel is straight for about 2,000 feet above and 4,000 feet below the station. The right bank is high, covered with underbrush, and not subject to overflow. The left bank is low, cleared, and liable to overflow. From the top of the left bank there is an upward slope of about

[a] Formerly called Pend Oreille River.

10 per cent. The water flows in one channel, and the bed of the stream is composed of sand, with occasional bowlders. The bench mark from which all elevations were obtained is the United States Geological Survey bench mark south of Priest River station, at the northeast corner of the hotel. Its elevation above sea level is 2,077 feet. A second bench mark, under the gage board platform, is at an elevation of 2,066.19 feet above sea level. A third, on a stump near the gage, is at an elevation of 2,073.02 feet above sea level. On July 16, 1903, the length of the gage wire from the end of the weight to the marker was measured and found to be 32.60 feet. On the bridge rail on the opposite side from the gage 2 copper tacks were driven 32.60 feet apart, to be used for future checking of the length of the wire by the observer.

The observations at this station during 1904 have been made under the direction of T. A. Noble, district engineer.

Discharge measurements of Clark Fork at Priest River, Idaho, in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
March 12	C. E. Hewett	790	5,715	2.50	44.39	14,260
May 27	W. G. Steward	948	16,740	5.34	56.00	89,420
July 20	do	905	10,560	4.28	49.92	45,340
August 11	do	845	7,234	3.13	46.33	22,770

Mean daily gage height, in feet, of Clark Fork at Priest River, Idaho, for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	44.50	43.60	43.50	44.25	52.15	56.30	53.40	47.75	44.40	43.20	42.80	42.80
2	44.45	43.60	43.50	44.30	52.50	56.40	53.25	47.55	44.40	43.15	42.80	42.80
3	44.45	43.70	43.50	44.35	52.75	56.30	53.10	47.40	44.35	43.10	42.80	42.75
4	44.45	43.75	43.50	44.20	52.85	56.40	52.85	47.30	44.30	43.20	42.85	42.80
5	44.35	43.70	43.50	44.35	53.20	56.40	52.65	47.15	44.30	43.15	42.75	42.75
6	44.30	43.70	43.50	44.40	53.45	56.30	52.50	47.00	44.20	43.10	42.75	42.75
7	44.30	43.70	43.60	44.55	53.50	56.40	52.30	46.85	44.15	43.10	42.75	42.70
8	44.30	43.70	43.70	44.70	53.65	56.40	52.15	46.70	44.10	43.05	42.70	42.75
9	44.10	43.60	43.75	44.80	53.65	56.40	51.90	46.50	44.05	43.10	42.75	42.70
10	44.30	43.70	44.10	44.90	53.60	56.20	51.70	46.40	44.00	43.10	42.75	42.65
11	44.25	43.55	44.25	45.00	53.60	56.20	51.50	46.30	43.95	43.10	42.75	42.70
12	44.20	43.50	44.40	45.40	53.65	56.20	51.30	46.15	43.90	43.00	42.70	42.65
13	44.10	43.50	44.45	45.90	53.60	56.00	51.15	46.00	43.90	43.05	42.70	42.70
14	44.10	43.55	44.65	46.35	53.65	55.80	50.90	45.90	43.80	43.00	42.65	42.65
15	44.10	43.60	44.50	47.00	53.55	55.70	50.70	45.75	43.80	43.00	42.65	42.55
16	44.10	43.55	44.60	47.55	53.60	55.40	50.60	45.70	43.80	43.00	42.65	42.70
17	44.20	43.55	44.65	48.20	53.65	55.30	50.35	45.60	43.80	42.95	42.60	42.60
18	44.05	43.55	44.50	48.60	53.70	55.10	50.20	45.40	43.75	42.95	42.60	42.70
19	44.15	43.55	44.55	49.00	53.80	55.20	50.00	45.35	43.70	42.90	42.65	42.65
20	44.10	43.50	44.50	49.25	53.80	55.20	49.95	45.30	43.65	42.90	42.70	42.70

Mean daily gage height, in feet, of Clark Fork at Priest River, Idaho, for 1904—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
21	44.10	43.50	44.50	49.50	54.10	55.10	49.65	45.20	43.50	42.90	42.85	42.65
22	44.05	43.45	44.55	49.85	54.30	55.00	49.40	45.10	43.45	42.90	42.90	42.65
23	44.05	43.40	44.55	50.10	54.80	54.70	49.20	45.05	43.40	42.85	42.90	42.70
24	43.85	43.50	44.65	50.40	55.10	54.70	49.10	44.95	43.45	42.90	42.95	42.65
25	44.00	43.50	44.45	50.60	55.50	54.60	48.85	44.90	43.40	42.90	42.90	42.60
26	43.95	43.50	44.40	50.80	55.80	54.50	48.70	44.85	43.35	42.85	42.85	42.60
27	43.95	43.50	44.40	50.90	56.00	54.30	48.45	44.80	43.30	42.80	42.90	42.65
28	43.85	43.50	44.40	51.10	56.10	54.10	48.35	44.75	43.30	42.80	42.80	42.60
29	43.80	43.45	44.35	51.45	56.20	53.80	48.20	44.65	43.30	42.80	42.85	42.65
30	43.80	.....	44.20	51.90	56.20	53.60	47.95	44.55	43.25	42.80	42.90	42.65
31	43.80	.....	44.25	.....	56.30	.....	47.80	44.40	.....	42.80	.....	42.70

Rating table for Clark Fork at Priest River, Idaho, from June 26, 1903, to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
42.00	6,550	43.90	12,250	45.80	21,010	49.20	40,740
42.10	6,770	44.00	12,650	45.90	21,530	49.40	41,980
42.20	6,990	44.10	13,050	46.00	22,050	49.60	43,220
42.30	7,220	44.20	13,470	46.20	23,100	49.80	44,470
42.40	7,460	44.30	13,890	46.40	24,190	50.00	45,750
42.50	7,700	44.40	14,320	46.60	25,310	50.50	49,000
42.60	7,960	44.50	14,760	46.80	26,440	51.00	52,300
42.70	8,230	44.60	15,200	47.00	27,600	51.50	55,600
42.80	8,510	44.70	15,650	47.20	28,760	52.00	59,000
42.90	8,810	44.80	16,110	47.40	29,920	52.50	62,400
43.00	9,110	44.90	16,570	47.60	31,080	53.00	65,900
43.10	9,420	45.00	17,050	47.80	32,250	53.50	69,400
43.20	9,740	45.10	17,530	48.00	33,450	54.00	73,100
43.30	10,070	45.20	18,010	48.20	34,650	55.00	81,000
43.40	10,410	45.30	18,490	48.40	35,850	56.00	89,300
43.50	10,750	45.40	18,990	48.60	37,050	57.00	99,000
43.60	11,110	45.50	19,490	48.80	38,260	58.00	109,800
43.70	11,480	45.60	19,990	49.00	39,500	59.00	121,200
43.80	11,860	45.70	20,490				

The above table is applicable only for open-channel conditions. It is based upon 10 discharge measurements made during 1903, 1904, and 1905. It is well defined between gage heights 42.50 feet and 50.00 feet. The table has been extended beyond these limits.

Estimated monthly discharge of Clark Fork at Priest River, Idaho, for 1903 and 1904.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
1903.				
July	113,700	44,790	73,940	4,568,000
August	43,900	19,390	28,900	1,777,000
September	18,990	14,280	15,790	939,600
October	16,570	14,230	15,490	952,400
November	18,060	15,420	16,090	957,400
December	17,240	15,110	16,500	1,014,000
The period				10,210,000
1904.				
January	14,760	11,860	13,200	811,600
February	11,670	10,410	11,000	632,700
March	15,420	10,750	13,500	830,100
April	58,320	13,470	31,330	1,864,000
May	92,000	60,020	74,540	4,583,000
June	93,000	70,120	85,040	5,060,000
July	68,700	32,250	49,850	3,065,000
August	31,950	14,320	21,500	1,322,000
September	14,320	9,900	11,920	709,300
October	9,740	8,510	9,057	556,900
November	8,960	7,960	8,437	502,000
December	8,510	7,830	8,182	503,100
The year	93,000	7,830	28,130	20,440,000

PRIEST RIVER AT PRIEST RIVER, IDAHO.

This station was established in June, 1903, by T. A. Noble, assisted by G. H. Bliss. It is located at the highway bridge, on the road from the railroad station at Priest River to Priest Lake. The gage is a vertical board nailed to a pile on the downstream side of the right pier of the highway bridge. A ladder is attached to the pier to facilitate reading the gage. It is read once each day by George Young. Discharge measurements are made from the downstream side of the bridge, to which the gage is attached. The initial point for soundings is the bolt at the end of the guard rail at the right bank. A circle has been painted around the bolt. The channel is straight for 500 feet above and for 200 feet below the bridge. Both banks are high, wooded, and not liable to overflow. Extending from

each pier of the single-span bridge to the bank is a breakwater composed of piles faced with planks. These breakwaters make the current sluggish between the piers and the banks. Under the main span of the bridge, a distance of 120 feet, the current is swift. The bed of the stream is composed of gravel.

Bench mark No. 1 is the bolt in the guard rail at the west end of the bridge, which is used as the initial point for soundings. Its elevation is 29.04 feet above the zero of the gage, and 2,079.7 feet above sea level. Bench mark No. 2 is a spike driven in a stump under the right approach to the bridge. Its elevation is 17.48 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of T. A. Noble, district engineer.

Discharge measurements of Priest River at Priest River, Idaho, in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
March 10	C. E. Hewett	115	477	3.01	4.40	1,434
May 3	W. G. Steward	166	906	6.48	7.47	5,882
May 26	Murphy and Steward	129	898	6.40	7.76	5,755
July 21	W. G. Steward	127	504	3.41	4.61	1,720
August 10	do	125	399	2.39	3.70	955
September 16	O. Laurguard	118	307	1.85	2.86	568

Mean daily gage height, in feet, of Priest River at Priest River, Idaho, for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.80	3.65	3.60	4.00	6.60	7.80	5.80	4.10	3.15	2.75	2.70	3.05
2	3.80	3.55	3.65	4.10	6.95	7.90	5.80	4.05	3.15	2.70	2.70	3.00
3	3.80	3.60	3.60	4.15	7.45	7.85	5.70	4.00	3.10	2.70	2.65	3.00
4	3.80	3.65	3.65	4.25	7.45	7.90	5.70	3.95	3.10	2.70	2.65	3.00
5	3.80	3.70	3.65	4.35	7.45	7.80	5.60	3.90	3.05	2.70	2.65	3.00
6	3.75	3.70	3.75	4.75	7.40	7.85	5.45	3.85	3.00	2.70	2.65	2.95
7	3.75	3.70	3.85	4.75	7.35	7.90	5.35	3.85	3.00	2.75	2.65	2.95
8	3.75	3.70	4.15	4.75	7.25	7.90	5.30	3.80	3.00	2.80	2.65	2.95
9	3.75	3.70	4.45	4.80	7.20	7.85	5.20	3.75	2.95	2.80	2.65	2.95
10	3.75	3.65	4.40	4.95	7.15	7.75	5.10	3.70	2.95	2.80	2.65	2.95
11	3.75	3.70	4.40	5.20	7.10	7.70	5.10	3.65	2.90	2.80	2.60	2.95
12	3.75	3.70	4.30	5.45	7.05	7.60	4.95	3.60	2.90	2.75	2.60	3.00
13	3.75	3.70	4.30	5.70	7.00	7.40	5.00	3.60	2.90	2.70	2.60	2.95
14	3.75	3.70	4.25	6.00	7.00	7.30	4.90	3.55	2.90	2.75	2.60	3.00
15	3.80	3.70	4.20	6.50	7.00	7.20	4.90	3.55	2.85	2.70	2.65	3.10
16	3.90	3.70	4.10	6.70	7.00	7.10	4.85	3.50	2.85	2.75	2.70	3.10
17	3.95	3.70	4.30	6.70	7.00	6.95	4.80	3.50	2.85	2.70	2.70	3.10
18	3.95	3.70	4.15	6.60	7.00	6.95	4.75	3.45	2.85	2.70	2.70	3.05
19	3.90	3.65	4.10	6.50	7.15	7.00	4.70	3.45	2.80	2.70	2.70	3.05
20	3.80	3.65	4.15	6.50	7.20	6.95	4.65	3.40	2.80	2.70	2.95	3.05
21	3.85	3.65	4.10	6.60	7.30	6.80	4.60	3.35	2.75	2.70	3.50	3.05

Mean daily gage height, in feet, of Priest River at Priest River, Idaho, for 1904—Cont'd.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
22	3.95	3.65	4.10	6.80	7.45	6.65	4.55	3.35	2.85	2.70	3.45	3.05
23	3.80	3.60	4.05	6.90	7.60	6.60	4.50	3.30	2.85	2.65	3.15	2.95
24	3.80	3.65	4.05	6.90	7.70	6.55	4.45	3.25	2.85	2.65	3.10	3.00
25	3.75	3.65	3.90	6.85	7.75	6.40	4.40	3.25	2.80	2.65	3.05	3.00
26	3.75	3.70	3.90	6.90	7.75	6.20	4.35	3.20	2.75	2.65	3.05	3.00
27	3.70	3.70	3.90	7.10	7.80	6.15	4.30	3.20	2.75	2.65	3.05	3.00
28	3.70	3.60	3.95	7.30	7.80	6.05	4.25	3.20	2.75	2.65	3.05	3.00
29	3.70	3.65	3.95	7.60	7.80	6.00	4.20	3.20	2.75	2.65	3.05	3.00
30	3.65	.....	4.00	7.65	7.80	5.85	4.15	3.20	2.75	2.65	3.05	3.20
31	3.65	.....	4.00	.....	7.80	.....	4.10	3.15	.....	2.70	.....	3.25

Rating table for Priest River at Priest River, Idaho, from June 28, 1903, to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
2.50	460	3.90	1,085	5.30	2,480	7.40	5,820
2.60	485	4.00	1,160	5.40	2,600	7.60	6,200
2.70	515	4.10	1,240	5.50	2,720	7.80	6,580
2.80	545	4.20	1,325	5.60	2,850	8.00	6,960
2.90	580	4.30	1,410	5.70	2,980	8.20	7,360
3.00	615	4.40	1,500	5.80	3,120	8.40	7,760
3.10	655	4.50	1,590	5.90	3,260	8.60	8,160
3.20	695	4.60	1,690	6.00	3,400	8.80	8,560
3.30	740	4.70	1,790	6.20	3,700	9.00	8,960
3.40	785	4.80	1,900	6.40	4,020	9.20	9,360
3.50	835	4.90	2,010	6.60	4,350	9.40	9,760
3.60	890	5.00	2,120	6.80	4,700	9.60	10,160
3.70	950	5.10	2,240	7.00	5,060	9.80	10,560
3.80	1,015	5.20	2,360	7.20	5,440		

The above table is applicable only for open-channel conditions. It is based upon 8 discharge measurements made during 1903 and 1904. It is fairly well defined between gage heights 2.80 feet and 7.50 feet. The table has been extended beyond these limits. Above gage height 8.00 feet the rating curve is a tangent, the difference being 200 per tenth.

Estimated monthly discharge of Priest River at Priest River, Idaho, for 1903 and 1904.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
1903.				
July	8,760	1,720	3,854	237,000
August	1,690	956	1,360	83,620
September	1,092	830	926	55,100
October	1,092	820	978	60,140
November	1,316	890	1,033	61,470
December	1,368	1,036	1,188	73,050
The period				570,400
1904.				
January	1,122	920	1,007	61,920
February	950	862	930	53,490
March	1,545	890	1,196	73,540
April	6,295	1,160	3,503	208,400
May	6,580	4,350	5,693	350,000
June	6,770	3,190	5,354	318,600
July	3,120	1,240	2,034	125,100
August	1,240	675	878	53,990
September	675	530	580	34,510
October	545	500	517	31,790
November	835	485	564	33,560
December	718	598	624	38,370
The year	6,770	485	1,907	1,383,000

SPOKANE RIVER AT SPOKANE, WASH.

This gaging station was originally established October 17, 1896, by C. C. Babb, on the Oregon Railroad and Navigation Company's wooden bridge, about 1 mile above the falls, where discharge measurements and gage readings were taken until July 8, 1903. The distance from the end of the weight to the index of the first wire gage was 22.00 feet, and from the zero of the rod to the outside edge of the pulley 1.80 feet. The gage datum was found to be 1,880 feet above sea level by city datum and 1,865 feet by Government datum.

During 1901 new gages and bench marks were established. The bench mark is a railroad spike in an electric-railway pole close to, and on the south side of the railroad track, at the west end of bridge. Its elevation is 1,896.86 feet above city datum, as determined by the Washington Water Power Company, and 1,882.72 feet above Government datum, as determined by the United States Geological

Survey, July 6, 1903, from a Government bench mark at the county court-house in Spokane.

A second wire gage was afterwards established on the north side of the west span of the bridge. The zero of this gage was at an elevation of 1,879.35 feet, coinciding with the position of the zero of the old gage. The distance from the end of the weight of the marker was also 22.00 feet, but the distance from the zero of the rod to the outside of the pulley was only 1.90 feet.

In July, 1903, the wooden bridge was torn out to be replaced by a steel structure, and the second gage board was destroyed. A third wire gage was established July 8, 1903, on the Olive Avenue Bridge, 950 feet below the railroad bridge. It is located on the south side of the bridge, between the fifth and seventh verticals from the west end, just outside a wooden conduit for pipes. It is 22.30 feet between the end of weight and marker.

The bench mark is a railroad spike in the north face of the first telegraph pole west of the west approach to bridge. Its elevation is 1,881.05 feet above Government datum and 17.16 feet above rod datum.

This gage was established with the idea that readings taken at this point would be a continuation of readings taken at the Oregon Railroad and Navigation Company's bridge, as the two gages were made to read the same when the new one was put in place, and both sections are practically the same. For two weeks before the second gage (that on the railroad bridge) was destroyed, simultaneous readings were obtained, which showed no appreciable difference. The slope in the water surface between the two stations was 1.43 feet on July 8, 1904. At all of the above stations near the Oregon Railroad and Navigation Company's bridge, Mr. Z. Taylor, station agent, has been the observer.

On March 30, 1905, the station on the Olive Avenue Bridge was abandoned, and as the new steel bridge of the Oregon Railroad and Navigation Company was no longer considered safe from which to measure the river, on account of the exposure to danger, a new cable station was established about one-half mile above the Mission Street Bridge, or 1 mile above the former stations at the Oregon Railroad and Navigation Company and Olive Avenue bridges. The station is equipped with $\frac{5}{8}$-inch cable, stay wire, and tag wire. The gage is vertical and is fastened to the inside of the most easterly pier on the south side of the Mission Street Bridge, one-half mile below the station. It is divided into feet and tenths, and is read once each day by Mr. A. C. Lingle, a carpenter living near the gage. A secondary gage is located about 100 feet above the cable, and is read by the hydrographer, at the time of measurement, to assist in computing areas. The upper portion is vertical and is fastened to a cottonwood

tree; the lower portion is inclined and nailed to pieces buried in the ground. The rod is divided vertically into feet and tenths. The section here is a good one for stream measurements; the bed is composed of gravel and small bowlders and not liable to change. The banks on both sides are high and will not overflow. The current, except at the lowest stages, is swift.

The observations at this station during 1904 have been made under the direction of T. A. Noble, district engineer.

Discharge measurements of Spokane River at Spokane, Wash., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
April 25	W. W. Schlecht	260	4,298	6.12	11.84	26,420
May 13	W. G. Steward	252	3,875	5.50	10.22	21,300
June 3	C. M. Hurlburt	253	3,722	5.10	9.06	18,980
June 15	do	236	3,219	4.19	7.60	13,490
June 20	W. G. Steward	230	3,025	3.87	7.00	11,690
June 27	do	227	2,906	3.36	5.90	9,771
July 5	do	223	2,593	2.91	5.02	7,539
July 12	C. M. Hurlburt	221	2,411	2.82	4.31	6,794
July 22	W. G. Steward	216	2,169	2.11	3.56	4,580
July 30	C. M. Hurlburt	212	1,938	1.89	2.99	3,648
August 8	do	215	2,034	1.68	2.50	3,414
August 20	Price and Hurlburt	214	1,778	1.32	2.08	2,339
August 29	O. Laurgaard	203	1,779	1.10	1.85	1,966
August 29 [a]	do	221	626	3.20	1.84	2,006
September 16	C. Casteel	201	1,696	.96	1.56	1,630
September 22	do	200	1,668	.88	1.47	1,465
September 22 [b]	C. E. Hewett	182	1,111	1.31	1.47	1,458
October 6	do	202	1,651	.85	1.39	1,398
October 20	G. G. Mair	202	1,660	.83	1.42	1,384
October 20	do	202	1,656	.85	1.42	1,400

[a] Olive Avenue Bridge, one-half mile below station. [b] 250 feet below Olive Avenue Bridge.

Note.—All measurements, 1904, were taken at cable station, except as noted.

Mean daily gage height, in feet, of Spokane River at Spokane (Olive Avenue Bridge), Wash., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	Day.	Jan.	Feb.	Mar.	Apr.
1	3.65	3.05	3.20	4.75	17	3.10	2.75	5.95	.....
2	3.60	3.00	3.25	4.75	18	3.20	2.75	5.75	.....
3	3.55	3.00	3.25	4.75	19	3.30	2.75	5.65	.....
4	3.50	2.90	3.25	4.90	20	3.35	2.75	5.70	.....
5	3.45	2.90	3.25	5.00	21	3.40	2.75	5.70	.....
6	3.40	2.90	3.35	5.20	22	3.40	2.75	5.70	.....
7	3.40	2.90	3.40	5.40	23	3.40	2.80	5.60	.....
8	3.35	2.80	3.75	5.60	24	3.35	2.85	5.50	.....
9	3.30	2.80	4.50	5.75	25	3.35	2.90	5.40	.....
10	3.25	2.80	5.30	(a)	26	3.30	2.95	5.30	.....
11	3.25	2.75	5.80	.....	27	3.25	3.05	5.15	.....
12	3.25	2.75	5.95	.....	28	3.25	3.10	5.05	.....
13	3.25	2.75	6.00	.....	29	3.20	3.20	4.95	.....
14	3.25	2.75	6.00	.....	30	3.15	.....	4.95	.....
15	3.30	2.70	6.00	.....	31	3.10	.....	4.80	.....
16	3.40	2.70	5.95	.....					

a Discontinued.

NOTE.—Readings approximate—about 5 per cent too large.

Mean daily gage height, in feet, of Spokane River at Spokane (Mission Street Bridge), Wash., for 1904.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	5.50	11.95	9.25	5.50	2.85	1.85	1.45	1.40	1.60
2	.....	5.50	12.00	9.15	5.40	2.85	1.80	1.45	1.40	1.65
3	.....	5.50	11.85	9.10	5.30	2.80	1.80	1.45	1.40	1.70
4	.....	5.60	11.70	9.00	5.20	2.75	1.75	1.45	1.40	1.70
5	.....	5.70	11.60	8.90	5.05	2.70	1.75	1.40	1.40	1.70
6	.....	5.90	11.50	8.75	4.95	2.60	1.75	1.40	1.40	1.70
7	.....	6.10	11.35	8.70	4.85	2.55	1.75	1.40	1.40	1.75
8	.....	6.30	11.20	8.60	4.75	2.55	1.70	1.40	1.40	1.70
9	.....	6.45	11.00	8.55	4.65	2.45	1.70	1.40	1.35	1.70
10	.....	6.60	10.70	8.45	4.50	2.45	1.70	1.40	1.35	1.70
11	.....	6.80	10.50	8.30	4.40	2.40	1.70	1.40	1.35	1.70
12	.....	7.30	10.35	8.15	4.30	2.35	1.65	1.40	1.35	1.70
13	.....	7.90	10.25	8.00	4.25	2.30	1.65	1.35	1.35	1.70
14	.....	8.60	10.15	7.80	4.10	2.30	1.60	1.35	1.35	1.75
15	.....	9.40	10.05	7.65	4.00	2.25	1.60	1.35	1.35	1.75
16	.....	10.30	10.00	7.50	4.00	2.25	1.55	1.35	1.35	1.75
17	.....	11.30	9.90	7.35	3.90	2.20	1.50	1.35	1.40	1.75
18	.....	11.80	9.85	7.30	3.85	2.20	1.50	1.40	1.35	1.75
19	.....	11.90	9.80	7.15	3.80	2.15	1.50	1.40	1.35	1.70
20	.....	11.90	9.85	7.05	3.70	2.10	1.50	1.40	1.35	1.70
21	.....	12.00	9.85	6.95	3.65	2.10	1.45	1.45	1.40	1.65
22	.....	12.10	9.85	6.80	3.55	2.05	1.45	1.45	1.40	1.65
23	.....	12.10	9.90	6.65	3.50	2.00	1.45	1.45	1.40	1.70
24	.....	12.10	10.00	6.50	3.40	2.00	1.45	1.45	1.50	1.70
25	.....	11.90	10.10	6.30	3.35	2.00	1.45	1.45	1.50	1.70
26	.....	11.70	10.10	6.20	3.25	1.95	1.45	1.40	1.55	1.70
27	.....	11.50	9.95	6.00	3.20	1.90	1.45	1.40	1.55	1.70
28	.....	11.45	9.80	5.90	3.10	1.85	1.45	1.40	1.55	1.70
29	.....	11.55	9.60	5.70	3.05	1.85	1.45	1.40	1.60	1.70
30	5.60	11.70	9.50	5.60	3.00	1.85	1.45	1.40	1.60	1.75
31	5.55	.....	9.35	.....	2.95	1.85	.....	1.40	.....	1.80

Rating table for Spokane River at Spokane, Wash., from April 1 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.00	940	2.70	3,260	4.40	6,280	7.00	11,830
1.10	1,030	2.80	3,420	4.50	6,470	7.20	12,330
1.20	1,130	2.90	3,580	4.60	6,660	7.40	12,850
1.30	1,240	3.00	3,740	4.70	6,850	7.60	13,380
1.40	1,360	3.10	3,910	4.80	7,050	7.80	13,930
1.50	1,490	3.20	4,080	4.90	7,250	8.00	14,490
1.60	1,620	3.30	4,250	5.00	7,450	8.50	15,900
1.70	1,760	3.40	4,420	5.20	7,850	9.00	17,380
1.80	1,900	3.50	4,600	5.40	8,250	9.50	18,980
1.90	2,040	3.60	4,780	5.60	8,660	10.00	20,580
2.00	2,190	3.70	4,960	5.80	9,080	10.50	22,280
2.10	2,340	3.80	5,140	6.00	9,510	11.00	23,980
2.20	2,490	3.90	5,330	6.20	9,950	11.50	25,780
2.30	2,640	4.00	5,520	6.40	10,400	12.00	27,580
2.40	2,790	4.10	5,710	6.60	10,860	12.50	29,380
2.50	2,940	4.20	5,900	6.80	11,340	13.00	31,180
2.60	3,100	4.30	6,090				

The above table is applicable only for open-channel conditions. It is based upon 20 discharge measurements made during 1904. It is well defined between gage heights 1.40 feet and 12.00 feet. The table has been extended beyond these limits. Above gage height 11.00 feet the rating curve is a tangent, the difference being 360 per tenth.

Estimated monthly discharge of Spokane River at Spokane (Olive Avenue Bridge), Wash., for 1904.

[Drainage area, 4,005 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
January	6,174	4,958	5,459	335,700	1.36	1.57
February	5,172	4,141	4,305	247,600	1.07	1.15
March	12,420	5,172	9,574	588,700	2.39	2.76
April 1–9	11,680	8,896	9,917	177,000	2.48	.80
The period				1,349,000		

Note.—Estimates are based on rating curve of station at O. R. & N. Rwy. bridge, 900 feet above, where conditions are nearly the same as at Olive avenue.

Estimated monthly discharge of Spokane River at Spokane (Mission Street Bridge), Wash., for 1904.

[Drainage area, 4,005 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
March 30–31	.....	.....	8,608	34,150	2.15	0.160
April	27,940	8,450	18,780	1,117,000	4.69	5.23
May	27,580	18,500	22,120	1,360,000	5.52	6.36
June	18,180	8,660	13,510	803,900	3.37	3.76
July	8,450	3,660	5,706	350,800	1.42	1.64
August	3,500	1,970	2,605	160,200	.650	.749
September	1,970	1,425	1,617	96,220	.404	.451
October	1,425	1,300	1,369	84,180	.342	.394
November	1,620	1,300	1,384	82,360	.346	.386
December	1,900	1,620	1,769	108,800	.442	.510
The period	.....	.....	.....	4,198,000	.....	.....

HANGMAN CREEK AT TEKOA, WASH.

This station was established April 1, 1904, by W. W. Schlecht. It is located at the footbridge across Hangman Creek about 1,000 feet above the mouth of North Fork of Hangman Creek, in the town of Tekoa, Wash. There is a fall of about 2½ feet between the two points. A plain staff gage, graduated to feet and tenths, is attached vertically to the right pile bent of the bridge. It is read once each day by A. C. McLaughlin. Discharge measurements are made from the downstream side of the footbridge to which the gage is attached. The initial point for soundings is the center of a telegraph pole on the right bank, marked with a 20-penny nail and zero. Five-foot intervals are marked on the bridge. The channel is straight for about 75 feet above and 40 feet below the station. The current is sluggish. About 50 feet below the station is the head of a series of rapids. The right bank is fringed with brush, and liable to overflow to the railroad embankment, about 50 feet. The left bank is high, steep, composed of clay, fringed with brush, and not subject to overflow. The bed of the stream is composed of solid rock with earth banks and is not liable to shift. The station may at times be affected by backwater from the North Fork.

Bench mark No. 1 is a standard United States Geological Survey aluminum tablet marked "2537" set in the vertical wall of a brick house on the corner one square north of the bank of Tekoa. Its elevation is 62.11 feet above the zero of the gage. Bench mark No. 2

is the top of the head of a 60-penny spike driven into the telegraph pole at the initial point for soundings. Its elevation is 11.41 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of T. A. Noble, district engineer.

Discharge measurements of Hangman Creek at Tekoa, Wash., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec feet.*
April 2	W. W. Schlecht	69	383	0.98	4.88	376
April 5	do	68	409	1.17	5.25	480
April 20	W. G. Steward	60	308	.87	4.20	281
May 6	W. W. Schlecht	28	65	1.21	2.17	78
May 16	W. G. Steward	15	21	1.75	1.47	37
May 24	Steward and Murphy	15	17	1.42	1.15	24
June 4	W. W. Schlecht	16	18	1.46	1.45	26
June 22	W. G. Steward	14	12	.71	.74	8
July 16 [a]	do	8	4	1.07	.58	4
July 16 [b]	do	13	10	.41	.58	4
August 29 [c]	do	1	.35	.80	.41	.28
August 29 [a]	do	1.5	.45	1.02	.42	.46

[a] One-half mile below station.
[b] 300 feet above station.
[c] 150 feet above railroad bridge.

Mean daily gage height, in feet, of Hangman Creek at Tekoa, Wash., for 1904.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct	Nov.	Dec.
1	4.90	2.95	1.00	0.60	0.45	0.40	0.40	0.70	0.65
2	4.90	2.90	1.00	.60	.45	.40	.40	.70	.65
3	5.40	2.70	1.05	.60	.45	.40	.40	.70	.65
4	5.40	2.40	1.45	.60	.45	.40	.40	.70	.65
5	5.30	2.20	1.50	.65	.45	.40	.40	.70	.65
6	5.55	2.10	1.35	.65	.45	.40	.40	.65	.65
7	5.30	2.05	1.30	.65	.40	.40	.45	.65	.65
8	4.85	1.95	1.50	.65	.40	.40	.45	.65	.65
9	4.65	1.85	1.55	.65	.40	.40	.50	.65	.70
10	4.90	1.80	1.30	.45	.40	.40	.50	.65	.70
11	5.80	1.90	1.20	.45	.40	.40	.50	.60	.70
12	6.30	1.85	1.15	.45	.40	.40	.60	.55	.70
13	6.20	1.70	1.00	.45	.40	.40	.60	.55	.70
14	6.10	1.60	.95	.45	.40	.40	.60	.55	.75
15	6.20	1.55	1.00	.45	.40	.40	.65	.55	.80
16	6.90	1.50	.95	.50	.40	.40	.65	.60	.90
17	5.75	1.45	.90	.60	.40	.40	.65	.60	.80
18	4.85	1.40	.95	.60	.40	.40	.70	.60	.80
19	4.30	1.40	.95	.60	.40	.40	.70	.60	.80
20	4.30	1.30	.90	.55	.40	.40	.70	.65	.80
21	4.20	1.35	.90	.60	.40	.40	.70	.65	.80
22	4.20	1.25	.75	.55	.40	.40	.70	.70	.80

Mean daily gage height, in feet, of Hangman Creek at Tekoa, Wash, for 1904—Continued.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
23	4.10	1.20	0.75	0.55	0.40	0.40	0.70	0.70	0.80
24	3.80	1.15	1.20	.55	.40	.40	.70	.70	.80
25	3.50	1.10	2.35	1.20	.40	.40	.70	.70	.80
26	3.20	1.00	2.20	1.80	.40	.40	.70	.75	.80
27	3.05	.95	2.15	.45	.40	.40	.70	.75	.80
28	3.25	1.00	2.15	.45	.40	.45	.70	.75	.85
29	3.40	.95	1.10	.45	.40	.45	.70	.70	.85
30	3.20	.95	.60	.45	.40	.45	.65	.70	.90
31	.....	.90	.....	.45	.40	.....	.65	.....	.90

NOTE.—Gage heights affected by opening of floodgate.

Rating table for Hangman Creek at Tekoa, Wash., from April 1 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
0.40	0.2	1.40	34	3.00	142	4.50	318
.45	1.0	1.50	38	3.10	150	4.60	335
.50	2.0	1.60	43	3.20	158	4.70	353
.55	3.0	1.70	49	3.30	167	4.80	372
.60	4.5	1.80	55	3.40	177	4.90	392
.65	6.0	1.90	61	3.50	187	5.00	412
.70	7.5	2.00	67	3.60	197	5.10	434
.75	9.0	2.10	73	3.70	207	5.20	456
.80	10.5	2.20	79	3.80	218	5.30	478
.85	12	2.30	86	3.90	230	5.40	500
.90	14	2.40	94	4.00	243	5.50	522
.95	16	2.50	102	4.10	257	5.60	546
1.00	18	2.60	110	4.20	271	5.70	570
1.10	22	2.70	118	4.30	286	5.80	594
1.20	26	2.80	126	4.40	302	5.90	618
1.30	30	2.90	134				

The above table is applicable only for open-channel conditions. It is based upon 12 discharge measurements made during 1904. It is well defined between gage heights 0.40 foot and 5.30 feet. The table has been extended beyond these limits. Above gage height 5.50 feet the rating curve is a tangent, the difference being 24 per tenth.

Estimated monthly discharge of Hangman Creek at Tekoa, Wash., for 1904.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
April	858	146	405	24,100
May	138	14	50.1	3,080
June	79	4.5	29.9	1,779
July	56	1	5.6	344
August	1	.2	.35	22
September	1	.2	.28	17
October	7.5	.2	4.6	283
November	9	3	6.2	369
December	14	6	9.2	566
The period				30,560

HANGMAN CREEK AT POOLE'S RANCH, NEAR TEKOA, WASH.

This station was established September 28, 1904, by T. A. Noble. It is located 4 miles northwest of Tekoa, Wash., one-fourth mile south of highway bridge across Hangman Creek, and 300 feet south of J. M. Poole's farm crossing. A 6-inch hook gage is used once each day by John M. Poole. Discharge measurements are made by means of a weir 14 feet long. The top of the weir is the same height as the top of a nail driven into the plank which forms part of the dead-man for the bench mark, 7 feet upstream from the weir. The channel is straight for about 80 feet above and 25 feet below the station and the current is sluggish. Both banks are about 6 to 8 feet high, lined with brush, and subject to overflow during high water. The bed of the stream is composed of rock, cemented gravel, free from vegetation, and permanent. There is but one channel at low, and two at high water. The bench mark is the top of a 60-penny nail driven into right-of-way post of the Oregon Railroad and Navigation Company, 40 feet east of the weir. Its elevation is 8.627 feet above the top of the weir or iron lip.

The observations at this station during 1904 have been made under the direction of T. A. Noble, district engineer.

Mean daily gage height, in feet, of Hangman Creek at Poole's ranch near Tekoa, Wash., for 1905.

Day.	Sept.	Oct.	Nov.	Dec.	Day.	Sept.	Oct.	Nov.	Dec.
1	.....	0.383	0.364	0.385	17	.....	0.414	0.382	0.744
2	.....	.383	.376	.419	18	.....	.384	.446	.628
3	.....	.362	.375	.386	19	.....	.340	.445	.733
4	.....	.384	.365	.418	20	.....	.444	.463	.688
5	.....	.314	.377	.398	21	.....	.372	.480	.552
6	.....	.345	.365	.388	22	.....	.375	.554	.534
7	.....	.412	.384	.323	23	.....	.395	.610	.533
8	.....	.496	.375	.379	24	.....	.383	.782	.532
9	.....	.460	.383	.323	25	.....	.385	.647	.....
10	.....	.520	.361	.333	26	.....	.387	.589	.....
11	.....	.570	.371	.354	27	.....	.364	.528	.....
12	.....	.563	.393	.437	28	.....	0.347	.354	.491	.....
13	.....	.571	.394	.466	29	.....	.344	.342	.461	.....
14	.....	.620	.394	.518	30	.....	.383	.388	.415	.....
15	.....	.726	.393	.617	31	.....	.....	.386	.....	.....
16	.....	.442	.370	.779						

From September 28 to October 15, inclusive, length of weir, 1.01 feet; from October 16 to November 24, inclusive, length of weir, 3 feet; from November 25 to December 24, inclusive, length of weir, 5 feet.

HANGMAN CREEK (NORTH FORK) AT TEKOA, WASH.

This station was established April 2, 1904, by W. W. Schlecht. It is located at the highway bridge in Tekoa, Wash., on the road leading north. A plain staff gage, graduated to feet and tenths, is fastened vertically to the concrete abutment of the railway bridge on the northern arm of the "Y" of the Oregon Railroad and Navigation Company's tracks, 25 feet upstream from the bridge from which discharge measurements are made. The gage is read once each day by C. J. McLaughlin. Discharge measurements are made from the downstream side of the highway bridge. The initial point for soundings is the center of telegraph pole on the right bank. It is indicated by a 20-penny nail and marked zero. Five-foot intervals are marked on the bridge. The channel is straight for about 60 feet above and below the station and the current is swift. There is a series of rapids between the gaging station and the mouth of the creek, having a total fall of about 4 to 5 feet. The right bank is of earth, fringed with brush, having a number of houses built close to the river, and does not overflow. The left bank is low, and is liable to overflow above and below the station 50 to 100 feet back to the railroad embankment. The bed of the stream is composed of gravel and a few bowlders, and is permanent. At the gaging section there is but one channel at all stages.

Bench mark No. 1 is a United States Geological Survey standard aluminum tablet set in the vertical wall of a brick house on the corner 1 square north of the bank in Tekoa. It is marked "2537" and is 58.29 feet above the zero of the gage. Bench mark No. 2 is a point

on the concrete abutment of the railroad bridge near the gage. Its elevation is 8.39 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of T. A. Noble, district engineer.

Discharge measurements of Hangman Creek (North Fork) at Tekoa, Wash., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
April 2	W. W. Schlecht	44	119	1.71	2.28	203
April 9	do	44	108	1.09	1.88	117
April 20	W. G. Steward	40	93	.38	1.50	37
May 6[a]	W. W. Schlecht	18	13	.79	1.23	10
May 11[a]	W. G. Steward	30	2.8	1.36	.80	3.8
May 24[a]	Murphy and Steward		1.9	.83	.62	1.6
June 22[a]	W. G. Steward	3	1.9	.35	.42	.67
July 16[a]	do	3	1.8	.38	.50	.70
August 29[a]	do	.8	.24	1.17	.42	.28

[a] Not at regular section.

Mean daily gage height, in feet, of Hangman Creek (North Fork) at Tekoa, Wash., for 1904.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1		1.30	0.65	0.40	0.47	0.44	0.44	0.70	0.70
2	2.30	1.40	.70	.47	.47	.44	.44	.70	.70
3	2.35	1.30	1.00	.47	.46	.44	.44	.70	.70
4	2.25	1.20	1.00	.50	.46	.44	.44	.70	.70
5	2.20	1.15	.75	.50	.46	.44	.44	.70	.70
6	2.30	1.20	.75	.47	.46	.44	.44	.70	.70
7	1.94	1.20	.75	.47	.47	.44	.45	.70	.70
8	1.93	1.10	.80	.50	.46	.44	.46	.75	.70
9	1.90	1.00	.70	.50	.46	.44	.50	.70	.70
10	1.90	1.00	.65	.47	.45	.44	.50	.70	.70
11	1.95	1.20	.50	.47	.45	.44	.60	.70	.75
12	1.98	1.00	.55	.46	.45	.44	.60	.70	.75
13	1.80	.90	.60	.47	.45	.44	.60	.70	.76
14	1.70	.90	.55	.47	.46	.44	.60	.70	.76
15	1.90	.80	.43	.47	.46	.44	.60	.70	.77
16	2.00	.80	.50	.50	.45	.44	.65	.70	.85
17	1.70	.77	.50	.60	.45	.44	.66	.70	.80
18	1.70	.77	.50	.50	.44	.44	.70	.70	.85
19	1.50	.80	.50	.50	.44	.44	.70	.70	.85
20	1.30	.85	.45	.50	.44	.44	.70	.75	.85
21	1.30	.77	.45	.50	.43	.44	.70	.75	.85
22	1.70	.70	.45	.47	.43	.44	.70	.75	.85
23	1.70	.70	.40	.47	.43	.44	.70	.75	.85
24	1.50	.55	.40	.47	.43	.44	.70	.67	.80
25	1.50	.40	.40	.50	.43	.44	.70	.70	.80
26	1.40	.40	.90	.50	.44	.44	.70	.70	.80
27	1.40	.40	.40	.50	.44	.44	.70	.70	.90
28	1.45	.50	.35	.50	.44	.44	.70	.70	.98
29	1.40	.35	.40	.50	.44	.44	.65	.70	.98
30	1.40	.50	.40	.50	.44	.44	.65	.70	.98
31		.50		.47	.44		.65		.99

Rating table for Hangman Creek (North Fork) at Tekoa, Wash., from April 2 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
0.35	0.1	.80	3.5	1.25	10.6	1.90	121
.40	.2	.85	4.0	1.30	13.0	2.00	142
.45	.4	.90	4.6	1.35	16.4	2.10	163
.50	.7	.95	5.4	1.40	21.4	2.20	184
.55	1.0	1.00	6.2	1.45	29	2.30	205
.60	1.5	1.05	7.0	1.50	37	2.40	226
.65	2.0	1.10	7.8	1.60	58		
.70	2.5	1.15	8.6	1.70	79		
.75	3.0	1.20	9.4	1.80	100		

The above table is applicable only for open-channel conditions. It is based upon 9 discharge measurements. It is well defined between gage heights 0.30 foot and 2.30 feet. The table has been extended beyond these limits. Above gage height 2.40 the rating curve is a tangent, the difference being 22 per tenth.

Estimated monthly discharge of Hangman Creek (North Fork) at Tekoa, Wash., for 1904.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
April 2–30	215	21.4	95.8	5,510
May	21.4	.1	5.23	322
June	6.2	.1	1.61	96
July	1.5	.2	.62	38
August	.5	.3	.42	26
September	.4	.4	.40	24
October	2.5	.4	1.61	99
November	3.0	2.2	2.57	153
December	6.0	2.5	3.57	220
The period				6,488

LITTLE SPOKANE RIVER NEAR SPOKANE, WASH.

This station was established August 3, 1903, by George H. Bliss. It is located about 2 miles above the mouth of the river at the second bridge above the mouth. It is 9 miles northwest of Spokane, Wash., and 1½ miles northeast of what is known as the "9-mile bridge" over Spokane River. The wire gage is located on the upstream side of the bridge. The center of the pulley is 105 feet from the south end of the bridge. The length of the wire from the end of the weight to the

marker is 13.25 feet. This distance has been laid off on the upper surface of the bottom rail near the gage and is marked by copper tacks inclosed in circles of black paint. These marks are used in checking the length of the gage wire. The gage is read once each day by Mary A. Keenan. Discharge measurements are made from the upstream side of the bridge to which the gage is attached. The initial point for soundings is the vertical end post on the upstream side of the bridge at the south approach. The channel is straight for 100 feet above and 150 feet below the station. The current is swift. Both banks are high, covered with underbrush, and liable to overflow only at very high stages. The bed of the stream is composed of clean gravel. The channel is broken by four bridge piers and has a width at ordinary stages of about 125 feet. The bench mark is a wire nail driven into the root of a black pine tree 2 feet in diameter. The root is on the north side of the tree and extends toward the bridge. It is 60 feet distant from the south end of the bridge. The tree is blazed. It is marked "B. M." with black paint. The bench mark has an elevation of 21.00 feet above gage datum.

The observations at this station during 1904 have been made under the direction of T. A. Noble, district engineer.

Discharge measurements of Little Spokane River near Spokane, Wash., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
March 3	G. H. Bliss	134	544	1.54	8.90	838
April 19	W. G. Steward	122	801	3.02	10.98	2,416
May 20	Steward and Murphy	102	546	1.56	8.48	850

Mean daily gage height, in feet, of Little Spokane River near Spokane, Wash., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	6.60	6.68	7.50	8.95	10.60	7.33	6.60	6.10	6.09	6.10	6.35	6.30
2	6.60	6.65	7.35	8.94	9.82	7.40	6.50	6.30	6.15	6.29	6.30	6.34
3	6.60	6.57	7.10	8.91	9.76	7.50	6.40	6.20	6.20	6.30	6.29	6.20
4	6.65	6.65	7.10	9.15	9.60	7.40	6.70	6.20	6.15	6.10	6.25	6.27
5	6.68	6.74	7.30	9.56	9.62	7.45	7.35	6.18	6.20	6.15	6.18	6.28
6	6.50	6.90	7.55	9.90	9.55	7.60	7.32	6.30	6.01	6.23	6.24	6.19
7	6.60	6.75	7.90	10.20	9.40	7.70	7.40	6.21	6.04	6.30	6.30	6.30
8	6.55	6.80	8.60	10.15	9.35	7.04	7.45	6.20	6.00	6.05	6.20	6.25
9	6.62	6.70	9.55	10.05	9.32	7.50	7.32	6.19	6.01	6.19	6.30	6.34
10	6.70	6.50	9.55	10.20	9.21	7.34	6.40	6.24	6.03	6.18	6.34	6.40
11	6.68	6.64	9.40	10.50	9.16	7.24	6.45	6.30	6.10	6.20	6.35	.....
12	6.70	6.70	9.30	10.85	9.00	7.10	6.50	6.20	6.01	6.19	6.37	.....
13	6.78	6.80	9.25	10.90	8.96	7.00	6.40	6.17	6.00	6.20	6.30	.....
14	6.78	6.75	9.30	11.00	8.84	7.05	6.20	6.20	5.99	6.10	6.25	.....
15	6.80	6.78	9.25	11.30	8.82	[a]6.85	6.30	6.15	5.99	6.23	6.40	.....
16	6.80	6.76	9.30	[a]12.00	8.00	6.82	6.40	6.20	6.01	6.25	6.10	.....

[a] Highest water in 17 years, according to observer.

Mean daily gage height, in feet, of Little Spokane River near Spokane, Wash., for 1904—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
17	7.05	6.90	9.20	11.70	8.76	6.75	6.50	6.15	6.00	6.09	6.29	.....
18	7.10	6.80	9.15	11.20	8.68	6.50	6.40	6.20	6.13	6.10	6.50	.....
19	7.05	6.70	9.20	11.00	8.53	6.60	6.30	6.05	6.00	6.08	6.27	.....
20	6.85	6.90	9.20	10.94	8.30	6.50	6.45	6.16	6.20	6.00	6.39	.....
21	6.80	6.70	9.25	10.60	8.15	6.50	6.20	6.18	6.25	6.16	6.40	.....
22	6.89	6.90	9.15	10.55	8.20	6.65	6.32	6.15	6.30	6.39	6.25	.....
23	6.85	7.50	9.10	10.42	8.13	6.70	6.48	6.13	6.20	6.40	6.30	.....
24	6.67	7.11	9.05	10.35	8.10	6.60	6.32	6.17	6.00	6.20	6.28	.....
25	6.65	7.15	9.00	10.20	8.00	6.55	6.00	6.10	6.29	6.50	6.30	.....
26	6.65	7.25	8.85	10.07	7.95	6.50	6.15	6.08	6.18	6.48	6.45	.....
27	6.67	7.40	8.64	10.17	7.90	6.45	6.30	6.15	6.23	6.69	6.30	.....
28	6.71	7.60	8.73	10.00	7.81	6.30	6.20	6.12	6.20	6.29	6.25	.....
29	6.68	7.60	8.70	9.95	7.70	6.35	6.20	6.27	6.10	6.20	6.29	.....
30	6.78	.....	9.00	10.00	7.30	6.60	6.18	6.13	6.15	6.15	6.34	.....
31	6.78	.....	8.48	.....	7.28	.....	6.15	6.10	.....	6.20	.....	.....

SINLAHEKIN CREEK NEAR LOOMIS, WASH.

This station was established June 13, 1903, by Charles E. Hewitt. It is located on the main road between Loomis and Conconully, Wash., 3 miles from Loomis and 19 miles from Conconully. The gage is a vertical staff driven into the ground and braced to the gatepost at the northeast corner of R. A. Garrett's yard. Mrs. Mary Garrett, the observer, reads the gage once each day. There is a highway bridge 500 feet north of Mr. Garrett's house, but discharge measurements are made from a plank footbridge near the gage. The initial point for soundings is a 1 by 2 inch iron bar 15 feet long driven flush with the ground at the northeast corner of the main part of Mr. Garrett's house, and 50 feet from the gage. The channel is straight for 20 feet above and for 50 feet below the station. Beyond these points are large bends in the stream. The right bank is low for about 15 feet back from the water's edge. Beyond this point it is not subject to overflow, as it rises more abruptly. The water's edge is covered with shrubbery. The left bank is low grass land, subject to overflow. The bed of the stream is a gravelly clay or loam, and is quite stable. The bench mark is the top of the iron bar used as the initial point for sounding. Its elevation is 11.40 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of T. A. Noble, district engineer.

Mean daily gage height, in feet, of Sinlahekin Creek near Loomis, Wash., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.5	3.0	2.7	2.9	7.7	6.0	3.6	2.7	2.6	2.5	2.8	2.8
2	2.5	3.0	2.6	3.2	7.5	5.9	3.5	2.6	2.6	2.5	2.8	2.8
3	2.4	3.2	2.6	3.5	7.5	5.8	3.4	2.6	2.5	2.5	2.8	2.8
4	2.4	3.2	2.6	3.5	7.4	5.8	3.4	2.6	2.5	2.5	2.8	2.8
5	2.4	3.3	2.5	3.5	7.3	5.8	3.3	2.6	2.5	2.5	2.8	2.8
6	2.4	3.0	2.4	3.3	6.9	5.7	3.2	2.6	2.5	2.5	2.8	2.7
7	2.5	2.8	2.4	3.0	6.7	5.6	3.2	2.6	2.5	2.5	2.8	2.7
8	2.5	2.8	2.6	2.9	6.7	5.5	3.3	2.6	2.5	2.5	2.8	2.7
9	2.5	2.8	3.0	2.9	6.6	5.3	3.2	2.5	2.5	2.5	2.8	2.7
10	2.6	3.0	2.6	2.9	6.6	5.2	3.2	2.5	2.5	2.6	2.8	2.7
11	2.8	3.5	2.5	3.0	6.6	5.0	3.1	2.5	2.5	3.3	2.8	2.7
12	2.7	4.0	2.5	3.3	6.6	4.8	3.5	2.5	2.5	3.6	2.8	2.7
13	2.6	3.8	2.5	3.8	6.5	4.8	3.0	2.5	2.5	3.0	2.8	2.7
14	2.6	3.7	2.5	4.0	6.6	4.5	3.0	2.5	2.5	2.9	2.8	2.7
15	2.6	3.6	2.5	4.7	6.8	4.5	3.0	2.5	2.5	2.8	2.9	2.7
16	2.6	3.5	2.5	7.3	6.9	4.4	3.2	2.5	2.5	2.8	3.0	2.7
17	2.8	3.4	2.5	7.6	7.0	4.4	3.1	2.5	2.5	2.7	3.0	2.7
18	2.8	3.4	2.4	6.8	7.0	4.5	3.0	2.5	2.5	2.7	2.9	2.7
19	2.5	3.4	2.4	6.7	7.1	5.8	3.0	2.5	2.5	2.7	2.8	2.7
20	2.5	3.0	2.4	6.8	7.3	4.8	2.9	2.5	2.5	2.7	2.8	2.7
21	2.6	3.5	2.4	6.8	7.6	4.6	2.8	2.5	2.5	2.7	2.8	2.7
22	2.6	3.6	2.4	7.2	7.6	4.4	2.8	2.5	2.5	2.7	2.8	2.7
23	2.6	3.6	2.4	7.2	7.5	4.2	2.8	2.5	2.5	2.7	2.8	2.7
24	2.6	3.6	2.4	7.0	7.4	4.1	2.8	2.5	2.5	2.7	2.8	2.7
25	2.7	3.6	2.4	6.7	7.0	4.0	2.8	2.5	2.5	2.7	2.8	2.7
26	2.8	3.7	2.4	6.8	6.7	3.9	2.8	2.5	2.5	2.7	2.8	2.7
27	2.8	3.5	2.4	7.0	6.6	3.8	2.8	2.5	2.5	2.7	2.8	2.7
28	2.8	3.3	2.4	7.7	6.5	3.7	2.7	2.6	2.5	2.7	2.8	2.7
29	2.7	2.8	2.4	(a)	6.4	3.6	2.7	2.7	2.5	2.7	2.8	2.8
30	2.6	.....	2.5	8.0	6.3	3.6	2.7	2.7	2.5	2.7	2.8	2.8
31	2.6	.....	2.7	.....	6.0	.....	2.7	2.6	.....	2.7	.....	2.7

[a] Water above gage.

Rating table for Sinlahekin Creek near Loomis, Wash., from June 13, 1903, to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.60	4.5	2.40	11	3.20	34	3.90	62
1.70	5	2.50	13	3.30	37	4.00	66
1.80	5.5	2.60	16	3.40	41	4.10	72
1.90	6	2.70	19	3.50	45	4.20	77
2.00	6.5	2.80	22	3.60	49	4.30	82
2.10	7	2.90	25	3.70	53	4.40	87
2.20	8	3.00	28	3.80	57	4.50	92
2.30	9	3.10	31				

The above table is applicable only for open-channel conditions. It is based upon 4 discharge measurements made during 1903. It is well defined between gage heights 2.40 feet

and 4.10 feet. The table has been extended beyond these limits. Above gage height 3.90 feet the rating curve is a tangent, the difference being 5 per tenth.

Estimated monthly discharge of Sinlahekin Creek near Loomis, Wash., for 1904.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January	22	11	15.8	972
February	66	22	39.2	2,255
March	28	11	13.3	818
April	266	25	133	7,914
May	251	166	21.3	1,310
June	166	49	106	6,307
July	49	19	29.4	1,808
August	19	13	14.3	879
September	16	13	13.2	786
October	49	13	19.1	1,174
November	28	22	22.1	1,315
December	22	19	19.2	1,181
The year	266	11	37.2	26,720

JOHNSON CREEK NEAR RIVERSIDE, WASH.

This station was established by T. A. Noble, May 30, 1903. It is located at Sogle's ranch, on the road from Riverside to Conconully, 1 mile from Riverside and 17 miles from Conconully. The equipment consists of a sharp crested weir with an 8-foot opening and vertical sides. Below the level of the crest the weir consists of two 2-inch pine planks, 12 inches wide, securely spiked together. Above the crest on each end are two planks 12 inches wide, which form the ends of the weir. The edges of the crest and ends are one-fourth inch wide and beveled on the downstream side to an angle of 60°. The pool above the weir is 10 feet long, 10 to 15 feet wide, and 1 foot deep below the crest. The water has a fall of about 1 foot after passing the weir and then flows rapidly away.

The depth of water on the crest is determined by a hook gage and vernier reading to thousandths of a foot. The zero on the gage is level with the crest of the weir. Readings are made once each day by S. Sogle. The right bank of the stream is low for 10 feet back from the water's edge and then it rises more abruptly. The left bank is steep and rocky. The bed of the creek is composed of small gravel. Bench mark No. 1 is the top of the fence post opposite the weir. Its elevation is 19.12 feet above gage datum. Bench mark No. 2 is a nail driven into a stake 3 feet northwest of the weir. Its elevation is 0.29

foot above gage datum. The weir was destroyed July 30, 1904, and the station discontinued.

The observations at this station during 1904 have been made under the direction of T. A. Noble, district engineer.

Mean daily gage height, in feet, of Johnson Creek near Riverside, Wash., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.
1	0.38	0.32	0.40	0.62	0.68	0.44	0.45
2	.37	.31	.39	.65	.66	.48	.48
3	.38	.32	.36	.68	.62	.48	.45
4	.38	.32	.40	.74	.63	.47	.42
5	.37	.32	.40	.77	.63	.46	.42
6	.38	.38	.40	.78	.61	.46	.44
7	.39	.38	.45	.71	.65	.46	.44
8	.40	.34	.44	.68	.63	.45	.45
9	.40	.31	.44	.65	.60	.43	.45
10	.41	.31	.45	.69	.61	.43	.46
11	.43	.32	.50	.70	.61	.45	.46
12	.38	.33	.50	.67	.59	.45	.46
13	.39	.34	.51	.67	.55	.44	.46
14	.39	.24	.50	.67	.54	.44	.48
15	.41	.30	.47	.76	.52	.42	.52
16	.44	.34	.46	.78	.52	.43	.52
17	.43	.34	.46	.74	.50	.42	.52
18	.41	.35	.45	.71	.48	.54	.50
19	.32	.38	.45	.78	.47	.56	.49
20	.37	.38	.45	.78	.46	.48	.48
21	.35	.37	.50	.79	.44	.48	.48
22	.36	.38	.52	.79	.45	.47	.48
23	.36	.33	.52	.79	.48	.49	.45
24	.36	.38	.50	.73	.48	.48	.45
25	.34	.37	.49	.72	.49	.47	.44
26	.34	.39	.49	.72	.48	.48	.44
27	.33	.40	.48	.68	.46	.50	.44
28	.32	.40	.51	.64	.47	.51	.45
29	.33	.39	.57	.69	.45	.49	.45
30	.32	.....	.53	.66	.43	.48	a.45
31	.32	.....	.61	.....	.44	.....	a.45

a Estimated.

Rating table for Johnson Creek near Riverside, Wash., from May 29 to December 31, 1904.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
0.1	0.9	0.4	6.7	0.7	15.3	1.0	26.0
.2	2.4	.5	9.3	.8	18.7	.....	.....
.3	4.4	.6	12.2	.9	22.3	.....	.....

a The computations for the rating table were based on the formula for contracted weirs.

Gage heights give directly depth of water over weir.

Estimated monthly discharge of Johnson Creek near Riverside, Wash., for 1904.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January	7.7	4.9	6.10	375
February	6.7	3.2	5.47	315
March	12.5	5.8	8.58	528
April	18.4	12.8	15.9	946
May	14.7	7.5	10.4	640
June	11.0	7.2	8.48	505
July	9.9	7.2	8.33	512
The period				3,821

SALMON CREEK NEAR MALOTT, WASH.

This station was established April 11, 1903, by T. A. Noble. It is located opposite R. D. Jones's house, which is on the county road halfway between Malott and Conconully, Okanogan County. It is reached by way of the Great Northern Railway to Wenache, thence by way of the Columbia River steamers to Brewster, and by the Conconully stage from Brewster to Jones's ranch. The gage is vertical and consists of a 1 by 6 inch board graduated to feet and inches, and fastened to a small alder tree on the left bank of the river opposite the house of the observer, R. D. Jones, who reads the gage once each day. Discharge measurements are made from the footbridge just above the gage. The initial point for soundings is a large nail driven in a birch hub, 8 inches in diameter and 2 feet long, 4 feet east of the bridge and 14 feet north of the gage. It is on the left bank, 7 feet from the water's edge at ordinary stages. The channel is straight for 100 feet above and for 200 feet below the station. There are rapids at the bend in the river 100 feet above the station and at another bend 300 feet below the station. The current is swift. The right bank is low and will overflow for about 100 feet, at which point it becomes steep. The left bank is low and may overflow for 200 feet at extreme flood stages. Both banks are without trees or brush with the exception of a fringe of alder at the water's edge. The bed is rocky at the center and sandy along the banks. It is without vegetation except near the banks. The bench mark is the initial point for soundings. Its elevation is 4.58 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of T. A. Noble, district engineer.

Discharge measurements of Salmon Creek near Malott, Wash., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
March 23	G. H. Bliss	18	28	0.62	0.82	17
July 2	W. W. Schlecht	21	33	1.17	1.12	38

Mean daily gage height, in feet, of Salmon Creek near Malott, Wash., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	0.71	0.67	0.65	0.82	3.12	2.67	1.66	0.84	0.91	0.67	0.82	0.87
2	.93	.75	.58	.87	3.18	2.50	1.56	.85	.94	.71	.83	.85
3	.83	.77	.67	.96	3.17	2.54	1.54	.83	.92	.66	.83	.85
4	.69	.75	.79	1.02	3.00	2.52	1.50	.77	.91	.60	.83	.84
5	.67	.71	.74	1.00	2.34	2.50	1.46	.75	.85	.60	.82	.84
6	.85	.67	.75	1.08	2.44	2.63	1.48	.77	.82	.67	.82	.83
7	.83	.69	.77	1.04	2.54	2.58	1.42	.74	.79	.63	.83	.83
8	.60	.75	.83	1.08	2.58	2.33	1.49	.67	.75	.60	.83	.83
9	.72	.58	.81	1.17	2.59	2.33	1.42	.83	.75	.67	.83	.84
10	.79	.69	.77	1.30	2.57	2.21	1.38	.82	.79	.69	.82	.84
11	.67	.67	.79	1.42	2.54	2.15	1.29	.88	.77	1.33	.81	.83
12	.83	.75	.75	1.54	2.58	2.08	1.29	1.00	.79	1.27	.82	.83
13	.71	.67	.69	1.70	2.60	2.04	1.23	1.04	.75	1.29	.83	.84
14	.81	.77	.75	2.83	2.69	2.08	1.21	1.00	.79	1.00	.83	.84
15	.67	.75	.71	2.53	2.75	2.10	1.19	.99	.77	.96	.94	.85
16	.83	.77	.99	2.09	2.71	2.08	1.23	.96	.75	.88	.98	.84
17	.87	.79	1.00	2.58	2.67	2.06	1.21	.94	.76	.92	1.02	.84
18	.67	.75	.99	2.50	2.71	2.21	1.18	.96	.75	.94	1.00	.83
19	.83	.74	.92	2.54	2.79	2.38	1.17	.92	.69	.87	.92	.83
20	.58	.69	.81	2.67	2.83	2.13	1.09	.96	.74	.83	.92	.82
21	.71	.69	.85	2.75	3.04	2.04	1.08	.94	.77	.85	.91	.80
22	.80	.75	.83	2.96	3.21	1.94	1.04	.93	.71	.91	.92	.79
23	.79	.69	.82	2.75	3.08	1.83	1.00	.94	.75	.83	.90	.75
24	.79	.75	.67	2.75	2.92	1.79	.99	.96	.71	.79	.90	.71
25	.79	.67	.64	2.71	2.75	1.76	.98	.83	.67	.79	.89	.....
26	.73	.71	.62	2.94	2.79	1.75	1.00	.88	.69	.82	.89	.....
27	.75	.73	.67	3.28	2.75	1.72	.92	.83	.67	.83	.88	.....
28	.67	.79	.69	3.58	2.71	1.69	.91	.83	.71	.79	.88	.....
29	.79	.69	.82	3.63	2.67	1.67	.92	.85	.62	.77	.87	.....
30	.71	.....	.75	3.27	2.58	1.64	.90	.88	.58	.79	.86	.....
31	.71	.....	.79	.....	2.59	.....	.88	.92	.....	.81	.....	.....

Rating table for Salmon Creek near Malott, Wash., from January 1 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
0.6	11	1.3	57	2.0	166	2.6	292
.7	13	1.4	71	2.1	183	2.7	318
.8	16	1.5	86	2.2	202	2.8	345
.9	20	1.6	102	2.3	222	2.9	373
1.0	27	1.7	118	2.4	244	3.0	401
1.1	35	1.8	134	2.5	267	3.1	429
1.2	45	1.9	150				

The above table is applicable for open-channel conditions only. It is based on discharge measurements made during 1903 and 1904. It is well defined between 0.85 foot and 3.14 feet gage height. It has been extended below 0.85 foot.

Estimated monthly discharge of Salmon Creek near Malott, Wash., for 1904.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January	22	11	14.7	904
February	16	11	13.5	777
March	27	11	15.7	965
April	577	17	224.	13,330
May	451	231	332.	20,410
June	310	108	195.	11,600
July	112	19	51.1	3,142
August	30	12	20.0	1,230
September	22	11	15.1	898
October	61	11	20.1	1,236
November	29	16	19.3	1,148
December (1–24)	19	13	17.2	819
The period				56,460

METHOW RIVER NEAR PATEROS, WASH.

Methow River has its source in the Cascade Mountains near the boundary line between the United States and British Columbia, and flows in a southeast direction into Columbia River. The stream is a very rapid one, and is at present used to a considerable extent for irrigation purposes.

The gaging station was originally established May 3, 1903, by T. A. Noble, and was located upon a highway bridge about 1,000 feet above the mouth of the river. The first two measurements were taken from

this bridge. During the summer of 1903 this bridge was washed away, and a temporary bridge, 400 feet farther down stream was used in making the measurement of March 20, 1904.

During the spring of 1904, this bridge was also abandoned because of its temporary nature and the poor section at this point, and a cable station was established about a mile above the mouth of the river where a very good section exists for taking measurements, except at the highest stage of the river. At such times the current at the station becomes too swift to measure, and it is necessary to use a boat farther down the stream, where the backwater from Columbia River retards the current.

The gage is located about 500 feet below the cable, and above any effect of backwater from Columbia River. It is fastened between two pine trees on the left bank. The lower section is inclined and reads from 0 to 10 feet. The upper section is vertical and reads from 10 to 19 feet. Both sections are divided into feet and tenths. All gage heights given below and all discharge measurements are referred to this gage. A secondary gage is in place at the cable to be used by the hydrographer at the time of measurement, to assist in computing areas.

Both banks at the station are high and not liable to overflow. The bed of the stream is covered with small bowlders and gravel and is liable to slight changes. The initial point for soundings is a cross marked "I. P." on rock about 10 feet back of shear legs on left bank.

Bench mark No. 1 is a United States Geological Survey standard iron post in front of Ives Hotel, at Pateros, Wash. Its elevation is 26.05 feet above zero of the gage and 780 feet above sea level. Bench mark No. 2 is the top of a large white stone, marked "B. M.," which is 30 feet northeast of gage board on left bank. Elevation of the highest point is 15.20 feet above gage datum.

The observations at this station during 1904 have been made under the direction of T. A. Noble, district engineer.

Discharge measurements of Methow River near Pateros, Wash., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
March 20 [a]	G. H. Bliss	66	124	3.82	4.20	474
June 10 [b]	W. G. Steward	250	2,631	2.77	8.80	7,293
July 1	C. M. Hurlburt	245	2,041	3.81	8.60	7,790
July 30 [b]	W. G. Steward	170	534	2.56	5.39	1,368

[a] Made at temporary bridge. [b] Made at new cable station.

Mean daily gage height, in feet, of Methow River near Pateros, Wash., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	4.60	4.30	4.30	4.20	9.00	9.30	8.50	5.30	4.50	4.10	4.15	4.20
2	4.55	4.35	4.30	4.20	8.75	9.25	8.60	5.30	4.50	4.10	4.15	4.20
3	4.50	4.45	4.25	4.25	8.50	9.20	8.20	5.20	4.45	4.10	4.15	4.20
4	4.50	4.50	4.25	4.25	8.40	9.15	8.20	5.15	4.45	4.10	4.15	4.20
5	4.50	4.50	4.25	4.30	8.30	9.30	8.10	5.15	4.45	4.10	4.15	4.20
6	4.50	4.50	4.25	4.35	8.05	9.50	8.10	5.10	4.40	4.10	4.15	4.20
7	4.55	4.50	4.25	4.40	7.85	9.60	8.20	5.10	4.40	4.10	4.15	4.20
8	4.55	4.45	4.25	4.45	7.75	9.20	7.90	5.05	4.35	4.10	4.15	4.20
9	4.55	4.40	4.25	4.50	7.60	8.75	7.60	5.05	4.30	4.10	4.15	4.20
10	4.50	4.40	4.25	4.65	7.60	8.85	7.40	4.95	4.30	4.50	4.15	4.20
11	4.50	4.45	4.25	4.90	7.60	8.50	7.30	4.85	4.30	4.50	4.15	4.20
12	4.50	4.55	4.25	5.40	7.60	8.50	7.20	4.80	4.30	4.40	4.15	4.20
13	4.50	4.50	4.20	6.25	7.65	8.50	6.90	4.80	4.30	4.30	4.15	4.20
14	4.50	4.60	4.20	7.00	7.90	8.50	6.55	4.75	4.25	4.30	4.15	4.25
15	4.55	4.60	4.20	8.20	7.90	8.20	6.40	4.70	4.25	4.30	4.15	4.25
16	4.55	4.55	4.20	8.70	8.00	8.20	6.25	4.70	4.25	4.25	4.20	4.20
17	4.55	4.50	4.20	8.50	8.10	8.15	6.10	4.70	4.20	4.25	4.20	4.20
18	4.55	4.50	4.20	8.30	8.30	9.90	6.00	4.70	4.20	4.25	4.25	4.15
19	4.50	4.45	4.20	8.40	8.50	9.40	5.90	4.65	4.20	4.25	4.20	4.10
20	4.30	4.45	4.20	8.40	9.10	9.10	5.90	4.60	4.15	4.25	4.20	4.05
21	4.30	4.45	4.20	8.50	9.80	8.50	5.90	4.60	4.15	4.20	4.25	4.05
22	4.30	4.40	4.20	8.45	10.00	8.20	5.85	4.55	4.20	4.20	4.30	4.05
23	4.45	4.40	4.20	8.40	11.00	7.10	5.85	4.55	4.25	4.20	4.30	4.05
24	4.40	4.40	4.20	8.15	10.50	7.60	5.80	4.50	4.25	4.15	4.30	4.00
25	4.40	4.35	4.20	8.10	9.50	7.40	5.70	4.40	4.20	4.15	4.30	3.90
26	4.40	4.35	4.20	8.05	9.25	7.80	5.60	4.40	4.20	4.15	4.30	3.85
27	4.40	4.35	4.20	8.45	9.00	8.20	5.60	4.40	4.15	4.15	4.25	4.05
28	4.40	4.35	4.20	9.30	9.20	8.50	5.55	4.40	4.15	4.15	4.25	4.10
29	4.40	4.30	4.20	10.00	9.60	8.50	5.50	4.65	4.10	4.15	4.20	4.15
30	4.30	.....	4.20	9.65	9.50	8.50	5.40	4.60	4.10	4.15	4.20	4.15
31	4.30	.....	4.20	.....	9.30	.....	5.35	4.55	.....	4.15	.....	4.15

Rating table for Methow River near Pateros, Wash., from June 17, 1903, to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
3.80	345	5.30	1,250	6.80	3,320	8.40	6,420
3.90	365	5.40	1,360	6.90	3,500	8.60	6,840
4.00	390	5.50	1,475	7.00	3,680	8.80	7,260
4.10	420	5.60	1,595	7.10	3,860	9.00	7,680
4.20	460	5.70	1,720	7.20	4,040	9.20	8,100
4.30	505	5.80	1,850	7.30	4,220	9.40	8,520
4.40	555	5.90	1,980	7.40	4,400	9.60	8,940
4.50	605	6.00	2,110	7.50	4,580	9.80	9,360
4.60	665	6.10	2,240	7.60	4,780	10.00	9,780
4.70	725	6.20	2,370	7.70	4,980	10.20	10,200
4.80	790	6.30	2,510	7.80	5,180	10.40	10,620
4.90	865	6.40	2,670	7.90	5,380	10.60	11,040
5.00	950	6.50	2,830	8.00	5,580	10.80	11,460
5.10	1,045	6.60	2,990	8.20	6,000	11.00	11,880
5.20	1,145	6.70	3,150				

The preceding table is applicable only for open-channel conditions. It is based upon 7 discharge measurements made during 1903 and 1904. The table has been extended beyond these limits. Above gage height 8.00 feet the rating curve is a tangent, the difference being 210 per tenth.

Estimated monthly discharge of Methow River near Pateros, Wash., for 1903 and 1904.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
1903.				
June 17–30	13,140	7,260	10,020	278,300
July	6,630	1,746	3,230	198,600
August	1,707	790	1,129	69,420
September	1,045	665	830	49,390
October	1,145	790	984	60,500
November	1,145	769	942	56,050
December	950	665	790	48,580
The period				760,800
1904.				
January	665	505	588	36,160
February	665	505	578	33,250
March	505	460	469	28,840
April	9,780	460	4,101	244,000
May	11,880	4,780	7,018	431,500
June	9,570	3,860	6,945	413,300
July	6,840	1,305	3,353	206,200
August	1,250	555	806	49,560
September	605	420	496	29,510
October	605	420	463	28,470
November	505	440	460	27,370
December	480	355	439	26,990
The year	11,880	355	2,143	1,555,000

CHELAN RIVER BELOW LAKE CHELAN, WASHINGTON.

The Chelan is a short river, being only about 4 miles in length. It connects Lake Chelan with Columbia River, entering the latter at Chelan Falls. It is valuable principally for the water power that can be developed upon it.

A station, to determine the flow from the lake, was established November 6, 1903, by G. H. Bliss. It is located at the highway bridge 3,000 feet below the outlet of the lake and in the town of Chelan. The gage is a vertical rod 16 feet long attached to the third pile bent

of the northwestern approach to the bridge. It is read once each day by G. L. Richardson. Discharge measurements are made from the downstream side of the new highway bridge, to which the gage is attached. The initial point for soundings is the end vertical on the downstream side of the bridge at the northwest approach. The channel is straight for 50 feet above and for 150 feet below the station. The right bank can not overflow. The left bank is lower than the right, but is not liable to overflow. Both banks are without trees. The bed of the stream is composed of rocks and gravel, free from vegetation, and liable to shift somewhat. The bench mark is a wire spike driven into the root of a large cottonwood tree, which is 40 feet downstream from the northwestern approach to the bridge and 30 feet from the river. The root is on the west side of the tree. The elevation of the bench mark is 11.86 feet above the zero of the gage.

A dam which has been constructed at the foot of the lake by the town of Chelan holds back the flow of water from the lake to some extent during the dry season. This dam is about 3,000 feet above the gage board and bridge described above.

The observations at this station during 1904 have been made under the direction of T. A. Noble, district engineer.

Discharge measurements of Chelan River below Lake Chelan, Washington, in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
March 24	G. H. Bliss	249	538	2.11	5.95	1,136
May 21	Steward and Murphy	302	1,331	4.45	9.13	5,926
June 11	W. G. Steward	310	1,664	4.88	10.27	8,122
July 31	do	296	1,092	4.05	8.17	4,421
August 22	do	280	773	3.19	7.15	2,571

Mean daily gage height, in feet, of Chelan River below Lake Chelan, Washington, for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	5.80	5.60	5.60	5.80	9.00	10.25	10.10	8.30	5.60	5.60	5.40	5.50
2	5.80	5.60	5.55	5.80	9.00	10.30	10.20	8.25	5.40	5.60	5.40	5.50
3	5.75	5.60	5.50	5.75	8.95	10.30	10.30	8.20	5.40	5.60	5.35	5.50
4	5.70	5.55	5.50	5.75	8.90	10.30	10.35	8.15	5.40	5.60	5.40	5.50
5	5.50	5.50	5.50	5.75	8.90	10.35	10.40	8.10	5.45	5.60	5.40	5.50
6	5.60	5.00	5.50	5.75	8.75	10.50	10.50	8.00	6.45	5.60	5.35	5.50
7	5.65	5.45	5.50	5.75	8.65	10.65	10.40	8.00	6.40	5.60	5.35	5.50
8	5.60	5.40	5.55	5.75	8.60	10.60	10.50	7.95	6.45	5.55	5.40	5.50
9	5.70	[a] 5.80	5.55	5.75	8.60	10.50	10.45	7.90	6.40	5.50	5.40	5.45
10	5.70	5.80	5.60	5.75	8.55	10.40	10.55	7.90	6.50	5.50	5.45	5.45
11	5.65	5.75	5.65	5.85	8.50	10.30	10.45	7.80	6.45	5.45	5.45	5.40
12	5.65	5.75	5.60	6.10	8.45	10.20	10.50	7.75	6.40	5.45	5.50	5.40

[a] Opening made in dam.

Mean daily gage height, in feet, of Chelan River below Lake Chelan, Washington, for 1904— Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
13	5.65	5.70	5.60	6.30	8.40	10.10	10.45	7.70	6.40	5.40	5.50	5.40
14	5.70	5.70	5.60	6.70	8.40	10.00	10.20	7.60	6.40	[a]5.80	5.45	5.45
15	5.65	5.65	5.60	6.90	8.45	10.05	10.00	7.50	6.40	5.80	5.50	5.50
16	5.60	5.60	5.90	7.20	8.50	10.10	9.80	7.50	6.35	5.80	5.50	5.50
17	5.60	5.60	5.85	7.50	8.60	10.10	9.60	7.40	6.35	5.80	5.50	5.45
18	5.75	5.60	6.20	7.65	8.65	10.30	9.40	7.40	[a]6.15	5.80	5.45	5.45
19	5.70	5.60	6.20	7.80	8.80	10.40	9.20	7.40	6.15	5.75	5.45	5.45
20	5.60	5.60	6.25	7.90	8.90	10.40	9.10	7.30	6.15	5.75	5.50	5.45
21	5.55	5.60	6.25	8.10	9.00	10.40	8.90	7.20	6.15	5.70	5.50	5.45
22	5.65	5.70	6.15	8.20	9.30	10.35	8.85	7.15	6.10	5.70	5.50	5.45
23	5.60	5.50	6.10	8.25	9.55	10.25	8.85	7.10	6.10	5.70	5.50	5.45
24	5.65	5.50	5.90	8.20	9.80	10.00	8.75	7.05	6.00	5.65	5.50	5.40
25	5.70	5.60	5.90	8.25	9.90	10.00	8.65	7.00	6.05	5.65	5.55	5.40
26	5.70	5.65	5.90	8.30	10.00	9.90	8.20	6.90	6.00	5.60	5.55	5.35
27	5.65	5.70	5.90	8.35	10.00	9.80	8.10	[b]6.40	5.60	5.55	5.55	5.40
28	5.60	5.65	5.85	8.50	10.00	9 80	8.40	6.00	5.60	5.50	5.50	5.40
29	5.60	5.60	5.80	8.85	10.00	9.90	8.40	5.40	5.60	5.45	5.50	5.35
30	5.60	.....	5.80	8.95	10.10	9.95	8.30	5.50	5.60	5.45	5.50	5.35
31	5.60	.....	5.75	.....	10.15	.....	8.30	5.60	.....	5.40	.....	5.35

[a] Dam partly opened. [b] Dam closed.

Rating table for Chelan River below Lake Chelan, Washington, from November 6, 1903, to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
5.30	655	6.50	1,650	7.70	3,455	8.90	5,525
5.40	715	6.60	1,770	7.80	3,625	9.00	5,705
5.50	780	6.70	1,900	7.90	3,795	9.20	6,080
5.60	850	6.80	2,040	8.00	3,965	9.40	6,460
5.70	930	6.90	2,190	8.10	4,135	9.60	6,840
5.80	1,010	7.00	2,340	8.20	4,305	9.80	7,220
5.90	1,090	7.10	2,490	8.30	4,475	10.00	7,600
6.00	1,170	7.20	2,640	8.40	4,645	10.20	7,980
6.10	1,255	7.30	2,800	8.50	4,815	10.40	8,360
6.20	1,345	7.40	2,960	8.60	4,985	10.60	8,740
6.30	1,440	7.50	3,120	8.70	5,165	10.80	9,120
6.40	1,540	7.60	3,285	8.80	5,345	11.00	9,500

The above table is applicable only for open-channel conditions. It is based upon 6 discharge measurements made during 1903 and 1904. It is well defined between gage heights 5.90 feet and 10.50 feet. The table has been extended beyond these limits. Above gage height 9.00 feet the rating curve is a tangent, the difference being 190 per tenth.

Estimated monthly discharge of Chelan River below Lake Chelan, Washington, for 1903 and 1904.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
1903.				
November 6–30	1,782	1,300	1,525	90,740
December	2,310	1,010	1,250	76,860
1904.				
January	1,010	780	893	54,910
February	1,010	500	856	49,240
March	1,390	780	997	61,300
April	5,615	970	2,686	159,800
May	7,885	4,545	5,865	360,600
June	8,835	7,220	8,008	476,500
July	8,645	4,135	6,776	416,600
August	4,475	715	2,982	183,400
September	1,650	715	1,235	73,490
October	1,010	715	863	53,060
November	815	685	755	44,930
December	780	685	742	45,620
The year	8,835	500	2,722	1,979,000

WENACHE RIVER AT CASHMERE, WASH.

This station was established July 26, 1904, by W. G. Steward. It is located at the highway bridge just north of the town of Cashmere, Wash. A plain staff gage, graduated to feet and tenths, is nailed vertically to the downstream edge of the south face of the middle pier. It is read once each day by A. C. Jones. Discharge measurements are made from the downstream side of the two-span bridge to which the gage is attached. The initial point for soundings is a bolt head in the southeast corner of the bridge, marked zero. The point is identical with bench mark No. 2. The channel is curved for about 800 feet above and below the station, and the current is swift. The right bank is high, gravelly and rocky, lined with timber and bushes, and not liable to overflow. The left bank is not high, but overflows only in extremely high water. The bed of the stream is covered with small rounded bowlders and cobblestones. It is free from vegetation and permanent. The channel is divided by the pier into two channels. The bridge is located about midway of a long sweeping curve. The water is quite swift, especially at the middle of the south span, which makes sounding at this point difficult, except with heavy weight and small wire.

Bench mark No. 1 is the head of an 8-penny nail driven into a timber at the southeast corner of the middle pier. Its elevation is 12.98 feet above the zero of the gage. Bench mark No. 2 is a bolt head at the southeast corner of the bridge, identical with the initial point. Its elevation is 16.63 feet above the zero of the gage. Bench mark No. 3 is a railroad spike driven into a telephone pole at the left end of the bridge. Its elevation is 10.91 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of T. A. Noble, district engineer.

Discharge measurement of Wenache River at Cashmere, Wash., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
July 26	W. G. Steward	197	1,174	3.22	3.88	3,646

Mean daily gage height, in feet, of Wenache River at Cashmere, Wash., for 1904.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	3.40	2 20	1.70	1.20	2.30
2	.....	3.40	2.10	1.70	1.30	2.30
3	.....	3.40	2.00	1.60	1.30	2.20
4	.....	3.30	2.00	1.60	1.30	2.10
5	.....	3.30	2.00	1.50	1.30	2.00
6	.....	3.20	1.90	1.40	1.30	1.90
7	.....	3.20	1.90	1.40	1.30	1.90
8	.....	3.20	1.90	1.30	1.10	1.80
9	.....	3.20	2.00	1.30	1.20	1.80
10	.....	3.10	2.00	1.20	1.30	1.80
11	.....	2.90	1.90	1.80	1.30	1.80
12	.....	2.70	1.90	2.00	1.30	1.70
13	.....	2.60	1.90	1.80	1.30	1.70
14	.....	2.60	1.70	1.60	1.30	1.80
15	.....	2.60	1.70	1.50	1.30	2.10
16	.....	2.60	1.60	1.40	1.40	2.20
17	.....	2.50	1.60	1.40	2.00	2.20
18	.....	2.50	1.60	1.40	1.80	2.30
19	.....	2.40	1.60	1.30	1.80	2.20
20	.....	2.40	1.60	1.30	1.90	2.30
21	.....	2.30	1.50	1.30	2.20	2.30
22	.....	2.20	1.50	1.40	2.40	2.20
23	.....	2.10	1.60	1.30	2.60	2.20
24	.....	2.05	1.60	1.30	2.40	2.10
25	.....	2.00	1.50	1.20	2.20	1.90
26	.....	2.00	1.50	1.20	2.10	1.90
27	3.90	2.00	1.50	1.20	2.10	1.80
28	3.90	2.00	1.40	1.20	2.20	1.80
29	3.70	2.40	1.40	1.20	2.50	1.80
30	3.50	2.40	1.60	1.20	2.40	1.80
31	3.40	2.30	.....	1.20	.....	1.80

CRAB CREEK AT WILSON CREEK, WASH.

This station was established March 18, 1904, by Charles E. Hewitt. It is located at a wagon bridge one-fourth mile west of the Great Northern Railroad depot at Wilson Creek, Wash., and 300 feet south of the railroad. Discharge measurements are made from the upstream side of the bridge. The gage is a 6-inch board 13 feet long, graduated to feet and half tenths, and attached to the west end of the first pier from the north end of the bridge. The initial point for sounding is a nail in a 2 by 4 inch stake 94 feet south of the face of the south abutment of the bridge and 5 feet east of the road. The channel is straight for one-fourth mile above and 50 feet below the station. The right bank is low and overflows at extreme high water. The left bank is high and not liable to overflow. The bed of the stream is mud and gravel and is fairly permanent. The current is swift. The stream is divided into five channels at high water and two channels at ordinary stages. The bench mark is the top of a stone 5 feet east of the road and 1.3 feet south of the initial point. Its elevation is 18.22 feet above gage datum. This station was abandoned June 26, 1904. High water mark - Spring of 1904 = 9.5 feet

The observations at this station during 1904 have been made under the direction of T. A. Noble, district engineer.

Discharge measurements of Crab Creek at Wilson Creek, Washington, in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
March 18	C. E. Hewett	81	308	2.55	4.86	785
April 29	W. G. Steward	50	196	1.14	3.95	223
June 16	do		266	1.32	3.77	345

26.6 34.5

Mean daily gage height, in feet, of Crab Creek at Wilson Creek, Washington, for 1904.

Day.	March.	April.	May.	June.	Day.	March.	April.	May.	June.
1		4.70	4.20	3.00	17		4.25	3.80	3.75
2		5.05	4.20	4.35	18		4.25	3.75	3.70
3		4.80	4.60	4.30	19	5.00	4.25	3.75	3.80
4		4.85	4.60	4.25	20	4.97	4.20	3.70	3.70
5		4.89	4.60	3.00	21	4.95	4.21	3.70	3.70
6		5.00	4.60	3.00	22	4.90	4.20	3.70	3.65
7		4.95	4.60	3.95	23	4.86	4.21	3.00	3.65
8		4.85	4.60	3.90	24	4.86	5.20	3.55	3.60
9		4.70	4.60	3.85	25	4.85	5.15	3.55	3.55
10		4.55	4.50	3.80	26	4.83	5.15	3.55	
11		4.57	4.20	3.75	27	4.70	4.00	3.50	
12		4.45	4.15	3.80	28	4.65	5.10	3.50	
13		4.40	4.10	3.75	29	4.60	4.00	3.35	
14		4.35	4.05	3.75	30	4.80	4.00	3.35	
15		4.30	3.00	3.70	31	4.74		3.30	
16		4.24	3.85	3.75					

YAKIMA RIVER NEAR MARTIN, WASH.

Lake Keechelus is the uppermost of the three lakes forming the source of Yakima River. At the mouth a good dam site exists and by the construction of a dam a considerable portion of the flow of the Yakima, at this point, can be stored and used for irrigation in the lower Yakima Valley during the dry season.

A gaging station was established October 18, 1903, by G. H. Bliss, 1,000 feet below the outlet of Lake Keechelus and 800 feet below the dam of the Cascade Lumber Company. It is 4 miles northwest of Martin, Wash. The original gage was in two sections and was located on the right bank just above the cable. The lower inclined section read from 5 to 7 feet. The upper vertical section read from 7 to 13 feet. Observations were taken daily from this gage until November 14, 1903, on which date the gage was destroyed by the caving of the river bank. Observations were then discontinued until January 28, 1904, when a new vertical gage, No. 2, was installed by the Yakima Development Company, at a point 75 feet above the location of the old gage, and readings were resumed by the United States Geological Survey. This gage is in present use. It is a vertical rod, fastened to an overhanging tree, and is divided into feet and tenths. The gage is read daily by Christian Hansen, a trapper, living at the foot of the lake. Discharge measurements are made by means of a cable, car, tagged wire, and stay wire. The cable has a total span of 200 feet. The initial point for soundings is the north face of the tree on the south, or right, bank, to which the cable is fastened. The channel is straight for 500 feet above and for 350 feet below the station. Both banks are high, not liable to overflow, and are heavily timbered. The current is swift. There is but one channel at all stages. The bed of the stream is composed of gravel, free from vegetation, and permanent.

Bench mark No. 1 was destroyed with the original gage. Bench mark No. 2 is the top of a spike in the root on the north side of a large cedar tree 50 feet south and 50 feet west of the gage. Its elevation is 21.59 feet above the zero of gage No. 2. Bench mark No. 3 is a nail in the base of a 48-inch fir tree on the right bank, 25 feet above the cable, and 50 feet from the river. The tree is blazed and marked "B. M." The elevation of the bench mark is 25.22 feet above the datum of gage No. 2 which is 0.07 foot higher than that of gage No. 1.

The observations at this station during 1904 were made under the direction of T. A. Noble, district engineer.

Discharge measurements of Yakima River near Martin, Wash., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
May 13	G. F. Harley	117	288	1.90	8.15	543
June 15	do	119	365	2.27	8.88	827
July 21	do	116	208	1.17	7.25	244
August 4	do	106	175	.77	6.88	135
September 20	do	104	122	.48	6.34	58

Mean daily gage height, in feet, of Yakima River near Martin, Wash., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	7.10	6.90	6.90	8.65	8.90	8.40	6.90	6.50	6.40	6.50	8.00
2	.....	7.00	6.90	6.90	8.45	9.00	8.40	6.90	6.50	6.40	6.50	7.90
3	.....	7.00	6.80	6.80	8.35	9.10	8.30	6.90	6.50	6.40	6.50	7.70
4	.....	7.00	6.80	6.80	8.25	9.30	8.20	6.90	6.40	6.40	6.50	7.60
5	.....	7.00	6.90	6.90	8.15	9.40	8.20	6.80	6.40	6.40	6.50	7.50
6	.....	7.00	6.90	6.90	8.10	9.40	8.20	6.80	6.40	6.40	6.50	7.40
7	.....	7.00	6.90	6.90	8.10	9.40	8.10	6.80	6.40	6.30	6.50	7.30
8	.....	7.00	6.95	6.90	8.05	9.20	8.00	6.80	6.40	6.40	6.50	7.20
9	.....	6.95	7.00	6.90	8.00	8.80	7.90	6.80	6.40	6.40	6.50	7.20
10	.....	6.90	7.05	7.00	8.00	8.80	7.80	6.70	6.40	6.40	6.50	7.10
11	.....	6.90	7.10	7.15	7.90	8.70	7.75	6.70	6.40	6.40	6.50	7.10
12	.....	6.90	7.10	7.55	8.20	8.55	7.70	6.70	6.40	6.40	6.50	7.10
13	.....	6.90	7.10	8.10	8.20	8.60	7.60	6.65	6.40	6.40	6.50	7.10
14	.....	6.90	7.10	8.60	8.70	8.70	7.45	6.60	6.40	6.40	6.50	7.20
15	.....	6.90	7.10	9.00	8.60	8.80	7.40	6.60	6.40	6.40	6.50	7.40
16	.....	6.90	7.05	9.00	8.60	8.90	7.30	6.60	6.40	6.50	6.60	7.60
17	.....	6.90	7.00	8.80	8.55	8.80	7.30	6.60	6.40	6.50	6.75	8.00
18	.....	6.85	7.00	8.65	8.55	9.00	7.30	6.60	6.40	6.50	6.80	8.10
19	.....	6.80	7.00	8.60	8.70	9.10	7.30	6.60	6.30	6.50	6.95	8.20
20	.....	6.80	7.00	8.60	8.80	8.85	7.30	6.60	6.30	6.50	7.30	8.30
21	.....	6.90	7.00	8.65	8.95	8.75	7.20	6.50	6.30	6.50	7.85	8.15
22	.....	6.90	6.90	8.60	9.20	8.60	7.25	6.50	6.30	6.50	8.15	8.00
23	.....	7.00	6.90	8.50	9.40	8.45	7.20	6.50	6.30	6.50	8.20	7.90
24	.....	7.00	6.90	8.30	9.30	8.25	7.10	6.50	6.30	6.50	8.00	7.75
25	.....	6.90	6.90	8.15	9.10	8.20	7.10	6.50	6.30	6.50	7.90	7.60
26	.....	6.90	6.80	8.15	9.00	8.10	7.10	6.50	6.30	6.50	7.90	7.50
27	.....	6.25	6.80	8.35	9.00	8.20	7.00	6.50	6.30	6.50	7.85	7.40
28	7.20	6.90	6.80	8.70	9.00	8.20	7.00	6.50	6.30	6.50	8.10	7.30
29	7.20	6.90	6.90	9.00	9.10	8.30	7.00	6.50	6.40	6.50	8.10	7.20
30	7.10	.....	6.90	8.95	9.10	8.40	7.00	6.50	6.40	6.40	8.00	7.20
31	7.10	.....	6.90	.....	9.10	.....	6.90	6.50	.....	6.50	.....	7.20

Rating table for Yakima River, near Martin, Wash., from January 28 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
6.30	51	7.30	249	8.20	566	9.10	920
6.40	63	7.40	281	8.30	604	9.20	960
6.50	76	7.50	315	8.40	642	9.30	1,000
6.60	90	7.60	349	8.50	680	9.40	1,040
6.70	107	7.70	383	8.60	720	9.50	1,080
6.80	127	7.80	418	8.70	760	9.60	1,120
6.90	148	7.90	454	8.80	800	9.70	1,160
7.00	170	8.00	490	8.90	840	9.80	1,200
7.10	194	8.10	528	9.00	880	9.90	1,240
7.20	220						

The above table is applicable only for open-channel conditions. It is based upon 5 discharge measurements made during 1904. It is well defined between gage heights 6.36 feet and 8.88 feet. The table has been extended beyond these limits. Above gage height 8.50 feet the rating curve is a tangent, the difference being 40 per tenth.

Estimated monthly discharge of Yakima River near Martin, Wash., for 1904.

[Drainage area, 56 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Second-feet per square mile.	Depth in inches.
	Maximum.	Minimum.	Mean.			
February	194	127	156	8,973	2.79	3.01
March	194	127	159	9,777	2.84	3.27
April	880	127	499	29,690	8.91	9.94
May	1,040	454	733	45,070	13.1	15.1
June	1,040	528	785	46,710	14.0	15.6
July	642	148	339	20,840	6.05	6.98
August	148	76	103	6,333	1.84	2.12
September	76	51	58.6	3,487	1.05	1.17
October	76	51	69.4	4,243	1.24	1.43
November	566	76	230	13,680	4.11	4.59
December	604	194	339	20,840	6.05	6.98
The period				209,600		

YAKIMA RIVER AT EASTON, WASH.

This station was established May 12, 1904, by G. H. Bliss. It is located at Easton, Wash., three-eighths of a mile below the Cascade Lumber Company's dam, at the bridge on the road leading from

Easton to Kachess Lake. A vertical staff gage, graduated to feet and tenths, is nailed to a stump on the left bank, 20 feet below the bridge. It is read once each day by W. W. Johnson. Discharge measurements are made from the downstream side of the highway bridge. The initial point for soundings is a point marked by a circle and cross on the top of the downstream railing 12 feet north of the pier on the left bank. The channel is straight for about 400 feet above and 700 feet below the station, and the water is swift at medium and high stages. The right bank is high, sparsely wooded, and not liable to overflow. The left bank is low, sparsely wooded, and overflows only at extreme high water. The bed of the stream is composed of clean gravel, and is shifting. There is but one channel, which is broken at higher stages by the piling supports of the trestle approaches at either end. There is a shifting gravel bar on the right side of the channel. Diagonal currents interfere with the accuracy of measurements. The bench mark is the top of the case of the steel and concrete pier at the left end on the downstream side of the bridge. Its elevation is 19.39 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of T. A. Noble, district engineer.

Discharge measurements of Yakima River at Easton, Wash., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
May 12	G. F. Harley	148	384	3.70	6.95	1,417
June 14	do	173	428	4.36	7.35	1,868
July 12	do	140	219	3.27	5.74	717
July 21	do	136	169	2.98	5.06	502
August 4	do	125	119	2.79	4.45	332
August 24	do	122	80	2.33	3.86	186

Mean daily gage height, in feet, of Yakima River at Easton, Wash., for 1904.

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	7.75	6.40	4.70	4.40	4.20	3.90
2	.....	8.00	6.30	4.60	4.40	4.40	3.90
3	.....	7.90	6.40	4.50	4.40	4.30	3.90
4	.....	7.90	6.70	4.80	4.35	4.40	3.90
5	.....	8.05	6.70	4.50	4.40	4.30	3.80
6	.....	8.10	6.60	4.50	4.40	4.25	3.80
7	.....	7.90	6.50	4.50	4.40	4.25	3.80
8	.....	7.70	6.30	4.30	4.40	4.25	3.80
9	.....	7.60	5.90	4.50	4.40	4.25	3.80
10	.....	7.50	5.80	4.30	4.40	4.30	3.80
11	.....	7.60	5.80	4.50	4.40	4.30	3.80
12	6.95	7.25	5.70	4.50	4.45	4.20	3.90

Mean daily gage height, in feet, of Yakima River at Easton, Wash., for 1904—Continued.

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
13	7.00	7.10	5.60	4.50	4.30	4.20	3.90
14	7.40	7.50	5.40	4.50	4.30	4.20	3.90
15	7.50	7.30	5.50	4.50	4.40	4.20	3.80
16	7.40	7.30	5.30	4.40	4.35	4.20	3.80
17	7.10	7.25	5.40	4.40	4.30	4.20	3.90
18	6.70	7.70	5.30	4.00	4.40	4.20	3.95
19	6.70	7.35	5.20	4.00	4.30	4.10	4.10
20	6.70	7.60	5.20	4.00	3.80	4.10	4.85
21	7.20	7.50	5.20	4.00	3.90	4.00	5.30
22	7.70	7.10	5.00	4.20	4.40	4.20	5.80
23	8.00	6.90	5.00	4.30	4.40	4.00	5.90
24	7.90	6.70	4.90	3.85	4.40	3.90	5.90
25	7.50	6.50	4.90	4.20	4.40	3.95	5.80
26	7.70	6.30	4.90	4.30	4.40	4.00	5.80
27	7.70	6.40	4.90	4.40	4.40	4.00	5.80
28	7.80	6.20	4.80	4.40	4.40	3.90	6.20
29	7.70	6.20	4.90	4.50	4.40	3.90	(a)
30	7.80	6.20	4.70	4.40	4.40	3.90	.....
31	7.80	.....	4.70	4.40	.....	3.90	.....

a Gage washed out.

Rating table for Yakima River at Easton, Wash., from May 12 to November 28, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
3.90	195	5.00	484	6.00	814	7.00	1,490
4.00	220	5.10	512	6.10	862	7.10	1,590
4.10	246	5.20	540	6.20	910	7.20	1,695
4.20	272	5.30	572	6.30	966	7.30	1,805
4.30	298	5.40	604	6.40	1,022	7.40	1,920
4.40	324	5.50	636	6.50	1,086	7.50	2,040
4.50	350	5.60	668	6.60	1,154	7.60	2,160
4.60	376	5.70	700	6.70	1,230	7.70	2,290
4.70	402	5.80	736	6.80	1,310	7.80	2,420
4.80	428	5.90	774	6.90	1,395	7.90	2,550
4.90	456						

The above table is applicable only for open-channel conditions. It is based upon 6 discharge measurements made during 1904. It is well defined between gage heights 3.86 feet and 7.35 feet. The table has been extended beyond these limits. Above gage height 7.60 feet the rating curve is a tangent, the difference being 130 per tenth.

Estimated monthly discharge of Yakima River at Easton, Wash., for 1904.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
May 12–31	2,680	1,230	1,974	78,310
June	2,810	910	1,867	111,100
July	1,230	402	690	42,430
August	428	185	316	19,430
September	337	175	311	18,510
October	324	195	257	15,800
November 1–28	910	175	357	19,830
The period				305,400

YAKIMA RIVER NEAR NORTH YAKIMA, WASH.

This station was established May 5, 1904, by G. H. Bliss. It is located at the highway bridge, 2¼ miles north of North Yakima, Wash., one-fourth mile above the confluence of Yakima and Naches rivers, and 300 feet east of the bridge of the Northern Pacific Railway Company. A plain staff gage is fastened vertically to the south side of the pier at the right end of the 4-span highway bridge. The gage is read once each day by Patrick Gallagher. Discharge measurements are made from the downstream side of the bridge to which the gage is attached. The initial point for soundings is a point marked zero on the top of railing near the right end of the bridge, downstream side. The channel is straight for about 800 feet above and 600 feet below the station. The current is sluggish at low stages. Both banks are low, partly wooded, and subject to overflow during high water. The bed of the stream is composed of gravel and sand, free from vegetation and stable. There is one channel at all stages, broken by 3 bridge piers. The bench mark is the top of the shoe plate on the lower side of the bridge above the pier nearest the right bank. Its elevation is 16.64 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of T. A. Noble, district engineer.

Discharge measurements of Yakima River near North Yakima, Wash., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
May 5	G. F. Harley	217	1,600	4.21	6.83	6,740
July 13	do	201	1,090	2.39	4.40	2,610
July 25	J. C. Dry	188	850	1.60	3.30	1,360
July 30	G. F. Harley	187	830	1.35	3.10	1,123
August 17	J. C. Dry	156	727	0.77	2.40	556
September 1	do	156	725	0.61	2.32	444

Mean daily gage height, in feet, of Yakima River near North Yakima, Wash., for 1904.

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	7.20	5.20	3.10	2.30	2.40	2.40
2	.....	7.00	5.20	3.00	2.30	2.40	2.40
3	.....	7.00	.....	3.00	2.30	2.40	2.40
4	.....	7.10	5.30	3.00	.....	2.40	2.40
5	.....	.....	5.40	2.90	2.30	2.50	2.40
6	.....	7.50	5.30	2.90	2.30	2.50	.....
7	.....	7.60	5.20	.....	2.20	2.50	2.40
8	.....	7.10	5.10	2.80	2.20	2.50	2.40
9	6.00	6.70	5.00	2.70	2.20	2.50	2.40
10	5.90	6.30	.....	2.70	2.20	2.50	2.40
11	5.80	6.90	4.70	2.60	.....	2.50	2.40
12	5.80	.....	4.50	2.60	2.20	2.60	2.40
13	5.90	5.70	4.40	2.60	2.20	2.60	.....
14	6.30	5.70	4.30	2.60	2.20	2.60	2.40
15	.....	5.90	4.20	2.50	2.20	2.60	2.40
16	6.80	6.10	4.10	2.50	2.10	2.60	2.40
17	6.80	6.30	.....	2.50	2.10	2.60	2.40
18	6.80	6.50	3.80	2.40	.....	2.60	2.40
19	6.90	.....	3.70	2.40	2.10	2.60	2.40
20	6.90	6.40	3.60	2.40	2.10	2.60	.....
21	7.10	6.30	3.50	.....	2.10	2.50	2.90
22	.....	6.10	3.40	2.30	2.10	2.50	3.90
23	8.10	5.90	3.40	2.30	2.10	.....	3.60
24	8.40	5.60	.....	2.30	2.10	2.50	3.90
25	7.90	5.30	3.30	2.30	.....	2.50	3.70
26	7.50	.....	3.30	2.30	2.30	2.50	3.70
27	7.20	5.20	3.30	2.30	2.30	2.50	.....
28	7.10	5.10	3.20	.....	2.40	2.40	3.80
29	.....	5.00	3.20	2.30	2.40	2.40	3.90
30	7.30	5.10	3.10	2.30	2.40	.....	4.00
31	7.30	.....	.....	2.30	.....	2.40	.....

NOTE.—Observations were made during irrigating season only.

Rating table for Yakima River near North Yakima, Wash., from May 9 to November 30, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
2.00	210	3.30	1,342	4.60	2,916	5.90	5,004
2.10	285	3.40	1,445	4.70	3,059	6.00	5,190
2.20	362	3.50	1,550	4.80	3,204	6.20	5,562
2.30	441	3.60	1,658	4.90	3,351	6.40	5,934
2.40	522	3.70	1,769	5.00	3,500	6.60	6,306
2.50	605	3.80	1,883	5.10	3,651	6.80	6,678
2.60	690	3.90	2,000	5.20	3,805	7.00	7,050
2.70	777	4.00	2,120	5.30	3,962	7.20	7,422
2.80	866	4.10	2,243	5.40	4,124	7.40	7,794
2.90	957	4.20	2,370	5.50	4,290	7.60	8,166
3.00	1,050	4.30	2,501	5.60	4,461	7.80	8,538
3.10	1,145	4.40	2,636	5.70	4,637	8.00	8,910
3.20	1,242	4.50	2,775	5.80	4,818	8.50	9,840

The above table is applicable only for open-channel conditions. It is based upon 6 discharge measurements made during 1904. It is well defined between gage heights 2.50 feet and 4.50 feet. The table has been extended beyond these limits. Above gage height 5.80 feet the rating curve is a tangent, the difference being 186 per tenth.

Estimated monthly discharge of Yakima River near North Yakima, Wash., for 1904.[a]

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
May 9–31	9,654	4,818	6,896	314,600
June	8,166	3,500	5,705	339,500
July	4,124	1,145	2,431	149,500
August	1,145	441	663	40,770
September	522	285	376	22,370
October	690	522	608	37,380
November	2,120	522	955	56,830
The period				961,000

[a] Discharge for missing gage heights interpolated.

YAKIMA RIVER NEAR YAKIMA, WASH.

Yakima River enters Columbia River just above the town of Pasco. The first measurement of the river was made at this point on August 14, 1893. At that time there was an old vertical river rod attached to

the central pier of the bridge. As the foot of this gage at low water was covered by rock and could not be read, an inclined gage was put in position at the west end of the county bridge. This consisted of two pieces of timber, having a total length of 24 feet. These were firmly secured to timbers, bedded, and loaded with rock. The gage rod was painted white and lettered in vertical feet and tenths. After this new gage was located it was ascertained that the readings on the old gage would be 1.13 feet higher than on the new. The zero of this new gage was 19.02 feet below the top of the rail of the Northern Pacific Railroad immediately west of the west end of the bridge, which was about 40 feet from the gage. The high-water mark at that time showed that a flood had risen to 8.80 feet on the old gage. Readings at this point were begun on October 2, 1893, and continued during the following winter and spring until May 19, 1894. Owing to the destruction of the gage by floods the station was for a time abandoned.

During August, 1895, Arthur P. Davis visited the locality and found that the section was not favorable for making discharge measurements. He accordingly selected the present station, which is located at Union Gap, 2 miles below Yakima, Wash., and 1,000 feet below the highway bridge. It is about 3 miles above the intake of the Sunnyside canal. The station is of value, as it is the only point near the large irrigated area above and below which is unaffected by the taking out of water in irrigating canals. The gage rod is inclined and is attached to a willow stump and post set in the ground. It is read once each day by Hugh Kennedy, the section foreman. Discharge measurements are made by means of a cable, car, and tagged wire 150 feet above the gage and 1,000 feet below the highway bridge. The initial point for soundings is a cross chiseled on a rock 2.7 feet from the cable support on the right bank. The channel is straight for 1,000 feet above and below the station. The current has a moderate velocity. The right bank is high, not liable to overflow, and is covered with sagebrush. The left bank is a low gravel bar which overflows during extreme high water. The bed of the stream is composed of gravel, free from vegetation and permanent. There is one channel at low water and two channels at ordinary and flood stages. Bench mark No. 1 is the top of a large bowlder between two other bowlders 43 feet north of the gage and 6.5 feet east of the fence. Its elevation is 17.52 feet above the zero of the gage. Bench mark No. 2 is the top of a large bowlder under the railroad fence 12 feet north of the gage. Its elevation is 21.29 feet above the zero of the gage. The elevation of the initial point for soundings is 17.45 feet above the zero of the gage. The bench marks are marked "B. M." with black paint.

The observations at this station during 1904 have been made under the direction of T. A. Noble, district engineer.

Discharge measurements of Yakima River near Yakima, Wash., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec. feet.*
May 9	G. F. Harley	343	2,140	4.29	7.85	9,180
May 16	do	353	2,530	5.33	8.85	13,490
May 19	Murphy and Bliss	349	2,570	5.48	8.87	14,080
May 24	G. F. Harley	468	3,310	6.40	10.40	21,180
May 25	do	457	3,050	6.07	10.00	18,560
June 29	do	337	1,850	4.17	7.40	7,750
July 18	do	241	1,340	2.51	5.78	3,370
July 23	do	239	1,273	2.26	5.48	2,873
August 1	do	237	1,131	1.78	4.87	2,015
August 25	do	234	865	1.05	3.79	910

Mean daily gage height, in feet, of Yakima River near Yakima, Wash., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	5.50	5.50	4.90	5.70	10.20	9.40	7.60	4.90	3.80	3.90	3.80	6.00
2	5.50	5.50	4.90	5.90	9.70	9.20	7.60	4.90	3.80	3.90	3.80	5.90
3	5.30	5.40	4.90	6.50	9.40	9.50	7.40	4.80	3.80	3.90	3.80	5.90
4	5.30	5.40	4.90	7.20	9.30	9.00	7.40	4.80	3.80	3.90	3.80	5.60
5	5.30	5.40	4.80	7.10	9.00	9.10	7.60	4.70	3.80	3.90	3.80	5.40
6	5.00	5.30	5.20	7.80	8.90	9.40	7.60	4.70	3.75	3.90	3.80	5.40
7	5.10	5.30	5.60	7.50	8.60	9.40	7.60	4.60	3.70	3.90	3.80	5.30
8	5.20	5.30	7.30	7.30	8.00	9.00	7.40	4.50	3.70	3.90	3.90	5.20
9	5.20	5.30	6.10	7.50	7.80	8.60	7.30	4.50	3.70	3.90	3.90	5.20
10	5.20	5.10	6.10	8.70	7.80	8.40	7.00	4.30	3.70	3.90	3.90	5.00
11	5.30	5.10	6.80	9.30	7.90	8.00	6.90	4.30	3.70	4.00	3.90	5.00
12	5.40	5.00	6.40	10.10	8.00	7.90	6.90	4.20	3.70	4.00	3.90	5.00
13	5.40	4.90	6.30	10.80	8.00	7.60	6.70	4.20	3.70	4.00	3.90	4.90
14	5.90	5.00	6.10	11.50	8.40	7.70	6.30	4.10	3.70	4.10	3.90	4.90
15	6.00	5.10	6.00	12.20	8.60	8.00	6.10	4.10	3.70	4.10	3.90	5.00
16	6.70	5.10	6.00	12.10	8.60	8.30	6.00	4.10	3.70	4.00	3.85	5.40
17	6.70	5.00	5.90	11.50	8.80	8.50	6.00	4.00	3.65	4.00	3.85	5.50
18	6.50	5.00	5.70	10.70	8.80	8.70	5.90	4.00	3.65	4 00	4.00	5.50
19	6.50	5.00	5.70	10.50	8.90	8.60	5.90	4.00	3.65	4.00	4.00	5.50
20	6.30	5.00	5.80	10.50	9.00	8.40	5.80	3.9	3.65	4.00	4.10	5.60
21	6.30	5.00	5.80	11.30	9.20	8.30	5.70	3.90	3.65	4.00	5.80	5.70
22	6.10	5.00	5.90	10.50	10.00	8.20	5.60	3.90	3.65	4.00	6.30	5.80
23	6.10	5.40	5.70	10.50	10.60	8.20	5.60	3.80	3.70	3.90	6.30	5.80
24	6.00	5.20	5.70	9.70	10.50	8.00	5.50	3.80	3.80	3.90	6.30	5.80
25	6.00	5.20	5.60	9.40	10.50	7.80	5.50	3.80	3.80	3.90	6.20	5.60
26	5.90	5.20	5.60	9.70	9.05	7.60	5.30	3.80	3.80	3.90	6.00	5.50
27	5.90	5.30	5.60	10.20	9.10	7.20	5.20	3.80	3.80	3.90	6.20	5.30
28	5.80	5.10	6.40	10.50	9.00	7.20	5.20	3.85	3.85	3.90	6.20	5.20
29	5.60	5.00	5.40	11.00	9.40	7.30	5.00	3.85	3.85	3.90	6.30	5.20
30	5.60	.....	5.60	10.90	9.40	7.60	5.00	3.80	3.80	3.80	6.30	5.10
31	5.50	.....	5.70	.....	9.50	.....	5.00	3.80	.....	3.80	.....	5.10

Rating table for Yakima River near Yakima, Wash., from January 1 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
3.70	840	5.10	2,315	6.40	4,775	8.40	11,600
3.80	920	5.20	2,455	6.50	5,035	8.60	12,480
3.90	1,000	5.30	2,600	6.60	5,295	8.80	13,360
4.00	1,090	5.40	2,750	6.70	5,565	9.00	14,240
4.10	1,180	5.50	2,910	6.80	5,835	9.20	15,120
4.20	1,280	5.60	3,070	6.90	6,115	9.40	16,000
4.30	1,380	5.70	3,240	7.00	6,405	9.60	16,880
4.40	1,480	5.80	3,420	7.20	7,025	9.80	17,760
4.50	1,580	5.90	3,615	7.40	7,720	10.00	18,640
4.60	1,690	6.00	3,830	7.60	8,440	10.50	20,840
4.70	1,800	6.10	4,055	7.80	9,170	11.00	23,040
4.80	1,920	6.20	4,285	8.00	9,930	11.50	25,240
4.90	2,045	6.30	4,525	8.20	10,740	12.00	27,440
5.00	2,180						

The above table is applicable only for open-channel conditions. It is based upon 10 discharge measurements made during 1904. It is fairly well defined between gage heights 3.80 and 10.00. The table has been extended beyond these limits. Above gage height 8.30 feet the rating curve is a tangent, the difference being 440 per tenth.

Estimated monthly discharge of Yakima River near Yakima, Wash., for 1904.

[Drainage area, 3,300 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
January	5,570	2,180	3,482	214,800	1.06	1.22
February	2,910	2,050	2,430	139,800	.736	.794
March	7,360	1,920	3,487	214,400	1.06	1.22
April	29,320	3,240	16,730	995,300	5.07	5.66
May	21,280	9,170	14,400	885,500	4.36	5.03
June	16,440	7,030	11,460	681,100	3.47	3.87
July	8,440	2,180	4,939	303,700	1.50	1.73
August	2,050	920	1,287	79,130	.390	.450
September	960	800	868	51,650	.263	.293
October	1,180	920	1,036	63,700	.314	.362
November	4,525	920	2,082	123,900	.631	.704
December	3,830	2,045	2,778	170,800	.842	.971
The year	29,320	800	5,415	3,924,000	1.64	22.30

YAKIMA RIVER AT PROSSER, WASH.

This station was established May 30, 1904, by G. H. Bliss. It is located at the highway bridge 600 feet below Prosser Falls at Prosser, Wash. A standard chain gage is attached to the upstream side of the bridge near the right bank. The length of the chain from the end of the weight to the marker is 28.06 feet. This length is marked on the upstream guard rail by means of two nails. The gage is read twice each day by J. N. Jacoby and Bernard Winter. Discharge measurements are made from the downstream side of the bridge to which the gage is attached. The bridge has a single span with trestle approach at either end. The initial point for soundings is a nail driven into the downstream guard rail 30 feet from the right bank. The channel is straight for about 100 feet above and 600 feet below the station. The current above the station is swift, the foot of the rapids being 150 feet above. The current below the station is sluggish at ordinary and swift at higher stages. Both banks are high and not subject to overflow. The bed of the stream is composed of rock, free from vegetation, and permanent. There are large bowlders in the channel. There is but one channel at all stages, broken by the trestle bents on either side during the higher stages. Bench mark No. 1 is a spike in a sill on the east end of the pump house of the Prosser Irrigation Company's canal. Its elevation is 13.870 feet above the datum of the gage. Bench mark No. 2 is a spike on upright bridge timber 20 feet south of the steel and concrete pier on the south bank. Its elevation is 11.422 feet above the datum of the gage. Bench mark No. 3 is the top of the steel cylinder of the concrete pier at the right bank, upstream side. Its elevation is 23.923 feet above the datum of the gage.

The observations at this station during 1904 have been made under the direction of T. A. Noble, district engineer.

Discharge measurements of Yakima River at Prosser, Wash., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
May 30	G. F. Harley	228	2,500	5.90	10.08	[a] 14,800
July 26	do	151	1,340	1.51	4.00	2,030
August 11	do	136	1,020	.70	2.30	705
September 17	G. H. Bliss				.90	[b] 258

[a] Surface measurement.

[b] Flume, 175; river, 90; pump 7.

Mean daily gage height, in feet, of Yakima River at Prosser, Wash., for 1904.

Day.	June.	July.	Aug.	Sept.	Oct.	Day.	June.	July.	Aug.	Sept.	Oct.
1	10.04	7.50	3.46	1.08	1.58	17	8.75	5.58	1.87	.83	.....
2	.....	7.87	3.42	1.12	1.50	18	9.00	5.37	1.75	.83	.....
3	.....	8.08	3.33	1.17	1.75	19	9.37	4.75	1.67	.92	.....
4	9.62	8.29	3.25	1.04	1.75	20	9.33	4.71	1.50	.96	.....
5	9.75	8.37	3.12	1.12	1.75	21	9.04	4.54	1.42	.96	.....
6	10.00	8.31	2.92	1.17	1.75	22	8.71	4.50	1.33	.96	.....
7	10.21	8.08	2.75	1.12	1.75	23	8.54	4.37	1.29	1.00	.....
8	10.10	8.00	2.67	1.00	1.83	24	8.12	4.21	1.29	1.04	.....
9	9.50	7.50	2.54	.87	1.83	25	7.67	4.08	1.25	1.17	.....
10	9.04	7.25	2.42	.79	1.83	26	7.33	4.04	1.29	1.23	.....
11	8.79	7.08	2.33	.75	.....	27	7.17	3.87	1.21	1.42	.....
12	8.50	6.92	2.25	.83	.....	28	7.21	3.79	1.21	1.42	.....
13	8.23	6.67	2.12	.83	.....	29	7.37	3.75	1.17	1.42	.....
14	8.04	6.33	2.08	.83	.....	30	7.50	3.67	1.17	1.50	.....
15	8.19	6.08	2.00	.83	.....	31	.....	3.62	1.08	.....	.....
16	8.50	5.83	1.96	.92	.....						

Rating table for Yakima River at Prosser, Wash., from May 29 to October 10, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
0.80	252	2.40	766	3.90	1,920	5.80	4,800
.90	260	2.50	820	4.00	2,030	6.00	5,200
1.00	270	2.60	877	4.10	2,140	6.20	5,600
1.10	283	2.70	936	4.20	2,250	6.40	6,020
1.20	300	2.80	998	4.30	2,360	6.60	6,460
1.30	321	2.90	1,063	4.40	2,470	6.80	6,940
1.40	346	3.00	1,132	4.50	2,595	7.00	7,420
1.50	375	3.10	1,204	4.60	2,725	7.50	8,620
1.60	408	3.20	1,279	4.70	2,860	8.00	9,820
1.70	445	3.30	1,358	4.80	3,000	8.50	11,020
1.80	485	3.40	1,439	4.90	3,150	9.00	12,220
1.90	527	3.50	1,523	5.00	3,310	9.50	13,420
2.00	570	3.60	1,610	5.20	3,660	10.00	14,620
2.10	616	3.70	1,705	5.40	4,020	10.50	15,820
2.20	664	3.80	1,810	5.60	4,400	11.00	17,020
2.30	714						

The above table is applicable only for open-channel conditions. It is well defined to gage height 10.08 feet. The table has been extended above this limit. Above gage height 6.60 feet the rating curve is a tangent, the difference being 240 per tenth.

Estimated monthly discharge of Yakima River at Prosser, Wash., for 1904.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
April[a]			16,670	957,000
May[a]			13,810	849,400
June[b]	15,100	7,780	11,500	695,000
July	10,660	1,610	5,512	338,900
August	1,480	280	658	40,460
September	375	250	282	16,780
October 1–10			457	9,243
The period				2,907,000

[a] Estimated from discharge at Union Gap. [b] Discharge estimated for June 2 and 3.

NOTE.—The discharges given above are those which occur below the wasteway of flume of Prosser Falls power house. Flume waste = 200 second-feet

YAKIMA RIVER AT KIONA, WASH.

This station was established August 20, 1895. It is located at the highway bridge on the county road about 1,800 feet northwest of the Northern Pacific Railroad station at Kiona, Wash. It is about 23 miles above the mouth of the river. The original gage consisted of an inclined and a vertical section, spiked to the east end of the south pier of the bridge and anchored with rocks. The present gage is of the wire type, and is located on the downstream side of the bridge between the fifth and seventh verticals from the right bank. The length of the wire from the end of the weight to the marker is 27.21 feet. The distance from the end of the scale board to the outside edge of the pulley is 2.00 feet. The gage is read once each day by W. A. Kelso. Discharge measurements are made from the upstream side of the bridge to which the gage is attached. There is a stay wire 70 feet above the bridge. The initial point for soundings is a point on the west side of the bridge 100 feet south of the center of the south pier of the main span. The channel is straight for 500 feet above and for 400 feet below the station. The current has a moderate velocity. The right bank is low, but is well protected by a levee and is not subject to overflow. The left bank is somewhat higher and is not subject to overflow. The bed of the stream is composed of fine gravel, not subject to change. At low water the river flows beneath the middle main span; at high water it passes under an additional shorter span at each end of the bridge. Bench mark No. 1 is the top of a spike in the east end of the cap of the first trestlebent on the right bank. Its elevation above gage datum is 20.94 feet. Bench mark No. 2 is a spike on the north side of the stay-wire post on the right bank. Its elevation above gage datum is 18.73 feet. Bench mark No. 3 is a nail in

the upstream end of the first trestle bent on the left bank. Its elevation is 18.73 feet above gage datum. The top of the 2-inch pulley is 25.62 feet above gage datum. The United States Geological Survey standard iron bench-mark post, near the Northern Pacific Railroad station, has an elevation above sea level of 515 feet. The elevation of gage datum above sea level is 453 feet. All bench marks are marked "B. M." with black paint.

The observations at this station during 1904 have been made under the direction of T. A. Noble, district engineer.

Discharge measurements of Yakima River at Kiona, Wash., in 1904.

Date.	Hydrographer	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
June 6	G. F. Harley	326	2,600	5.34	10.59	13,880
September 8	do	205	528	.41	2.70	217

Mean daily gage height, in feet, of Yakima River at Kiona, Wash., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	5.45	5.55	5.20	6.05	13.05	10.65	8.20	4.40	2.70	3.10	3.60	6.65
2	5.40	5.50	5.15	6.25	12.10	10.20	8.35	4.30	2.70	3.20	3.60	6.40
3	5.40	5.50	5.15	6.90	11.45	10.30	8.45	4.20	2.75	3.20	3.65	6.65
4	5.35	5.50	5.10	7.10	10.80	10.25	8.70	4.10	2.75	3.25	3.85	6.50
5	5.35	5.45	5.00	7.95	10.60	10.40	8.90	4.00	2.75	3.25	4.00	5.90
6	5.30	5.40	5.05	8.10	10.25	10.65	8.80	3.90	2.75	3.30	4.00	5.80
7	5.25	5.40	5.70	9.05	9.85	10.90	8.55	3.85	2.75	3.30	4.05	5.70
8	5.20	5.35	7.40	8.65	9.50	10.65	8.40	3.80	2.65	3.30	4.05	5.60
9	5.20	5.30	7.55	8.50	9.30	10.00	8.15	3.80	2.70	3.30	4.15	5.45
10	5.35	5.25	7.50	8.80	9.20	9.60	7.75	3.80	2.70	3.30	4.10	5.40
11	5.35	5.25	7.50	9.20	9.15	9.30	7.45	3.60	2.70	3.35	4.15	5.30
12	5.35	5.25	7.50	10.90	9.10	9.05	7.20	3.60	2.70	3.35	4.10	5.35
13	5.30	5.25	7.10	11.80	9.20	8.75	7.05	3.50	2.65	3.90	4.15	5.25
14	5.90	5.15	6.85	12.55	9.30	8.70	6.70	3.45	2.65	3.95	4.10	5.20
15	6.55	5.20	6.80	13.50	9.50	8.75	6.50	3.40	2.65	3.95	4.20	5.15
16	6.90	5.20	6.65	14.60	9.85	9.15	6.20	3.35	2.70	3.90	4.20	5.40
17	7.00	5.15	6.45	15.00	10.25	9.40	5.95	3.30	2.70	3.80	4.15	5.80
18	7.05	5.10	6.45	14.40	10.25	9.55	5.75	3.30	2.70	3.80	4.20	5.90
19	6.80	5.00	6.35	13.65	10.30	9.90	5.60	3.20	2.75	3.75	4.20	7.00
20	6.60	5.10	6.35	13.45	10.35	9.75	5.45	3.00	2.75	3.75	4.20	7.00
21	6.20	5.05	6.35	13.55	10.40	9.50	5.25	3.00	2.75	3.75	4.30	6.15
22	6.20	5.05	6.30	13.55	10.70	9.25	5.20	3.00	2.70	3.75	6.20	6.20
23	6.20	5.05	6.20	13.25	11.45	9.05	5.15	2.95	2.70	3.80	6.80	6.30
24	6.20	5.20	6.10	12.75	11.90	8.60	5.05	2.90	2.75	3.80	6.70	6.20
25	5.90	5.35	6.00	11.85	12.35	8.15	5.00	2.90	2.75	3.75	6.60	6.00
26	5.95	5.25	5.90	11.60	11.75	7.80	4.90	2.90	2.75	3.75	6.30	5.80
27	5.85	5.25	5.85	11.35	11.00	7.75	4.80	2.80	2.80	3.70	6.50	5.65
28	5.80	5.25	5.75	11.80	10.75	7.70	4.75	2.75	3.00	3.65	6.30	5.60
29	5.70	5.25	5.70	12.50	10.70	7.90	4.65	2.65	3.00	3.60	6.45	5.50
30	5.60	.....	5.80	13.05	10.80	8.00	4.55	2.65	3.10	3.65	6.15	5.50
31	5.65	.....	5.80	.....	10.75	.....	4.50	2.70	.....	3.70	.....	5.80

Rating table for Yakima River at Kiona, Wash., from January 1, 1903, to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
2.60	195	4.30	1,160	6.90	3,320	8.40	8,350
2.70	215	4.40	1,250	6.10	3,480	8.60	8,830
2.80	245	4.50	1,350	6.20	3,650	8.80	9,320
2.90	280	4.60	1,450	6.30	3,820	9.00	9,820
3.00	315	4.70	1,560	6.40	3,990	9.20	10,320
3.10	355	4.80	1,670	6.50	4,170	9.40	10,840
3.20	395	4.90	1,780	6.60	4,350	9.60	11,360
3.30	440	5.00	1,900	6.70	4,540	9.80	11,880
3.40	490	5.10	2,020	6.80	4,740	10.00	12,400
3.50	555	5.20	2,150	6.90	4,950	10.50	13,720
3.60	620	5.30	2,280	7.00	5,160	11.00	15,100
3.70	690	5.40	2,420	7.20	5,600	11.50	16,580
3.80	760	5.50	2,560	7.40	6,040	12.00	18,080
3.90	835	5.60	2,700	7.60	6,480	13.00	21,080
4.00	910	5.70	2,850	7.80	6,940	14.00	24,080
4.10	990	5.80	3,000	8.00	7,400	15.00	27,080
4.20	1,070	5.90	3,160	8.20	7,870		

The above table is applicable only for open-channel conditions. It is based upon discharge measurements made during 1903 and 1904. It is well defined to gage height, 9.00 feet. The table has been extended beyond this limit.

Estimated monthly discharge of Yakima River at Kiona, Wash., for 1904.

[Drainage area, 5,230 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
January	5,270	2,150	3,144	193,300	0.601	0.693
February	2,630	1,900	2,234	128,500	.427	.461
March	6,370	1,900	3,800	233,700	.727	.838
April	27,080	3,400	15,800	940,200	3.02	3.37
May	21,230	10,070	13,860	852,200	2.65	3.06
June	14,820	6,710	10,690	636,100	2.04	2.28
July	9,570	1,350	4,654	286,200	.890	1.03
August	1,250	205	551	33,880	.105	.121
September	355	205	232	13,800	.044	.049
October	872	355	620	38,120	.119	.137
November	4,740	620	1,892	112,600	.362	.404
December	5,160	2,085	3,166	194,700	.605	.698
The year	27,080	205	5,054	3,663,000	.966	13.14

KACHESS RIVER NEAR EASTON, WASH.

This station was established October 14, 1903, by G. H. Bliss. It is located 2 miles northwest of Easton, Wash., and one-half mile below the foot of Lake Kachess, at which a dam is being constructed by the Cascade Canal Company. The gage is an inclined rod on the left bank, directly under the cable. The gage is read once each day by W. W. Johnson. Discharge measurements are made by means of a cable car, tagged wire, and stay wire. The cable is of one-half inch plow steel and has a span of 120 feet. The initial point for soundings is the south side of the aspen tree to which the cable is fastened, on the left bank. The channel is straight for 600 feet above and for 150 feet below the station. The current is swift. Both banks are high, wooded, and not liable to overflow. The bed of the stream is composed of gravel and rocks, free from vegetation. The bench mark is the top of a large wire nail driven into the south side of the large aspen tree to which the cable is fastened, on the left or north bank. The tree is blazed and is marked "B. M." with black paint. The nail is near the base of the tree and has an elevation of 11.27 feet above the zero of the gage.

During periods noted in the table of gage heights the wasteway of the dam was closed and the entire flow of the river impounded. The tabulated mean monthly discharge for the months affected is the average for the entire month, including the period during which the wasteway was closed. No water is diverted above the gaging station.

Observations at this station during 1904 have been made under the direction of T. A. Noble, district engineer.

Discharge measurements of Kachess River near Easton, Wash., in 1903 and 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
1903.		*Feet.*	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
October 14	G. H. Bliss	72	206	3.11	5.30	642
1904.						
May 12	G. F. Harley	74	193	2.73	5.06	527
May 18[a]	G. H. Bliss		5	2.0	2.65	10
June 14	G. F. Harley	73	235	3.42	5.64	805
July 12	do		140	2.32	4.27	326
July 20	do		119	2.00	3.97	239
August 3	do	68	95	1.56	3.61	148
August 24	do	63	71	.90	3.26	64

[a] Floats, below station.

Mean daily gage height, in feet, of Kachess River near Easton, Wash., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.90	4.00	(a)	3.70	5.90	6.00	4.00	3.60	3.50	4.25	3.30	4.10
2	3.90	4.00	(a)	3.70	5.70	5.80	4.10	3.50	3.50	3.80	3.30	4.35
3	3.90	3.90	(a)	3.70	5.60	5.95	4.50	3.40	3.50	3.70	3.30	4.35
4	3.90	3.90	(a)	3.70	5.60	6.00	5.50	3.60	3.50	3.80	3.30	4.35
5	3.90	3.90	(a)	3.70	5.50	6.25	5.20	3.40	3.55	3.75	3.20	4.25
6	3.80	3.90	4.20	3.70	5.40	6.30	5.10	3.40	3.50	3.70	3.20	.....
7	3.80	3.90	4.60	3.70	5.40	6.20	5.00	3.40	3.50	3.65	3.20	.....
8	3.80	3.80	4.50	3.70	5.40	6.05	4.50	3.50	3.50	3.65	3.20	.....
9	3.80	3.80	4.50	3.70	5.30	6.00	4.40	3.60	3.50	3.60	3.20	.....
10	4.00	3.80	4.50	3.80	5.20	5.90	4.40	3.55	3.50	3.70	3.20	.....
11	4.00	3.80	4.50	3.80	5.20	5.80	4.40	3.50	3.50	3.60	3.20	.....
12	4.10	3.80	4.40	4.00	5.10	5.60	4.30	3.50	3.45	3.60	3.20	.....
13	4.20	3.80	4.40	4.00	5.15	5.60	4.20	3.50	3.25	3.60	3.20	.....
14	4.30	3.80	4.30	(a)	5.25	5.70	4.10	3.50	3.40	3.60	3.20	.....
15	4.40	3.80	4.20	(a)	5.30	5.60	4.10	3.50	3.50	3.60	3.20	.....
16	4.50	3.80	4.10	(a)	5.30	5.60	4.10	3.40	3.70	3.60	3.20	4.40
17	4.50	3.80	4.10	5.70	4.50	5.60	4.10	3.40	3.70	3.60	3.30	4.50
18	4.50	3.80	4.10	6.20	(a)	5.70	4.00	3.30	3.40	3.60	3.35	4.55
19	4.50	3.80	4.00	6.10	(a)	5.70	4.00	3.30	3.70	3.50	3.40	4.60
20	4.50	3.50	4.00	6.00	(a)	5.60	4.00	3.30	3.00	3.60	3.75	4.65
21	4.50	3.50	4.00	6.00	(a)	5.60	4.00	3.30	3.85	3.50	3.90	4.65
22	4.40	3.50	3.90	5.90	4.30	5.50	3.90	3.25	3.90	3.50	4.00	4.65
23	4.30	3.60	3.90	5.90	4.80	5.40	3.90	3.50	3.85	3.30	4.10	4.65
24	4.30	(a)	3.80	5.80	5.10	5.30	3.80	3.55	3.80	3.40	4.10	4.60
25	4.20	(a)	3.80	5.60	5.10	5.20	3.80	3.55	3.80	3.40	4.10	4.55
26	4.20	(a)	3.80	5.50	5.20	5.15	3.80	3.55	3.80	3.40	4.10	4.50
27	4.10	(a)	3.70	5.60	5.30	4.90	3.80	3.55	3.90	3.40	4.10	4.40
28	4.10	(a)	3.70	5.70	5.40	4.40	3.75	3.55	3.90	3.30	4.25	4.40
29	4.00	(a)	3.70	5.90	5.50	4.15	3.80	3.55	3.80	3.29	4.35	4.40
30	4.00	.....	3.70	5.90	5.90	3.90	3.60	3.55	3.80	3.30	4.35	4.35
31	4.00	.....	3.70	.....	6.00	.....	3.60	3.55	.....	3.30	.....	4.30

[a] Water shut off at dam.

Rating table for Kachess River near Easton, Wash., from November 20, 1903, to December 31 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
2.60	9	3.60	145	4.60	420	5.60	785
2.70	12	3.70	170	4.70	450	5.70	825
2.80	17	3.80	195	4.80	485	5.80	865
2.90	24	3.90	220	4.90	520	5.90	910
3.00	33	4.00	245	5.00	555	6.00	955
3.10	44	4.10	270	5.10	590	6.10	1,000
3.20	57	4.20	300	5.20	625	6.20	1,050
3.30	73	4.30	330	5.30	665	6.30	1,100
3.40	95	4.40	360	5.40	705	6.40	1,150
3.50	120	4.50	390	5.50	745	6.50	1,200

The preceding table is applicable only for open-channel conditions. It is based upon 8 discharge measurements made during 1903 and 1904. It is well defined between gage heights 2.60 feet and 5.60 feet. The table has been extended beyond these limits. Above gage height 6.10 feet the rating curve is a tangent, the difference being 50 per tenth.

Estimated monthly discharge of Kachess River near Easton, Wash., for 1903 and 1904.

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
1903.						
November 20–30	530	170	353	7,702	5.60	2.29
December	745	245	426	26,190	6.76	7.79
1904.						
January	390	195	286	17,580	4.54	5.23
February	245	[b]0	153	8,801	2.43	2.62
March	420	[b]0	227	13,960	3.60	4.15
April	1,050	[b]0	495	29,460	7.86	8.77
May	955	[b]0	588	36,160	9.33	10.76
June	1,100	220	778	46,290	12.30	13.72
July	745	145	305	18,750	4.84	5.58
August	145	65	113	6,948	1.79	2.06
September	220	33	147	8,747	2.33	2.60
October	315	73	138	8,485	2.19	2.52
November	345	57	141	8,390	2.24	2.50
December[a]	.....	.....	376	23,120	5.97	6.88
The year	.....	.....	312	226,700	4.95	67.39

[a] Discharge December 6 to 15 interpolated. [b] Water shut off at dam.

CLEALUM RIVER NEAR ROSLYN, WASH.

This station was established October 10, 1903, by G. H. Bliss. It is located 1,000 feet below the outlet of Lake Clealum. It is 2½ miles northwest of Roslyn and 6½ miles northwest of Clealum, Wash. The gage is an inclined rod on the left bank, 20 feet upstream from the cable. It is read once each day by Charles M. Davis. Discharge measurements are made by means of a cable, car, tagged wire, and stay wire. The initial point for soundings is the south face of the black pine tree, 18 inches in diameter, to which the cable is fastened, on the left bank. The channel is straight for 300 feet above and for 900 feet below the station. The current is swift. Both banks are high, not liable to overflow, and are heavily timbered. The bed of the stream is composed of gravel, free from vegetation, and permanent. The bench mark is a large spike driven into the root of the

tree to which the cable is fastened, on the left bank. The root is on the east or downstream side of the tree, and the tree is blazed. The elevation of the bench mark is 17.40 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of T. A. Noble, district engineer.

Discharge measurements of Clealum River near Roslyn, Wash., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
1904.		*Feet.*	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
May 11	G. F. Harley	130	906	1.46	4.05	1,319
May 18	Bliss and Murphy	141	1,146	2.46	5.60	2,820
May 23	G. F. Harley	154	1,383	3.22	7.15	4,459
June 13	do	135	1,036	1.98	4.85	2,048
June 22	do	140	1,124	2.29	5.50	2,580
July 20	do	127	809	1.11	3.22	897
August 4	do	123	763	0.91	2.81	693
August 18	do	120	696	0.69	2.27	480
August 31	do	118	649	0.58	1.86	378
September 22	do	117	608	0.36	1.49	220
September 26[a]	do	148	187	1.17	1.38	219

[a] Wading 800 feet above station.

Mean daily gage height, in feet, of Clealum River near Roslyn, Wash., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept	Oct.	Nov.	Dec.
1	2.10	2.50	1.70	1.65	5.45	6.00	5.70	2.85	1.80	1.55	1.30	2.80
2	2.05	2.35	1.70	1.70	5.30	5.90	5.80	2.85	1.75	1.60	1.35	2.75
3	2.00	2.10	1.68	1.70	5.10	5.95	5.70	2.80	1.70	1.55	1.35	2.65
4	2.01	2.08	1.65	1.90	4.90	6.50	5.60	2.80	1.70	1.50	1.35	2.60
5	2.00	2.03	1.65	2.00	4.70	6.70	5.45	2.80	1.70	1.50	1.45	2.50
6	2.00	2.00	1.70	2.10	4.55	6.90	5.45	2.75	1.70	1.50	1.45	2.40
7	1.95	2.00	1.70	2.20	4.35	6.50	5.40	2.75	1.70	1.45	1.45	2.20
8	1.97	1.50	1.73	2.20	4.30	6.10	5.20	2.75	1.70	1.40	1.45	2.10
9	2.00	1.90	1.75	2.35	4.10	5.60	5.00	2.70	1.70	1.40	1.50	2.00
10	2.20	1.85	1.75	3.35	3.90	5.40	4.85	2.70	1.70	1.35	1.55	2.00
11	2.20	1.90	2.00	3.60	4.00	5.20	4.70	2.65	1.65	1.45	1.55	1.95
12	2.35	1.95	2.20	4.80	4.20	4.90	4.55	2.50	1.60	1.50	1.55	1.90
13	2.50	2.00	2.30	5.70	4.50	4.95	4.35	2.45	1.55	1.55	1.55	1.90
14	2.90	1.90	2.20	6.10	4.65	5.00	4.10	2.40	1.50	1.60	1.45	2.00
15	3.20	1.90	2.10	6.60	5.25	5.40	3.85	2.35	1.45	1.65	1.45	2.30
16	3.27	1.90	2.05	6.70	5.40	5.75	3.60	2.30	1.40	1.65	1.50	2.50
17	3.20	1.85	2.10	6.35	5.45	5.80	3.45	2.30	1.40	1.65	1.60	2.60
18	3.20	1.80	2.20	5.90	5.60	6.00	3.40	2.25	1.40	1.60	1.80	2.70
19	3.00	1.80	2.20	5.60	5.80	6.20	3.30	2.25	1.40	1.55	1.90	2.80
20	2.90	1.80	2.35	5.50	6.30	5.90	3.20	2.20	1.40	1.50	2.10	2.75
21	2.85	1.82	2.35	5.50	6.45	5.70	3.15	2.15	1.40	1.50	2.60	2.70
22	2.77	1.80	2.30	5.50	6.80	5.50	3.20	2.10	1.40	1.50	2.70	2.65
23	2.70	1.85	2.20	5.45	7.05	5.15	3.25	2.10	1.40	1.50	2.90	2.60

Mean daily gage height, in feet, of Clealum River near Roslyn, Wash., for 1904—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
24	2.60	1.90	1.90	5.45	7.20	4.80	3.25	2.05	1.40	1.50	2.85	2.60
25	2.50	1.90	1.90	5.00	6.80	4.50	3.20	1.95	1.35	1.45	2.75	2.50
26	2.40	1.85	1.65	4.90	6.50	4.50	3.15	1.90	1.30	1.40	2.60	2.40
27	2.40	1.80	1.65	4.70	6.10	4.60	3.15	1.80	1.30	1.30	2.60	2.30
28	2.30	1.83	1.70	5.60	6.10	4.90	3.15	1.80	1.35	1.20	2.80	2.20
29	2.27	1.75	1.60	6.50	6.20	5.10	3.10	1.80	1.40	1.20	2.90	2.10
30	2.20	.....	1.63	6.55	6.25	5.40	3.00	1.80	1.50	1.20	2.85	2.15
31	2.70	.....	1.60	.....	6.15	.....	2.90	1.80	.....	1.25	.....	2.20

Rating table for Clealum River near Roslyn, Wash., from October 10, 1903, to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.20	165	2.80	685	4.30	1,520	5.80	2,890
1.30	190	2.90	725	4.40	1,590	5.90	2,990
1.40	215	3.00	770	4.50	1,670	6.00	3,100
1.50	240	3.10	815	4.60	1,750	6.10	3,210
1.60	270	3.20	865	4.70	1,830	6.20	3,320
1.70	300	3.30	915	4.80	1,920	6.30	3,430
1.80	330	3.40	965	4.90	2,010	6.40	3,540
1.90	360	3.50	1,020	5.00	2,100	6.50	3,660
2.00	390	3.60	1,075	5.10	2,190	6.60	3,780
2.10	425	3.70	1,130	5.20	2,290	6.70	3,900
2.20	460	3.80	1,185	5.30	2,390	6.80	4,020
2.30	495	3.90	1,245	5.40	2,490	6.90	4,140
2.40	530	4.00	1,310	5.50	2,590	7.00	4,260
2.50	565	4.10	1,380	5.60	2,690	7.10	4,390
2.60	605	4.20	1,450	5.70	2,790	7.20	4,520
2.70	645						

The above table is applicable only for open-channel conditions. It is based upon 12 discharge measurements made during 1903 and 1904. It is well defined between gage heights 1.20 feet and 7.20 feet.

Estimated monthly discharge of Clealum River near Roslyn, Wash., for 1903 and 1904.

[Drainage area, 205 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
1903.						
October 10–31	1,534	589	967	42,200	4.72	3.86
November	1,630	478	746	44,390	3.64	4.06
December	3,900	425	1,022	62,840	4.98	5.74
1904.						
January	900	375	567	34,860	2.77	3.19
February	565	240	367	21,110	1.79	1.93
March	512	270	367	22,570	1.79	2.06
April	3,900	285	1,971	117,300	9.61	10.72
May	4,520	1,245	2,629	161,700	12.82	14.78
June	4,140	1,670	2,676	159,200	13.05	14.56
July	2,890	725	1,512	92,970	7.38	8.51
August	705	330	517	31,790	2.52	2.90
September	330	190	250	14,880	1.22	1.36
October	285	165	234	14,390	1.14	1.31
November	725	190	391	23,270	1.91	2.13
December	685	360	527	32,400	2.57	2.96
The year	4,520	165	1,001	726,400	4.88	66.41

NACHES RIVER NEAR NILE, WASH.

This station was established June 25, 1904, by G. F. Harley. It is located $1\frac{3}{8}$ miles above the highway bridge, 23 miles northwest of North Yakima, and 8 miles southeast of Nile, Wash. The station is $1\frac{3}{4}$ miles above the junction of Naches and Tieton rivers. An inclined staff gage, graduated to read direct to feet and tenths, is fastened to timbers buried on the left bank. The gage is read once each day by W. F. White. Discharge measurements are made by means of a cable, car, and tagged wire, at the gage. The cable has a span of 216 feet. The initial point for soundings is the south face of the pine to which the cable is fastened on the north bank. The channel is straight for about 600 feet above and 300 feet below the station. The current is moderate at the station, and swift above and below. The right bank is low, wooded, and overflows only during extreme high floods. The left bank is high, rocky, clean, and not liable to overflow. The bed of the stream is composed of clean gravel and cobbles, and is permanent. There is one channel at all except very

high stages, when there are two. The section is flat and shallow. Bench mark No. 1 is a point on the ledge 25 feet upstream from the tree supporting the cable on the north bank, marked with a cross and "B. M." Its elevation is 9.85 feet above the zero of the gage. Bench mark No. 2 is a large spike in the base of a 30-inch pine tree 115 feet upstream from the north cable support. Its elevation is 8.76 feet above the zero of the gage. Bench mark No. 3 is a United States Geological Survey standard bronze tablet set in a bowlder 700 feet east of north cable support, 300 feet from the river, marked on the tablet "1661." Its exact elevation is 1,660.824 feet above sea level and 9.20 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of T. A. Noble, district engineer.

Discharge measurements of Naches River near Nile, Wash., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
June 25	G. F. Harley	192	490	4.39	5.25	2,150
July 6	do	192	540	5.00	5.55	2,720
July 16	do	190	370	3.43	4.63	1,270
July 28	do	190	290	2.78	4.25	805
August 12	do	189	215	2.16	3.84	465
September 6	J. C. Dry	186	182	1.70	3.61	310

Mean daily gage height, in feet, of Naches River near Nile, Wash., for 1904.

Day.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1		5.80	4.10	3.50	3.20	3.30	4.40
2		5.80	4.10	3.50	3.30	3.30	4.30
3		5.70	4.10	3.50	3.30	3.30	4.20
4		5.70	4.10	3.40	3.30	3.30	4.10
5		5.70	4.00	3.40	3.30	3.30	4.00
6		5.60	4.00	3.40	3.30	3.30	4.00
7		5.50	4.00	3.20	3.30	3.35	3.90
8		5.40	4.00	3.10	3.30	3.40	3.90
9		5.30	4.00	3.10	3.30	3.40	3.80
10		5.20	3.70	3.20	3.30	3.40	3.80
11		5.10	3.70	3.10	3.50	3.40	3.80
12		5.10	3.70	3.05	3.70	3.40	3.80
13		5.00	3.70	3.05	3.50	3.35	3.80
14		4.80	3.60	3.05	3.60	3.30	4.10
15		4.70	3.60	3.05	3.55	3.35	4.00
16		4.60	3.60	3.05	3.40	3.40	4.00
17		4.60	3.60	3.05	3.45	3.45	4.00
18		4.50	3.50	3.00	3.50	3.50	4.00
19		4.50	3.50	3.00	3.45	3.50	4.00
20		4.40	3.50	3.00	3.40	4.00	4.00
21		4.40	3.50	3.00	3.45	5.05	4.10
22		4.50	3.50	3.10	3.45	5.40	4.00

Mean daily gage height, in feet, of Naches River near Nile, Wash., for 1904—Continued.

Day.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
23	.....	4.50	3.50	3.10	3.40	5.20	3.90
24	.....	4.40	3.50	3.10	3.30	4.80	3.80
25	5.30	4.40	3.50	3.10	3.30	4.60	3.80
26	5.30	4.30	3.50	3.05	3.30	4.80	3.90
27	5.40	4.30	3.50	3.05	3.30	4.70	3.80
28	5.50	4.30	3.50	3.05	3.30	5.00	3.80
29	5.60	4.20	3.50	3.05	3.30	4.80	3.90
30	5.70	4.20	3.50	3.05	3.30	4.70	4.00
31	.....	4.20	3.50	.....	3.30	.....	3.90

Rating table for Naches River near Nile, Wash., from June 25 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
3.00	139	3.90	496	4.80	1,476	5.70	2,997
3.10	158	4.00	576	4.90	1,614	5.80	3,185
3.20	181	4.10	664	5.00	1,760	5.90	3,373
3.30	208	4.20	760	5.10	1,914	6.00	3,561
3.40	239	4.30	864	5.20	2,078	6.10	3,749
3.50	274	4.40	975	5.30	2,250	6.20	3,937
3.60	316	4.50	1,093	5.40	2,433	6.30	4,125
3.70	366	4.60	1,216	5.50	2,621	6.40	4,313
3.80	425	4.70	1,344	5.60	2,809	6.50	4,501

The above table is applicable only for open-channel conditions. It is based upon 6 discharge measurements made during 1904. It is well defined between gage heights 3.61 feet and 5.55 feet. The table has been extended beyond these limits. Above gage height 5.50 feet the rating curve is a tangent, the difference being 188 per tenth.

Estimated monthly discharge of Naches River near Nile, Wash., for 1904.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
June 25–30	2,997	2,250	2,560	30,470
July	3,185	760	1,662	102,200
August	664	274	390	23,980
September	274	139	173	10,290
October	366	181	234	14,390
November	2,433	208	713	42,430
December	975	425	553	34,000
The period	.....	.....	.....	257,800

NACHES RIVER NEAR NORTH YAKIMA, WASH.

Naches River has its source in the Cascade Mountains, Yakima County, Wash., and flows southeasterly, entering Yakima River a short distance above North Yakima. Its principal tributaries are Tieton River, Cowiche, Rattlesnake, and Nile creeks, and Bumping River. The flow of the latter has already been increased by American River when it joins the Naches.

Naches River is important because of its rapid fall and the ease with which it can be used for irrigation purposes. Naches Valley, through which it flows, is already extensively irrigated from it. It is also the source of domestic water supply for the town of North Yakima and of water supply and power for the Northwestern Light and Water Company.

Two gaging stations are at present maintained upon Naches River, one near its junction with the Yakima and one just above the mouth of the Tieton.

The original station on Naches River was established August 14, 1893, by Mr. F. H. Newell, at a point a few hundred yards above the mouth of the river, near the bridge of the Northern Pacific Railroad.

The first gage, known as No. 1, was vertical and was nailed to the cribwork on the right-hand side of the river, above the railroad bridge. The 12-foot mark was 9.97 feet below the top of the rail on the bridge, the gage being about 60 feet easterly from the rail. The top of the iron pier, on the southeast end of the county bridge, was 5.87 feet above this 12-foot mark. Measurements were made from the county bridge. The locality was, however, not favorable for the purpose, as the water was very swift and was broken by the piers of the bridge. Owing to the difficulty of securing accurate measurements the readings were discontinued on September 20, 1894, and not resumed until August 19, 1895.

When the station was visited in July, 1896, it was found that the channel under the bridge, from which previous gagings had been made, had been greatly changed by the deposition of several carloads of rock and by the building of a short wing dam placed just above the gage rod. On July 28 gage No. 1 was removed and gage No. 2 fastened to the bulwark just above the highway bridge, and about 100 yards above its old position. The gage height in its old position when removed was 3.8, in its new position when placed 2.4. When the station was visited October 21 it was found that the water had fallen below the end of gage No. 2, and it was therefore removed and fastened again to the bulwark just below the highway bridge, and lowered in elevation 1 foot. Before changing, the gage height was −0.24 foot; after the change it was 0.76 foot. The gage-height records for 1896 are referred to this gage, known as gage No. 3.

The flood of November, 1896, modified the channel very greatly, depositing a large mass of coarse gravel and small bowlders along the right side of the channel at the section, so that the rod was about 50 feet from the edge of the water at low stages. The current is swift, even at low water. On account of the instability of the channel the station was abandoned in February, 1897, although a number of discharge measurements were made during the season.

May 19, 1897, a station was established on Yakima River, 5 miles above the mouth of the Naches, at the Northern Pacific Railway bridge near Selah, Wash., with the idea that the difference in discharge between this station and the one at Union Gap would give approximately the discharge of Naches River. Two ditches, located in the Moxee Valley, took water out of the river between these two points, but their combined flow was about counterbalanced by that received from Atanum Creek and the Wide Hollow wastage at Old Town.

The station on Naches River was reestablished February 1, 1898, and the station at Selah, on Yakima River, was discontinued. Since the reestablishment of the Naches station the river channel has been in a condition more favorable for meter observations than formerly. Discharge measurements were made from the lower side of the highway bridge. A new horizontal gage rod, No. 4, with wire and weight, was attached to the main span of the Northern Pacific Railway bridge at the mouth of the Naches, a few hunderd feet downstream from the highway bridge. The length of the gage wire from index to foot of weight was 30.41 feet. The elevation of top of pulley was 24.57 feet. The bench mark was the top of the north end of east sill of clearance posts, about 150 feet north of Northern Pacific Railway bridge. Elevation, 23.77 feet above zero of gage. On December 27, 1898, the top of the northeast concrete pier of the highway bridge was found to be at an elevation of 22.09 feet above zero.

On June 20, 1899, the gage rod and bench mark having been disturbed during alterations to the railroad bridge and approaches, a new 4 by 4 inch inclined gage rod, No. 5, was established on the left bank of the river, 30 feet downstream from the railroad bridge. This is the gage in present use. The lower section of the rod is inclined at an angle of 36° 30′ with the horizontal. The upper section is inclined at an angle of 80° with the horizontal.

On September 21, 1903, the station was changed to a location between the railroad and highway bridge and equipped with a cable, car, tagged wire, and stay wire. The cable is located 180 feet above the Northern Pacific Railway bridge, and 170 feet below the highway bridge, at which discharge measurements were formerly made. The stay wire is 85 feet above the cable. The cable has a total span of 280 feet. The initial point for soundings is the south face of the

cottonwood tree to which the cable is fastened on the north bank. The channel is straight for 100 feet above and for 75 feet below the cable. The current is swift. Both banks are low and covered with gravel. At flood stages the rock-filled crib will prevent overflow on both banks. The bed of the stream is composed of gravel, free from vegetation, and somewhat shifting. Although the present location does not have many of the characteristics of an ideal gaging station it has more of them than any location below the Tieton.

Naches River below the Tieton, almost to the point where it enters the Yakima, flows over flat bars of river gravel in numerous, crooked, and constantly changing channels. These gravel bars are in some instances one-half mile in width.

The datum of gage board No. 5, now in use, has been referred to the following bench marks: Bench mark No. 1 is a United States Geological Survey copper plug marked "1090 T" and its elevation is 1,089.959 feet above sea level and 19.74 above the zero of the gage. It is located in the center of the west end of the most southerly stone pier of the railroad bridge. The elevation of the zero of the gage is 1,070.22 feet above sea level. Bench mark No. 2 is a cross in the top of the center of the downstream end of the railroad bridge pier on the right bank. Its elevation above the zero of the gage is 19.94 feet and above sea level is 1,090 feet. Bench mark No. 3 is a railroad spike driven into the south side of the telegraph pole 23 feet north of the gage and 21 feet east of the railroad track. Its elevation is 17.81 feet above the zero of the gage. The observer is Patrick Gallagher, section foreman for the Northern Pacific Railway, who lives in North Yakima.

The observations at this station during 1904 have been made under the direction of T. A. Noble, district engineer.

Discharge measurements of Naches River near North Yakima, Wash., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
April 26	G. F. Harley	182	757	6.29	8.30	4,764
April 29	do	228	1,031	7.46	9.45	7,696
May 6	do	180	670	5.13	7.59	3,420
June 18	do	208	835	6.16	8.47	5,140
June 28	do	177	665	4.81	7.35	3,201
July 13	do	171	526	4.10	6.61	2,159
July 19	do	128	390	3.05	5.71	1,190
July 30	do	125	322	2.52	5.13	810
August 9	do	123	268	2.19	4.73	588
August 17	do	120	222	1.69	4.29	375
September 1	J. C. Dry	118	178	1.26	3.95	225
September 13	G. F. Harley	117	165	1.24	3.80	205

Mean daily gage height, in feet, of Naches River near North Yakima, Wash., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	6.10	5.90	5.70	6.10	8.80	8.30	7.80	5.10	4.00	4.00	4.00	6.00
2	6.10	5.90	5.60	6.20	8.40	8.20	7.80	5.00	3.90	3.95	3.90	5.80
3	6.10	5.90	5.60	6.50	8.20	8.20	7.80	5.00	3.80	3.90	3.90	5.60
4	6.10	5.90	5.60	6.80	8.20	8.30	7.80	4.90	3.75	3.90	3.90	5.45
5	6.10	5.80	5.60	6.80	7.90	8.50	7.90	4.90	3.70	3.90	3.90	5.30
6	6.00	5.80	5.70	7.50	7.70	8.70	7.70	4.80	3.70	3.80	4.00	5.20
7	6.00	5.80	5.80	7.30	7 40	8.60	7.60	4.80	3.60	3.80	4.10	5.10
8	6.00	5.80	6.20	7.30	7.40	8.20	7.50	4.80	3.60	3.80	4.20	5.00
9	6.00	5.80	6.20	7.40	7.40	7.80	7.20	4.70	3.60	3.85	4.20	5.00
10	6.00	5.80	6.60	8.20	7.40	7.80	7.10	4.60	3.60	3.90	4.10	5.00
11	6.00	5.80	6.50	8.90	7.40	7.60	7.00	4.50	3.65	4.00	4.10	4.95
12	6.00	5.80	6.40	9.50	7.60	7.40	6.90	4.50	3 70	4.70	4.10	4.90
13	6.00	5.80	6.35	10.00	7.80	7.30	6.60	4.40	3.70	4.40	4.10	4.90
14	6.70	5.75	6.30	10.30	8.20	7.50	6.20	4.40	3.70	4.40	4.20	4.90
15	6.90	5 70	6.30	10.30	8.30	7.90	6.10	4.40	3.70	4.40	4.20	5.10
16	6.80	5.70	6.20	9.70	8.40	8.10	6.00	4.40	3.60	4.30	4.30	5.20
17	6.70	5.70	6.20	9.40	8.30	8.20	5.95	4.40	3.60	4.20	4.30	5.20
18	6.60	5.70	6.20	9.00	8.40	8.50	5.90	4.30	3.60	4.10	4.30	5.20
19	6.50	5.70	6.20	9.30	8.50	8.30	5.80	4.30	3.60	4.10	4.30	5.20
20	6.50	5.70	6.15	9.50	8.60	8.10	5.70	4.20	3.60	4.10	5.45	5.20
21	6.40	5.70	6.10	9.50	8.90	8.00	5.70	4.15	3.60	4.00	6.60	5.20
22	6.40	5.70	6.10	9.10	9.30	7.90	5.70	4.10	3.70	4.00	6.70	5.10
23	6.40	5.80	6.00	8.70	9.70	7.60	5.70	4.10	3.70	4.00	6.60	5.10
24	6.25	5.80	6.00	8.50	9.50	7.20	5.65	4.10	3.80	4.00	6.20	5.10
25	6.10	5.80	6.00	8.20	9.00	7.00	5.60	3.90	3.80	4.00	6.10	5.00
26	6.00	5.80	6.00	8.30	8.60	7.00	5.60	3.90	3.80	4.00	6.10	4.90
27	6.00	5.80	5.95	8.90	8.50	7.10	5.60	3.80	3.80	4.00	6.25	4.90
28	6.00	5.75	5.90	9.30	8.50	7.30	5.40	3.90	3.90	4.00	6.40	4.90
29	6.00	5.70	5.90	9.70	8.55	7.50	5.20	4.00	3.90	4.00	6.30	4.90
30	6.00	.....	5.90	9.30	8.60	7.70	5.10	4 10	4.00	4.00	6.10	5.00
31	5.95	.....	6.00	.....	8.50	.....	5.10	4.00	.....	4.00	.....	5.20

NOTE.—Gage heights for Sundays interpolated.

Rating table for Naches River near North Yakima, Wash., from January 1 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
3.60	163	5.00	725	6.40	1,882	7.80	3,856
3.70	182	5.10	781	6.50	2,004	7.90	4,025
3.80	205	5.20	839	6.60	2,128	8.00	4,199
3.90	232	5.30	898	6.70	2,255	8.20	4,585
4.00	263	5.40	961	6.80	2,384	8.40	5,040
4.10	298	5.50	1,028	6.90	2,515	8.60	5,539
4.20	335	5.60	1,099	7.00	2,648	8.80	6,051
4.30	374	5.70	1,174	7.10	2,785	9.00	6,563
4.40	415	5.80	1,253	7.20	2,926	9.20	7,075
4.50	458	5.90	1,339	7.30	3,071	9.40	7,587
4.60	507	6.00	1,433	7.40	3,220	9.60	8,099
4.70	559	6.10	1,535	7.50	3,373	9.80	8,611
4.80	613	6.20	1,645	7.60	3,530	10.00	9,123
4.90	669	6.30	1,762	7.70	3,691	10.20	9,635

The above table is applicable only for open-channel conditions. It is based upon 12 discharge measurements made during 1904. It is well defined between gage heights 3.80 feet and 9.45 feet. The table has been extended beyond these limits. Above gage height 8.60 feet the rating curve is a tangent, the difference being 256 per tenth.

Estimated monthly discharge of Naches River near North Yakima, Wash., for 1904.

[Drainage area, 1,000 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
January	2,530	1,400	1,691	104,000	1.69	1.95
February	1,350	1,180	1,245	71,610	1.24	1.34
March	2,140	1,110	1,511	92,910	1.51	1.74
April	9,890	1,550	5,706	339,500	5.71	6.37
May	8,360	3,230	5,016	308,400	5.02	5.79
June	5,800	2,660	4,074	242,400	4.07	4.54
July	4,030	780	2,076	127,600	2.08	2.40
August	780	210	436	26,810	.436	5.03
September	260	160	189	11,200	.189	.211
October	560	200	284	17,460	.284	.327
November	2,260	230	832	49,510	.832	.928
December	1,440	670	816	50,170	.816	.941
The year	9,890	160	1,989	1,442,000	1.99	27.04

TIETON RIVER NEAR NORTH YAKIMA, WASH.

The gaging station on this stream was established April 14, 1902, at a point immediately below the mouth of Oak Creek, in sec. 3, T. 14 N., R. 16 E. of the Willamette meridian, and about 22 miles from North Yakima by road. The gage rod is inclined at an angle of 55° with the horizontal, and is on the left bank of the stream. It consists of a 1 by 5 inch cedar plank, supported and braced by stout logs. The equipment with which measurements are made consists of a ⅝-inch cable, car, tag wire, and stay wire. The initial point for soundings is a cross chiseled in a ledge, with a black ring painted around it. It is under the cable, 4 feet east of the west shear legs. The observer is Omer Tetherow, a farmer. There are no side channels and the banks are not subject to overflow. The bed of the stream is rocky, with shifting gravel bars, which make it difficult to find suitable cross sections for meter measurements. The point selected for the station is, however, a fairly good one, and the channel is straight both above and below the station for several hundred yards. At low water the underground flow at this station is estimated to be as much as 50 per cent of the measured flow. Bench mark No. 1 is a point of rock on a ledge 12 feet from the gage. Its elevation above gage datum is 15.67. Bench mark No. 2 is a nail in a cottonwood stump 40 feet south of the gage. Its elevation above gage datum is 15.93. Bench mark No. 3 is top of a bowlder 20 feet northwest of the cable shear legs. Its elevation above gage datum is 17.52. The gage datum is 1,683.365 above sea level.

The observations at this station during 1904 have been made under the direction of T. A. Noble, district engineer.

Discharge measurements of Tieton River near North Yakima, Wash., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
April 28	G. F. Harley	118	365	7.00	10.65	2,569
May 18	do	116	288	5.38	9.65	1,550
June 26	do	114	251	4.26	8.90	1,065
July 7	do	116	280	5.21	9.55	1,460
July 15	do	109	208	3.77	8.35	785
July 28	do	108	185	3.41	8.12	630
August 12	do	107	157	2.83	7.65	445
September 7	J. C. Dry	106	136	2.85	7.40	397

Mean daily gage height, in feet, of Tieton River near North Yakima, Wash., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	7.15	7.10	6.95	7.20	9.65	9.70	9.75	8.00	7.25	7.25	6.70	7.70
2	7.20	7.10	6.95	7.40	9.50	9.70	9.55	8.05	7.25	7.20	6.70	7.55
3	7.20	7.00	6.95	7.70	9.40	9.85	9.60	7.95	7.30	7.10	6.70	7.35
4	7.15	7.15	6.95	7.80	9.35	9.90	9.80	7.90	7.30	7.00	6.65	7.25
5	7.10	7.05	6.95	7.90	9.25	10.00	9.75	7.95	7.30	7.00	6.70	7.25
6	7.10	7.10	7.00	8.20	9.05	10.15	9.55	8.00	7.35	6.95	6.65	7.20
7	7.10	7.10	7.35	8.05	9.00	9.70	9.50	8.05	7.35	6.95	6.75	7.15
8	7.10	7.05	7.60	8.20	8.95	9.45	9.25	7.95	7.35	6.90	6.85	7.15
9	7.15	6.85	7.65	8.40	8.85	9.35	9.10	7.85	7.45	6.90	6.75	7.10
10	7.15	7.00	7.60	8.90	8.90	9.35	9.00	7.75	7.35	6.85	6.70	7.10
11	7.10	7.10	7.60	9.60	9.05	9.10	9.15	7.70	7.25	7.80	6.65	7.05
12	7.25	7.00	7.45	10.15	9.15	8.95	9.00	7.60	7.20	7.45	6.70	7.00
13	7.70	7.00	7.40	10.50	9.30	9.05	8.70	7.60	7.20	7.15	6.65	7.05
14	7.80	7.00	7.40	11.10	9.60	9.30	8.50	7.70	7.10	7.00	6.60	7.10
15	7.80	7.00	7.35	10.95	9.55	9.65	8.35	7.75	7.10	6.95	6.75	7.75
16	7.75	7.00	7.15	10.50	9.50	9.80	8.30	7.70	7.10	6.90	6.85	7.35
17	7.65	6.95	7.30	10.10	9.55	9.90	8.20	7.60	7.20	6.85	7.00	7.45
18	7.60	6.95	7.25	10.10	9.70	10.35	8.10	7.60	7.10	6.85	6.90	7.45
19	7.50	6.95	7.25	10.25	9.80	9.65	8.00	7.60	7.05	6.85	6.80	7.45
20	7.35	7.00	7.25	10.55	9.90	9.50	8.15	7.60	7.05	6.80	8.05	7.55
21	7.45	7.00	7.25	10.40	10.30	9.60	8.25	7.45	7.00	6.85	9.15	7.45
22	7.40	7.20	7.20	10.10	10.80	9.50	8.55	7.40	7.15	6.85	8.75	7.40
23	7.40	7.15	7.20	9.70	10.90	9.20	8.45	7.40	7.15	6.80	8.30	7.30
24	7.35	7.05	7.10	9.45	10.65	8.90	8.05	7.35	7.05	6.75	8.00	7.30
25	7.20	6.95	7.05	9.40	10.10	8.80	8.20	7.30	7.05	6.75	8.00	7.15
26	7.25	7.00	7.05	9.65	9.90	8.85	8.20	7.35	7.05	6.75	8.30	7.00
27	7.15	7.00	7.10	10.65	9.85	9.10	8.25	7.45	7.05	6.75	8.20	7.00
28	7.10	7.00	7.10	10.80	10.00	9.30	8.15	7.50	7.10	6.75	8.25	7.10
29	7.20	6.95	7.10	10.05	10.05	9.40	7.95	7.55	7.30	6.70	8.00	7.20
30	7.20	.....	7.15	9.55	10.05	9.65	7.90	7.40	7.25	6.70	7.80	7.90
31	7.10	.....	7.15	.....	9.85	.....	7.95	7.35	.....	6.70	.....	7.55

Rating table for Tieton River near North Yakima, Wash., from January 1 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
6.50	210	7.80	500	9.10	1,180	10.40	2,250
6.60	220	7.90	540	9.20	1,240	10.50	2,370
6.70	233	8.00	580	9.30	1,300	10.60	2,490
6.80	249	8.10	625	9.40	1,370	10.70	2,620
6.90	267	8.20	670	9.50	1,440	10.80	2,750
7.00	287	8.30	720	9.60	1,510	10.90	2,880
7.10	308	8.40	775	9.70	1,590	11.00	3,010
7.20	330	8.50	830	9.80	1,670	11.20	3,270
7.30	353	8.60	885	9.90	1,750	11.40	3,530
7.40	376	8.70	940	10.00	1,840	11.60	3,790
7.50	400	8.80	1,000	10.10	1,930	11.80	4,050
7.60	430	8.90	1,060	10.20	2,030	12.00	4,310
7.70	465	9.00	1,120	10.30	2,140		

The preceding table is applicable only for open-channel conditions. It is based upon 8 discharge measurements made during 1904. It is well defined between gage heights 7.00 feet and 9.70 feet. The table has been extended beyond these limits. Above gage height 10.60 feet the rating curve is a tangent, the difference being 130 per tenth.

Estimated monthly discharge of Tieton River near North Yakima, Wash., for 1904.

[Drainage area, 289 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
January	500	308	360	22,140	1.25	1.44
February	330	258	293	16,850	1.01	1.09
March	447	277	337	20,720	1.17	1.35
April	3,140	330	1,582	94,140	5.47	6.10
May	2,880	1,030	1,614	99,240	5.58	6.43
June	2,195	1,000	1,456	86,640	5.04	5.62
July	1,670	540	961	59,090	3.33	3.84
August	602	353	458	28,160	1.58	1.82
September	388	287	329	19,580	1.14	1.27
October	500	233	278	17,090	.962	1.11
November	1,210	220	413	24,580	1.43	1.60
December	540	287	357	21,950	1.24	1.43
The year	3,140	220	703	510,200	2.43	33.10

ATANUM CREEK NEAR YAKIMA, WASH.

This station was established May 11, 1904, by G. H. Bliss, for the purpose of studying the flow of the creek during the irrigating season. It is located at the Northern Pacific Railway Company's bridge, about 1 mile southeast of Yakima, Wash., 50 feet to the left of the road leading to the Yakima Indian Reservation. The station is three-fourths mile north of the gaging station on Yakima River at Union Gap. A plain staff gage, graduated to feet and tenths, is driven vertically into the bed of the creek and braced to the banks. It is read once each day by Hugh Kennedy. Discharge measurements are made from the downstream side of the railway bridge. The initial point for soundings is the face of the concrete abutment at the right bank. It is marked zero, and 5-foot intervals are marked across the bridge. The channel is straight for 50 feet above and below the station. The current is swift at high, and sluggish at low stages. The right bank is of medium height, clean, and not liable to overflow except at extremely high stages. The left bank is low, clean, and liable to overflow. The bed of the stream is composed of mud, free from vegetation, and not liable to change. There is but one channel

at all stages, broken by one pier. The bench mark is a point on the upstream edge of the top of the center pier of the railway bridge. Its elevation is 11.85 feet above the zero of the gage. The station was discontinued November 30, 1904.

The observations at this station during 1904 have been made under the direction of T. A. Noble, district engineer.

Discharge measurements of Atanum Creek near Yakima, Wash., in 1904.

Date.	Hydrographer.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Sq. feet.	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
May 26	G. H. Bliss	127	4.45	6.63	565
July 1	J. C. Dry	47	3.08	4.90	145
July 18	do	38	2.22	4.40	84
August 11	do	18.2	.80	3.40	14.5
August 19	do	14.9	.73	3.38	10.9

Mean daily gage height, in feet, of Atanum Creek near Yakima, Wash., in 1904.

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	6.3	4.9	3.7	3.3	3.0	3.2
2	.....	6.3	4.9	3.6	3.3	3.0	3.2
3	.....	6.1	4.9	3.6	3.3	3.0	3.2
4	.....	6.0	4.9	3.6	3.3	3.0	3.2
5	.....	6.1	5.0	3.6	3.3	3.0	3.2
6	.....	6.0	5.0	3.6	3.3	3.0	3.2
7	.....	6.0	5.0	3.6	3.3	3.0	3.2
8	.....	6.0	4.9	3.6	3.3	3.0	3.3
9	.....	6.0	4 9	3.6	3.0	3.0	3.3
10	.....	5.9	4.9	3.6	3.0	3.0	3.3
11	5.3	5.9	4.7	3.5	3.0	3.2	3.3
12	5.4	5.9	4.5	3.5	3.0	3.2	3.3
13	5.5	5.6	4.5	3.5	3.0	3.1	3.3
14	5.5	5.6	4.4	3 5	3.0	3.1	3.3
15	5.6	5.5	4.3	3.5	3.0	3.1	3.3
16	5.8	5.7	4.3	3.5	3.0	3.1	3.3
17	5.8	5.6	4.3	3.5	3.0	3.1	3.3
18	5.7	5.9	4.3	3.5	3.0	3.1	3.3
19	5.7	5.8	4.3	3.4	3.0	3.1	3.4
20	5.8	5 9	4.2	3.4	3.0	3.2	3.4
21	5.9	5.9	4.2	3.4	3.0	3.2	3.6
22	6.0	5.9	4.0	3.4	3.0	3.2	3.8
23	6.5	5.9	3.9	3.4	3.0	3.1	3.8
24	6.5	5.9	3.9	3.4	3.0	3.3	3.8
25	6.5	5.8	3.9	3.4	3.0	3.3	3.7
26	6.5	5.4	3.9	3.4	3.0	3.3	3.7
27	6.3	5.2	3.9	3.4	3.0	3.3	3.7
28	6.1	5.2	3.9	3.4	3.0	3.2	3.7
29	6.2	5.2	3.9	3.4	3.0	3.2	3.7
30	6.2	5.2	3.7	3.3	3.0	3.2	3.7
31	6.3	.....	3.7	3.3	.....	3.2	.....

NOTE.—Observations were made during irrigating season only.

Rating table for Atanum Creek near Yakima, Wash., from May 11 to November 30, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
3.00	0	4.10	58	5.10	176	6.10	425
3.10	2	4.20	66	5.20	196	6.20	451
3.20	6	4.30	74	5.30	218	6.30	477
3.30	10	4.40	83	5.40	243	6.40	503
3.40	14	4.50	93	5.50	269	6.50	529
3.50	18	4.60	104	5.60	295	6.60	555
3.60	23	4.70	116	5.70	321	6.70	581
3.70	29	4.80	128	5.80	347	6.80	607
3.80	35	4.90	142	5.90	373	6.90	633
3.90	42	5.00	158	6.00	399	7.00	659
4.00	50						

The above table is applicable only for open-channel conditions. It is based upon 5 discharge measurements taken during 1904. It is well defined between gage heights 3.40 feet and 6.60 feet. The table has been extended beyond these limits. Above gage height 5.40 feet the rating curve is a tangent, the difference being 26 per tenth.

Estimated monthly discharge of Atanum Creek near Yakima, Wash., for 1904.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
May 11–31	530	220	389	16,200
June	480	200	346	20,580
July	160	30	87.8	5,399
August	30	10	19.4	1,193
September	10	0	2.7	161
October	10	0	3.6	214
November	35	6	14.9	887
The period				44,630

CANALS IN THE YAKIMA RIVER VALLEY, WASHINGTON.

Nowhere in the State of Washington has irrigation been practiced longer or have matters pertaining to irrigation reached a higher state of development than in the Yakima Valley. The rapid fall of the rivers, the great fertility of the soil, and the climatic conditions have all served to bring this about.

The chief sources of water supply for canals used for irrigation are the Yakima and Naches rivers, the latter of which, when it joins the

Yakima, has already received the water of the Tieton. Besides these rivers the Wenas, Cowiche, Atanum, Toppenish, and Satus creeks, and some small creeks in the vicinity of Ellensburg, irrigate large areas of land lying in the valleys through which they flow. From these sources there are about 125,000 acres of land at present under irrigation, and with the available storage reservoirs at the head of the Yakima, Naches, and Tieton rivers, and with economy in the use of the water, it is probable that 300,000 additional acres of land could be irrigated.

There are at the present time about 50 irrigating canals in operation in the Yakima Valley, which obtain their water from the sources above mentioned, and irrigate the low land lying near the streams. This land is of volcanic origin, and very fertile. When water is applied, large and very profitable crops of fruit, hay, hops, and grain are raised.

There remains at the present time a large area of the best quality of land in the Yakima Valley unirrigated, but the available water supply, especially at the low stages of the streams, is practically exhausted, so that the irrigation of additional land is dependent upon stored water, to be used during about two and one-half months of the irrigating season.

There are five reservoir sites available for the storage of water in the Yakima region. These are Lake Clealum, Lake Kachess, and Lake Keechelus, at the head of Yakima River, Bumping Lake, at the head of Naches River, and McAlisters Meadows, on Tieton River.

The canals at present in operation in the Yakima Valley are mostly in the hands of stock companies, which, with but few exceptions, furnish the farmers under the canal water enough to supply all demands. Most farmers have taken from the ditches what water seemed most convenient for their use, which in many instances has been far in excess of the amount actually needed to irrigate their land economically and profitably. The results of this excessive use of water are only too apparent to those who have traveled through the oldest irrigated sections of the Yakima Valley. Land that was once valuable is now water-logged and worthless, alkali being everywhere visible.

The contracts of the best managed canals in the Yakima Valley allow 1 second-foot for 100 and 160 acres of land, which gives a total depth of water of 44 and 27 inches, respectively, over the land irrigated. From the figures which follow, it can be seen that nearly twice this amount was used during the season of 1904.

To determine more accurately the hydrographic conditions existing in the Yakima Valley, a systematic series of investigations were made during the irrigation season of 1904 under the direction of T. A. Noble,

district engineer, by G. H. Bliss, assisted by G. F. Harley. Not only were the former gaging stations on the Yakima, Naches, and Tieton rivers continued, but new stations were established at other controlling points on these rivers, and also upon all but the smallest canals taking water from them. In each case discharge measurements and daily gage readings were taken near the head works of the canals.

As a rule the irrigation season in the Yakima Valley opens about April 16 and closes about October 15, and estimates of discharge have been made for this period. In the tables of monthly discharge the flow for periods during which no gage readings were taken has been estimated. The maximum, minimum, and mean discharges are computed for periods during which water was actually flowing in the canal, the days when the water was shut off as noted in the table of gage heights not being considered. The "total in acre-feet" represents the entire discharge of the canal for the same periods. The figures for "depth in inches over the irrigated area" are computed from the run-off in acre-feet and no allowances are made for losses from waste or other causes. For a list of the canals, see table on page 165 et seq.

CASCADE CANAL NEAR THORP, WASH.

This is the first canal taking water from Yakima River. It heads in the river on its left bank in sec. 33, T. 19 N., R. 17 E., and has just been completed. Owing to the lateness of its completion no land was irrigated from it during the season of 1904. The canal is controlled by a cooperative association.

WEST KITTITAS CANAL NEAR THORP, WASH.

This canal heads in Yakima River on its right bank in sec. 33, T. 19 N., R. 17 E., about 3 miles northwest of Thorp. It is controlled by the West Kittitas Irrigation Company, a cooperative association.

Discharge measurements of West Kittitas canal near Thorp, Wash., in 1904.

Date.	Hydrographer.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Sq. feet.	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
June 17	Geo. F. Harley	25.8	2.07	1.91	53.5
September 23	do	20.5	1.77	1.48	36.3
September 23	do	18.4	1.78	1.32	32.5
September 23	do	.0	.00	.00	.0

NOTE.—Measured in a 14-foot flume.

Mean daily gage height, in feet, of West Kittitas canal near Thorp, Wash., for 1904.

Day.	June.	July.	Aug.	Sept.	Oct.	Day.	June.	July.	Aug.	Sept.	Oct.
1	.....	(a)	1.58	2.33	2.00	17	1.92	1.75	1.92	.....	.....
2	.....	(a)	(a)	2.29	2.00	18	1.96	1.67	1.79	.....	.....
3	.....	(a)	(a)	2.25	.....	19	2.00	1.62	1.58	.....	.....
4	.....	1.67	2.04	2.17	.....	20	1.96	1.54	1.54	.....	.....
5	.....	1.83	2.04	2.17	.....	21	1.87	1.46	1.50	.....	.....
6	.....	1.83	1.96	2.17	.....	22	1.96	1.37	1.50	.....	.....
7	.....	1.67	1.92	(b)	.....	23	1.96	1.96	1.42	1.75	.....
8	.....	1.96	1.87	.....	.....	24	1.83	1.92	1.37	1.75	.....
9	.....	1.83	1.87	.....	.....	25	1.79	1.83	2.00	1.71	.....
10	.....	2.21	1.87	.....	.....	26	(a)	1.33	2.17	1.71	.....
11	.....	2.21	1.83	.....	.....	27	(a)	(a)	2.25	1.71	.....
12	.....	2.17	2.00	.....	.....	28	(a)	(a)	2.37	1.75	.....
13	.....	2.12	1.92	.....	.....	29	(a)	1.83	2.37	1.87	.....
14	.....	2.00	1.92	.....	.....	30	(a)	1.83	2.42	1.96	.....
15	.....	2.00	2.00	.....	.....	31	.....	1.67	2.42	.....	.....
16	.....	1.83	1.96	.....	.....						

[a] Water shut off.
[b] No record.

Rating table for West Kittitas canal near Thorp, Wash., from June 17 to October 2, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
0.00	0.0	0.65	9.9	1.30	30.5	1.95	53.9
.05	.5	.70	11.0	1.35	32.3	2.00	55.7
.10	1.1	.75	12.2	1.40	34.1	2.05	57.5
.15	1.7	.80	13.5	1.45	35.9	2.10	59.3
.20	2.3	.85	14.9	1.50	37.7	2.15	61.1
.25	3.0	.90	16.4	1.55	39.5	2.20	62.9
.30	3.7	.95	18.0	1.60	41.3	2.25	64.7
.35	4.5	1.00	19.7	1.65	43.1	2.30	66.5
.40	5.3	1.05	21.5	1.70	44.9	2.35	68.3
.45	6.1	1.10	23.3	1.75	46.7	2.40	70.1
.50	7.0	1.15	25.1	1.80	48.5	2.45	71.9
.55	7.9	1.20	26.9	1.85	50.3	2.50	73.7
.60	8.9	1.25	28.7	1.90	52.1		

The above table is based upon 4 discharge measurements made during 1904. It is not well defined. Above gage height 1.00 foot the rating curve is a tangent, the difference being 3.6 per tenth.

Mean daily discharge, in second-feet, of West Kittitas canal near Thorp, Wash., for 1904.

Day.	June.	July.	Aug.	Sept.	Oct.	Day.	June.	July.	Aug.	Sept.	Oct.
1	.....	(a)	41	68	56	17	52	47	52	.....	.....
2	.....	(a)	(a)	67	56	18	54	43	49	.....	.....
3	.....	(a)	(a)	65	.....	19	56	41	41	.....	.....
4	.....	43	58	61	.....	20	54	40	40	.....	.....
5	.....	50	58	61	.....	21	50	36	38	.....	.....
6	.....	50	54	61	.....	22	54	32	38	.....	.....
7	.....	43	52	.....	.....	23	54	54	34	47	.....
8	.....	54	50	.....	.....	24	50	52	32	47	.....
9	.....	50	50	.....	.....	25	49	50	56	45	.....
10	.....	63	50	.....	.....	26	(a)	32	61	45	.....
11	.....	63	50	.....	.....	27	(a)	(a)	65	45	.....
12	.....	61	56	.....	.....	28	(a)	(a)	68	47	.....
13	.....	59	52	.....	.....	29	(a)	50	68	50	.....
14	.....	56	52	.....	.....	30	(a)	50	70	54	.....
15	.....	56	56	.....	.....	31	(a)	43	70	.....	.....
16	.....	50	54	.....	.....						

[a] Water shut off.

Estimated monthly discharge of West Kittitas canal near Thorp, Wash., for 1904.

[Irrigated area, 7,000 acres.]

Month.	Discharge in second-feet.			Total in acre-feet.	Depth of run-off in inches, over irrigated area.
	Maximum.	Minimum.	Mean.		
April 16–30[a]	.....	.....	50	1,488	2.54
May[a]	.....	.....	50	3,074	5.27
June[a b]	.....	.....	53	2,628	4.50
July[b]	63	32	48.8	2,517	4.30
August[c]	70	32	52.2	3,003	5.14
September[d]	68	45	55	3,273	5.60
October 1–15	.....	.....	56	1,666	2.85
The period	70	32	52	17,650	30.20

[a] Estimated.
[b] Water shut off 5 days.
[c] Water shut off 2 days.
[d] September 7–22 estimated.

TOWN CANAL NEAR ELLENSBURG, WASH.

This canal heads in the left bank of Yakima River about 9 miles northwest of Ellensburg, in sec. 7, T. 18 N., R. 18 E. The discharge was gaged June 16 and again August 5. About July 10 the canal was cleaned and considerable material which had been washed in was removed. On account of these changes of the channel the estimates of discharge are only approximate. The canal is controlled by a cooperative association.

Discharge measurements of Town canal near Ellensburg, Wash., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
June 16	G. F. Harley	20	61.2	2.06	4.15	126
August 5	do	20	58.3	2.19	3.75	128

Mean daily gage height, in feet, of Town canal near Ellensburg, Wash., for 1904.

Day.	June.	July.	Aug.	Sept.	Day.	June.	July.	Aug.	Sept.
1	.....	4.08	3.67	3.75	17	4.17	3.83	3.83	3.50
2	.....	4.08	3.67	3.67	18	4.17	3.83	3.83	3.46
3	.....	4.08	3.67	3.71	19	4.25	3.67	3.83	3.46
4	.....	4.08	3.67	3.67	20	(a)	3.67	3.92	3.42
5	.....	4.08	3.75	3.67	21	(a)	3.67	3.92	.....
6	.....	4.08	3.75	3.67	22	4.00	3.67	3.92	.....
7	.....	4.08	3.75	3.71	23	4.00	3.67	3.92	.....
8	.....	4.33	3.71	3.62	24	3.92	3.67	3.92	.....
9	.....	4.33	3.71	3.62	25	4.08	3.67	3.83	.....
10	.....	(a)	3.67	3.58	26	4.08	3.67	3.83	.....
11	.....	(a)	3.67	3.58	27	4.08	3.75	3.83	.....
12	.....	(a)	3.58	3.54	28	4.08	3.75	3.83	.....
13	.....	(a)	3.58	3.50	29	4.08	3.75	3.83	.....
14	.....	(a)	3.67	3.50	30	4.08	3.67	3.75	.....
15	.....	(a)	3.67	3.50	31	.....	3.67	3.75	.....
16	4.17	3.92	3.75	3.50					

a Water shut off.

Mean daily discharge, in second-feet, of Town canal near Ellensburg, Wash., for 1904.

Day.	June.	July.	Aug.	Sept.	Day.	June.	July.	Aug.	Sept.
1	.....	122	120	128	17	126	132	132	112
2	.....	122	120	120	18	126	132	132	110
3	.....	122	120	127	19	129	120	132	110
4	.....	122	120	120	20	(a)	120	136	108
5	.....	122	128	120	21	(a)	120	136	.....
6	.....	122	128	120	22	119	120	136	.....
7	.....	122	128	127	23	119	120	136	.....
8	.....	134	127	117	24	114	120	136	.....
9	.....	134	127	117	25	122	120	132	.....
10	.....	(a)	120	114	26	122	120	132	.....
11	.....	(a)	120	114	27	122	128	132	.....
12	.....	(a)	114	113	28	122	128	132	.....
13	.....	(a)	114	112	29	122	128	132	.....
14	.....	(a)	120	112	30	122	120	128	.....
15	.....	(a)	120	112	31	.....	120	128	.....
16	126	135	128	112					

a Water shut off.

Estimated monthly discharge of Town canal near Ellensburg, Wash., for 1904.

[Irrigated area, 8,000 acres.]

Month.	Discharge in second-feet.			Total in acre-feet.	Depth of run-off in inches over irrigated area.
	Maximum.	Minimum.	Mean.		
April 16–31 [a]	.....	.....	100	2,975	4.46
May	.....	.....	110	6,764	10.2
June [b]	129	114	122	6,776	10.2
July [c]	135	120	124	6,150	9.23
August	136	114	127	7,809	11.7
September [a]	128	108	116	6,902	10.4
October 1–15 [d]	.....	.....	100	2,975	4.46
The period	136	108	116	40,350	60.6

[a] Estimated.
[b] Water shut off 2 days; estimated June 1–15.
[c] Water shut off 6 days.
[d] Estimated September 21–30.

OLSEN (OR MILL) DITCH NEAR ELLENSBURG, WASH.

This ditch heads in the left bank of Yakima River just below Town canal. It has under it about 1,200 acres of land, nearly all cultivated. A miscellaneous measurement taken August 5 gave a discharge of 14 second-feet.

SELAH-MOXEE CANAL NEAR NORTH YAKIMA, WASH.

This canal heads in the left bank of Yakima River just below the Yakima Canyon in sec. 8, T. 14 N., R. 19 E. It is the next canal of importance below the Olsen (or Mill) ditch at Ellensburg. Measurements taken on the wasteways of the Selah-Moxee canal show that its direct waste into the river rarely exceeds 25 per cent of the water taken in at the headworks and often is practically nothing.

Discharge measurements of Selah-Moxee canal near North Yakima, Wash., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-ft.*
April 26	G. H. Bliss	22	41	2.46	2.42	84
June 8	do	19	40	1.70	2.17	[a] 68
June 22	do	23	52	1.92	2.50	[b] 99
June 30	J. C. Dry	20	45	1.71	2.25	77
September 21	G. H. Bliss	19	37	1.37	(c)	51

[a] 10 second-feet wasting.
[b] 40 second-feet wasting.
[c] Measured below wasteway No 2.

Mean daily gage height, in feet, of Selah-Moxee canal near North Yakima, Wash., for 1904.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1	.....	2.83	2.29	2.37	2.29	2.33	1.42
2	.....	2.58	2.25	2.37	2.21	2.33	1.42
3	.....	2.42	2.25	2.37	2.29	2.29	1.42
4	.....	2.33	2.25	2.37	2.37	2.29	1.42
5	.....	2.17	2.29	2.00	2.21	2.29	1.42
6	.....	2.08	2.37	2.29	2.25	2.29	1.42
7	.....	2.08	2.42	2.29	2.21	2.29	1.25
8	.....	1.79	2.17	2.21	2.17	2.33	.....
9	.....	1.58	2.04	2.21	2.21	2.33	.....
10	.....	1.42	1.04	2.12	2.29	2.33	.....
11	.....	2.21	2.21	2.04	2.17	2.33	.....
12	.....	2.21	2.29	2.00	2.29	2.33	.....
13	.....	2.21	2.21	2.04	2.29	2.33	.....
14	.....	2.25	2.08	2.12	2.25	2.33	.....
15	.....	2.29	2.08	2.00	2.29	2.33	.....
16	.....	2.29	2.33	1.92	2.29	2.29	.....
17	.....	2.25	2.25	2.00	2.29	2.29	.....
18	.....	2.21	2.37	2.00	2.29	2.25	.....
19	.....	2.25	2.42	2.04	2.29	2.25	.....
20	.....	2.25	2.46	2.17	2.29	2.25	.....
21	.....	2.29	2.46	2.12	2.29	2.25	.....
22	.....	2.46	2.50	2.12	2.29	2.25	.....
23	.....	2.46	2.37	2.12	2.37	2.25	.....
24	.....	2.42	2.37	2.21	2.37	2.17	.....
25	.....	2.33	2.25	2.21	2.32	2.17	.....
26	2.42	2.29	2.17	2.12	2.25	1.79	.....
27	2.00	2.25	2.08	2.21	2.29	1.42	.....
28	2.58	2.25	2.25	2.12	2.29	1.42	.....
29	2.67	2.33	2.29	2.21	2.33	1.42	.....
30	2.75	2.33	2.25	2.12	2.42	1.42	.....
31	.....	2.33	.....	2.12	2.33	.....	.....

Mean daily discharge, in second-feet, of Selah-Moxee canal near North Yakima, Wash., for 1904.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1	.....	132	78	86	78	83	40
2	.....	107	75	86	73	83	40
3	.....	91	75	86	78	78	40
4	.....	81	75	86	86	78	40
5	.....	70	78	60	73	78	40
6	.....	65	86	78	75	78	40
7	.....	65	91	78	73	78	36
8	.....	52	68	73	70	83	.....
9	.....	46	62	73	73	83	.....
10	.....	40	31	67	78	83	.....
11	.....	73	73	63	70	83	.....
12	.....	73	78	60	78	83	.....
13	.....	73	73	63	78	83	.....
14	.....	75	65	67	75	83	.....
15	.....	78	65	60	78	83	.....
16	.....	78	82	57	78	78	.....
17	.....	75	75	60	78	78	.....
18	.....	73	86	60	78	75	.....
19	.....	75	91	63	78	75	.....

Mean daily discharge, in second-feet, of Selah-Moxee canal near North Yakima, Wash., for 1904—Continued.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
20	.....	75	95	70	78	75	.....
21	.....	78	96	67	78	75	.....
22	.....	95	99	67	78	75	.....
23	.....	95	86	67	86	75	.....
24	.....	91	86	72	86	70	.....
25	.....	82	75	72	83	70	.....
26	84	78	68	67	75	52	.....
27	60	75	65	73	78	40	.....
28	107	75	75	67	78	40	.....
29	116	82	78	73	83	40	.....
30	124	82	77	67	91	40	.....
31	.....	82	.....	67	83	.....	.....

Rating table for Selah-Moxee canal near North Yakima, Wash., from April 26 to October 7, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.35	39	1.80	52	2.20	72	2.60	109
1.40	40	1.85	54	2.25	75	2.65	114
1.45	41	1.90	56	2.30	79	2.70	119
1.50	42	1.95	58	2.35	84	2.75	124
1.55	43	2.00	60	2.40	89	2.80	129
1.60	44	2.05	63	2.45	94	2.85	134
1.65	46	2.10	66	2.50	99	2.90	139
1.70	48	2.15	69	2.55	104	2.95	144
1.75	50						

The above table is based upon five discharge measurements made during 1904. Above gage height 2.25 the table is well defined.

Estimated monthly discharge of Selah-Moxee canal near North Yakima, Wash., for 1904.

[Irrigated area, 6,000 acres.]

Month.	Discharge in second-feet.			Total in acre-feet.	Depth of run-off in inches over irrigated area.
	Maximum.	Minimum.	Mean.		
April 16–30 [a]	.....	.....	98.0	2,916	5.83
May	132	40	77.8	4,784	9.57
June	99	31	76.9	4,576	9.15
July	86	57	69.5	4,273	8.55
August	91	70	78.2	4,808	9.62
September	83	40	72.6	4,320	8.64
October 1–15 [b]	.....	.....	39.0	1,160	2.32
The period	132	31	74.9	26,840	53.7

[a] Estimated April 16–25. [b] Estimated October 8–15.

TAYLOR CANAL NEAR NORTH YAKIMA, WASH.

This is the next canal taking water from the Yakima below the Selah-Moxee canal. It heads in the right bank about 4 miles above the mouth of Naches River. The canal was built by the original owners of the adjacent land, and as they have disposed of their land they have included in the sale a water right which is understood to be 1 miner's inch per acre, though there is no accurate system of measuring the water used. Maintenance is carried on by assessments.

No station has been maintained on this canal. Two measurements were taken just below the headworks with the following results:

	Sec.-feet.
August 9, discharge	9
September 19, discharge	13

MOXEE AND HUBBARD CANALS NEAR NORTH YAKIMA, WASH.

The Moxee Company controls and operates these canals. They head in the Yakima River near the line between secs. 7 and 18 in T. 13 N., R. 19 E. Gaging stations were maintained on each canal, but the table of estimated monthly discharge is computed for the combined flow and the area irrigated by both canals. Very little water is wasted directly into the river by either of these canals.

Discharge measurements of Moxee canal near North Yakima, Wash., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Square ft.*	*Ft. per sec.*	*Feet.*	*Second-ft.*
May 20	G. H. Bliss	9	10.8	1.39	1.17	15
June 17	do	9	9.9	.91	1.08	9
September 3	J. C. Dry	9	15.0	.80	1.54	12

Mean daily gage height, in feet, of Moxee canal near North Yakima, Wash., for 1904.

Day.	May.	June.	July.	Aug.	Sept.	Oct.
1	.....	1.37	1.14	1.33	1.58	1.04
2	.....	1.37	(a)	1.44	1.58	1.06
3	.....	1.37	(a)	1.37	1.54	.62
4	.....	1.39	.83	1.37	1.54	.69
5	.....	1.35	.81	(a)	1.62	.....
6	.....	1.39	.92	(a)	1.50	.....
7	.....	1.33	.94	1.44	1.54	.....
8	.....	1.37	.92	1.50	1.54	.....
9	.....	1.35	.92	1.46	1.56	.....
10	.....	1.46	.95	1.53	1.50	.....
11	.....	1.45	.92	1.46	1.49	.....
12	.....	1.42	.90	1.53	1.50	.....
13	.....	1.17	.88	1.56	1.46	.....
14	.....	1.19	.98	1.50	1.46	.....

a Water shut off.

Mean daily gage height, in feet, of Moxee canal near North Yakima, Wash., for 1904—Cont'd.

Day.	May.	June.	July.	Aug.	Sept.	Oct.
15	.....	1.06	1.14	1.48	1.45	.....
16	.....	1.07	.85	1.52	1.44	.....
17	.....	1.08	.91	1.54	1.44	.....
18	.....	1.12	.96	1.54	1.39	.....
19	.....	1.11	1.12	1.54	1.39	.....
20	1.17	1.09	1.15	1.60	1.39	.....
21	1.12	1.08	1.29	1.57	1.42	.....
22	1.21	1.04	1.36	1.56	1.50	.....
23	1.15	1.02	1.29	1.56	1.58	.....
24	1.17	.96	1.19	1.58	1.60	.....
25	1.21	1.17	1.17	1.67	1.25	.....
26	1.15	1.21	1.43	1.61	1.06	.....
27	1.29	1.17	1.35	1.65	1.04	.....
28	1.27	1.21	1.29	1.67	1.08	.....
29	1.29	1.23	1.27	1.74	1.08	.....
30	1.29	1.21	1.27	1.58	1.04	.....
31	1.23	.....	1.27	1.52	.....	.....

Mean daily discharge, in second-feet, of Moxee canal near North Yakima, Wash., for 1904.

Day.	May.	June.	July.	Aug.	Sept.	Oct.
1	.....	28	13	25	40	6
2	.....	28	(a)	33	40	7
3	.....	28	(a)	28	39	1
4	.....	29	1	28	39	1
5	.....	26	1	(a)	42	.....
6	.....	29	2	(a)	36	.....
7	.....	25	2	33	39	.....
8	.....	28	2	36	39	.....
9	.....	26	2	33	39	.....
10	.....	33	3	38	39	.....
11	.....	33	2	33	34	.....
12	.....	31	2	38	36	.....
13	.....	15	1	39	34	.....
14	.....	16	4	36	34	.....
15	.....	7	12	34	33	.....
16	.....	8	1	37	32	.....
17	.....	9	2	39	32	.....
18	.....	11	2	39	29	.....
19	.....	10	12	39	29	.....
20	15	9	13	42	29	.....
21	11	8	23	40	32	.....
22	17	6	26	39	36	.....
23	13	5	23	39	40	.....
24	15	1	16	40	42	.....
25	17	15	15	47	20	.....
26	13	16	33	42	7	.....
27	23	15	26	45	6	.....
28	22	17	23	47	9	.....
29	23	19	22	51	9	.....
30	23	17	22	39	6	.....
31	19	.....	22	37	.....	.....

a Water shut off.

Discharge measurements of Hubbard canal near North Yakima, Wash., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
May 20	G. H. Bliss	12	20.0	1.50	1.92	30
June 17	do	12	17.6	1.14	1.66	20
June 17	do	12	14.5	1.17	1.42	17
September 3	J. C. Dry	12	18.5	1.29	1.78	24

Mean daily gage height, in feet, of Hubbard canal near North Yakima, Wash., for 1904.

Day.	May.	June.	July.	Aug.	Sept.	Oct.
1	.....	1.96	1.96	1.71	1.79	1.14
2	.....	1.94	2.12	2.02	1.79	1.14
3	.....	1.95	2.12	2.00	1.77	1.17
4	.....	1.95	1.74	1.95	1.73	1.15
5	.....	1.96	1.72	1.83	1.75	.....
6	.....	1.95	1.71	1.81	1.62	.....
7	.....	1.99	1.69	1.75	1.62	.....
8	.....	1.92	1.26	1.79	1.60	.....
9	.....	1.86	1.25	2.12	1.69	.....
10	.....	1.95	1.24	2.03	1.69	.....
11	.....	1.85	1.23	1.96	1.68	.....
12	.....	1.62	1.21	1.85	1.67	.....
13	.....	1.59	1.31	1.85	1.67	.....
14	.....	1.67	1.20	1.78	1.67	.....
15	.....	1.73	1.10	1.73	1.67	.....
16	.....	1.74	1.62	2.14	1.67	.....
17	.....	1.42	1.62	2.10	1.67	.....
18	.....	1.42	1.79	2.10	1.62	.....
19	.....	1.42	1.60	2.10	1.62	.....
20	1.92	1.39	1.71	2.12	1.33	.....
21	1.79	1.39	1.83	2.11	1.33	.....
22	1.85	1.95	1.87	1.98	1.33	.....
23	1.78	1.79	1.77	1.94	1.42	.....
24	1.79	1.04	1.62	1.87	1.42	.....
25	1.88	1.04	1.50	1.79	1.14	.....
26	1.79	1.77	1.98	1.73	1.14	.....
27	2.06	1.79	2.00	1.89	1.12	.....
28	2.05	1.81	2.00	1.92	1.12	.....
29	2.05	1.79	1.95	2.04	1.12	.....
30	2.05	1.79	1.87	1.83	1.14	.....
31	2.04	.....	1.87	1.79	.....	.....

Mean daily discharge, in second-feet, of Hubbard canal near North Yakima, Wash., for 1904.

Day.	June.	July.	Aug.	Sept.	Oct.	Day.	May.	June.	July.	Aug.	Sept.
1	31	31	21	24	15	17	.....	17	19	42	20
2	31	42	34	24	15	18	.....	17	24	42	19
3	31	42	34	23	15	19	.....	17	19	42	19
4	31	23	31	23	15	20	28	17	21	42	16
5	31	21	26	23	.....	21	24	17	26	42	16
6	31	21	24	19	.....	22	26	31	26	34	16
7	34	21	23	19	.....	23	24	24	23	31	17
8	28	16	24	19	.....	24	24	15	19	26	17
9	26	16	42	21	.....	25	28	15	18	24	15
10	31	16	31	21	.....	26	24	23	34	23	15
11	26	16	31	21	.....	27	38	24	34	28	15
12	19	16	26	20	.....	28	38	24	34	28	15
13	19	16	26	20	.....	29	38	24	31	38	15
14	20	16	23	20	.....	30	38	24	26	26	15
15	23	15	23	20	.....	31	38	.....	26	24	.....
16	23	19	47	20	.....						

Rating table for Hubbard canal near North Yakima, Wash., from May 20 to October 4, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.00	14.9	1.35	16.3	1.65	20.2	1.95	31
1.05	15.0	1.40	16.8	1.70	21.2	2.00	34
1.10	15.1	1.45	17.3	1.75	22.6	2.05	38
1.15	15.3	1.50	17.8	1.80	24.2	2.10	42
1.20	15.5	1.55	18.4	1.85	26.0	2.15	47
1.25	15.7	1.60	19.2	1.90	28.2	2.20	53
1.30	16.0						

The above table is based upon four discharge measurements made during 1904. Above gage height 1.40 it is well defined.

Estimated monthly discharge of Moxee and Hubbard canals near North Yakima, Wash., for 1904.

[Irrigated area, 3,500 acres.]

Month.	Discharge in second-feet.			Total in acre-feet.	Depth of run-off in inches over irrigated area.
	Maximum.	Minimum.	Mean.		
April 16–30 [a]	.....	.....	35.0	1,041	3.57
May	61	35	49.0	3,013	10.3
June	67	16	42.4	2,523	8.64
July	68	16	33.8	2,078	7.12
August	98	46	72.8	4,476	15.4
September	66	21	49.6	2,951	10.1
October 1–15	.....	.....	19	568	1.95
The period	98	16	45.9	16,650	57.1

[a] Estimated April 16 to May 19; also October 5–15.

FOWLER CANAL NEAR NORTH YAKIMA, WASH.

This canal heads in Yakima River, in sec. 18, T. 13 N., R. 19 E. It is controlled by a stock company.

Discharge measurements of Fowler canal near North Yakima, Wash., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
May 20	G. H. Bliss	10	14.7	2.38	1.24	35.0
June 17	do	10	9.8	1.86	.75	18.2
September 3	J. C. Dry	10	13.7	2.18	1.20	29.1
September 3	do				.00	Dry.

Mean daily gage height, in feet, of Fowler canal near North Yakima, Wash., for 1904.

Day.	May.	June.	July.	Aug.	Sept.	Oct.
1		1.10	1.04	0.82	1.21	0.79
2		1.08	1.09	.89	1.19	.00
3		1.09	1.10	.81	1.17	.33
4		1.11	1.17	.71	1.17	.73
5		1.10	1.14	.85	1.17	
6		1.15	1.08	.83	1.21	
7		1.01	1.04	.60	1.21	
8		.98	1.04	.64	1.19	
9		.92	.92	1.00	1.29	
10		1.02	.88	1.00	1.33	
11		1.00	1.10	.96	1.31	
12		.98	1.04	.92	1.31	
13		.92	.71	.92	1.25	
14		.95	.54	.85	1.25	
15		1.00	.46	.92	1.24	
16		1.07	1.08	.92	1.21	
17		.78	1.04	.83	1.21	
18		.52	.92	.85	1.17	
19		.52	.83	.81	1.17	
20	1.24	.50	.88	1.06	1.21	
21	1.25	.50	.88	1.06	1.25	
22	1.32	.44	.88	1.04	1.25	
23	1.15	.65	.83	1.02	1.27	
24	1.14	.67	.75	1.00	1.27	
25	1.03	.69	.56	.98	1.29	
26	1.33	.62	1.00	.98	1.29	
27	1.21	.87	1.00	1.08	1.29	
28	1.20	1.00	.94	.0	.0	
29	1.21	.92	.89	.77	.0	
30	1.21	1.04	.82	1.21	.0	
31	1.19		.88	.0		

Mean daily discharge, in second-feet, of Fowler canal near North Yakima, Wash., for 1904.

Day.	May.	June.	July.	Aug.	Sept.	Oct.
1	.....	29	27	20	32	20
2	.....	29	29	23	32	0
3	.....	29	29	20	30	7
4	.....	29	30	17	30	18
5	.....	29	30	21	30	.....
6	.....	30	29	21	32	.....
7	.....	26	27	14	32	.....
8	.....	26	27	15	32	.....
9	.....	23	23	26	35	.....
10	.....	26	23	26	37	.....
11	.....	26	29	24	35	.....
12	.....	26	27	23	35	.....
13	.....	23	17	23	34	.....
14	.....	24	12	21	34	.....
15	.....	26	10	23	34	.....
16	.....	27	29	23	32	.....
17	.....	20	27	21	32	.....
18	.....	11	23	21	30	.....
19	.....	11	21	20	30	.....
20	34	11	23	27	32	.....
21	34	11	23	27	34	.....
22	35	10	23	27	34	.....
23	30	15	21	26	34	.....
24	30	15	18	26	34	.....
25	27	17	12	26	35	.....
26	37	14	26	26	35	.....
27	32	21	26	29	35	.....
28	32	26	24	0	0	.....
29	32	23	23	20	0	.....
30	32	27	20	32	0	.....
31	32	.....	23	0	.....	.....

Rating table for Fowler canal near North Yakima, Wash., from May 20 to October 4, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
0.30	6.0	0.60	13.7	0.90	22.5	1.15	30.3
.35	7.2	.65	15.1	.95	24.0	1.20	31.9
.40	8.4	.70	16.5	1.00	25.5	1.25	33.5
.45	9.7	.75	18.0	1.05	27.1	1.30	35.1
.50	11.0	.80	19.5	1.10	28.7	1.35	36.7
.55	12.3	.85	21.0				

The above table is based upon 4 discharge measurements made during 1904. It is not well defined.

Estimated monthly discharge of Fowler canal near North Yakima, Wash., for 1904.

[Irrigated area, 2,000 acres.]

Month.	Discharge in second-feet.			Total in acre-feet.	Depth of run-off, in inches, over irrigated area.
	Maximum.	Minimum.	Mean.		
April 16–30 [a]			25.0	744	4.46
May	37	27	34.0	2,091	12.6
June	30	10	22.0	1,309	7.85
July	30	10	23.6	1,451	8.71
August [b]	32	14	23.0	1,323	7.94
September [c]	37	30	33.0	1,767	10.6
October 1–15 [d e]			15.0	444	2.66
The period	37	10	25.9	9,129	54.8

[a] Estimated April 16 to May 19.
[b] Water shut off 2 days.
[c] Water shut off 3 days.
[d] Water shut off 1 day.
[e] Estimated October 5–15.

GRANGER CANAL NEAR NORTH YAKIMA, WASH.

This canal heads in Yakima River in sec. 18, T. 13 N., R. 19 E. It is owned and operated by a private party and irrigates a small tract of land in the Moxee Valley. Owing to insufficient measurements no estimates of discharge were made for this canal.

Discharge measurements of Granger canal near North Yakima, Wash., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
May 20	G. H. Bliss	17	11.5	1.6	2.0	[a] 17.7

[a] Backwater in canal.

Mean daily gage height, in feet, of Granger canal near North Yakima, Wash., for 1904.

Day.	May.	June.	July.	Aug.	Sept.	Oct.
1		1.98	2.00	1.44	2.04	1.12
2		1.93	2.23	1.48	2.02	1.12
3		1.94	2.17	1.46	2.00	1.12
4		1.96	2.21	1.42	1.98	1.12
5		1.99	2.19	1.48	1.98	
6		2.01	2.14	1.46	2.02	
7		1.19	2.08	1.39	2.00	
8		1.17	2.12	1.42	2.00	
9		1.11	2.06	1.73	1.17	
10		1.12	2.02	1.71	1.17	
11		1.10	1.46	1.69	1.17	
12		1.10	1.46	2.57	1.14	
13		2.54	1.39	2.60	1.12	
14		2.57	1.35	2.58	1.12	

Mean daily gage height, in feet, of Granger canal near North Yakima, Wash., for 1904—Continued.

Day.	May.	June.	July.	Aug.	Sept.	Oct.
5	.....	2.62	1.35	1.79	1.12	.....
6	.....	2.10	1.42	1.93	1.12	.....
7	.....	2.50	1.36	1.85	1.12	.....
8	.....	2.52	1.37	1.85	1.12	.....
9	.....	2.52	1.35	1.83	1.08	.....
10	2.00	2.52	1.37	1.93	1.08	.....
11	2.00	2.54	1.37	1.87	1.08	.....
12	2.06	2.51	1.87	2.07	1.08	.....
13	1.73	2.48	1.85	2.06	1.10	.....
14	1.75	2.50	1.81	2.01	1.10	.....
25	1.75	2.56	1.81	1.96	1.10	.....
26	2.04	2.52	1.89	1.94	1.10	.....
27	2.00	2.52	1.94	2.00	1.12	.....
28	2.00	2.58	1.89	1.94	1.08	.....
29	2.00	2.02	1.85	2.12	1.12	.....
30	2.00	2.21	1.78	2.21	1.12	.....
31	1.99	.....	1.43	2.10	.....	.....

NEW RESERVATION CANAL NO. 2 IN YAKIMA INDIAN RESERVATION, WASH.

This is the first canal taking water from Yakima River below Atanum Creek. It was built by the Government to irrigate lands in the Yakima Indian Reservation. It heads in the right bank in sec. 17, T. 12 N., R. 19 E. Only about 4½ miles of the main canal had been constructed in 1904. The length of the main canal as proposed will be 65 miles, with three laterals aggregating 25 miles. The gradient is .03 per 100 feet, which causes a wash in some places.

Discharge measurements of New Reservation canal No. 2 in Yakima Indian Reservation, Wash., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
May 9	G. H. Bliss	40	17.5	1.00	0.41	17.7
June 7	do	40	40	1.10	.75	44
June 27	do	40	44	1.25	.95	55
July 22	J. C. Dry	40	54	1.53	1.17	82
August 19	do	40	40	1.30	.83	52

Mean daily gage height, in feet, of New Reservation canal No. 2 in Yakima Indian Reservation, for 1904.

Day.	May.	June.	July.	Aug.	Sept.	Day.	May.	June.	July.	Aug.	Sept.
1	.....	0.62	1.17	1.21	1.17	17	0.58	1.00	1.08	0.87	1.00
2	.....	.67	1.17	1.25	1.17	18	.58	1.00	1.08	.87	1.00
3	.....	.71	1.17	1.21	1.17	19	.67	.50	1.08	.83	1.00
4	.....	.71	1.17	1.29	1.17	20	.58	.83	1.17	.83	1.00
5	.....	.67	1.17	1.00	1.17	21	.67	.92	1.21	.83	1.00
6	.....	.67	1.17	1.29	1.17	22	.62	.92	1.19	.83	1.00
7	.....	.75	1.17	1.17	1.17	23	.75	.92	1.00	.83	.92
8	.....	.83	1.17	1.12	1.17	24	.71	.92	1.17	.83	.92
9	0.40	.75	1.08	1.00	1.17	25	.75	.92	1.17	.83	.92
10	.42	.75	1.08	1.00	1.17	26	.71	.92	1.12	.92	.83
11	.42	.77	1.08	.92	1.17	27	.67	.92	1.08	1.00	.83
12	.42	.75	1.08	.96	1.08	28	.67	.96	1.08	1.17	.83
13	.53	.83	1.08	.83	1.08	29	.67	1.00	1.17	1.50	.75
14	.53	.83	1.08	.92	1.08	30	.67	1.17	1.17	.75	.75
15	.53	1.00	1.08	.83	1.08	31	.67	.....	1.12	(a)	.....
16	.53	1.00	1.08	.75	1.08						

a Water shut off.

Mean daily discharge, in second feet, of New Reservation canal No. 2 in Yakima Indian Reservation, Wash., for 1904.

Day.	May.	June.	July.	Aug.	Sept.	Day.	May.	June.	July.	Aug.	Sept.
1	.....	27	90	97	90	17	27	69	83	49	69
2	.....	30	90	104	90	18	27	69	83	49	69
3	.....	34	90	97	90	19	30	21	83	49	69
4	.....	34	90	121	90	20	27	49	90	49	69
5	.....	30	90	69	90	21	30	55	97	49	69
6	.....	30	90	121	90	22	27	55	97	49	69
7	.....	38	90	90	90	23	38	55	69	49	55
8	.....	49	90	83	90	24	34	55	90	49	55
9	17	38	83	69	90	25	38	55	90	49	55
10	17	38	83	69	90	26	34	55	83	55	49
11	17	38	83	55	90	27	30	55	83	69	49
12	17	38	83	62	83	28	30	62	83	90	49
13	24	49	83	49	83	29	30	69	90	149	38
14	24	49	83	55	83	30	30	90	90	38	38
15	24	69	83	49	83	31	30	.....	83	(a)	.....
16	24	69	83	38	83						

a Water shut off.

Rating table for New Reservation canal No. 2 in Yakima Indian Reservation, Wash., from May 9 to September 30, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
0.15	10	0.50	21	0.85	49	1.20	97
.20	11	.55	24	.90	55	1.25	104
.25	12	.60	27	.95	62	1.30	121
.30	13	.65	30	1.00	69	1.35	128
.35	15	.70	34	1.05	76	1.40	135
.40	17	.75	38	1.10	83	1.45	142
.45	19	.80	43	1.15	90	1.50	149

The above table is based upon 5 discharge measurements made during 1904. It is not well defined.

Estimated monthly discharge of New Reservation canal No. 2 in Yakima Indian Reservation, Wash., for 1904.

[Irrigated area, 2,700 acres.]

Month.	Discharge in second-feet.			Total in acre-feet.	Depth of run-off in inches, over irrigated area.
	Maximum.	Minimum.	Mean.		
April 16–30 [a]	.....	.....	20.0	595	2.64
May	38	17	27.0	1,660	7.38
June	90	21	49.1	2,922	13.0
July	97	63	86.4	5,312	23.6
August [b]	149	38	69.0	4,106	18.2
September	90	38	73.6	4,380	19.5
October 1–15 [c]	.....	.....	50.0	1,488	6.61
The period	149	21	56.4	20,460	90.9

[a] Estimated April 15 to May 8. [b] Water shut off 1 day. [c] Estimated.

OLD RESERVATION CANAL NO. 1 IN YAKIMA INDIAN RESERVATION, WASH.

This canal takes water from Yakima River, on its right bank, in sec. 28, T. 12 N., R. 19 E. It was built by the Government from an Indian fund derived from the sale of the Wenache fishery lands, which formerly belonged to the Indians.

Discharge measurements of Old Reservation canal No. 1 in Yakima Indian Reservation, Wash., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
May 9	G. H. Bliss	12	43	3.00	2.83	130
June 7	do	12	49	3.10	3.17	152
June 27	do	13	51	3.60	3.29	184
July 22	J. C. Dry	12	44	2.91	2.99	127
August 19	do	12	41	2.69	2.83	110

Mean daily gage height, in feet, of Old Reservation canal No. 1 in Yakima Indian Reservation Wash., for 1904.

Day.	June.	July.	Aug.	Day.	June.	July.	Aug.	Day.	June.	July.	Aug.
1	.....	3.37	3.17	12	2.06	3.33	3.08	22	3.17	2.92	3.17
2	.....	3.33	3.25	13	2.06	3.33	3.08	23	3.17	2.96	3.17
3	.....	3.33	3.27	14	2.06	3.29	3.08	24	3.25	2.92	3.17
4	.....	3.35	3.25	15	2.00	3.29	3.04	25	3.25	2.21	3.17
5	.....	3.33	3.29	16	2.07	3.25	3.00	26	3.17	2.21	3.17
6	.....	3.35	3.17	17	2.06	3.25	3.00	27	3.33	2.25	3.17
7	3.17	3.35	3.17	18	3.02	3.17	2.92	28	3.33	2.17	3.17
8	3.00	3.33	3.17	19	3.02	3.21	2.83	29	3.33	2.17	3.17
9	3.00	3.33	3.12	20	3.02	3.12	2.83	30	3.33	2.12	3.17
10	3.00	3.33	3.08	21	3.02	3.00	3.17	31	.....	2.08	3.17
11	3.02	3.33	3.08								

Mean daily discharge, in second-feet, of Old Reservation canal No. 1 in Yakima Indian Reservation, Wash., for 1904.

Day.	June.	July.	Aug.	Day.	June.	July.	Aug.	Day.	June.	July.	Aug.
1	.....	214	152	12	112	200	143	22	152	133	152
2	.....	200	167	13	112	200	143	23	152	136	152
3	.....	200	170	14	112	170	143	24	167	133	152
4	.....	205	167	15	111	170	140	25	167	115	152
5	.....	200	170	16	112	167	139	26	149	115	152
6	.....	205	152	17	112	167	139	27	190	116	152
7	152	205	152	18	138	152	133	28	190	114	152
8	139	200	152	19	138	158	130	29	190	114	152
9	139	200	145	20	138	145	130	30	190	113	152
10	139	200	143	21	138	139	152	31	.....	112	152
11	138	200	143								

Estimated monthly discharge[a] of Old Reservation canal No. 1 in Yakima Indian Reservation, Wash., for 1904.

[Irrigated area, 8,000 acres.]

Month.	Discharge in second-feet.			Total in acre-feet.	Depth of run-off, in inches, over irrigated area.
	Maximum.	Minimum.	Mean.		
April 16–30[b]	.....	.....	100	2,975	4.46
May	.....	.....	130	7,993	12.0
June	190	111	145	8,628	12.9
July	214	112	164	10,080	15.1
August	170	130	149	9,162	13.7
September	.....	.....	100	5,950	8.92
October 1–15[c]	.....	.....	90	2,678	4.01
The period	214	111	130	47,470	71.1

[a] Approximate. [b] Estimated April 15 to June 6. [c] Estimated September 1 to October 15.

GOVERNMENT CANAL NO. 3 NEAR TOPPENISH, WASH.

This canal heads in Yakima River in sec. 28, T. 11 N., R. 20 E., near Toppenish. Like the Old Reservation canal, it was built from a fund derived from the sale of the Wenaché fisheries. It irrigates about 2,300 acres in the Yakima Indian Reservation. No water was ever appropriated for it. Its average flow is about 10 second-feet.

SUNNYSIDE CANAL NEAR YAKIMA, WASH.

This canal, which is owned and operated by the Washington Irrigation Company, takes water from the east bank of Yakima River, in sec. 28, T. 12 N., R. 19 E., nearly opposite the intake of the Old Reservation canal No. 1. It is several times larger than any other canal in the Yakima region, the maximum flow being about 630 second-feet. Six discharge measurements were taken at the headworks during the summer. Miscellaneous measurements and gage readings were taken at eight other places along the canal, for the purpose of obtaining seepage and wastage from the canal. The latter never exceeded 2 per cent, and very little of this amount found its way directly to the river. On June 10 a seepage experiment was made upon a stretch of the canal extending from the headworks to Zillah, a distance of 17 miles. The result showed a seepage loss of 4.5 per cent in this distance. Previous to this experiment all the laterals leading from the canal were closed and the canal allowed to regulate itself for twelve hours. The measurements at the beginning and end of the stretch were both taken by the same meter, and all chances of error eliminated. The section experimented upon is the oldest section of the canal, excavated in very fine volcanic soil. There has also

been deposited from time to time a fine silt of a clayish nature, which serves to make the banks more or less impervious to water. The first experiment was checked upon August 15, by a similar test over the same section, with the finding of a loss of 4 per cent due to seepage.

It is interesting to compare this with a seepage test made upon the first 9 miles of the Kennewick canal later, where the loss due to seepage was found to be 26 per cent. (See p. 138.)

The value of the water right on the basis of a duty of 160 acres per second-foot is $30 per acre. The value of the land, with the water right attached, is $60 to $90 per acre.

Discharge measurements of Sunnyside canal near Yakima, Wash., in 1904.

Date.	Hydrographer.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Sq. feet.	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
April 22	G. H. Bliss	153	3.05	2.54	467
May 26	do	184	3.00	3.18	553
June 10	do	160	3.04	2.79	[a] 487
July 2	G. F. Harley	202	3.12	3.62	630
August 15	G. H. Bliss	192	2.93	3.33	[b] 564
August 16	do	206	3.09	3.50	[c] 636

[a] 4.5 per cent seepage in 17 miles.
[b] 4 per cent seepage in 17 miles.
[c] Integration method at bridge.

Mean daily gage height, in feet, of Sunnyside canal near Yakima, Wash., for 1904.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1	.....	2.96	3.25	3.54	3.46	3.37	2.53
2	.....	2.96	3.25	3.62	3.46	3.37	2.53
3	.....	2.96	3.25	(a)	3.46	3.37	2.53
4	.....	2.96	3.25	(a)	3.46	3.37	2.54
5	.....	2.96	3.25	(a)	3.50	3.37	2.52
6	.....	3.04	3.25	(a)	3.54	3.35	2.50
7	.....	3.04	3.25	(a)	3.54	3.33	2.50
8	.....	3.04	3.21	2.17	3.54	3.29	2.50
9	.....	3.04	2.79	2.65	3.54	3.29	2.50
10	.....	2.00	2.79	3.29	3.54	3.29	2.46
11	.....	3.04	3.12	3.33	3.54	3.29	2.33
12	.....	3.04	3.12	3.37	3.54	3.25	2.33
13	.....	3.04	3.06	3.41	3.55	3.12	2.33
14	.....	3.04	3.06	3.46	3.56	3.08	2.23
15	.....	3.04	3.14	3.46	3.33	3.04	2.23
16	.....	3.10	3.17	3.46	3.58	2.79	.....
17	.....	3.08	3.19	3.46	3.56	2.79	.....
18	.....	3.10	3.29	3.46	3.56	2.79	.....
19	.....	3.12	3.29	3.46	3.56	2.79	.....
20	.....	3.12	3.29	3.46	3.56	2.79	.....
21	.....	3.12	3.33	3.46	3.56	2.79	.....

[a] Water shut off.

Mean daily gage height, in feet, of Sunnyside canal near Yakima, Wash., for 1904—Continued.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
22	2.54	3.12	3.35	3.46	3.56	2.79	.....
23	2.79	3.12	3.35	3.46	3.56	2.79	.....
24	2.83	3.12	3.42	3.46	3.56	2.75	.....
25	2.83	3.14	3.39	3.46	3.56	2.71	.....
26	2.83	3.18	3.54	3.46	3.56	2.71	.....
27	2.83	3.19	3.46	3.46	3.56	2.71	.....
28	2.90	3.25	3.46	3.46	3.56	2.62	.....
29	2.92	3.25	3.50	3.46	3.53	2.62	.....
30	2.95	3.25	3.54	3.46	3.50	2.62	.....
31	.....	3.25	.....	3.46	3.44	.....	.....

Mean daily discharge, in second-feet, of Sunnyside canal near Yakima, Wash., for 1904.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1	.....	513	558	613	597	580	468
2	.....	513	558	629	597	580	468
3	.....	513	558	0	597	580	468
4	.....	513	558	0	597	580	464
5	.....	513	558	0	605	580	462
6	.....	525	558	0	613	576	460
7	.....	525	558	0	613	572	460
8	.....	525	552	433	613	565	460
9	.....	525	491	475	613	565	460
10	.....	419	491	565	613	565	456
11	.....	525	537	572	613	565	445
12	.....	525	537	580	613	558	445
13	.....	525	528	587	615	537	445
14	.....	525	528	597	617	531	442
15	.....	525	540	597	572	525	442
16	.....	534	545	597	621	491	.....
17	.....	531	548	597	617	491	.....
18	.....	534	565	597	617	491	.....
19	.....	537	565	597	617	491	.....
20	.....	537	565	597	617	491	.....
21	.....	537	572	597	617	491	.....
22	464	537	576	597	617	491	.....
23	491	537	576	597	617	491	.....
24	496	537	589	597	617	486	.....
25	496	540	583	597	617	481	.....
26	496	547	613	597	617	481	.....
27	496	548	597	597	617	481	.....
28	505	558	597	597	617	472	.....
29	508	558	605	597	617	472	.....
30	512	558	613	597	605	472	.....
31	.....	558	.....	597	593	.....	.....

Rating table for Sunnyside canal near Yakima, Wash., from April 22 to October 15, 1904.

Gage height.	Discharge.	Gage height.	Discharge	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
2.00	419	2.45	455	2.90	505	3.35	576
2.05	423	2.50	460	2.95	512	3.40	585
2.10	427	2.55	465	3.00	519	3.45	595
2.15	431	2.60	470	3.05	526	3.50	605
2.20	435	2.65	475	3.10	534	3.55	615
2.25	439	2.70	480	3.15	542	3.60	625
2.30	443	2.75	486	3.20	550	3.65	636
2.35	447	2.80	492	3.25	558	3.70	647
2.40	451	2.85	498	3.30	567	3.75	658

The above table is based upon 6 discharge measurements made during 1904. It is fairly well defined between gage heights 2.50 feet and 3.60 feet.

Estimated monthly discharge of Sunnyside canal near Yakima, Wash., for 1904.

[Irrigated area, 35,000 acres.]

Month.	Discharge in second-feet.			Total in acre-feet.	Depth of run-off in inches, over irrigated area.
	Maximum.	Minimum.	Mean.		
April 16-30[a]	512	464	496	14,760	5.06
May	558	419	529	32,530	11.2
June	613	491	561	33,380	11.5
July[b]	629	433	585	30,170	10.3
August	617	572	610	37,510	12.9
September	580	472	524	31,180	10.7
October 1-15	468	442	456	13,570	4.65
The period	629	419	547	193,100	66.3

[a] Estimated April 16-21. [b] Water shut off 5 days.

GILBERT CANAL NEAR TOPPENISH, WASH.

This canal heads in a slough from Yakima River in sec. 19, T. 11 N., R. 20 E., in the Yakima Indian Reservation. It was built by an association of men who lease lands from the Indians. At the expiration of the lease the canal belongs to the land through which it runs. A large part, probably 50 per cent, of the water taken into the canal is wasted into sloughs which drain into the river. No appropriation of water has been made and no water right acquired.

Discharge measurements of Gilbert canal near Toppenish, Wash., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
June 9 [a]	G. F. Harley	14	23	2.30	1.60	53
September 6 [b]	do	7	7.6	1.62	1.04	12.3
September 6 [c]	do	6	2.9	.86	.40	2.5

[a] Main branch. [b] East branch. [c] West branch.

Mean daily gage height, in feet, of Gilbert canal (east branch) near Toppenish, Wash., for 1904.

Day.	June. [a]	July.	Aug.	Sept.	Day.	June. [a]	July.	Aug.	Sept.
1	1.79	1.75	1.42	1.25	17	1.83	1.33	1.67	.....
2	1.75	1.75	1.42	1.17	18	1.83	1.29	1.42	.....
3	1.75	1.75	1.37	1.08	19	1.79	1.29	1.58	.....
4	1.75	1.42	1.37	1.06	20	1.79	1.33	1.58	.....
5	1.75	1.42	1.33	1.05	21	1.83	1.50	1.42	.....
6	1.79	1.54	1.33	1.04	22	1.87	1.50	1.17	.....
7	1.79	1.67	1.33	.....	23	1.92	1.67	1.08	.....
8	1.67	1.42	1.50	.....	24	1.67	1.50	1.00	.....
9	1.62	1.25	1.50	.....	25	1.67	1.50	1.17	.....
10	1.58	1.25	1.75	.....	26	1.67	1.67	1.00	.....
11	1.58	1.25	1.71	.....	27	1.67	1.75	.96	.....
12	1.58	1.33	1.42	.....	28	1.67	1.75	.92	.....
13	1.58	1.33	1.33	.....	29	1.75	1.67	.92	.....
14	1.62	1.37	1.42	.....	30	1.75	1.67	1.25	.....
15	1.67	1.37	1.42	.....	31	.....	1.58	(b)	.....
16	1.79	1.33	1.50	.....					

[a] June 1 to 23, gage above the forks. [b] Water shut off.

Mean daily discharge, in second-feet, of Gilbert canal (east branch) near Toppenish, Wash., for 1904.

Day.	June.	July.	Aug.	Sept.	Day.	June.	July.	Aug.	Sept.
1	58	35	20	15	17	60	17	30	.....
2	57	35	20	14	18	60	16	20	.....
3	57	35	18	13	19	58	16	25	.....
4	57	20	18	13	20	58	17	25	.....
5	57	20	17	12	21	60	22	20	.....
6	58	23	17	12	22	62	22	14	.....
7	58	30	17	.....	23	65	30	13	.....
8	55	20	22	.....	24	30	22	12	.....
9	53	15	22	.....	25	30	22	14	.....
10	51	15	35	.....	26	30	30	12	.....
11	51	15	32	.....	27	30	35	11	.....
12	51	17	20	.....	28	30	35	11	.....
13	51	17	17	.....	29	35	30	11	.....
14	53	18	20	.....	30	35	30	15	.....
15	55	18	20	.....	31	.....	25	0	.....
16	58	17	22	.....					

Mean daily gage height, in feet, of Gilbert canal (west branch) near Toppenish, Wash., for 1904.

Day.	June.[a]	July.	Aug.	Sept.	Day.	June.[a]	July.	Aug.	Sept.
1		1.33	1.00	0.58	17		1.17	1.00	
2		1.33	1.00	.50	18		1.08	.92	
3		1.33	1.00	.54	19		1.17	1.00	
4		1.17	1.00	.50	20		1.17	1.00	
5		1.17	1.00	.45	21		1.00	.92	
6		1.50	1.00	.40	22		1.00	.67	
7		1.42	1.00		23		1.08	.58	
8		1.25	1.00		24	1.33	1.00	.54	
9		1.17	1.00		25	1.33	1.00	.58	
10		1.17	1.00		26	1.33	1.00	.50	
11		1.17	1.00		27	1.33	1.08	.50	
12		1.25	.92		28	1.33	1.17	.50	
13		1.25	.83		29	1.37	1.17	.50	
14		1.25	.92		30	1.33	1.08	.58	
15		1.25	.92		31		1.00	(b)	
16		1.17	1.00						

[a] June 1 to 23, gage above the forks.

[b] Water shut off.

Mean daily discharge, in second-feet, of Gilbert canal (west branch) near Toppenish, Wash., for 1904.

Day.	June.	July.	Aug.	Sept.	Day.	June.	July.	Aug.	Sept.
1		35	12	4	17		25	12	
2		35	12	3	18		19	9	
3		35	12	3.5	19		25	12	
4		25	12	3.0	20		25	12	
5		25	12	2.6	21		12	9	
6		47	12	2.5	22		12	5	
7		41	12		23		19	4	
8		30	12		24	35	12	4	
9		25	12		25	35	12	4	
10		25	12		26	35	12	3	
11		25	12		27	35	19	3	
12		30	9		28	35	25	3	
13		30	7		29	36	25	3	
14		30	9		30	35	19	4	
15		30	9		31		12	0	
16		25	12						

Estimated monthly discharge[a] of Gilbert canal near Toppenish, Wash., for 1904.

[Irrigated area, 3,000 acres.]

Month.	Discharge in second-feet.			Total in acre-feet.	Depth of run-off in inches, over irrigated area.
	Maximum.	Minimum.	Mean.		
April 16–30[b]	.....	.....	25.0	744	2.98
May	.....	.....	40.0	2,460	9.84
June	71	51	58.9	3,505	14.0
July	71	34	47.9	2,945	11.8
August[c]	47	14	28.6	1,702	6.81
September[d]	19	15	17.0	1,012	4.05
October 1–15	.....	.....	10.0	298	1.19
The period	71	14	35.1	12,670	50.7

[a] Approximate.
[b] Estimated April 16 to May 31.
[c] Water shut off one day.
[d] Estimated September 7 to October 15.

HATCH CANAL NEAR TOPPENISH, WASH.

This canal is also called the Alfalfa Siding canal. It heads in a slough from Yakima River on its right bank near Toppenish in sec. 30, T. 10 N., R. 21 E. The status of this canal as regards ownership and water rights is the same as that of the Gilbert canal above. No gaging station was maintained on it. Two discharge measurements were taken with the following results:

Discharge measurements of Hatch canal near Toppenish, Wash., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Second-feet.*
June 9	G. F. Harley	6	6.1	2.10	12.8
September 6	do	6	4.0	1.00	4.0

PROSSER FALLS IRRIGATION COMPANY'S POWER CANAL AT PROSSER, WASH.

This company pumps water from Yakima River at Prosser, to be used for domestic purposes and irrigation. The water is carried to the wheels of the pumps by a flume 12 feet wide and a mean depth of water of about 6 feet, carrying on an average 205 second-feet of water when both pumps are running. Most of this amount of water is only used for the power purposes, however, and is spilled directly back into the river and is immediately available for irrigation lower down the valley.

The pumping plant consists of two Smith-Vaile pumps, of two cylinders each, of inside diameter of 25 inches and length of stroke of 24 inches. Diameter of wheel, 52 inches.

The average amount of water pumped is about 15 second-feet, or only about 7 per cent of the amount passing through the flume.

Discharge measurements of Prosser Falls Irrigation Company's power canal at Prosser, Wash., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
May 30	G. F. Harley	12	108	1.93	22.44	210
July 26	do	12	71	2.94	19.05	209
August 11	do	12	55	4.03	17.65	222
September 10	do	12	49	3.96	17.20	194
September 17	G. H. Bliss	12	61	2.85	18.25	175

[a] Change in velocities due to change in stage of river.

Mean daily discharge, in second-feet, of Prosser Falls Irrigation Company's power canal at Prosser, Wash., for 1904.

Day.	May.	June.	July.	Aug.	Sept.	Oct.
1	.....	210	216	205	194	209
2	.....	0	216	209	194	209
3	.....	0	216	200	194	209
4	.....	210	216	200	194	209
5	.....	210	216	200	194	209
6	.....	210	216	200	194	209
7	.....	210	216	200	194	209
8	.....	210	216	212	194	209
9	.....	210	216	212	194	209
10	.....	210	216	212	194	209
11	.....	210	212	212	194	.....
12	.....	210	212	212	194	.....
13	.....	210	212	212	194	.....
14	.....	210	212	212	194	.....
15	.....	210	212	210	194	.....
16	.....	210	212	210	194	.....
17	.....	210	210	200	194	.....
18	.....	216	210	200	194	.....
19	.....	216	210	200	194	.....
20	.....	216	210	194	194	.....
21	.....	216	210	194	194	.....
22	.....	216	210	194	194	.....
23	.....	216	209	194	194	.....
24	.....	216	209	194	194	.....
25	.....	220	209	194	194	.....
26	.....	220	209	194	194	.....
27	.....	220	209	194	194	.....
28	.....	220	209	194	200	.....
29	.....	220	204	194	200	.....
30	210	220	204	194	200	.....
31	210	.....	204	194	.....	.....

Estimated monthly discharge of Prosser Falls Irrigation Company's power canal at Prosser, Wash., for 1904.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
April 16–30	.....	.....	190	5,653
May	.....	.....	210	12,910
June	220	210	214	12,730
July	216	204	212	13,040
August	212	194	201	12,360
September	200	194	195	11,600
October 1–15	209	209	209	6,218
The period	220	194	205	74,510

Mean daily discharge,[a] in second-feet, of Prosser Falls Irrigation Company's irrigating canal at Prosser, Wash., for 1904.

Day.	May.	June.	July.	Aug.	Sept.	Oct.
1	.....	14.7	15.8	14.5	14.9	14.9
2	.....	(b)	15.8	14.5	14.9	14.9
3	.....	(b)	15.8	13.5	14.9	14.9
4	.....	14.9	15.8	13.5	14.9	14.9
5	.....	14.9	15.8	13.5	14.9	14.9
6	.....	14.9	15.8	13.5	14.9	14.9
7	.....	14.9	15.8	13.5	14.9	14.9
8	.....	14.9	15.8	14.5	14.9	14.9
9	.....	14.9	15.8	14.5	14.9	13.5
10	.....	14.9	15.8	14.5	14.9	13.5
11	.....	14.5	15.8	14.5	14.9	.....
12	.....	14.5	15.8	14.5	14.9	.....
13	.....	14.5	15.8	14.5	14.9	.....
14	.....	14.5	15.8	14.5	14.9	.....
15	.....	14.7	15.4	14.5	14.9	.....
16	.....	14.7	15.4	14.5	14.9	.....
17	.....	14.7	15.4	14.5	14.9	.....
18	.....	15.5	15.4	14.5	14.9	.....
19	.....	15.5	15.4	14.5	14.9	.....
20	.....	15.8	15.4	14.5	14.9	.....
21	.....	15.8	15.4	14.5	14.9	.....
22	.....	15.8	15.4	14.5	14.9	.....
23	.....	15.8	15.4	14.5	14.9	.....
24	.....	15.8	15.4	14.9	14.9	.....
25	.....	16.3	15.4	14.9	14.9	.....
26	.....	16.3	15.4	14.9	14.9	.....
27	.....	16.3	15.4	14.9	14.9	.....
28	.....	16.3	15.4	14.9	14.9	.....
29	.....	16.3	15.4	14.9	14.9	.....
30	14.5	16.3	15.4	14.9	14.9	.....
31	14.5	.....	15.4	14.9	.....	.....

[a] Computed from revolutions of the pumps. [b] Pumps not running.

Estimated monthly discharge[a] of Prosser Falls Irrigation Company's irrigating canal at Prosser, Wash., for 1904.

[Irrigated area, 1,200 acres.]

Month.	Discharge in second-feet.			Total in acre-feet.	Depth of run-off in inches, over irrigated area.
	Maximum.	Minimum.	Mean.		
April 16–30	.....	.....	14.5	431	4.31
May	.....	.....	14.5	892	8.92
June[b]	16.3	14.7	15.1	898	8.98
July	15.8	15.4	15.6	959	9.59
August	14.9	13.5	14.4	885	8.85
September	14.9	14.9	14.9	887	8.87
October 1–15	.....	.....	14.6	434	4.34
The period	16.3	13.5	14.8	5,386	53.9

[a] Included in discharge of Power canal. [b] Water shut off two days.

LEDBETTER CANAL NEAR PROSSER, WASH.

This canal heads into Yakima River, above the falls at Prosser, just opposite the intake of the Prosser Falls Irrigation Company's flume. The canal has never been completed, and that part of it which had already been constructed has been allowed to fall into a dilapidated condition.

The proposed canal contemplated the irrigation of about 125,000 acres of land lying north and east of the Rattlesnake Range in the Columbia Valley and 25,000 acres additional lying upon the right bank of Yakima River above that covered by the Kennewick canal.

During the season of 1904 there were 3 or 4 miles in use by farmers who maintained it for the benefits derived, and a total acreage covered of about 360 acres.

No measurements were taken upon the canal.

KIONA CANAL NEAR KIONA, WASH.

This canal heads in the left bank of Yakima River about 4 miles west of Kiona in sec. 10, T. 9 N., R. 26 E. The canal is controlled by the Northern Pacific Irrigation Company. On account of the shifting of the channel at the gaging station the estimates of discharge of this canal are only approximate. Less than 5 per cent of the water taken in at the head-gates was wasted directly into the river.

Discharge measurements of Kiona canal near Kiona, Wash., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec. feet.*
April 14	G. H. Bliss	8	7.4	1.37	1.10	10.2
June 3	G. F. Harley	8	14.2	1.41	2.55	20.1
September 8	do	8	13.5	1.11	2.60	15.0

Mean daily gage height, in feet, of Kiona canal near Kiona, Wash., for 1904.

Day.	June.	July.	Aug.	Sept.	Oct.	Day.	June.	July.	Aug.	Sept.	Oct.
1	.....	2.52	2.58	2.67	2.67	17	2.50	2.42	2.54	2.71	.....
2	.....	2.58	2.67	2.67	2.75	18	2.50	2.33	2.50	2.71	.....
3	.....	2.67	2.58	2.67	2.83	19	2.54	2.50	2.46	2.71	.....
4	.....	(a)	2.50	2.67	2.71	20	2.56	2.50	2.46	2.71	.....
5	.....	2.67	2.44	2.67	2.71	21	2.62	2.50	2.46	2.71	.....
6	.....	2.64	2.42	2.67	2.71	22	2.60	2.46	2.50	2.75	.....
7	2.62	2.64	2.42	2.67	2.71	23	2.58	2.42	2.54	2.79	.....
8	2.62	2.64	2.44	2.67	2.71	24	2.58	2.33	2.62	2.67	.....
9	2.54	2.62	2.46	2.67	2.71	25	2.58	2.50	2.67	2.67	.....
10	2.50	2.62	2.39	2.67	2.71	26	2.50	2.58	2.67	2.67	.....
11	2.48	2.62	2.39	2.67	2.71	27	2.42	2.62	2.67	2.67	.....
12	2.37	2.60	2.33	2.71	2.71	28	2.50	2.62	2.67	2.67	.....
13	2.33	2.58	2.33	2.71	2.71	29	2.50	2.54	2.67	2.67	.....
14	2.50	2.58	2.33	2.71	2.71	30	2.50	2.56	2.67	2.67	.....
15	2.50	2.54	2.54	2.71	2.71	31	.....	2.56	2.67	.....	.....
16	2.50	2.54	2.54	2.71	2.71						

[a] Water shut off.

Mean daily discharge, in second-feet, of Kiona canal near Kiona, Wash., for 1904.

Day.	June.	July.	Aug.	Sept.	Oct.	Day.	June.	July.	Aug.	Sept.	Oct.
1	.....	20	21	19	19	17	20	18	20	21	.....
2	.....	21	24	19	23	18	20	17	20	21	.....
3	.....	24	21	19	25	19	20	20	19	21	.....
4	.....	0	20	19	21	20	21	20	19	21	.....
5	.....	24	18	19	21	21	23	20	19	21	.....
6	.....	24	18	19	21	22	22	19	20	23	.....
7	23	24	18	19	21	23	21	18	20	24	.....
8	23	24	18	19	21	24	21	17	16	19	.....
9	20	23	19	19	21	25	21	20	19	19	.....
10	20	23	17	19	21	26	20	21	19	19	.....
11	19	23	17	19	21	27	18	23	19	19	.....
12	18	22	17	21	21	28	20	23	19	19	.....
13	17	21	17	21	21	29	20	20	19	19	.....
14	20	21	17	21	21	30	20	21	19	19	.....
15	20	20	20	21	21	31	.....	21	19	.....	.....
16	20	20	20	21	21						

Estimated monthly discharge of Kiona canal near Kiona, Wash., for 1904.

[Irrigated area, 800 acres.]

Month.	Discharge in second-feet.			Total in acre-feet.	Depth of run-off in inches, over irrigated area.
	Maximum.	Minimum.	Mean.		
April 16–30 [a]	.....	.....	17.0	506	7.59
May	.....	.....	20.0	1,230	18.4
June	23	17	20.0	1,190	17.8
July [b]	24	17	21.1	1,256	18.8
August	24	17	19.0	1,168	17.5
September	24	19	20.3	1,208	18.1
October 1–15	25	19	21.3	634	9.51
The period	25	17	19.9	7,192	107.7

[a] Estimated April 15 to June 6th. [b] Water shut off one day.

KIONA WATER SUPPLY COMPANY'S CANAL NEAR KIONA, WASH.

This canal heads in the left bank of Yakima River, just above Kiona. It is owned by a stock company of 150 shares. It is a power canal used to turn small irrigating wheels. Nearly all the water taken in at the head is returned to the river. The discharge as measured June 6 was 18.5 second-feet.

KENNEWICK CANAL NEAR KENNEWICK, WASH.

This canal is owned and operated by the Northern Pacific Irrigation Company. Next to the Sunnyside it is the largest irrigation canal in the Yakima Valley. It takes water from the Yakima River on its right bank just above Horn Rapids, about 11 miles north of Kiona, in sec. 3, T. 10 N., R. 27 E. Besides two measurements taken at the head-gates, various other points along the canal were measured in order to determine the amount of water wasted and the loss due to seepage. The water wasted directly into the river was found to be about 15 per cent of the discharge at the intake, of which about 10 per cent was spilled into Columbia River.

Careful measurements taken September 9 at two points 8 miles apart near the upper end of the canal showed a seepage of 26 per cent in this distance. All the laterals along this stretch had been tightly closed and the canal allowed to regulate itself before the measurements were made. Over the stretch tested the canal is excavated in sand and gravel for almost the entire distance, differing in this respect from the Sunnyside canal. The Kennewick canal is also of more recent construction.

Discharge measurements of Kennewick canal near Kennewick, Wash., in 1904.

Date	Hydrographer.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Sq. feet.	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
June 4	G. F. Harley	58	1.65	2.71	96
September 9	do	75	1.64	3.20	123
September 9[a]	do	28	3.25	[b]2.10	91

[a] Seepage test, flume No. 1. [b] Gage in flume.

Mean daily gage height, in feet, of Kennewick canal near Kennewick, Wash., for 1904.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1	.....	2.38	2.75	3.1	3.2	3.3	3.2
2	.....	2.38	2.75	3.1	3.2	3.2	3.2
3	.....	2.38	2.75	3.1	3.1	3.2	3.2
4	.....	2.38	2.75	3.1	3.3	3.2	3.2
5	.....	2.38	2.75	3.1	3.3	3.2	3.2
6	.....	2.38	2.75	3.1	3.3	3.2	3.2
7	.....	2.38	2.79	3.1	3.25	3.2	3.1
8	1.00	2.38	2.79	3.1	3.35	3.2	3.1
9	1.33	2.38	2.87	3.1	3.2	3.2	3.1
10	1.50	2.46	2.92	3.1	3.4	3.2	3.1
11	2.17	2.46	2.25	3.1	3.4	3.2	3.1
12	2.17	2.46	2.25	3.1	2.9	3.2	3.1
13	2.17	2.50	2.25	3.1	3.3	3.2	3.1
14	2.17	2.50	2.50	3.1	3.4	3.2	3.1
15	2.17	2.58	2.42	3.1	3.4	3.2	3.1
16	2.17	2.67	3.0	3.1	3.4	3.2	3.1
17	2.17	2.67	3.0	3.1	3.4	3.2	3.1
18	2.17	2.67	3.0	3.1	3.4	3.2	3.1
19	2.17	2.67	3.0	3.0	3.0	3.2	(a)
20	2.17	2.67	3.1	2.9	3.15	3.2	(a)
21	2.21	2.67	2.8	2.9	3.15	3.2	3.0
22	2.21	2.67	2.8	2.85	3.4	3.2	3.0
23	2.21	2.67	3.0	3.00	3.4	3.2	3.1
24	2.21	2.67	3.1	2.95	3.4	3.25	3.0
25	2.17	2.75	3.1	2.80	3.3	3.25	2.9
26	.83	2.75	3.1	2.75	3.3	3.25	2.9
27	1.00	2.75	3.1	2.75	3.25	3.25	3.0
28	2.50	2.75	3.1	2.60	3.2	3.25	3.0
29	2.50	2.75	3.1	2.70	3.3	3.2	2.9
30	2.50	2.75	3.1	2.90	3.3	3.2	2.9
31	.....	2.75	.....	3.00	3.2	.....	2.9

[a] Water shut off.

Mean daily discharge, in second-feet, of Kennewick canal near Kennewick, Wash., for 1904.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1	.....	73	98	123	125	127	125
2	.....	73	98	123	125	125	125
3	.....	73	98	123	123	125	125
4	.....	73	98	123	127	125	125
5	.....	73	98	123	127	125	125
6	.....	73	98	123	127	125	125
7	.....	73	102	123	126	125	123
8	10	73	102	123	128	125	123
9	18	73	106	123	125	125	123
10	20	77	110	123	129	125	123
11	59	77	63	123	129	125	123
12	59	77	63	123	110	125	123
13	59	80	63	123	127	125	123
14	59	80	80	123	129	125	123
15	59	87	75	123	129	125	123
16	59	92	116	123	129	125	123
17	59	92	116	123	129	125	123
18	59	92	116	123	129	125	123
19	59	92	116	116	116	125	0
20	59	92	123	110	124	125	0
21	48	92	102	110	124	125	116
22	48	92	102	105	129	125	116
23	48	92	116	116	129	125	123
24	48	92	123	112	129	126	116
25	59	98	123	102	127	126	110
26	8	98	123	98	127	126	110
27	10	98	123	98	126	126	116
28	80	98	123	116	125	126	116
29	80	98	123	94	127	125	110
30	80	98	123	110	127	125	110
31	.....	98	.....	116	125	.....	110

Estimated monthly discharge of Kennewick canal near Kennewick, Wash., for 1904.

[Irrigated area, 6,000 acres.]

Month.	Discharge in second-feet.			Total in acre-feet.	Depth of run-off in inches, over irrigated area.
	Maximum.	Minimum.	Mean.		
April 16–30	59	8	53.6	1,595	3.19
May	98	73	85.5	5,257	10.5
June	123	63	101	6,010	12.0
July	123	94	117	7,194	14.4
August	129	110	126	7,747	15.5
September	127	125	126	7,498	15.0
October 1–15	125	123	124	3,690	7.38
The period	129	8	107	38,990	78.0

GROSSCUP'S CANAL NEAR KIONA, WASH.

This canal is sometimes called the Lower Yakima canal. It heads into Yakima River upon its left bank, at Horn Rapids directly opposite the intake of the Kennewick canal. The same diversion weir is used for both canals, as is also the same water appropriation.

During the season of 1904, 5½ miles were constructed, but no water used for irrigation purposes. The canal as constructed is owned and operated by Mr. Grosscup. The Northern Pacific Irrigation Company, of whom the right of way was secured, reserve the right to extend the canal at any time and to supply the present owner with what water he needs.

SINCLAIR AND COBB CANAL NEAR NORTH YAKIMA, WASH.

There are no canals of any consequence taking water from Tieton River. A small irrigating canal heads in Tieton River on its left bank, about 3 miles above its mouth. It is owned and operated by Sinclair and Cobb, and carries about 5 second-feet of water. The total discharge of Tieton River therefore flows practically unused into Naches River.

SELAH VALLEY CANAL NEAR NORTH YAKIMA, WASH.

The only important canal taking water from Naches River above the mouth of the Tieton is the Selah Valley canal. There are a few canals above the Selah Valley, but they are small private ditches, and their combined flow would probably not exceed 15 second-feet.

The Selah Valley canal heads in Naches River on its left bank about 1 mile above the mouth of the Tieton in sec. 35, T. 15 N., R. 16 E. With the exception of the Powe: canal it is the largest canal taking water from the Naches. The canal ends in the sandy prairie some distance from the river. The wasteways are for emergencies only. Very little water is wasted directly into the river.

Discharge measurements of Selah Valley canal near North Yakima, Wash., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
April 27	G. F. Harley	14	14.0	1.60	2.05	22.4
June 8	do	13	12.6	1.44	1.94	18.2
July 9	do	15	18.9	1.66	2.36	31.6
July 9	do	16	24.7	1.91	2.76	47.6
July 9	do	17	31.3	2.14	3.17	66.9
July 15	do	17	36.7	2.30	3.48	84.4
August 12	do	7	17.5	3.17	.....	[a] 54.4

[a] "Twin Flume" 5 miles below the head-gates.

Mean daily gage height, in feet, of Selah Valley canal near North Yakima, Wash., for 1904.

Day.	May.	June.	July.	Aug.	Sept.	Oct.
1	.....	3.50	3.50	3.42	3.54	3.00
2	.....	3.50	3.50	3.50	3.54	3.00
3	.....	3.50	3.50	3.50	3.54	3.00
4	.....	3.50	3.50	3.50	3.54	3.00
5	.....	3.50	2.00	3.50	3.54	3.00
6	.....	3.50	2.00	3.50	3.54	3.00
7	.....	3.50	2.00	3.50	3.54	3.00
8	.....	3.50	2.00	3.50	3.54	3.00
9	.....	3.50	2.50	3.58	3.54	3.00
10	.....	3.50	2.67	3.58	3.54	3.00
11	.....	3.50	2.67	3.58	3.54	3.00
12	.....	3.50	2.83	3.50	3.54	3.00
13	.....	3.50	3.17	3.42	3.54	3.00
14	.....	3.42	3.50	3.58	3.54	3.00
15	.....	3.50	3.50	3.58	3.54	3.00
16	.....	3.50	3.33	3.58	3.54	.....
17	.....	3.50	3.25	3.58	3.50	.....
18	.....	3.50	3.42	3.58	3.50	.....
19	0.50	3.50	3.42	3.58	3.50	.....
20	0.50	3.50	3.50	3.58	3.33	.....
21	2.33	3.50	3.50	3.58	3.33	.....
22	2.92	3.50	3.50	3.58	3.33	.....
23	3.17	3.42	3.50	3.58	3.33	.....
24	3.33	3.42	3.50	3.58	3.33	.....
25	3.17	3.42	3.50	3.58	3.33	.....
26	3.17	3.50	3.50	3.54	3.25	.....
27	3.33	3.50	3.50	3.54	3.17	.....
28	3.42	3.50	3.50	3.54	3.00	.....
29	3.42	3.50	3.50	3.54	3.00	.....
30	3.42	3.50	3.50	3.54	3.00	.....
31	3.50	.....	3.50	3.54	.....	.....

Mean daily discharge, in second-feet, of Selah Valley canal near North Yakima, Wash., for 1904.

Day.	May.	June.	July.	Aug.	Sept.	Oct.
1	.....	84	84	79	87	60
2	.....	84	84	84	87	60
3	.....	84	84	84	87	60
4	.....	84	84	84	87	60
5	.....	84	20	84	87	60
6	.....	84	20	84	87	60
7	.....	84	20	84	87	60
8	.....	84	20	84	87	60
9	.....	84	37	89	87	60
10	.....	84	43	89	87	60
11	.....	84	43	89	87	60
12	.....	84	52	84	87	60
13	.....	84	79	79	87	60
14	.....	79	84	89	87	60
15	.....	84	84	89	87	60
16	.....	84	77	89	87	60

Mean daily discharge, in second-feet, of Selah Valley canal near North Yakima, Wash., for 1904—Continued.

Day.	May.	June.	July	Aug.	Sept.	Oct.
17	.....	84	72	89	84	48
18	.....	84	79	89	84	43
19	2	84	79	89	84	43
20	2	84	84	89	77	.....
21	31	84	84	89	77	.....
22	55	84	84	89	77	.....
23	67	79	-	89	77	.....
24	77	79	84	89	77	.....
25	67	79	84	89	77	.....
26	67	84	84	87	72	.....
27	77	84	84	87	67	.....
28	79	84	84	87	60	.....
29	79	84	84	87	60	.....
30	79	84	84	87	60	.....
31	84	.....	84	87	.....	.....

Rating table for Selah Valley canal near North Yakima, Wash., from May 19 to October 15, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.80	15.1	2.30	29.7	2.75	47.6	3.20	69.4
1.85	16.3	2.35	31.4	2.80	49.9	3.25	71.8
1.90	17.6	2.40	33.1	2.85	52.3	3.30	74.3
1.95	19.0	2.45	34.9	2.90	54.7	3.35	76.7
2.00	20.4	2.50	36.8	2.95	57.1	3.40	79.2
2.05	21.9	2.55	38.8	3.00	59.6	3.45	81.6
2.10	23.4	2.60	40.9	3.05	62.0	3.50	84.1
2.15	24.9	2.65	43.1	3.10	64.5	3.55	86.5
2.20	26.5	2.70	45.3	3.15	66.9	3.60	89.0
2.25	28.1						

This table is based upon 6 discharge measurements made during 1904. It is well defined between gage heights 2.00 feet and 3.50feet. The table has been extended beyound these limits.

Estimated monthly discharge of Selah Valley canal near North Yakima, Wash., for 1904.

[Irrigated area, 6,000 acres.]

Month.	Discharge in second-feet.			Total in acre-feet.	Depth of run-off in inches, over irrigated area.
	Maximum.	Minimum.	Mean.		
April 16–30[a]			45.0	1,339	2.68
May			59.0	3,511	7.04
June	84	79	83.3	4,957	9.91
July	84	20	69.5	4,273	8.55
August	89	79	86.7	5,331	10.7
September	87	60	80.8	4,808	9.62
October 1–15	60	60	60.0	1,785	3.57
The period	89	60	72.0	26,000	52.1

[a] Estimated April 16 to May 18.

WAPATOX CANAL NEAR NORTH YAKIMA, WASH.

This canal heads in the left bank of Naches River opposite the mouth of the Tieton in sec. 36, T. 15 N., R. 16 E. It is maintained by a stock company of 100 equal shares. Owing to the fact that the velocity of the current in the canal was greatly influenced by changes in the stage of the river and in the opening of the headgate, the canal was not accurately rated. The estimates of discharge are therefore only approximate.

Discharge measurements of Wapatox canal near North Yakima, Wash., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
May 19	G. F. Harley	9	3.46	0.62	0.42	2.2
July 8	do	9	12.3	.80	1.26	9.9
July 9	do	10	25.3	1.38	2.48	35.
July 16	do	10	19.34	1.45	1.90	27.9
July 28	do	10	22.0	1.50	2.19	33.

Mean daily gage height, in feet, of Wapatox canal near North Yakima, Wash., for 1904.

Day.	May.	June.	July.	Aug.	Sept.	Oct.
1	.....	2.67	2.83	2.25	2.58	1.83
2	.....	2.67	2.75	2.25	2.58	1.83
3	.....	2.67	2.58	2.08	2.50	1.67
4	.....	2.67	2.67	2.00	2.50	1.67
5	.....	2.67	(a)	2.00	2.50	1.67
6	.....	2.67	(a)	2.17	2.50	1.67
7	.....	2.67	(a)	2.33	2.67	1.58
8	.....	2.67	(a)	2.33	2.67	1.50
9	.....	2.58	1.25	2.42	2.67	1.50
10	.....	2.50	2.42	2.33	2.67	1.67
11	.....	2.50	2.42	2.25	2.25	1.17
12	.....	2.50	2.33	2.17	2.25	1.17
13	.....	2.33	2.17	2.67	2.08	1.17
14	.....	2.33	1.83	2.83	2.08	1.17
15	.....	2.17	1.67	2.83	2.00	1.17
16	.....	2.25	1.83	2.83	2.00	1.17
17	.....	2.33	1.83	2.75	2.08	1.08
18	0.42	2.33	1.75	2.67	2.00	1.00
19	.33	2.33	1.92	2.67	2.00	1.00
20	2.33	2.33	1.83	2.67	2.00	.....
21	2.83	2.42	2.00	2.58	2.00	.....
22	3.00	2.42	2.33	2.50	2.00	.....
23	2.83	2.42	2.50	2.67	2.00	.....
24	2.50	2 42	2.33	2.67	1.92	.....
25	2.50	2.50	2.17	2.67	1.83	.....
26	2.67	2.50	2.17	2.67	1.83	.....
27	2.58	2.50	2.25	2.67	1.83	.....
28	2.58	2.67	2.25	2.75	1.83	.....
29	2.58	2.75	2.08	2.58	1.83	.....
30	2.67	2.83	2.00	2.58	1.83	.....
31	2.50	.....	2.17	2.58	.....	.....

(a) Water shut off.

Mean daily discharge, in second-feet, of Wapatox canal near North Yakima, Wash., for 1904.

Day.	May.	June.	July.	Aug.	Sept.	Oct.
1	.....	41	45	31	39	21
2	.....	41	43	31	39	21
3	.....	41	39	27	37	18
4	.....	41	41	25	37	18
5	.....	41	0	25	37	18
6	.....	41	0	29	37	18
7	.....	41	0	33	41	15
8	.....	41	0	33	41	14
9	.....	39	10	35	41	14
10	.....	37	35	33	41	18
11	.....	37	35	31	31	9
12	.....	37	33	29	31	9
13	.....	33	29	41	27	9
14	.....	33	21	45	27	9
15	.....	29	18	45	25	9
16	.....	31	21	45	25	9
17	.....	33	21	43	27	8

Mean daily discharge, in second-feet, of Wapatox canal near North Yakima, Wash., for 1904—Continued.

Day.	May.	June.	July.	Aug.	Sept.	Oct.
18	1	33	19	41	25	7
19	1	33	23	41	25	7
20	33	33	21	41	25	.....
21	45	35	25	39	25	.....
22	49	35	33	37	25	.....
23	45	35	37	41	25	.....
24	37	35	33	41	23	.....
25	37	37	29	41	21	.....
26	41	37	29	41	21	.....
27	39	37	31	41	21	.....
28	39	41	31	43	21	.....
29	39	43	27	39	21	.....
30	41	45	25	39	21	.....
31	37	.....	29	39	.....	.....

Estimated monthly discharge of Wapatox canal near North Yakima, Wash., for 1904.

[Irrigated area, 1,400 acres.]

Month.	Discharge in second-feet.			Total in acre-feet.	Depth of run-off in inches, over irrigated area.
	Maximum.	Minimum.	Mean.		
April 16–30 [a]	.....	.....	20.0	595	5.10
May	.....	.....	40.0	2,460	21.1
June	45	29	37.2	2,214	19.0
July [b]	45	10	29.0	1,553	13.3
August	45	25	37.0	2,275	19.5
September	41	21	26.1	1,553	13.3
October 1–15	21	9	14.8	440	3.77
The period	45	9	31.2	11,090	95.1

[a] Estimated April 15–May 17. [b] Water shut off four days.

SMALL CANALS.

Below the Wapatox and above the Yakima Valley canal a group of small canals take water from both banks of Naches River. They are the Cox, Upper Scott, Lower Scott, Fortune, and Laswell canals on the right bank, and the Clark, Lowery, and Kelly canals on the left bank.

Below the intake of the Yakima Valley canal and above Cowiche Creek six more small ditches head into Naches River, namely: The Morrissey, White and Leach, McCormick, and Shearer and Chapman ditches on the left bank, and the two Rhodenbach Schuler ditches on the right bank.

For data concerning these canals see tables on pages 167–169.

GLEED CANAL NEAR NORTH YAKIMA, WASH.

This is the next large canal below the Wapatox. It is owned by the Naches Canal Company. Its intake is on the left bank of the Naches River about 11 miles from North Yakima in sec. 24, T. 14 N., R. 17 E. Just below the head-gates and below the rating station the canal forks. The lower lateral is owned by an association of farmers who irrigate 400 acres from it, and help maintain the main canal above the fork. This 400 acres is not included in the 1,400 irrigated by the Gleed canal.

Discharge measurements of Gleed canal near North Yakima, Wash., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq.-feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
May 19	G. F. Harley	14	39	1.96	2.41	74
July 9	do	14	23	1.09	1.08	25
August 30	J. C. Dry	14	35	1.40	2.04	49

Mean daily gage height, in feet, of Gleed canal near North Yakima, Wash., for 1904.

Day.	May.	June.	July.	Aug.	Sept.	Oct.
1	.....	2.00	2.58	2.50	2.17	1.33
2	.....	2.33	2.58	2.50	2.17	1.33
3	.....	2.33	2.58	2.50	2.08	1.33
4	.....	2.33	2.58	2.50	2.08	.....
5	.....	2.33	1.00	2.50	2.00	.....
6	.....	2.25	1.17	2.50	1.83	.....
7	.....	2.25	1.33	2.42	1.83	.....
8	.....	2.33	1.33	2.42	2.00	.....
9	.....	2.33	1.33	2.50	2.00	.....
10	.....	2.25	1.17	2.42	2.00	.....
11	.....	2.25	1.08	2.42	2.00	.....
12	.....	2.17	1.67	2.42	1.75	.....
13	.....	2.25	1.83	2.42	1.75	.....
14	.....	2.25	1.83	2.42	1.75	.....
15	.....	2.25	1.83	2.42	1.50	.....
16	.....	2.17	1.83	2.42	1.50	.....
17	.....	2.17	1.83	2.42	1.33	.....
18	.....	2.33	1.75	2.33	1.33	.....
19	2.42	1.83	1.92	2.33	1.33	.....
20	2.50	1.83	2.00	2.33	1.33	.....
21	2.58	2.00	2.00	2.25	1.33	.....
22	2.67	2.00	2.25	2.21	1.33	.....
23	2.00	2.00	2.25	2.17	1.33	.....
24	2.25	2.00	2.33	2.17	1.33	.....
25	2.17	1.83	2.33	2.17	1.33	.....
26	2.33	1.67	2.50	2.17	1.33	.....
27	2.33	1.67	2.50	2.08	1.33	.....
28	2.42	2.25	2.50	2.08	1.33	.....
29	1.00	2.50	2.50	2.00	1.33	.....
30	1.00	2.58	2.50	2.00	1.33	.....
31	2.50	.....	2.50	2.17	.....	.....

Mean daily discharge, in second-feet, of Gleed canal near North Yakima, Wash., for 1904.

Day.	May.	June.	July.	Aug.	Sept.	Oct.
1	.....	52	86	80	59	28
2	.....	71	86	80	59	28
3	.....	71	86	80	56	28
4	.....	71	86	80	56	.....
5	.....	71	21	80	52	.....
6	.....	65	24	80	46	.....
7	.....	65	28	74	46	.....
8	.....	71	28	74	52	.....
9	.....	71	28	80	52	.....
10	.....	65	24	74	52	.....
11	.....	65	23	74	52	.....
12	.....	59	38	74	42	.....
13	.....	65	46	74	42	.....
14	.....	65	46	74	42	.....
15	.....	65	46	74	32	.....
16	.....	59	46	74	32	.....
17	.....	59	46	74	28	.....
18	.....	71	42	71	28	.....
19	74	46	48	71	28	.....
20	80	46	52	71	28	.....
21	86	52	52	65	28	.....
22	89	52	65	62	28	.....
23	52	52	65	59	28	.....
24	65	52	71	59	28	.....
25	59	46	71	59	28	.....
26	71	38	80	59	28	.....
27	71	38	80	56	28	.....
28	74	65	80	56	28	.....
29	21	80	80	52	28	.....
30	21	86	80	52	28	.....
31	80	.....	80	59	.....	.....

Rating table for Gleed canal near North Yakima, Wash., from May 19 to October 3, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.00	21	1.45	30	1.90	48	2.35	71
1.05	22	1.50	32	1.95	50	2.40	74
1.10	23	1.55	34	2.00	52	2.45	77
1.15	24	1.60	36	2.05	54	2.50	80
1.20	25	1.65	38	2.10	56	2.55	83
1.25	26	1.70	40	2.15	59	2.60	86
1.30	27	1.75	42	2.20	62	2.65	89
1.35	28	1.80	44	2.25	65	2.70	92
1.40	29	1.85	46	2.30	68	2.75	95

The above table is based upon 3 discharge measurements made during 1904. It is well defined between gage heights 1.00 foot and 2.50 feet.

Estimated monthly discharge of Gleed canal near North Yakima, Wash., for 1904.

[Irrigated area, 1,800 acres a.]

Month.	Discharge in second-feet.			Total in acre-feet.	Depth of run-off in inches, over irrigated area.
	Maximum.	Minimum.	Mean.		
April 16–30 b			40.0	1,190	7.94
May			65.0	3,997	26.6
June	86	38	61.1	3,636	24.2
July	86	21	55.9	3,437	22.9
August	80	52	69.4	4,267	28.4
September	59	28	38.8	2,309	15.4
October 1–15 c			28.0	833	5.55
The period	86	21	54.2	19,670	131.0

a Includes 400 acres under the lower lateral.
b Estimated April 15–May 18.
c Estimated September 4–15.

YAKIMA VALLEY CANAL NEAR NORTH YAKIMA, WASH.

This canal heads in the right bank of the Naches River about three-fourths mile below the intake of the Gleed canal in sec. 24, T. 14 N., R. 17 E. It extends by flume to Cowiche Creek, which is crossed by an inverted siphon of two pipes. It irrigates land north and west of North Yakima. The canal is the property of a cooperative company of 4,200 shares, or 1 share for each acre under the canal.

Discharge measurements of Yakima Valley canal near North Yakima, Wash., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
May 14	G. H. Bliss	9	20.2	2.55	1.71	51.4
June 30	G. F. Harley	9	15.9	2.42	1.37	38.5
July 20	J. C. Dry	9	19.6	3.11	1.92	61.1
August 13	G. F. Harley	9	23.3	3.29	2.13	79.0

Mean daily gage height, in feet, of Yakima Valley canal near North Yakima, Wash., for 1904.

Day.	May.	June.	July.	Aug.	Sept.	Oct.
1	1.60	1.81	1.92	2.00	2.12	1.64
2	1.58	1.81	1.92	2.04	2.10	1.64
3	1.56	1.83	1.92	2.04	2.08	1.64
4	1.37	1.83	1.87	2.08	2.04	1.64
5	1.39	1.83	1.87	2.08	2.00	1.62
6	1.25	1.83	(a)	2.08	2.00	1.50
7	1.08	1.79	(a)	2.08	2.00	1.50
8	1.04	1.79	(a)	2.08	2.00	1.48

a Water shut off.

Mean daily gage height, in feet, of Yakima Valley canal near North Yakima, Wash., for 1904—Continued.

Day.	May.	June.	July.	Aug.	Sept.	Oct.
9	1.33	1.75	1.71	2.08	2.00	1.33
10	1.54	1.73	1.75	2.12	2.00	1.33
11	1.56	1.71	1.75	2.08	2.00	1.50
12	1.60	1.71	1.92	2.12	2.00	1.48
13	1.62	1.71	1.96	2.12	1.87	1.48
14	1.71	1.67	1.92	2.12	1.87	1.46
15	1.71	1.67	1.92	2.12	1.87	1.25
16	1.71	1.67	1.92	2.12	1.83	.....
17	1.71	1.67	1.92	2.12	1.83	.....
18	1.71	1.67	1.92	2.12	1.83	.....
19	1.71	1.69	1.92	2.12	1.83	.....
20	1.69	1.75	1.92	2.12	1.83	.....
21	1.71	1.77	1.92	2.12	1.83	.....
22	1.67	1.79	1.92	2.12	1.83	.....
23	1.67	1.83	1.96	2.12	1.83	.....
24	1.71	1.85	1.96	2.14	1.83	.....
25	1.33	1.87	1.96	2.17	1.79	.....
26	1.71	1.92	1.96	2.17	1.79	.....
27	1.75	1.92	2.00	2.17	1.79	.....
28	1.75	1.94	2.00	2.17	.83	.....
29	1.79	1.92	2.00	2.17	.83	.....
30	1.81	(a)	2.00	2.17	.83	.....
31	1.79	.....	2.00	2.14	.....	.....

[a] Water shut off.

Mean daily discharge, in second-feet, of Yakima Valley canal near North Yakima, Wash., for 1904.

Day.	May.	June.	July.	Aug.	Sept.	Oct.
1	47	56	62	69	77	49
2	47	56	62	73	77	49
3	45	59	62	73	77	49
4	37	59	59	77	73	49
5	39	59	59	77	69	47
6	35	59	0	77	69	43
7	31	56	0	77	69	43
8	30	56	0	77	69	43
9	37	53	51	77	69	37
10	45	53	53	77	69	37
11	45	51	53	77	69	43
12	47	51	62	77	69	43
13	47	51	65	77	59	43
14	51	49	62	77	59	41
15	51	49	62	77	59	35
16	51	49	62	77	59	.....
17	51	49	62	77	59	.....
18	51	49	62	77	59	.....
19	51	51	62	77	59	.....
20	51	53	62	77	59	.....
21	51	53	62	77	59	.....
22	49	56	62	77	59	.....
23	49	59	65	77	59	.....
24	51	59	65	81	59	.....

Mean daily discharge, in second-feet, of Yakima Valley canal near North Yakima, Wash., for 1904—Continued.

Day.	May.	June.	July.	Aug.	Sept.	Oct.
25	37	59	65	81	56	.....
26	51	62	65	81	59	.....
27	53	62	69	81	59	.....
28	53	65	69	81	29	.....
29	56	62	69	81	29	.....
30	56	0	69	81	29	.....
31	56	.....	69	81	.....	.....

Rating table for Yakima Valley canal near North Yakima, Wash., from May 1 to October 15, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
0.85	28.5	1.25	35	1.65	49	2.00	69
90	29	1.30	36	1.70	51	2.05	73
95	29.5	1.35	37	1.75	53	2.10	77
1.00	30	1.40	39	1.80	56	2.15	81
1.05	31	1.45	41	1.85	59	2.20	86
1.10	32	1.50	43	1.90	62	2.25	91
1.15	33	1.55	45	1.95	65	2.30	96
1.20	34	1.60	47				

The above table is based upon 4 discharge measurements made during 1904. It is well defined between gage heights 1.35 feet and 2.15 feet. The table has been extended beyond these limits.

Estimated monthly discharge of Yakima Valley canal near North Yakima, Wash., for 1904.

[Irrigation area, 3,600 acres.]

Month.	Discharge in second-feet.			Total in acre-feet.	Depth of run-off in inches, over irrigated area.
	Maximum.	Minimum.	Mean.		
April 16–30[a]	.....	.....	40.0	1,190	3.97
May	56	30	46.8	2,878	9.59
June[b]	65	49	55.3	3,181	10.6
July[c]	69	51	62.5	3,471	11.6
August	81	69	77.5	4,765	15.9
September	77	29	60.8	3,618	12.1
October 1–15	49	35	43.4	1,291	4.30
The period	81	30	57.4	20,390	68.1

[a] Estimated. [b] Water shut off 1 day. [c] Water shut off 3 days.

NACHES-COWICHE CANAL NEAR NORTH YAKIMA, WASH.

The intake of this canal is on the right bank of the river just below Nelson's bridge at Painted Rocks, in sec. 9, T. 13 N., R. 18 E. About one-half mile below the intake the canal crosses Cowiche Creek and until about the middle of June takes nearly all its water from this source. The amount of water taken from the river gradually increases until about the 1st of August, after which date the entire flow of the canal is drawn from Naches River.

Discharge measurements of Naches-Cowiche canal near North Yakima, Wash., in 1904.

Date.	Hydrographer	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec. feet.*
May 4	G. F. Harley	8	15	2.13	2.63	32
May 14	G. H. Bliss	8	22	2.00	3.20	44
July 12	do	8	21	1.93	3.12	41
August 12	J. C. Dry	8	24	1.96	3.30	46

Mean daily gage height, in feet, of Naches-Cowiche canal near North Yakima, Wash., for 1904.

Day.	May.	June.	July.	Aug.	Sept.	Oct.
1	.....	3.12	2.96	3.08	2.83	1.50
2	.....	3.12	3.00	1.02	2.83	1.50
3	.....	3.08	3.04	3.75	2.79	1.50
4	.....	3.15	3.04	3.92	2.79	1.50
5	.....	3.08	3.04	3.92	2.71	1.50
6	3.08	3.00	3.04	3.83	2.71	1.67
7	3.08	3.00	3.04	3.92	2.71	1.67
8	3.08	2.96	3.04	3.92	2.71	1.67
9	3.12	2.96	3.17	3.92	2.71	1.67
10	3.17	2.87	3.04	3.83	2.62	1.50
11	3.17	2.83	3.08	3.83	2.62	.....
12	3.17	2.75	3.17	3.92	2.62	.....
13	3.17	2.62	3.17	3.92	2.62	.....
14	3.21	2.50	3.17	3.92	2.45	.....
15	3.21	2.50	3.17	3.92	2.50	.....
16	3.04	2.50	3.17	3.92	2.50	.....
17	3.12	2.87	3.17	3.17	2.25	.....
18	3.12	3.12	3.17	3.17	2.12	.....
19	3.12	3.12	2.75	3.17	2.17	.....
20	3.17	3.17	2.75	3.21	2.17	.....
21	3.17	3.17	2.62	3.17	1.92	.....
22	3.17	3.17	2.62	3.17	1.92	.....
23	3.21	3.04	2.83	3.21	1.92	.....
24	3.17	3.04	2.83	3.17	1.92	.....
25	3.12	3.17	2.92	3.12	1.92	.....
26	3.15	3.17	2.92	3.12	1.50	.....
27	3.12	3.17	2.96	3.12	1.50	.....
28	3.17	3.17	2.96	3.12	1.50	.....
29	3.17	3.21	2.96	3.12	1.50	.....
30	3.17	3.25	3.08	3.08	1.50	.....
31	3.17	.....	3.08	3.12	.....	.....

Mean daily discharge, in second-feet, of Naches-Cowiche canal near North Yakima, Wash., for 1904.

Day.	May.	June.	July.	Aug.	Sept.	Oct.
1	.....	41	38	41	36	24
2	.....	41	39	23	36	24
3	.....	41	40	64	35	24
4	.....	41	40	70	35	24
5	.....	41	40	70	33	24
6	41	39	40	68	33	24
7	41	39	40	70	33	25
8	41	38	40	70	33	24
9	41	38	42	70	33	25
10	42	36	40	68	31	24
11	42	36	41	68	31	.....
12	42	34	42	70	31	.....
13	42	31	42	70	31	.....
14	44	30	42	70	30	.....
15	44	30	42	70	30	.....
16	40	30	42	70	30	.....
17	41	36	42	42	28	.....
18	41	41	42	42	26	.....
19	41	41	34	42	27	.....
20	42	42	34	44	27	.....
21	42	42	31	42	25	.....
22	42	42	31	42	25	.....
23	44	40	36	44	25	.....
24	42	40	36	42	25	.....
25	41	42	37	41	25	.....
26	42	42	37	41	24	.....
27	41	42	38	41	24	.....
28	42	42	38	41	24	.....
29	42	44	38	41	24	.....
30	42	45	41	41	24	.....
31	42	.....	41	41	.....	.....

Rating table for Naches-Cowiche canal near North Yakima, Wash., from May 6 to October 10, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
2.00	25.8	2.50	30.0	3.00	39	3.50	54
2.05	26.0	2.55	30.5	3.05	40	3.55	56
2.10	26.2	2.60	31	3.10	41	3.60	58
2.15	26.5	2.65	32	3.15	42	3.65	60
2.20	27.0	2.70	33	3.20	43	3.70	62
2.25	27.5	2.75	34	3.25	44	3.75	64
2.30	28.0	2.80	35	3.30	46	3.80	66
2.35	28.5	2.85	36	3.35	48	3.85	68
2.40	29.0	2.90	37	3.40	50	3.90	70
2.45	29.5	2.95	38	3.45	52	3.95	72

The preceding table is based upon 4 discharge measurements made during 1904. It is well defined between gage heights 2.60 feet and 3.30 feet. The table has been extended beyond these limits.

Estimated monthly discharge of Naches-Cowiche canal near North Yakima, Wash., for 1904.

[Irrigated area, 1,500 acres.]

Month.	Discharge in second-feet.			Total in acre-feet.	Depth of run-off in inches, over irrigated area.
	Maximum.	Minimum.	Mean.		
April 16–30 [a]			30.0	893	7.14
May	44	40	42.0	2,582	20.6
June	45	30	38.9	2,315	18.5
July	42	31	38.9	2,392	19.1
August	70	23	53.5	3,290	26.3
September	36	24	29.1	1,732	13.9
October 1–15 [b]	24	24	24.0	714	5.71
The period	70	23	38.4	13,920	111.2

[a] Estimated April 16 to May 5. [b] Estimated October 10–15.

BROADGAUGE CANAL NEAR NORTH YAKIMA, WASH.

This canal heads in a slough on the right bank of the river in sec. 10, T. 13 N., R. 18 E. About 3 miles below the intake it crosses the wasteway of the Power canal and draws from it the entire flow which it carries beyond this point The Broadgauge canal is now the property of the Northwestern Light and Water Company.

Discharge measurements of Broadgauge canal near North Yakima, Wash., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
May 4 [a]	G. F. Harley	10	11.0	0.50	2.42	5.1
June 16 [a]	G. H. Bliss	10	9.5	.25	2.25	2.4
June 30 [b]	J. C. Dry	6	11.7	1.36	1.19	15.9
July 16 [b]	do	6	11.6	1.41	1.15	16.3
September 15 [b]	do	6	5.7	.89	.22	5.1

[a] Measured at headworks. [b] Measured below Power canal.

Mean daily gage height, in feet, of Broadgauge canal near North Yakima, Wash., for 1904.

Day.	May.	June.	Day.	May.	June.	Day.	May.	June.
1		2.42	12		2.25	22	2.58	2.50
2		2.42	13		2.25	23	2.49	2.50
3		2.45	14		2.17	24	2.42	2.33
4		2.42	15		2.17	25	2.42	2.33
5		2.42	16		2.25	26	2.42	2.33
6		2.42	17	2.42	2.42	27	2.42	2.25
7		2.37	18	2.50	2.42	28	2.46	2.25
8		2.33	19	2.50	2.82	29	2.42	2.50
9		2.25	20	2.62	2.50	30	2.73	2.50
10		2.25	21	2.67	2.50	31	2.71	
11		2.25						

Mean daily discharge, in second-feet, of Broadgauge canal near North Yakima, Wash., for 1904.

Day.	May.	June.	Day.	May.	June.	Day.	May.	June.
1		5.0	12		2.5	22	5.5	5.5
2		5.0	13		2.5	23	5.5	5.5
3		5.0	14		2.0	24	5 0	4.5
4		5.0	15		2.0	25	5.0	4.5
5		5.0	16		2.5	26	5.0	4.5
6		5.0	17	5.0	5.0	27	5.0	2.5
7		4.5	18	5.5	5.0	28	5.0	2.5
8		4.5	19	5.5	7.0	29	5.0	5.5
9		2.5	20	6.0	5.5	30	6.5	5.5
10		2.5	21	6.0	5.5	31	6.5	
11		2.5						

Estimated monthly discharge of Broadgauge canal near North Yakima, Wash., for 1904.

[Irrigated area, 500 acres.]

Month.	Discharge in second-feet.	Total in acre-feet.	Depth of run-off in inches, over irrigated area.
April 16–30	4.0	119	2.86
May	5.5	338	8.11
June [a]	17.0	1,012	24.3
July [b]	15.9	978	23.5
August [b]	16.3	1,002	24.0
September [b]	10.0	595	14.3
October 1–15 [b]	8.0	238	5.71
The period	11.8	4,282	102.8

[a] Partly from the Power canal. [b] Taken from the Power canal.

POWER CANAL AT NORTH YAKIMA, WASH.

This canal heads in the river on its right bank in sec. 10, T. 13 N., R. 18 E. Previous to October, 1904, it was known as the Yakima Valley Light and Power Company canal. It is now the property of the Northwestern Light and Water Company, and is the largest canal taking water from Naches River. The new company now controls also the Shanno and Broadgauge canals. These two canals and the Union canal cross the Power canal, and during the summer are supplied chiefly by it. Only 250 acres are irrigated from the Power canal. It is used mainly for power purposes, and all of its flow not withdrawn by other canals is spilled into the Yakima River. The wastage is very regular in amount as shown by measurements of the wasteway.

Discharge measurements of Power canal at North Yakima, Wash., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec. feet.*
May 5 [a]	G. F. Harley	25	63	2.83	2.71	178
June 28 [a]	J. C. Dry	25	37	3.11	1.88	116
July 21 [b]	do	25	38	3.26	2.05	124
August 10 [b]	do	25	68	2.88	2.79	196
September 12 [b]	do	25	42	3.22	2.15	134
September 14 [b]	do	25	43	2.98	2.17	128

[a] Measured at the regulating gates.
[b] Measured on the wasteway near the Yakima River; average waste 125 second-feet.

Mean daily gage height, in feet, of Power canal at North Yakima, Wash., for 1904.

Day.	May.	June.	July.	Aug.	Sept.	Oct.
1	.....	2.67	2.71	2.75	2.79	2.79
2	.....	2.71	2.71	2.75	2.75	2.79
3	.....	2.71	2.67	2.75	2.83	2.79
4	.....	2.75	2.67	2.75	2.83	2.79
5	2.71	2.75	2.71	2.75	2.83	2.79
6	2.71	2.58	2.67	2.75	2.87	2.79
7	2.79	2.58	2.71	2.75	2.79	2.83
8	2.83	2.71	2.67	2.71	2.83	2.83
9	2.71	2.67	2.62	2.67	2.79	2.75
10	2.67	2.67	2.71	2.75	2.79	2.75
11	2.71	2.67	2.67	2.75	2.79	2.87
12	2.67	2.67	2.67	2.62	2.79	2.83
13	2.67	2.71	2.62	2.79	2.79	.....
14	2.71	2.71	2.67	2.79	2.79	.....
15	2.67	2.75	2.71	2.79	2.83	.....
16	2.67	2.71	2.67	2.75	2.79	.....
17	2.67	2.67	2.67	2.75	2.79	.....
18	2.71	2.67	2.79	2.71	2.79	.....
19	2.71	2.71	2.75	2.75	2.75	.....

Mean daily gage height, in feet, of Power canal at North Yakima, Wash., for 1904—Cont'd.

Day.	May.	June.	July.	Aug.	Sept.	Oct.
20	2.71	2.62	2.75	2.75	2.83	.....
21	2.67	2.75	2.75	2.75	2.79	.....
22	2.62	2.67	2.71	2.79	2.83	.....
23	2.50	2.67	2.79	2.75	2.79	.....
24	2.67	2.71	2.67	2.71	2.83	.....
25	2.67	2.75	2.71	2.75	2.79	.....
26	2.67	2.71	2.75	2.71	2.87	.....
27	2.67	2.71	2.67	2.75	2.87	.....
28	2.67	2.75	2.75	2.79	2.87	.....
29	2.62	2.75	2.75	2.79	2.87	.....
30	2.67	2.79	2.83	2.67	2.87	.....
31	2.71	.....	2.83	2.67	.....	.....

Mean daily discharge, in second-feet, of Power canal at North Yakima, Wash., for 1904.

Day.	May.	June.	July.	Aug.	Sept.	Oct.
1	.....	172	178	187	196	196
2	.....	178	178	187	187	196
3	.....	178	172	187	198	196
4	.....	187	172	187	198	196
5	178	187	178	187	198	196
6	178	160	172	187	210	196
7	196	160	178	187	196	198
8	198	178	172	178	198	198
9	178	172	165	172	196	187
10	172	172	178	187	196	187
11	178	172	172	187	196	210
12	172	172	172	165	196	198
13	172	178	165	196	196	.....
14	178	178	172	196	196	.....
15	172	187	178	196	198	.....
16	172	178	172	187	196	.....
17	172	172	172	187	196	.....
18	178	172	196	178	196	.....
19	178	178	187	187	187	.....
20	178	172	187	187	198	.....
21	172	187	187	187	196	.....
22	165	172	178	196	198	.....
23	150	172	196	187	196	.....
24	172	178	172	178	198	.....
25	172	187	178	187	196	.....
26	172	178	187	178	210	.....
27	172	178	172	187	210	.....
28	172	187	187	196	210	.....
29	172	187	187	196	210	.....
30	172	196	198	172	210	.....
31	178	.....	198	172	.....	.....

Estimated monthly discharge of Power canal at North Yakima, Wash., for 1904.

[Irrigated area, 250 acres.]

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
April 16–30 [a]			170	5,058
May	198	150	174	10,700
June	196	160	178	10,590
July	198	165	176	10,820
August	196	165	189	11,620
September	210	187	199	11,840
October 1–15 [b]	210	187	196	5,831
The period	210	150	183	66,460
Wasted into Yakima River			125	45,370
Used for irrigation and supplied to other canals			58	21,090

[a] Estimated April 15 to May 4. [b] Estimated October 13–15.

SHANNO CANAL AT NORTH YAKIMA, WASH.

This canal heads in Naches River on the right bank in sec. 11, T. 13 N., R. 18 E., in sec. 13. It crosses the Power canal and receives from it all the water carried beyond this point. The headworks of this canal were washed away during 1904, and in October, 1904, it became the property of the Northwestern Light and Water Company.

Discharge measurements of Shanno canal at North Yakima, Wash., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec. feet.*
May 5 [a]	G. F. Harley	9	13.0	1.77	1.19	23
June 16 [a]	G. H. Bliss	12	25.0	2.20	2.21	55
June 30 [a]	J. C. Dry	9	17.8	1.54	1.88	27
July 12 [b]	do	9	13.8	.74	.88	10
August 12 [b]	do	9	21.0	1.43	2.12	30
September 15 [b]	do	9	19.5	1.00	2.05	19

[a] Measured at the headworks. [b] Measured below the Power canal.

Mean daily gage height, in feet, of Shanno canal at North Yakima, Wash., for 1904.

Day.	May.	June.	July.	Day.	May.	June.	July.	Day.	May.	June.	July.
1	.....	.92	2.17	12	1.21	.92	.....	22	1.46	1.62	.....
2	.....	.87	1.96	13	1.25	.75	.....	23	1.46	1.00	.....
3	1.17	1.08	1.96	14	1.33	1.33	.....	24	1.50	(a)	.....
4	1.29	1.17	2.17	15	1.50	1.67	.....	25	1.25	.50	.....
5	1.25	1.50	2.17	16	1.46	2.17	.....	26	1.08	.50	.....
6	1.18	2.04	1.83	17	1.50	2.33	.....	27	.92	1.42	.....
7	1.17	1.67	1.62	18	1.25	2.83	.....	28	1.00	1.50	.....
8	1.17	.67	1.58	19	.92	2.62	.....	29	1.04	1.67	.....
9	1.08	.67	1.25	20	.92	2.04	.....	30	1.12	2.00	.....
10	1.12	.67	.83	21	1.04	1.67	.....	31	.83	.....	.....
11	1.12	(a)	.....								

a Water shut off.

Mean daily discharge, in second-feet, of Shanno canal at North Yakima, Wash., for 1904.

Day.	May.	June.	July.	Day.	May.	June.	July.	Day.	May.	June.	July.
1	.....	12	53	12	21	12	.....	22	30	36	.....
2	.....	10	46	13	23	8	.....	23	30	15	.....
3	20	18	46	14	24	25	.....	24	31	0	.....
4	24	20	53	15	31	33	.....	25	23	3	.....
5	22	31	53	16	30	54	.....	26	17	3	.....
6	20	48	42	17	31	59	.....	27	13	28	.....
7	20	36	34	18	23	75	.....	28	15	31	.....
8	20	6	34	19	12	69	.....	29	16	36	.....
9	17	6	23	20	12	49	.....	30	18	48	.....
10	18	6	10	21	16	37	.....	31	10	.....	.....
11	18	0	.....								

Rating table for Shanno canal at North Yakima, Wash., from May 3 to July 10, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
0.35	0.0	1.00	14.8	1.65	36.1	2.30	58.2
.40	1.0	1.05	16.4	1.70	37.8	2.35	59.9
.45	2.0	1.10	18.0	1.75	39.5	2.40	61.6
.50	3.0	1.15	19.6	1.80	41.2	2.45	63.3
.55	4.0	1.20	21.2	1.85	42.9	2.50	65.0
.60	5.0	1.25	22.9	1.90	44.6	2.55	66.7
.65	6.0	1.30	24.6	1.95	46.3	2.60	68.4
.70	7.0	1.35	26.2	2.00	48.0	2.65	70.1
.75	8.0	1.40	27.8	2.05	49.7	2.70	71.8
.80	9.0	1.45	29.5	2.10	51.4	2.75	72.5
.85	10.0	1.50	31.2	2.15	53.1	2.80	74.2
.90	11.6	1.55	32.8	2.20	54.8	2.85	75.9
.95	13.2	1.60	34.4	2.25	56.5		

The preceding table is based upon 3 discharge measurements made in 1904. It is well defined between gage heights 0.80 foot and 2.20 feet. The table has been extended beyond these limits.

Estimated monthly discharge of Shanno canal at North Yakima, Wash., for 1904.

[Irrigated area, 1,000 acres.]

Month.	Discharge in second-feet.			Total in acre-feet.	Depth of run-off in inches, over irrigated area.
	Maximum.	Minimum.	Mean.		
April 16–30 [a]	.....	.....	20.0	595	7.14
May	31	10	21.0	1,291	15.5
June [b]	75	2	29.1	1,616	19.4
July [c]	53	10	30.0	1,845	22.1
August	.....	.....	30.0	1,845	22.1
September	.....	.....	19.0	1,131	13.6
October 1–15	.....	.....	15.0	446	5.35
The period	75	2	24.4	8,769	105.2

[a] Estimated April 16 to May 2. [b] Water shut off two days. [c] After July 10 supplied by Power canal.

UNION CANAL AT NORTH YAKIMA, WASH.

This canal heads in Naches River in two places about one-half mile apart on the right bank in sec. 11, T. 13 N., R. 18 E. It is a very old canal, having first taken water from the Naches River in 1869. No appropriation was ever made for it, but the Union Canal Company agree to supply 3,000 miner's inches to its shareholders and 40 inches to private parties. The two branches unite about three-fourths mile below the upper headworks. In section 13 the Union canal crosses the wasteway of the Power canal and takes some additional water from it. From the Power canal to a point on Naches avenue, in sec. 18, T. 13 N., R. 19 E., a distance of about a mile, it is known as the Mill ditch. Here it leaves the Mill ditch, taking about half its flow, and continues south along Naches avenue. The water remaining in the Mill ditch is returned to the wasteway of the Power canal. The Union canal spills into Yakima River in sec. 32, T. 13 N., R. 19 E. Its waste here is about 1.5 per cent of the water taken in at the head-gates. The town of North Yakima uses water from this canal for the irrigation of shade trees.

Discharge measurements of Union canal at upper head works, at North Yakima, Wash., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
May 5	G. F. Harley	8	7.2	2.10	0.83	15.2
May 6	G. H. Bliss	8	8.0	2.04	.92	16.4
June 16	do	6	5.2	.72	.42	3.8
July 12	do	6	2.8	1.00	.33	2.8

Mean daily gage height, in feet, of Union canal at upper head works, at North Yakima, Wash., for 1904.

Day.	May.	June.	July.	Aug	Sept	Day.	May.	June.	July.	Aug.	Sept.
1	.....	0.33	0.67	0.17	0.25	17	0.50	0.42	0.17	0.50	.....
2	.....	.33	.58	.17	.33	18	.50	.42	(a)	.42	.....
3	0.83	.33	.67	.33	.25	19	.42	.42	(a)	.42	.....
4	.92	.33	.71	.17	.17	20	.33	.37	(a)	.42	.....
5	1.00	.33	.50	.17	.08	21	.42	.42	.17	.37	.....
6	1.00	.33	.50	.17	.08	22	.25	.46	.50	.25	.....
7	(a)	.29	.46	.17	.08	23	.25	.42	.33	.25	.....
8	.50	.33	.42	.17	.12	24	.33	.37	.25	.17	.....
9	.50	.33	.33	.42	.08	25	.25	.37	(a)	.17	.....
10	.42	.33	.42	.33	.08	26	.33	.37	(a)	(a)	.....
11	.42	.50	.37	.17	.....	27	.42	.50	.33	.17	.....
12	1.25	.50	.25	.17	.....	28	.33	.50	.17	.25	.....
13	.50	.58	.25	.17	.....	29	.33	.50	.08	.58	.....
14	.50	.58	(a)	.12	.....	30	.42	.58	.17	.58	.....
15	.50	.58	(a)	.08	.....	31	.33	.....	.17	.37	.....
16	.50	.79	(a)	.50	.....						

a Water shut off.

Mean daily discharge, in second-feet, of Union canal at upper head works, at North Yakima, Wash., for 1904.

Day.	May.	June.	July.	Aug.	Sept.	Day.	May.	June.	July.	Aug.	Sept.
1	.....	3	9	1	2	17	5	4	1	4	.....
2	.....	3	6	1	3	18	5	4	0	4	.....
3	15	3	9	3	2	19	4	4	0	4	.....
4	16	3	9	1	1	20	3	3	0	3	.....
5	22	3	5	1	.5	21	4	4	1	2	.....
6	22	3	5	1	.5	22	2	5	5	2	.....
7	0	2	4	1	.5	23	2	4	3	1	.....
8	5	3	4	1	1	24	3	3	2	1	.....
9	5	3	3	4	.5	25	2	3	0	0	.....
10	4	3	4	3	.5	26	3	3	0	1	.....
11	4	5	3	1	.....	27	4	5	3	2	.....
12	35	5	2	1	.....	28	3	5	1	7	.....
13	5	6	2	1	.....	29	3	5	.5	7	.....
14	5	6	0	1	.....	30	4	6	1	3	.....
15	5	6	0	0.5	.....	31	3	.....	1	.....	.....
16	5	14	0	5	.....						

Discharge measurements of Union canal at lower head works, at North Yakima, Wash., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec. feet.*
June 16 [a]	G. H. Bliss	13	17.6	2.27	1.92	40.0
July 12 [a]	do	13	19.0	1.71	1.70	32.5
August 12 [a]	J. C. Dry	13	20.4	1.89	2.04	38.5
June 28 [b]	do	10	23.0	1.84	2.02	42.4
July 16 [b]	do	10	23.4	1.70	1.92	39.4
September 14 [b]	do	10	21.1	1.63	1.80	34.5

[a] At the headworks. [b] Below the mill ditch.

Mean daily gage height, in feet, of Union canal at lower head works, at North Yakima, Wash., for 1904.

Day.	May.	June.	July.	Aug.	Sept.	Day.	May.	June.	July.	Aug.	Sept.
1	.....	1.92	1.92	1.50	1.67	17	2.00	2.00	1.67	1.92	1.50
2	.....	1.83	1.92	1.58	1.67	18	1.83	2.08	1.67	1.83	1.50
3	.....	1.92	2.00	2.08	1.67	19	1.92	2.00	1.50	1.67	1.50
4	.....	1.92	2.00	2.00	1.50	20	1.92	1.96	2.33	1.67	1.50
5	.....	1.92	2.00	2.00	1.50	21	2.00	1.83	2.08	1.50	1.42
6	0.67	2.00	1.92	2.00	1.50	22	2.00	1.92	2.00	1.50	1.67
7	1.33	1.83	1.92	2.08	1.67	23	1.92	1.92	1.67	1.50	1.83
8	1.33	1.92	1.83	2.33	1.67	24	1.83	1.67	1.67	1.17	1.83
9	1.42	1.92	1.75	2.17	1.67	25	1.75	1.67	1.67	1.17	1.75
10	1.42	1.67	1.83	2.17	1.67	26	1.83	1.67	1.67	1.00	1.58
11	1.75	1.67	1.83	2.00	1.58	27	1.83	1.83	1.67	1.67	1.67
12	2.00	1.92	1.67	2.17	1.58	28	1.92	2.00	1.67	1.00	1.83
13	1.83	1.92	1.42	1.92	1.00	29	1.92	2.17	1.58	2.00	2.00
14	2.00	2.00	1.33	2.00	1.54	30	1.92	2.08	1.58	1.67	2.17
15	2.08	2.00	1.67	2.00	1.42	31	1.92	.....	1.50	1.83	.....
16	2.00	2.08	1.67	1.92	1.50						

Mean daily discharge, in second-feet, of Union canal at lower head works, at North Yakima, Wash., for 1904.

Day.	May.	June.	July.	Aug.	Sept.	Day.	May.	June.	July.	Aug.	Sept.
1	.....	39	39	28	33	17	40	40	33	39	28
2	.....	35	39	28	33	18	35	41	33	35	28
3	.....	39	40	41	33	19	39	40	28	33	28
4	.....	39	40	40	28	20	39	40	47	33	28
5	.....	39	40	40	28	21	40	35	41	28	26
6	9	40	39	40	28	22	40	39	40	28	33
7	24	35	39	41	33	23	39	39	33	28	35
8	24	39	35	47	33	24	35	33	33	20	35
9	26	39	34	43	33	25	34	33	33	20	34
10	26	33	35	43	33	26	35	33	33	16	28
11	34	33	35	41	28	27	35	35	33	33	33
12	40	39	33	43	28	28	39	40	33	16	35
13	35	39	26	39	16	29	39	43	30	40	40
14	40	40	24	40	28	30	39	41	30	33	44
15	41	40	33	40	26	31	39	.....	28	35	.....
16	40	41	33	39	28						

Estimated monthly discharge[a] of Union canal at North Yakima, Wash., for 1904.

[Irrigated area, 2,000 acres.]

Month.	Discharge in second-feet.			Total in acre-feet.	Depth of run-off, in inches, over irrigated area.
	Maximum.	Minimum.	Mean.		
April 16–30[b]	.....	.....	35.0	1,041	6.24
May	46	24	41.7	2,564	15.4
June	53	36	39.0	2,321	13.9
July	50	28	37.3	2,294	13.8
August	48	16	36.9	2,269	13.6
September	36	16	32.0	1,904	11.4
October 1–15[b]	.....	.....	30.0	893	5.35
The period	53	16	36.6	13,290	79.7

[a] Sum of discharge at the two intakes. [b] Estimated.

TOWN CANAL AT NORTH YAKIMA, WASH.

This canal heads in Naches River on the right bank one-eighth mile above the Northern Pacific Railway bridge and three-fourths mile above the mouth of the river. It is the property of the town of North Yakima and is used chiefly for the irrigation of shade trees. It irrigates also about 640 acres of land.

Discharge measurements of Town canal at North Yakima, Wash., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
May 5	G. H. Bliss	8	11.5	1.04	1.83	12,0
July 12	do	8	11.1	1.25	1.85	13.9

Mean daily gage height, in feet, of Town canal at North Yakima, Wash., for 1904.

Day.	May.	June.	July.	Aug.	Sept.	Oct.
1	.....	1.79	2.04	1.92	2.00	2.08
2	.....	1.79	1.96	2.08	2.00	2.00
3	.....	1.75	2.00	1.92	1.92	1.92
4	.....	1.75	2.04	1.83	1.92	1.75
5	1.83	1.92	1.96	2.00	1.87	1.58
6	1.75	2.00	1.92	2.50	1.83	1.50
7	1.67	1.75	1.83	2.33	1.83	1.42
8	1.71	1.58	1.87	2.50	1.75	1.33
9	1.67	1.37	1.71	2.42	1.75	1.25
10	1.62	1.92	1.75	2.37	1.83	.....
11	1.92	1.75	1.71	2.33	1.83	.....
12	1.92	1.79	1.67	2.33	1.83	.....
13	1.92	1.75	1.83	2.33	1.75	.....
14	2.33	1.83	1.92	2.21	1.75	.....

Mean daily gage height, in feet, of Town canal at North Yakima, Wash., for 1904—Cont'd.

Day.	May.	June.	July.	Aug.	Sept.	Oct.
15	2.29	1.79	1.79	2.21	1.67	.....
16	2.33	1.96	1.75	2.17	1.62	.....
17	2.33	2.00	1.67	2.17	1.58	.....
18	2.37	2.25	1.50	2.17	1.58	.....
19	2.33	2.08	2.25	2.17	1.58	.....
20	2.29	2.00	2.33	2.12	1.62	.....
21	2.67	2.00	2.33	2.08	1.67	.....
22	2.67	1.96	2.08	2.04	1.75	.....
23	2.67	1.92	2.00	2.00	1.83	.....
24	2.54	1.92	2.00	2.00	1.75	.....
25	2.25	1.92	1.92	1.96	1.67	.....
26	1.92	1.83	1.92	1.87	1.58	.....
27	1.92	2.00	2.21	2.04	1.58	.....
28	1.83	1.87	2.00	2.25	1.67	.....
29	1.92	2.04	1.83	2.17	2.21	.....
30	1.92	2.00	1.67	2.17	2.17	.....
31	1.83	.....	1.50	2.08	.....	.....

Mean daily discharge, in second-feet, of Town canal at North Yakima, Wash., for 1904.

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

Estimated monthly discharge of Town canal at North Yakima, Wash., for 1904.

[Irrigated area, 640 acres.]

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
April 1 6–30[a]	.....	.....	10.0	298
May	20	10	14.0	861
June	15	8	12.3	732
July	16	9	12.5	769
August	17	12	14.5	892
September	15	10	11.4	678
October 1–15[b]	13	8	10.0	298
The period	20	8	12.5	4,528

[a] Estimated April 16 to May 4. [b] Estimated October 10–15.

NORTHWESTERN LIGHT AND WATER COMPANY'S PROPOSED CANAL.

This company, upon October 3, 1904, filed upon 1,000 second-feet of water from Naches River, just below the mouth of Tieton River, on the left or north bank. It is a point in sec. 36, T. 15 N., R. 16 E., which is at the head works of the Wapatox canal.

The company proposes to construct a large canal, the flow of which will be used to generate power. The canal will be 9 miles long and will include the Wapatox canal throughout its length. At the end of the 9 miles all water except that required by the Wapatox canal, will be spilled back into the river at a point just above the intake of the Gleed canal.

CANALS TAKING WATER FROM YAKIMA, TIETON, AND NACHES RIVERS.

Canals taking water from Yakima River.

Canal.	Location.				Bank of river.	Length in miles.
	Nearest town.	Head works.				
		Section.	Township.	Range.		
Below Clealum River and above Naches River.						
Cascade	Thorp	.....	19 N..	17 E..	Left....	42½
West Kittitas	.....do.....	33	19 N..	17 E..	Right...	14
Town	Ellensburg.....	7	18 N..	17 E..	Left....	30
Olsen	.....do.....	18	18 N..	18 E..	....do...	.....
Selah-Moxee	North Yakima.....	8	14 N..	19 E..	....do...	27
Taylor	.....do.....	.....	.....	.....	Right...	4½
Below Naches River and above Atanum Creek.						
Moxee[a]	North Yakima.....	7	13 N..	19 E..	Left....	8
Hubbard	.....do.....	7	13 N..	19 E..	....do...	7
Fowler	.....do.....	18	13 N..	19 E..	....do...	8½
Granger	.....do.....	18	13 N..	19 E..	....do...	.....

[a] Contract, 1 second-foot per 160 acres.

Canals taking water from Yakima River—Continued.

Canal.	Location.				Bank of river.	Length in miles.
	Nearest town.	Head works.				
		Section.	Township.	Range.		
Below Atanum Creek.						
New reservation No. 2	Yakima	17	12 N.	19 E.	Right	[a] 4½
Old reservation No. 1	do	28	12 N.	19 E.	do	12½
Government canal No. 3	Toppenish	28	11 N.	20 E.	do	4
Sunnyside [b]	Yakima	28	12 N.	19 E.	Left	38
Gilbert	Toppenish	19	11 N.	20 E.	Right	7
Hatch	do	30	10 N.	21 E.	do	3
Prosser Falls [c]	Prosser				do	10
Ledbetter	do				do	
Kiona [d]	Kiona	10	9 N.	26 E.	Left	9
Kiona Water Supply Co	do				do	
Kennewick [b]	Kennewick	3	10 N.	27 E.	Right	39½
Grosscup's	Kiona	3	10 N.	27 E.	Left	5½

Canal.	Appropriation.		Area under canal.		
	Amount in second-feet.	Date.	Irrigated.	Irrigable.[e]	Proposed extension.
Below Clealum River and above Naches River.			*Acres.*	*Acres.*	*Acres.*
Cascade	[f] 1,000 [g] 500	Nov. 19, 1903 Feb. 28, 1903		16,000	None.
West Kittitas	[h] 10,000	——, 1889	7,000	7,000	None.
Town	None.	[i] Apr. 25, 1889	8,000	10,000	None.
Olsen			1,200	1,200	None.
Selah-Moxee	150	Nov. 9, 1900	6,000	6,000	None.
Taylor	20	Mar. 24, 1888	1,000	1,400	None.
Below Naches River and above Atanum Creek.					
Moxee [b]	150	Oct. 11, 1892	3,500	4,500	None.
Hubbard					
Fowler	160	July 13, 1892	2,000	3,000	None.
Granger					
Below Atanum Creek.					
New reservation No. 2	1,000	Feb. 19, 1903	2,700	23,700	[j] 53,000
Old reservation No. 1	None.		8,000	17,000	None.
Government canal No. 3	None.			2,300	None.
Sunnyside [b]	1,000	Mar. 23, 1891	35,000	66,000	[j] 156,000
Gilbert	None.		3,000	4,000	None.
Hatch			600		None.
Prosser Falls [c]	(k)		1,200	2,200	None.
Ledbetter	1,000	July 22, 1892		360	None.
Kiona [d]	1,000	Aug. 28, 1889	1,800	800	[j] 26,000
Kiona Water Supply Co			150	150	None.
Kennewick [b]	300	Aug. 6, 1891	6,000	14,000	None.
Grosscup's	(l)	do		3,000	None.
Total			79,150	165,110	235,000

[a] Already constructed. Length as proposed, 65 miles.
[b] Contract, 1 second-foot per 160 acres.
[c] Power canal. Contract, old, 1 second-foot per 160 acres; new, 1 second-foot per 120 acres.
[d] Contract, 1 second-foot per 100 acres.
[e] "Acres irrigated" included in "Acres irrigable."
[f] From Lake Kachess.
[g] Yakima River.
[h] Miner's inches.
[i] Began using water.
[j] Additional.
[k] All river at this point.
[l] Uses same appropriation as Kennewick.

Canals taking water from Yakima River—Continued.

Canal.	Discharge in second-feet.								Total.
	Apr. 16–30.	May.	June.	July.	Aug.	Sept.	Oct. 1–15.	Average.	
Below Clealum River and above Naches River.									
Cascade								[a]125	
West Kittitas	50	50	53	48.8	52.2	55	56	52	
Town	100	110	122	124	127	116		116	
Olsen								14	
Selah-Moxee	98	77.8	76.9	69.5	78.2	72.6	39	74.9	
Taylor								11	393
Below Naches River and above Atanum Creek.									
Moxee [b]	17	18	18.3	10.3	35.4	30.7	4	21.1	
Hubbard	18	31	24.1	23.5	37.4	18.9	15	24.8	
Fowler	25	34	22	23.6	23	33	16	25.9	
Granger								18	90
Below Atanum Creek.									
New reservation	20	27	49.1	86.4	69	73.6	50	56.4	
Old reservation	100	130	145	164	147	100	90	130	
Government canal No. 3								10	
Sunnyside [b]	496	529	561	585	610	524	456	547	
Gilbert	25	40	58.9	47.9	28.6	17	10	35.1	
Hatch								8	
Prosser Falls [c]	190	210	214	212	201	195	209	205	
Ledbetter								2	
Kiona [d]	17	20	20	21.1	19	20.3	21.3	19.9	
Kiona Water Supply Co								19	
Kennewick [b]	53.6	85.5	101	117	126	126	124	107	
Grosscup's									1,139
Total									1,622

Canals taking water from Tieton and Naches rivers.

Canal.	Location.				Bank of river.	Length in miles.
	Nearest town.	Head works.				
		Section.	Township.	Range.		
From Tieton River.						
Sinclair and Cobb	North Yakima	10	14 N.	16 E.	Left	
From Naches above Tieton River.						
Selah Valley [e]	North Yakima	35	15 N.	16 E.	Left	20
Small ditches (combined)						
From Naches below Tieton and above Cowiche Creek.						
Wapatox	North Yakima	36	15 N.	16 E.	Left	16
Cox	do	6	14 N.	17 E.	Right	
Upper Scott	do	4	14 N.	17 E.	do	
Lower Scott	do	9	14 N.	17 E.	do	
Fortune	do	9	14 N.	17 E.	do	

[a] Estimated capacity of canal.
[b] Contract, 1 second-foot per 160 acres.
[c] Power canal. Contract, old, 1 second-foot per 160 acres; new, 1 second-foot per 120 acres.
[d] Contract, 1 second-foot per 100 acres.
[e] Contract: Old, 1 second-foot to 160 acres; new, 1 second-foot to 100 acres.

Canals taking water from Tieton and Naches rivers—Continued.

Canal.	Location.				Length in miles.
	Nearest town.	Head works.		Band of river.	
		Section.	Township.	Range.	
From Naches below Tieton and above Cowiche Creek—Continued.					
Laswell	North Yakima	14	14 N.	17 E.	Right	
Yakima Valley	do	24	14 N.	17 E.	do	22
Rhodenbach-Schuler	do	6	13 N.	18 E.	do	
Clark	do		14 N.	17 E.	Left	
Lowry	do		14 N.	17 E.	do	
Kelly	do		14 N.	17 E.	do	
Gleed	do	24	14 N.	17 E.	do	6
Morrisey	do	25	14 N.	17 E.	do	
White and Leach	do	(a)			do	
McCormick	do	(a)			do	
Shearer-Chapman	do	(b)			do	
Naches-Cowiche	do	9	13 N.	18 E.	Right	7
From Naches below Cowiche Creek.						
Broadgauge [c]	North Yakima	10	13 N.	18 E.	Right	3
Power [c]	do	10	13 N.	18 E.	do	6
Shanno [c]	do	11	13 N.	18 E.	do	8
Union	do	11	13 N.	18 E.	do	8½
Town	do	12	13 N.	18 E.	do	

Canal.	Appropriation.		Area under canal—		Proposed extension.
	Amount in second-feet.	Date.	Irrigated.	Irrigable.	
From Tieton River.			*Acres.*	*Acres.*	*Acres.*
Sinclair and Cobb			320	320	None.
From Naches above Tieton River.					
Selah Valley	800	Nov. 13, 1888	6,000	9,500	[d] [e] 5,000
Small ditches (combined)					None.
From Naches below Tieton and above Cowiche Creek.					
Wapatox	30	Apr. 13, 1888	1,400	2,000	[d] 3,000
Cox			60	210	None.
Upper Scott			200	600	None.
Lower Scott			150	400	None.
Fortune	1,000	Apr. 23, 1892	200	400	None.
Laswell	[f] 5,000		275	650	None.
Yakima Valley	150	Mar. 22, 1894	3,600	4,200	None.
Rhodenbach-Schuler	5	1882–1892	300	300	None.
Clark	[f] 1,500	Mar. 6, 1889	400	450	None.
Lowry	[f] 2,000	——, 1884	300	400	None.
Kelly			500	600	None.
Gleed	100	Apr. 1, 1889	1,400	1,400	None.
Morrisey	[f] 300	Nov. 13, 1894	300	400	None.
White and Leach			200	300	None.
McCormick			200	200	None.
Shearer-Chapman			400	400	None.
Naches-Cowiche	100	Feb. 9, 1895	1,500	1,500	None.

[a] About 2 miles below Gleed canal.
[b] About 4 miles below Gleed canal.
[c] Property of the Northwestern Light and Power Company.
[d] Additional.
[e] Pipe line extensions.
[f] Miner's inches.

Canals taking water from Tieton and Naches rivers—Continued.

Canal.	Appropriation.		Area under canal—		Proposed extension.
	Amount in second-feet.	Date.	Irrigated.	Irrigable.	
From Naches below Cowiche Creek.			*Acres.*	*Acres.*	*Acres.*
Broadgauge	16	—— —, 1885	500	800	None.
Power	450	Oct. 1, 1889	250	250	None.
	400	Jan. 8, 1902			
Shanno	60	—— —, 1870	1,000	1,600	None.
Union	(a)	None.b	2,000	3,000	None.
Town			640	640	
Total			22,090	30,520	

Canal.	Discharge in second-feet.								
	Apr. 16-30.	May.	June.	July.	Aug.	Sept.	Oct. 1-15.	Average.	Total.
From Tieton River.									
Sinclair and Cobb								5	5
From Naches above Tieton River.									
Selah Valley	45	59	83.3	69.5	86.7	80.8	60.0	72.0	
Small ditches (combined)								15	87
From Naches below Tieton and above Cowiche Creek.									
Wapatox	20.0	40.0	37.2	29.0	37.0	26.1	14.8	31.2	
Cox								4	
Upper Scott								7	
Lower Scott								10	
Fortune								7	
Laswell								10	
Yakima Valley	40.0	46.8	55.3	62.5	77.5	60.8	43.4	57.4	
Rhodenbach-Schuler								6	
Clark								5	
Lowry								15	
Kelly								c 30	
Gleed	40	65	61.1	55.9	69.4	38.8	28.0	54.2	
Morrisey								c 6	
White and Leach								c 8	
McCormick								c 5	
Shearer-Chapman								6	
Naches-Cowiche	30.0	42.0	38.9	38.9	53.5	29.1	24.0	38.4	300
From Naches below Cowiche Creek.									
Broadgauge	4.0	5.5	d 17.0	d 15.9	d 16.3	d 10.0	d 8.0	d 11.8	
Power	170	174	178	176	189	199	196	183	
Shanno	20.0	21	29.1	d 30	d 30	d 19	d 15	d 24.4	
Union	35	41.7	39	37.3	36.9	32.0	30.0	36.6	
Town	10	14	12.3	12.5	14.5	11.4	10.0	12.5	c 268
Total									e 660

a Agrees to deliver 3,000 inches.
b First used water, 1869.
c Partly seepage water from canals above.
d From Power canal.
e Forty second-feet estimated amount included in discharge of other canals drawing from Power canal.

SNAKE RIVER (NORTH FORK) NEAR ORA, IDAHO.

This station was established August 20, 1902, by N. S. Dils, and a temporary gage was set. It is located at the North Fork Bridge, 2 miles south of Ora and 10 miles above St. Anthony, Idaho. A permanent vertical gage was set on October 6, 1904, by William G. Davies. The zero of this permanent gage is at the same elevation as the zero of the temporary gage. This gage consists of a 2 by 12 inch plank securely spiked to the first bridge pier from north abutment. This plank is beveled on one edge. The gage is graduated to feet and half tenths painted white, and marked with United States Geological Survey name plate. The observer is Mrs. Martha J. Fritz. The initial point for soundings is a bolt through the toe of the end brace on the lower side of the north end of the bridge. The bridge is 210 feet long. It consists of four spans resting on three rock-filled crib piers. Measurements are made from the lower side of this bridge. The channel is straight both above and below this station. The banks are high and do not overflow. The bed of the stream is hard gravel, quite smooth, and not liable to change. The current is swift. Bench mark No. 1 is a United States Geological Survey aluminum tablet set in a large rock about 30 feet northeast from north end of bridge. Its elevation is 12.84 above zero of gage. Bench mark No. 2 is a cross on a large flat rock marked "B. M." 25 feet northeast from north end of bridge. Its elevation is 11.10 feet above zero of gage.

The observations at this station during 1904 have been made under the direction of D. W. Ross, district engineer.

Discharge measurements of Snake River (Nork Fork) near Ora, Idaho, in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
April 12	F. S. Stockton	177	361	3.31	2.1	1,194
May 3	do	177	593	5.37	3.3	3,183
May 17	Wm. G Davies	178	717	6.45	4.1	4,623
July 11	do	177	423	3.60	2.4	1,523

Mean daily gage height, in feet, of Snake River (North Fork) near Ora, Idaho, for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.0	2.0	2.0	1.9	3.0	3.3	2.5	2.3	2.2	2.2	2.2	2.1
2	2.0	2.0	2.0	1.9	3.3	3.3	2.5	2.3	2.2	2.2	2.2	2.1
3	2.0	2.0	2.0	1.9	3.3	3.5	2.5	2.3	2.2	2.2	2.2	2.1
4	2.0	2.0	2.0	2.0	3.7	3.3	2.5	2.2	2.2	2.2	2.2	2.1
5	2.0	2.0	2.0	2.0	3.8	3.2	2.5	2.2	2.2	2.2	2.2	2.1
6	2.0	2.0	2.0	2.0	4.2	3.2	2.6	2.2	2 2	2 2	2 2	2.1
7	2.0	2.0	2.0	2.0	4.1	3.1	2.6	2.2	2.2	2.2	2.2	2.1
8	2.0	2.0	2.0	2.0	4.0	3.1	2.4	2.2	2.2	2.2	2.2	2.1
9	2.0	2.0	2.0	2.0	4.1	3.1	2.4	2 2	2 2	2.2	2.2	2.1
10	2.0	2.0	2.0	2.0	4.2	3.1	2.4	2.2	2.2	2.2	2.2	2.1
11	2.0	2.0	2.0	2.0	4.0	3.0	2.4	2.2	2.2	2.2	2.2	2.1
12	2.0	2.0	2.0	2.1	4.0	3.0	2.4	2.2	2.2	2.2	2.2	2.1
13	2.0	2.0	2.0	2.2	4.0	3.0	2.4	2.2	2.2	2.2	2.2	2.1
14	2.0	2.0	2.0	2.3	4.1	3.0	2.4	2.2	2.2	2.2	2.2	2.1
15	2.0	2.0	2.0	2.4	4.2	2.9	2.4	2.2	2.2	2.2	2.2	2.1
16	2.0	2.0	2.0	2.4	4.1	2.9	2.4	2.2	2.2	2.3	2.2	2.1
17	2.0	2.0	1.9	2.3	4.1	2.8	2.3	2.2	2.2	2.3	2.2	2.1
18	2.0	2.0	1.9	2.3	4.1	2.8	2.3	2.1	2.2	2.3	2.2	2.1
19	2.0	2.0	1.9	2.4	4.2	2.8	2.3	2.1	2.2	2.2	2.2	2.1
20	2.0	2.0	1.9	2.5	4.5	2.8	2.3	2.1	2.2	2.2	2.2	2.1
21	2.0	2.0	1.9	2.5	4.3	2.7	2.3	2.1	2.2	2.2	2.1	2.1
22	2.0	2.0	1.9	2.4	4.2	2.7	2.3	2.1	2.2	2.2	2.1	2.1
23	2.0	2.0	1.9	2.3	4.2	2.7	2.3	2.1	2.2	2.2	2.1	2.1
24	2.0	2.0	2.0	2.3	4.0	2.6	2.3	2.2	2.2	2.2	2.1	2.1
25	2.0	2.0	2.0	2.3	3.8	2.6	2.3	2.2	2.2	2.2	2.1	2.1
26	2.0	2.0	2.0	2.4	3.5	2.6	2.3	2.2	2.2	2.2	2.1	2.1
27	2.0	2.0	1.9	2.5	3.4	2.6	2.3	2.2	2.2	2.2	2.1	2.1
28	2.0	2.0	1.9	3.0	3.3	2.6	2.3	2.2	2.2	2.2	2.1	2.1
29	2.0	2.0	1.9	2.9	3.2	2.5	2.3	2.2	2.2	2.2	2.1	2.1
30	2.0	.....	1.9	2.9	3.3	2.5	2.3	2.2	2.2	2.2	2.1	2.1
31	2.0	.....	1.9	.....	3.3	.....	2.3	2.2	.....	2.2	.....	2.2

Rating table for Snake River (North Fork) near Ora, Idaho, from January 1 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.90	1,020	2.60	1,900	3.30	3,160	4.00	4,420
2.00	1,110	2.70	2,080	3.40	3,340	4.10	4,610
2.10	1,205	2.80	2,260	3.50	3,520	4.20	4,800
2.20	1,310	2.90	2,440	3.60	3,700	4.30	4,990
2.30	1,425	3.00	2,620	3.70	3,880	4.40	5,180
2.40	1,555	3.10	2,800	3.80	4,060	4.50	5,370
2.50	1,720	3.20	2,980	3.90	4,240		

The above table is applicable only for open-channel conditions. It is based upon 11 discharge measurements made during 1902 to 1904, inclusive. It is well defined between gage heights 2.00 feet and 4.10 feet. The table has been extended beyond these limits.

Estimated monthly discharge of Snake River (North Fork) near Ora, Idaho, for 1904.

[Drainage area, 1,040 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
January	1,110	1,110	1,110	68,250	1.07	1.23
February	1,110	1,110	1,110	63,850	1.07	1.15
March	1,110	1,020	1,075	66,100	1.03	1.19
April	2,620	1,020	1,448	86,170	1.39	1.55
May	5,370	2,620	4,167	256,200	4.01	4.62
June	3,520	1,720	2,458	146,300	2.36	2.63
July	1,900	1,425	1,541	94,750	1.48	1.71
August	1,425	1,205	1,301	80,000	1.25	1.44
September	1,310	1,310	1,310	77,950	1.26	1.41
October	1,425	1,310	1,321	81,220	1.27	1.46
November	1,310	1,205	1,275	75,870	1.23	1.37
December	1,310	1,205	1,208	74,280	1.16	1.34
The year	5,370	1,020	1,610	1,171,000	1.55	21.10

SNAKE RIVER NEAR MINIDOKA, IDAHO.

Ten miles above the gaging station at Montgomery's ferry occurs a natural dam site, from which, as a starting point, surveys for canal lines have been run, covering the large extent of rolling country susceptible of irrigation on both sides of the river. Measurements at Montgomery's ferry show the amount of water available for irrigation purposes there, and for the newly constructed Twin Falls canals heading 23 miles below, and also the conditions that will exist for power purposes at Shoshone Falls, about 45 miles below, after the irrigable lands of Snake River Valley shall have been reclaimed.

This station was originally established August 5, 1895, at Montgomery's ferry on the stage road from Minidoka to Albion, Idaho.

When the station was visited on October 14, 1899, a comparison was made of the gage rod with the bench mark, and it was found that the rod had moved to a considerable extent, due to the action of the quicksand on the inclined portion of the rod. The heights as recorded by the observer, as well as the discharge measurements, were corrected. Gage readings were not taken during 1900.

The station was reestablished May 1, 1901, and the gage read morning and evening for the remainder of the year. Part of the inclined gage rod which had been moved by quicksand was corrected August 9, 1901, and all previous gage readings were carefully adjusted to correspond with the present position of the rod.

On October 16, 1903, the gage was carefully checked by means of a level. Different sections of the gage were found to be from 0.1 to 0.3 foot too high. The gage was corrected and the gage heights adjusted to conform with the old gage datum. The lower section of the gage is an inclined 4 by 4 inch timber and reads from zero to 6.8 feet. The upper section is vertical and reads from 6.8 to 13 feet. The gage is read twice each day by George Montgomery, the ferryman. Discharge measurements are made from the ferryboat. A tagged wire has been stretched above the ferry cable. The initial point for soundings is the cable support on the right bank. The channel is straight for 300 feet above and below the station and has a width at the ferry of about 800 feet. Both banks are high, without vegetation, and are not liable to overflow. There is but one channel at all stages. The bench mark, established when the original gage was installed, is a spike in the east post of the tool house on the right bank. The spike is 1.2 feet above the ground, 52 feet west of the gage, and has an elevation of 17.50 feet above the zero of the gage. The letters "B. M." are marked in black paint on the post.

The observations at this station during 1904 have been made under the direction of D. W. Ross, district engineer.

Discharge measurements of Snake River near Minidoka, Idaho, in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
April 9	F. Stockton	804	3,709	1.48	2.90	5,494
May 5	do	840	6,816	2.73	6.40	18,590
May 12	Wm. G. Davies	865	7,524	2.70	7.05	20,190
June 10	do	881	9,556	3.43	9.30	29,860
July 7	J. B. Bond	782	6,476	2.51	6.70	16,400
August 2	do	817	4,255	1.51	3.50	6,794
August 13	do	798	3,215	1.37	2.20	4,331
September 22	Wm. G. Davies	800	3,592	1.29	2.68	4,655
October 30	do	810	4,034	1.26	3.21	5,521

Mean daily gage height, in feet, of Snake River near Minidoka, Idaho, for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	5.0	3.0	3.4	3.1	6.0	10.1	6.8	3.55	2.95	2.8	3.2	3.1
2	5.0	3.1	3.5	3.1	6.1	10.1	6.65	3.45	3.15	2.8	3.2	3.2
3	4.9	2.85	3.55	3.0	6.1	10.1	6.7	3.35	3.3	2.8	3.2	3.2
4	4.85	2.65	3.4	3.0	6.2	10.1	6.75	3.15	3.3	2.8	3.2	3.1
5	4.75	2.6	3.4	3.0	6.4	10.2	6.7	3.05	3.3	2.8	3.2	3.1
6	4.6	2.6	3.3	3.0	6.6	10.05	6.8	2.85	3.15	2.8	3.2	3.0
7	4.45	2.6	3.3	3.0	7.0	9.8	6.65	2.65	3.1	2.8	3.2	3.0
8	4.3	2.6	3.4	3.0	7.1	9.4	6.55	2.55	3.1	2.9	3.2	3.0
9	4.15	2.75	3.55	2.95	7.3	9.3	6.35	2.45	3.1	2.9	3.2	3.0

Mean daily gage height, in feet, of Snake River near Minidoka, Idaho, for 1904—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
10	4.0	3.2	3.6	2.9	7.25	9.3	6.2	2.35	3.1	3.0	3.2	3.0
11	3.9	a3.9	3.6	2.9	7.15	9.3	6.1	2.25	3.0	3.0	3.2	3.0
12	3.8	a4.7	3.7	2.9	7.1	9.1	6.1	2.2	2.9	3.0	3.2	3.1
13	3.7	a4.45	3.6	2.9	7.4	9.2	6.0	2.1	2.9	3.0	3.2	3.1
14	3.6	a3.8	3.5	3.0	7.6	9.1	5.9	2.1	2.8	3.0	3.2	3.2
15	3.65	3.35	3.4	3.15	7.7	8.9	5.9	2.1	2.8	3.0	3.2	3.2
16	3.8	3.15	3.3	3.35	7.8	8.55	5.8	2.1	2.8	3.0	3.2	3.2
17	3.9	3.0	3.3	3.6	8.0	8.4	5.7	2.1	2.8	3.05	3.1	3.2
18	4.0	2.9	3.3	4.0	8.1	8.65	5.55	2.1	2.8	3.1	3.1	3.1
19	4.2	2.75	3.2	4.35	8.3	8.75	5.35	2.1	2.8	3.1	3.1	3.0
20	4.2	2.55	3.2	4.4	8.3	8.8	5.15	2.2	2.8	3.1	3.1	2.9
21	4.05	2.7	3.3	4.5	8.5	8.6	4.95	2.35	2.7	3.1	3.1	2.9
22	3.95	3.45	3.4	4.9	8.9	8.6	4.75	2.3	2.7	3.1	3.1	2.9
23	3.75	3.3	3.4	5.3	9.3	8.6	4.55	2.3	2.7	3.1	3.1	2.9
24	3.65	3.35	3.4	5.3	9.65	8.6	4.35	2.4	2.7	3.1	3.1	2.9
25	3.55	3.25	3.4	5.1	9.9	8.5	4.2	2.45	2.7	3.1	3.1	2.95
26	3.5	3.15	3.3	4.95	10.2	8.4	4.15	2.5	2.7	3.1	3.1	a3.45
27	3.4	3.1	3.3	4.75	10.6	8.2	4.05	2.5	2.7	3.2	3.2	a3.85
28	3.3	3.2	3.25	4.8	11.0	7.65	3.95	2.6	2.7	3.2	3.2	a4.25
29	3.2	3.3	3.2	5.05	10.8	7.25	3.85	2.7	2.8	3.2	3.2	a4.6
30	3.1	.....	3.2	5.55	10.45	7.05	3.7	2.7	2.8	3.2	3.2	a4.85
31	3.1	.....	3.15	.....	10.2	.....	3.65	2.75	.....	3.2	.....	a4.7

a Ice.

Rating table for Snake River near Minidoka, Idaho, from January 1 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
2.00	3,930	3.50	6,790	5.00	10,720	7.00	19,000
2.10	4,100	3.60	7,010	5.10	11,060	7.20	19,920
2.20	4,275	3.70	7,240	5.20	11,410	7.40	20,840
2.30	4,450	3.80	7,470	5.30	11,780	7.60	21,760
2.40	4,630	3.90	7,710	5.40	12,160	7.80	22,680
2.50	4,810	4.00	7,950	5.50	12,560	8.00	23,600
2.60	4,995	4.10	8,190	5.60	12,960	8.20	24,560
2.70	5,180	4.20	8,440	5.70	13,360	8.40	25,520
2.80	5,370	4.30	8,690	5.80	13,760	8.60	26,480
2.90	5,560	4.40	8,950	5.90	14,180	8.80	27,440
3.00	5,750	4.50	9,220	6.00	14,600	9.00	28,400
3.10	5,950	4.60	9,490	6.20	15,460	9.50	30,800
3.20	6,150	4.70	9,770	6.40	16,340	10.00	33,200
3.30	6,360	4.80	10,070	6.60	17,220	10.50	35,600
3.40	6,570	4.90	10,390	6.80	18,100	11.00	38,000

The above table is applicable only for open-channel conditions. It is based upon discharge measurements made during 1895 to 1904, inclusive. It is well defined. Above gage height 8.00 feet the rating curve is a tangent, the difference being 480 per tenth.

Estimated monthly discharge of Snake River near Minidoka, Idaho, for 1904.

[Drainage area, 22,600 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
January [a]	.....	.....	6,050	372,000	0.338	0.390
February	.....	.....	5,783	332,600	.323	.348
March	7,240	6,050	6,534	401,800	.365	.421
April	12,760	5,560	7,790	463,500	.435	.485
May	38,000	14,600	24,520	1,508,000	1.37	1.58
June	34,160	19,230	28,200	1,678,000	1.58	1.76
July	18,100	7,125	12,970	797,500	.725	.836
August	6,900	4,100	4,881	300,100	.273	.315
September	6,360	5,180	5,576	331,800	.311	.347
October	6,150	5,370	5,778	355,300	.323	.372
November	6,150	5,950	6,083	362,000	.340	.379
December	.....	.....	5,832	358,600	.326	.376
The year	.....	.....	10,000	7,261,000	.559	7.61

[a] Discharge estimated January 1–31–February 11–14–December 26–31 on account of ice gorging.

FALL RIVER AT FREMONT, IDAHO.

This station supersedes the station at Wilson's Mill, near Marysville, which was discontinued December 31, 1903, because of the difficulty of securing an observer. It was established January 1, 1904, when a temporary gage was placed at Fremont, 3 miles below Wilson's Mill, and readings were made from this gage until October 28, when a cable, car, and permanent gage were installed. The gage consists of a 4 by 4 inch timber graduated to feet and tenths, fastened in a vertical position by anchor bolts and vertical braces. It is painted white and marked with United States Geological Survey name plate. The gage is on the south bank of the stream, about 900 feet from Fremont post-office. The zero of this gage is at the same elevation as the zero of the temporary gage. The observer is Mrs. Eva A. Loomis. P. Wilson has been observer of the Wilson's Mill gage during high water. The initial point for soundings is a tin tag marked "I. P." on the inside face of the cable on the south bank of the stream. The cable is about 500 feet below the gage. The channel is straight above and below the station. Both banks are high, wooded, steep, and are not liable to overflow. There is but one channel at all stages. The bench mark is a standard aluminum tablet set in a rock 20 feet from the gage. Its elevation is 10.36 feet above the zero of the gage.

The Brady canal, capacity about 100 second-feet, heads in the right bank of the river between Wilson's Mill and the Fremont station.

The observations at this station during 1904 have been made under the direction of D. W. Ross, district hydrographer.

Discharge measurements of Fall River at Fremont, Idaho, in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
May 19	W. G. Davies	115	640	6.59	[a] 5.20	4,235
June 28	do	114	451	4.62	[a] 3.55	2,096
August 1	J. G. Bond	112	300	3.51	[a] 2.40	1,140
August 14	W. G. Davies	110	246	3.04	[a] 2.28	[b] 739
October 28	do	140	209	2.37	[c] 2.10	496

[a] Gaged at Wilson's Mill.
[b] Gage at Fremont station 2.25. Discharge of Brady canal 85 second-feet. Discharge at Fremont station 654 second-feet.
[c] Gaged at Fremont.

Mean daily gage height, in feet, of Fall River at Fremont, Idaho, for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.0	1.8	1.9	1.9	.....	3.8	3.2	2.4	2.25	2.15	2.1	2.0
2	2.0	1.8	1.9	1.9	.....	3.8	3.2	.....	2.25	2.1	2.1	2.0
3	2.0	1.8	1.9	1.9	.....	3.8	.....	.....	2.2	2.1	2.1	2.0
4	2.0	1.8	1.9	1.9	.....	3.8	3.2	2.3	2.2	2.15	2.05	2.0
5	2.0	1.8	1.9	1.9	.....	3.7	.....	.....	2.2	2.15	2.05	2.0
6	2.0	1.8	1.9	1.9	.....	.....	3.2	2.3	2.18	2.18	2.05	2.0
7	2.0	1.8	2.0	1.9	.....	3.7	.....	.....	2.18	2.2	2.05	2.0
8	2.0	1.8	2.0	1.9	.....	.....	3.2	2.2	2.18	2.2	2.05	2.0
9	2.0	1.8	2.0	1.9	.....	3.7	.....	.....	2.18	2.2	2.05	2.0
10	2.0	1.8	2.0	1.9	.....	.....	3.1	.....	2.18	2.2	2.05	2.0
11	1.9	1.8	2.0	2.0	.....	3.7	.....	.....	2.18	2.2	2.05	2.05
12	1.9	1.8	1.9	2.1	.....	3.6	3.0	.....	2.18	2.15	2.05	2.05
13	1.9	1.8	1.9	2.25	.....	3.6	.....	.....	2.18	2.15	2.05	2.05
14	1.9	1.8	1.9	2.25	.....	3.6	3.0	2.25	2.18	2.1	2.05	2.05
15	1.9	1.8	1.9	2.5	.....	3.6	.....	2.25	2.18	2.1	2.05	2.05
16	1.9	1.8	1.9	2.35	.....	3.6	3.0	2.25	2.18	2.1	2.05	2.05
17	1.9	1.8	1.9	2.3	.....	3.6	.....	2.28	2.18	2.1	2.05	2.05
18	1.9	1.8	1.9	2.3	.....	3.6	3.0	2.28	2.18	2.1	2.05	2.05
19	1.8	1.8	1.9	2.4	.....	3.6	.....	2.28	2.18	2.1	2.05	2.0
20	1.8	1.8	1.9	2.45	.....	3.6	3.0	2.28	2.18	2.1	2.05	2.0
21	1.8	1.8	1.9	2.4	.....	3.6	.....	2.25	2.18	2.1	2.05	2.0
22	1.8	1.8	1.9	2.35	.....	3.6	2.8	2.25	2.15	2.1	2.05	2.0
23	1.8	1.8	1.9	2.3	.....	3.6	.....	2.25	2.18	2.1	2.0	2.0
24	1.8	1.8	1.9	.....	.....	3.6	2.8	2.28	2.18	2.1	2.0	2.0
25	1.8	1.8	1.9	.....	.....	3.6	.....	2.3	2.15	2.1	2.0	2.0
26	1.8	1.8	1.9	.....	.....	3.6	2.7	2.35	2.15	2.1	2.0	2.0
27	1.8	1.8	1.9	.....	.....	3.6	2.6	2.35	2.15	2.1	2.0	2.0
28	1.8	1.9	1.9	.....	.....	3.6	.....	2.35	2.15	2.1	2.0	2.0
29	1.8	1.9	1.9	.....	.....	3.5	.....	2.3	2.15	2.1	2.0	2.0
30	1.8	.....	1.9	.....	.....	3.5	2.5	2.3	2.15	2.1	2.0	2.0
31	1.8	.....	1.9	.....	.....	.....	.....	2.28	.....	2.1	.....	2.0

NOTE.—Gage heights from June 1 to August 8 are based on gage heights at Wilson Mill gage and also on simultaneous readings. Gage heights from October 16 to 22 are interpolated.

TETON RIVER NEAR ST. ANTHONY, IDAHO.

This station was established April 23, 1903, by N. S. Dils. It is located at the bridge on the stage road from St. Anthony to Victor, Idaho. The gage is a vertical 2 by 12 inch timber 8 feet long, spiked to the upstream side of the right crib abutment. A permanent gage was set October 5, 1904. This gage consists of 2 by 12 inch fir timber set vertical and spiked to the upstream side of the north end abutment. The gage is graduated to half tenths of a foot; the graduations being marked by metallic numerals and staples. The gage is painted white, and marked with a United States Geological Survey name plate. The zero of this gage is same elevation as zero of old gage. It is read once each day by William Ferguson. Discharge measurements are made from the two-span bridge to which the gage is attached. The bridge is supported by crib abutments, constructed of logs, filled with lava rock and by a similar middle pier. The initial point from which soundings are made is a large bolt marked "I. P." in the upstream side of the south end abutment. The channel is straight for a short distance above and below the station. The right bank is high, and will not overflow. The left bank will overflow at extreme flood stages. The current is sluggish. Both banks and bed are composed of hard gravel, and the latter is permanent. Bench mark No. 1 is a United States Geological Survey aluminum tablet set in solid rock about 30 feet northeast of north end of bridge. Its elevation is 13.53 feet above the zero of the gage. Bench mark No. 2 is a cross on a large flat rock 40 feet northeast of the right end of the bridge. It is marked "B. M." and has an elevation of 14.25 feet above the zero of the gage. Bench mark No. 3 is a similar rock 60 feet northwest of the right end of the bridge. It is similarly marked, and has an elevation of 14.41 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of D. W. Ross, district engineer.

Discharge measurements of Teton River near St. Anthony, Idaho, in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
April 11	F. Stockton	78	376	2.29	2.30	862
May 3	Stockton and Murphy	78	394	2.78	2.60	1,077
June 22	Wm. G. Davies	78	522	4.95	4.10	2,582
July 25	do	78	384	2.40	2.45	921
October 5	do	65	310	1.65	1.70	512

Mean daily gage height, in feet, of Teton River near St. Anthony, Idaho, for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.00	2.70	.....	.....	2.30	4.10	3.30	2.20	1.90	1.70	1.60	1.50
2	3.10	2.70	.....	.....	2.50	4.10	3.30	2.20	1.90	1.70	1.60	1.50
3	3.00	2.70	.....	.....	2.60	4.10	3.30	2.20	1.90	1.70	1.60	1.50
4	2.90	2.70	.....	.....	2.80	3.80	3.20	2.10	1.90	1.70	1.60	1.50
5	2.90	2.70	.....	.....	3.00	3.50	3.10	2.10	1.80	1.70	1.60	1.60
6	2.90	2.70	.....	.....	3.00	3.40	3.00	2.10	1.80	1.70	1.60	1.65
7	2.90	2.70	.....	.....	2.90	3.40	3.00	2.10	1.80	1.70	1.60	1.80
8	2.90	2.70	.....	.....	2.70	3.40	3.00	2.10	1.80	1.70	1.60	1.80
9	2.90	2.70	.....	.....	2.50	3.50	3.00	2.00	1.80	1.70	1.60	1.80
10	2.80	2.90	.....	.....	2.70	3.80	3.00	2.00	1.80	1.75	1.60	1.80
11	2.80	2.90	.....	2.30	2.80	3.90	2.90	2.00	1.80	1.70	1.60	1.80
12	2.80	3.00	.....	2.30	3.00	3.60	2.90	2.00	1.80	1.80	1.60	1.80
13	2.80	3.00	.....	2.30	3.00	3.60	2.90	2.00	1.70	1.80	1.50	1.80
14	2.70	3.00	.....	2.40	3.10	3.60	3.10	2.00	1.70	1.80	1.50	1.80
15	2.70	3.00	.....	2.60	3.40	3.70	2.90	2.00	1.70	1.80	1.50	1.80
16	2.70	3.10	.....	2.60	3.30	3.90	2.70	2.00	1.70	1.80	1.50	1.80
17	2.70	3.10	.....	2.40	3.40	4.00	2.70	2.00	1.70	1.80	1.50	1.80
18	2.70	3.10	.....	2.20	3.60	4.10	2.60	2.00	1.70	1.75	1.50	1.70
19	2.70	3.10	.....	2.40	4.20	4.20	2.50	2.00	1.70	1.75	1.55	1.60
20	2.70	3.10	.....	2.60	4.40	4.20	2.40	2.00	1.70	1.75	1.55	1.50
21	2.70	3.10	.....	2.40	4.40	4.10	2.50	1.90	1.70	1.70	1.55	1.40
22	2.70	3.00	.....	2.30	4.80	3.90	2.50	1.90	1.70	1.70	1.50	1.40
23	2.70	3.00	.....	2.10	5.20	4.00	2.50	1.90	1.70	1.70	1.50	1.40
24	2.70	3.00	.....	2.10	5.60	3.80	2.50	1.90	1.70	1.70	1.50	1.40
25	2.70	3.00	.....	2.00	5.30	3.50	2.40	1.90	1.70	1.70	1.50	1.70
26	2.70	.....	.....	2.00	4.60	3.20	2.40	1.90	1.70	1.70	1.50	1.80
27	2.70	.....	.....	2.20	4.10	3.00	2.40	1.90	1.70	1.70	1.50	1.90
28	2.70	.....	.....	2.60	4.00	3.00	2.40	1.90	1.70	1.65	1.50	1.90
29	2.70	.....	.....	2.50	4.00	3.10	2.50	1.90	1.70	1.65	1.50	1.90
30	2.70	.....	.....	2.40	4.10	3.10	2.30	2.00	1.70	1.65	1.50	2.00
31	2.70	.....	.....	.....	4.00	.....	2.30	1.90	.....	1.65	.....	2.10

Rating table for Teton River near St. Anthony, Idaho, from January 1 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.40	365	2.50	955	3.60	1,915	4.70	3,550
1.50	410	2.60	1,020	3.70	2,035	4.80	3,740
1.60	460	2.70	1,085	3.80	2,160	4.90	3,925
1.70	510	2.80	1,155	3.90	2,295	5.00	4,115
1.80	560	2.90	1,230	4.00	2,435	5.10	4,310
1.90	610	3.00	1,310	4.10	2,580	5.20	4,515
2.00	665	3.10	1,395	4.20	2,730	5.30	4,725
2.10	720	3.20	1,485	4.30	2,885	5.40	4,940
2.20	775	3.30	1,585	4.40	3,045	5.50	5,160
2.30	835	3.40	1,690	4.50	3,215	5.60	5,385
2.40	895	3.50	1,800	4.60	3,385		

Estimated monthly discharge of Teton River near St. Anthony, Idaho, for 1904.

[Drainage area, 960 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
January [a]	1,395	1,085	1,147	70,530	1.19	1.37
February 1–25 [a]	1,395	1,085	1,243	61,640	1.29	1.20
April 11–30	1,020	665	858	34,040	.894	.665
May	5,385	835	2,130	131,000	2.22	2.56
June	2,730	1,310	2,058	122,500	2.14	2.39
July	1,585	835	1,147	70,530	1.19	1.37
August	775	610	667	41,010	.695	.801
September	610	510	537	31,950	.559	.624
October	560	485	520	31,970	.542	.625
November	460	410	432	25,710	.450	.502
December	720	365	512	31,480	.533	.614
The period				652,400		

[a] River frozen; discharge probably too large.

SNAKE RIVER (SOUTH FORK) AT MORAN, WYO.

This station was established September 21, 1903, by Fred Stockton. It is located directly back of the post-office at Moran, Wyo., and about three-fourths of a mile below the outlet of Jackson Lake. A permanent gage was set on October 23, 1904. This gage is a 4 by 4 inch timber anchored well by three vertical timbers. This gage is inclined; 1.85 feet along the gage is equivalent to 1 foot vertical. The gage is graduated to half-tenths of a foot marked with metallic numbers and copper staples; painted white and marked with United States Geological Survey name plate. The gage is read once each day by Lizzie Roche. Discharge measurements are made from a car and cable about 150 feet below gage. The initial point for soundings is on the inner face of cable support on north side of river. The channel is slightly curved for about 300 feet above the station. Below the station the channel is straight. At and above the station the current is smooth and has a well-distributed velocity. Below the station the current is broken by small bowlders. Both banks are high and are not liable to overflow. The right bank is wooded and the left bank is composed of gravel and is without trees. The bed of the stream is composed of firm gravel. There is but one channel at all stages. The bench mark is a United States Geological Survey iron bench-mark post set about 30 feet from the gage. The elevation is 10.77 feet above zero of gage.

The observations at this station during 1904 have been made under the direction of D. W. Ross, district engineer.

Discharge measurements of Snake River (South Fork) at Moran, Wyo., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
June 26 [a]	Wm. G. Davies	395	1,609	4.31	6.16	6,932
September 1 [a]	do	205	370	2.97	1.95	1,101
October 22	do	190	487	1.09	1.25	530

[a] Gaged at Sheffields Bridge.

Mean daily gage height, in feet, of Snake River (South Fork) at Moran, Wyo., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.2	1.1	1.2	1.5	1.9	6.65	5.4	3.3	2.0	1.5	1.2	1.0
2	1.2	1.1	1.2	1.5	1.9	6.65	5.3	3.3	2.0	1.5	1.2	1.0
3	1.2	1.1	1.2	1.5	1.9	6.7	5.2	3.2	2.0	1.5	1.2	1.0
4	1.1	1.1	1.2	1.5	1.8	6.65	5.1	3.1	2.0	1.5	1.2	1.0
5	1.1	1.1	1.2	1.5	1.9	6.5	5.0	3.0	2.0	1.5	1.1	1.0
6	1.1	1.1	1.3	1.5	2.0	6.35	4.9	2.9	2.0	1.4	1.1	1.0
7	1.1	1.1	1.3	1.4	2.1	6.1	4.8	2.8	2.0	1.4	1.1	1.0
8	1.1	1.1	1.4	1.4	2.2	6.2	4.7	2.7	2.0	1.4	1.1	1.0
9	1.1	1.1	1.4	1.3	2.3	6.1	4.6	2.7	2.0	1.4	1.1	1.0
10	1.1	1.2	1.4	1.3	2.3	6.2	4.5	2.7	2.0	1.4	1.1	1.0
11	1.1	1.2	1.5	1.3	2.4	6.2	4.4	2.7	2.1	1.4	1.1	1.0
12	1.1	1.2	1.5	1.3	2.6	6.2	4.4	2.6	2.1	1.3	1.1	1.0
13	1.1	1.2	1.5	1.3	2.8	6.3	4.4	2.6	2.0	1.3	1.1	1.0
14	1.1	1.2	1.5	1.4	2.9	6.3	4.4	2.6	2.0	1.3	1.1	1.0
15	1.1	1.2	1.5	1.4	3.0	6.4	4.3	2.5	2.0	1.3	1.1	1.0
16	1.1	1.2	1.5	1.4	3.1	6.4	4.2	2.5	2.0	1.3	1.1	1.0
17	1.1	1.2	1.5	1.4	3.1	6.5	4.1	2.4	2.0	1.3	1.1	1.0
18	1.1	1.2	1.5	1.4	3.3	6.6	4.0	2.4	2.0	1.2	1.1	1.0
19	1.1	1.2	1.5	1.5	3.5	6.6	3.9	2.3	1.9	1.2	1.0	1.0
20	1.1	1.2	1.5	1.5	4.1	6.7	3.8	2.3	1.8	1.2	1.0	1.0
21	1.1	1.2	1.5	1.5	4.5	6.7	3.8	2.3	1.8	1.2	1.0	1.0
22	1.1	1.2	1.5	1.6	4.9	6.7	3.8	2.2	1.8	1.1	1.0	1.0
23	1.1	1.2	1.5	1.6	5.3	6.5	3.7	2.2	1.8	1.2	1.0	1.0
24	1.1	1.2	1.5	1.6	6.0	6.3	3.7	2.2	1.8	1.2	1.0	1.0
25	1.1	1.2	1.5	1.6	6.5	6.1	3.6	2.2	1.7	1.2	1.0	1.0
26	1.1	1.2	1.5	1.6	6.7	5.9	3.6	2.1	1.7	1.2	1.0	1.0
27	1.1	1.2	1.5	1.6	6.6	5.7	3.6	2.1	1.7	1.2	1.0	1.0
28	1.1	1.2	1.5	1.7	6.5	5.6	3.5	2.1	1.6	1.2	1.0	1.0
29	1.1	1.2	1.5	1.8	6.5	5.5	3.4	2.0	1.6	1.2	1.0	1.0
30	1.1	.....	1.5	1.8	6.6	5.4	3.4	2.0	1.5	1.2	1.0	1.0
31	1.1	.....	1.5	.....	6.6	.....	3.3	2.0	.....	1.2	.....	1.0

Rating table for Snake River (South Fork) at Moran, Wyo., from September 21, 1903, to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.00	390	2.50	1,660	4.00	3,530	5.40	5,650
1.10	440	2.60	1,770	4.10	3,670	5.50	5,810
1.20	500	2.70	1,880	4.20	3,810	5.60	5,980
1.30	570	2.80	1,990	4.30	3,950	5.70	6,150
1.40	640	2.90	2,110	4.40	4,100	5.80	6,320
1.50	720	3.00	2,230	4.50	4,250	5.90	6,490
1.60	800	3.10	2,350	4.60	4,400	6.00	6,660
1.70	880	3.20	2,470	4.70	4,550	6.10	6,840
1.80	970	3.30	2,590	4.80	4,700	6.20	7,020
1.90	1,060	3.40	2,720	4.90	4,850	6.30	7,200
2.00	1,150	3.50	2,850	5.00	5,010	6.40	7,380
2.10	1,250	3.60	2,980	5.10	5,170	6.50	7,560
2.20	1,350	3.70	3,110	5.20	5,330	6.60	7,740
2.30	1,450	3.80	3,250	5.30	5,490	6.70	7,930
2.40	1,550	3.90	3,390				

Estimated monthly discharge of Snake River (South Fork) at Moran, Wyo., for 1903 and 1904.

[Drainage area, 820 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
1903.						
October	720	640	674	41,440	0.822	0.948
November	640	570	596	35,460	.727	.838
December	640	500	561	34,500	.684	.789
1904.						
January	500	440	446	27,420	.544	.627
February	500	440	481	27,670	.587	.633
March	720	500	667	41,010	.813	.937
April	970	570	714	42,490	.871	.972
May	7,930	970	3,561	219,000	4.34	5.00
June	7,930	5,650	7,190	427,800	8.77	9.78
July	5,650	2,590	3,869	237,900	4.72	5.44
August	2,590	1,150	1,695	104,200	2.07	2.39
September	1,250	720	1,059	630,20	1.29	1.44
October	720	440	574	35,290	.700	.807
November	500	390	428	25,470	.522	.582
December	390	390	390	23,980	.476	.549
The year	7,930	390	1,756	1,275,000	2.14	29.16

SNAKE RIVER (SOUTH FORK) NEAR LYON, IDAHO.

This station was established April 18, 1903, by N. S. Dils. It is located at the old site of Wedekind's ferry, between Lyon and Swan Valley, at the upper end of Conant Valley. It is about 45 miles from Idaho Falls, Idaho. A new gage was set on October 16, 1904. It is on the north bank one-fourth mile below Carr's ferry and about 1 mile above location of gaging station. The gage consists of a 4 by 4 inch timber well anchored, graduated and marked to half tenths of a foot by metallic numerals and staples. The gage is inclined; 1.55 feet along the gage corresponds to 1 vertical; 2.01 on the new gage corresponds to 1.75 on the old gage. The new gage is painted white, with a United States Geological Survey name plate. This gage is read once a day by O. J. Carr. The same volume of water flows past each gage.

Discharge measurements are now made from a cable and car at the old site of Wedekind's ferry. A tagged wire has been installed at the cable. The initial point for soundings is the pin in the top of a log of the crib cable support on the left bank. The channel is straight above and below the station, and the current is swift. The right bank is high and steep and will not overflow. At very high stages the left bank will overflow for a considerable distance and some water will pass around the station through a slough. The bed of the stream is composed of hard gravel, free from vegetation, and permanent. Bench mark No. 1 is a United States Geological Survey iron bench-mark post set about 6 feet from the new gage. The elevation is 11.15 above zero of gage. Bench mark No. 2 is a United States Geological Survey aluminum tablet set in a rock on the left bank about 100 feet above Carr's ferry landing, and is about 6 feet above high-water mark. Its elevation is 10.44 feet above zero of gage. This bench mark is for use in high water when ferry service is discontinued.

The observations at this station during 1904 have been made under the direction of D. W. Ross, district engineer.

Discharge measurements of Snake River (South Fork) near Lyon, Idaho, in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
May 23	Wm. G. Davies	363	3,459	11.90	8.25	41,160
August 1	do	275	2,140	4.39	3.5	9,407
September 4	J. B. Bond	285	1,664	3.14	2.3	5,213
September 7	Wm. G. Davies	260	1,582	2.84	2.1	4,508
October 17	do	260	1,630	2.13	1.75	3,482

Mean daily gage height, in feet, of Snake River (South Fork) near Lyon, for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	1.52	1.55	1.60	4.40	8.05	6.15	3.65	2.40	1.90	1.50	1.20
2	.....	1.52	1.58	1.60	4.40	8.10	6.00	3.60	2.40	1.90	1.50	1.20
3	1.65	1.52	1.58	1.60	4.40	7.60	5.90	3.50	2.35	1.85	1.50	1.15
4	1.65	1.52	1.58	1.62	4.85	7.20	5.85	3.40	2.35	1.85	1.45	1.10
5	1.65	1.52	1.58	1.65	4.85	7.40	5.80	3.30	2.30	1.85	1.45	1.00
6	1.62	1.52	1.58	1.65	4.90	7.30	5.65	3.20	.....	1.80	1.43	1.00
7	1.62	1.52	1.58	1.70	4.92	7.30	5.50	3.10	.....	1.80	1.40	1.15
8	1.62	1.52	1.60	1.75	4.65	7.10	5.40	3.00	.....	1.80	1.40	1.20
9	1.62	1.52	1.60	1.75	4.40	7.10	5.30	2.90	.....	1.75	1.40	1.15
10	1.62	1.52	1.60	1.80	4.80	7.50	5.20	2.80	.....	1.95	1.37	1.10
11	1.62	1.52	1.60	1.82	5.00	7.60	5.00	2.85	.....	1.95	1.35	1.15
12	1.60	1.52	1.60	1.92	5.20	7.30	5.00	2.80	2.05	1.95	1.30	1.15
13	1.60	1.55	1.60	2.15	5.35	7.00	4.85	2.75	2.05	1.83	1.30	1.20
14	1.60	1.55	1.60	2.30	5.55	7.10	4.75	2.75	2.05	1.80	1.35	1.20
15	1.60	1.55	1.60	2.50	5.80	7.30	4.65	2.75	2.00	1.75	1.30	1.20
16	1.60	1.55	1.60	2.70	5.80	7.50	4.60	2.80	2.00	1.75	1.35	1.15
17	1.60	1.55	1.62	2.90	5.90	7.60	4.50	2.80	2.00	1.75	1.35	1.15
18	1.60	1.55	1.62	3.25	6.20	7.50	4.45	2.80	1.95	1.70	1.35	1.15
19	1.60	1.55	1.62	3.50	6.70	7.55	4.40	2.75	1.95	1.70	1.35	1.15
20	1.60	1.55	1.75	3.80	7.20	7.60	4.35	2.75	1.95	1.70	1.33	1.15
21	1.60	1.55	1.80	3.50	7.30	7.60	4.35	2.65	1.90	1.65	1.30	1.15
22	1.60	1.55	1.65	3.10	7.65	7.50	4.30	2.60	1.90	1.65	1.30	1.15
23	1.60	1.55	1.65	2.80	8.25	7.40	4.25	2.55	1.95	1.65	1.27	1.10
24	1.55	1.55	1.62	3.00	8.90	7.25	4.20	2.40	1.95	1.60	1.25	1.10
25	1.55	1.55	1.62	3.10	9.05	7.60	4.10	2.45	1.95	1.60	1.25	1.15
26	1.55	1.55	1.62	3.45	8.35	6.40	4.05	2.45	1.90	1.60	1.25	1.05
27	1.55	1.55	1.60	3.95	7.50	6.30	4.00	2.50	1.90	1.60	1.25	0.85
28	1.55	1.55	1.60	4.50	7.50	6.20	4.00	2.60	1.90	1.60	1.25	0.85
29	1.55	1.55	1.60	4.45	7.80	6.00	3.90	2.55	1.90	1.55	1.25	1.15
30	1.55	1.55	1.60	4.45	7.75	6.10	3.80	2.50	1.85	1.55	1.25	1.20
31	1.55	1.55	1.60	.....	7.80	.....	3.70	2.45	.....	1.55	.....	1.20

NOTE.—The above gage heights refer to the old gage.

Rating table for Snake River (South Fork) near Lyon, Idaho, from January 1 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
0.80	1,400	2.30	5,160	3.70	10,200	5.20	16,800
.90	1,590	2.40	5,480	3.80	10,600	5.40	17,760
1.00	1,790	2.50	5,800	3.90	11,020	5.60	18,780
1.10	2,000	2.60	6,120	4.00	11,440	5.80	19,840
1.20	2,220	2.70	6,460	4.10	11,860	6.00	20,980
1.30	2,440	2.80	6,800	4.20	12,280	6.20	22,200
1.40	2,670	2.90	7,140	4.30	12,720	6.40	23,500
1.50	2,910	3.00	7,500	4.40	13,160	6.60	24,950
1.60	3,160	3.10	7,860	4.50	13,600	6.80	26,500
1.70	3,420	3.20	8,240	4.60	14,040	7.00	28,200
1.80	3,690	3.30	8,620	4.70	14,480	7.50	32,900
1.90	3,970	3.40	9,000	4.80	14,940	8.00	38,300
2.00	4,260	3.50	9,400	4.90	15,400	8.50	44,300
2.10	4,560	3.60	9,800	5.00	15,860	9.00	50,800
2.20	4,860						

The above table is applicable only for open-channel conditions. It is based upon 8 discharge measurements made during 1903 and 1904. It is well defined between gage heights 1.70 feet and 3.50 feet. The table has been extended beyond these limits.

Estimated monthly discharge of Snake River (South Fork) near Lyon, Idaho, for 1904.

[Drainage area, 5,480 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
January	3,290	3,035	3,159	194,200	0.576	0.664
February	3,035	2,960	3,004	172,800	.548	.591
March	3,690	3,035	3,195	196,500	.583	.672
April	13,600	3,160	6,639	395,000	1.21	1.35
May	51,450	13,160	24,820	1,526,000	4.53	5.22
June	39,500	20,980	30,720	1,828,000	5.61	6.26
July	21,890	10,200	14,970	920,500	2.73	3.15
August	10,000	5,480	6,972	428,700	1.27	1.46
September	5,480	3,830	4,451	264,800	.812	.906
October	4,115	3,035	3,534	217,300	.645	.744
November	2,910	2,330	2,546	151,500	.465	.519
December	2,220	1,495	2,057	126,500	.375	.432
The year	51,450	1,495	8,839	6,421,800	1.61	21.97

NOTE.—Discharge interpolated for missing gage heights.

WILLOW CREEK NEAR PROSPECT, IDAHO.

This station was established April 21, 1903, by N. S. Dils. It is located at the ranch of Thomas L. Wails, 3 miles east of Prospect and 17 miles from Idaho Falls, Idaho. The temporary gage is a vertical 2 by 4 inch rod driven into the bed of the creek and fastened at the top to a willow root. It is read twice each day by Thomas L. Wails. There is a bridge below the gage at which discharge measurements may be made. The creek is crooked and the banks are covered with willows. Both banks are high and are not liable to overflow except in case of extreme high water, as in 1904. The bed of the stream is composed of mud. When the water is low in the creek water is discharged into it through a canal one-half mile below the temporary gage. This is a temporary station and was discontinued October 8, 1904.

The observations at this station during 1904 have been made under the direction of D. W. Ross, district engineer.

Discharge measurements of Willow Creek near Prospect, Idaho, in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
May 25	Wm. G. Davies	51	511	2.0	7.15	1,108
July 23	do	51	384	0.20	4.05	[a] 79

[a] Backwater.

Mean daily gage height, in feet, of Willow Creek near Prospect, Idaho, for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1	2.20	.....	.....	2.15	7.75	5.95	4.40	3.80	1.90	2.70
2	2.20	.....	.....	1.95	8.15	6.10	4.40	3.80	2.30	2.90
3	2.20	.....	.....	1.90	8.80	5.90	4.30	3.80	3.40	2.90
4	2.20	.....	.....	2.05	8.90	5.90	4.05	3.80	3.40	2.90
5	2.20	.....	.....	2.20	10.10	6.05	4.15	3.70	3.40	2.90
6	2.20	.....	.....	2.25	9.90	6.00	4.10	3.80	3.20	3.00
7	2.15	.....	.....	2.40	9.30	5.90	3.90	3.80	2.80	3.00
8	2.10	.....	.....	2.20	9.10	5.50	3.90	3.70	2.80	[a]
9	2.10	.....	.....	2.20	8.80	5.40	4.50	3.70	2.80	.....
10	[b]	.....	.....	2.20	8.60	5.35	4.05	3.70	2.80	.....
11	.....	.....	.....	2.30	9.10	5.35	4.10	3.70	2.90	.....
12	.....	.....	.....	2.55	9.10	5.50	3.80	3.80	2.90	.....
13	.....	.....	.....	2.85	8.70	5.40	4.10	3.80	2.90	.....
14	.....	.....	.....	3.25	8.30	5.40	4.20	3.70	2.90	.....
15	.....	.....	.....	3.50	8.00	5.50	4.00	3.70	2.90	.....
16	.....	.....	.....	4.35	8.30	5.40	3.90	3.70	2.90	.....
17	.....	.....	.....	4.60	8.20	5.40	3.85	3.80	2.90	.....
18	.....	.....	1.90	4.40	7.95	5.40	3.95	3.80	2.80	.....
19	.....	.....	2.15	4.50	7.75	5.30	4.00	3.80	2.80	.....
20	.....	.....	2.35	5.35	7.75	5.20	4.00	3.80	2.90	.....
21	.....	.....	2.50	5.70	7.80	5.20	4.10	3.80	2.80	.....

[a] Station discontinued.

[b] River frozen from January 10 to March 17, inclusive.

Mean daily gage height, in feet, of Willow Creek near Prospect, Idaho, for 1904—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
22			2.40	5.85	7.80	4.90	4.00	3.70	3.00	
23			2.40	4.90	7.65	4.80	4.00	3.60	3.00	
24			2.30	4.65	7.35	4.90	4.00	3.60	3.00	
25			2.10	4.20	7.10	4.70	3.90	3.60	2.25	
26			2.00	4.25	6 80	4.80	3.90	3.30	2.10	
27			2.00	5.35	6.50	4.90	3.90	3.30	2.10	
28			2.00	6.55	6.35	4.50	3.80	3.10	2.10	
29			2.10	7.70	6.05	4.40	3.90	3.00	2.20	
30			2.20	7.70	6.00	4.40	3.90	2.10	2.40	
31			2.20		5.80		3.80	2.00		

BLACKFOOT RIVER NEAR PRESTO, IDAHO.

This station was established April 17, 1903, by N. S. Dils, and a temporary gage was set. It is located on the ranch of the observer, James Just, 2 miles west of Presto and about 15 miles from Blackfoot, Idaho. A permanent gage was set October 13, 1904. This gage consists of an inclined 4 by 4 inch timber having 1.36 feet on the gage equivalent to 1 foot vertical. The gage is graduated to half-tenths of a foot, marked with metallic numerals, copper staples, and a United States Geological Survey name plate. Discharge measurements are made from a cable and car located about one-fourth mile below the gage. The initial point for sounding is a tag marked "I. P." fastened to the inner face of the cable support on the west bank. The current is sluggish. The banks are high and wooded and will not overflow. The bed of the stream is gravel, free from vegetation, and permanent. The bench mark is a copper plug set in corner stone of James Just's brick house. The elevation is 12.18 above the zero of the gage.

The observations at this station during 1904 have been made under the direction of D. W. Ross, district engineer.

Discharge measurements of Blackfoot River near Presto, Idaho, in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
May 4	Fred Stockton	60	441	2.70	6.6	[a] 1,193
June 14	Wm. G. Davies	54	208	2.44	2.65	508
July 2	J. B. Bond	54	160	1.26	1.1	220
July 27	do	53	125	1.11	0.7	146
August 30	do	53	161	1.48	1.1	235

[a] Surface velocity taken.

Mean daily gage height, in feet, of Blackfoot River near Presto, Idaho, for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	(a)	.....	.....	1.1	5.7	3.75	1.1	0.7	0.9	1.1	1.4	1.1
2	.....	.....	.....	1.0	5.85	3.95	1.1	.7	.9	1.1	1.35	1.1
3	.....	.....	.....	1.1	5.75	3.85	1.1	.7	.9	1.2	1.3	1.2
4	.....	.....	.....	1.1	6.3	3.8	1.1	.7	.9	1.2	1.3	1.2
5	.....	.....	.....	1.2	6.85	3.6	1.1	.7	.9	1.2	1.3	1.15
6	.....	.....	1.0	1.3	6.65	3.65	1.1	.7	.9	1.2	1.3	1.3
7	.....	.....	1.1	1.3	6.75	3.5	1.1	.7	.9	1.2	1.3	1.2
8	.....	.....	1.4	1.3	7.0	3.5	1.1	.7	.9	1.2	1.3	1.4
9	.....	.....	1.4	1.4	7.05	3.35	1.0	.7	.9	1.2	1.3	1.4
10	.....	.....	1.2	1.4	6.7	3.25	1.0	.7	.9	1.2	1.3	1.2
11	.....	.....	1.1	1.5	6.3	3.2	1.0	.7	.9	1.3	1.3	(a)
12	.....	.....	1.1	1.8	6.25	3.0	.9	.7	.9	1.3	1.25	.....
13	.....	.....	1.2	2.1	6.05	2.9	.9	.7	.9	1.3	1.25	.....
14	.....	.....	1.1	2.65	6.25	2.7	.9	.8	1.0	1.3	1.2	.....
15	.....	.....	1.1	3.15	6.15	2.5	.9	.8	1.0	1.3	1.2	.....
16	.....	.....	1.1	4.2	6.05	2.2	.8	.8	1.0	1.3	1.2	.....
17	.....	.....	1.1	4.4	5.8	2.2	.8	.8	1.0	1.3	1.2	.....
18	.....	.....	1.2	4.65	5.7	2.1	.8	.8	1.0	1.3	1.2	.....
19	.....	.....	1.4	5.5	5.45	2.0	.8	.8	1.0	1.35	1.2	.....
20	.....	.....	1.6	6.75	5.3	1.8	.8	.8	1.1	1.35	1.2	.....
21	.....	.....	1.4	6.9	5.45	1.6	.8	.8	1.1	1.35	1.2	.....
22	.....	.....	1.4	6.1	5.3	1.5	.7	.8	1.1	1.4	1.2	.....
23	.....	.....	1.3	5.65	5.05	1.5	.7	.8	1.1	1.4	1.15	.....
24	.....	.....	1.3	5.2	5.0	1.4	.7	.8	1.1	1.4	1.15	.....
25	.....	.....	1.2	5.05	4.9	1.4	.7	.8	1.1	1.4	1.15	.....
26	.....	.....	1.3	5.1	4.75	1.3	.7	.8	1.1	1.4	1.15	.....
27	.....	.....	1.3	5.55	4.65	1.2	.7	.8	1.1	1.4	1.1	.....
28	.....	.....	1.2	5.7	4.4	1.2	.7	.8	1.1	1.4	1.1	.....
29	.....	.....	1.2	5.6	4.2	1.2	.7	.9	1.1	1.4	1.1	.....
30	.....	.....	1.1	5.4	4.0	1.2	.7	.9	1.1	1.4	1.1	.....
31	.....	.....	1.1	.....	3.85	.....	.7	.9	.....	1.4	.....	.....

a River frozen from January 1 to March 5, and December 11 to 31, inclusive.

BIG LOST RIVER NEAR MACKAY, IDAHO.

This station was established November 12, 1903, by Fred Stockton and a temporary gage was set. It is located 3½ miles above Mackay, Idaho, above "The Narrows." A permanent gage was set November 3, 1904, at "The Narrows," about a mile below the temporary gage. It is located back of Joseph Cresto's (the observer) house and consists of a 4 by 4 inch post set vertical and securely anchored, graduated to one-half tenths of a foot, and marked with a United States Geological Survey name plate. Gagings are made from a cableway at the original station site. All gage heights for 1904 were taken from the temporary gage. On November 30, 1904, the temporary gage read 0.90, the permanent gage read 2.80, the discharge being the same at both places.

The channel of the stream is slightly curved both above and below the station. The south bank is steep and high and does not overflow, the north bank slopes gradually and will overflow during high water.

The initial point for soundings is a tin tag marked "I. P." on the inside face of cable support on north bank of stream. A United States Geological Survey iron bench-mark post is set about 15 feet from gage. The elevation is 9.83 above zero of gage.

The observations at this station during 1904 have been made under the direction of D. W. Ross, district engineer.

Discharge measurements of Big Lost River near Mackay, Idaho, in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
June 3	Wm. G. Davies	55	222	5.22	3.1	1,162
July 29	J. B. Bond	42	140	3.70	1.7	524
August 18	do	39	112	2.83	1.2	317
September 7	do	38	95	2.48	.9	236
November 3	Wm. G. Davies	36	90	2.05	.95	185

Mean daily gage height, in feet, of Big Lost River near Mackay, Idaho, for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	0.7	0.65	0.7	0.7	.....	3.8	3.3	1.5	1.0	0.85	0.95	0.85
2	.7	.65	.7	.7	.....	3.9	3.2	1.5	1.0	.85	.95	.85
3	.7	.65	.7	.7	.....	3.7	3.2	1.5	1.0	.85	.95	.85
4	.7	.65	.7	.7	0.5	3.3	3.1	1.4	1.0	.85	.95	.85
5	.7	.65	.7	.7	.55	3.1	3.0	1.4	.9	.85	.95	.85
6	.7	.65	.7	.7	.55	3.0	2.9	1.3	.95	.85	.95	.85
7	.7	.65	.7	.7	.5	3.4	2.8	1.3	.95	.85	.95	.85
8	.7	.65	.7	.7	.55	3.4	2.8	1.3	.95	.85	.95	.85
9	.7	.65	.7	.7	.55	3.4	2.7	1.3	.95	.85	.95	.85
10	.7	.65	.7	.7	.55	3.8	2.8	1.3	.95	.85	.95	.85
11	.7	.65	.7	.7	.5	3.9	2.6	.....	.95	.85	.95	.85
12	.7	.65	.7	.7	.5	3.6	2.6	.....	.95	.95	.95	.85
13	.7	.65	.7	.7	.7	3.4	2.6	.....	.95	.95	.9	.85
14	.7	.65	.7	.7	1.0	3.5	2.6	.....	.95	.95	.9	.85
15	.7	.65	.7	.7	1.3	3.8	2.4	.....	.95	.95	.9	.85
16	.7	.65	.7	.7	1.6	3.9	2.2	1.2	.95	.95	.9	.85
17	.7	.65	.7	.7	1.7	4.2	2.0	1.2	.85	.95	.9	.85
18	.7	.65	.7	.7	2.0	4.4	1.9	1.2	.85	.95	.9	.85
19	.7	.65	.7	.7	2.3	4.4	1.8	1.1	.85	.95	.9	.85
20	.7	.65	.7	.7	2.3	4.4	1.9	1.1	.85	.95	.9	.85
21	.7	.65	.7	.65	2.5	4.1	1.8	1.0	.85	.95	.9	.85
22	.7	.65	.7	.65	2.7	4.0	1.9	1.0	.85	.95	.9	.85
23	.7	.65	.7	.65	3.3	4.0	1.9	1.0	.85	.95	.9	.85
24	.7	.65	.7	.65	3.9	3.9	2.0	1.0	.85	.95	.9	.85
25	.7	.65	.7	.65	4.2	3.5	1.9	1.0	.85	.95	.9	.85
26	.7	.65	.7	.65	4.1	3.2	1.8	1.0	.85	.95	.9	.8
27	.7	.7	.7	.6	3.6	3.0	1.8	1.0	.85	.95	.9	.8
28	.7	.7	.7	.6	3.3	3.0	1.8	1.0	.85	.95	.9	.8
29	.7	.7	.7	.6	3.4	3.1	1.7	1.0	.85	.95	.9	.8
30	.7	.....	.7	.6	3.6	3.2	1.7	1.0	.85	.95	.9	.8
31	.7	.....	.7	.....	3.6	.....	1.6	1.0	.....	.95	.....	.8

Rating table for Big Lost River near Mackay, Idaho, from November 12, 1903, to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
0.60	175	1.60	480	2.50	890	3.40	1,300
.70	195	1.70	525	2.60	935	3.50	1,345
.80	215	1.80	570	2.70	980	3.60	1,390
.90	235	1.90	615	2.80	1,025	3.70	1,435
1.00	260	2.00	660	2.90	1,070	3.80	1,480
1.10	285	2.10	710	3.00	1,120	3.90	1,525
1.20	315	2.20	755	3.10	1,165	4.00	1,570
1.30	350	2.30	800	3.20	1,210	4.10	1,620
1.40	390	2.40	845	3.30	1,255	4.20	1,665
1.50	435						

The above table is applicable for open-channel conditions only. It is based upon 5 discharge measurements made during 1904. It is fairly well defined.

Estimated monthly discharge of Big Lost River near Mackay, Idaho, for 1903 and 1904.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
1903.				
December	195	195	195	11,990
1904.				
January	195	195	195	11,990
February	195	185	186	10,700
March	195	195	195	11,990
April	195	175	190	11,310
May [a]	1,665	160	668	41,070
June	1,755	1,120	1,410	83,900
July	1,255	480	813	49,990
August [b]	435	260	318	19,550
September	260	225	238	14,160
October	248	225	240	14,760
November	248	235	240	14,280
December	225	215	223	13,710
The year	1,755	160	410	297,400

[a] Discharge May 1–3 interpolated.

[b] Discharge August 11–15 interpolated.

BIG LOST RIVER NEAR CHILLY, IDAHO.

This station was established April 25, 1904, by Fred Stockton. It is located at Frank Uehren's ranch, about 25 miles upstream from Mackay, 7 miles from Chilly, and about 3 miles above Kinickinick Point. This ranch is the last one on the east bank.

The gage is about one-fourth mile from the ranch house. The gage consists of a 4 by 4 inch timber set vertical, well braced and anchored, and graduated to half tenths of a foot. The graduations are marked by metallic numerals and staples. The gage is painted white and marked with U. S. G. S. name plate. A permanent gage was set November 1, 1904, at the same elevation as the temporary gage. Discharge measurements are made from a cable and car located about three-fourths mile above Uehren's house. The initial point for soundings is a tin tag marked "I. P." on the face of the cable support on east side. The channel is straight for about 200 feet above and 250 feet below the station. Both banks are low and liable to overflow during high water. The stream has but one channel during all stages. A United States Geological Survey iron bench-mark post has been set about 10 feet from the gage. The elevation is 7.49 feet above the zero of the gage. The observer is Frank Uehren.

The observations at this station during 1904 have been made under directions of D. W. Ross, district engineer.

Discharge measurements of Big Lost River near Chilly, Idaho, in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
June 4	Wm. G. Davies	80	280	4.39	4.35	1,230
July 29	J. B. Bond	80	195	2.98	3.0	550
August 18	do	80	156	1.85	2.4	309
September 7	do	80	135	1.28	1.8	178
November 1	Wm. G. Davies	80	120	.84	1.57	106

Mean daily gage height, in feet, of Big Lost River near Chilly, Idaho, for 1904.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	2.1	4.6	4.3	2.8	2.0	1.65	1.6	2.0
2	.....	1.95	4.4	4.2	2.8	1.95	1.6	1.6	2.0
3	.....	1.95	.....	4.3	2.7	2.0	1.6	1.6	2.0
4	.....	2.2	4.3	.....	.....	1.9	1.6	1.55	2.0
5	.....	2.4	4.35	.....	2.7	1.9	1.6	1.6	2.0
6	.....	2.5	4.45	3.8	2.6	1.85	1.6	1.55	2.3
7	.....	2.7	4.25	3.9	2.55	1.85	1.6	1.6	2.3
8	.....	2.7	4.5	3.9	2.55	1.9	1.7	.....	2.3
9	.....	2.9	4.8	3.9	2.5	1.8	1.7	.....	2.2
10	.....	3.1	4.95	3.9	2.5	1.8	1.65	1.6	2.1
11	.....	3.2	4.4	3.7	2.5	1.8	1.6	1.6	2.1
12	.....	3.3	4.15	4.0	2.45	.....	1.6	1.55	2.0
13	.....	3 4	4 3	3.9	2.4	1.8	1.6	1.6	2.0
14	.....	3.8	4.3	3.6	2.45	1.75	.....	1.6	1.9
15	.....	3.9	4.6	3.4	.....	1.7	1 6	1.6	1.7
16	.....	3.9	.....	3.1	2.5	1.7	1.6	1.6	1.6
17	.....	4.05	4 8	3.2	2.4	1.7	1.6	1.5	1.6
18	.....	4.25	4.85	3.05	2.3	1.7	1.65	1.5	1.6
19	.....	4.2	5.1	3.1	2.3	1.7	1.7	1.5	1.5
20	.....	4.1	4.8	3.1	2.2	1.7	1.6	1.5	1 2
21	.....	4.6	4.7	.....	2.1	1.7	1.6	1.5	1.15
22	.....	4.9	4.6	3.2	2.1	1 7	1.6	1 5	1.3
23	.....	5.0	4.35	3.3	.....	1.7	1.6	1.5	1.4
24	.....	4 9	3.9	3.2	2.0	1.7	1.6	1.5	1.5
25	1.7	4.9	4.0	3.2	2.0	.....	1.6	1.5	1.5
26	1.9	4.3	4.1	3.0	2.0	1.7	1.6	1.5	1.3
27	2.15	4.0	4.0	3 1	2.1	1.7	1.6	1.6	1.3
28	2 1	4.2	4.1	3.05	2.0	1.7	1.6	1.6	1.25
29	2.0	4.45	4.6	3.0	2.0	1.7	1.6	1.6	.....
30	2.0	4.5	.....	2.9	2.05	1.65	.....	1.6	.....
31	.....	4.6	.....	2.85	2.05	.....	.....	.....	1.3

Rating table for Big Lost River near Chilly, Idaho, from April 25 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.10	65	2.20	260	3.20	650	4.20	1,155
1.20	80	2.30	285	3.30	700	4.30	1,205
1.30	95	2.40	310	3.40	750	4.40	1,255
1.40	110	2.50	340	3.50	800	4.50	1,305
1.50	125	2.60	370	3.60	850	4.60	1,355
1.60	140	2.70	410	3.70	900	4.70	1,405
1.70	160	2.80	450	3.80	950	4.80	1,455
1.80	180	2.90	500	3.90	1,000	4.90	1,505
1.90	200	3.00	550	4.00	1,050	5.00	1,555
2.00	220	3.10	600	4.10	1,105	5.10	1,605
2.10	240						

The foregoing table is applicable for open-channel conditions only. It is based upon 4 discharge measurements made during 1904. It is well defined between 1.80 feet and 3.00 feet gage height. Above 3.00 feet the table depends on one measurement at 4.35 feet gage height.

Estimated monthly discharge of Big Lost River near Chilly, Idaho, for 1904.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
April 25–30	250	160	215	2,559
May	1,555	210	898	55,220
June [a]	1,605	1,000	1,284	76,410
July [a]	1,205	475	799	49,130
August [a]	450	220	307	18,880
September [a]	220	150	175	10,410
October [a]	160	140	143	8,793
November [a]	140	125	134	7,974
December [a]	285	73	168	10,330
The period				239,700

[a] Discharge for missing gage heights interpolated.

BIG WOOD RIVER NEAR GIMLET, IDAHO.

This station was established by Fred Stockton on April 25, 1904. It is located on a wagon bridge on the road from Hailey to Ketchum, near Gimlet station on the Oregon Short Line Railroad, a small station about 6 miles from Hailey and 6 miles from Ketchum. The bridge is about 200 feet below the railroad bridge crossing Big Wood River. The gage consists of a 2 by 4 inch timber spiked against a timber on the up-stream side of the north end abutment to the wagon bridge. This gage is graduated to half-tenths of a foot. Graduations are marked by metallic numbers and staples. The gage is marked with a United States Geological Survey name plate. Discharge measurements are made from the bridge. The initial point for soundings is a tin tag marked "I. P." nailed on the hand rail on the downstream side of the bridge. The channel is straight for 250 feet above and 1,000 feet below the bridge. The banks are high and covered with brush and are not liable to overflow, and the stream has but one channel in either high or low water. The bench mark is a United States Geological Survey iron bench-mark post set in the dooryard of the first ranch house above Gimlet. Its elevation above sea level is 5,544 feet and 15.09 feet above zero of gage. The observer is C. A. Comstock.

The observations at this station during 1904 have been under the direction of D. W. Ross, district engineer.

Discharge measurements of Big Wood River near Gimlet, Idaho, in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
April 29	Wm. G. Davies	88	214	3.77	1.82	806
May 14	do	88	314	5.71	3.15	1,794
July 8	J. B. Bond	92	239	4.91	2.30	1,293
August 3	do	55	170	3.49	1.25	620
November 10	Wm. G. Davies	37	151	1.25	.75	189

Mean daily gage height, in feet, of Big Wood River near Gimlet, Idaho, for 1904.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	1.7	3.8	2.5	1.2	0.8	0.7	0.7	0.65
2	.....	1.7	3.8	2.7	1.2	.8	.7	.7	.65
3	.....	1 9	3.6	2.6	1.2	.8	.7	.7	.65
4	.....	2.2	3.3	2.4	1.2	.8	.7	.7	.65
5	.....	2.4	3.3	2.3	1.2	.8	.7	.7	.65
6	.....	2.5	3.5	2.2	1.2	.8	.7	.7	.65
7	.....	2.6	3.4	2.2	1.2	.7	.7	.7	.65
8	.....	2.5	3.3	2.3	1.1	.7	.7	.7	.65
9	.....	2.5	3.7	2.3	1.1	.7	.7	.7	.65
10	.....	2 8	3.5	2.2	1.1	.7	.7	.65	.65
11	.....	2.9	3.2	2.1	1.1	.7	.7	65	.65
12	.....	2.9	3.3	2.0	1.0	.7	.7	.65	.65
13	.....	3.0	3.4	1.9	1.0	.7	.7	.65	.65
14	.....	3.2	3.5	1.8	1.0	.7	.7	.65	65
15	.....	3.4	3.6	1.6	1.0	.7	.7	.65	.65
16	.....	3.3	3.7	1.6	1.3	.7	.7	.65	.65
17	.....	3.6	3.9	1.5	1.2	.7	.7	.65	.65
18	.....	3.5	3.9	1.5	1.1	.7	.7	.65	.6
19	.....	3.6	3.8	1.5	1.1	.7	.7	.65	.6
20	.....	3.6	3.6	1.5	1.0	.7	.6	.65	.6
21	.....	4.1	3.7	1.5	1 0	.7	.7	.65	.6
22	.....	4.6	3.5	1.5	1.0	.7	.7	.65	.6
23	.....	4.8	3.3	1.4	1.0	.7	.7	.65	.6
24	.....	5.1	3.0	1.4	1.0	.7	.7	.65	.6
25	.....	5.2	2.9	1.4	.9	.7	.7	.65	.6
26	.....	4.9	2.5	1.4	.9	.7	.7	.65	.6
27	.....	3.8	2.6	1.3	.9	.7	.7	.65	.6
28	1.8	3.8	2.5	1.3	.9	.7	.7	.65	.6
29	1.8	3.8	2.5	1.3	.9	.7	.7	.65	.6
30	1.8	3.9	2.6	1.2	.9	.7	.7	.65	.6
31	.....	3.8	.....	1.2	.9	.....	.7	.....	.6

LITTLE WOOD RIVER NEAR CAREY, IDAHO.

This station was established on April 28, 1904, by William G. Davies. It is located 7 miles upstream from Carey on the Carey-Muldoon road, about one-half mile above dam at head of east and west

side canals, and above the slough or delta section of the river. This station is 35 miles from Picabo, the nearest railroad point. The gage is a 4 by 4 inch timber, set vertical, and bolted to a lava wall. It is graduated to half-tenths of a foot, the graduation being marked by metallic numerals and staples. The gage is painted white and marked with a United States Geological Survey name plate. It is set on the east bank of the river. Discharge measurements are made from a cable and car. The initial point for soundings is a tin tag marked "I. P." on an iron anchor set in a rock on west bank. The channel is straight both above and below the station. The banks are high and clean and not liable to overflow. The stream has one channel at both high and low water and its bed is smooth and clean. The bench mark is a United States Geological Survey aluminum bench-mark tablet set 3 feet from the gage in solid lava. The elevation is 6.00 feet above zero of the gage. Mrs. F. M. Ford is the observer.

The observations at this station during 1904 have been made under the direction of D. W. Ross, district engineer.

Discharge measurements of Little Wood River near Carey, Idaho, in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
June 12	Wm. G. Davies	48	128	4.23	2.75	542
July 9	J. B. Bond	46	98	4.49	2.2	457
August 4	do	45	62	2.57	1.4	163
November 9[a]	Wm. G. Davies	38	79	.85	1.05	67

[a] Gaged above the station.

Mean daily gage height, in feet, of Little Wood River near Carey, Idaho, for 1904.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1		4.55	3.4	2.2	1.4	1.0	0.9	1.0	1.0
2		4.8	3.4	2.1	1.4	1.0	.9	1.0	1.0
3		4.1	3.1	2.1	1.4	1.0	.9	1.0	1.0
4		4.15	2.9	2.1	1.4	1.0	.9	1.0	1.0
5		4.5	2.8	2.1	1.4	1.0	.9	1.0	1.0
6		4.15	2 8	2.2	1.4	1.0	1.0	1.0	1.0
7		4.35	3.0	2.2	1.3	1.0	1.0	1.0	1.0
8		4.15	2.9	2.1	1.3	1.0	1.0	1.0	1.0
9		4.35	2.9	2.0	1.3	.9	1.0	1.0	1.0
10		4.4	3.0	2.0	1.3	.9	1.0	1.0	1.0
11		4.6	2.9	1.9	1.2	.9	1.0	1.0	1.0
12		5.0	2.7	2.0	1.2	.9	1.0	1.0	1.0
13		4.75	2.8	2.0	1.2	.9	1.0	1.0	1.0
14		4.95	2.8	2.0	1.2	.9	1.0	1.0	1.0
15		4.05	2.8	2.0	1.2	.9	1.0	1.0	1.0
16		4.25	3.0	2.0	1.2	.9	1.0	1.0	1.0
17		4.15	3.0	1.7	1.3	.9	1.0	1.0	1.0

Mean daily gage height, in feet, of Little Wood River near Carey, Idaho, for 1904—Continued.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
18	.....	4.1	3.0	1.6	1.2	.9	1.0	1.0	1.0
19	.....	4.1	3.0	1.5	1.2	0.9	1.0	1.0	1.0
20	.....	4.75	2.9	1.4	1.2	.9	1.0	1.0	1.0
21	.....	5.05	2.8	1.4	1.2	.9	1.0	1.0	1.0
22	.....	5.1	2.7	1.4	1.1	1.0	1.0	1.0	1.0
23	.....	5.05	2.8	1.5	1.1	.9	1.0	1.0	1.0
24	.....	5.0	2.4	1.4	1.0	.9	1.0	1.0	1.0
25	.....	4.7	2.0	1.4	1.0	.9	1.0	1.0	1.0
26	.....	4.1	2.4	1.3	1.0	.9	1.0	1.0	1.0
27	.....	3.7	2.3	1.3	1.0	1.0	1.0	1.0	1.0
28	4.00	3.6	2.2	1.2	1.0	1.0	1.0	1.0	1.0
29	3.95	3.6	2.2	1.2	1.0	1.0	1.0	1.0	1.0
30	4.10	3.7	2.2	1.2	1.0	1.0	1.0	1.0	1.0
31	.....	3.4	.....	1.3	1.0	.....	1.0	.....	1.0

SUCCOR CREEK NEAR HOMEDALE, IDAHO.

This station was established March 19, 1903, by N. S. Dils. It was discontinued September 30, 1903, but was taken up again before water began flowing in the winter. It is located at a small truss bridge built to carry a flume and is about one-half mile above the mouth of the river. The gage is a vertical rod driven into the bed of the stream, fastened to the downstream side of the footbridge. A new station was established January 31, 1905, about half a mile above the old station and about 17 miles from Caldwell, the nearest railroad station. It is 1 mile west of Homedale, near the Caldwell-Jordan Valley stage road, and 1 mile west of Mussel's ferry on Snake River. This gaging station is one-fourth of a mile below the head of the lowest ditch on Succor Creek, and about three-fourths of a mile above the mouth of the creek. The new gage consists of a 4 by 4 inch post inclined so that 1.27 feet along gage represents 1 foot vertically. This gage is well anchored and bolted, graduated to feet and tenths. The graduations are marked by metallic numbers and staples marked with a United States Geological Survey name plate. The gage is on the left bank of the stream about one-third of a mile above the house of Mrs. Minnie Tracy, the observer. Discharge measurements are made from a cable and car which are located about 10 feet above gage. The initial point for soundings is the inside face of cable support on left bank of stream. The river channel is straight for about 200 feet above and below the station. The bed of stream is gravelly and has one channel at all stages. The right bank is low and slopes uniformly, and may overflow during high water. The left bank is high and not liable to overflow.

A United States Geological Survey iron bench-mark post is set 10 feet back from gage. The elevation is 9.88 feet above the gage zero.

The observations at this station during 1904 have been made under the direction of D. W. Ross, district engineer.

Discharge measurements of Succor Creek near Homedale, Idaho, in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
February 19	F. Stockton	30	58	1.35	2.65	78
May 12	do	42	42	1.07	3.40	[a] 45

[a] Backwater.

Mean daily gage height, in feet, of Succor Creek near Homedale, Idaho, for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.6	2.4	2.8	3.25	2.85	2.65						
2	2.6	2.4	2.65	3.4	3.0	2.45						
3	2.6	2.4	2.6	3.35	2.95	2.2						
4	2.6	2.4	2.65	3.25	3.0	2.05						
5	2.6	2.45	2.4	3.2	3.0	1.9						
6	2.6	2.55	2.75	3.3	3.0	2.0						
7	2.6	2.5	4.25	3.4	3.0	2.0						
8	2.6	2.45	4.15	3.4	3.0	2.0						
9	2.6	2.4	4.4	3.2	3.05	1.9						
10	2.6	2.4	4.1	3.25	3.45	1.25						
11	3.45	2.5	4.5	3.55	3.5	1.25						
12	3.0	2.5	3.55	3.5	3.45	1.15						
13	3.05	2.75	3.3	3.5	3.5	1.05						
14	2.65	2.6	3.25	3.5	2.55	1.0						
15	2.6	3.75	3.15	3.45	1.6	1.0						
16	2.65	4.25	3.0	3.45	1.6	[a]						
17	2.65	3.75	2.95	3.2	1.65							
18	2.6	3.45	3.95	3.15	1.65							
19	2.6	3.15	3.35	3.25	1.65							
20	2.5	3.0	3.65	3.95	1.7							
21	2.5	2.75	3.15	3.6	1.65							
22	2.5	5.25	3.05	3.3	1.6							
23	2.5	5.0	2.95	3.1	1.55							
24	2.5	5.15	2.9	3.1	1.65							
25	2.4	4.75	2.8	3.05	1.75							
26	2.4	4.1	2.8	3.0	2.15							
27	2.4	3.55	2.8	2.9	2.25							
28	2.4	3.0	3.25	2.95	2.4							
29	2.4	2.95	5.85	2.9	2.65							
30	2.4		5.1	2.8	2.85							3.5
31	2.4		4.3		2.9							4.0

[a] River dry June 16 to December 29, inclusive.

OWYHEE RIVER NEAR OWYHEE, OREG.

This station was established August 27, 1903, by John H. Lewis. It is located at the county bridge 1½ miles from Owyhee, Oreg. A large irrigation ditch takes water from the river about 6 miles above. The gage is an inclined 2 by 6 inch timber reading from 1 to 5 feet.

It is located at the upstream steel caisson of the left abutment of the bridge. The gage is painted on the vertical caisson from 5 to 18 feet. A standard chain gage was attached to the upstream side of the bridge, near the center of the left span, July 28, 1904. The length of the chain from the end of the weight to the marker is 26.40 feet. It is read once each day by D. T. Rigsby. Discharge measurements are made from the bridge at ordinary stages and by wading above the bridge at extreme low water. The initial point for soundings is the center of the upstream caisson of the left abutment. The channel is straight for 200 feet above and for 400 feet below the station. The current is sluggish at low water. The right bank is high and rocky and will not overflow. The left bank will overflow only at extreme high water. The bed of the stream is composed of sand and gravel, and is liable to shift during freshets. There are two channels at low water and one at high water. The bench mark is the top of the steel caisson, at its outer edge directly above the gage. Its elevation is 18.60 feet above the zero of the gage. The bench mark to which the old station, located at this point, was referred has been destroyed.

The observations at this station during 1904 have been made under the direction of J. T. Whistler, district engineer.

Discharge measurements of Owyhee River near Owyhee, Oreg., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
March 13 [a]	J. H. Lewis	318	1,606	3.80	7.00	6,195
March 14 [a]	do	318	1,492	3.50	6.60	5,270
April 18	H. D. Newell	300	1,528	3.80	6.70	5,835
May 10 [b]	Murphy and Sawyer	293	888	2.40	4.85	2,156
June 18 [b]	Torkelson and Sawyer	140	330	1.40	3.20	452
July 2 [b]	M. W. Torkelson	133	214	.64	2.45	136
July 28 [c]	Torkelson and Sawyer	55	34	1.00	2.00	34
September 1 [c]	E. N. Smith	47	59	.27	1.90	16
October 12	do	140	219	.76	2.50	168

[a] No water in ditch. [b] Ditch not included. [c] Wading above station.

Mean daily gage height, in feet, of Owyhee River near Owyhee, Oreg., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.00	2.69	6.70	7.90	5.20	4.20	2.40	1.90	1.90	2.05	2.70	2.70
2	2.85	2.64	6.20	6.90	5.10	4.25	2.40	1.85	1.95	2.10	2.65	2.70
3	2.90	2.64	6.00	6.50	5.00	4.20	2.40	1.90	1.90	2.05	2.70	2.75
4	3.00	2.65	5.80	6.40	5.05	4.05	2.40	1.85	1.95	2.10	2.65	2.70
5	3.50	2.68	5.60	6.30	5.10	4.00	2.40	1.80	1.90	2.20	2.70	2.65
6	3.10	2.70	5.60	6.40	5.15	3.95	2.40	1.85	1.95	2.15	2.65	2.60
7	2.90	2.72	6.30	6.45	5.10	3.90	2.45	1.80	1.90	2.20	2.60	2.65

Mean daily gage height, in feet, of Owyhee River near Owyhee, Oreg., for 1904—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
8	2.75	2.73	6.20	6.20	5.10	3.85	2.40	1.75	1.95	2.30	2.65	3.00
9	2.55	2.75	7.50	6.00	5.00	3.80	2.35	1.70	2.00	2.60	2.70	2.90
10	2.75	2.78	8.20	5.80	4.95	3.75	2.35	1.75	1.95	2.55	2.65	2.85
11	2.90	2.80	8.10	5.70	4.90	3.70	2.35	1.75	2.00	2.60	2.70	2.80
12	3.00	2.81	7.60	5.60	4.95	3.55	2.35	1.70	1.95	2.55	2.65	2.75
13	3.10	2.80	7.20	6.00	4.90	3.50	2.35	1.75	2.00	2.50	2.70	2.70
14	3.05	2.90	7.00	6.30	5.00	3.45	2.25	1.65	2.00	2.55	2.65	2.75
15	2.90	3.00	6.40	6.40	4.90	3.40	2.20	1.70	2.05	2.50	2.70	2.70
16	2.82	6.50	6.20	6.50	4.80	3.35	2.25	1.65	2.00	2.55	2.65	2.70
17	2.75	6.00	6.00	6.70	4.70	3.30	2.15	1.60	2.05	2.50	2.65	2.75
18	2.85	5.60	6.10	6.60	4.60	3.25	2.20	1.60	2.00	2.55	2.70	2.70
19	2.50	6.00	6.40	6.50	4.70	3.10	2.15	1.65	2.05	2.60	2.65	2.75
20	2.40	5.30	7.30	6.40	4.60	3.75	2.20	1.70	2.10	2.70	2.70	2.70
21	2.50	6.00	8.00	6.50	4.55	3.20	2.15	1.65	2.15	2.65	2.65	2.70
22	2.70	6.50	7.80	6.40	4.50	2.90	2.10	1.70	2.10	2.70	2.70	2.75
23	2.80	6.77	7.40	6.30	4.45	2.80	2.10	1.75	2.05	2.65	2.70	2.70
24	2.85	12.20	6.50	6.20	4.40	2.78	2.05	1.70	2.00	2.70	2.65	2.75
25	2.86	9.60	6.40	6.10	4.35	2.70	2.00	1.75	2.05	2.65	2.70	2.70
26	2.88	9.40	6.00	6.00	4.30	2.65	2.05	1.70	2.10	2.70	2.70	2.65
27	2.92	8.60	5.80	5.90	4.35	2.60	2.00	1.75	2.15	2.65	2.70	2.70
28	2.85	8.10	6.20	5.60	4.30	2.55	2.05	1.70	2.10	2.70	2.65	2.75
29	2.80	7.65	7.50	5.40	4.25	2.50	2.00	1.75	2.05	2.65	2.70	2.70
30	2.75	.....	7.90	5.30	4.20	2.45	1.95	1.80	2.10	2.70	2.65	2.75
31	2.70	.....	9.00	.....	4.15	.....	2.00	1.75	.....	2.65	.....	3.00

Rating table for Owyhee River near Owyhee, Oreg., from August 28, 1903, to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.60	4	3.20	495	4.80	2,070	6.80	5,880
1.70	6	3.30	555	4.90	2,220	7.00	6,360
1.80	9	3.40	620	5.00	2,380	7.20	6,840
1.90	16	3.50	685	5.10	2,540	7.40	7,330
2.00	30	3.60	755	5.20	2,700	7.60	7,840
2.10	50	3.70	830	5.30	2,860	7.80	8,360
2.20	72	3.80	910	5.40	3,020	8.00	8,900
2.30	96	3.90	1,000	5.50	3,190	8.20	9,440
2.40	123	4.00	1,095	5.60	3,370	8.40	9,990
2.50	155	4.10	1,195	5.70	3,550	8.60	10,550
2.60	190	4.20	1,300	5.80	3,740	8.80	11,110
2.70	230	4.30	1,410	5.90	3,930	9.00	11,670
2.80	275	4.40	1,525	6.00	4,130	9.50	13,070
2.90	325	4.50	1,650	6.20	4,540	10.00	14,520
3.00	380	4.60	1,780	6.40	4,970	11.00	17,420
3.10	435	4.70	1,920	6.60	5,420	12.00	20,320

The above table is applicable only for open-channel conditions. It is based upon 12 discharge measurements made during 1903 and 1904. It is well defined between gage heights 1.80 feet and 7.00 feet. The table has been extended beyond these limits.

Estimated monthly discharge of Owyhee River near Owyhee, Oreg., for 1903 and 1904.

[Drainage area, 9,875 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
1903.						
September	44	13	27.6	1,642	0.0028	0.0031
October	118	42	97.5	5,995	.0099	.011
November	495	118	338.	20,110	.034	.038
December	408	205	283.	17,400	.029	.033
1904.						
January	685	123	302	18,570	.031	.036
February	20,920	206	3,955	227,500	.401	.432
March	11,670	3,370	6,012	369,700	.609	.702
April	8,630	2,860	4,680	278,500	.474	.529
May	2,700	1,248	1,998	122,900	.202	.233
June	1,355	139	664	39,510	.067	.075
July	139	23	800	4,919	.0081	.0093
August	16	4	7.8	482	.00079	.00091
September	61	16	34.1	2,029	.0035	.0039
October	230	40	162	9,961	.016	.018
November	230	190	219	13,030	.022	.025
December	380	190	250	15,370	.025	.029
The year	20,920	4	1,530	1,102,000	.155	2.09

To obtain the total discharge of the river above the Owyhee ditch division the following monthly discharges of the ditch should be added:

Estimated monthly discharge of Owyhee ditch near Owhee, Oreg., for 1904.

Month.	Total in acre-feet.	Month.	Total in acre-feet.
May	6,926	August	9,104
June	9,726	September	7,571
July	11,054	October 1–20	2,271

BOISE RIVER NEAR BOISE, IDAHO.

The station, established December 15, 1894, is located about 9 miles above Boise, Idaho, at the mouth of the canyon. The original gage was in two sections. The lower part is of 2 by 6 inch plank.

inclined and marked from 1 foot to 7.5 feet; the upper part is a 4 by 4 inch timber, placed vertically, and marked from 7.5 to 12 feet, both portions painted white. The bench mark is a bridge spike driven into a cottonwood tree 20 feet from gage and 20 feet from river. It is 3.40 feet above the 8-foot mark on the gage. Measurements are made from a cable just below the gage.

In the latter part of July, 1895, it was decided to locate a secondary gage on Boise River to obtain the slope of the water surface. This was placed 425 feet below the old gage and carefully connected by means of a level. Both were referred to the same datum. At that time the lower end of the old gage was found to be warped and was corrected. A gage was also placed on the lower Boise in order to determine the water going by at the lowest stage during the irrigating season. The meter can generally be used by wading, but in high water measurements can be made from a wagon bridge.

April 18, 1897, the river cut into the right bank of the station, carrying out the cable and leaving the gage on a small island, so that the record after that date is unreliable. A temporary gage was therefore established May 12 at the Broadway Bridge, at Boise, and a record kept by it until June 17, when a new gage, which is now used, was again placed in the canyon 1 mile above the old location. The inclined rod is firmly attached to a cottonwood tree. The bench mark is a 20-penny spike in the upstream face of the 6 by 8 inch cable support, about 2 feet above the ground. Its elevation is 15.00 feet above datum. Two spikes in same post are 14.00 feet above datum. Discharge measurements are made from a cable and car 50 feet below the gage. An auxiliary cable for flood measurements is placed 117 feet above the main cable. The initial point for soundings is the face of the cable support on the right bank. At ordinary stages the channel is straight, both above and below the station. The banks are high and not liable to overflow. About 300 feet below the cable is a gravel bar, reducing the width of the river at low water to about one-third of the channel and forcing the entire flow against the south bank. The channel is liable to change during extreme high floods. During 1900 the New York Canal Company built a wing dam of timber and loose rock, headed about 150 feet below the station and extending from the north bank diagonally down and across the stream a distance of about 50 feet, in order to protect the north bank from erosion. The construction of this wing dam did not seem to interfere with the flow of the river at the station. During the year 1902 new cable supports were set and bench marks were carefully verified.

The observations at this station during 1904 have been made under the direction of D. W. Ross, district engineer.

Discharge measurements of Boise River near Boise, Idaho, in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
May 7	F. S. Stockton	309	1,930	6.53	5.95	12,600
June 8	Stockton and Bond	295	1,660	6.08	5.10	10,090
June 28	do	288	1,224	4.44	3.56	5,433
July 16	do	284	796	3.48	2.10	2,772
August 11	do	270	396	2.90	.70	1,188
October 7	do	270	353	2.62	.40	1,003

Mean daily gage height, in feet, of Boise River near Boise, Idaho, for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1	0.6	.....	2.5	2.9	5.2	5.7	3.7	1.05	0.3	0.4
2	.....	.....	2.1	2.9	5.2	5.7	3.6	1.0	.05	.35
3	.....	.....	2.1	3.1	5.6	5.3	3.6	1.0	.05	.2
4	.....	0.85	1.95	3.5	6.0	5.0	3.6	1.0	.05	.12
5	.....	.....	1.95	3.7	5.8	5.0	3.2	.95	.05	.2
6	.....	.....	1.95	3.8	5.85	5.2	3.2	1.1	.05	.3
7	.....	.....	2.5	3.7	5.8	5.1	3.2	1.05	−.4	.4
8	.....	.....	4.6	3.75	5.7	5.1	3 2	1.1	−.4	.4
9	.....	.....	5.6	4.1	5.7	5.05	3.2	1.1	−.4	.45
10	.....	.....	4.1	5.3	5.85	5.0	2.9	.65	−.4	.5
11	.....	.....	3.5	5.6	5.85	5.0	2.7	.65	.3	.5
12	.....	.88	3.3	6.25	6.0	4.8	2.5	.6	.3	.5
13	.....	.....	3.1	6.75	6.0	4.6	2.4	.6	.3	.45
14	.....	.....	2.9	7.4	6.1	4.7	2.3	.6	.3	.4
15	.9	.....	2.8	7.85	6.2	4.8	2.2	.58	.3	.4
16	.....	.....	2.6	7.35	6.2	5.2	2.1	.55	.3	.6
17	.....	3.0	2.7	7.0	6.2	5.4	1.9	.58	.3	.6
18	.....	.....	2.8	6.7	6.3	5.3	1.9	.55	.2	.6
19	.....	.....	3.3	7.2	6.3	5.2	1.85	.58	.25	.65
20	.....	.....	3.2	7.4	6.6	4.85	1.8	.55	.2	.5
21	.....	.....	3.05	6.7	7.0	4.7	1.8	.65	.3	.5
22	.....	.....	2.85	5.8	7.4	4.6	1 8	.65	.2	.42
23	.....	.....	2.8	5.2	7.6	4.4	1.85	.65	.3	.4
24	.....	2.5	2.6	4.9	7.4	4.0	1.7	.3	.3	.4
25	.9	.....	2.55	4.9	6.9	3.8	1.6	.3	.3	.4
26	.....	.....	2.4	5.5	6.55	3.6	1.4	.2	.3	.4
27	.....	.....	2.45	6.2	5.8	3.6	1.3	.12	.4	.45
28	.....	.....	2.3	5.7	5.8	3.6	1.3	.12	.4	.4
29	.....	.....	3 2	5.5	6.0	3.7	1.3	.12	.4	.4
30	.....	.....	3.2	5.35	5.6	3.7	1.2	.4	.4	.4
31	.....	.....	2.9	.....	5.7	.....	1.1	.4	.....	.4

Rating table for Boise River near Boise, Idaho, from January 1 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
−0.40	280	1.40	1,920	3.20	4,680	5.00	9,440
− .30	350	1.50	2,030	3.30	4,890	5.10	9,770
− .20	425	1.60	2,140	3.40	5,100	5.20	10,110
− .10	500	1.70	2,260	3.50	5,320	5.30	10,450
.00	580	1.80	2,380	3.60	5,540	5.40	10,790
.10	665	1.90	2,500	3.70	5,770	5.60	11,470
.20	750	2.00	2,630	3.80	6,010	5.80	12,150
.30	840	2.10	2,760	3.90	6,250	6.00	12,830
.40	930	2.20	2,900	4.00	6,500	6.20	13,550
.50	1,020	2.30	3,050	4.10	6,760	6.40	14,270
.60	1,115	2.40	3,210	4.20	7,020	6.60	14,990
.70	1,210	2.50	3,370	4.30	7,300	6.80	15,710
.80	1,305	2.60	3,540	4.40	7,580	7.00	16,450
.90	1,400	2.70	3,720	4.50	7,880	7.20	17,210
1.00	1,500	2.80	3,900	4.60	8,180	7.40	17,970
1.10	1,600	2.90	4,090	4.70	8,480	7.60	18,730
1.20	1,705	3.00	4,280	4.80	8,800	7.80	19,490
1.30	1,810	3.10	4,480	4.90	9,120		

The above table is applicable only for open-channel conditions. It is based upon 6 discharge measurements made during 1904. It is fairly well defined between gage heights 0.50 foot and 6.00 feet. The table has been extended beyond these limits.

Estimated monthly discharge of Boise River near Boise, Idaho, for 1904.

[Drainage area, 2,614 square miles.[a]]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
March	11,470	2,565	4,260	261,900	1.63	1.88
April	19,680	4,090	11,200	666,400	4.28	4.78
May	18,730	10,110	13,360	821,500	5.11	5.89
June	11,810	5,540	8,689	517,000	3.32	3.70
July	5,770	1,600	3,257	200,300	1.25	1.44
August	1,600	682	1,156	71,080	.442	.510
September	930	280	730	43,440	.279	.311
October	1,163	682	951	58,480	.364	.420
The period				2,640,000		

[a] Drainage area revised since 1903 report.

MALHEUR RIVER NEAR WESTFALL, OREG.

This station was established December 15, 1903, by John H. Lewis. It is located 3 miles below the Harper ranch, near Westfall, 22 miles above Vale, Oreg. A plain staff gage, graduated to feet and tenths, was attached vertically to a frame bent of a bridge which formerly occupied this site, on the left bank. An inclined gage, graduated to read direct to feet and tenths, was established on the right bank 50 feet above the cable July 27, 1904. The slope is 2 inclined to 1 vertical. The gage is read gratuitously once each day by Lewis Scott, Superintendent Pacific Live Stock Company. Discharge measurements are made by means of a cable, car, tagged wire, and stay wire. The initial point for soundings is the zero of the tagged wire, and is 20.6 feet from the lower end of the turn-buckle. The channel is straight for about 1,000 feet above and 200 feet below the station, and the current is swift. The right bank is low, covered with sage brush, and overflows during high water. The left bank is high, rocky, and not liable to overflow. The bed of the stream is composed of gravel and sand, free from vegetation, and is shifting. There is but one channel at low water, and one main channel and two sloughs at high stages. Bench mark No. 1 is the head of a drift bolt projecting from the top surface at the east end of the frame bent to which the gage is attached. Its elevation is 17.64 feet above the zero of the gage. Bench mark No. 2 is the top of a stake on the left bank near the gage and 75 feet from the river bank. Its elevation is 23.14 feet above the zero of the gage. Bench mark No. 3 is the top of a stake on the right bank, directly in line with the cable and 185 feet from the deadman. Its elevation is 18.50 feet above the zero of the gage.

The bench mark for the inclined gage is a nail in the top of a 3 by 6 inch post to which the stay wire is fastened. Its elevation is 15.92 feet above the zero of the gage. As the inclined gage is referred to a new datum, this bench mark supersedes the others.

The observations at this station during 1904 have been made under the direction of John T. Whistler, district engineer.

Discharge measurements of Malheur River near Westfall, Oreg., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
March 8	J. H. Lewis	201	1,330	6.20	11.10	8,300
March 9	do	201	1,456	6.30	11.65	9,150
March 10	do	199	1,009	5.10	9.50	5,160
April 7	Lewis and Newell	198	688	4.31	8.65	2,965
April 13	H. D. Newell	201	896	5.90	9.70	5,290
May 18	J. M. Griffin	195	455	3.77	7.30	1,716
May 25	do	195	439	3.76	7.30	1,652
June 17	Sawyer and Torkelson	190	186	2.40	6.18	446
July 21[a]	M. W. Torkelson	40	58	2.50	5.50	145
August 25[a]	Sawyer and Smith	23	19	2.32	5.25	44
October 23[a]	E. N. Smith	39	46	3.20	5.63	147

[a] Made at different section.

Mean daily gage height, in feet, of Malheur River near Westfall, Oreg., for 1904.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1		7.80	8.90	6.60	5.70	5.40	5 20	5.50	5.60
2		8.00	8.60	6.50	5 70	5.40	5 20	5.50	5.60
3		8.20	8.50	6.50	5.70	5.40	5 20	5.50	5.60
4		8.70	8.30	6.40	5.70	5.35	5 20	5.50	5.60
5		8.80	8.30	6.40	5.70	5.35	5 20	5.50	5.60
6		8.60	8.20	6.30	5.70	5.30	5 30	5.50	5.60
7		8.70	8.00	6.30	5.70	5.30	5 20	5.50	5.60
8	11.01	8.30	7.70	6.30	5.70	5.30	5 20	5.55	5.60
9	11.70	8.30	7.80	6.30	5.70	5.30	5 20	5.55	5 60
10	9.40	8.80	7.80	6.30	5.80	5.25	5 20	5.62	5.60
11	8.60	9.10	7.80	6.30	5.80	5.25	5 20	5.60	5.60
12	8.20	9.50	7.80	6.20	5.80	5.25	5 30	5.60	5.60
13	7.80	9.70	7.60	6.20	6.30	5.25	5 30	5.60	5.60
14	7.80	10.20	7.50	6.20	5.70	5.30	5 30	5.62	5.60
15	7.80	10.50	7.50	6.20	5.70	5.30	5.30	5.62	5.60
16	8.30	10.50	7.40	6.20	5.60	5.30	5 30	5.60	5.60
17	8.40	10.20	7.40	6.20	5.60	5.25	5 30	5.60	5.60
18	8.70	10:00	7.30	6.10	5.60	5.25	5.40	5.62	5.70
19	8.70	9.70	7.30	6.10	5.60	5.25	5 40	5.60	5.70
20	8.70	10.70	7.30	6.10	5.60	5.25	5 40	5.60	5.70
21	8.50	10.60	7.30	6.10	5.60	5.25	5 40	5.60	.....
22	8.40	10.60	7.10	6.10	5.50	5.25	5.40	5.60	.....
23	7.30	9.80	7.10	6.00	5.50	5.25	5 40	5.60	.....
24	7.00	9.80	7.20	6.00	5.50	5.25	5.40	5.60	.....
25	6.80	9.50	7.30	5.90	5.50	5.25	5 40	5.60	.....
26	6.70	8.20	7.20	5.80	5.50	5.25	5.55	5.60	.....
27	6.70	9.70	7.10	5.80	5.50	5.30	5 55	5.60	.....
28	6.70	9.20	7.00	5.80	5.50	5.30	5 50	5.60	.....
29	9.10	9.40	6.90	5.80	5.50	5 25	5 50	5.60	.....
30	9.00	9.00	6.80	5.70	5.40	5.25	5 50	5.60	.....
31	8.30	.....	6.70	.....	5.40	5.20	.....	5.60	.....

Rating table for Malheur River near Westfall, Oreg., from March 8 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
5.30	64	6.80	893	8.20	2,513	10.20	6,288
5.40	104	6.90	982	8.30	2,668	10.40	6,696
5.50	146	7.00	1,075	8.40	2,827	10.60	7,104
5.60	188	7.10	1,172	8.50	2,990	10.80	7,512
5.70	230	7.20	1,273	8.60	3,160	11.00	7,920
5.80	274	7.30	1,378	8.70	3,332	11.20	8,328
5.90	318	7.40	1,487	8.80	3,509	11.40	8,736
6.00	362	7.50	1,600	8.90	3,692	11.60	9,144
6.10	411	7.60	1,717	9.00	3,880	11.80	9,552
6.20	463	7.70	1,838	9.20	4,263	12.00	9,960
6.30	519	7.80	1,963	9.40	4,657	12.50	10,980
6.40	581	7.90	2,092	9.60	5,064	13.00	12,000
6.50	650	8.00	2,225	9.80	5,472	14.00	14,040
6.60	727	8.10	2,365	10.00	5,880	15.00	16,080
6.70	808						

The above table is applicable for open-channel conditions only. It is based upon 11 discharge measurements, made during 1904. It is fairly well defined between 5.25 feet and 11.50 feet gage heights.

Estimated monthly discharge of Malheur River near Westfall, Oreg., for 1904.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January [a]			219	14,080
February [a]			3,099	178,300
March [a]	9,348	808	2,787	170,100
April	7,308	1,963	4,617	274,700
May	3,692	808	1,749	107,500
June	727	230	450	26,780
July	519	104	206	12,670
August	104	34	58	3,566
September	167	34	80	4,760
October	196	146	178	10,940
November [a]			216	12,850
December [a]			230	14,140
The period			1,157	830,400

[a] Estimated January, February, March 1 to 7, November 21 to 30, and December 1 to 31.

MALHEUR RIVER AT VALE, OREG.

This station was established as a temporary station May 20, 1903, by N. S. Dils. The permanent station was established June 30, 1903. It is located at the steel highway bridge one-eighth mile southeast of Vale, Oreg. The lower section of the original gage was an inclined 2 by 6 inch timber under the downstream edge of the bridge, near the left pier. It read from 0 to 14 feet. This section being destroyed by flood February 16, 1904, it was replaced February 25, 1904, by a vertical section nailed to a vertical post 12 feet downstream from caisson at the left abutment of the bridge. The upper section, reading from 14 to 20 feet, was painted on the downstream side of the downstream caisson of the left abutment. A standard chain gage was attached to the downstream side of the bridge near the center of the span July 25, 1904. The length of the chain from the end of the weight to the marker is 30.41 feet.

During 1904 the gage was read twice each day by E. R. Murray and J. A. Newton. Discharge measurements were originally made from the upstream side of the bridge at which the gage is located. On March 2, 1904, a cable, car, and tagged and stay wire were installed about one-fourth mile downstream from the gage and directly opposite the town of Vale. The initial point for soundings is the zero of the tagged wire, on the left bank, 28.7 feet from the lower end of the turn-buckle. The channel is straight for about 200 feet above and 300 feet below the station, and the current is swift. The right bank is high, rocky, free from vegetation, and does not overflow. The left bank is low, composed of firm earth, covered with small sagebrush, and liable to overflow at high water, at which times the water flows in two sloughs on the left bank, which can be measured by wading. The bed of the stream is composed of gravel and sand, free from vegetation, and is liable to shift. There is but one channel at all stages, with the exception of the above-mentioned sloughs. A station has been maintained here at intervals since 1890. The bench mark is the top surface of the east steel caisson at the north end of the bridge. Its elevation is 21.63 feet above the zero of the gage and 2,236.56 feet above sea level.

The observations at this station during 1904 have been made under the direction of John T. Whistler, district engineer.

Discharge measurements of Malheur River at Vale, Oreg., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
March 11	J. H. Lewis	156	968	4.85	8 28	4,695
April 5	Lewis and Newell	159	862	4.95	8 42	4,269
April 12	H. D. Newell	162	1,090	5.63	9.33	6,136
April 16	....do	.....	1,265	6.26	10.22	7,912
April 24	J. M. Griffin	158	1,050	5.60	8 75	5,670
May 9	Murphy and Sawyer	150	697	3.38	6 82	2,310
June 15	J. M. Griffin	115	312	1.78	5 10	556
June 16	Sawyer and Torkelson	106	290	1.48	4.98	430
July 11	M. W. Torkelson	105	217	1.00	4.40	214
July 20	....do	100	185	.60	4.00	107
August 6 [a]	Smith and Torkelson	44	44	1.05	3 75	47
September 24	E. N. Smith	45	46	1.24	3 78	57
October 10 [b]	....do	.....	73	1.03	4.08	75

[a] Wading above station. [b] Floats.

Mean daily gage height, in feet, of Malheur River at Vale, Oreg., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	4.20	4.80	7.00	7.70	8.20	5.65	4.20	3.78	3.75	3.90	4.20	4.35
2	4.00	4.75	7.00	7.40	7.95	5.60	4.20	3.80	3.70	3.90	4.20	4.32
3	4.10	4.50	6.68	8.70	7.80	5.60	4.20	3.80	3.70	3.90	4.20	4.25
4	4.20	4.25	6.45	8.30	7.60	5.60	4.20	3.70	3.70	3.90	4.20	4.10
5	4.20	4.20	6.90	8.55	7.45	5.60	4.20	3.80	3.70	3.90	4.20	4.28
6	4.15	4.20	7.50	8.50	7.35	5.50	4.10	3.75	3.70	3.95	4.25	4.10
7	4.25	4.20	9.10	8.25	7.10	5.50	4.10	3.70	3.70	4.00	4.25	4.20
8	4.35	4.10	10.55	8.08	6.95	5.50	4.70	3.70	3.70	4.40	4.25	4.28
9	4.50	4.00	10.90	8.00	6.80	5.40	4.45	3.70	3.70	4.10	4.25	4.25
10	4.35	4.20	9.50	8.04	6.80	5.40	4.20	3.80	3.70	4.10	4.25	4.20
11	4.30	4.40	8.10	8.07	6.70	5.30	4.30	3.80	3.70	4.10	4.30	4.25
12	4.30	4.55	7.70	9.03	6.70	5.30	4.40	3.80	3.70	4.10	4.25	4.35
13	4.30	4.50	7.10	9.06	6.65	5.20	4.40	3.80	3.70	4.20	4.25	4.35
14	4.30	4.30	6.95	9.08	6.60	5.15	4.35	3.80	3.70	4.20	4.25	4.40
15	4.35	4.45	7.05	10.02	6.50	5.10	4.20	3.80	3.70	4.20	4.25	4.35
16	4.45	10.15	7.15	10.02	6.50	5.00	4.20	3.80	3.70	4.20	4.25	4.10
17	4.60	8.75	6.95	9.90	6.45	4.90	4.20	3.80	3.70	4.20	4.25	4.40
18	4.65	8.55	7.65	9.55	6.40	4.80	4.15	3.80	3.70	4.30	4.30	4.40
19	4.60	7.10	8.05	9.30	6.35	4.80	4.10	3.80	3.70	4.30	4.30	4.40
20	4.50	6.45	8.40	10.10	6.30	4.75	4.00	3.80	3.70	4.20	4.30	4.40
21	4.40	6.00	8.28	10.55	6.20	4.70	4.00	3.80	3.70	4.20	4.30	4.35
22	4.45	13.60	7.20	10.90	6.10	4.70	4.00	3.80	3.75	4.20	4.30	4.20
23	4.55	10.20	7.05	9.70	6.10	4.70	4.00	3.75	3.75	4.25	4.30	4.25
24	4.60	11.10	6.70	9.05	6.15	4.60	4.00	3 75	3.80	4.20	4.35	4.35
25	4.60	13.70	6.38	8.70	6.20	4.60	3.90	3.75	3.85	4.20	4.35	4.20
26	4.80	9.85	6.20	8.45	6.20	4.55	3.95	3.75	3.90	4.20	4.38	4.30
27	4.80	8.15	6.22	8.15	6.05	4.50	3.92	3.75	4.00	4.20	4.40	4.30
28	4.70	7.40	6.40	8.35	6.00	4.40	3.90	3.80	3.95	4.22	4.40	4.40
29	4.65	6.90	7.60	8.50	5.95	4.40	3.88	3.80	3.90	4.20	4.40	4.25
30	4.60	.....	8.45	8.35	5.80	4.30	3.82	3.75	3.90	4.20	4.40	4.25
31	4.75	.....	8.30	.....	5.70	.....	3.82	3.75	.....	4.20	.....	4.75

Rating table for Malheur River at Vale, Oreg., from March 11 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
3.70	40	5.20	595	6.60	1,921	9.00	5,700
3.80	57	5.30	660	6.70	2,046	9.20	6,076
3.90	81	5.40	729	6.80	2,176	9.40	6,452
4.00	107	5.50	800	6.90	2,311	9.60	6,828
4.10	133	5.60	877	7.00	2,450	9.80	7,204
4.20	159	5.70	958	7.20	2,732	10.00	7,580
4.30	186	5.80	1,044	7.40	3,021	10.50	8,520
4.40	215	5.90	1,138	7.60	3,321	11.00	9,460
4.50	250	6.00	1,240	7.80	3,630	11.50	10,400
4.60	288	6.10	1,345	8.00	3,950	12.00	11,340
4.70	329	6.20	1,454	8.20	4,280	12.50	12,280
4.80	371	6.30	1,566	8.40	4,624	13.00	13,220
4.90	419	6.40	1,681	8.60	4,976	13.50	14,160
5.00	475	6.50	1,800	8.80	5,334	14.00	15,100
5.10	534						

The above table is applicable for open-channel conditions. It is based upon 20 discharge measurements made during 1903 and 1904. It is fairly well defined between gage heights, 3.70 feet and 9.30 feet. The table has been extended above 9.30 feet.

Estimated monthly discharge of Malheur River at Vale, Oreg., for 1904.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January [a]	371	107	236	14,510
February [a]	14,540	107	3,105	178,600
March [a]	9,272	1,454	3,461	212,800
April	9,272	3,021	5,524	328,700
May	4,280	958	2,027	124,600
June	917	186	533	31,720
July	329	61	146	8,977
August	57	40	52.1	3,203
September	107	40	50.4	2,999
October	215	81	144	8,854
November	215	159	182	10,830
December	350	133	188	11,560
The year	14,540	40	1,304	937,400

[a] January 1 to March 10, inclusive, estimated

MALHEUR RIVER AT M'LAUGHLIN'S BRIDGE, NEAR VALE, OREG.

This station was established December 10, 1904, by W. C. Sawyer. It is located at the new county bridge, known as McLaughlin's bridge, 10 miles above Vale, Oreg. A standard chain gage is attached to the upstream hand rail of the bridge, near the left bank. The length of the chain from the end of the weight to the marker is 21.72 feet. The gage is read weekly during ordinary, and daily during flood stages by R. N. Linebarger. Discharge measurements are made from the iron bridge to which the gage is fastened, consisting of two spans and wooden approaches.

The observations at this station during 1904 have been made under the direction of John T. Whistler, district engineer.

MALHEUR RIVER AT HALLIDAY'S BRIDGE, NEAR ONTARIO, OREG.

This station was established December 8, 1904, by W. C. Sawyer. It is located at the county bridge, known as Halliday's bridge, which is 10 miles above Ontario, Oreg. A standard chain gage is attached to the upstream handrail of the bridge near the right bank. The length of the chain from the end of the weight to the marker is 23.70 feet. The gage is read daily by T. W. Halliday. The measurements are made from the upstream side of the bridge. The channel is straight for about one-fourth mile above the station and 800 feet below. The right bank is clean, high, and does not overflow. The left bank is clean and high, but overflows at very high water. The bed of the stream is sandy, clean, and shifting. There is one channel at all stages. The initial point for soundings is 20 feet from the truss pin of the upstream truss on the right bank. Bench mark No. 1 is the south end of the bedplate which supports the south end of the upstream truss. Its elevation is 18.99 feet above datum of the gage and 2,201.40 feet above sea level. Bench mark No. 2 is the north end of the bedplate which supports the north end of the upstream truss. Its elevation is 18.89 feet above datum of the gage. A temporary bench mark is the top of the upstream end of the first floor beam from the right bank, 38.5 feet from the initial point for soundings. Its elevation is 19.27 feet above the datum of the gage. This station was established as a temporary one to assure records in case other stations on Malheur River and Willow Creek should be damaged by floods.

The observations at this station during 1904 have been made under the direction of John T. Whistler, district engineer.

Discharge measurements of Malheur River at Halliday's bridge, near Ontario, Oreg., in 1904.

Date.	Hydrographer.	Width.	Area of section	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
February 23....	J. H. Lewis.....	130	1,073	7.8	12.2	8,370
December 7	W. C. Sawyer.....	28	48	1.6	2.05	76

Mean daily gage height, in feet, of Malheur River, at Halliday's bridge near Ontario, Oreg., for 1904.

Day.	Dec.	Day.	Dec.	Day.	Dec.	Day.	Dec.
8.....	2.5	14.....	2.5	20.....	2.6	26.....	2.1
9.....	2.5	15.....	2.5	21.....	2.5	27.....	2.15
10.....	2.3	16.....	2.3	22.....	2.4	28.....	2.3
11.....	2.25	17.....	2.4	23.....	2.4	29.....	2.25
12.....	2.4	18.....	2.9	24.....	2.5	30.....	2.4
13.....	2.45	19.....	2.7	25.....	2.4	31.....	3.0

MALHEUR RIVER NEAR ONTARIO, OREG.

This station was established December 8, 1903, by John H. Lewis. It is located at the new county bridge about 2½ miles northwest of Ontario, Oreg., and about 1¼ miles above the junction of the Malheur with Snake River. Brosnan ditch takes water from the river on the left bank 3 miles above the station, and the Nevada ditch, on the right bank 12 miles above. Both conduct some water past the station at certain times. The gage is in two sections. The lower, graduated to read direct to feet and tenths from 2 to 10 feet, is fastened in an inclined position to the left bank just above the bridge. The gage is continued on a vertical staff to 21 feet. The gage was read twice each day by William O'Brien. Discharge measurements were made from the single-span highway bridge. The initial point for soundings is the left end of the upstream railing of the bridge over the pier. Five-foot intervals are marked on the railing with 10-penny nails. The channel is straight for about 150 feet above and 200 feet below the station and the current is sluggish. Both banks are low, covered with brush, and liable to overflow during extreme high water. The bed of the stream is composed of sand and gravel, free from vegetation, and may shift slightly during floods. There is one channel at low, and several at high water, flowing in sloughs which are measured by wading. Floods in Snake River occur at different times from those in Malheur River, but the water surface at the gage is said to have been unaffected by back water during recent years. Bench mark No. 1

is the edge of the steel band on the upstream bridge caisson at the left bank. Its elevation is 18.90 feet above the zero of the gage. Bench mark No. 2 is a notch cut in the southeast corner of the observer's house. Its elevation is 20.00 feet above the zero of the gage. The bridge was washed away in May, 1904, and the station abandoned.

The observations at this station during 1904 have been made under the direction of John T. Whistler, district engineer.

Discharge measurements of Malheur River near Ontario, Oreg., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
February 22	J. H. Lewis	110	632	5.00	12.10	3,190
February 22	do	115	790	5.40	13.42	4,270
February 22	do	117	890	5.90	14.35	5,270
February 22	do	117	975	6.30	15.08	6,210

Mean daily gage height, in feet, of Malheur River near Ontario, Oreg., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	Day.	Jan.	Feb.	Mar.	Apr.	May.
1	6.30	6.90	10.60	11.90	13.70	17	8.50	16.60	11.45	15.35	.....
2	6.30	7.00	10.90	12.50	13.45	18	8.50	11.70	12.15	14.80	.....
3	6.30	6.80	10.68	12.35	13.15	19	7.50	9.60	12.45	14.50	.....
4	6.20	6.90	10.28	12.40	13.00	20	7.20	8.55	13.20	15.25	.....
5	6.70	7.28	10.25	13.20	12.85	21	7.20	8.35	13.20	16.45	.....
6	6.60	7.48	10.60	13.75	12.75	22	7.20	11.65	12.05	16.80	.....
7	6.50	6.51	13.00	13.10	12.85	23	7.30	17.40	11.20	15.40	.....
8	6.50	6.52	15.95	13.70	12.55	24	7.30	16.30	10.70	14.70	.....
9	6.50	7.55	16.75	13.10	12.50	25	7.00	17.45	10.15	14.50	.....
10	6.50	6.32	15.45	13.10	12.45	26	6.90	16.60	10.10	13.65	.....
11	6.70	7.38	13.65	13.55	12.42	27	6.80	14.30	10.30	13.65	.....
12	6.80	7.45	12.60	14.15	12.35	28	6.80	13.65	10.35	13.85	.....
13	7.80	7.50	12.10	14.55	12.18	29	6.70	11.10	11.00	13.20	.....
14	7.80	6.92	11.40	14.95	12.20	30	6.90	.....	13.50	12.70	.....
15	7.80	7.38	11.55	15.35	.....	31	6.90	.....	13.15	.....	.....
16	7.80	12.15	11.65	15.55	.....						

BULLY CREEK ABOVE VALE, OREG.

This station was established August 10, 1903, by John H. Lewis. It was located about one-eighth mile below the mouth of Cottonwood Creek and 13 miles from Vale, Oreg. It was about 2 miles below a proposed reservoir site on this creek. The gage was located on the left bank and consisted of 2 by 6 inch timbers. The lower section was inclined and read from 0 to 6 feet. The upper section is vertical and read from 6 to 12 feet. The gage was about 200

feet from the house of F. O'Neill, who read the gage twice each day. Discharge measurements were made by means of a cable and a car about 70 feet below the gage. The initial point for soundings was the zero on the tagged wire on the left bank, 25 feet from the lower end of the turnbuckle. The main channel at ordinary stages is straight for 200 feet above the cable. At flood stages the right bank overflows above the cable, causing a bend in the channel about 75 feet above. The channel is straight for 800 feet below the station. At the cable the right bank is low, will overflow at extreme flood stages, and is covered with sagebrush. The left bank is low, but is not liable to overflow. The bed of the stream is composed of gravel and sand, free from vegetation, and liable to shift. There is but one channel at all stages. Bench mark No. 1 is a projecting stone on the top of the wall in the front of the observer's house on the west side of the entrance. Its elevation is 16.92 feet above the zero of the gage. Bench mark No. 2 is a 2 by 4 inch timber projecting from the northeast corner of the granary, about 42 feet from the gage. Its elevation is 12.37 feet above the zero of the gage.

Owing to changes in the channel and destruction of the original gage by flood the cable was moved 125 feet downstream February 26 and a new gage installed February 27, 1904. The new gage was a 2 by 6 inch timber supported in a horizontal position above high water and projecting over the water. Readings were made by means of a graduated rod by reading down from the bottom of the 2 by 6 inch timber, which was at 11.30 above zero. This gage was at the same datum as the old gage. The water surface between the new and old gage was practically level for gage height 5.50 feet, being 0.03 foot lower at the new gage than at the old.

The station, as reestablished February 27, 1904, was destroyed by flood and abandoned March 11, 1904, a new channel having been formed several hundred feet from the gage. On the latter date a new station was established on Bully Creek near its mouth, at Vale, Oreg. Except for a few days when surface snow is going off no streams enter Bully Creek between the new and the old station. Five small ditches divert water during the irrigation season.

The observations at this station during 1904 have been made under the direction of John T. Whistler, district engineer.

Discharge measurement of Bully Creek above Vale, Oreg., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
February 27	J. H. Lewis	82	152	3.60	5.50	560

Mean daily gage height, in feet, of Bully Creek above Vale, Oreg., for 1904.

Day.	Jan.	Feb.	Mar.	Day.	Jan.	Feb.	Mar.	Day.	Jan.	Feb.	Mar.
1	2.60	2.47	5.00	12	2.60	2.61	.....	22	2.60	7.25	.....
2	2.60	2.42	5.35	13	2.60	2.60	.....	23	2.60	6.75	.....
3	2.60	2.45	5.00	14	2.60	2.54	.....	24	2.60	8.50	.....
4	2.60	2.60	5.24	15	2.60	2.71	.....	25	2.60	7.44	.....
5	2.60	2.60	4.70	16	2.60	6.00	.....	26	2.60	6.20	.....
6	2.60	2.54	5.40	17	2.60	3.90	.....	27	2.57	5.62	.....
7	2.60	2.50	7.80	18	2.60	2.75	.....	28	2.50	5.00	.....
8	2.60	2.50	7.70	19	2.60	2.55	.....	29	2.52	5.10	.....
9	2.60	2.50	5.20	20	2.60	2.50	.....	30	2.51	.....	.....
10	2.60	2.50	5.20	21	2.60	2.50	.....	31	2.50	.....	.....
11	2.60	2.55	.....								

BULLY CREEK AT VALE, OREG.

This station was established April 8, 1904, by John H. Lewis. It is located at the county highway bridge across Bully Creek just above its junction with Malheur River at Vale, Oreg. The station is 13 miles below the former station on this creek, which was destroyed by flood and discontinued March 11, 1904. The original gage consisted of a rod graduated to feet and tenths, by means of which the distance of the water surface below the top of a projecting floor beam on the east side of the bridge was measured. A standard chain gage was attached to the bridge October 29, 1904. The length of the chain from the end of the weight to the marker is 17.22 feet. Discharge measurements are made from the downstream side of the single-span bridge. The initial point for soundings is the south end of the east bridge railing. Five-foot intervals are marked along the bridge with black paint. The channel is straight for about 50 feet above and 300 feet below the station and the current is swift. Both banks are high, clear, and not subject to overflow. The bed of the stream is composed of clay and sand and is shifting. There is but one channel at all stages. Bench mark No. 1 is the top surface of the north projecting floor beam on the east side of the bridge. Its elevation is 15.36 feet above the datum of the gage. Bench mark No. 2 is on the north end of stone doorsill at the north door on the west side of old flour mill about 390 feet southeast of the bridge. Its elevation is 18.80 feet above the datum of the gage. Except for a few days when surface snow is going off no streams enter Bully Creek between this and the old station. Five small ditches divert water during the irrigation season. The station is affected by back water and will not be maintained longer than necessary to make a comparison between the results obtained at this station and the former station 13 miles upstream.

The observations at this station during 1904 have been made under the direction of John T. Whistler, district engineer.

Discharge measurements of Bully Creek at Vale, Oreg., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
February 24			268	4.20	7.09	1,120
April 8			181	5.35	7.00	968
April 11			265	5.44	8.40	1,442
April 12			254	5.58	7.50	1,416
April 14	H. D. Newell	50	285	4.90	8.00	1,390
April 16	do	50	269	3.90	7.75	1,050
April 25	J. M. Griffin	45	172	4.06	6.90	698
May 7	do	40	81	2.60	5.76	210
May 9	Murphy and Sawyer	43	79	2.30	5.50	180
June 16 [a]	W. C. Sawyer	14	14	1.60	4.10	22
August 26	Smith and Sawyer	15	5	.75	3.78	4
September 24 [a]	E. N. Smith	9	5	.63	3.75	3

[a] Measurement made at different section.

Mean daily gage height, in feet, of Bully Creek at Vale, Oreg., for 1904.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1		6.60	4.10	4.10	3.90	3.70	3.70	3.75	3.65
2		6.40	4.10	4.10	3.90	3.70	3.70	3.75	3.50
3		6.40	4.10	4.10	3.90	3.70	3.70	3.75	3.45
4		6.20	4.10	4.10	3.90	3.70	3.70	3.75	3.20
5		6.30	4.10	4.10	3.90	3.70	3.70	3.70	3.30
6		5.90	4.10	4.10	3.90	3.70	3.70	3.70	3.20
7		5.70	4.10	4.10	3.90	3.70	3.75	3.70	3.45
8	7.00	5.60	4.10	5.00	3.80	3.70	3.75	3.70	3.70
9	7.02	5.50	4.10	4.40	3.80	3.70	3.75	3.70	3.60
10	7.05	5.40	4.10	4.30	3.80	3.70	3.75	3.70	3.70
11	7.50	5.30	4.10	4.20	3.80	3.70	3.75	3.65	3.70
12	8.00	5.10	4.10	4.30	3.80	3.70	3.75	3.65	3.70
13	8.01	5.00	4.10	4.30	3.80	3.70	3.75	3.65	3.80
14	8.02	5.00	4.10	4.30	3.80	3.70	3.75	3.65	3.80
15	8.04	5.00	4.10	4.20	3.80	3.70	3.75	3.65	4.40
16	8.00	5.00	4.10	4.20	3.80	3.70	3.75	3.65	3.70
17	7.08	5.00	4.10	4.20	3.80	3.70	3.75	3.65	3.60
18	7.04	5.00	4.10	4.20	3.80	3.70	3.75	3.65	4.20
19	7.20	4.90	4.10	4.10	3.80	3.70	3.80	3.65	3.60
20	7.80	4.70	4.10	4.10	3.80	3.70	3.80	3.65	3.70
21	7.85	4.50	4.10	4.10	3.80	3.70	3.80	3.65	3.80
22	7.90	4.40	4.10	4.10	3.70	3.70	3.80	3.65	3.70
23	8.00	4.30	4.10	4.10	3.70	3.70	3.80	3.65	3.80
24	7.50	4.20	4.10	4.00	3.70	3.70	3.70	3.65	3.70
25	7.20	4.10	4.10	4.00	3.70	3.70	.....	3.65	3.80
26	7.00	4.10	4.10	4.00	3.70	3.70	.....	3.65	3.80
27	6.80	4.10	4.10	4.00	3.70	3.70	.....	3.65	3.70
28	6.80	4.10	4.10	4.00	3.70	3.70	.....	3.65	3.70
29	6.70	4.10	4.10	4.00	3.70	3.70	3.70	3.65	3.60
30	6.60	4.10	4.10	3.90	3.70	3.70	3.70	3.65	3.60
31	.....	4.10	.....	3.90	3.70	.....	3.75	.....	3.70

Estimated monthly discharge of Bully Creek at Vale, Oreg., for 1904.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January [a]			12.5	769
February [a]			327	18,810
March [a]			725	44,580
April [a]			1,018	60,580
May	547	22	159	9,777
June	22	22	22.0	1,309
July	112	10.5	26.5	1,629
August	10.5	2.1	5.58	343
September	2.1	2.1	2.10	125
October	5.6	2.1	3.17	195
November	3.3	1.2	1.66	99
December	44	.0	4.34	267
The year			192	138,500

[a] From March 11 to April 7, inclusive, the discharge was estimated.

NOTE.—Owing to the shifting character of the bed the above estimates are only approximate.

WILLOW CREEK NEAR MALHEUR, OREG.

This station was established November 4, 1904, by W. C. Sawyer. It is located at Beer's ranch, about 5 miles from Malheur on the road to Huntington, Oreg. A plain staff gage, graduated to feet and tenths, is attached to an immense bowlder at the mouth of the canyon, about one-half mile below the cable. The gage is read once each day by S. P. Colt. Discharge measurements are made by means of a cable and car. The initial point for soundings is the eyebolt to which the cable is attached at the left bank. The channel is straight for 100 feet above and below the station and the current swift. Both banks are high, clean, and do not overflow. The bed of the stream is composed of rock and gravel, free from vegetation, and is permanent. There is but one channel at all stages. Bench mark No. 1 is a square chisel draft, marked with the letters "B. M." in black paint, on the top of the bowlder to which the gage is fastened, 5.4 feet upstream from the gage. Its elevation is 5.74 feet above the zero of the gage. Bench mark No. 2 is a square chisel draft on top of a rock 14 feet upstream from the cable at a point 21 feet from the anchorage of the right end of the cable. Its elevation is assumed at 100.00 feet for reference for cross section at cable.

The observations at this station during 1904 have been made under the direction of John T. Whistler, district engineer.

Discharge measurement of Willow Creek near Malheur, Oreg., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
September 20	W. C. Sawyer	6.5	3.9	1.11	0.7	4.3

Mean daily gage height, in feet, of Willow Creek near Malheur, Oreg., for 1904.

Day.	Nov.	Dec.	Day.	Nov.	Dec.	Day.	Nov.	Dec.
1		0.85	11			21	0.85	0.8
2		.75	12			22	.85	.8
3		.85	13			23	.85	
4			14			24	.85	
5		.95	15			25	.8	
6		.95	16		0.8	26	.85	
7		.95	17		.8	27	.85	
8		.9	18		.8	28	.85	
9		.8	19		.8	29	.85	
10		.8	20	0.85	.8	30	.85	

WILLOW CREEK NEAR DELL, OREG.

This station was established May 12, 1904, by H. D. Newell. It is located at a bridge at Cole's ranch near Dell, Oreg., 28 miles above Vale. A plain staff gage was attached to a pole which was driven into the sand and spiked to the bridge. On November 1, 1904, a standard chain gage was attached, at the same datum, to the downstream side of the bridge. The length of the chain from the end of the weight to the marker is 18.06 feet. The gage is read once each day by Emory Cole. Discharge measurements are made from the downstream side of the wooden highway bridge to which the gage is attached. The bridge has a single span of about 137 feet and trestle approach at each end. The initial point for soundings is the left end of the downstream hand rail. The channel is slightly curved for about 200 feet above and straight for 200 feet below the station, somewhat obstructed by willows. The current is moderate. Both banks are low, but all the water passes between the abutments of the bridge. The bed of the stream is composed of mud and is slightly shifting. There is but one channel at all stages, broken by the bridge bents. Bench mark No. 1 is a group of three spikes driven into a post at the corner of the fence about 40 feet east of the initial point. Its elevation is 14.92 feet above the zero of the gage. Bench mark No. 2 is a cross painted on the top of stone of east abutment 6.5 feet from the initial point and marked "B. M." Its elevation is 14.79 feet above the zero of the gage. Bench mark No. 3 is the top of a bolt at the foot of the inclined end post of the south truss of the bridge, 20 feet from the initial point for soundings. Its elevation is 14.97 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of John T. Whistler, district engineer.

Discharge measurements of Willow Creek near Dell, Oreg., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
April 14	H. D. Newell	80	340	2.80	7.06	940
April 15	do	57	328	2.70	6.86	880
April 23	J. M. Griffin	53	175	2.32	5.46	412
May 12	do	52	84	2.23	4.21	187
June 20	Sawyer and Torkelson	35	15	1.20	2.52	18
July 8 [a]	M. W. Torkelson	14	3	1.30	2.29	4
September 3 [a]	E. N. Smith	4	1.5	.99	2.00	1.5
November 1 [b]	W. C. Sawyer	14	8.3	1.34	2.26	11

[a] Floats. [b] Wading.

Mean daily gage height, in feet, of Willow Creek near Dell, Oreg., for 1904.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	5.06	3.30	2.55	1.90	1.90	2.15	2.40	2.30
2	.....	5.06	3.30	2.60	1.90	1.90	2.10	2.45	2.30
3	.....	4.89	3.28	2.67	1.90	1.90	2.15	2.45	2.30
4	.....	4.73	3.23	2.65	1.90	1.90	2.15	2.45	2.30
5	.....	4.48	3.20	2.30	1.90	1.90	2.20	2.45	2.30
6	.....	4.40	3.10	2.60	1.90	1.90	2.20	2.42	2.30
7	.....	4.27	3.05	2.30	1.90	1.90	2.25	2.40	2.35
8	.....	4.23	2.97	2.35	1.90	1.90	2.25	2.40	2.40
9	.....	4.23	2.95	2.40	1.90	1.90	2.30	2.40	2.40
10	.....	4.14	2.97	2.30	1.90	1.90	2.30	2.35	2.40
11	.....	.....	2.90	2.35	1.90	1.90	2.35	2.35	2.40
12	.....	4.21	2.90	2.35	1.90	2.00	2.30	2.35	2.40
13	.....	4.20	2.95	2.35	1.90	2.00	2.40	2.35	2.40
14	7.06	4.22	2.80	2.35	1.90	2.00	2.30	2.30	2.40
15	6.86	4.19	2.70	2.30	1.90	2.00	2.40	2.30	2.35
16	.....	4.00	2.67	2.15	1.90	2.10	2.40	2.30	2.35
17	.....	4.00	2.49	2.15	1.90	2.10	2.40	2.30	2.35
18	.....	3.97	2.48	2.10	1.90	2.10	2.40	2.30	2.40
19	.....	3.95	2.47	2.05	1.90	2.10	2.40	2.30	2.40
20	.....	3.92	2.48	2.05	1.90	2.10	2.45	2.30	2.40
21	.....	3.85	2.48	2.00	1.90	2.10	2.45	2.30	2.40
22	.....	3.80	2.48	2.00	1.90	2.10	2.45	2.30	2.40
23	5.46	3.80	2.50	2.00	1.90	2.10	2.45	2.30	2.45
24	.....	3.75	2.50	1.97	1.90	2.10	2.45	2.35	2.45
25	.....	3.62	2.50	1.90	1.90	2.10	2.45	2.35	2.45
26	4.81	3.54	2.51	1.90	1.90	2.10	2.45	2.30	2.50
27	4.73	3.50	2.51	1.90	1.90	2.10	2.45	2.30	2.50
28	4.56	3.48	2.51	1.95	1.90	2.10	2.45	2.30	2.60
29	5.06	3.40	2.50	1.92	1.90	2.15	2.45	2.30	2.65
30	4.98	3.35	2.50	1.90	1.90	2.15	2.40	2.30	2.70
31	.....	3.30	.....	1.90	1.90	.....	2.40	.....	2.75

Rating table for Willow Creek near Dell, Oreg., from April 1 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.90	0.5	3.20	59	4.50	226	6.60	776
2.00	1.5	3.30	68	4.60	244	6.80	852
2.10	3	3.40	78	4.70	262	7.00	930
2.20	5	3.50	88	4.80	280	7.20	1,010
2.30	7	3.60	98	4.90	300	7.40	1,090
2.40	11	3.70	110	5.00	320	7.60	1,170
2.50	15	3.80	122	5.20	362	7.80	1,250
2.60	20	3.90	134	5.40	408	8.00	1,330
2.70	26	4.00	148	5.60	456	8.50	1,530
2.80	32	4.10	162	5.80	511	9.00	1,730
2.90	38	4.20	177	6.00	570	9.50	1,930
3.00	44	4.30	193	6.20	636	10.00	2,130
3.10	51	4.40	209	6.40	704		

The above table is applicable only for open-channel conditions. It is based upon 8 discharge measurements made during 1904. It is well defined between gage heights 2.00 feet and 7.10 feet. The table has been extended beyond these limits. Above gage height 6.90 feet the rating curve is a tangent, the difference being 40 per tenth.

Estimated monthly discharge of Willow Creek near Dell, Oreg., for 1904.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January [a]			10.0	615
February [a]			221	12,710
March [a]			783	48,140
April [a]			624	37,130
May	332	68	163	10,020
June	68	14	31.7	1,886
July	24	.5	6.87	422
August	.5	.5	.50	31
September	4	.5	1.95	116
October	13	3	9.42	579
November	13	7	8.90	530
December	29	7	12.2	750
The year			156	112,900

[a] Estimated.

WEISER RIVER NEAR WEISER, IDAHO.

The drainage basin of this river is mountainous and rocky, in contrast to the well-wooded areas of the Boise and Payette basins, and the effect is shown in the high flood discharges and low summer flow. A number of small ditches utilize considerable water from this river, but the principal canal is the Galloway canal, which irrigates lands of the Weiser irrigation district north of Weiser. Above this canal is a bench country susceptible of cultivation if water could be brought to it.

The station was established December 6, 1894, by A. P. Davis. It is located on J. W. Lane's ranch in the canyon of the river about 10 miles above Weiser, Idaho. The gage rod, which was installed in 1898, was covered during the process of grading for the roadbed of the Pacific and Idaho Northern Railroad, a line intended to run from Weiser to the mining country in the mountainous district to the north. The present gage was installed October 31, 1899, at a point 100 feet above the old gage on the right bank. It is a 4 by 4 inch inclined timber, 12 feet long, bolted to the rock bluff. One foot measured vertically equals 1.15 feet measured along the gage. The gage is read once each day by Mrs. Annie T. Lane. Discharge measurements are made from a cable and car about 300 feet downstream from the gage. The initial point for soundings is 10 feet from the cable support on the right bank. The channel is straight for 300 feet above and below the station. The current is sluggish. The right bank is high and rocky and is not liable to overflow. The left bank is low and will overflow for 100 feet. Both banks are without trees, but brush grows on that part of the left bank liable to overflow. There is but one channel at all stages. The bed of the stream is composed of gravel, free from vegetation, and not liable to change. Bench mark No. 1 is the highest point of a rock 40 feet southwest of the south anchorage of the cable. Its elevation is 19.54 feet above the zero of the gage. Bench mark No. 2 is the highest point of a rock 60 feet southwest of the cable anchorage on the right bank. Its elevation is 25.16 feet above the zero of the gage. This station was discontinued December 31, 1904.

The observations at this station during 1904 have been made under the direction of D. W. Ross, district engineer.

Mean daily gage height, in feet, of Weiser River near Weiser, Idaho, for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.2	2.1	4.8	5.5	4.7	4.4	2.2	0.7	0.5	0.4	0.7	0.6
2	1.2	2.1	6.25	5.4	4.6	4.4	2.3	.6	.5	.6	.7	.6
3	1.2	2.1	6.15	5.4	5.0	4.4	2.2	.6	.5	.6	.7	.6
4	1.2	2.1	4.4	5.8	4.9	4.4	2.2	.6	.5	.6	.7	.6
5	1.2	2.1	4.0	5.5	4.7	4.3	2.1	.6	.5	.5	.7	.6
6	1.2	2.1	5.1	5.5	4.7	4.3	2.0	.7	.5	.6	.7	.6
7	1.2	2.1	8.0	5.5	4.7	4.0	1.9	.7	.5	.4	.7	.6
8	1.0	2.1	10.5	5.0	4.7	4.0	1.9	.6	.4	.6	.7	.6
9	1.0	2.1	9.9	5.0	4.8	4.0	1.9	.5	.4	.8	.7	.6
10	1.2	2.1	7.95	5.25	4.6	4.0	1.8	.5	.3	.8	.7	.6
11	1.2	2.1	8.9	6.1	4.6	3.8	1.7	.5	.3	.9	.7	.6
12	1.2	2.1	7.0	6.55	4.6	3.5	1.7	.5	.3	.9	.7	.6
13	1.2	2.1	5.8	7.0	4.6	3.3	1.7	.4	.3	.8	.7	.6
14	1.2	2.1	5.6	7.35	4.6	3.3	1.6	.5	.3	.8	.7	.6
15	1.2	2.1	6.5	7.55	4.7	3.3	1.5	.5	.3	.8	.7	.6
16	1.2	2.5	5.7	7.8	4.7	3.4	1.5	.5	.3	.8	.7	.6
17	1.3	6.65	7.0	7.5	4.7	3.5	1.5	.5	.3	.8	.7	.7
18	1.4	5.45	6.45	6.8	4.7	3.6	1.4	.5	.3	.8	.7	.7
19	1.6	5.2	9.0	6.7	4.7	3.5	1.3	.4	.3	.8	.7	.7
20	1.6	4.0	8.4	6.85	4.9	3.2	1.2	.4	.3	.8	.7	.7
21	1.7	4.0	6.0	7.0	5.05	3.2	1.2	.4	.3	.8	.7	.7
22	1.8	4.0	5.6	6.1	5.5	3.0	1.1	.4	.3	.8	.7	.7
23	2.0	4.4	5.0	5.5	5.5	3.0	1.0	.4	.3	.8	.7	.7
24	2.0	5.8	4.5	5.0	5.5	2.9	1.0	.4	.3	.7	.7	.7
25	2.2	5.7	4.4	4.7	5.4	2.7	1.0	.4	.3	.7	.7	.8
26	2.2	7.3	4.4	4.7	4.9	2.5	.9	.4	.3	.7	.7	.8
27	2.2	6.4	4.0	5.15	4.5	2.5	.8	.3	.3	.7	.7	.8
28	2.2	5.4	4.35	5.65	4.5	2.4	.8	.5	.3	.7	.7	.8
29	2.2	4.9	7.2	5.3	4.4	2.4	.7	.6	.3	.7	.7	.8
30	2.1	.....	7.5	5.0	4.4	2.3	.7	.8	.3	.7	.7	.8
31	2.1	.....	6.0	.....	4.4	.....	.7	.6	.....	.7	.....	.8

Rating table for Weiser River near Weiser, Idaho, from January 1, 1902, to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
0.2	39	2.2	875	4.2	3,125	6.2	5,825
.4	71	2.4	1,050	4.4	3,395	6.4	6,095
.6	105	2.6	1,235	4.6	3,665	6.6	6,365
.8	150	2.8	1,425	4.8	3,935	6.8	6,635
1.0	215	3.0	1,625	5.0	4,205	7.0	6,900
1.2	290	3.2	1,840	5.2	4,475	7.5	7,575
1.4	375	3.4	2,075	5.4	4,745	8.0	8,250
1.6	470	3.6	2,325	5.6	5,015	8.5	8,925
1.8	585	3.8	2,585	5.8	5,285	9.0	9,600
2.0	720	4.0	2,855	6.0	5,555	9.5	10,275

The above table is applicable for open-channel conditions only. It is based upon discharge measurement made during 1902 and 1903, and is fairly well defined.

Estimated monthly discharge of Weiser River near Weiser, Idaho, for 1904.

[Drainage area, 1,670 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
January	875	215	473	29,080	0.283	0.326
February	7,305	798	2,532	145,600	1.52	1.64
March	11,620	2,855	6,004	369,200	3.60	4.15
April	7,980	3,800	5,467	325,300	3.27	3.65
May	4,880	3,395	3,911	240,500	2.34	2.70
June	3,395	962	2,204	131,100	1.32	1.47
July	962	127	453	27,850	.271	.312
August	150	55	91.6	5,632	.055	.063
September	88	55	63.8	3,796	.038	.042
October	182	71	132	8,116	.079	.091
November	127	127	127	7,557	.076	.085
December	150	105	121	7,440	.072	.083
The year	11,620	55	1,798	1,301,000	1.08	14.61

POWDER RIVER NEAR BAKER CITY, OREG.

This station was established December 20, 1903, by John H. Lewis. It is located 10 miles above Baker City, Oreg., and one-fourth mile below Salisbury, a station on the Sumpter Valley Railroad. A plain staff gage, graduated to feet and tenths, is nailed in a vertical position to a tree on the left bank, about 400 feet below the house of R. M. Garrett, who reads the gage twice each day. Discharge measurements are made from a wagon bridge having a single span of about 50 feet. The initial point for soundings is at the left end of the bridge. Five-foot intervals are marked on the bridge by means of 20-penny nails. The channel is straight for about 75 feet above and 100 feet below the station, and the current is swift. Both banks are low, timbered, and liable to overflow. The bed of the stream is composed of gravel, free from vegetation, and is permanent. There is but one channel at all stages. The bench mark is a group of three 30-penny nails driven into a large cottonwood tree which stands on the left bank of the stream 35 feet below the gage and 6 feet above the end of the bridge. Its elevation is 8.00 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of John T. Whistler, district engineer.

Discharge measurements of Powder River near Baker City, Oreg., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
March 16	J. H. Lewis	39	53	3.10	2.95	162
May 7	W. C. Sawyer	40	110	5.20	4.30	572
May 11	Murphy and Sawyer	40	118	5.60	4.56	660
July 2	W. C. Sawyer	38	50	2.69	2.92	133
September 22 [a]	do	16	8.4	.94	1.74	7.9
December 6 [b]	do	9	10	1.84	2.15	18.4

[a] Wading. [b] Channel partly frozen.

Mean daily gage height, in feet, of Powder River near Baker City, Oreg., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.24	2.40	2.75	3.15	4.45	4.45	2.95	2.25	2.15	1.80	2.15	2.10
2	2.24	2.45	2.70	3.20	4.55	4.30	2.95	2.20	2.05	1.75	2.15	2.05
3	2.24	2.44	2.80	3.35	4.45	4.40	2.90	2.20	2.05	1.80	2.15	2.00
4	2.24	2.45	2.40	3.60	4.60	4.35	2.80	2.20	2.00	1.85	2.10	1.95
5	2.24	2.42	2.48	3.45	4.55	4.30	2.90	2.15	2.00	1.85	2.15	1.90
6	2.24	2.45	2.75	4.35	4.45	4.50	2.75	2.10	1.95	1.80	2.10	2.15
7	2.24	2.48	3.40	4.35	4.40	4.50	2 85	2.15	1.95	1.85	2.10	2.20
8	2.24	2.40	3.20	4.80	4.45	4.25	2.85	2.15	1.95	1.75	2.05	2.15
9	2.24	2.52	2.95	5.30	4.35	4.35	2.90	2.15	1.90	1.80	2.00	2.20
10	2.24	2.62	3.05	5.40	4.45	4.10	2.75	2.10	1.90	1.90	2.00	2.15
11	2.24	2.58	3.00	6.15	4.55	3.95	2.70	2.05	1.90	2.15	2.05	1.95
12	2.24	2.68	2.90	6.90	4.55	3.75	2.65	2.10	1.85	2.25	2.05	1.95
13	2.24	2.78	2.85	6.45	4.60	3.80	2.60	2.10	1.90	2.20	2.00	2.00
14	2.24	2.65	4.20	7.30	4.50	3.80	2.60	2.05	1.85	2.15	2.00	2.05
15	2.24	2.75	3.05	7.10	4.50	3.85	2.55	2.05	1.85	2.15	2.00	2.15
16	2.24	3.00	2.90	6.35	4.60	3.95	2.50	2.00	1.70	2.15	2.05	2.05
17	2.24	2.92	3.20	5.85	4.65	3.90	2.45	1.85	1.70	2.15	2.00	2.05
18	2.24	3.00	2.90	5.70	4.70	3.80	2.50	1.85	1.65	2.25	2.00	2.15
19	2.24	2.95	2.70	5.65	4.45	3.80	2.40	1.70	1.45	2.35	2.05	2.15
20	2.24	3.10	3.10	6.20	4.45	3.65	2.35	1.75	1.30	2.30	2.05	2.10
21	2.24	3.15	2.85	5.40	4.70	3.50	2.40	1.75	1.85	2.25	2.05	2.10
22	2.24	3.50	2.80	4.30	5.15	3.40	2.35	1.75	1.80	2.30	2.10	2.10
23	2.24	3.15	3.40	4.85	5.40	3.25	2.30	2.15	1.90	2.15	2.10	2.10
24	2.40	3.35	2.85	4.55	4.55	3.25	2.35	2.05	2.00	2.15	2.10	2.15
25	2.34	3.20	2.75	4.35	4.65	3.10	2.30	2.10	2.00	2.15	2.15	2.05
26	2.36	3.17	2.70	4.57	4.55	3.05	2.30	2.15	2.10	2.15	2.15	1.95
27	2.40	3.25	2.50	4.70	4.45	3.05	2.35	2.15	2.05	2.20	2.10	2.00
28	2.39	2.95	2.60	5.10	4.50	2.90	2.25	2.20	2.00	2.20	2.10	2.00
29	2.35	2.95	3.00	5.55	4.50	2.80	2.25	2.20	2.00	2.10	2.10	2.00
30	2.42	.....	2.95	4.90	4.50	2.95	2.30	2.20	1.95	2.15	2.10	2.05
31	2.42	.....	2.95	.....	4.50	.....	2.25	2.30	.....	2.15	.....	2.15

Rating table for Powder River near Baker City, Oreg., from January 1 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.60	4	2.90	140	4.20	537	5.80	1,082
1.70	7	3.00	161	4.30	571	6.00	1,150
1.80	11	3.10	184	4.40	605	6.20	1,218
1.90	16	3.20	209	4.50	639	6.40	1,286
2.00	22	3.30	237	4.60	673	6.60	1,354
2.10	30	3.40	267	4.70	707	6.80	1,422
2.20	38	3.50	299	4.80	741	7.00	1,490
2.30	48	3.60	333	4.90	775	7.20	1,558
2.40	60	3.70	367	5.00	810	7.40	1,626
2.50	72	3.80	401	5.20	878	7.60	1,694
2.60	86	3.90	435	5.40	946	7.80	1,762
2.70	102	4.00	469	5.60	1,014	8.00	1,830
2.80	120	4.10	503				

The above table is applicable only for open-channel conditions. It is based upon 7 discharge measurements made during 1903 and 1904. It is fairly well defined between gage heights 1.70 feet and 4.60 feet. The table has been extended beyond these limits. Above gage height 3.50 feet the rating curve is a tangent, the difference being 34 per tenth.

Estimated monthly discharge of Powder River near Baker City, Oreg., for 1904.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January	62	42	46.2	2,841
February	299	60	133	7,650
March	537	60	154	9,469
April	1,592	196	843	50,160
May	946	588	663	40,770
June	639	120	398	23,680
July	150	43	85.0	5,226
August	48	7	28.8	1,771
September	34	2	17.2	1,024
October	54	9	29.5	1,814
November	34	22	28.0	1,666
December	38	16	27.6	1,697
The year	1,592	2	204	147,800

GRANDE RONDE RIVER AT HILGARD, OREG.

This station was established November 6, 1903, by John H. Lewis. It is located at the county highway bridge one-half mile below the Oregon Railroad and Navigation Company station at Hilgard, Oreg. It is just below the mouth of Five Points Creek, which is the first important tributary above Grande Ronde Valley. There are two dams about 20 miles upstream, used to flood the river during the log-driving season. The gage is a 1 by 4 inch board nailed to a vertical 4 by 6 inch timber, which is driven into the ground at the downstream end of the middle bridge pier and bolted at the upper end to the log pier. J. D. Casey and Jay Hawes read the gage once each day at ordinary stages and twice during floods. Discharge measurements are made from the downstream side of the two-span bridge to which the gage is attached. The bridge is supported by two timber crib abutments and by one middle crib pier. The initial point for soundings is at the point where the end post meets the lower chord of the bridge on the right bank. It is directly over the vertical outer edge of the abutment. The channel is straight for 100 feet above and for 200 feet below the station. At ordinary stages all the water passes under the right span, which has a length of 70 feet from the right abutment to the middle pier. At high water the water also passes under the shorter span, which has a length of 52 feet from the left abutment to the middle pier. The right bank is low, but is not liable to overflow. The left bank is low and will overflow only at a few points above the bridge. The bed of the stream is composed of sand and clay, free from vegetation and bowlders. It is permanent under the main span, but is liable to shift in the high-water channel under the shorter span. Bench mark No. 1 is the head of a bolt through the lower chord of the bridge 7.5 feet from the timber to which the gage is attached. Its elevation is 13.80 feet above the zero of the gage. Bench mark No. 2, established July 15, 1904, is a square chisel draft and the letters "U. S. B. M." cut in the top of a rock 200 feet from the right bank, 150 feet upstream from the bridge. Its elevation is 12.81 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of John T. Whistler, district engineer.

Discharge measurements of Grande Ronde River at Hilgard, Oreg., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
May 6	W. C. Sawyer	125	457	4.86	5.60	2,223
July 15	do	66	202	.36	2.92	72
July 15	do	67	223	.80	3.25	179
July 23	do	67	200	.39	3.00	79
November 5[a]	do	42	60	.52	2.72	31

[a] Made at bridge 1 mile below.

Mean daily gage height, in feet, of Grande Ronde River at Hilgard, Oreg., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.50	2.70	3.00	4.50	5.60	4.20	3.30	.....	.....	.....	.....	2.80
2	2.50	2.70	2.70	4.80	5.40	4.30	3.30	.....	.....	.....	.....	2.90
3	2.50	2.90	2.90	5.30	5.30	4.20	3.30	.....	.....	.....	.....	2.68
4	2.50	2.80	2.90	5.30	5.20	4.20	3.30	.....	.....	.....	.....	2.50
5	2.50	2.80	3.00	5.20	4.90	4.20	3.30	.....	.....	.....	.....	2.50
6	2.50	2.80	3.20	5.30	5.00	4.20	3.30	.....	.....	.....	.....	3.30
7	2.50	2.70	3.90	5.40	4.80	4.20	3.30	.....	.....	.....	.....	2.80
8	2.50	2.70	5.30	5.40	5.60	4.20	3.30	.....	.....	.....	.....	2.90
9	2.50	2.80	4.60	6.00	4.90	4.10	3.30	.....	.....	.....	2.80	2.75
10	2.50	2.80	4.20	6.50	4.80	4.10	3.30	.....	.....	.....	3.00	2.80
11	2.60	2.80	3.90	6.80	4.90	4.00	3.30	.....	.....	.....	2.80	2.75
12	2.50	2.80	3.80	7.20	4.60	3.90	3.30	.....	.....	.....	2.72	2.72
13	2.50	2.70	3.70	7.40	4.50	3.90	3.30	.....	.....	.....	2.65	2.75
14	2.50	2.80	3.60	7.50	4.60	3.80	3.30	.....	.....	.....	2.70	2.90
15	2.50	2.90	3.90	7.40	4.80	3.70	3.20	.....	.....	.....	2.70	2.80
16	2.50	2.90	3.80	7.00	4.80	3.70	3.20	.....	.....	.....	2.70	2.80
17	2.40	2.90	4.00	6.80	4.70	3.60	.....	.....	.....	.....	2.70	2.80
18	2.40	2.90	4.20	6.70	4.80	3.50	.....	.....	.....	.....	2.70	2.90
19	2.40	2.90	4.60	6.60	4.70	3.50	.....	.....	.....	.....	2.65	2.85
20	2.40	2.90	4.30	6.30	4.70	3.40	.....	.....	.....	.....	2.65	2.90
21	2.50	3.00	3.90	6.00	4.80	3.30	.....	.....	.....	.....	2.62	2.85
22	2.50	3.30	3.70	5.80	4.80	3.30	.....	.....	.....	.....	2.95	2.85
23	2.50	3.50	3.60	5.70	4.70	3.30	.....	.....	.....	.....	2.68	2.82
24	2.60	3.40	3.50	5.60	4.70	3.30	.....	.....	.....	.....	2.62	2.78
25	2.60	3.30	3.40	5.60	4.60	3.30	.....	.....	.....	.....	2.98	2.85
26	2.60	3.20	3.30	5.70	4.40	3.30	.....	.....	.....	.....	2.68	2.75
27	2.60	4.00	3.20	5.90	4.30	3.30	.....	.....	.....	.....	2.62	2.75
28	2.60	2.90	3.60	6.00	4.20	3.30	.....	.....	.....	.....	2.62	2.80
29	2.60	3.00	4.00	5.90	4.30	3.30	.....	.....	.....	.....	2.95	2.85
30	2.60	.....	4.60	5.80	4.30	3.30	.....	.....	.....	.....	2.80	3.00
31	2.60	.....	4.00	.....	4.30	.....	.....	.....	.....	.....	.....	3.25

Rating table for Grande Ronde River at Hilgard, Oreg., from January 1 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
2.50	14	3.70	386	4.80	1,275	5.90	2,592
2.60	19	3.80	444	4.90	1,384	6.00	2,717
2.70	28	3.90	507	5.00	1,495	6.20	2,969
2.80	39	4.00	574	5.10	1,608	6.40	3,221
2.90	57	4.10	645	5.20	1,725	6.60	3,473
3.00	83	4.20	720	5.30	1,846	6.80	3,725
3.10	116	4.30	799	5.40	1,968	7.00	3,977
3.20	153	4.40	883	5.50	2,092	7.20	4,229
3.30	194	4.50	974	5.60	2,216	7.40	4,481
3.40	238	4.60	1,069	5.70	2,341	7.60	4,733
3.50	284	4.70	1,170	5.80	2,466	7.80	4,985
3.60	333						

The above table is applicable only for open-channel conditions. It is based upon 5 discharge measurements made during 1904. It is well defined between gage heights 2.70 feet and 3.30 feet. The table has been extended beyond these limits.

Estimated monthly discharge of Grande Ronde River at Hilgard, Oreg., for 1904.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January	19	12	15.2	935
February	574	28	93.5	5,378
March	1,846	28	485	29,820
April	4,607	974	2,706	165,800
May	2,216	720	1,270	78,090
June	799	194	434	25,820
July 1–16	194	153	189	5,998
November 9–30	83	21	35.9	1,566
December	194	14	50.6	3,111
The period				316,500

GRANDE RONDE RIVER AT ELGIN, OREG.

This station was established November 20, 1903, by John H. Lewis. It is located at the county bridge on the road from Elgin to Wallowa, Oreg., and is one-fourth mile east of the railroad station. It is at

the lower end of the Grande Ronde Valley. The lower section of the original gage, reading from zero to 2 feet, was a 2 by 4 inch rod driven into the mud on the upstream side of the vertical steel caisson of the left pier. From 2 to 9 feet the gage was painted on the side of the caisson. On July 21, 1904, a standard chain gage was attached to the upstream side of the bridge, near the center of the stream. The length of the chain from the end of the weight to the marker is 22.00 feet. It is read once each day by John Graham. Discharge measurements are made from the downstream side of the bridge, to which the gage is attached. This bridge has a span between piers of 100 feet, with 130 feet of trestle approach from the left bank and 30 feet of approach from the right bank. The initial point for soundings is on the right bank directly over the center of the bent, 30 feet from the caisson. The channel is curved above a point 30 feet above the bridge, and is straight for 200 feet below. The right bank is high, rocky, free from vegetation, and will not overflow. The left bank is low, free from vegetation, and will overflow only under the trestle approach. The bed of the stream is uneven, covered with large bowlders, and is free from vegetation. It is not liable to shift. The channel is broken by the piers and the trestle bents at high water. The bench mark is the top surface of the steel caisson directly over the gage. Its elevation is 15.14 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of John T. Whistler, district engineer.

Discharge measurements of Grande Ronde River at Elgin, Oreg., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
May 12	Murphy and Sawyer	160	550	6.30	4.87	3,460
July 22	W. C. Sawyer	89	244	0.85	2.03	209
August 22	do	77	183	0.27	1.48	50
August 22 [a]	do	36	28	2.11	1.48	58
September 28	do	79	214	.52	1.76	111

[a] Made ¼ mile below.

Mean daily gage height, in feet, of Grande Ronde River at Elgin, Oreg., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.80	2.10	3.20	4.40	5.50	4.20	2.50	1.65	1.50	1.70	1.70	.....
2	1.90	2.00	3.20	4.40	5.40	4.30	2.40	1.65	1.50	1.70	1.70	1.75
3	1.80	2.00	3.00	4.50	5.30	4.30	2.40	1.65	1.55	1.70	1.70	1.75
4	1.90	2.10	3.00	4.50	5.20	4.30	2.40	1.65	1.55	1.60	1.70	1.70
5	1.90	2.20	3.00	4.80	5.20	4.20	2.40	1.65	1.55	1.60	1.70	1.70
6	1.90	2.20	3.40	5.00	5.10	4.10	2.30	1.60	1.55	1.60	1.70	1.85
7	1.90	2.20	3.50	5.00	5.10	4.20	2.30	1.60	1.55	1.60	1.75	1.75

Mean daily gage height, in feet, of Grande Ronde River at Elgin, Oreg., for 1904—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
8	1.90	2.10	4.90	5.00	5.00	4.10	2.40	1.60	1.50	1.60	1.75	1.75
9	1.80	2.00	4.80	5.20	4.90	4.10	2.50	1.60	1.50	1.65	1.70	1.65
10	1.70	1.90	4.80	5.70	4.90	4.10	2.50	1.60	1.50	1.75	1.70	1.70
11	1.90	1.80	4.80	6.20	4.90	4.00	2.50	1.60	1.55	1.80	1.70	1.70
12	1.90	1.90	4.60	6.50	4.90	3.90	2.50	1.60	1.45	1.80	1.80	1.70
13	1.90	1.90	4.40	6.80	4.90	3.80	2.40	1.55	1.45	1.80	.....	1.75
14	2.00	2.10	4.20	7.00	4.90	3.70	2.40	1.55	1.50	1.85	1.70	1.80
15	2.10	2.20	4.10	7.60	4.90	3.70	2.40	1.55	1.50	1.85	1.70	1.80
16	2.20	3.00	4.10	7.60	4.90	3.60	2.30	1.50	1.50	1.85	1.80	1.70
17	2.40	3.00	4.10	7.60	4.80	3.60	2.30	1.50	1.50	1.90	1.75	1.70
18	2.20	2.90	4.10	7.60	4.80	3.60	2.20	1.50	1.50	2.00	1.70	1.75
19	2.10	2.70	4.20	7.60	4.80	3.60	2.10	1.50	1.45	1.90	1.70	1.80
20	2.10	2.70	4.30	7.20	4.80	3.50	2.00	1.50	1.45	1.80	1.75	1.80
21	1.80	2.70	4.40	7.00	4.80	3.40	2.00	1.45	1.45	1.75	1.75	1.80
22	2.10	2.70	4.30	6.80	4.80	3.20	2.00	1.45	1.45	1.75	1.75	1.75
23	2.20	3.20	4.10	6.60	4.80	3.10	2.00	1.45	1.50	1.75	1.70	1.75
24	2.10	3.70	3.90	6.20	4.80	3.00	1.95	1.45	1.50	1.80	1.75	1.80
25	2.00	3.50	3.80	5.90	4.80	2.90	1.90	1.45	1.55	1.80	1.70	1.80
26	2.20	3.50	3.60	5.80	4.80	2.80	1.85	1.45	1.65	1.75	1.75	[a]1.60
27	2.30	3.50	3.40	5.70	4.70	2.80	1.80	1.45	1.65	1.75	1.75	[a]1.70
28	2.20	3.20	3.50	5.60	4.60	2.80	1.75	1.50	1.80	1.75	1.75	[a]1.85
29	2.20	3.10	3.70	5.60	4.40	2.70	1.80	1.55	1.80	1.70	1.75	[a]1.85
30	2.20	.....	4.30	5.60	4.20	2.60	1.75	1.55	1.80	1.70	1.75	[a]1.70
31	2.20	.....	4.50	.....	4.20	.....	1.70	1.55	.....	1.70	.....	[a]1.80

[a] Gage heights December 26 to 31, inclusive, are approximate, owing to ice.

Rating table for Grande Ronde River at Elgin, Oreg., from January 1 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.50	53	2.80	589	4.10	2,114	5.80	5,127
1.60	74	2.90	663	4.20	2,277	6.00	5,485
1.70	99	3.00	743	4.30	2,446	6.20	5,843
1.80	128	3.10	829	4.40	2,621	6.40	6,201
1.90	158	3.20	923	4.50	2,800	6.60	6,559
2.00	190	3.30	1,025	4.60	2,979	6.80	6,917
2.10	225	3.40	1,135	4.70	3,158	7.00	7,275
2.20	264	3.50	1,253	4.80	3,337	7.20	7,633
2.30	307	3.60	1,379	4.90	3,516	7.40	7,991
2.40	354	3.70	1,513	5.00	3,695	7.60	8,349
2.50	405	3.80	1,655	5.20	4,053	7.80	8,707
2.60	462	3.90	1,804	5.40	4,411	8.00	9,065
2.70	523	4.00	1,957	5.60	4,769		

The above table is applicable only for open-channel conditions. It is based upon 5 discharge measurements made during 1904. It is not well defined. Above gage height 4.40 feet the rating curve is a tangent, the difference being 179 per tenth.

Estimated monthly discharge of Grande Ronde River at Elgin, Oreg., for 1904.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January	354	99	204	12,540
February	1,513	128	528	30,370
March	3,516	743	2,007	123,400
April	8,349	2,621	5,525	328,800
May	4,590	2,277	3,471	213,400
June	2,446	462	1,496	89,020
July	405	99	271	16,660
August	86	44	63 1	3,880
September	128	44	63 2	3,760
October	190	74	114	7,010
November	128	99	107	6,367
December	143	74	114	7,010
The year	8,349	44	1,168	842,200

GRANDE RONDE RIVER AT ZINDEL, WASH.

This station was established June 30, 1904, by W. G. Steward. It is located at Zindel Ferry, 2 miles above the mouth of the river and 1½ miles below Joseph Creek. The gage is located just below the ferry on the left bank. It is an inclined fir log, hewed flat on the top face and graduated to vertical feet and tenths, from 2.5 to 8.9 feet. The gage is read daily by M. W. Zindel, who is paid by the Lewiston Water and Power Company. Discharge measurements are made from the ferryboat. The distances are measured on the stay-line used for the ferry. The initial point is an 8-penny nail in a pine tree 30 feet south of the cable post on the right bank. The channel is curved above the station, but straight for 1,200 feet below. There are rapids 600 feet above and also 1,200 feet below the station. The right bank is rocky and slopes gradually. It is liable to overflow at extreme high water. The left bank is high and rocky, and not liable to overflow. The bed is rocky and permanent. It is fairly even for soundings. There is one channel at all stages. The bench mark is located 29 feet downstream from the gage.

The observations at this station during 1904 have been made under the direction of John T. Whistler, district engineer.

Discharge measurements of Grande Ronde River at Zindel, Wash., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
June 29	W. G. Steward	208	1,182	3.18	4.32	3,762
August 11	C. M. Hulburt	192	801	1.40	2.58	1,118

Mean daily gage height, in feet, of Grande Ronde River at Zindel, Wash., for 1904.

Day.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	5.00	2.90	2.40	2.30	2.30	2.30
2	.....	5.00	2.85	2.35	2.30	2.30	2.25
3	.....	4.65	2.80	2.35	2.30	2.30	2.25
4	.....	4.70	2.75	2.30	2.25	2.30	2.15
5	.....	4.65	2.70	2.30	2.20	2.25	2.15
6	.....	4.60	2.70	2.29	2.25	2.25	2.15
7	.....	4.60	2.70	2.28	2.30	2.25	2.25
8	.....	4.55	2.63	2.25	2.30	2.25	2.30
9	.....	4.45	2.65	2.23	2.35	2.25	2.40
10	.....	4.40	2.60	2.21	2.35	2.25	2.30
11	.....	4.30	2.00	2.20	2.35	2.25	2.25
12	.....	4.25	2.00	2.20	2.35	2 30	2.25
13	.....	4.20	2.55	2.20	2.40	2.30	2.30
14	.....	4.05	2.55	2.20	2.45	2.25	2.30
15	.....	3.90	2.50	2.20	2.60	2.25	2.35
16	.....	4.00	2.50	2.20	2.50	2.25	2.40
17	.....	3.90	2.50	2.20	2.50	2.25	2.35
18	.....	3.90	2.50	2.20	2.45	2.25	2.35
19	.....	3.80	2.50	2.20	2.45	2.25	2.35
20	.....	3.60	2.50	2.20	2.45	2.25	2.30
21	.....	3.55	2.40	2.20	2.45	2.30	2.30
22	.....	3.60	2.40	2.20	2.40	2.30	2.40
23	.....	3.55	2.35	2.20	2.40	2.30	2.50
24	.....	3.50	2.30	2.20	2.40	2.25	2.15
25	.....	3.50	2.30	2.20	2.40	2.25	2.30
26	.....	3.40	2.30	2.35	2.35	2.25	2.20
27	.....	3.25	2.30	2.40	2.35	2.30	2.20
28	.....	3.30	2.30	2.30	2.30	2.30	2.25
29	4.32	3.30	2.45	2.30	2.30	2.30	2.30
30	4.18	3.10	2.50	2.30	2.30	2.30	2.60
31	.....	3.00	2.50	.....	2.30	.....	2.65

WALLOWA RIVER NEAR JOSEPH, OREG.

This station was established November 12, 1903, by John H. Lewis. The gage is located on Wallowa Lake near its outlet. It is a vertical 2 by 6 inch board fastened to a log pier which extends into the lake. It reads from zero to 5 feet. It is read once each day by F. L. Bedingfield. Discharge measurements are made from a footbridge about 500 feet below the outlet of Wallowa Lake and 1¼ miles above Joseph, Oreg. The bridge has a single span of 50 feet. The initial point for soundings is the end of the upstream log supporting the footbridge on the left bank. The channel is straight for 100 feet above and for 75 feet below the station. The right bank is liable to overflow at high water for about 30 feet, at which point it becomes steep. The left bank will overflow for about 20 feet at high water. Both banks are timbered.

At the bridge the bed of the stream is composed of large bowlders, free from vegetation, and is not liable to shift. There is but one channel at all stages. The direction of the wind is liable to affect both the gage readings on the lake and the discharge. The bench mark is a square chisel draft and the letters "U. S. G. S. B. M." painted in black on a granite bowlder on the beach, under a large cottonwood tree, about 65 feet northwest of the gage. Its elevation is 4.95 feet.

The observations at this station during 1904 have been made under the direction of John T. Whistler, district engineer.

Discharge measurements of Wallowa River near Joseph, Oreg., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
July 18	W. C. Sawyer	40	102	3.94	2.98	402
July 18[a]	do	60	194	2.13	2.97	413
August 18	do	35	67	3.50	2.38	234
September 26	do	31	36	2.30	1.53	84
September 26[a]	do	75	78	1.21	1.54	95

[a] At footbridge.

Mean daily gage height, in feet, of Wallowa River near Joseph, Oreg., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.45	1.10	.....	1.40	2.00	3.20	3.80	2.70	.....	1.50	.....	1.30
2	1.45	1.20	.....	1.45	2.00	3.20	3.80	2.70	.....	1.50	1.40	1.30
3	.....	.....	.....	1.35	2.00	3.20	3.95	2.60	.....	1.50	1.40	1.30
4	.....	1.25	.....	1.33	2.00	3.20	3.95	2.60	.....	1.50	1.40	1.30
5	.....	1.25	.....	1.30	2.00	3.20	3.90	.....	.....	1.50	1.40	1.30
6	.....	.....	.....	1.30	2.00	3.25	3.90	.....	.....	1.50	1.40	1.30
7	.....	1.20	.....	1.30	2.00	3.25	3.90	.....	.....	1.50	.....	1.30
8	.....	1.20	1.45	1.30	2.00	3.25	3.85	.....	.....	1.50	1.30	1.30
9	.....	1.20	1.45	1.30	2.00	3.30	3.80	.....	.....	1.60	1.30	1.30
10	1.42	.....	.....	1.33	2.00	3.30	3.80	.....	.....	.....	1.30	1.30
11	1.42	.....	.....	1.37	2.07	3.30	3.75	.....	.....	1.40	1.30	1.30
12	1.40	1.25	.....	1.40	2.10	.....	3.70	.....	.....	1.60	1.30	1.30
13	1.40	1.25	.....	1.45	2.15	.....	3.65	.....	.....	1.60	1.30	.....
14	1.40	1.25	1.50	1.52	2.20	.....	3.50	.....	.....	1.60	.....	.....
15	1.40	1.25	1.40	1.70	2.25	3.30	3.45	.....	.....	1.60	1.30	1.30
16	1.40	1.35	1.40	1.80	2.30	3.40	.....	.....	.....	1.60	1.30	1.30
17	.....	1.35	1.40	1.85	2.38	3.50	3.10	2.38	.....	1.60	.....	1.30
18	.....	1.40	1.40	1.90	2.50	3.60	3.00	2.40	.....	1.60	1.30	1.30
19	.....	1.45	1.45	1.95	2.58	3.70	2.90	.....	.....	1.50	1.30	1.30
20	.....	1.45	1.45	2.00	2.60	3.80	2.80	.....	.....	1.50	.....	1.20
21	.....	1.40	.....	2.00	2.65	3.80	2.85	.....	.....	1.50	.....	1.30
22	.....	1.40	.....	2.00	2.75	3.80	2.80	.....	.....	1.50	1.30	1.30
23	.....	1.40	1.45	2.00	2.90	3.70	2.95	.....	.....	1.50	1.30	.....
24	1.40	1.40	1.45	2.00	3.05	3.60	3.00	.....	.....	1.50	1.30	1.30
25	1.35	1.40	1.40	1.95	3.10	3.55	3.10	.....	1.54	1.50	1.30	1.30
26	1.35	1.35	1.40	1.95	3.10	3.50	3.50	.....	1.53	1.40	1.30	1.30
27	1.30	.....	1.45	.....	3.05	3.50	3.00	.....	.....	1.40	1.30	1.20
28	1.25	.....	1.40	1.95	.....	3.55	3.00	.....	1.50	1.40	.....	1.20
29	1.25	.....	1.50	1.95	3.05	3.65	2.95	.....	1.60	1.40	1.30	.....
30	1.25	.....	1.50	1.95	3.05	3.70	2.90	.....	1.50	.....	.....	1.40
31	1.25	.....	1.45	.....	3.15	.....	2.80	.....	.....	1.40	.....	1.40

Rating table for Wallowa River near Joseph, Oreg., from November 13, 1903, to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.20	53	2.00	157	2.70	315	3.40	541
1.30	63	2.10	175	2.80	344	3.50	575
1.40	73	2.20	195	2.90	374	3.60	609
1.50	85	2.30	216	3.00	406	3.70	643
1.60	97	2.40	238	3.10	439	3.80	677
1.70	110	2.50	262	3.20	473	3.90	711
1.80	125	2.60	283	3.30	507	4.00	745
1.90	141						

The above table is applicable only for open-channel conditions. It is based upon 6 discharge measurements made during 1903 and 1904. It is well defined between gage heights 1.50 feet and 3.00 feet. The table has been extended beyond these limits.

Estimated monthly discharge of Wallowa River near Joseph, Oreg., for 1903 and 1904.

Month.	Discharge in second-feet.[a]			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
1903.				
November 13–30	103	85	94.2	3,363
December	97	77	86.0	5,288
1904.				
January	79	58	72.0	4,427
February	79	45	63.1	3,630
March	85	73	78.0	4,796
April	157	63	110	6,545
May	456	157	266	16,360
June	677	473	555	33,020
July	728	344	534	32,830
August	315	185	240	14,760
September	185	85	133	7,914
October	97	73	85.4	5,251
November	73	63	65.3	3,889
December	73	53	62.7	3,855
The year	728	45	189	137,300

[a] Discharge interpolated for missing gage heights.

WALLOWA RIVER NEAR WALLOWA, OREG.

This station was established November 14, 1903, by John H. Lewis. It is located at the county bridge, 1½ miles below Wallowa, Oreg., and one-fourth mile below the mouth of Bear Creek. A small irrigation

ditch which carries about 2 second-feet takes water from the river about 300 feet above the bridge on the right bank. The gage is a vertical 2 by 6 inch timber nailed to the downstream side of the timber crib pier on the right bank. Its location is such that it is protected by the pier from drift. It is read once each day by L. S. Johnson. Discharge measurements are made from the upstream side of the bridge to which the gage is attached. The initial point for soundings is the left end of the lower chord on the upstream side of the bridge. The channel is straight for 400 feet above and for 600 feet below the station. The current is swift. Both banks are low, wooded, and not liable to overflow. The bed of the stream is composed of gravel, free from vegetation, and is not liable to shift. There is but one channel at low water. At high water the channel is broken by the rock-filled timber crib pier, to which the gage is fastened. Bench mark No. 1 is the head of a 30-penny wire nail driven nearly flush with the top of the crib, 2 inches from the edge, near the gage. Its elevation is 6.60 feet above the zero of the gage. Bench mark No. 2 is a square chisel draft on top of a rock near rail fence across the ditch 50 feet from the right end of the bridge. Its elevation is 8.10 feet above the gage zero.

The observations at this station during 1904 have been made under the direction of John T. Whistler, district engineer.

Discharge measurements of Wallowa River near Wallowa, Oreg., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
July 19	W. C. Sawyer	88	200	5.30	3.09	1,058
August 19	do	84	106	3.60	2.12	379
September 24	do	72	87	3.08	1.82	268

Mean daily gage height, in feet, of Wallowa River near Wallowa, Oreg., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.70	1.70	1.95	2.20	2.70	3.80	4.20	.....	2.10	1.80	1.90	1.90
2	1.70	1.70	1.85	2.30	2.80	3.60	4.10	.....	2.10	1.80	1.90	1.90
3	1.70	1.68	1.85	2.40	2.75	3.60	4.20	.....	2.10	1.80	1.90	1.80
4	1.72	1.70	1.90	2.40	2.80	3.50	4.00	.....	2.10	1.80	1.90	1.70
5	1.75	1.70	1.95	2.50	2.80	3.70	4.00	2.30	2.10	1.80	1.90	1.70
6	1.75	1.72	2.00	2.80	2.70	4.00	4.10	2.30	2.00	2.00	1.90	1.70
7	1.74	1.68	3.02	2.50	2.70	4.00	4.00	2.00	2.00	2.00	1.90	1.70
8	1.78	1.62	3.75	2.50	2.70	3.70	3.90	2.00	2.00	1.90	1.90	1.70
9	1.72	1.56	2.90	2.55	2.75	3.70	4.00	2.20	2.00	1.90	1.90	1.80
10	1.72	1.50	2.60	2.80	2.75	3.70	4.00	2.20	2.00	1.90	1.90	1.70
11	1.74	1.70	2.70	2.80	2.80	3.50	4.00	2.30	2.00	1.90	1.90	1.80
12	1.74	1.88	2.55	2.70	2.90	3.50	3.90	2.20	2.00	2.00	1.90	1.80
13	1.80	1.68	2.45	2.80	2.90	3.50	3.70	2.20	2.00	2.00	1.90	1.80
14	1.80	1.60	2.45	3.50	3.30	3.50	3.50	2.20	1.90	2.00	1.90	1.80
15	1.75	1.68	2.50	3.70	3.00	3.30	3.40	2.20	1.90	2.10	1.90	1.80
16	1.75	2.00	2.30	3.80	3.00	3.90	3.40	2.20	1.90	2.10	1.90	1.80
17	1.80	1.85	2.30	3.50	3.10	3.70	3.20	2.20	1.90	2.10	1.90	1.80
18	1.80	1.60	2.30	3.50	3.30	4.20	3.10	2.20	1.90	2.00	1.90	1.80

Mean daily gage height, in feet, of Wallowa River near Wallowa, Oreg., for 1904—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
19	1.70	1.70	2.30	3.40	3.30	4.10	3.10	2.10	1.90	2.00	1.90	1.80
20	1.65	1.75	2.30	3.40	3.20	4.00	3.10	2.10	1.80	2.00	1.90	1.80
21	1.60	1.78	2.30	3.20	3.50	3.90	3.20	2.10	1.80	2.00	1.90	1.80
22	1.60	2.40	2.20	3.10	3.70	4.00	3.30	2.10	1.80	2.00	1.90	1.80
23	1.60	2.50	2.20	3.00	4.00	3.70	3.20	2.10	1.80	2.00	1.90	1.80
24	1.60	2.25	2.10	2.80	4.20	3.40	3.20	2.10	1.80	2.00	1.90	1.80
25	1.60	2.20	2.10	2.80	3.80	3.30	3.00	2.10	1.80	2.00	1.90	1.80
26	1.60	2.20	2.55	2.80	3.50	3.20	3.00	2.10	1.80	1.90	1.90	1.80
27	1.60	2.20	2.00	2.90	3.50	3.30	2.90	2.00	1.80	1.90	1.90	1.80
28	1.60	2.00	2.00	2.90	3.50	3.30	2.80	2.20	1.80	1.90	2.00	1.80
29	1.60	2.00	2.40	2.90	3.50	3.50	2.70	2.20	1.80	1.90	1.90	1.80
30	1.60	.....	2.40	2.80	3.70	3.60	2.60	2.20	1.80	1.90	1.90	2.10
31	1.65	.....	2.20	.....	3.20	.....	2.00	2.20	.....	1.90	.....	2.10

Rating table for Wallowa River near Wallowa, Oreg., from January 1 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.70	226	2.40	512	3.10	1,063	3.70	1,730
1.80	258	2.50	567	3.20	1,169	3.80	1,844
1.90	293	2.60	626	3.30	1,277	3.90	1,958
2.00	331	2.70	693	3.40	1.388	4.00	2,072
2.10	371	2.80	772	3.50	1,502	4.10	2,186
2.20	414	2.90	862	3.60	1,616	4.20	2,300
2.30	461	3.00	960				

The above table is applicable only for open-channel conditions. It is based upon 3 discharge measurements made during 1904. It is well defined between gage heights 1.80 feet and 3.10 feet. The table has been extended beyond these limits.

Estimated monthly discharge of Wallowa River near Wallowa, Oreg., for 1904.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January	258	197	225	13,840
February	567	172	284	16,340
March	1,787	275	517	31,790
April	1,844	414	923	54,920
May	2,300	693	1,165	71,640
June	2,300	1,169	1,681	100,000
July	2,300	331	1,473	90,570
August [a]	461	331	397	24,410
September	371	258	303	18,030
October	371	258	311	19,120
November	331	293	294	17,490
December	371	226	261	16,050
The year	2,300	172	653	474,200

[a] Discharge interpolated August 1–4.

WALLOWA RIVER NEAR ELGIN, OREG.

This station was established November 18, 1903, by John H. Lewis. It is located at the county highway bridge just below the mouth of Minam River and 12 miles from Elgin, Oreg. The gage is in 2 sections of 2 by 6 inch timber, located under the lower side of the bridge on the left bank. Both sections are held in place by bolts, cemented into the solid rock. The lower or inclined section reads from 1.7 to 3 feet. The upper or vertical section reads from 3 to 10 feet. The gage is read once each day by John McCulloch. Discharge measurements are made from the downstream side of the single-span bridge, to which the gage is attached. On account of the velocity of the water a stay wire is used in making discharge measurements. The initial point for soundings is the end of the bridge rail on the left bank. The channel is straight for 100 feet above and for 1,000 feet below the station. Both banks are high, rocky, not liable to overflow, and without timber or brush. The current is swift. The bed of the stream is composed of gravel, free from vegetation, and not liable to shift. There is but one channel at all stages. Bench mark No. 1 is the highest point of the rock to which the vertical section of the gage is fastened. It is 6 inches from the gage rod and has an elevation of 9.60 feet above the zero of the gage. Bench mark No. 2 is the center of the hole in the rock in which the bolt supporting vertical rod is set. Its elevation is 7.07 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of John T. Whistler, district engineer.

Discharge measurements of Wallowa River near Elgin, Oreg., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
July 20	W. C. Sawyer	160	363	4.58	3.70	1,663
August 20	do	147	196	2.90	2.65	568
September 27	do	135	164	2.54	2.35	416

Mean daily gage height, in feet, of Wallowa River near Elgin, Oreg., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.50	2.30	2.90	3.30	3.80	4.80	5.00	3.00	2.60	2.30	2.30	2.30
2	2.60	2.30	2.90	3.40	3.80	5.00	4.80	3.00	2.60	2.30	2.30	2.30
3	2.60	2.30	2.80	3.60	3.80	4.80	4.80	3.00	2.50	2.30	2.30	2.30
4	2.60	2.40	2.80	3.70	4.00	4.70	4.80	3.00	2.50	2.30	2.30	2.30
5	2.50	2.60	2.80	3.80	3.90	4.80	4.70	2.90	2.50	2.30	2.30	2.30
6	2.50	2.50	2.90	4.30	3.80	5.10	4.70	2.90	2.50	2.30	2.30	2.30
7	2.50	2.50	3.70	3.90	3.80	5.00	4.60	2.90	2.50	2.40	2.30	2.30
8	2.50	2.40	5.00	3.80	3.80	4.90	4.60	2.90	2.40	2.50	2.30	2.30
9	2.60	2.40	4.40	4.00	3.80	4.80	4.60	2.80	2.40	2.40	2.30	2.30
10	2.60	2.50	3.90	4.40	3.90	4.70	4.50	2.80	2.40	2.40	2.30	2.30
11	2.60	2.50	3.80	4.80	4.00	4.50	4.40	2.80	2.40	2.40	2.30	2.30
12	2.70	2.60	3.60	4.80	4.00	4.50	4.40	2.80	2.40	2.60	2.30	2.30
13	2.70	2.60	3.40	5.00	4.10	4.50	4.30	2.70	2.40	2.50	2.30	2.30
14	2.70	2.60	3.40	5.20	4.20	4.50	4.10	2.70	2.40	2.50	2.30	2.30
15	2.70	2.60	3.70	5.20	4.20	4.80	4.10	2.70	2.40	2.60	2.30	2.30
16	2.70	2.70	3.40	5.20	4.20	5.00	4.00	2.70	2.40	2.60	2.30	2.30
17	2.70	2.70	3.40	4.80	4.30	5.00	3.80	2.70	2.30	2.50	2.30	2.30
18	2.70	2.50	3.40	4.60	4.50	5.20	3.70	2.70	2.30	2.50	2.30	2.30
19	2.70	2.70	3.40	4.60	4.50	5.00	3.70	2.70	2.30	2.50	2.30	2.30
20	2.30	2.60	3.50	4.60	4.40	4.80	3.70	2.60	2.30	2.40	2.30	2.30
21	2.40	2.60	3.30	4.60	4.60	4.70	3.70	2.60	2.30	2.40	2.30	2.30
22	2.50	3.00	3.20	4.20	5.00	4.70	3.80	2.60	2.30	2.40	2.30	2.30
23	2.50	3.50	3.20	4.10	5.30	4.60	3.80	2.60	2.30	2.40	2.30	2.30
24	2.40	3.90	3.20	3.90	5.40	4.30	3.80	2.60	2.30	2.40	2.30	2.30
25	2.40	3.00	3.20	3.80	5.00	4.30	3.70	2.60	2.30	2.40	2.30	2.30
26	2.30	3.00	2.90	3.80	4.60	4.30	3.60	2.50	2.30	2.40	2.30	2.30
27	2.30	3.30	2.90	3.90	4.60	4.30	3.50	2.60	2.30	2.40	2.30	2.30
28	2.30	3.00	2.90	4.00	4.60	4.30	3.50	2.70	2.30	2.30	2.40	2.30
29	2.30	3.00	3.40	4.00	4.70	4.50	3.30	2.70	2.30	2.30	2.30	2.30
30	2.30	.....	3.60	3.90	4.80	4.60	3.20	2.60	2.30	2.30	2.30	2.30
31	2.30	.....	3.40	.....	4.80	.....	3.10	2.60	.....	2.30	.....	2.50

Rating table for Wallowa River near Elgin, Oreg., from November 21, 1903, to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
2.30	386	3.10	926	3.90	1,946	4.70	3,082
2.40	435	3.20	1,027	4.00	2,088	4.80	3,224
2.50	488	3.30	1,137	4.10	2,230	4.90	3,366
2.60	545	3.40	1,256	4.20	2,372	5.00	3,508
2.70	606	3.50	1,384	4.30	2,514	5.10	3,650
2.80	674	3.60	1,520	4.40	2,656	5.20	3,792
2.90	750	3.70	1,662	4.50	2,798	5.30	3,934
3.00	834	3.80	1,804	4.60	2,940	5.40	4,076

The above table is applicable only for open-channel conditions. It is based upon 4 discharge measurements made during 1903 and 1904. It is well defined between gage heights 2.35 feet and 3.70 feet. The table has been extended beyond these limits. Above gage height 3.70 feet the rating curve is a tangent, the difference being 142 per tenth.

Estimated monthly discharge of Wallowa River near Elgin, Oreg., for 1903 and 1904.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
1903.				
November 17–30	1,804	545	999	27,740
December	834	488	652	40,090
1904.				
January	606	386	501	30,800
February	1,946	386	661	38,020
March	3,508	674	1,27[illegible]	78,270
April	3,792	1,137	2,431	144,700
May	4,076	1,804	2,555	157,100
June	3,792	2,514	3,082	183,400
July	3,508	926	2,201	135,300
August	834	488	641	39,410
September	545	386	428	25,470
October	545	386	440	27,050
November	435	386	388	23,090
December	488	386	389	23,920
The year	4,076	386	1,250	906,400

ASOTIN CREEK 1¼ MILES ABOVE ASOTIN, WASH.

This station was established March 26, 1904, by W. W. Schlecht. It is located at the highway bridge about 1¼ miles above Asotin, Wash., at the power house of the Lewiston Water and Power Company. A plain staff gage, graduated to feet and tenths, is nailed vertically to the downstream face of the left abutment. It is read once each day by M. E. Turner. Discharge measurements are made from the side of the single-span bridge to which the gage is attached. The initial point for soundings is a 20-penny nail driven into the floor of the bridge above the mean edge of the left abutment, and marked zero. The channel is straight for about 120 feet above and 40 feet below the station, and the current is swift. Both banks are low and liable to overflow during extreme high water. They are both lined with brush, the left bank being covered with orchards and houses. The bed of the stream is composed of gravel and bowlders, free from vegetation, and fairly permanent. There is but one channel at low and two channels at high stages. At low water the current near the right bank may flow diagonally toward the center of the stream, at which times it is advisable to make the measurements from the upstream side of the bridge, while during high stages the water at the

upstream side is too swift and broken for accurate measurements. Bench mark No. 1 is a 20-penny nail driven horizontally into the guy pole for the chimney of the Lewiston Water and Power Company's power house between the power house and the bridge. It is marked "U. S. G. S. B. M." The elevation is 6.44 feet above the zero of the gage. Bench mark No. 2 is a 20-penny nail driven vertically into the stump of an old telegraph pole on the south side of the road about 100 feet from the bridge, marked "U. S. G. S. B. M." Its elevation is 7.57 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of T. A. Noble, district engineer.

Discharge measurements of Asotin Creek 1¼ miles above Asotin, Wash., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
March 19	W. W. Schlecht	37	50	3.79	2.47	189
April 22	W. G. Steward	51	87	7.83	3.94	685
July 1	do	30	32	1.31	2.52	42
August 12	Hulburt and Moore	28	11	.39	2.10	5

Mean daily gage height, in feet, of Asotin Creek 1¼ miles above Asotin, Wash., for 1904.

Day.	Mar.	Apr.	May.	June	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1		2.60	3.60	3.20	2.50	2.00	2.20	2.20	2.30	2.30
2		2.50	3.60	3.20	2.50	2.00	2.20	2.20	2.30	2.30
3		2.60	3.50	3.20	2.90	1.90	2.20	2.20	2.30	2.30
4		2.70	3.50	3.10	2.70	1.90	2.10	2.20	2.30	2.20
5		2.70	3.50	3.10	2.60	1.90	2.10	2.20	2.30	2.20
6		2.90	3.50	3.20	2.50	1.90	2.10	2.20	2.30	2.20
7		2.80	3.40	3.20	2.40	2.00	2.10	2.30	2.30	2.20
8		2.60	3.40	3.10	2.40	2.00	2.10	2.30	2.30	2.20
9		2.80	3.40	3.00	2.40	2.10	2.10	2.30	2.30	2.20
10		2.80	3.40	3.00	2.40	2.10	2.10	2.30	2.30	2.20
11		3.10	3.50	3.00	2.30	2.10	2.10	2.30	2.30	2.20
12		3.20	3.50	3.00	2.30	2.10	2.10	2.30	2.30	2.20
13		3.20	3.50	2.90	2.20	2.10	2.10	2.30	2.30	2.20
14		3.50	3.50	2.90	2.20	2.10	2.20	2.30	2.30	2.20
15		3.60	3.60	2.90	2.40	2.10	2.20	3.10	2.30	2.20
16			3.50	2.90	2.30	2.10	2.20	2.50	2.30	2.30
17		4.30	3.50	2.80	2.30	2.10	2.20	2.30	2.30	2.30
18		4.20	3.60	2.80	2.20	2.10	2.20	2.30	2.30	2.30
19		4.10	3.60	2.80	2.20	2.10	2.20	2.30	2.30	2.30
20		4.20	3.60	2.80	2.20	2.10	2.20	2.30	2.30	2.30
21		4.10	3.60	2.70	2.20	2.10	2.20	2.30	2.30	2.30
22		4.00	3.70	2.70	2.10	2.10	2.20	2.30	2.30	2.20
23		3.80	3.80	2.60	2.10	2.10	2.20	2.30	2.30	2.20
24		3.70	3.70	2.60	2.10	2.10	2.20	2.30	2.30	2.20
25		3.70	3.60	2.60	2.10	2.10	2.20	2.30	2.30	2.20
26		3.60	3.40	2.60	2.10	2.10	2.30	2.30	2.30	2.20

Mean daily gage height, in feet, of Asotin Creek 1¼ miles above Asotin, Wash., for 1904—Continued.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
27	2.10	3.80	3.30	2.50	2.00	2.10	2.30	2.30	2.30	2.20
28	2.20	3.90	3.30	2.50	2.00	2.10	2.20	2.30	2.30	2.20
29	2.70	3.80	3.20	2.50	2.00	2.30	2.20	2.30	2.30	2.30
30	2.75	3.70	3.10	2.50	2.00	2.20	2.20	2.30	2.30	2.60
31	2.50	.....	3.10	.....	2.00	2.20	.....	2.30	.....	2.40

ASOTIN CREEK AT SHELMAN'S RANCH, NEAR ASOTIN, WASH.

This station was established March 25, 1904, by W. W. Schlecht. It is located at Shelman's ranch, about 8 miles above Asotin, Wash. The station is 50 feet above the head-gate of Shelman's irrigation ditch. A plain staff gage, graduated to feet and tenths, is nailed to a tree on the left bank. It is read once each day by George Shelman. Discharge measurements are made by means of a cable, car, and tagged wire. The initial point for soundings is a nail driven into a hub below the cable support on the left bank. The tagged wire is marked every 5 feet. The channel is straight for about 100 feet above and below the station, and the current is swift. The right bank is a flood plain about 350 feet wide which may be flooded at extreme high water. The left bank is a similar plain about 120 feet wide which overflows during high water. Both banks are lined with trees and brush. The bed of the stream is composed of gravel and bowlders, free from vegetation, and fairly permanent. There is one channel at ordinary, and two at extreme high stages. The bench mark is the top of a 40-penny nail driven horizontally into a large willow tree about 40 feet west of Shelman's house, 2 feet north of the road, marked "U. S. G. S. B. M." Its elevation is 10.00 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of T. A. Noble, district engineer.

Discharge measurements of Asotin Creek at Shelman's ranch, near Asotin, Wash., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
March 25	W. W. Schlecht	35	31	3.61	2.03	113
April 22	W. G. Steward	40	70	6.54	3.15	458
July 1	do	30	31	3.00	1.79	92
August 12	Hulburt and Moore	26	17	2.31	1.52	40

Mean daily gage height, in feet, of Asotin Creek at Shelman's ranch, near Asotin, Wash., for 1904.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	2.32	2.60	2.60	1.78	1.56	1.56	1.65	1.55
2	.....	2.40	2.60	2.50	1.80	1.54	1.55	1.55	1.55
3	.....	2.50	2.50	2.55	1.92	1.54	1.65	1.55	1.55
4	.....	2.55	2.50	2.50	1.95	1.54	1.55	1.55	1.55
5	.....	2.72	2.50	2.45	1.90	1.54	1.54	1.55	1.55
6	.....	2.75	2.50	2.60	1.80	1.54	1.54	1.58	1.55
7	.....	2.65	2.40	2.50	1.79	1.54	1.53	1.58	1.55
8	.....	2.60	2.40	2.40	1.81	1.53	1.53	1.59	1.55
9	.....	2.68	2.40	2.35	1.75	1.53	1.53	1.59	1.55
10	.....	3.10	2.45	2.35	1.75	1.55	1.53	1.56	1.55
11	.....	3.45	2.50	2.20	1.70	1.55	1.53	1.56	1.55
12	.....	3.62	2.50	2.10	1.70	1.55	1.53	1.56	1.55
13	.....	3.80	2.50	2.05	1.64	1.55	1.53	1.56	1.55
14	.....	4.05	2.60	2.05	1.68	1.55	1.53	1.56	1.55
15	.....	4.30	2.60	2.05	1.72	1.55	1.53	1.79	1.55
16	.....	3.80	2.60	2.05	1.72	1.55	1.53	1.60	1.55
17	.....	3.35	2.60	2.05	1.70	1.55	1.53	1.60	1.55
18	.....	3.25	2.70	2.05	1.69	1.55	1.53	1.60	1.55
19	.....	3.25	2.70	2.05	1.66	1.55	1.53	1.60	1.55
20	.....	3.35	2.70	2.00	1.65	1.55	1.53	1.56	.....
21	2.25	3.35	2.70	1.95	1.65	1.55	1.53	1.56	.....
22	2.25	3.20	2.90	1.95	1.65	1.55	1.53	1.56	.....
23	2.20	2.95	3.00	1.90	1.61	1.55	1.66	1.56	.....
24	2.10	2.68	3.00	1.85	1.61	1.55	1.62	1.55	.....
25	2.05	2.60	2.75	1.82	1.60	1.54	1.60	1.55	.....
26	2.00	2.65	2.60	1.80	1.59	1.54	1.56	1.55	.....
27	1.95	2.90	2.50	1.80	1.59	1.55	1.58	1.55	.....
28	1.95	3.00	2.50	1.78	1.58	1.57	1.58	1.55	.....
29	2.15	2.90	2.50	1.78	1.58	1.60	1.55	1.55	.....
30	2.30	2.60	2.50	1.75	1.57	1.58	1.55	1.55	.....
31	2.30	.....	2.50	.....	1.57	1.56	.....	1.55	.....

PALOUSE RIVER AT ELBERTON, WASH.

This station was established May 6, 1904, by W. G. Steward. It is located at the highway bridge about one-half mile above the depot in the town of Elberton, Wash. A plain staff gage, graduated to feet and tenths, is nailed vertically to the south end of the face of the left abutment of the bridge. It is read once each day by W. B. Peoples. Discharge measurements are made for the west channel from the upstream side of the bridge. For the east channel, measurements are made from the downstream side of the bridge. Sounding points are painted on the guard rails. The initial point for the west channel is a point on the guard rail immediately above the face of the left abutment. The initial point for the east channel is the left end of the downstream hand rail. Both initial points are marked zero with nails and black paint. The west channel is straight for about 1,500 feet above and below the station. The current is swift. The east channel leaves the main or west channel about

150 feet above the station and makes a reverse curve striking the bridge at an angle of about 30°. The east channel is straight for 300 feet below and curved above the station. At high water the current is swift; at low water there is no flow in this channel. The right bank is high and not liable to overflow except in case of extreme high water, in which case the town would be flooded. The left bank is low, and overflows during high water along the roadway to the east of the east channel. The bed of the stream is composed of rock and gravel, free from vegetation, and shifting. All the water flows in the one channel at low and two channels at high stages. Bench mark No. 1 is a 20-penny nail in a large white post on the south side of the railroad track about one-fourth mile east of the depot. Its elevation is 2,198.05 feet above sea level, and 5.80 feet above the zero of the gage. Bench mark No. 2 is a square black paint mark on the southeast window sill of the hotel. Its elevation is 2,203.91 feet above sea level, and 11.66 feet above the zero of the gage. Bench mark No. 3 is the head of a rivet in the base of the bridge truss at the southwest corner of the bridge, painted "U. S. G. S." on the plate. Its elevation is 2,206.01 feet above sea level, and 13.76 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of T. A. Noble, district engineer.

Discharge measurements of Palouse River at Elberton, Wash., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
May 6	W. G. Steward	110	247	2.68	3.35	664
May 18	do	76	180	2.15	2.58	384
June 22	do	52	52	1.23	1.55	64
July 15[a]	do	49	49	1.07	1.44	53
August 30[a]	do	14	8	.85	.88	7

[a] Made at different sections.

Mean daily gage height, in feet, of Palouse River at Elberton, Wash., for 1904.

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	2.00	1.60	1.10	0.90	0.90	1.20	1.40
2	.....	2.00	1.80	1.20	.90	1.00	1.30	1.40
3	.....	2.30	1.90	1.00	1.00	1.00	1.30	1.10
4	.....	2.40	1.60	1.00	1.00	.90	1.10	1.10
5	.....	2.30	1.10	1.00	.90	.90	1.10	1.10
6	3.30	2.20	1.30	0.90	.90	1.00	1.10	1.20
7	[a] 3.30	2.30	1.20	1.10	1.00	1.00	1.20	1.20
8	[a] 3.20	2.60	1.50	1.00	1.00	1.10	1.20	1.20
9	[a] 3.20	2.30	1.20	1.00	1.10	1.10	1.10	1.20

[a] Interpolated.

Mean daily gage height, in feet, of Palouse River at Elberton, Wash., for 1904—Continued.

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
10	a 3.10	2.20	1.10	1.00	1.10	1.00	1.00	1.20
11	a 3.00	2.20	1.40	.90	1.00	1.00	1.00	1.10
12	a 3.00	2.20	1.30	.90	1.00	1.10	1.00	1.10
13	2.90	2.00	1.30	.80	1.00	1.10	1.00	1.10
14	2.80	2.00	1.30	.80	.90	1.10	1.00	1.20
15	2.70	1.90	1.40	.80	.90	1.30	1.00	1.20
16	2.70	1.90	1.40	.90	.90	1.30	1.00	1.20
17	2.70	1.80	1.40	.80	.90	1.20	1.00	1.20
18	2.60	1.70	1.30	.80	.90	1.30	1.00	1.30
19	2.60	1.70	1.50	.80	.90	1.20	0.90	1.40
20	2.60	1.80	1.50	.80	.90	1.00	1.00	1.50
21	2.50	1.60	1.60	.80	.80	1.30	1.20	1.60
22	2.50	1.60	1.40	1.00	.90	1.20	1.00	1.60
23	2.40	1.60	1.20	1.00	1.00	1.20	1.00	1.60
24	2.40	1.60	1.20	.70	.90	1.40	1.70	1.70
25	2.30	1.60	1.20	.70	.90	1.30	1.80	1.70
26	2.30	1.60	1.10	.90	.90	1.00	1.70	1.80
27	2.20	1.50	1.00	.80	.90	1.00	1.00	1.70
28	2.10	1.40	1.00	.80	.90	1.00	1.50	1.70
29	2.00	1.50	1.20	1.00	.80	1.00	1.30	1.70
30	2.00	1.50	1.20	.90	.80	1.30	1.50	1.70
31	2.00	.....	1.10	.90	.....	1.30	.....	1.70

a Interpolated.

Rating table for Palouse River at Elberton, Wash., from May 6 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
0.70	2	1.60	76	2.50	353	3.30	649
.80	5	1.70	94	2.60	390	3.40	686
.90	9	1.80	115	2.70	427	3.50	723
1.00	14	1.90	140	2.80	464	3.60	760
1.10	21	2.00	169	2.90	501	3.70	797
1.20	29	2.10	205	3.00	538	3.80	834
1.30	38	2.20	242	3.10	575	3.90	871
1.40	49	2.30	279	3.20	612	4.00	908
1.50	62	2.40	316				

The above table is applicable only for open-channel conditions. It is based upon 5 discharge measurements made during 1904. It is well defined between gage heights 0.80 foot and 3.40 feet. The table has been extended beyond these limits. Above gage height 2.10 feet the rating curve is a tangent, the difference being 37 per tenth.

Estimated monthly discharge of Palouse River at Elberton, Wash., for 1904.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
May 6–31 [a]	330	200	402	24,720
June	316	62	162	9,640
July	140	14	45.6	2,800
August	29	5	10.1	621
September	21	5	10.7	637
October	49	9	23.1	1,420
November	115	9	31.1	1,850
December	115	21	54.4	3,340
The period				45,030

[a] Discharge May 7–12 interpolated.

PALOUSE RIVER AT HOOPER, WASH.

The headwater tributaries of this river have their sources in western Idaho. After reaching Washington they unite to form Palouse River, which has a general southwesterly direction, flowing through a rolling country. Six miles below Hooper, Wash., the river bends suddenly southward and enters its canyon, through which it continues until its junction with Snake River. For some distance above Hooper the river consists of a succession of deep pools, from 10 to 15 feet in depth, connected by short riffles. Its valley is about one-half mile in width and bordered with basaltic cliffs approximately 300 feet in height. A short distance above the mouth of the river are the Palouse Falls, which are approximately 180 feet in height.

The measurements of Palouse River are of value in showing the amount of water that could be utilized for irrigation on the lands of Washtucna Valley and in the section north of Pasco.

The gaging station is located at Hooper, Wash. Gage No. 1 was established April 1, 1897, by the land department of the Northern Pacific Railroad. On September 9, 1897, C. C. Babb took charge of the station for the United States Geological Survey, and placed gage No. 2 a mile below the former location and opposite the water tank, and stretching a cable across the river for discharge measurements. The rod was inclined, fastened to posts driven into the right bank. The bench mark was a point of rock, marked with red paint, on a ledge on the left bank of the river opposite the gage and its elevation was 7.60 feet above datum. When the new gage read 2.1 feet the height on the Northern Pacific Railroad gage was 6.1 feet.

A wire gage, No. 3, was established about 20 feet above the cable by Sydney Arnold in 1903, the datum remaining the same as for gage No. 2. The gage was repaired and checked from the original bench mark August 26, 1903. At this time it was discovered that the observer was reporting readings 0.85 too low, and the daily gage readings were adjusted back to November 9, 1900, the most probable date of error. During the high spring floods of 1904, gage No. 3 was washed away and a new gage, No. 4, was established, the same datum being used as was used for gages Nos. 2 and 3. From 1.3 to 10 feet the rod is inclined, and from 10 to 14.2 feet it is vertical. This rod is firmly fastened to the bank, graduated to feet and tenths, and painted with white paint. Gage No. 4 is the one now in use. The gage is read once each day by Frank Hill, a rancher living near the station. Discharge measurements are made by means of a cable, car, tagged wire, and stay wire. The stay wire is located about 60 feet upstream from the cable. The initial point for soundings is the cable post on the left bank. The channel is straight for 200 feet above and for one-fourth of a mile below the cable. The current is swift. The left bank is high and can not overflow. The right bank overflows during high stages of the river. Both banks are covered with brush. The bed of the stream is rocky and free from vegetation. Bowlders in the bed of the stream make it difficult to obtain accurate results at this point at low water. There is but one channel at all stages. Bench mark No. 1 is the original bench mark established by C. C. Babb. It is the highest point on a ledge of rock on the left bank 200 feet below the cable, directly opposite the point at which the inclined gage was located. It is painted black. Its elevation is 7.60 feet above gage datum. Bench mark No. 2 is the top of a large rock on the right bank 250 feet west of the cable post and 115 feet from the water's edge. Its elevation is 10.88 feet above gage datum.

The observations at this station during 1904 have been made under the direction of T. A. Noble, district engineer.

Discharge measurements of Palouse River at Hooper, Wash., in 1904.

Date.	Hydrographer.	Width.	Area of section	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
January 15	C. B. Cox	92	305	2.34	4.00	715
January 16	do	97	352	2.97	4.65	1,043
January 19	do	95	332	2.60	4.32	862
January 21	do	88	258	2.00	3.43	496
February 26	G. H. Bliss	106	515	4.00	6.15	2,050
February 27	G. F. Harley	108	554	4.37	6.57	2,420
February 29	do	106	489	4.01	6.00	1,965
March 1	do	107	473	3.78	5.74	1,790
March 4	do	101	395	3.32	5.08	1,310
March 6	do	104	427	3.44	5.32	1,470
March 8	do	213	1,068	5.52	9.85	5,900
March 8	do	216	1,071	5.99	10.40	6,410
March 10	do	253	1,939	6.75	13.50	13,080
March 10	do	237	1,647	5.87	12.35	9,670
April 1	do	110	715	5.10	7.93	3,647
April 1	do	110	715	5.24	7.92	3,750
April 2	do	110	665	4.75	7.44	3,156
April 2	do	110	654	4.91	7.38	3,210
April 13	W. G. Steward	183	939	5.35	9.06	5,020
April 13	do	183	939	5.18	9.03	4,966
June 1	do	79	165	1.50	2.50	257
July 15	do	72	99	.86	1.48	86
August 4	do	54	36	1.00	1.10	36
August 30	do	39	22	.76	.80	17

Mean daily gage height, in feet, of Palouse River at Hooper, Wash., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.10	2.70	5.90	8.20	5.70	2.50	1.60	1.10	0.80	0.85	1.00	1.30
2	2.10	2.60	5.80	7.50	5.60	2.50	1.70	1.10	.80	.85	1.00	1.30
3	2.00	2.65	5.15	7.15	5.10	2.60	1.65	1.10	.80	.85	1.00	1.35
4	2.00	2.65	5.00	7.25	4.85	2.95	1.70	1.10	.80	.85	1.10	1.25
5	2.10	2.75	5.00	7.60	4.70	3.30	1.70	1.10	.80	.85	1.10	1.25
6	2.10	3.00	5.25	7.50	4.45	3.10	2.00	1.05	.80	.85	1.05	1.25
7	2.05	3.15	6.35	7.60	4.40	2.95	1.70	1.05	.80	.85	1.05	1.20
8	2.00	3.00	9.70	7.70	4.30	3.20	1.60	1.00	.80	.85	1.05	1.15
9	2.05	2.90	14.75	7.35	4.20	3.35	1.60	1.00	.75	.90	1.10	1.10
10	2.15	2.75	13.60	6.90	4.05	3.15	1.85	1.00	.75	.90	1.10	1.20
11	2.55	2.80	12.25	7.05	3.90	2.95	1.65	.95	.75	.90	1.05	1.20
12	2.25	3.20	10.80	7.60	3.95	2.80	1.55	.95	.75	.95	1.10	1.30
13	2.70	3.10	9.20	8.90	3.95	2.70	1.45	.95	.75	.95	1.10	1.30
14	3.60	3.10	8.40	9.25	3.90	2.55	1.40	.95	.75	.95	1.10	1.30
15	3.85	3.20	8.30	9.40	3.60	2.50	1.40	.95	.80	1.00	1.10	1.35

Mean daily gage height, in feet, of Palouse River at Hooper, Wash., for 1904—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
16	4.70	3.85	8.45	9.60	3.55	2.40	1.50	.95	.80	1.00	1.10	1.45
17	4.40	4.10	8.25	9.90	3.50	2.30	1.45	.90	.80	1.00	1.10	1.45
18	4.60	4.70	7.95	10.30	3.45	2.20	1.45	.90	.80	1.00	1.05	1.45
19	4.35	4.55	8.30	8.30	3.40	2.15	1.45	.90	.80	1.10	1.05	1.45
20	3.85	4.55	8.40	7.25	3.35	2.10	1.35	.85	.80	1.05	1.10	1.45
21	3.50	4.30	8.30	7.15	3.35	2.05	1.35	.85	.85	1.10	1.15	1.45
22	3.30	4.25	8.85	7.10	3.30	2.00	1.35	.85	.85	1.10	1.15	1.75
23	3.30	4.50	7.90	7.00	3.20	2.00	1.35	.85	.85	1.10	1.20	1.55
24	3.40	6.00	7.55	6.70	3.10	1.90	1.25	.85	.85	1.10	1.20	1.55
25	3.25	5.95	6.90	6.30	3.00	1.90	1.25	.85	.85	1.05	1.30	1.40
26	3.05	6.20	6.85	5.70	2.90	1.85	1.20	.80	.85	1.10	1.20	1.35
27	2.90	6.35	6.35	5.35	2.90	1.80	1.20	.80	.85	1.10	1.25	1.35
28	2.85	6.60	6.25	5.20	2.80	1.80	1.15	.80	.85	1.10	1.35	1.40
29	2.90	6.30	6.65	5.45	2.70	1.90	1.15	.80	.85	1.10	1.40	1.20
30	2.85	.....	6.95	5.70	2.55	1.75	1.15	.80	.85	1.10	1.30	1.30
31	2.80	.....	8.80	.....	2.50	.....	1.15	.80	.....	1.05	.....	1.35

Rating table for Palouse River at Hooper, Wash., from January 1, 1903, to December 31 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
0.60	10	2.30	215	4.00	715	7.50	3,270
.70	13	2.40	236	4.20	805	8.00	3,780
.80	17	2.50	259	4.40	900	8.50	4,330
.90	22	2.60	283	4.60	1,015	9.00	4,880
1.00	28	2.70	307	4.80	1,135	9.50	5,470
1.10	36	2.80	331	5.00	1,265	10.00	6,080
1.20	46	2.90	355	5.20	1,400	10.50	6,750
1.30	57	3.00	380	5.40	1,540	11.00	7,550
1.40	69	3.10	405	5.60	1,680	11.50	8,500
1.50	82	3.20	430	5.80	1,820	12.00	9,530
1.60	96	3.30	457	6.00	1,965	12.50	10,650
1.70	110	3.40	486	6.20	2,120	13.00	11,880
1.80	125	3.50	517	6.40	2,280	13.50	13,180
1.90	141	3.60	551	6.60	2,440	14.00	14,480
2.00	158	3.70	588	6.80	2,620	15.00	17,080
2.10	176	3.80	628	7.00	2,800	16.00	19,680
2.20	195	3.90	670				

The above table is applicable only for open-channel conditions. It is based upon 34 discharge measurements made during 1903 and 1904. It is well defined between gage heights 0.80 foot and 13.50 feet. The table has been extended beyond these limits. Above gage height 12.90 feet the rating curve is a tangent, the difference being 260 per tenth.

Estimated monthly discharge of Palouse River at Hooper, Wash., for 1904.

[Drainage area, 2,210 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
January	1,075	158	409	25,150	0.185	0.213
February	2,440	283	873	50,220	.395	.426
March	16,430	1,265	4,305	264,700	1.95	2.25
April	6,470	1,400	3,351	199,400	1.52	1.70
May	1,750	259	678	41,690	.307	.354
June	471	117	258	15,350	.117	.130
July	158	41	78.8	4,845	.036	.042
August	36	17	24.5	1,506	.011	.013
September	19	15	17.3	1,029	.0078	.0087
October	36	19	27.8	1,709	.013	.015
November	69	28	39.6	2,356	.018	.020
December	117	36	63.0	3,874	.029	.033
The year	16,430	15	844	611,800	.382	5.20

ROCK CREEK NEAR ST. JOHN, WASH.

This station was established October 15, 1903, by G. H. Bliss. It is located at the highway bridge which crosses Rock Creek at the outlet of Rock Lake, three-fourths of a mile from the ranch of the observer, C. K. Reimer. It is 9 miles northeast of St. John, Whitman County, Wash. The gage is a vertical rod fastened to the fifth pile bent of the southeast or left-bank approach. At high stages discharge measurements are made from the downstream side of the highway bridge, to which the gage is attached. At low stages they are made by wading below the bridge. The bridge is supported by pile bents and has a total span of 210 feet. The initial point for soundings is the end post of the downstream hand rail. The channel is straight for 200 feet above and for 75 feet below the station. The current is sluggish at the bridge at low stages. Both banks are low and rocky and liable to overflow at flood stages. The bed of the stream is covered with rocks and gravel and is liable to shift at flood stages. Bench mark No. 1 is a spike driven into the downstream side of the top of the sill of the third pile bent from the southeast or left-bank approach. Its elevation is 12.52 feet above the zero of the gage. Bench mark No. 2 is the top of a large rock on a point of rocks on the southeast side of the lake about 3,000 feet above the outlet. Its elevation is 16.70 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of T. A. Noble, district engineer.

Discharge measurements of Rock Creek near St. John, Wash., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
January 29	G. H. Bliss	70	38	2.98	11.99	112
February 29[a]	do	102	159	3.16	13.84	502
March 11	do	181	833	1.86	14.95	1,549
March 13	do	179	784	1.52	14.40	1,190
April 5	W. G. Steward	177	478	1.04	13.20	502
May 17	do	64	39	2.59	11.55	100
June 24	do	46	30	1.24	10.96	37
August 29	T. A. Noble	3	0.9	0.57	10.20	0.5

[a] From boat 2 miles below station.

Mean daily gage height, in feet, of Rock Creek near St. John, Wash., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	11.00	11.90	13.80	13.60	12.10	11.20	10.80	10.50	10.15	10.00	10.05	10.10
2	11.00	11.90	13.75	13.50	12.05	11.20	10.80	10.50	10.15	10.00	10.05	10.10
3	11.00	11.90	13.60	13.40	12.00	11.25	10.80	10.50	10.15	10.00	10.05	10.10
4	11.00	11.90	13.60	13.30	12.00	11.25	10.80	10.45	10.15	10.00	10.05	10.10
5	11.00	11.90	13.50	13.20	11.95	11.25	10.80	10.45	10.15	10.00	10.05	10.10
6	11.00	11.90	13.55	13.10	11.95	11.25	10.80	10.40	10.15	10.00	10.05	10.10
7	11.00	11.90	14.00	13.10	11.90	11.25	10.80	10.40	10.15	10.00	10.05	10.15
8	11.00	11.90	15.20	13.05	11.90	11.25	10.80	10.40	10.10	10.00	10.05	10.15
9	11.00	11.90	15.60	12.95	11.85	11.25	10.80	10.40	10.10	10.00	10.05	10.15
10	11.05	11.90	15.40	12.85	11.85	11.20	10.80	10.40	10.10	10.05	10.05	10.20
11	11.05	11.90	15.00	12.80	11.80	11.20	10.80	10.40	10.10	10.05	10.05	10.20
12	11.10	11.90	14.70	12.75	11.75	11.20	10.80	10.40	10.10	10.00	10.05	10.20
13	11.15	11.90	14.60	12.70	11.70	11.15	10.80	10.40	10.10	10.00	10.05	10.20
14	11.25	11.90	14.45	12.65	11.65	11.10	10.75	10.40	10.10	10.00	10.05	10.20
15	11.40	11.95	14.25	12.60	11.60	11.10	10.75	10.40	10.10	10.00	10.05	10.20
16	11.60	12.00	14.10	12.50	11.60	11.10	10.70	10.40	10.10	10.00	10.05	10.25
17	11.80	12.10	14.00	12.55	11.55	11.10	10.70	10.35	10.05	10.00	10.05	10.30
18	11.95	12.20	13.85	12.60	11.50	11.10	10.65	10.35	10.05	10.00	10.05	10.30
19	12.10	12.30	13.85	12.55	11.50	11.10	10.65	10.35	10.05	10.00	10.05	10.30
20	12.15	12.45	13.90	12.50	11.50	11.10	10.60	10.30	10.05	10.00	10.05	10.30
21	12.15	12.50	13.90	12.50	11.45	11.05	10.60	10.30	10.05	10.00	10.05	10.35
22	12.10	12.55	13.90	12.45	11.40	11.00	10.60	10.30	10.05	10.00	10.05	10.35
23	12.10	12.60	13.80	12.40	11.40	11.00	10.60	10.30	10.00	10.00	10.05	10.40
24	12.10	12.85	13.75	12.35	11.40	11.00	10.60	10.30	10.00	10.00	10.05	10.40
25	12.10	13.10	13.70	12.30	11.35	10.95	10.60	10.25	10.00	10.05	10.05	10.40
26	12.05	13.30	13.60	12.30	11.35	10.95	10.55	10.25	10.00	10.05	10.05	10.40
27	12.00	13.50	13.50	12.25	11.30	10.90	10.55	10.20	10.00	10.05	10.05	10.40
28	12.00	13.80	13.40	12.20	11.30	10.85	10.55	10.20	10.00	10.05	10.05	10.40
29	12.00	13.80	13.35	12.10	11.30	10.85	10.55	10.20	10.00	10.05	10.10	10.45
30	11.95	.....	13.50	12.10	11.30	10.85	10.50	10.20	10.00	10.05	10.10	10.50
31	11.90	.....	13.60	.....	11.25	.....	10.50	10.20	.....	10.05	.....	10.50

Rating table for Rock Creek near St. John, Wash., from October 15, 1903, to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
10.00	0	11.20	59	12.40	245	13.50	650
10.10	.5	11.30	70	12.50	267	13.60	705
10.20	1.5	11.40	82	12.60	292	13.70	760
10.30	3	11.50	94	12.70	320	13.80	820
10.40	6	11.60	107	12.80	350	13.90	880
10.50	10	11.70	120	12.90	383	14.00	940
10.60	14	11.80	134	13.00	420	14.20	1,070
10.70	19	11.90	149	13.10	460	14.40	1,200
10.80	25	12.00	165	13.20	505	14.60	1,330
10.90	32	12.10	183	13.30	550	14.80	1,460
11.00	40	12.20	203	13.40	600	15.00	1,590
11.10	49	12.30	223				

The above table is applicable only for open-channel conditions. It is based upon 7 discharge measurements made during 1903 and 1904. It is well defined between gage heights 10.20 feet and 15.00 feet. The table has been extended beyond these limits. Above gage height 14.00 feet the rating curve is a tangent, the difference being 65 per tenth.

Estimated monthly discharge of Rock Creek, near St. John, Wash., for 1903 and 1904.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
1903.				
October 15–31	1.5	0.3	0.48	16
November	8	.4	3 66	218
December	38.0	8	20.0	1,230
1904.				
January	193	40	109	6,702
February	820	149	268	15,420
March	1,980	575	969	59,580
April	705	183	345	20,530
May	183	64	113	6,948
June	64	28	49.7	2,957
July	25	10	19 1	1,174
August	10	1.5	4.9	301
September	1	0	.42	25
October	.2	0	.06	3.7
November	.5	.2	.22	13
December	10	.5	3 3	203
The year	1,980	0	157	113,900

COW CREEK NEAR KEYSTONE, WASH.

This station was established November 10, 1904, by Calvin Casteel. It is located at the highway bridge on the Sprague-Ritzville road crossing of Cow Creek, 2¼ miles east of Keystone, Wash., and one-fourth mile southeast of Lakeview schoolhouse. The station is a short distance below the foot of Colville Lake. A plain staff gage is nailed vertically to a post of the bridge at the upper left end. It is read once each day by S. A. Fulquartz. Discharge measurements are made from the upstream side of the single-span bridge, to which the gage is attached. The bridge is 18.6 feet long between abutments. The initial point for soundings is a nail driven into the end of a plank on the deck of the bridge above the edge of the abutment. The channel is straight for about 200 feet above and 100 feet below the station. The current above the station is moderate at ordinary and sluggish at low stages; below the station it is swift at all stages. Both banks are high, clean, and not liable to overflow. The bed of the stream is composed of rock and gravel, and is permanent. There is but one channel at all stages. The bench mark is a United States Geological Survey standard aluminum tablet set in a large bowlder, 125 feet up Cow Creek from Sprague-Ritzville road crossing, on the right bank. The bench mark is marked 1883. Its elevation is 1,883.150 feet above sea level and 4.19 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of T. A. Noble, district engineer.

Discharge measurements of Cow Creek near Keystone, Wash., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
November 8	C. Casteel	7	4	0.58	0.61	3
November 8	do	7	4.5	.58	.61	2.6

Mean daily gage height, in feet, of Cow Creek near Keystone, Wash., for 1904.

Day.	Nov.	Dec.	Day.	Nov.	Dec.	Day.	Nov.	Dec.
1	.....	0.72	12	.....	0.77	22	0.68	0.82
2	.....	.72	13	0.62	.78	23	.70	.81
3	.....	.71	14	.48	.80	24	.71	.80
4	.....	.70	15	.65	.77	25	.72	.87
5	.....	.71	16	.63	.78	26	.73	.82
6	.....	.71	17	.63	.78	27	.73	.81
7	.....	.72	18	.61	.82	28	.74	.81
8	.....	.73	19	.65	.82	29	.75	.83
9	.....	.74	20	.65	.83	30	.74	.85
10	0.61	.75	21	.67	.82	31	.....	.87
11	.62	.76						

COW CREEK AT HOOPER, WASH.

This station was established February 26, 1904, by G. H. Bliss. It is located one-half mile east of Hooper, Wash., about a half mile above the point where the creek empties into Palouse River. A plain vertical staff gage graduated to feet and tenths is driven into the bed of the stream and braced to a stake on the left bank. The gage is read only at the time of making meter measurements. Discharge measurements are made by wading at the gage. The initial point for soundings is a nail driven into the top of the stake, to which the gage is braced. The channel is straight for about 50 feet above and 25 feet below the station. The current is fairly swift at flood stages. Both banks are high and clean. The right bank may overflow during flood stages. The bed of the stream is composed of clean sand, and is permanent. There is but one channel at all stages. Bench mark No. 1 is the top of the nail, which serves as the initial point for soundings. Its elevation is 7.68 feet above the zero of the gage. Bench mark No. 2 is a mark on a large rock 100 feet south and a little to the west of the gage. A piece has been broken from the east face of the rock, and it is marked "B. M." The elevation of this bench mark is 8.56 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of T. A. Noble, district engineer.

Discharge measurements of Cow Creek at Hooper, Wash., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
February 26	G. H. Bliss	25	22	1.41	4.80	32
March 7	Geo. F. Harley	25	22	1.78	4.82	46
August 5	W. G. Steward	3	1	.85	4.32	1
August 31 [a]	do	12	10	.44	4.46	4

[a] 75 feet above gage.

WALLA WALLA RIVER (SOUTH FORK) NEAR MILTON, OREG.

This station was originally established February 15, 1903, 6 miles above the mouth of the river and 12 miles from Milton, Oreg. The gage was read once each day from the date of establishment to October 31, 1903, by N. Redden. As there were no means for making flood measurements at this point, the station was moved to the highway bridge one-fourth mile above the junction of the North and South forks, 6 miles from Milton. The gage is a vertical 1¼ by 9 inch timber, secured to a stump on the right bank three-fourths mile above the highway bridge and directly back of the house of the observer,

Harry Huber, who reads the gage once each day. Discharge measurements are made from the upstream side of the single-span highway bridge one-fourth mile above the mouth of the South Fork. The initial point for soundings is the south side of a projecting beam which supports the north end of the lower chord of the bridge. The bridge has a span of 65 feet between abutments. The channel is straight for 100 feet above, and for 150 feet below the bridge. The current is swift. The right bank is low, wooded, and liable to overflow. The left bank is low, but is not liable to overflow, and is without trees. The bed of the stream is composed of gravel, free from vegetation, and not liable to shift to any considerable extent. Bench mark No. 1 is a 20-penny nail driven into a cottonwood tree 1 foot in diameter 15 feet above the gage rod. Its elevation is 7.00 feet above the zero of the gage. Bench mark No. 2 is a 20-penny nail driven into the tree to which the gage is attached. Its elevation is 7.00 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of John T. Whistler, district engineer.

Discharge measurements of Walla Walla River (South Fork) near Milton, Oreg., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
April 15	Yates and Saxton	60	136	5.70	2.70	955
May 14[a]	Murphy and Sawyer	49	74	6.80	2.18	505
August 12	W. C. Sawyer	32	33	3.50	1.51	118
October 20	do	35	32	3.59	1.52	113

[a] 6 miles above railroad station.

Mean daily gage height, in feet, of Walla Walla River (South Fork) near Milton, Oreg., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.75	1.70	1.90	1.85	.....	2.00	1.60	1.55	.....	.....	1.50	1.50
2	1.75	1.70	1.95	1.75	2.10	1.90	1.60	.....	.....	.....	1.50	1.50
3	1.75	1.70	1.90	1.85	2.20	1.90	1.60	.....	.....	1.50	1.50	1.50
4	1.75	1.70	1.90	.....	2.10	1.90	.....	1.55	.....	1.50	1.50	1.50
5	1.70	1.70	1.90	1.75	2.00	.....	1.65	.....	.....	1.50	1.50	1.50
6	1.70	1.70	2.00	1.95	2.05	1.95	1.60	.....	1.50	1.50	1.50	1.50
7	1.70	.....	2.40	1.85	2.10	1.85	1.60	.....	.....	1.55	1.50	1.50
8	1.70	1.70	2.70	1.80	2.00	1.80	1.65	.....	1.50	.....	1.50	1.55
9	1.75	1.70	2.45	1.85	2.00	1.75	1.60	1.55	.....	1.55	1.50	1.55
10	1.80	1.70	2.10	.....	2.20	1.75	.....	.....	.....	1.50	1.50	1.55
11	1.80	.....	1.90	2.40	2.15	1.70	1.60	.....	.....	1.50	1.50	1.55
12	1.80	1.70	1.80	2.65	2.20	1.70	1.60	1.51	.....	1.60	1.50	1.55
13	1.90	1.75	1.80	2.90	2.20	1.65	1.55	.....	.....	1.55	1.50	1.55
14	2.00	1.70	1.70	3.40	2.15	1.65	1.55	1.50	.....	1.55	1.55	1.60
15	2.10	1.85	1.80	3.20	.....	1.65	1.60	.....	.....	1.60	1.55	1.60
16	2.00	2.10	1.75	2.50	2.10	1.65	1.60	.....	1.50	1.55	1.55	1.60
17	2.00	2.00	1.70	.....	2.10	1.65	1.65	.....	1.50	1.55	1.55	1.60
18	1.95	1.95	1.75	2.30	.....	1.65	1.65	.....	1.50	1.55	1.55	1.60
19	1.80	1.90	1.70	2.50	.....	1.60	1.65	.....	.....	1.60	.....	1.60
20	1.85	1.85	1.80	2.50	2.15	1.60	1.60	.....	.....	1.55	1.55	1.60
21	1.85	1.80	1.75	2.35	2.20	1.60	1.60	1.50	1.50	1.55	1.55	1.60

Mean daily gage height, in feet, of Walla Walla River (South Fork) near Milton, Oreg., for 1904—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
22	1.80	2.00	1.70	2.20	2.20	.....	1.60	.....	.....	1.55	1.55	1.60
23	1.85	2.05	1.60	2.10	2.25	1.55	1.60	.....	1.50	1.50	1.60	1.55
24	.....	2.00	1.50	2.00	2.10	1.50	1.60	.....	.....	1.50	.....	1.60
25	1.85	2.00	1.50	2.00	2.00	.....	.....	.....	1.50	1.50	1.60	1.60
26	1.80	2.00	1.45	2.05	1.95	1.55	1.55	.....	.....	1.50	1.60	1.60
27	1.75	2.05	1.45	2.20	1.90	1.60	1.55	.....	.....	1.50	1.60	1.60
28	.....	2.00	1.50	2.25	1.90	1.60	1.55	1.50	1.50	1.50	1.60	1.60
29	1.75	2.00	1.85	2.20	.....	1.60	1.55	.....	1.50	.....	1.50	1.60
30	.....	.....	2.00	2.10	1.90	1.60	1.55	.....	1.50	1.50	1.50	1.78
31	1.70	.....	1.80	.....	.....	.....	1.55	.....	.....	1.50	.....	1.75

Rating table for Walla Walla River (South Fork) near Milton, Oreg., from January 1 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.40	71	2.00	374	2.50	765	3.00	1,255
1.50	109	2.10	443	2.60	858	3.10	1,355
1.60	152	2.20	516	2.70	955	3.20	1,455
1.70	200	2.30	595	2.80	1,055	3.30	1,555
1.80	253	2.40	678	2.90	1,155	3.40	1,655
1.90	310						

The above table is applicable only for open-channel conditions. It is based upon 4 discharge measurements made during 1904. It is well defined between gage heights 1.50 feet and 2.70 feet. The table has been extended beyond these limits. Above gage height 2.70 feet the rating curve is a tangent, the difference being 100 per tenth.

Estimated monthly discharge of Walla Walla River (South Fork) near Milton, Oreg., for 1904.

Month.	Discharge in second-feet.[a]			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January	443	200	264	16,230
February	443	200	282	16,220
March	955	90	294	18,080
April	1,655	226	560	33,860
May	555	310	430	26,620
June	374	109	200	12,080
July	175	130	149	9,162
August	130	109	117	7,194
September	109	109	109	6,486
October	152	109	121	7,440
November	152	109	124	7,379
December	242	109	143	8,793
The year	1,655	90	234	169,500

[a] Discharge interpolated for missing gage heights.

WALLA WALLA RIVER AT MILTON, OREG.

This station was established February 14, 1903, by T. A. Noble. The gage is a vertical rod on the left bank one-half mile above the county bridge and just above the head-gate of an irrigation ditch. The gage is read once each day by S. L. Smith. During 1903 discharge measurements were made from a cable just above the gage. Measurements made at this point include the discharge of the irrigation ditch just below the gage. On October 29, 1903, a stay wire was installed about 35 feet above the county bridge, to be used in making flood measurements. At the close of the season of 1903 the cable was abandoned, and discharge measurements have since been made from the highway bridge. Measurements made at this point do not include the discharge of the irrigation ditch just below the gage. This ditch has to be measured separately, but is included in the estimate given below. There is another irrigation ditch taken out on the left bank just below the bridge, which is included in the measurements made at the bridge. The gage heights have been adjusted to obviate the effect of changes in a diversion dam below the gage. The initial point for soundings is the end of the lower chord on the upstream side of the bridge at the right bank. The bridge has a single span of 75 feet between abutments. The channel is straight for 80 feet above and for 150 feet below the station. The current is swift. Both banks are low, wooded, but not liable to overflow. There is but one channel at all stages. The bed of the stream is composed of gravel, free from vegetation, and liable to shift. The bench mark is the top of a sharp projecting rock 4 feet from the gage and 3 feet from the tree to which the gage is attached. Its elevation is 4.37 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of John T. Whistler, district engineer.

Discharge measurements of Walla Walla River at Milton, Oreg., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
April 16	H. A. Yates	66	186	7.46	2.5	1,387
May 14	Murphy and Sawyer	64	107	6.70	1.93	715
June 13	W. C. Sawyer	46	64	3.55	1.37	267
August 12	do	44	40	2.42	1.01	139
October 20	do	.....	43	3.37	1.05	145

Mean daily gage height, in feet, of Walla Walla River at Milton, Oreg., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.04	0.96	1.33	1.91	1.80	1.58	1.13	1.01	1.03	1.01	1.08	1.17
2	1.04	.96	1.36	1.90	1.72	1.68	1.12	1.01	1.03	1.00	1.09	1.17
3	1.04	.96	1.28	1.93	1.81	1.68	1.11	1.01	1.02	.97	1.09	1.17
4	1.03	.95	1.33	1.95	1.92	1.67	1.20	1.00	1.02	.97	1.10	1.19
5	1.02	.95	1.30	1.88	1.88	1.65	1.20	1.00	1.01	1.00	1.10	1.18
6	1.00	.96	1.47	2.10	1.86	1.63	1.18	1.00	1.00	1.00	1.10	1.16
7	1.02	.95	1.85	1.95	1.81	1.65	1.22	1.01	1.00	1.02	1.10	1.18
8	1.03	.95	3.20	1.90	1.78	1.58	1.20	1.01	1.00	1.02	1.10	1.19
9	1.02	.95	2.66	1.95	1.74	1.53	1.17	1.01	1.00	1.01	1.11	1.16
10	1.10	.92	2.20	2.31	1.98	1.50	1.16	1.00	1.00	1.01	1.13	1.14
11	1.07	.92	2.02	2.60	2.00	1.47	1.14	1.01	.99	1.06	1.12	1.16
12	1.22	1.01	1.90	2.92	1.96	1.43	1.13	1.01	.99	1.11	1.14	1.17
13	1.50	.99	1.75	2.93	1.97	1.38	1.12	1.00	.98	1.06	1.14	1.16
14	1.45	.97	1.73	3.20	1.98	1.37	1.11	1.00	.97	1.04	1.15	1.20
15	1.43	1.03	1.85	3.00	1.95	1.35	1.15	1.00	.94	1.10	1.16	1.19
16	1.38	1.45	1.80	2.51	1.90	1.34	1.20	1.01	.94	1.09	1.17	1.18
17	1.36	1.43	1.74	2.43	1.90	1.36	1.14	1.01	.94	1.07	1.18	1.17
18	1.33	1.30	1.70	2.31	1.92	1.36	1.12	1.00	.94	1.06	1.19	1.19
19	1.30	1.20	1.74	2.45	2.01	1.35	1.11	1.01	.94	1.05	1.19	1.20
20	1.16	1.22	1.84	2.55	2.02	1.35	1.10	1.02	.93	1.05	1.22	1.20
21	1.15	1.15	1.76	2.33	2.03	1.34	1.09	1.00	.93	1.06	1.22	1.21
22	1.21	1.45	1.72	2.21	2.02	1.32	1.08	1.00	.93	1.06	1.21	1.20
23	1.19	1.47	1.69	2.08	2.02	1.25	1.07	1.01	1.04	1.06	1.19	1.19
24	1.15	1.44	1.65	2.01	2.01	1.22	1.07	1.00	1.04	1.07	1.18	1.19
25	1.13	1.37	1.54	1.92	1.84	1.20	1.05	1.00	1.00	1.06	1.18	1.18
26	1.10	1.40	1.50	2.05	1.78	1.18	1.04	1.01	1.05	1.05	1.17	1.18
27	1.07	1.45	1.47	2.11	1.72	1.16	1.03	1.00	1.01	1.05	1.16	1.17
28	1.04	1.40	1.54	2.18	1.67	1.17	1.03	1.01	1.00	1.04	1.15	1.17
29	1.02	1.36	1.95	2.08	1.62	1.16	1.02	1.01	1.00	1.04	1.16	1.22
30	1.00	.....	2.21	2.18	1.61	1.14	1.02	1.02	1.00	1.07	1.17	1.40
31	.98	.....	1.98	.....	1.60	.....	1.01	1.02	.....	1.07	.....	1.42

Rating table for Walla Walla River at Milton, Oreg., from January 1 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
0.90	120	1.50	339	2.10	913	2.70	1,625
1.00	135	1.60	408	2.20	1,031	2.80	1,744
1.10	159	1.70	488	2.30	1,149	2.90	1,863
1.20	192	1.80	577	2.40	1,268	3.00	1,982
1.30	233	1.90	679	2.50	1,387	3.10	2,101
1.40	281	2.00	795	2.60	1,506	3.20	2,220

The above table is applicable only for open-channel conditions. It is based upon 4 discharge measurements made during 1904, and is fairly well defined.

Estimated monthly discharge of Walla Walla River at Milton, Oreg., for 1904.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January	339	131	183	11,250
February	321	122	195	11,220
March	2,220	225	606	37,260
April	2,220	658	1,105	65,750
May	830	408	654	40,210
June	472	171	297	17,670
July	200	137	165	10,140
August	139	135	136	8,362
September	146	124	134	7,974
October	162	131	145	8,916
November	200	154	175	10,410
December	292	171	192	11,810
The year	2,220	122	332	241,000

UMATILLA RIVER AT GIBBON, OREG.

This station was established by C. C. Babb July 22, 1896. The original gage rod was located one-fourth mile below the railroad station. The gage, together with the cable from which discharge measurements were made, was carried away by a flood in May, 1902. The bench mark, consisting of a cross on the highest point of the rock to which the original gage was fastened, has also been destroyed. On September 10, 1902, the station was reequipped with a wire gage, cable, and car. The cable is located in its original position. To secure a better location for the gage the new wire gage was established a few hundred feet nearer the cable. It was located on a beam projecting over the water and spiked to the top of the cribwork on the left bank about 10 feet north of the railroad track. The wire gage was repaired July 29, 1903, but no change was made in the datum. The length of the wire from the marker to the bottom of the eye in the center of the web of the section of the rail, used as a weight, was 16.30 feet. Bench mark No. 1 is the head of a 40-penny spike driven flush with the surface of the crib timber opposite the 1-foot mark of the gage scale. Its elevation is 8.66 feet above gage datum. Bench mark No. 2 is a 40-penny spike in a telegraph pole directly across the railroad track from the gage and 30 feet distant. Its elevation is 10.35 feet above gage datum.

The flood in March and April, 1904, changed the channel at the gage to such an extent that the gage was rendered useless. A vertical staff gage, graduated to feet and tenths, was bolted and braced,

on October 15, 1904, to a point of rocks in a pool where the bed is least liable to shift, on the north side of the river, about one-half mile below the railroad station at Bingham Springs and one-half mile above the cable from which discharge measurements are made. The bench mark for this gage is a square chisel draft, and the letters "B. M." cut in the rock about 15 feet from the gage, 10 feet downstream. Its elevation is 5.17 feet above the zero of the gage. No relation has been established between this and previous gages. During 1904 the gage was read once each day by Walter Swart. The initial point for soundings is the face of the tree to which the cable is attached, on the right bank. The channel is straight for 100 feet above and below the cable. The right bank is high. The left bank is rather low, and has a slough during high water. The bed of the stream is composed of gravel and is somewhat shifting.

The observations at this station during 1904 have been made under the direction of John T. Whistler, district engineer.

Discharge measurements of Umatilla River at Gibbon, Oreg., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
March 19	J. H. Lewis	120	188	6.3	1.85	1,180
April 14	Brainard and Saxton	144	683	8.34	5.63	5,715
April 25	W. C. Sawyer	111	234	6.79	1.00	1,591
October 14	do		35	2.80	[a] 1.17	98

[a] New gage.

Mean daily gage height, in feet, of Umatilla River at Gibbon, Oreg., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.00	1.30	1.70	2.00	0.80						1.20	1.30
2	1.00	1.30	1.60	2.25	.70						1.20	1.20
3	1.00	1.30	1.60	2.70	.90						1.20	1.20
4	1.00	1.25	1.50	2.50	.90						1.20	1.20
5	1.00	1.25		2.30	.80						1.20	1.20
6	1.00	1.25	2.20	3.20	.70						1.20	1.20
7	1.00	1.20	3.35	2.60	.70						1.10	1.20
8	1.00	1.20	4.75	2.60	.70						1.10	1.20
9	1.10	1.20	3.60	3.00	.70						1.10	1.20
10	1.20	1.20	2.85	4.00	.70						1.10	1.20
11	1.20	1.20	2.40	4.40	.70						1.10	1.20
12	1.40	1.20	2.00	4.60	.70						1.10	1.20
13	1.80	1.20	1.70	5.20	.70						1.10	1.20
14	1.90	1.20	1.80	5.35	.60						1.10	1.30
15	2.10	1.30	1.80	4.80	.60					1.17	1.20	1.30
16	2.00	1.90	1.70	4.00	.60						1.20	1.30
17	1.90	1.80	1.60	3.50	.50					1.22	1.20	1.30
18	1.80	1.70	1.80	3.20	.50						1.20	1.30
19	1.50	1.60	1.80	3.50	.60					1.20	1.20	
20	1.40	1.90	1.90	2.70	.70					1.20	1.20	1.30

Mean daily gage height, in feet of Umatilla River at Gibbon, Oreg., for 1904—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
21	1.40	1.70	1.75	.....	.60	.....	.....	.....	.....	1.15	1.20	1.30
22	1.90	1.60	1.50	1.70	.50	.....	.....	.....	.....	1.10	1.20	1.30
23	2.00	2.10	1.40	1.10	.40	.....	.....	.....	.....	1.10	1.20	1.30
24	1.90	2.10	1.10	.90	.30	.....	.....	.....	.....	1.20	1.20	1.30
25	1.80	2.00	1.00	1.00	.10	.....	.....	.....	.....	1.20	1.20	.....
26	1.60	2.00	1.00	.....	.00	.....	.....	.....	.....	1.20	1.20	1.30
27	1.50	1.90	1.00	1.50	.....	.....	.....	.....	.....	1.20	1.20	1.30
28	1.40	1.80	1.10	1.50	.....	.....	.....	.....	.....	1.20	1.30	1.30
29	1.50	1.80	2.10	1.20	.....	.....	.....	.....	.....	1.20	1.30	1.40
30	1.30	.....	2.60	1.00	.....	.....	.....	.....	.....	1.20	1.30	1.50
31	1.30	.....	2.20	.....	.....	.....	.....	.....	.....	1.20	.....	1.70

NOTE.—Gage heights October 15 to December 31 referred to new gage.

UMATILLA RIVER AT PENDLETON, ORE.

This station was established May 22, 1903, by F. W. Huber. It is located at the Main Street Bridge at Pendleton, Oreg. A short distance above the bridge at which the gage is located water is taken out of the river by the Farmers Mill ditch. This ditch carries from 30 to 50 second-feet, and at low stages the entire river is diverted into this ditch. The water is returned to the river at a point about 4,000 feet below the Main Street Bridge and about 1,500 feet above the railroad bridge, at which discharge measurements are made. The original river gage was a vertical 1 by 5 inch board, 10 feet long, spiked to the middle of the left or south side of the center pier of the Main Street Bridge. On July 18, 1903, this gage was replaced by a 2 by 6 inch board, 10 feet long, fastened in the same position as the original gage and on the same datum. During 1904 the gage has been read by the Geological Survey office at Pendleton. Discharge measurements are made from the Oregon Railroad and Navigation Company's bridge, about 1 mile downstream from the gage. The initial point for soundings is the face of the crib abutment on the left bank. The railroad bridge consists of a single span of 145 feet, there being 116 feet of trestle approach on the right bank and an approach of 34 feet on the left bank. The channel is straight for 250 feet above and 200 feet below the railroad bridge. The current is swift at this point, but has a lower velocity than at the bridge at which the gage is located. The right bank is low and will overflow under the trestle on this bank. The left bank is high and is partly riprap. At low stages there will be some backwater at the south bank. There is but one channel at all stages. The bed of the stream is composed of gravel and is shifting. The bench mark is the top of the south side of the steel caisson at the east end of the middle pier of the Main Street Bridge. Its elevation is 16.50 feet above the zero of the gage.

The flour mill ditch (Byer's) takes 100 second-feet or more of water

about a mile and a half above the gage and returns it to the river about 200 feet above the gage, so that it interferes with the measurements in no way except for a time during very low water, when the water is drawn down and then stored again. The gage was read only when the flow was normal. This accounts for the few gage heights during the summer.

The Farmers Mill ditch does not affect the reading of the gage when above 4 feet. When the water is below that height it takes about 40 second-feet of water from the river above the gage and returns it above the bridge, where measurements are made; so for low stages of the river the amount of water in the ditch should be taken out from the measured discharge in making curve and rating table and should then be added to the discharge taken from the table.

On June 15, 1904, a gage was placed on the Farmers Mill ditch and read from that time until the station was temporarily abandoned, September 4, on account of fluctuations caused by the mill above and the building of a concrete diversion dam below the gage.

The observations at this station during 1904 have been made under the direction of John T. Whistler, district engineer.

Discharge measurements of Umatilla River at Pendleton, Oreg., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
February 18	H. A. Yates	100	252	4.20	2.80	1,065
March 7	do	131	482	5.67	4.58	2,735
March 9	do	182	864	6.54	6.45	5,645
March 23	do	108	356	4.00	2.95	1,430
April 13	Brainard and Saxton	191	816	6.86	7.05	5,597
May 24	W. C. Sawyer	101	285	4.16	2.70	1,185
May 28	do	100	263	2.28	1.90	570 [b]
June 7	do	87	253	2.07	2.00	492 [c]
July 12	do	16	14.5	3.07	1.25	6 [d]
August 14 [a]	do	25	12	2.30	.95	28
August 14	do	28	12.5	2.30	.95	28.5

[a] Wading 800 feet above station.
[b] 30 second-feet subtracted for canal.
[c] 33 second-feet subtracted for canal.
[d] 40 second-feet subtracted for canal.

Mean daily gage height, in feet, of Umatilla River at Pendleton, Oreg., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.
1	1.75	1.90	2.90	4.00	3.38	1.82	1.25
2	1.70	1.85	2.95	4.15	3.18	1.92	1.25
3	1.65	1.80	2.85	4.72	3.42	2.05	1.41
4	1.65	1.80	2.80	4.52	3.42	2.08	1.25
5	1.65	1.90	2.80	4.28	3.30	2.05	1.30
6	1.60	1.90	3.18	5.22	3.10	2.05	1.20
7	1.60	1.90	4.62	4.75	3.10	2.02	1.20
8	1.67	1.85	6.60	4.35	2.95	2.00	1.20
9	1.68	1.80	6.35	4.85	2.98	1.92	1.20
10	1.75	1.70	5.08	5.80	3.10	1.90	1.20
11	2.15	1.70	4.32	6.70	3.12	1.85	1.20
12	2.37	1.75	3.75	6.60	3.15	1.75	1.25
13	2.95	1.75	.....	7.14	3.15	1.70	1.15
14	2.90	1.70	3.10	7.04	3.08	1.65	.....
15	3.23	1.72	3.40	6.74	3.00	1.55	.....
16	3.17	3.05	3.20	5.90	2.80	1.50	.....
17	3.05	3.02	3.18	5.32	2.78	1.50	.....
18	2.95	2.80	3.32	5.08	2.75	1.45	.....
19	2.72	2.70	3.35	5.45	2.90	1.45	.....
20	2.50	2.60	3.50	5.75	2.95	1.38	.....
21	2.35	2.50	3.45	5.28	2.95	1.30	.....
22	2.53	2.82	3.20	4.85	2.75	1.30	.....
23	2.87	3.30	3.05	4.20	2.70	1.30	.....
24	2.85	3.28	2.75	3.72	2.65	1.30	.....
25	2.60	3.20	2.60	3.65	2.38	1.30	.....
26	2.55	3.18	2.50	4.28	2.20	1.30	.....
27	2.35	3.30	2.50	4.52	2.10	1.25	.....
28	2.15	3.10	2.60	4.40	1.95	1.25	.....
29	2.05	2.92	3.90	4.20	1.85	1.25	.....
30	2.00	.....	5.10	3.72	1.78	1.25	.....
31	1.95	.....	4.45	.....	1.75	.....	.....

UMATILLA RIVER AT YOAKUM, OREG.

This station was established May 5, 1903, by N. S. Dils. It is located one-half mile east of Yoakum station of the Oregon Railroad and Navigation Company, at what is known as the Yoakum wagon bridge. The original gage is a vertical split rail spiked to the face of the south abutment on the upstream side. On September 5, 1903, a new gage, consisting of a 2 by 6 inch timber, 14 feet long, was spiked in a vertical position to the right abutment on the opposite side of the river from the original gage. The new gage was necessary to obtain gage readings at low stages. It is set at the same datum as the original gage and both gages read the same. During 1904 readings have been made once each day by Luther Dehaven. Discharge measurements are made from the single-span wagon bridge at which both gages are located. The initial point for soundings is the end of the lower chord of the upstream truss on the left bank. The channel is straight for 1,000 feet above and below the station. The current

is swift and has a well-distributed velocity. Both banks are high and are composed of gravel. The right bank will not overflow. The left bank will overflow only at extreme flood stages. The bed of the stream is composed of gravel and is permanent. There is but one channel at all stages. The bench mark is a 60-penny nail and two 8-penny nails driven side by side into the second timber from the top of the left abutment near the old gage. The elevation of the bench mark is 13.00 feet above the zero of both gages.

The observations at this station during 1904 have been made under the direction of John T. Whistler, district engineer.

Discharge measurements of Umatilla River at Yoakum, Oreg., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
March 30	H. A. Yates	76	530	9.80	8.50	5,215
April 12	do	76	616	10.67	9.65	6,575
April 28	W. C. Sawyer	76	430	7.26	7.15	3,116
May 20	do	76	316	4.60	5.55	1,453
May 31	do	76	195	2.46	4.30	480
July 31	do	76	141	.98	3.36	138
September 3	do	72	99	.41	2.84	40

Mean daily gage height, in feet, of Umatilla River at Yoakum, Oreg., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	4.40	4.50	6.00	.....	6.30	4.30	3.10	2.80	2.80	3.00	3.20	3.20
2	4.30	4.50	5.90	.....	6.60	4.30	3.10	2.80	2.80	3.00	3.20	3.20
3	4.30	4.40	5.80	.....	6.60	4.30	3.10	2.70	2.80	3.00	3.20	3.20
4	4.30	4.30	5.80	.....	6.60	4.30	3.80	2.70	2.80	3.00	3.20	3.20
5	4.30	4.20	5.80	.....	6.50	4.30	3.70	2.70	2.90	3.00	3.20	3.20
6	4.30	4.20	6.00	.....	6.40	4.40	3.60	2.70	2.90	3.00	3.20	3.20
7	4.30	4.30	7.10	.....	6.30	4.30	3.60	2.70	2.90	3.00	3.20	3.20
8	4.40	4.50	9.70	.....	5.80	4.30	3.50	2.70	2.90	3.00	3.20	3.20
9	4.40	4.50	9.00	.....	5.80	4.20	3.50	2.70	2.90	3.00	3.20	3.20
10	4.50	4.50	8.70	.....	6.00	4.10	3.50	2.70	2.90	3.00	3.20	3.20
11	4.90	4.60	8.20	.....	6.00	4.00	3.40	2.70	2.90	3.20	3.20	3.20
12	5.10	4.60	7.00	.....	5.90	4.00	3.50	2.70	2.90	3.10	3.20	3.20
13	5.60	4.60	6.40	.....	5.80	4.00	3.40	2.70	2.90	3.10	3.20	3.20
14	5.70	4.60	6.30	.....	5.60	3.90	3.40	2.70	2.90	3.20	3.20	3.20
15	6.10	4.70	6.50	.....	5.50	3.80	3.40	2.70	2.90	3.30	.....	3.20
16	6.00	6.00	6.40	.....	5.40	3.80	3.40	2.70	2.90	3.30	3.20	3.20
17	6.00	6.10	6.30	.....	5.40	3.60	3.40	2.70	2.90	3.40	3.20	3.20
18	5.90	5.90	6.40	.....	5.50	3.50	3.30	2.70	2.90	3.30	3.20	3.30
19	5.70	5.70	6.40	.....	5.50	3.40	3.30	2.70	2.90	3.30	3.20	3.30
20	5.60	5.50	6.40	.....	5.40	3.40	3.30	2.70	2.90	3.30	3.20	3.40
21	5.40	5.60	6.30	.....	5.40	3.40	3.20	2.70	3.00	3.30	3.20	3.40
22	5.20	6.20	6.20	.....	5.40	3.30	3.20	2.80	3.00	3.30	3.20	3.40
23	5.00	6.40	6.20	.....	5.20	3.30	3.10	2.80	3.30	3.20	3.20	3.40
24	5.30	6.50	6.20	.....	5.10	3.30	3.00	2.80	3.20	3.20	3.20	3.40

Mean daily gage height, in feet, of Umatilla River at Yoakum, Oreg., for 1904—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
25	5.40	6.40	6.10	.....	4.90	3.30	3.00	2.80	3.10	3.20	3.20	3.40
26	5.30	6.40	5.70	.....	4.70	3.30	3.00	2.80	3.00	3.20	3.20	3.40
27	5.10	6.30	5.70	.....	4.60	3.20	2.90	2.80	3.00	3.20	3.20	3.40
28	5.00	6.20	5.90	7.10	4.60	3.10	2.90	2.80	3.00	3.20	3.20	3.40
29	4.90	6.10	7.70	6.70	4.50	3.10	2.90	2.80	3.00	3.20	3.20	3.50
30	4.70	.....	8.40	6.60	4.40	3.10	2.80	2.80	3.00	3.20	3.20	3.70
31	4.70	.....	7.50	.....	4.40	.....	2.80	2.80	.....	3.20	.....	3.80

Rating table for Umatilla River at Yoakum, Oreg., from January 1 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
2.70	30	4.20	457	5.60	1,475	7.00	2,971
2.80	41	4.30	510	5.70	1,568	7.20	3,217
2.90	53	4.40	567	5.80	1,663	7.40	3,469
3.00	65	4.50	628	5.90	1,760	7.60	3,730
3.10	78	4.60	691	6.00	1,859	7.80	3,995
3.20	95	4.70	758	6.10	1,960	8.00	4,270
3.30	116	4.80	827.	6.20	2,064	8.20	4,551
3.40	141	4.90	899	6.30	2,170	8.40	4,837
3.50	170	5.00	973	6.40	2,279	8.60	5,133
3.60	201	5.10	1,050	6.50	2,389	8.80	5,434
3.70	235	5.20	1,131	6.60	2,501	9.00	5,741
3.80	272	5.30	1,214	6.70	2,615	9.50	6,541
3.90	313	5.40	1,299	6.80	2,731	10.00	7,382
4.00	358	5.50	1,386	6.90	2,850	10.50	8,252
4.10	406						

The above table is applicable only for open-channel conditions. It is based upon 7 discharge measurements made during 1904 and is fairly well defined. Above gage height 10.00 feet the rating curve is a tangent, the difference being 174 per tenth.

Estimated monthly discharge of Umatilla River at Yoakum, Oreg., for 1904.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean	
January	1,960	510	1,046	64,320
February	2,389	457	1,264	72,710
March	6,871	1,568	2,730	167,900
April [a]	.....	.....	4,174	248,400
May	2,501	567	1,487	91,430
June	567	78	288	17,140
July	272	41	120	7,379
August	41	30	34.3	2,109
September	116	41	58 5	3,481
October	141	65	90.5	5,565
November	95	95	95 0	5,653
December	272	95	122	7,501
The year	.....	.....	959	693,500

[a] Discharge estimated April 1–27, inclusive.

UMATILLA RIVER NEAR UMATILLA, OREG.

This station was established October 21, 1903, by John H. Lewis. It is located about 2 miles above Umatilla, Oreg., and about one-fourth mile below the diversion dam of the Oregon Land and Water Company. This dam diverts water into an irrigation ditch on the left bank. The inclined gage is on the left bank 45 feet below the cable and is in two sections. Both sections are made of 2 by 6 inch timber fastened by bolts which are cemented into the rock. The lower section reads from 1.2 to 3.5 feet. The upper section reads from 3.5 to 10.8 feet. The gage is read every other day by B. V. Pompella. Gage readings are taken every day during floods. Discharge measurements are made by means of a $\frac{5}{8}$-inch wire cable, car, tagged wire, and stay wire. The cable has a span of 210 feet. The initial point for soundings is the zero mark on the tag wire, directly over the vertical portion of the left bank. The channel is straight for 500 feet above and for 1,000 feet below the cable. The current is swift. Both banks are high and rocky and will not overflow. The bed of the stream is composed of solid rock, free from vegetation, and permanent. The bench mark is the head of a bolt cemented in the solid rock $1\frac{1}{2}$ feet upstream from the gage rod. Its elevation is 10.30 feet above the zero of the gage. To obtain the total discharge of the river, the discharge of the irrigation ditch must be added to that of the river at the cable. The rapids just above Umatilla prevent

backwater from Columbia River from affecting the gage heights at the station.

The observations at this station during 1904 have been made under the direction of John T. Whistler, district engineer.

Discharge measurements of Umatilla River near Umatilla, Oreg., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
March 18	J. H. Lewis	178	420	5.02	4.40	2,190
March 30	do	183	742	7.40	6.30	5,484
April 11	H. A. Yates	187	760	8.00	6.65	6,030
May 13	Murphy and Sawyer	175	317	4.78	4.00	1,507
August 13[a]	W. C. Sawyer	20	8	0.78	1.86	7
October 24	do	50	40	1.58	2.42	62

[a] Made at different section.

Discharge measurements of Oregon Land and Water Company's ditch near Umatilla, Oreg., in 1904.

Date.	Discharge.	Date.	Discharge.
	Second-feet.		*Second-feet.*
March 18	0.0	May 13	12.4
March 30	0.0	October 24[a]	13
April 11	15		

[a] Estimated.

Mean daily gage height, in feet, of Umatilla River near Umatilla, Oreg., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.30	3.50	4.25	.....	.....	.....	2.15	.....	1.95	2.35	.....	.....
2	3.30	3.40	.....	5.40	4.55	3.20	.....	2.20	.....	.....	2.35	2.55
3	3.30	3.40	4.20	5.50	4.40	.....	2.15	.....	2.00	2.35	.....	.....
4	3.30	3.30	.....	5.65	.....	3.30	.....	2.10	.....	.....	2.35	2.55
5	3.30	3.30	4.25	5.60	4.30	3.20	3.10	.....	2.00	2.30	.....	.....
6	3.20	3.30	.....	5.50	4.25	.....	.....	2.05	.....	.....	2.35	2.55
7	3.20	3.40	4.80	5.90	4.25	3.15	3.00	.....	2.00	2.15	.....	.....
8	3.20	3.40	.....	5.80	4.25	3.10	.....	2.00	.....	.....	2.30	2.55
9	3.20	3.40	7.30	.....	4.15	3.10	2.80	.....	2.00	2.15	.....	.....
10	3.30	3.40	.....	6.00	4.05	3.05	.....	2.00	.....	.....	2.35	2.55
11	3.50	3.30	5.45	6.60	4.20	3.00	2.70	.....	2.00	2.30	.....	.....
12	3.70	3.30	.....	6.90	4.15	2.85	.....	1.95	.....	.....	2.35	2.55
13	3.80	3.30	4.80	7.05	4.00	2.85	3.00	.....	2.00	2.35	.....	.....
14	4.10	3.30	.....	7.40	4.00	2.80	.....	1.90	.....	.....	2.35	2.55
15	4.00	3.30	4.75	7.65	3.95	2.80	2.60	.....	2.20	2.45	.....	.....
16	4.20	3.90	.....	7.40	3.95	.....	.....	1.90	.....	2.45	2.40	2.60
17	4.20	4.40	4.60	6.45	3.90	2.75	2.60	.....	2.20	.....	.....	.....
18	4.10	.....	.....	.....	3.85	.....	.....	1.90	.....	2.45	2.35	2.60
19	4.10	4.20	4.40	5.40	3.85	2.70	2.55	.....	2.20	.....	.....	.....

Mean daily height, in feet, of Umatilla River near Umatilla, Oreg., for 1904—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
20	4.00	.....	.....	.....	3.90	.....	.....	1.90	.....	2.45	2.40	2.60
21	3.90	4.00	4.40	5.80	3.80	2.60	2.50	.....	2.20	.....	.....	.....
22	3.80	.....	4.45	.....	.....	.....	.....	1.90	.....	2.45	2.35	2.65
23	3.70	4.40	4 40	5.20	3.80	2.50	2.50	.....	2.20	.....	.....	.....
24	3.70	.....	4.35	5.00	3.80	.....	.....	1.90	.....	2.40	2.40	2.65
25	3.80	4.30	4.35	.....	3.70	2.50	2.50	.....	2.40	.....	.....	.....
26	3.80	.....	4.20	4.20	3.60	.....	.....	1.95	.....	2.40	2.40	2.65
27	3.80	4.20	4.10	4.50	3.45	2.45	2.40	.....	2.35	.....	.....	.....
28	3.70	.....	4.00	4.60	3.35	.....	.....	1.95	.....	2.40	2.50	2.65
29	3.60	4.20	4.80	.....	3.25	2.30	2.25	.....	2.30	.....	.....	.....
30	3.60	.....	6.45	4.80	3.20	.....	.....	1.95	.....	2.30	2.50	2.65
31	3.50	.....	5.95	.....	3.15	.....	2.20	.....	.....	2.30	.....	.....

Rating table for Umatilla River near Umatilla, Oreg., from October 22, 1903, to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.90	9	3.20	531	4.50	2,200	5.80	4,444
2.00	14	3.30	627	4.60	2,355	5.90	4,636
2.10	21	3.40	731	4.70	2,512	6.00	4,830
2.20	30	3.50	843	4.80	2,672	6.20	5,218
2.30	43	3.60	962	4.90	2,835	6.40	5,606
2.40	62	3.70	1,085	5.00	3,000	6.60	5,994
2.50	88	3.80	1,212	5.10	3,169	6.80	6,382
2.60	124	3.90	1,342	5.20	3,342	7.00	6,770
2.70	171	4.00	1,475	5.30	3,518	7.20	7,158
2.80	227	4.10	1,612	5.40	3,697	7.40	7,546
2.90	291	4.20	1,753	5.50	3,880	7.60	7,934
3.00	363	4.30	1,898	5.60	4,066	7.80	8,322
3.10	443	4.40	2,047	5.70	4,254	8.00	8,710

The above table is applicable only for open-channel conditions. It is based upon 8 discharge measurements made during 1903 and 1904. It is well defined between gage heights 1.85 feet and 6.15 feet. The table has been extended above 6.15 feet. Above gage height 6.00 feet the rating curve is a tangent, the difference being 194 per tenth.

Estimated monthly discharge of Umatilla River near Umatilla, Oreg., for 1903 and 1904.

Month.	Discharge in second-feet.[a]			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
1903.				
October 22–31	171	124	134	2,658
November	2,512	88	810	48,200
December	1,753	531	1,102	67,760
1904.				
January	1,753	531	1,049	64,520
February	2,047	627	1,219	70,110
March	7,352	1,475	2,827	173,900
April	8,031	1,753	4,371	260,100
May	2,512	486	1,415	87,020
June	627	30	269	16,030
July	443	25	145	8,886
August	30	9	13	807
September	62	11	27	1,617
October	74	25	55	3,366
November	88	43	58	3,437
December	146	88	121	7,462
The year	8,031	9	964	697,200

[a] Discharge for missing gage heights interpolated.

M'KAY CREEK NEAR PENDLETON, OREG.

This station was established May 23, 1903, by E. I. Davis. It was located at the footbridge near the residence of C. W. Lyman, 2 miles west of Pendleton, Oreg. The gage was a vertical 1 by 6 inch board 11 feet long nailed to a post which is set in the bed of the stream and braced to a large poplar tree. It was about 200 feet north of C. W. Lyman's house and is about 150 feet below the footbridge, on the left bank. It was read twice each day by C. W. Lyman. Discharge measurements were made from the footbridge of 65-foot span, above the gage. The initial point for soundings was the end of the log, of which the bridge consists, on the right bank. The channel is straight for 150 feet above and 100 feet below the bridge. The current has a good velocity at ordinary stages. Both banks are high, not liable to overflow, and are without trees. There is but one channel at all stages. The bed of the stream is composed of gravel, free from vegetation, and permanent. The bench mark was a nail in a blaze on a root of the poplar tree to which the gage was braced. Its

elevation was 5.82 feet above the zero of the gage. The station was abandoned July 6, 1904.

The observations at this station during 1904 have been made under the direction of John T. Whistler, district engineer.

Discharge measurements of McKay Creek near Pendleton, Oreg., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
March 5	H. A. Yates	40	126	3.40	2.20	434
March 11	do	42	150	4.90	2.05	740
April 12	do	43	182	6.00	2.90	1,100
June 2 [a]	W. C. Sawyer	16	14.5	1.73	1.22	25

[a] Made at different section.

Mean daily gage height, in feet, of McKay Creek near Pendleton, Oreg., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.
1	1.55	1.50	2.00	3.35	2.00	1.15	0.90
2	1.45	1.50	2.00	3.30	2.00	1.25	.90
3	1.40	1.45	2.00	3.40	2.00	1.25	.90
4	1.40	1.40	2.00	3.40	1.95	1.20	1.60
5	1.40	1.50	2.20	3.28	1.90	1.20	1.45
6	1.40	1.50	2.25	3.80	1.90	1.20	1.30
7	1.40	1.50	3.20	3.40	1.85	1.20	.....
8	1.40	1.50	4.10	3.25	1.80	1.20	.....
9	1.50	1.50	3.95	3.80	1.75	1.20	.....
10	1.50	1.50	3.35	4.00	1.70	1.20	.....
11	1.70	1.50	3.00	3.80	1.70	1.20	.....
12	1.90	1.50	2.50	3.80	1.60	1.20	.....
13	2.00	2.35	2.45	3.80	1.60	1.20	.....
14	2.30	2.50	2.40	3.80	1.55	1.20	.....
15	2.40	2.50	2.40	3.55	1.55	1.10	.....
16	2.30	2.35	2.40	3.50	1.50	1.05	.....
17	2.15	2.20	2.40	3.30	1.50	1.00	.....
18	2.10	2.15	2.40	3.05	1.50	1.00	.....
19	2.00	2.00	2.40	3.00	1.45	1.00	.....
20	1.85	2.00	2.42	2.90	1.45	.97	.....
21	1.85	1.90	2.40	2.85	1.40	.95	.....
22	1.95	2.40	2.25	2.80	1.40	.90	.....
23	2.10	2.50	2.12	2.55	1.38	.90	.....
24	2.00	2.50	2.00	2.40	1.35	.90	.....
25	2.00	2.25	1.95	2.30	1.30	.90	.....
26	1.90	2.20	1.90	2.30	1.28	.90	.....
27	1.85	2.15	1.90	2.25	1.25	.90	.....
28	1.75	2.10	2.10	2.20	1.20	.90	.....
29	1.70	2.00	3.35	2.10	1.20	.90	.....
30	1.60	.....	4.25	2.00	1.20	.90	.....
31	1.55	.....	3.40	.....	1.18	.....	.....

JOHN DAY RIVER AT M'DONALD, OREG.

This station was established December 16, 1904, by W. C. Sawyer. It is located at the ferry at McDonald, 16 miles above the mouth of the river, and 18 miles southwest of Arlington, Oreg. An inclined staff gage in two sections is fastened to old bridge timbers 183 feet upstream from the ferry cable. The lower section reads from 1 to 2 feet; the upper section reads from 2 to 11 feet. The gage is read once each day by William Murray. Discharge measurements are made by means of a car suspended from the ferry cable. The car is provided with steel snatch blocks and lever for passing the ferry traveler. The initial point for soundings is the face of the support on the right bank. The channel is straight for one-half mile above and below the cable. The current is swift. Both banks are high, free from vegetation, and do not overflow. The bed of the stream is composed of clean sand and gravel, and is slightly shifting. There is but one channel at all stages. Bench mark No. 1 is the top of the corner stone under the southeast corner of barn near the gage. Its elevation is 15.32 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of John T. Whistler, district engineer.

Discharge measurements of John Day River at McDonald, Oreg., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
October 26	W. C. Sawyer	263	602	0.96	2.00	580
December 16	do	262	627	.90	1.98	570

Mean daily gage height, in feet, of John Day River at McDonald, Oreg., for 1904.

Day.	Nov.	Dec.	Day.	Nov.	Dec.	Day.	Nov.	Dec.
1		1.95	12		1.95	22	1.90	2.00
2		1.95	13		2.01	23	1.90	2.00
3		1.95	14	1.70	2.00	24	1.95	2.00
4		1.95	15	1.70	2.00	25	1.95	2.00
5		1.95	16	1.70	1.95	26	1.95	2.00
6		1.90	17	1.80	2.00	27	1.95	1.85
7		1.80	18	1.80	2.00	28	1.95	1.80
8		1.70	19	1.90	1.95	29	1.95	1.65
9		1.70	20	1.90	1.90	30	1.95	1.85
10		1.80	21	1.90	1.95	31		1.90
11		1.90						

DESCHUTES RIVER NEAR BEND, OREG.

This station was established December 22, 1904, by W. C. Sawyer. It is located at the wagon bridge known as Sizemore's bridge, 1¼ miles south of Bend, Oreg. A plain staff gage, graduated to feet and tenths, is spiked vertically to the sixteenth bent of the bridge, 335 feet from the initial point for soundings. It is read once each day by Dr. W. S. Nichol, who is paid by the Deschutes Irrigation and Power Company. Discharge measurements are made from the downstream side of the bridge to which the gage is attached. The initial point for soundings is a point marked with black paint at the west end of the bridge, downstream side. The channel is straight for 300 feet above and below the station. The current is swift, and both banks are high. The left bank is subject to overflow at extreme high water. The bed of the stream is composed of rock and gravel, free from vegetation, and is permanent. There is but one channel at all stages. The bench mark is a copper bolt cemented in a large bowlder near the edge of the water, about 100 feet above the east end of the bridge. Its elevation is 5.20 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of John T. Whistler, district engineer.

Discharge measurement of Deschutes River near Bend, Oreg., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-ft.*
December 21	W. C. Sawyer	348	834	2.89	2.00	2,412

Mean daily gage height, in feet, of Deschutes River near Bend, Oreg., for 1904.

Day.	Dec.	Day.	Dec.	Day.	Dec.
22	2.0	26	2.0	29	2.0
23	2.0	27	1.9	30	2.0
24	2.0	28	1.9	31	2.0
25	2.0				

DESCHUTES RIVER (EAST FORK) AT ODELL, OREG.

This station was established December 25, 1904, by W. C. Sawyer. It is located at the county wagon bridge at Odell, Oreg. A plain staff gage, graduated to feet and tenths, is spiked vertically to logs projecting from a milk house belonging to the observer. It is read once each day by Charles Graves. Discharge measurements are made from the bridge at all ordinary stages. At extreme high water a foot log below the bridge is used. The initial point for soundings at the

bridge is a 10-penny nail driven into a log at the south end of the bridge, downstream side. The initial point at the foot log is a 10-penny nail driven into the north end of the foot log. The channel is curved. The current is swift. Both banks are low and clean. The left bank is liable to overflow at high water. The bed of the stream is composed of gravel and sand, free from vegetation, and is permanent. There are two or more channels at the bridge during high water and one at low and ordinary stages. There is but one channel at all stages at the foot log. The bench mark is a 60-penny nail in the base of a jack-pine tree used for gate post in the yard fence of the observer. Its elevation is 7.87 feet above the zero of the gage rod.

The observations at this station during 1904 have been made under the direction of John T. Whistler, district engineer.

Mean daily gage height, in feet, of Deschutes River (East Fork) at Odell, Oreg., for 1904.

Day.	Dec.	Day.	Dec.	Day.	Dec.
26	2.5	28	2.8	30	2.7
27	2.5	29	2.7	31	2.7

MISCELLANEOUS MEASUREMENTS IN COLUMBIA RIVER DRAINAGE BASIN.

The following discharge measurements were made in Columbia River drainage basin in 1904 under the direction of D. W. Ross, C. C. Babb, John T. Whistler, and T. A. Noble, district engineers:

Miscellaneous measurements in Idaho in 1904.

Date.	Stream.	Locality.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
			Feet.	*Sq. ft.*	*Ft. per sec.*	*Feet.*	*Sec.-ft.*
Aug. 31	Aster Creek	"Soldier Crossing"	.....	31	0.70	.....	20.4
Mar. 20	Clearwater River	Railway bridge between Lapwai and Potlatch Junction.	594	3,493	5.44	.....	19,018
July 19	Big Payette	At outlet of Big Payette Lake.	.....	.....	.....	.....	812
June 28	Conant Creek	Near Squirrel	.....	29	1.94	.....	56
June 12	Fish Creek	10 miles from Carey, above all canals.	.....	.....	.....	.....	49
Aug. 31	Lewis Lake Outlet	"Soldier Crossing," near falls.	.....	161	1.3	.....	220
Aug. 30	Shoshone Lake Outlet.	3 miles above Lewis Lake	.....	169	1.1	.....	183
Aug. 26	Snake River (Henry Fork).	Ford on Yellowstone Park road.	.....	48	1.2	.....	60
Aug. 17	Snake River (North Fork).	Island Park bridge	.....	414	2.4	.....	1,000
Sept. 16	Spokane River	Old Fort Sherman at outlet of Cœur d'Alene Lake.	450	1,043	.93	[a] 2,119	1,969

[a] Elevation of water surface above sea level.

Tributaries of the South Fork of Snake River, north side, from Sunnydell, Idaho, to Wyoming State line.

Date.	Stream.	Discharge.	Remarks.
Aug. 10	Lyman, or Lyon, Creek	0.4	Low. Above Sunnydell. Water rights disputed. Drainage area 36 miles.
Aug. 10	Hawley Springs	.8	Normal. Below Heise P. O. ½ mile.
Aug. 10	Kelly Creek	.7	Low. Above Heise 1 mile. Used on Kelly farm.
July 28	Rainy Creek	36	Low. In Swan Valley, 5 miles below Irwin. Entire summer flow used. Water rights in dispute. Gaged above all canals. Drainage area 70 miles.
July 29	Palisade Creek	106	Low. Gaged above all canals. In Swan Valley, 5 miles above Irwin. Drainage area 80 miles.
July 29	Sheep Creek	3.3	Low. In Swan Valley, 5 miles above Irwin. Flow taken by Tolman's ditch.
July 29	Elk Creek	105	Low. In Grand Valley, near Rosa. Gaged below all ditches.
July 30	Indian Creek	34	Low. In Grand Valley, near Rosa. Gaged below all canals. Trouble over water rights. Highest creek up river on north side used for irrigation in Idaho. Drainage area 50 miles.

Tributaries of the South Fork of Snake River, south side, from Wyoming State line to Poplar, Idaho.

Date.	Stream.	Discharge.	Remarks.
July 30	Williams Creek	1.3	Low. Below McCoy Creek 2 miles. Used for irrigation.
July 31	Edwards Creek	1.5	Low. Below McCoy Creek 5 miles. Entire summer flow used.
July 31	Cabin Creek	1.0	Low. Entire summer flow used.
July 31	Deer Creek	1.0	Do.
July 31	Summit Creek	1.3	Do.
July 31	Alder Creek	.7	Low. In Swan Valley, 15 miles below McCoy Creek. Entire summer flow used.
July 31	Dry Hollow Creek	.3	Low. Entire summer flow used.
July 31	Porcupine Creek	1.7	Do.
July 31	Deer Creek	1.8	Do.
Aug. 1	Indian Creek	3.0	Do.
Aug. 1	Squaw Creek	.7	Do.
Aug. 1	Fall Creek	23.9	Low. In Swan Valley. Used for irrigation. Drainage area 45 miles.
Aug. 1	Pritchard Creek	3.3	Low. In Conant Valley. Used for irrigation.

Tributaries of the South Fork of Snake River, south side, from Wyoming State line to Poplar, Idaho—Continued.

Date.	Stream.	Discharge.	Remarks
Aug. 2	Garden Creek	1.0	Low. Entire summer flow used for irrigation.
Aug. 2	Granite Creek	.8	Do.
Aug. 2	Antelope Creek	1.8	Low. Entire summer flow used for irrigation. Drainage area 35 miles.
Aug. 2	Little Pine Creek	.3	Low. Filings have been made on flow.

Tributaries of the North Fork of Snake River above Marysville, Idaho.

Date.	Stream.	Discharge.	Remarks
Aug. 15	Hill Creek	0.3	Low. North bank Snake opposite Marysville, near ford. Entire summer flow used.
Aug. 17	Thurman Creek	18	Bank full; spring fed. 30 miles from Marysville. Used for irrigation.
Aug. 17	Thurman Springs	.2	Normal. Used for irrigation.
Aug. 17	West Bald Cabin Springs	.2	Do.
Aug. 17	East Bald Cabin Springs	1.5	Do.
Aug. 17	Green Springs	.6	Do.
Aug. 17	Osborn Creek	6.0	Bank full; spring fed. Used for irrigation.
Aug. 18	Blue Springs	3.6	Normal. Water rights claimed.
Aug. 18	Tom Creek	.5	Normal. Used for irrigation. Flows into Buffalo Creek.
Aug. 18	Grizzly Spring	5.3	Normal. Used for irrigation. Tributary to Shotgun Creek.
Aug. 19	Ice House Creek	9.0	About normal; spring fed. Used for irrigation. Tributary to Shotgun Creek. Drainage area 35 miles.
Aug. 20	Willow Creek	3.0	Low. Used for irrigation. Tributary of Shotgun Creek. Ownership disputed. Drainage area 20 miles.
Aug. 20	Caldwell Spring No. 1	.5	Normal. In Icehouse Park. Upper watershed of Icehouse Creek. Used for irrigation and domestic purposes.
Aug. 20	Caldwell Spring No. 2	.3	Normal. Same as spring No. 1.
Aug. 21	Taylor Creek	.6	Low. Tributary of Shotgun Creek. Used for irrigation. Ownership disputed.
Aug. 22	Sorenson Spring	.8	Low. Rises between Taylor and Sheridan creeks above Sheridan ranch. Used for irrigation. Ownership disputed.
Aug. 22	Shotgun Creek	68	Gaged at Trude's bridge, about 1 mile above mouth. Drainage area 145 miles.

Tributaries of Henry Fork, a tributary of North Fork of Snake River, east bank, going upstream.

Date.	Stream.	Discharge.	Remarks.
Aug. 27	Meadow Creek	8.8	Bank full; spring fed. Used by ranchers.
Aug. 22	Pine Creek	.9	Mid height. Entire summer flow used for irrigation.
Aug. 23	Coolie Creek	12.3	Mid height. Used for irrigation.
Aug. 23	Snow Water Creek	.2	Low. Entire summer flow used.
Aug. 23	Bear or Little Spring	.5	Normal. Used for irrigation.
Aug. 23	Canyon Creek	.8	Do.
Aug. 23	Thompson Springs	5.0	Do.
Aug. 23	Garner Spring	.9	Do.
Aug. 23	Jessie Creek	3.0	Low.
Aug. 24	Twin Creek	6.8	Below normal.

Tributaries of Henry Lake, Idaho.

Date.	Stream.	Discharge.	Remarks
Aug. 24	Howard Creek	11	Low. Used for irrigation.
Aug. 24	Tahgee Creek	19	Do.
Aug. 25	Whitman Spring	1.7	Normal. Used to supply fish pond.
Aug. 25	Rock Springs	.7	Normal. Used for irrigation.
Aug. 25	Howe Creek	.7	Normal. Owned by Henry Lake Shooting Club. Used by rancher to make proof on desert entry.
Aug. 25	Sherwood Springs	1.2	Normal. Used for irrigation.
Aug. 25	Canyon Creek	.6	Low. Used for domestic purposes.
Aug. 25	Oswald Creek	.3	Low. Used for irrigation.
Aug. 25	Big Spring	1.2	Normal. Used for irrigation. Tributary of Timber Creek.
Aug. 25	Golf Spring	.7	Normal.
Aug. 25	Timber Creek	1.0	Gaged above confluence with Oswald, Big Spring, and Golf Spring creeks. Used for irrigation.
Aug. 26	Johnson Creek	3.2	Rises on Sherman ranch. Used on Sherman and Staley ranches.
Aug. 26	Duck Creek	9.6	Used on Sherman ranch.
Aug. 26	Rock Creek	6.4	Do.
Aug. 26	Hope Creek	2.4	Do.

Miscellaneous measurements in Montana in 1904.

SUBDRAINAGE BASIN OF MISSOULA RIVER.

Date.	Stream.	Locality.	Area of section.	Mean velocity.	Gage height.	Discharge.
			Sq. feet.	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
May 21	New Hedge ditch	Grantsdale	19	2.68	2.35	[a] 51
Aug. 26	do	do	27	4.00	3.15	[a] 107
May 21	Republican ditch	do	37	2.35	2.30	[a] 86
Aug. 26	do	do	35	3.00	2.60	[a] 104
May 19	Rattlesnake Creek	Missoula	111	5.82		646

[a] Measurements made directly above the United States Geological Survey gaging station at Grantsdale, on Bitterroot River.

Miscellaneous measurements in Oregon in 1904.

Date.	Stream.	Locality.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
			Feet.	*Square feet.*	*Ft. per second.*	*Feet.*	*Second-feet.*
July 15	Abiqua Creek	Highway bridge, near Silverton.				1.2	82
Apr. 9	Bully Creek	Bridge at Westfall	25	58	5.64		324
Apr. 11	do	do	25	92	6.95		643
July 22	Crescent Creek	Outlet Crescent Lake	105	303	.64		195
Aug. 1	do	do	105	279	.60		166
July 23	do	Above Deschutes River	34	71	2.70		192
Sept. 12	Davis Creek	½ mile above mouth	98	191	1.50		287
Aug. 6	Deschutes River	½ mile below Crescent Creek	72	97	2.25		219
July 21	Deschutes River, East Branch.	Odell	22	16	2.10		97
Aug. 21	do	do	24	38	1.81		69
Sept. 16	do	Rosland	65	120	2.05		246
July 23	Deschutes River, West Branch.	Royce's ranch, T. 24 S., R. 7 E.	24	27	3.22		86
Sept. 14	do	Sec. 8, T. 21 S., R. 8 E	104	514	1.10		566
July 16	Molalla River[a]	Highway bridge, near Canby.				.8	247
July 28	Outlet	Odell Lake	54	54	2.37		128
Oct. 25	Rock Creek	France	4	1.3	.73		.9
July 30	Rogue River[a]	Highway bridge, at Grants Pass.				.9	2,254
Nov. 2	Santiam River[a]	Scio ferry, near Marion				.1	726
July 15	Silver Creek[a]	Union Light and Power Co. station, near Silverton.				.8	28
Aug. 7	do	do				.0	11
Mar. 10	Wildhorse Creek	Pendleton	34	114	2.55		290
Oct. 20	Willamette River[a]	Highway bridge, at Eugene				.4	1,370

[a] Miscellaneous measurements furnished to the United States Geological Survey by Mr. J. H. Cunningham, civil and hydraulic engineer, Portland, Oreg.

Miscellaneous measurements in Washington, 1904.

Date.	Stream.	Locality.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge
			Feet.	*Square feet.*	*Ft. per second.*	*Feet.*	*Second feet.*
Aug. 27	American River	Mouth near Niles		66	1.64		108
Aug. 26	Bumping River	Bumping Lake		110	1.05		116
Sept. 21	Cabin Creek	Near Easton		6.2	1.11		6.9
Sept. 22	Clealum River	2 miles above Lake Clealum		155	1.33		206
Oct. 17	Colville River	Kettle Falls	125	257	.82	15.7	210
Apr. 6	Cottonwood Creek	Rock Lake	21	18.9	1.69		32
May 7	do	do	4	1.9	2.12		4.1
June 24	do	do	1.4	.7	.90		.6
Mar. 21	Crab Creek	3½ miles west of Odessa	24	125	3.29		410
Mar. 21	do	Odessa	34	126	3.21		403
Mar. 23	do	Railway bridge east of Stratford.	84	317	2.08		661
Aug. 16	do	Krupp	18	12.7	.66		8.4
Mar. 22	East Channel Crab Creek.	Blithe's ranch	8.7	10.4	3.46		36
Mar. 22	West Channel Crab Creek.	do				(a)	9.9
Mar. 30	Hangman Creek	Spokane	71	607	2.86	10.3	1,739
Oct. 21	Kettle River	Orient	108	1,185	.57	24.36	674
June 14	Pechastin Creek	Wenache	46	95	5.46		521
Sept. 16	Spokane River	Greenacres	254	1,181	.62		727
Mar. 19	Outlet Tule Lake	Tule Lake	6.1	27.1	1.72		46.7
June 14	Wenache River	Pechastin	237	1,542	6.35		10,830
June 16	do	Wenache		2,638	4.98		13,140
Sept. 21	Yakima River	Clealum	187	223	1.98		442
Sept. 23	do	Thorp	153	191	2.70		515
Mar. 19	Asotin Land and Water Co.'s canal.	Power plant, Asotin	1.8	.6	1.30		.8
Mar. 26	do	do	1.8	.6	1.27		.8
July 8	Clark canal	North Yakima		4.6	1.01		4.7
June 6	Kiona Water Supply Co.'s canal.	Kiona		14.1	1.31		18.5
Mar. 19	Lewiston Water Power Co.'s canal.	Above power pipe, Clarkson.	6	9	4.06	4.52	37
Mar. 26	do	do	6.2	11.3	2.63		30
July 1	do	do	5.8	11.3	3.76		43
July 1	do	Below power pipe, Clarkson	5.8	5.8	2.83		16.3
Aug. 5	Olsen canal	Ellensburg		11.6	1.23		14.3
June 30	Rhodenbach Schuler canal.	North Yakima		3.1	1.02		3.2
July 20	do	do		3.6	1.34		4.8
Aug. 9	Taylor canal	do		7.5	1.23		9.2
Sept. 19	do	do		14.3	.81		12.9
June 15	Wenache Canal Co.'s canal.	Pechastin	14	33	1.62		60
July 26	do	Cashmere	7	13.7	3.08		42
July 8	Lowry canal	North Yakima		11.9	1.21		14.5
July 2	Wide Hollow waste-way.	do		24	1.85		44
Aug. 1	do	do		28	1.01		28

(a) Weir.

PUGET SOUND DRAINAGE BASIN.

For convenience in arrangement, the smaller rivers which have their headwaters on the western slope of the Cascade Range and which flow into Puget Sound north of Seattle have been grouped as the Puget Sound drainage. Of these, White River has its source near Mount Rainier and flows into Puget Sound near Seattle, Wash. Cedar River is a tributary of Black River. Snoqualmie and Skykomish rivers unite to form the Snohomish, which flows into the Sound about 10 miles beyond the junction, near Everett, Wash. The Stilaguamish lies north of the Skykomish and has a parallel course. The results of the data collected in Puget Sound drainage basin are given on the following pages:

CEDAR RIVER NEAR RAVENSDALE, WASH.

This station is located at the intake of the Seattle waterworks and is 15 miles below Cedar Lake, 4 miles from the Northern Pacific Railway at Ravensdale and 6 miles from the Columbia and Puget Sound Railway at Maple Valley. The station was established September 27, 1902, by T. A. Noble. The gage is a plain staff graduated to feet and hundredths, to which is attached a hook gage and vernier reading to thousandths. When this gage reads zero the hook is level with the crest of the dam. It is fastened securely to the head gates above the dam, and is read daily by George Landsburg. The bench mark is the crest of the dam. The elevation, from city levels, of the south end is 535.831 feet and of the north end 535.840 feet. The gagings at this station are made at two points. The first is 142 feet below the dam, where the cross section is small, the current rapid, and suitable for gaging the stream at stages below 1 foot on the gage. The measurements at this point are made from a cable. The initial point for soundings is on the right bank. The channel is straight. The right bank is steep, the left bank has a sloping gravelly beach, and the bed of the stream is rocky. At all stages of the river above 1 foot on the gage the measurements are made from a cable located 600 feet above the dam, where the cross section is large and suitable for gaging the higher stages of the river. The initial point for soundings is a spike driven into the top of a hemlock stump about 12 inches in diameter near the edge of the water. The right bank is a sloping sandy beach; the left bank is steep and of hardpan formation. The bed is permanent—rocky near the right bank, and of sand and gravel near the left bank.

To the discharge measurements made below the dam should be added the amount of water flowing into the gravity system which supplies the city of Seattle. This varies from 34 to 37 second-feet. The discharge of this pipe line was measured during the winter of

1901–2 by T. A. Noble, and the results have been published in Volume XLIX, page 112, Transaction of the American Society of Civil Engineers.

The observations at this station during 1904 have been made under the direction of T. A. Noble, district engineer.

Discharge measurement of Cedar River near Ravensdale, Wash., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
August 23	G. F. Harley	73	105	1.23	0.45	[a] 166

[a] Gaged below the dam; 36 second-feet added for city pipe.

Mean daily gage height, in feet, of Cedar River near Ravensdale, Wash., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.53	1.68	1.20	1.21	1.90	1.49	1.36	0.69	0.46	0.41	0.38	1.45
2	1.50	1.62	1.17	1.19	1.78	1.54	1.36	.58	.44	.40	.38	1.33
3	1.48	1.58	1.16	1.20	1.65	1.66	1.33	.52	.43	.40	.38	1.19
4	1.50	1.59	1.18	1.19	1.61	1.77	1.29	.53	.43	.40	.37	1.11
5	1.46	1.56	1.30	1.41	1.54	1.77	1.28	.50	.43	.41	.37	1.10
6	1.42	1.55	1.38	1.41	1.51	1.71	1.22	.51	.42	.40	.38	.90
7	1.40	1.59	1.61	1.37	1.60	1.63	1.24	.50	.43	.39	.43	.92
8	.90	1.44	1.65	1.34	1.56	1.49	1.22	.60	.45	.39	.42	.90
9	.94	1.39	1.21	1.36	1.54	1.35	1.19	.49	.47	.40	.41	.89
10	1.75	1.37	1.52	1.43	1.51	1.39	1.16	.49	.44	.39	.39	.88
11	1.66	1.33	1.49	1.41	1.51	1.36	1.19	.49	.43	.43	.37	.88
12	1.98	1.24	1.45	1.66	1.49	1.33	1.10	.49	.58	.41	.37	.92
13	2.18	1.29	1.43	1.77	1.48	1.33	1.07	.48	.58	.40	.37	1.04
14	2.38	1.28	1.40	1.81	1.50	1.36	1.06	.48	.55	.39	.37	1.33
15	2.66	1.28	1.38	1.81	1.49	1.40	1.04	.47	.45	.38	.38	2.15
16	2.54	1.26	1.36	1.93	1.49	1.67	1.01	.47	.42	.42	.40	2.10
17	2.33	1.24	1.34	1.94	1.49	1.55	.91	.46	.42	.44	.43	2.07
18	2.17	1.23	1.34	1.95	1.52	1.54	.90	.46	.41	.42	.54	1.96
19	1.96	1.20	1.32	1.99	1.69	1.54	.90	.45	.42	.41	.68	2.23
20	1.88	1.18	1.32	2.00	1.72	1.50	.90	.45	.60	.40	1.09	2.09
21	1.79	.91	1.28	2.22	1.66	1.49	.81	.44	.56	.39	1.48	1.97
22	1.91	1.06	1.26	2.20	1.75	1.48	.70	.45	.56	.38	1.29	1.90
23	1.89	1.37	1.24	2.06	1.80	1.49	.61	.45	.55	.38	.94	1.74
24	1.90	1.34	.89	1.93	1.79	1.48	.82	.44	.52	.38	.97	1.51
25	1.84	1.30	1.20	1.82	1.72	1.46	.81	.44	.49	.37	1.26	1.37
26	1.88	1.28	1.20	1.82	1.63	1.45	.79	.43	.46	.38	1.31	1.26
27	1.84	1.26	1.16	1.84	1.60	1.43	.77	.43	.44	.36	1.35	1.18
28	1.81	1.24	1.21	1.89	1.57	1.40	.78	.45	.42	.37	1.57	1.16
29	1.76	1.23	1.25	2.06	1.56	1.39	.76	.48	.41	.37	1.64	1.62
30	1.72	.....	1.26	2.01	1.57	1.38	.74	.45	.40	.38	1.53	1.75
31	1.68	.....	1.24	.....	1.57	.....	.72	.43	.....	.38	.....	1.67

Rating table for Cedar River near Ravensdale, Wash., from September 27, 1902, to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
0.4	177	1.4	795	2.4	1,640	3.8	3,300
.5	235	1.5	861	2.5	1,750	4.0	3,540
.6	294	1.6	927	2.6	1,860	4.2	3,780
.7	354	1.7	995	2.7	1,980	4.4	4,020
.8	414	1.8	1,065	2.8	2,100	4.6	4,260
.9	476	1.9	1,145	2.9	2,220	4.8	4,500
1.0	538	2.0	1,235	3.0	2,340	5.0	4,740
1.1	600	2.1	1,335	3.2	2,580	5.2	4,980
1.2	664	2.2	1,435	3.4	2,820	5.4	5,220
1.3	729	2.3	1,535	3.6	3,060	5.6	5,460

The above table is applicable for open-channel conditions only. It is based on 13 discharge measurements made during 1902–1904. It is fairly well defined to 2.70 feet gage height. The table has been extended above 2.7 feet. The rating table gives discharge at the upper section, above the intake of Seattle water-supply system.

Estimated monthly discharge of Cedar River near Ravensdale, Wash., for 1904.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January	1,932	476	1,099	67,580
February	981	482	757	43,540
March	961	470	732	45,010
April	1,455	658	1,021	60,750
May	1,145	848	933	57,370
June	1,044	749	858	51,060
July	769	300	541	33,260
August	348	194	226	13,900
September	294	177	217	12,910
October	200	154	174	10,700
November	954	160	387	23,030
December	1,385	464	835	51,340
The year	1,932	154	648	470,400

SKYKOMISH RIVER (SOUTH FORK) NEAR INDEX, WASH.

This station was established October 6, 1902, by T. A. Noble. It is located about 2 miles above Index and about 300 feet from the railroad track. The gage is a plain staff graduated to feet and tenths. A hook gage is used for reading to hundredths of a foot. Readings are made daily by Louis G. Heybrook. The gage is fastened by means of plugs driven in drill holes in the solid rock. The bench

mark is a cross cut in the rock about 6 feet above low water and 40 feet downstream from the gage. Its elevation, as obtained from the Great Northern Railway, is 679.158 feet. The elevation of the zero of the gage is 669.926 feet. The initial point for soundings is on the left bank at a plug driven in the solid rock 10 feet from the edge of stream at low water. The gagings are made from a cable. The channel is straight for 500 feet above and 300 feet below the station. Both banks are of solid rock and are not liable to overflow. The bed of the stream is of sand and gravel, not liable to change except near the left bank, where the sand shifts at high water. This does not cause any important change in the cross section. This station is 300 feet upstream from Sunset Falls, where the river plunges down a solid granite ledge with a slope of about two horizontal to one vertical. The ledge answers the purpose of a spillway in regulating the flow of the river at the gaging station, since the water has a free discharge and a permanent bed just below the station.

The observations at this station during 1904 have been made under the direction of T. A. Noble, district engineer.

Mean daily gage height, in feet, of Skykomish River (South Fork) near Index, Wash., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.05	2.60	2.05	2.45	5.90	6.55	7.00	2.85	1.20	1.30	1.40	5.30
2	2.20	2.50	1.95	2.80	5.40	6.70	6.50	2.85	1.20	1.10	1.65	4.55
3	2.80	2.65	2.00	2.80	5.40	7.90	6.65	2.60	1.15	1.00	1.90	4.00
4	3.20	2.70	1.90	2.85	5.45	7.35	6.10	2.60	1.30	.95	1.55	3.55
5	3.10	2.85	2.30	3.85	5.60	7.95	6.60	2.55	1.35	.90	1.40	3.30
6	3.00	2.85	4.20	4.60	4.90	8.00	6.35	2.50	1.40	.80	1.30	3.00
7	3.70	2.70	7.30	3.90	5.00	6.50	6.10	2.45	1.40	.70	2.25	2.85
8	4.40	2.50	7.30	3.50	4.60	5.80	5.60	2.40	1.40	.65	2.60	2.75
9	4.50	2.40	5.90	4.15	4.40	6.40	5.60	2.15	1.40	.60	1.95	2.50
10	4.10	2.20	5.75	5.80	4.60	6.00	5.65	2.00	1.65	.55	1.70	2.40
11	5.00	2.15	4.80	6.95	4.55	5.60	5.35	1.90	1.80	1.60	1.35	2.85
12	5.00	2.20	3.40	8.25	4.90	6.05	5.10	1.85	1.00	2.00	1.20	2.80
13	9.50	2.10	3.25	9.45	5.60	6.10	4.35	1.80	.95	1.50	1.15	3.30
14	10.60	2.00	3.15	9.60	6.55	7.30	3.90	1.85	.95	1.40	1.15	8.80
15	7.50	1.90	2.95	7.95	6.10	7.35	4.10	1.85	.90	.95	2.80	9.10
16	6.35	1.85	2.90	7.65	5.70	7.20	4.20	1.80	.90	1.35	3.20	7.30
17	5.85	1.90	2.90	6.85	5.95	6.70	4.85	1.75	.90	1.80	5.80	7.45
18	5.20	1.80	2.85	6.75	6.85	8.30	4.30	1.65	.90	1.45	4.40	8.20
19	5.55	1.90	2.70	6.90	6.55	7.10	3.85	1.65	.85	1.70	7.40	8.50
20	4.00	1.85	2.65	7.10	6.40	6.65	3.90	1.55	.80	1.50	9.25	6.15
21	3.85	2.40	2.60	7.20	7.25	6.50	3.95	1.50	.70	1.45	9.45	5.35
22	3.70	2.80	2.60	6.50	7.90	6.20	4.05	1.40	.90	1.40	10.60	4.40
23	3.35	3.35	2.35	5.90	7.50	5.65	3.75	1.35	.90	1.40	7.00	4.20
24	3.75	2.85	2.20	5.25	7.10	5.10	3.40	1.30	.85	1.25	5.35	3.75
25	2.45	2.55	2.10	5.20	6.45	5.20	3.25	1.25	.80	1.15	5.80	3.35
26	3.20	2.35	2.00	5.40	6.55	6.00	3.20	1.25	.80	1.05	6.15	3.15
27	3.60	2.40	1.95	7.30	6.95	6.40	3.35	1.20	.80	.95	7.20	2.90
28	2.90	2.25	1.95	8.10	7.35	6.80	3.05	1.40	.80	.90	7.60	3.20
29	2.75	2.20	2.30	8.90	7.10	7.00	3.00	1.60	2.10	.70	6.40	3.60
30	2.70	.....	2.70	6.60	7.05	7.45	2.60	1.40	1.50	1.00	6.30	4.40
31	2.60	.....	2.50	.....	6.50	.....	2.75	1.25	.....	1.80	.....	4.15

Rating table for Skykomish River (South Fork) near Index, Wash., from January 1 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
0.40	340	1.90	810	3.40	1,550	5.60	3,045
.50	360	2.00	855	3.50	1,605	5.80	3,205
.60	385	2.10	900	3.60	1,660	6.00	3,375
.70	410	2.20	945	3.70	1,715	6.20	3,555
.80	435	2.30	990	3.80	1,775	6.40	3,740
.90	460	2.40	1,035	3.90	1,835	6.60	3,930
1.00	490	2.50	1,080	4.00	1,900	6.80	4,130
1.10	520	2.60	1,130	4.20	2,035	7.00	4,340
1.20	550	2.70	1,180	4.40	2,175	7.50	4,890
1.30	580	2.80	1,230	4.60	2,315	8.00	5,450
1.40	615	2.90	1,280	4.80	2,455	8.50	6,050
1.50	650	3.00	1,330	5.00	2,595	9.00	6,670
1.60	685	3.10	1,385	5.20	2,740	9.50	7,320
1.70	725	3.20	1,440	5.40	2,890	10.00	7,970
1.80	765	3.30	1,495				

The above table is applicable only for open-channel conditions. It is based upon 12 discharge measurements made during 1902 and 1903. It is well defined between gage heights 1.20 feet and 8.60 feet. The table has been extended beyond these limits. Above gage height 8.80 feet the rating curve is a tangent, the difference being 130 per tenth. This is a revision of the 1903 table.

Estimated monthly discharge of Skykomish River (South Fork) near Index, Wash., for 1904.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January	8,750	945	2,321	142,700
February	1,522	765	1,027	59,070
March	4,670	810	1,530	94,080
April	7,450	1,058	3,682	219,100
May	5,330	2,175	3,518	216,300
June	5,810	2,665	4,047	240,800
July	4,340	1,058	2,382	146,500
August	1,255	550	805	49,500
September	900	410	532	31,660
October	855	372	553	34,000
November	8,750	535	2,552	151,900
December	6,800	1,035	2,525	155,300
The year	8,750	372	2,123	1,541,000

SNOQUALMIE RIVER NEAR SNOQUALMIE FALLS, WASH.

This station was originally established by T. A. Noble on September 14, 1902. The gage was then located below the falls, but was destroyed by the flood of December 1, 1902. On November 2 another gage was placed about 3 miles above Snoqualmie Falls post-office. The gage consisted of a plain staff graduated to feet and tenths, and reading to hundredths of a foot by means of a hook gage. The elevation of the zero on the gage was assumed to be 100.00 feet. The gage was fastened to an alder tree. January 3, 1903, this gage was washed out and on January 7 was replaced by a gage in two parts, 7 and 8 feet long, respectively. The elevation of the zero of the gage is 100.06 feet. The bench mark is on a large maple stump on the right bank. It consists of a spike driven into the stump about 4 feet from the ground. Its elevation is 127.89, or 27.83 feet above the zero of the gage. This is also the initial point for the soundings. The right bank is high and never overflows; the left bank overflows at extreme high water. The bed of the stream is of gravel and sand and is not liable to shift. The station is located below the junction of the north, south, and middle forks of the Snoqualmie River. At Snoqualmie Falls, about 4 miles below this station, the river flows over a precipice 268 feet high. Above the falls the Snoqualmie Falls Power Company has built a dam and water-power plant. The slack water from this dam reaches back from the falls about 3 miles and probably affects the flow of the river slightly at the gaging station. This is the only possible location for a gaging station which will include all three forks of the river.

On August 14, 1902, the dam below the station was raised 4 feet, backing up the water on the gage. This affected the gage height from August 14 to October 5, 1903, at which time the dam was washed out.

The observations at this station during 1904 have been made under the direction of T. A. Noble, district engineer.

Mean daily gage height, in feet, of Snoqualmie River near Snoqualmie Falls, Wash., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.40	2.80	2.40	3.20	4.70	5.20	5.60	1.95	1.00	1.10	1.60	4.30
2	3.40	2.60	2.25	3.20	4.40	5.00	5.65	1.90	.95	1.00	1.60	4.05
3	3.15	2.55	2.30	3.15	4.40	5.15	5.25	1.85	.80	.90	1.65	3.60
4	3.55	2.75	2.55	3.10	4.45	5.50	4.65	1.75	.80	.80	1.80	3.25
5	3.20	3.15	3.45	3.70	4.30	6.00	4.30	1.65	.80	.70	1.55	2.70
6	3.10	3.10	5.20	5.25	4.10	6.25	4.10	1.65	.80	.65	1.60	2.70
7	4.00	2.90	8.30	4.00	4.00	5.70	4.00	1.65	.80	.60	1.75	2.50
8	4.70	2.75	6.80	4.20	3.95	4.35	3.70	1.60	.90	.55	2.10	2.50
9	4.60	2.60	5.30	4.30	3.65	4.35	3.65	1.50	1.00	.65	2.00	2.60
10	4.35	2.35	4.55	4.90	3.70	4.55	3.60	1.40	1.00	.70	1.70	3.35
11	4.30	2.35	4.05	5.00	3.85	4.75	3.20	1.30	.90	.80	1.45	3.15
12	10.65	2.40	3.70	8.45	4.20	4.80	2.80	1.20	.80	1.75	1.35	2.85
13	10.75	2.40	3.45	9.80	4.90	5.25	2.70	1.20	.75	1.70	1.40	2.90
14	12.45	2.35	3.30	9.50	5.75	5.40	2.70	1.20	.75	1.30	1.20	4.60
15	5.65	2.30	3.05	8.50	5.20	5.35	2.70	1.20	.70	1.05	1.50	10.30
16	6.40	2.35	2.90	7.30	4.45	5.40	3.25	1.20	.65	1.75	3.00	6.95
17	5.95	2.20	2.90	6.05	4.75	6.40	3.20	1.15	.60	2.70	4.20	6.35
18	5.15	2.15	2.85	5.85	5.00	6.45	2.90	1.10	.60	2.00	3.90	5.25
19	4.25	2.10	2.90	5.10	5.85	6.10	2.80	1.10	.60	1.95	3.50	5.25
20	4.00	2.10	2.90	6.20	5.50	6.25	2.80	1.05	.60	1.90	12.80	5.20
21	4.00	2.10	2.70	6.90	6.20	5.40	2.80	1.00	.55	1.85	10.20	5.20
22	4.10	4.50	2.60	6.00	6.10	5.00	2.80	.95	.60	1.80	9.55	4.70
23	4.15	4.10	2.45	5.20	6.00	4.55	2.75	.90	.65	1.45	6.45	4.10
24	3.90	3.45	2.30	4.65	5.60	3.90	2.65	.90	.60	1.30	6.55	3.60
25	3.80	3.10	2.20	4.50	5.00	4.00	2.40	.85	.60	1.20	6.80	3.30
26	3.50	2.80	2.10	4.55	5.15	4.40	2.30	.85	.55	1.05	6.05	3.15
27	3.30	2.70	2.05	5.40	5.70	4.85	2.20	.85	.50	.90	6.70	3.25
28	3.10	2.60	2.60	6.65	5.70	5.10	2.05	.95	.70	.90	6.30	5.35
29	3.00	2.55	3.35	7.00	5.60	5.35	2.00	1.10	1.60	.85	5.65	7.15
30	2.85	.....	3.30	6.00	5.60	5.60	1.90	1.05	1.50	1.00	4.60	6.20
31	2.75	.....	3.25	.....	5.45	.....	1.90	1.00	.....	1.55	.....	4.75

Rating table for Snoqualmie River near Snoqualmie Falls, Wash., from January 1 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
0.50	570	2.40	1,200	4.30	2,595	7.40	6,330
.60	590	2.50	1,250	4.40	2,690	7.60	6,610
.70	610	2.60	1,300	4.50	2,790	7.80	6,890
.80	630	2.70	1,360	4.60	2,890	8.00	7,170
.90	660	2.80	1,420	4.70	2,990	8.50	7,870
1.00	670	2.90	1,480	4.80	3,090	9.00	8,570
1.10	690	3.00	1,540	4.90	3,190	9.50	9,270
1.20	710	3.10	1,610	5.00	3,290	10.00	9,970
1.30	730	3.20	1,680	5.20	3,510	10.50	10,670
1.40	760	3.30	1,750	5.40	3,730	11.00	11,370
1.50	790	3.40	1,830	5.60	3,970	12.00	12,770
1.60	830	3.50	1,910	5.80	4,210	13.00	14,170
1.70	870	3.60	1,990	6.00	4,450	14.00	15,570
1.80	910	3.70	2,070	6.20	4,710	15.00	16,970
1.90	950	3.80	2,150	6.40	4,970	16.00	18,370
2.00	1,000	3.90	2,235	6.60	5,230	17.00	19,770
2.10	1,050	4.00	2,325	6.80	5,490	18.00	21,170
2.20	1,100	4.10	2,415	7.00	5,770	19.00	22,570
2.30	1,150	4.20	2,505	7.20	6,050	20.00	23,970

The above table is applicable only for open-channel conditions. It is based upon discharge measurements made during 1902–1903. It is well defined to gage height 8.70 feet. Above gage height 6.80 feet the rating curve is a tangent, the difference being 140 per tenth.

Estimated monthly discharge of Snoqualmie River near Snoqualmie Falls, Wash., for 1904.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January	13,400	1,390	3,298	202,300
February	2,790	1,050	1,394	80,180
March	7,590	1,025	1,961	120,600
April	9,690	1,610	4,215	250,800
May	4,710	2,030	3,288	202,200
June	4,970	2,235	3,567	212,200
July	4,030	950	1,799	110,600
August	975	640	741	45,600
September	830	570	630	37,500
October	1,360	580	754	46,400
November	13,890	710	3,055	181,800
December	10,390	1,250	2,887	177,500
The year	13,890	570	2,299	1,668,000

MISCELLANEOUS MEASUREMENTS IN PUGET SOUND DRAINAGE BASIN.

The following miscellaneous discharge measurements were made in the Puget Sound drainage basin in 1901 and 1903 by J. H. Cunningham, C. E., of Portland, Oreg.:

Miscellaneous measurements in Puget Sound drainage basin.

Date.	Stream.	Locality.	Gage height.	Discharge.
			Feet.	*Sec.-feet.*
Aug. 23, 1901	Green River	Kanasket, Wash		350
Sept. 1, 1901	do	do		238
Sept. 7, 1901	do	do		196
Oct. 8, 1901	do	do	0.0	179
July 21, 1901	Nesqually River	1 mile above Elbe, Wash		773
Oct. 4, 1901	do	do	.0	352
Sept. 19, 1901	do	Highway bridge near Yelm Prairie, Wash.		565
Oct. 7, 1901	do	do	.0	483
Sept. 15, 1901	Puyallup River	Puget Sound Power Co.'s gaging station, Wash.	.8	304
Jan. 18, 1903	do	do	.0	250
Feb. 23, 1903	do	do	8.0	9,560
July 28, 1901	Skykomish River	2 miles above Index, Wash		2,047
Aug. 26, 1901	do	do		942
Sept. 17, 1901	do	do	.0	606
Oct. 6, 1901	White River	Buckley, Wash		517

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