Water-Supply and Irrigation Paper No. 178 Series P, Hydrographic Progress Reports, 54

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

REPORT

OF

PROGRESS OF STREAM MEASUREMENTS

FOR

THE CALENDAR YEAR 1905

PREPARED UNDER THE DIRECTION OF F. H. NEWELL

PART XIV.—Columbia River and Puget Sound Drainages

BY

D. W. ROSS, J. T. WHISTLER, and T. A. NOBLE

WASHINGTON
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INTRODUCTION.

ORGANIZATION AND SCOPE OF WORK.

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. The first specific appropriation for gaging streams was made by the act of August 18, 1894, which contained an item of $12,500 "for gauging 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." (28 Stat. L., p. 398.)

Since that time the appropriations have been gradually increased, as shown by the following table:

Annual appropriation for hydrographic surveys, fiscal years ending June 30, 1895 to 1906.

1895	$12,500	1901	$100,000
1896	20,000	1902	100,000
1897	50,000	1903	200,000
1898	50,000	1904	200,000
1899	50,000	1905	200,000
1900	50,000	1906	200,000

As a result of the increased appropriations the work has been greatly extended, and at the same time it has been more thoroughly sytemized by the adoption of standard methods and by grouping the States into districts, in each of which a district hydrographer and a corps of assistants carry on a comprehensive study of the hydrographic resources.

The chief features of the hydrographic work are the collection of data relating to the flow of the surface waters and the study of the conditions affecting this flow. Information is also collected concerning river profiles, duration and magnitude of floods, water power, etc., which may be of use in hydrographic studies. This work includes the study of the hydrography of every important river basin in the United States, and is of direct value in the commercial and agricultural development of the country.

In order to collect the material from which estimates of daily flow are made, gaging stations are established. The selection of a site for a gaging station and the length of time it is maintained depend largely on the physical features and the needs of each locality. If the water is to be used for power, special effort is made to obtain information concerning the minimum flow; if water is to be stored, the maximum flow receives special attention.

In all sections of the country permanent gaging stations are maintained for general statistical purposes, to show the conditions existing through long periods. They are also used as primary stations, and their records, in connection with short series of measurements, serve as bases for estimating the flow at other points in the drainage basin.

During the calendar year 1905 the division of hydrography has continued measuring the flow of streams on the same general lines as in previous years. Many new and improved methods have been introduced, by which the accuracy and value of the results have been increased. Approximately 800 regular gaging stations were maintained during the year, and an exceptionally large number of miscellaneous measurements and special investigations were made. "The Report of Progress of Stream Measurements," which contains the results of this work, is published in a series of fourteen Water-Supply and Irrigation Papers, Nos. 165–178, as follows:

No. 165. Atlantic coast of New England drainage.
No. 166. Hudson, Passaic, Raritan, and Delaware river drainages.
No. 167. Susquehanna, Gunpowder, Patapsco, Potomac, James, Roanoke, and Yadkin river drainages.
No. 168. Santee, Savannah, Ogeechee, and Altamaha rivers, and eastern Gulf of Mexico drainages.
No. 169. Ohio and lower eastern Mississippi river drainages.
No. 170. Great Lakes and St. Lawrence River drainages.
No. 171. Hudson Bay, and upper eastern and western Mississippi River drainages.
No. 172. Missouri River drainage.
No. 173. Meramec, Arkansas, Red, and lower western Mississippi river drainages.
No. 174. Western Gulf of Mexico and Rio Grande drainages.
No. 175. Colorado River drainage.
No. 176. Great Basin drainage.
No. 177. Great Basin and Pacific Ocean drainages in California.
No. 178. Columbia River and Puget Sound drainages.

These papers embody the data collected at the regular gaging stations, the results of the computations based on the observations, and such other information as may have a direct bearing on the study of the subject, and include, as far as practicable, descriptions of the basins and the streams draining them.

For the purpose of introducing uniformity into the reports for the various years, the drainages of the United States have been divided into eleven grand divisions, which have been again divided into secondary divisions, as shown in the following list. The Progress Report has been made to conform to this arrangement, each part containing the data for one or more of the secondary divisions. The secondary divisions have in most cases been redivided, and the facts have been arranged, as far as practicable, geographically.

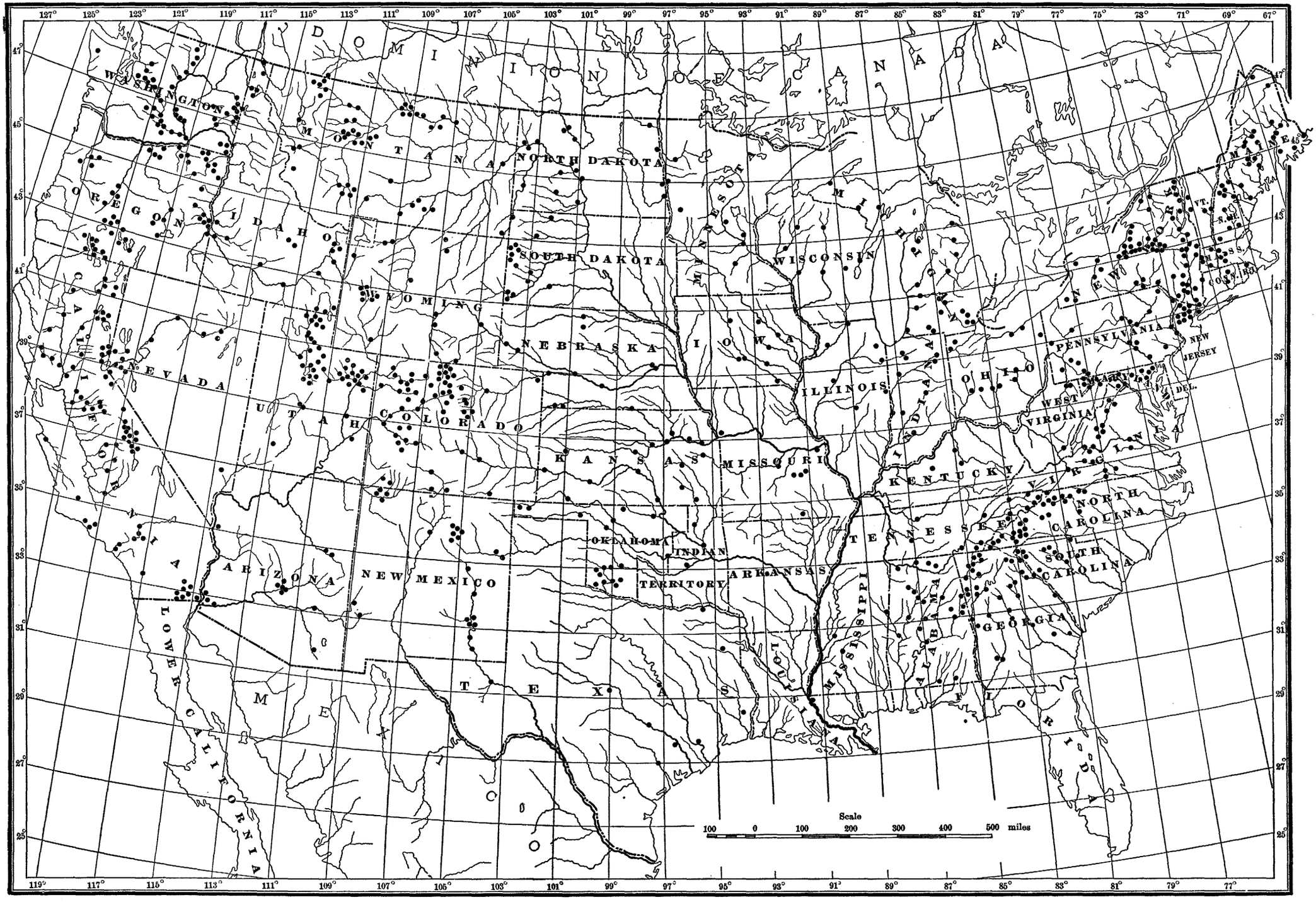
Drainage basins in the United States.

NORTHERN ATLANTIC DRAINAGE BASINS.

St. John.	Thames.
St. Croix.	Housatonic.
Penobscot.	Hudson.
Kennebec.	Passaic.
Androscoggin.	Raritan.
Presumpscot.	Delaware.
Saco.	Susquehanna.
Merrimac.	Potomac.
Connecticut.	Minor Chesapeake Bay.
Blackstone.	Minor northern Atlantic.

SOUTHERN ATLANTIC DRAINAGE BASINS.

James.	Great Pedee (Yadkin).
Chowan.	Santee.
Roanoke.	Savannah.
Tar.	Ogeechee.
Neuse.	Altamaha.
Cape Fear.	Minor southern Atlantic.



MAP OF THE UNITED STATES, SHOWING LOCATION OF PRINCIPAL RIVER STATIONS MAINTAINED DURING 1905.

EASTERN GULF OF MEXICO DRAINAGE BASINS.

Suwanee.
Apalachicola.
Mobile.
Pearl.
Minor eastern Gulf of Mexico.

EASTERN MISSISSIPPI RIVER DRAINAGE BASINS.

Lower eastern Mississippi.
Ohio.
Upper eastern Mississippi.

ST. LAWRENCE RIVER DRAINAGE BASINS.

Lake Superior.
Lake Michigan.
Lake Huron.
Lake St. Clair.
Lake Erie.
Niagara River.
Lake Ontario.
Lake Champlain (Richelieu River).
Minor St. Lawrence.

WESTERN MISSISSIPPI RIVER DRAINAGE BASINS.

Upper western Mississippi.
Missouri.
Meramec.
Lower western Mississippi.
Arkansas.
Red.

WESTERN GULF OF MEXICO DRAINAGE BASINS.

Sabine.
Neches.
Trinity.
Brazos.
Colorado (of Texas).
Guadalupe.
San Antonio.
Nueces.
Rio Grande.
Minor western Gulf of Mexico.

COLORADO RIVER DRAINAGE BASIN.

GREAT BASIN.

Wasatch Mountains.
Humboldt.
Sierra Nevada.
Minor streams in Great Basin.

PACIFIC COAST DRAINAGE BASINS.

Southern Pacific.
San Francisco Bay.
Northern Pacific.
Columbia.
Puget Sound.

HUDSON BAY DRAINAGE BASINS.

DEFINITIONS.

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

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

"Gallons per minute" is generally used in connection with pumping and city water supply.

The "miner's inch" is the rate of discharge of water passing through an orifice 1 inch square under a head which varies locally. It has been commonly used by miners and irrigators throughout the West, and is defined by statute in each State in which it is used. In most States the California miner's inch is used, which is the fiftieth part of a second-foot.

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

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

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

EXPLANATION OF TABLES.

For each regular gaging 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, based on all the facts obtained to date.

The descriptions of stations give such general information about the locality and equipment as would enable the reader to find and use the station. 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, including the date, the name of the hydrographer, the gage height, the area of cross section, the mean velocity, and the discharge in second-feet.

The table of daily gage heights gives the daily fluctuations of the surface of the river as found from the mean of the gage readings taken each day. The gage height given in the table represents the elevation of the surface of the water above the zero of the gage. At most 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 monthly discharge, the column headed "Maximum" gives the mean flow for the day when the mean gage height was highest; this 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" is the average flow for each second during the month. On this the computations for the three remaining columns, which are defined above, 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 be expressed by at least two and not more than four significant figures.
3. Any measurement in a vertical velocity, mean velocity, or discharge curve whose per cent of error is five times the average per cent of 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 is 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.

Special rules for computation.

1. Rating tables are to be constructed as closely as the data on 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 to at least three significant figures, except in the case of decimals where the first significant figure is preceded by one or more naughts (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.

CONVENIENT EQUIVALENTS.

1 second-foot equals 50 California miner's inches.
1 second-foot equals 38.4 Colorado miner's inches.
1 second-foot equals 40 Arizona miner's inches.
1 second-foot equals 7.48 United States gallons per second; equals 448.8 gallons per minute; equals 646,272 gallons for one day.
1 second-foot equals 6.23 British imperial gallons per second.
1 second-foot for one year covers 1 square mile 1.131 feet deep, 13.572 inches deep.
1 second-foot for one year equals 0.000214 cubic mile; equals 31,536,000 cubic feet.
1 second-foot equals about 1 acre-inch per hour.
1 second-foot falling 10 feet equals 1.136 horsepower.
100 California miner's inches equal 15 United States gallons per second.
100 California miner's inches equal 77 Colorado miner's inches.
100 California miner's inches for one day equal 4 acre-feet.
100 Colorado miner's inches equal 2.60 second-feet.
100 Colorado miner's inches equal 19.5 United States gallons per second.
100 Colorado miner's inches equal 130 California miner's inches.
100 Colorado miner's inches for one day equal 5.2 acre-feet.
100 United States gallons per minute equal 0.223 second-foot.
100 United States gallons per minute for one day equal 0.44 acre-foot.
1,000,000 United States gallons per day equal 1.55 second-feet.
1,000,000 United States gallons equal 3.07 acre-feet.
1,000,000 cubic feet equal 22.95 acre-feet.
1 acre-foot equals 325,850 gallons.
1 inch deep on 1 square mile equals 2,323,200 cubic feet.
1 inch deep on 1 square mile equals 0.0737 second-foot per year.
1 inch equals 2.54 centimeters.
1 foot equals 0.3048 meter.
1 yard equals 0.9144 meter.
1 mile equals 1.60935 kilometers.
1 mile equals 1,760 yards; equals 5,280 feet; equals 63,360 inches.
1 square yard equals 0.836 square meter.
1 acre equals 0.4047 hectare.
1 acre equals 43,560 square feet; equals 4,840 square yards.
1 acre equals 209 feet square, nearly.
1 square mile equals 259 hectares.
1 square mile equals 2.59 square kilometers.
1 cubic foot equals 0.0283 cubic meter.
1 cubic foot equals 7.48 gallons; equals 0.804 bushel.
1 cubic foot of water weighs 62.5 pounds.
1 cubic yard equals 0.7646 cubic meter.
1 cubic mile equals 147,198,000,000 cubic feet.
1 cubic mile equals 4,667 second-feet for one year.
1 gallon equals 3.7854 liters.
1 gallon equals 8.36 pounds of water.
1 gallon equals 231 cubic inches (liquid measure).
1 pound equals 0.4536 kilogram.
1 avoirdupois pound equals 7,000 grains.
1 troy pound equals 5,760 grams.
1 meter equals 39.37 inches. Log. 1.5951654.
1 meter equals 3.280833 feet. Log. 0.5159842.
1 meter equals 1.093611 yards. Log. 0.0388629.
1 kilometer equals 3,281 feet; equals five-eighths mile, nearly.
1 square meter equals 10,764 square feet; equals 1,196 square yards.

1 hectare equals 2.471 acres.
1 cubic meter equals 35.314 cubic feet; equals 1.308 cubic yards.
1 liter equals 1.0567 quarts.
1 gram equals 15.43 grains.
1 kilogram equals 2.2046 pounds.
1 tonneau equals 2,204.6 pounds.
1 foot per second equals 1,097 kilometers per hour.
1 foot per second equals 0.68 mile per hour.
1 cubic meter per minute equals 0.5886 second-foot.
1 atmosphere equals 15 pounds per square inch; equals 1 ton per square foot; equals 1 kilogram per square centimeter.
Acceleration of gravity equals 32.16 feet per second every second.
1 horsepower equals 550 foot-pounds per second.
1 horsepower equals 76 kilogram-meters per second.
1 horsepower equals 746 watts.
1 horsepower equals 1 second-foot falling 8.8 feet.
1⅛ horsepowers equal about 1 kilowatt.
To calculate water power quickly: $\frac{\text{Sec.-ft.} \times \text{fall in feet}}{11}$ = net horsepower on water wheel, realizing 80 per cent of the theoretical power.
Quick formula for computing discharge over weirs: Cubic feet per minute equals $0.4025\, lv\overline{h^3}$; l=length of weir in inches; h=head in inches flowing over weir, measured from surface of still water.
To change miles to inches on map:

Scale 1: 125,000, 1 mile=0.50688 inch.
Scale 1: 90,000, 1 mile=0.70400 inch.
Scale 1: 62,500, 1 mile=1.01376 inches.
Scale 1: 45,000, 1 mile=1.40800 inches.

FIELD METHODS OF MEASURING STREAM FLOW.

The methods used in collecting these data and in preparing them for publication are given in detail in Water-Supply Papers No. 94 (Hydrographic Manual, U. S. Geol. Survey) and No. 95 (Accuracy of Stream Measurements). In order that those who use this report may readily become acquainted with the general methods employed, the following brief descriptions are given:

Streams may be divided, with respect to their physical conditions, into three classes—(1) Those with permanent beds; (2) those with beds which change only during extreme low or high water; and (3) those with constantly shifting beds. In estimating the daily flow special methods are necessary for each class. The data on which these estimates are based and the methods of collecting them are, however, in general the same.

There are three distinct methods of determining the flow of open-channel streams—(1) By measurements of slope and cross section and the use of Chezy's and Kutter's formulas; (2) by means of a weir; and (3) by measurements of the velocity of the current and of the area of the cross section. The method chosen for any case depends on the local physical conditions, the degree of accuracy desired, the funds available, and the length of time that the record is to be continued.

Slope method.—Much information has been collected relative to the coefficients to be used in the Chezy formula, $v=c\sqrt{rs}$. This has been utilized by Kutter, both in developing his formula for c and in determining the values of the coefficient n which appears therein. The results obtained by the slope method are in general only roughly approximate, owing to the difficulty in obtaining accurate data and the uncertainty of the value for n to be used in Kutter's formula. The most common use of this method is in estimating the flood discharge of a stream when the only data available are the cross section, the slope as shown by marks along the bank, and a knowledge of the general conditions.

Weir method.—When funds are available and the conditions are such that sharp-crested weirs can be erected, these offer the best facilities for determining flow. If dams are suitably situated and constructed, they may be utilized for obtaining reliable estimates of flow. The conditions necessary to insure good results may be divided into two classes: (1) Those relating to the physical characteristics of the dam itself, and (2) those relating to the diversion and use of water around and through the dam.

The physical requirements are as follows: (*a*) Sufficient height of dam, so that backwater will not interfere with free fall over it; (*b*) absence of leaks of appreciable magnitude; (*c*) topography or abutments which confine the flow over the dam at high stages; (*d*) level crests which are kept free from obstructions caused by floating logs or ice; (*e*) crests of a type for which the coefficients to be used in $Q=c\,b\,h^{\frac{3}{2}}$, or some similar standard weir formula, are known (see Water-Supply Paper No. 150); (*f*) either no flashboards or exceptional care in reducing leakage through them and in recording their condition.

Preferably there should be no diversion of water through or around the dam. Generally, however, the dam is built for purposes of power or navigation, and part or all of the water flowing past it is diverted for such uses. This water is measured and added to that passing over the dam. To insure accuracy in such estimates, the amount of water diverted should be reasonably constant. Furthermore, it should be so diverted that it can be measured, either by a weir, a current meter, or a simple system of water wheels which are of standard make, or which have been rated as meters under working conditions and so installed that the gate openings, the heads under which they work, and their angular velocities may be accurately observed.

The combination of physical conditions and uses of the water should be such that the estimates of flow will not involve, for a critical stage of considerable duration, the use of a head on a broad-crested dam of less than 6 inches. Moreover, when all other conditions are good, the cooperation of the owners or operators of the plant is still essential if reliable results are to be obtained.

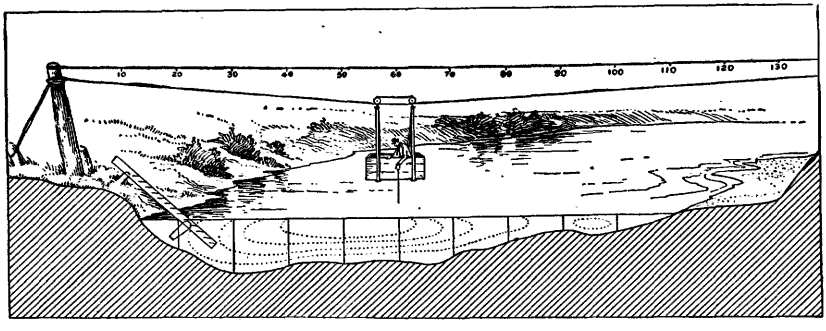


FIG. 1.—Cable station, showing section of river, car, gage, etc.

A gaging station at a weir or dam has the general advantage of continuity of record through the period of ice and floods and the disadvantages of uncertainty of coefficient to be used in the weir formula and of complications in the diversion and use of the water.

Velocity method.—The determination of the quantity of water flowing past a certain section of a stream at a given time is termed a discharge measurement. This quantity is the product of two factors—the mean velocity and the area of the cross section. The mean velocity is a function of surface slope, wetted perimeter, roughness of bed, and the channel conditions at, above, and below the gaging section. The area depends on the contour of the bed and the fluctuations of the surface. The two principal ways of measuring the velocity of a stream are by floats and current meters.

Great care is taken in the selection and equipment of gaging stations for determining discharge by velocity measurements in order that the data may have the required degree of accuracy. Their essential requirements are practically the same whether the velocity is determined by meters or floats. They are located as far as possible where the channel is straight both above and below the gaging section; where there are no cross currents, backwater, or boils; where the bed of the stream is reasonably free from large projections of a permanent character; and where the banks are high and subject to overflow only at flood stages. The station must be so far removed from the effects of tributary streams and dams or other artificial obstructions that the gage height shall be an index of the discharge.

Certain permanent or semipermanent structures, usually referred to as "equipment," are generally pertinent to a gaging station. These are a gage for determining the fluctuations of the water surface, bench marks to which the datum of the gage is referred, permanent marks on a bridge or a tagged line indicating the points of measurement, and, where the current is swift, some appliance (generally a secondary cable) to hold the meter in position in the water. As a rule, the stations are located at bridges if the channel conditions are satisfactory, as from them the observations can more readily be made and the cost of the equipment is small.

The floats in common use are the surface, subsurface, and tube or rod floats. A corked bottle with a flag in the top and weighted at the bottom makes one of the most satisfactory surface floats, as it is affected but little by wind. In case of flood measurements, good results can be obtained by observing the velocity of floating cakes of ice or débris. In case of all surface-float measurements coefficients must be used to reduce the observed velocity to the mean velocity. The subsurface and tube or rod floats are intended to give directly the mean velocity in the vertical. Tubes give excellent results when the channel conditions are good, as in canals.

In measuring velocity by a float, observation is made of the time taken by the float to pass over the "run," a selected stretch of river from 50 to 200 feet long. In each discharge measurement a large number of velocity determinations are made at different points across the stream, and from these observations the mean velocity for the whole section is determined. This may be done by plotting the mean positions of the floats as indicated by the distances from the bank as ordinates and the corresponding times as abscissas. A curve through these points shows the mean time of run at any point across the stream, and the mean time for the whole stream is obtained by dividing the area bounded by this curve and its axis by the width. The length of the run divided by the mean time gives the mean velocity.

The area used in float measurements is the mean of the areas at the two ends of the run and at several intermediate sections.

The essential parts of the current meters in use are a wheel of some type, so constructed that the impact of flowing water causes it to revolve, and a device for recording or indicating the number of revolutions. The relation between the velocity of the moving water and the revolutions of the wheel is determined for each meter. This rating is done by drawing the meter through still water for a given distance at different speeds, and noting the number of revolutions for each run. From these data a rating table is prepared which gives the velocity per second for any number of revolutions.

Many kinds of current meters have been constructed. They may, however, be classed in two general types—those in which the wheel is made up of a series of cups, as the Price, and those having a screw-propeller wheel, as the Haskell. Each meter has been developed for use under some special condition. In the case of the small Price meter, which has been largely developed and extensively used by the United States Geological Survey, an attempt has been made to get an instrument which could be used under practically all conditions.

Current-meter measurements may be made from a bridge, cable, boat, or by wading, and gaging stations may be classified in accordance with such use. Fig. 1 shows a typical cable station.

In making the measurement an arbitrary number of points are laid off on a line perpendicular to the thread of the stream. The points at which the velocity and depth are observed are known as measuring points, and are usually fixed at regular intervals, varying from 2 to 20 feet, depending on the size and condition of the stream. Perpendiculars dropped from the measuring points divide the gaging section into strips. For each strip or pair of strips the mean velocity, area, and discharge are determined independently, so that conditions existing in one part of the stream may not be extended to parts where they do not apply.

Three classes of methods of measuring velocity with current meters are in general use—multiple-point, single-point, and integration.

The three principal multiple-point methods in general use are the vertical velocity-curve; 0.2 and 0.8 depth; and top, bottom, and mid-depth.

In the vertical velocity-curve method a series of velocity determinations are made in each 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 among the resulting points, the vertical velocity curve is developed. This curve shows graphically the magnitude and changes in velocity from the surface to the bottom of the stream. The mean velocity in the vertical is then obtained by dividing the area bounded by this velocity curve and its axis by the depth. On account of the length of time required to make a complete measurement by this method, its use is limited to the determination of coefficients for purposes of comparison and to measurements under ice.

In the second multiple-point method the meter is held successively at 0.2 and 0.8 of the depth, and the mean of the velocities at these two points is taken as the mean velocity for that vertical. On the assumption that the vertical velocity curve is a common parabola with horizontal axis, the mean of the velocities at 0.22 and 0.79 of the depth will give (closely) the mean velocity in the vertical. Actual observations under a wide range of conditions show that this second multiple-point method gives the mean velocity very closely for open-water conditions where the depth is over 5 feet and the bed comparatively smooth, and moreover the indications are that it will hold nearly as well for ice-covered rivers.

In the third multiple-point method the meter is held at mid-depth, at 0.5 foot below the surafce, and at 0.5 foot above the bottom, and the mean velocity is determined by dividing by 6 the sum of the top velocity, four times the mid-depth velocity, and the bottom velocity. This method may be modified by observing at 0.2, 0.6, and 0.8 depth.

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 generally occurs 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, at which point the meter is held in a majority of the measurements. A large number of vertical velocity-curve measurements, taken on many streams and under varying conditions, show that the average coefficient for reducing the velocity obtained at 0.6 depth to mean velocity is practically unity.

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 effect of the wind or other disturbing influences. This is known as the subsurface method. The coefficient for reducing the velocity taken at the subsurface to the mean has been found to be from 0.85 to 0.95, depending on the stage, velocity, and channel conditions. The higher the stage the larger the coefficient. 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 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, and noting the number of revolutions and the time taken in the operation. This method has the advantage 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 in the velocity method of determining the discharge of a stream, depends on the stage of the river, which is observed on the gage, and on the general contour of the bed of the stream, which is determined by soundings. 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 streams 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 of value in obtaining the area for use in computations of high-water measurements, as accurate soundings are hard to obtain at high stages.

In computing the discharge measurements from the observed velocities and depths at various points of measurement 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 a double strip. The total discharge and the 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 determination of the flow of an ice-covered stream is difficult, owing to diversity and instability of conditions during the winter period and also to lack of definite information in regard to the laws of flow of water under ice. The method now employed is to make frequent discharge measurements during the frozen periods by the vertical velocity-curve method and to keep an accurate record of the conditions, such as the gage height to the surface of the water as it rises in a hole cut in the ice, the thickness and character of the ice, etc.

From these data an approximate estimate of the daily flow can be made by constructing a rating curve (really a series of curves) similar to that used for open channels, but considering, in addition to gage heights and discharge, the varying thickness of ice. Such data as are available in regard to this subject are published in Water-Supply Paper No. 146, pp. 141–148.

OFFICE METHODS OF COMPUTING RUN-OFF.

There are two principal methods of estimating run-off, depending on whether or not the bed of the stream is permanent.

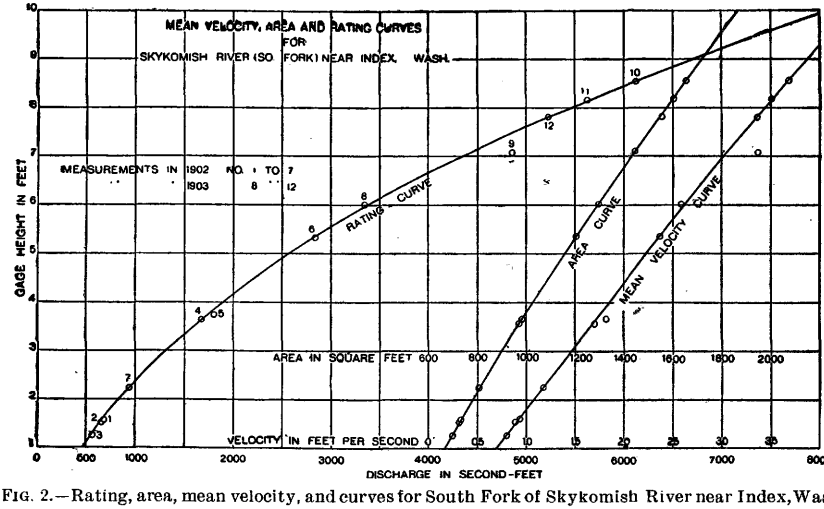


FIG. 2.—Rating, area, mean velocity, and curves for South Fork of Skykomish River near Index, Wash.

For stations on streams with permanent beds the first step in computing the run-off is the construction of a rating table, which shows the discharge corresponding to any stage of the stream. This rating table is applied to the record of stage to determine the amount of water flowing. The construction of the rating table depends on the method used in measuring flow.

For a station at a weir or dam the basis for the rating table is some standard weir formula. The coefficients to be used in its application depend on the type of dam and other conditions near its crest. After inserting in the weir formula the measured length of crest and the assumed coefficient the discharge is computed for various heads and the rating table constructed.

The data necessary for the construction of a rating table for a velocity-area station are the results of the discharge measurements, which include the record of stage of the river at the time of measurement, the area of the cross section, the mean velocity of the current, and the quantity of water flowing. A thorough knowledge of the conditions at and in the vicinity of the station is also necessary.

The construction of the rating table depends on the following laws of flow for open, permanent channels: (1) The discharge will remain constant so long as conditions at or near the gaging station remain constant; (2) the discharge will be the same whenever the stream is at a given stage if the change of slope due to the rise and fall of the stream be neglected; (3) the discharge is a function of and increases gradually with the stage.

The plotting of results of the various discharge measurements, using gage heights as ordinates, and discharge, mean velocity, and area as abscissas, will define curves which show the discharge, mean velocity, and area corresponding to any gage height. For the development of these curves there should be, therefore, a sufficient number of discharge measurements to cover the range of the stage of the stream. Fig. 2 shows a typical rating curve with its corresponding mean velocity and area curves.

As the discharge is the product of two factors, the area and the mean velocity, any change in either factor will produce a corresponding change in the discharge. Their curves are therefore constructed in order to study each independently of the other.

The area curve can be definitely determined from accurate soundings extending to the limits of high water. It is always concave toward the horizontal axis or on a straight line, unless the banks of the stream are overhanging.

The form of the mean velocity curve depends chiefly on the surface slope, the roughness of the bed, and the cross section of the stream. Of these, the slope is the principal factor. In accordance with the relative changes of these factors the curve may be either a straight line, convex or concave toward either axis, or a combination of the three. From a careful study of the conditions at any gaging station the form which the vertical velocity curve will take can be predicted, and it may be extended with reasonable certainty to stages beyond the limits of actual measurements. Its principal use is in connection with the area curve in locating errors in discharge measurements and in constructing the rating table.

The discharge curve is defined primarily by the measurements of discharge, which are studied and weighted in accordance with the local conditions existing at the time of each measurement. The curve may, however, best be located between and beyond the measurements by means of curves of area and mean velocity. The discharge curve under normal conditions is concave toward the horizontal axis and is generally parabolic in form.

In the preparation of the rating table the discharge for each tenth or half tenth on the gage is taken from the curve. The differences between successive discharges are then taken and adjusted according to the law that they shall either be constant or increasing.

The determination of daily discharge of streams with changeable beds is a difficult problem. In case there is a weir or dam available, a condition which seldom exists on streams of this class, estimates can be obtained by its use. In case of velocity-area stations frequent discharge measurements must be made if the estimates are to be other than rough approximations. For stations with beds which shift slowly or are materially changed only during floods rating tables can be prepared for periods between such changes and satisfactory results obtained with a limited number of measurements, provided that some of them are taken soon after the change occurs. For streams with continually shifting beds, such as the Colorado and Rio Grande, discharge measurements should be made every two or three days and the discharges for intervening days obtained either by interpolation modified by gage height or by Professor Stout's method, which has been described in full in the Nineteenth Annual Report of the United States Geological Survey, Part IV, page 323, and in the Engineering News of April 21, 1904. This method, or a graphical application of it, is also much used in estimating flow at stations where the bed shifts but slowly.

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 is a list, arranged alphabetically by States, of the hydrographers and others who have assisted in furnishing and preparing the data contained in this report:

Idaho.—Supervising engineer, D. W. Ross,[a] assisted by L. C. LaRue, William G. Davies, and J. B. Bond. Acknowledgments and thanks are due the Oregon Short Line Railroad for transportation furnished the district engineer and his assistants.

Montana.—District engineer, C. C. Babb,[b] assisted by L. R. Stockman, H. M. Morse, and J. H. Sloan. Acknowledgments are due the Northern Pacific Railway for transportation furnished the hydrographers.

Oregon.—District engineer, John T. Whistler,[c] assisted by Wilbur C. Sawyer, E. N. Smith, Ivan Landes, and R. S. Hall. Acknowledgments and thanks are due the Oregon Railroad and Navigation Company, Southern Pacific Company, Oregon Short Line Railroad, Sumpter Valley Railway, and Columbia Southern Railway for transportation; to W. G. McDonald for the use of his ferry cable on John Day River as a gaging station, and to the Deschutes Irrigation and Power Company, Bend, Oreg., for voluntary gage readings.

Washington.—District engineer, T. A. Noble, assisted by W. J. Lightfoot, W. C. Muldrow, and others. 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.

Wyoming.—District hydrographer, M. C. Hinderlider,[d] 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 Valley railroads.

COLUMBIA RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

Next to the Colorado, Columbia River drains the largest area of all the rivers in the arid region, its drainage including 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 its discharge 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.

Columbia River for most of its length in Washington and Oregon flows through a deep canyon, and can not be economically diverted for irrigation to any considerable extent, though there is one point at Priest Rapids where a very large amount of power can be economically developed and considerable land irrigated by gravity and a water-power pumping plant.

The tributaries which do not flow through deep canyons are extensively used for irrigation, and afford many opportunities for the installation of large water-power plants and extensive irrigation development in the future.

The following pages give the results of data collected in the Columbia River drainage basin during 1905.

COLUMBIA RIVER NEAR JULIA, WASH.

This station was established by the Reclamation Service March 1, 1905, for the study of the regimen of rise and fall of Columbia River, and was discontinued October 1, 1905. It is located near Koppen's house, at Wahluke, near Julia, Wash.

The channel is straight for 4,000 feet above and 3,000 feet below the station. The current is sluggish. Both banks are high, rocky, clean, and not liable to overflow during high water.

The gage is on the north bank of the river, and is in two sections. The lower is an inclined staff, graduated to read direct to 20 feet, and the upper is a vertical staff, graduated from 20 to 24 feet. The bench mark is a spike nail driven into the base log at the southwest corner of the observer's house, 600 feet northeast of the gage; elevation, 39.52 feet above gage datum. The gage is read twice each day by Jennie C. Koppen.

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[a] Office of supervising engineer, Boise, Idaho.
[b] District office for 1906 will be at Huntley, Mont., H. M. Morse, hydrographer in charge.
[c] District office for Oregon and Washington, 1906, will be 351 Washington street, Portland, Oreg., J. C. Stevens, hydrographer in charge.
[d] Office of the district hydrographer, Chamber of Commerce Building, Denver, Colo.

Daily gage height, in feet, of Columbia River near Julia, Wash., for 1905.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	2.0	4.8	7.45	12.2	14.3	11.75	7.62
2	2.28	4.78	7.5	12.52	14.12	11.7	7.4
3	2.22	4.77	7.58	13.12	14.0	11.62	7.22
4	2.42	4.7	7.6	13.7	13.92	11.52	7.12
5	2.58	4.7	7.6	14.05	13.88	11.45	6.95
6	2.7	4.65	7.68	14.08	13.82	11.45	6.78
7	2.88	4.6	7.8	14.88	13.72	11.4	6.62
8	3.0	4.65	7.95	15.15	13.55	11.35	6.5
9	3.15	4.7	8.18	15.55	13.4	11.3	6.38
10	3.32	4.7	8.48	15.98	13.3	11.25	6.35
11	3.52	4.75	8.7	16.28	13.25	11.2	6.28
12	3.8	4.75	9.0	16.48	13.2	11.15	6.18
13	3.8	4.75	9.0	16.55	13.15	11.0	6.15
14	3.88	4.82	9.1	16.72	13.1	11.98	6.15
15	3.9	4.88	9.2	16.85	13.02	10.88	6.13
16	3.98	4.92	9.35	16.9	12.92	10.88	6.08
17	3.96	4.98	9.48	16.75	12.88	10.78	6.0
18	3.98	5.0	9.68	16.4	12.78	10.62	5.98
19	4.0	5.0	9.92	16.28	12.68	10.45	5.88
20	4.12	5.08	10.1	16.15	12.5	10.15	5.82
21	4.4	5.18	10.08	15.85	12.25	9.9	5.75
22	4.45	5.35	10.12	15.65	12.12	9.65	5.75
23	4.6	5.55	10.35	15.48	11.98	9.45	5.7
24	4.7	5.9	10.42	15.4	11.92	9.2	5.65
25	4.75	6.52	10.5	15.32	11.88	8.98	5.65
26	4.7	6.78	10.75	15.22	11.78	8.68	5.65
27	4.77	7.05	10.92	15.1	11.78	8.45	5.68
28	4.75	7.42	11.2	14.8	11.73	8.25	5.78
29	4.8	7.6	11.48	14.68	11.75	8.05	5.95
30	4.8	7.5	11.75	14.5	11.75	7.85	6.12
31	4.77	.....	11.95	.....	11.75	7.73	.....

COLUMBIA RIVER NEAR PASCO, WASH.

This station was established October 15, 1904, by C. B. Cox. It is located at the bridge of the Northern Pacific Railway 1.2 miles from Pasco, Wash.

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 movements of the boat affect the measurements.

Discharge measurements are made by means of a boat held from the bridge by a one-fourth inch rope cable 400 feet long. The meter is lowered 2 feet above the bow of the boat, over a roller on a projecting plank, and is controlled by a windlass. The initial point for soundings is 400 feet below the railway bridge, opposite the center of the east pier.

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. 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; elevation, 349.78 feet above sea level and

42.03 feet above 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.

A description of this station, with gage heights and discharge data, is contained in Water-Supply Paper No. 135 of the United States Geological Survey, pages 24–25.

Daily gage height, in feet, of Columbia River near Pasco, Wash., for 1905.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	7.7	7.6	7.9	10.9	14.1	18.8	20.5	16.9	12.7	11.2	10.4	8.9
2	7.8	7.4	8.0	10.9	13.9	19.4	20.3	16.9	12.5	11.3	10.3	8.9
3	7.8	7.3	8.1	10.8	13.8	20.0	20.1	16.9	12.3	11.3	10.2	8.9
4	7.8	7.3	8.4	10.8	13.9	20.7	20.0	16.8	12.2	11.5	10.1	8.8
5	7.7	7.2	8.7	10.7	13.9	21.2	19.8	16.7	12.0	11.8	10.0	8.7
6	7.7	7.2	9.0	10.6	14.0	21.6	19.6	16.6	11.9	11.9	10.0	8.7
7	7.6	7.0	9.2	10.5	14.0	21.9	19.4	16.6	11.7	12.1	9.9	8.6
8	7.6	6.8	9.3	10.5	14.0	22.1	19.2	16.6	11.6	12.2	9.8	8.6
9	7.6	6.8	9.5	10.7	14.2	22.4	19.1	16.6	11.3	12.3	9.7	8.6
10	7.5	6.9	9.6	10.8	14.7	22.8	19.1	16.5	11.3	12.4	9.6	8.6
11	7.4	7.0	9.8	11.0	15.3	23.0	19.0	16.4	11.2	12.3	9.5	8.5
12	7.3	6.7	10.0	10.9	15.5	23.2	19.0	16.3	11.2	12.1	9.5	8.4
13	7.3	6.4	10.2	10.9	15.6	23.3	18.9	16.2	11.2	12.1	9.5	8.3
14	7.2	6.5	10.2	10.9	15.6	23.4	18.9	16.1	11.1	12.0	9.4	8.2
15	7.1	6.3	10.2	10.9	15.6	23.4	18.9	16.0	11.1	11.9	9.3	8.2
16	7.0	6.2	10.3	10.9	15.6	23.3	18.5	15.9	11.0	11.8	9.2	8.2
17	6.9	6.4	10.2	10.9	15.6	23.0	18.4	15.8	11.0	11.7	9.2	8.1
18	6.8	6.5	10.2	11.0	15.8	22.9	18.2	15.7	10.9	11.5	9.1	8.1
19	6.9	6.6	10.4	11.1	16.1	22.6	18.1	15.6	10.9	11.3	9.1	8.1
20	7.0	6.7	10.5	11.2	16.3	22.4	18.0	15.1	10.9	11.1	9.0	8.1
21	7.0	6.7	10.6	11.4	16.6	22.2	17.9	15.0	10.8	11.2	9.0	8.0
22	7.1	6.8	10.7	11.7	16.8	22.0	17.5	14.9	10.8	11.1	9.0	8.0
23	7.1	7.2	10.8	12.0	16.9	22.8	17.3	14.6	10.7	11.0	9.0	8.0
24	7.2	7.4	10.8	12.3	16.9	21.6	17.1	14.3	10.6	10.9	9.0	7.9
25	7.3	7.4	10.9	12.6	16.9	21.5	17.0	13.9	10.6	10.7	9.0	7.9
26	7.5	7.5	10.9	13.2	16.9	21.4	16.9	13.8	10.5	10.7	8.9	7.8
27	7.7	7.7	11.0	13.8	16.9	21.3	16.9	13.6	10.7	10.7	8.9	7.8
28	7.7	7.8	11.0	14.3	17.0	21.0	16.9	13.4	10.8	10.8	8.9	7.8
29	7.7	.....	11.0	14.4	17.5	20.8	16.9	13.2	10.9	10.8	8.9	7.8
30	7.8	.....	11.0	14.3	17.9	20.7	16.9	13.0	10.9	10.7	8.9	7.7
31	7.7	.....	10.9	.....	18.3	.....	16.9	12.9	.....	10.6	.....	7.7

NOTE.—No ice record.

CLARK FORK DRAINAGE BASIN.

DESCRIPTION OF BASIN.

Clark Fork of the Columbia has its source in Silverbow County, Mont., and flows northward 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 Big Blackfoot and Hellgate rivers and the mouth of Flathead River. From that point to its junction with Columbia River it is called Clark Fork of the 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 discharge is regulated by many small lakes, fed by banks of snow, which continue far into 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.

CLARK FORK[a] AT PRIEST RIVER, IDAHO.

This station was established in June, 1903, by T. A. Noble, and was discontinued April 30, 1905. It is located on the right bank of the river, about 1,000 feet west of Priest River railroad station.

The channel is straight for about 2,000 feet above and 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 10 per cent. The water flows in one channel, and the bed of the stream is composed of sand, with occasional bowlders.

Discharge measurements were made from a ferry cable, which is at a right angle to the stream. 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.

A wire gage is fastened to the railing of the platform, which is built between four trees. The bench marks are as follows: (1) A United States Geological Survey bench mark south of Priest River station, at the northeast corner of the hotel, from which all elevations were obtained; elevation, 2,077.00 feet; (2) a bench mark under the gage-board platform; elevation, 2,066.19 feet; (3) a bench mark on a stump near the gage; elevation, 2,073.02 feet. Elevations refer to sea level.

Information in regard to this station is contained in the following Water-Supply Papers of the United States Geological Survey:

Description: 100, pp. 399–400; 135, pp. 40–41.
Discharge: 100, p. 400; 135, p. 41.
Discharge, monthly: 135, p. 43.
Gage heights: 100, pp. 400–401; 135, pp. 41–42.
Rating table: 135, p. 42.

Discharge measurements of Clark Fork at Priest River, Idaho, in 1905.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Square feet.*	*Feet per second.*	*Feet.*	*Second-feet.*
January 19	Laurgaard and Costeel	715	3,896	2.02	42.52	7,852
February 3[a]	C. Costeel	704	3,498	1.55	41.85	5,419

[a] Ice conditions.

Daily gage height, in feet, of Clark Fork at Priest River, Idaho, for 1905.

Day.	Jan.	Feb.	Mar.	Apr.	Day.	Jan.	Feb.	Mar.	Apr.
1	42.68	42.15	42.72	43.78	17	42.42	42.31	43.2	43.9
2	42.67	41.3	42.78	43.75	18	42.5	42.3	43.28	43.9
3	42.72	41.85	42.8	43.74	19	42.52	42.29	43.31	43.92
4	42.68	42.22	42.88	43.8	20	42.55	42.32	43.33	43.92
5	42.7	42.34	42.9	43.75	21	42.57	42.41	43.35	43.95
6	42.69	42.4	42.92	43.69	22	42.59	42.42	43.45	44.01
7	42.8	42.49	43.0	43.68	23	42.6	42.48	43.5	44.1
8	42.71	42.45	43.05	43.68	24	42.62	42.52	43.52	44.19
9	42.62	42.5	43.09	43.77	25	42.65	42.55	43.6	44.35
10	42.62	42.75	43.19	43.7	26	42.62	42.6	43.55	44.27
11	42.54	41.69	43.35	43.71	27	42.68	42.64	43.63	44.55
12	41.59	42.0	43.39	43.77	28	42.7	42.69	43.7	44.75
13	41.12	42.12	43.32	43.9	29	42.73	.....	43.71	44.9
14	41.24	42.29	43.15	43.85	30	42.71	.....	43.73	45.01
15	42.04	42.28	43.19	43.85	31	42.8	.....	43.77	.....
16	42.32	42.3	43.19	43.89					

[a] Formerly called Pend Oreille River.

NOTE.—No ice record.

Station rating table for Clark Fork at Priest River, Idaho, from June 26, 1903, to April 30, 1905.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
41.10	5,680	42.20	6,990	43.20	9,740	44.20	13,470
41.20	5,770	42.30	7,220	43.30	10,070	44.30	13,890
41.30	5,865	42.40	7,460	43.40	10,410	44.40	14,320
41.40	5,960	42.50	7,700	43.50	10,750	44.50	14,760
41.50	6,055	42.60	7,960	43.60	11,110	44.60	15,200
41.60	6,150	42.70	8,230	43.70	11,480	44.70	15,650
41.70	6,250	42.80	8,510	43.80	11,860	44.80	16,110
41.80	6,350	42.90	8,810	43.90	12,250	44.90	16,570
41.90	6,450	43.00	9,110	44.00	12,650	45.00	17,050
42.00	6,550	43.10	9,420	44.10	13,050	45.90	21,530
42.10	6,770						

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1903–1905. It is well defined above gage height 42.5 feet.

Estimated monthly discharge of Clark Fork at Priest River, Idaho, for 1905.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January	8,510	5,698	7,791	479,000
February	8,370	5,865	7,316	406,300
March	11,750	8,286	10,030	616,700
April	17,100	11,400	12,700	755,700

MISSOULA RIVER AT MISSOULA, MONT.

This station was established July 10, 1898, at Higgins Avenue Bridge, Missoula, Mont. Because of fluctuations in the water surface, the station was removed May 27, 1899, to the bridge of the Bitterroot Valley division of the Northern Pacific Railway, about one-half mile downstream.

Both banks are high at this point. The water is deep and the current exceedingly swift during high water. At lower stages it is comparatively sluggish. The stream bed is probably shifting.

Ordinarily there is but one channel, broken only by two large crib piers, but in time of flood some water passes through a slough 600 feet south of the bridge. The channel is considerably obstructed by rip rap and remains of old cribs and piers.

Discharge measurements are made from the downstream side of the railway bridge. The initial point for soundings is at the right end over the northwest abutment, opposite the center of the first angle block of the truss.

A standard chain gage is attached to a horizontal timber bolted to a cottonwood tree on the right bank 400 feet above the bridge; length of chain, 21.94 feet. During 1905 the gage was read twice each day by Thomas E. Westby. The bench mark is a United States Geological Survey standard iron post on the north side of Front street, about 200 feet west of McCormick street; elevation, 3,194.64 feet above sea level (Missoula datum) and 32.46 feet above the datum of the gage.

Information in regard to this station is contained in the following publications of the United States Geological Survey (Ann=Annual Report; WS=Water-Supply Paper):

Description: Ann 20, iv, pp 490–491; 21, iv, p 418; WS 28, pp 156–157; 38, pp 364–365; 51, p 432; 66, p 131; 85, p 199; 100, p 403; 135, pp 28–29.

Discharge: WS 28, p 169; 38, p 365; 51, p 432; 66, p 131; 85, p 199; 100, p 403; 135, p 29.

Discharge, monthly: Ann 20, iv, p 491; 21, iv, p 418; 22, iv, p 435; WS 75, p 198; 85, p 201; 100, p 405; 135, p 31.

Discharge, yearly: Ann 20, iv, p 63.
Gage heights: WS 28, p 163; 38, pp 366–367; 51, p 433; 66, p 131; 85, p 200; 100, p 404; 135, p 30.
Hydrographs: Ann 21, iv, p 419; 22, iv, p 435; WS 75, p 199.
Rating tables: WS 28, p 170; 39, p 454; 52, p 522; 66, p 177; 85, p 200; 100, p 405; 135, p 31.

Discharge measurements of Missoula River at Missoula, Mont., in 1905.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Square feet.*	*Feet per second.*	*Feet.*	*Second-feet.*
April 17	L. R. Stockman	163	757	1.74	3.16	1,320
May 5	J. H. Sloan	169	860	2.05	3.50	1,766
May 22	do	184	1,015	3.89	4.66	3,950
June 16	do	283	1,236	4.06	5.44	5,016
July 10	do	170	918	2.52	4.00	2,310
August 11	do	163	778	1.52	3.00	1,181
September 5	do	158	665	1.34	2.56	888
October 3	do	154	673	1.35	2.67	907
October 24	Morse and Sloan	164	764	1.65	2.95	1,221

Daily gage height, in feet, of Missoula River at Missoula, Mont., for 1905.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	2.65	3.7	3.1	3.5	5.3	5.02	3.38	2.58	2.65	2.78	2.9
2	.....	2.65	3.45	3.1	3.5	5.48	4.95	3.3	2.55	2.65	3.0	2.95
3	.....	2.65	3.38	3.1	3.5	5.72	4.9	3.3	2.55	2.75	2.95	2.95
4	.....	2.65	3.42	3.1	3.45	5.75	4.78	3.3	2.55	2.75	2.95	2.95
5	.....	2.7	3.4	3.05	3.45	5.8	4.7	3.25	2.55	2.75	2.98	2.95
6	.....	2.85	3.4	3.08	3.35	5.92	4.55	3.2	2.52	2.7	3.0	2.92
7	2.75	2.92	3.35	3.15	3.35	6.16	4.35	3.12	2.45	2.7	3.0	2.9
8	.....	3.0	3.32	3.2	3.42	6.45	4.22	3.08	2.45	2.75	3.0	2.92
9	.....	3.02	3.25	3.2	3.8	6.4	4.12	3.02	2.42	2.82	2.98	2.95
10	.....	3.05	3.15	3.2	4.1	6.35	4.05	3.0	2.55	2.8	2.95	2.95
11	.....	3.1	3.02	3.12	4.05	6.18	3.98	3.0	2.55	2.8	2.95	2.95
12	.....	3.1	2.95	3.1	4.05	6.05	3.85	2.95	2.55	2.8	2.95	2.95
13	.....	3.05	2.95	3.18	4.0	5.95	3.8	2.9	2.52	2.8	2.95	2.95
14	3.8	3.05	3.05	3.25	3.95	5.95	3.7	2.88	2.5	2.75	2.95	2.95
15	.....	3.05	3.18	3.2	3.95	5.7	3.62	2.85	2.5	2.8	2.9	2.95
16	.....	3.1	3.25	3.12	3.9	5.48	3.55	2.85	2.5	2.8	2.85	2.95
17	.....	3.1	3.25	3.1	4.0	4.92	3.5	2.9	2.5	2.8	2.85	2.95
18	.....	3.1	3.25	3.15	4.22	5.12	3.5	2.95	2.5	2.85	2.85	2.95
19	.....	3.15	3.25	3.18	4.38	4.92	3.5	2.88	2.5	2.85	2.85	2.98
20	.....	3.25	3.25	3.32	4.5	4.8	3.42	2.82	2.5	2.85	2.9	3.0
21	3.6	3.2	3.2	3.3	4.6	4.7	3.35	2.8	2.55	2.9	2.95	3.0
22	.....	3.3	3.2	3.3	4.78	4.52	3.32	2.78	2.55	2.95	2.95	3.0
23	.....	3.38	3.2	3.35	4.7	4.75	3.28	2.62	2.55	.....	2.95	3.0
24	.....	3.52	3.15	3.42	4.68	4.98	3.25	2.65	2.5	.....	2.95	3.0
25	.....	3.6	3.1	3.5	4.48	5.05	3.22	2.65	2.5	.....	2.95	3.1
26	3.3	3.75	3.1	3.58	4.38	5.05	3.2	2.65	2.5	3.1	2.95	3.1
27	3.2	4.0	3.1	3.6	4.4	5.68	3.28	2.65	2.52	3.05	2.92	3.1
28	3.25	3.92	3.15	3.58	4.42	5.55	3.35	2.65	2.6	3.0	2.9	3.1
29	3.2	.....	3.15	3.5	4.5	5.38	3.35	2.65	2.6	3.0	2.85	3.1
30	3.28	.....	3.12	3.5	4.5	5.2	3.65	2.65	2.65	2.95	2.7	3.15
31	3.3	.....	3.1	.....	4.98	.....	3.42	2.6	.....	2.88	.....	3.15

NOTE.—River frozen during January and February, March 12–13, and November 24 to December 31; readings are to top of ice.

Station rating table for Missoula River at Missoula, Mont., from January 1 to December 31, 1905.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
2.40	735	3.30	1,485	4.20	2,570	5.00	4,050
2.50	800	3.40	1,590	4.30	2,720	5.20	4,510
2.60	870	3.50	1,700	4.40	2,880	5.40	5,000
2.70	945	3.60	1,810	4.50	3,050	5.60	5,530
2.80	1,025	3.70	1,930	4.60	3,230	5.80	6,100
2.90	1,110	3.80	2,050	4 70	3,420	6.00	6,710
3.00	1,200	3.90	2,170	4.80	3,620	6.20	7,370
3.10	1,290	4.00	2,300	4.90	3,830	6.40	8,110
3.20	1,385	4.10	2,430				

The above table is applicable only for open-channel conditions. It is based on 15 discharge measurements made during 1904–5. It is fairly well defined throughout.

Estimated monthly discharge of Missoula River at Missoula, Mont., for 1905.

[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.
March 1–11, 14–31	1,930	1,218	1,427	82,080	0.239	0.258
April	1,810	1,245	1,442	85,800	.242	.270
May	4,006	1,538	2,497	153,500	.419	.483
June	8,310	3,086	5,429	323,000	.911	1.02
July	4,096	1,385	2,182	134,200	.366	.422
August	1,569	870	1,132	69,600	.190	.219
September	908	748	819	48,730	.137	.153
October	1,290	908	1,069	65,730	.179	.206
November 1–23	1,200	1,009	1,140	52,000	.191	.163
The period				1,015,000		

NOTE.—No estimate for ice period.

BIG BLACKFOOT RIVER NEAR BONNER, MONT.

This station was established in July, 1898. It is situated a short distance above the junction of Big Blackfoot with Hellgate River, at the county highway bridge, one-half mile west of Bonner and 6 miles east of Missoula. The station was abandoned October 31, 1905, because of a dam which was being erected in Hellgate River just below the mouth of the Big Blackfoot.

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 river height. The channel at the station is straight for some distance. Both banks are high and rocky and are covered with brush and trees. Neither bank is subject to overflow. The bed of the stream is rocky and covered with cobble and bowlders. It is not liable to change. The depth of the water varies from 4 to 10 feet. The current is very swift and a stay line is necessary for the meter at all but the lowest stages.

Discharge measurements are made from the lower side of the bridge, the initial point for soundings being at the left bank.

A standard chain gage is attached to the downstream guard rail of the bridge; length of chain, 20.68 feet. During 1905 the gage was read twice each day by Charles Anderson. Bench marks were established as follows: (1) 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; elevation, 3,290.30 feet above sea level. (2) A standard United States Geological Survey iron post located in front of John McCormick's house just east of the highway bridge; elevation, 3,246.04 feet above sea level. The zero of the gage is 3,230.70 feet above sea level. All elevations refer to the Missoula datum.

Information in regard to this station is contained in the following publications of the United States Geological Survey (Ann=Annual Report; WS=Water-Supply Paper):

Description: Ann 20, iv, p 491; WS 28, pp 155–156; 38, p 362; 51, p 430; 66, p 130; 100, pp 410–411; 135, p 32.
Discharge: WS 28, p 168; 38, p 362; 51, p 430; 66, p 130; 85, p 216; 100, p 411; 135, p 33.
Discharge, monthly: Ann 20, iv, p 491; 21, iv, p 416; 22, iv, p 433; WS 75, p 198; 100, p 413; 135, p 34.
Discharge, yearly: Ann 20, iv, p 62.
Gage heights: WS 28, p 163; 38, p 363; 51, p 431; 66, p 130; 100, pp 411–412; 135, p 33.
Hydrographs: Ann 21, iv, p 416; 22, iv, p 434.
Rating tables: WS 28, p 170; 39, p 454; 52, p 522; 66, p 177; 100, p 412; 135, p 34.

Discharge measurements of Big Blackfoot River near Bonner, Mont., in 1905.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Square feet.*	*Feet per second.*	*Feet.*	*Second-feet.*
April 17	L. R. Stockman	120	428	1.14	0.30	486
May 5	J. H. Sloan	120	445	1.55	.46	690
May 22	do	127	614	3.15	2.04	1,936
June 16	do	133	677	4.07	2.80	2,754
July 10	do	125	565	2.26	1.32	1,278
August 10	do	121	460	1.46	.60	673
September 5	do	119	405	1.06	.36	432
October 3	do	119	405	1.08	.35	438
October 24	Morse and Sloan	118	415	1.02	.21	425

Daily gage height, in feet, of Big Blackfoot River near Bonner, Mont., for 1905.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1	0.75	2.3	1.0	0.2	0.7	2.8	1.9	0.7	0.3	0.3
2	.6	1.95	.7	.2	.8	3.05	1.8	.75	.25	.4
3	.45	1.85	.55	.25	.75	3.25	1.8	.75	.25	.35
4	.4	2.2	.45	.25	.8	3.4	1.7	.7	.3	.3
5	.25	2.1	.45	.15	.7	3.55	1.6	.7	.25	.25
6	.3	2.2	.45	.2	.7	3.85	1.55	.7	.25	.3
7	.45	2.1	.35	.25	.75	3.8	1.5	.65	.25	.3
8	.6	2.2	.35	.25	.8	3.75	1.4	.6	.25	.25
9	1.2	2.4	.3	.25	1.0	3.85	1.35	.6	.1	.35
10	.75	2.35	.35	.25	1.35	3.75	1.3	.6	.15	.3
11	.7	2.35	.25	.25	1.3	3.5	1.25	.6	.15	.4
12	.....	2.05	.05	.25	1.3	3.3	1.2	.5	.15	.4
13	.....	2.5	.2	.25	1.3	3.35	1.15	.5	.2	.3
14	.....	2.6	.25	.2	1.25	3.25	1.1	.5	.25	.4
15	.....	2.8	.25	.25	1.2	3.0	1.05	.5	.25	.35
16	.....	2.6	.2	.2	1.2	2.8	1.0	.5	.15	.45
17	.....	2.65	.25	.22	1.2	2.6	1.0	.5	.2	.35
18	.....	2.4	.25	.3	1.45	2.5	1.0	.5	.2	.5
19	.....	2.3	.2	.25	1.65	2.4	1.0	.5	.25	.4
20	.....	2.35	.3	.3	1.75	2.25	.9	.5	.2	.45
21	.....	2.15	.35	.3	1.85	2.1	.9	.4	.15	.4
22	.....	2.25	.3	.3	2.0	2.1	.9	.4	.15	.15
23	.....	2.05	.25	.3	1.85	2.2	.8	.4	.15	.3
24	.....	1.6	.2	.35	1.75	2.2	.8	.3	.15	.4
25	.....	1.4	.2	.4	1.65	2.1	.8	.3	.2	.4
26	.55	1.45	.25	.6	1.7	2.15	.8	.3	.35	.35
27	.4	1.3	.25	.65	1.7	2.25	.8	.3	.3	.3
28	.3	1.3	.25	.75	1.75	2.15	.85	.3	.35	.35
29	.15	.....	.25	.7	1.85	2.05	.9	.3	.3	.25
30	.2	.....	.2	.7	2.2	1.9	.8	.3	.4	.25
31	.4	.....	.2	.....	2.5	.....	.8	.3	.....	.25

NOTE.—River frozen January 12–25, also February 1–28. Readings to top of ice. Ice gorge below station during February.

Station rating table for Big Blackfoot River near Bonner, Mont., from January 1 to October 31, 1905.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
0.10	340	1.10	1,030	2.10	1,970	3.10	3,150
0.20	390	1.20	1,120	2.20	2,080	3.20	3,290
0.30	440	1.30	1,210	2.30	2,190	3.30	3,430
0.40	500	1.40	1,300	2.40	2,300	3.40	3,590
0.50	560	1.50	1,390	2.50	2,420	3.50	3,750
0.60	630	1.60	1,480	2.60	2,540	3.60	3,910
0.70	700	1.70	1,570	2.70	2,660	3.70	4,090
0.80	770	1.80	1,660	2.80	2,780	3.80	4,270
0.90	850	1.90	1,760	2.90	2,900	3.90	4,450
1.00	940	2.00	1,860	3.00	3,020	4.00	4,630

NOTE.—The above table is applicable only for open-channel conditions. It is based on 17 discharge measurements made during 1904–1905, and is fairly well defined throughout.

Estimated monthly discharge of Big Blackfoot River near Bonner, Mont., for 1905.

[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 1–11, 27–31	1,120	365	572	18,150	0.232	0.138
March	940	320	459	28,220	.186	.214
April	735	365	463	27,550	.188	.210
May	2,420	700	1,294	79,560	.525	.605
June	4,360	1,760	2,936	174,700	1.19	1.33
July	1,760	770	1,079	66,350	.437	.504
August	735	440	565	34,740	.229	.264
September	500	340	407	24,220	.165	.184
October	560	365	465	28,590	.189	.218
The period				482,100		

NOTE.—No estimate for ice period.

BITTERROOT RIVER NEAR GRANTSDALE, MONT.

This station was established April 25, 1902. It is located on the highway bridge 2 miles southwest of Grantsdale and 5 miles southwest of Hamilton, Mont. 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 channel is straight both above and below the station. The stream has a moderate velocity at ordinary stages, but is extremely swift in high water. The right bank has a gentle slope for about 100 feet, when it terminates at a high bank which is not liable to overflow. The left bank is high and formed above the bridge by a railway fill. The bed of the stream is composed of gravel and bowlders.

Discharge measurements are made from the downstream side of the highway bridge, with the aid of a stay wire. The initial point for soundings is a notch on the hand rail over the northwest bridge pier at the left bank.

A standard chain gage is fastened to the downstream truss of the bridge; length of chain, 23.33 feet. During 1905 the gage was read once each day by T. J. Holt. Bench marks were established as follows: (1) A wire nail driven in the northeast side of a pine stump across the road from the west end of the bridge; elevation, 24.40 feet. (2) The northwest bolt in the northwest abutment plate of the bridge; elevation, 19.36 feet. Elevations refer to the datum of the gage.

Information in regard to this station is contained in the following Water-Supply Papers of the United States Geological Survey:

Description: 85, p 201; 100, p 408; 135, p 35.
Discharge: 85, p 202; 100, p 408; 135, p 35.
Discharge, monthly: 85, p 203; 100, p 410; 135, p 37.
Gage heights: 85, p 202; 100, p 409; 135, p 36.
Rating tables: 85, p 203; 100, p 409; 135, p 36.

Discharge measurements of Bitterroot River near Grantsdale, Mont., in 1905.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Square feet.*	*Feet per second.*	*Feet.*	*Second-feet.*
April 18	Stockman and Sloan	170	412	1.73	2.22	713
May 6	J. H. Sloan	170	420	2.17	2.42	910
May 23	do	182	562	3.43	3.22	1,929
June 17	do	183	588	3.85	3.50	2,265
July 11	do	183	516	2.63	2.88	1,356
August 11	do	168	268	.75	1.51	200
September 6	do	156	221	.33	1.21	70
October 4	do	168	259	.64	1.46	167
October 25	Morse and Sloan	168	298	1.06	1.70	315

Daily gage height, in feet, of Bitterroot River near Grantsdale, Mont., for 1905.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.85	1.95	1.65	1.75	2.8	4.3	3.6	1.8	1.2	1.5	1.6	1.6
2	1.85	1.95	1.65	1.75	2.7	4.5	3.5	1.8	1.2	1.5	1.6	1.6
3	1.75	1.95	1.75	1.75	2.6	4.6	3.4	1.8	1.2	1.5	1.6	1.6
4	1.75	1.95	1.75	1.75	2.5	4.6	3.4	1.7	1.2	1.4	1.6	1.6
5	1.75	1.95	1.85	1.95	2.4	4.5	3.3	1.7	1.3	1.4	1.6	1.6
6	1.65	1.95	1.85	1.95	2.4	4.3	3.2	1.7	1.3	1.4	1.6	2.0
7	1.65	1.95	1.95	2.15	2.5	4.2	3.0	1.6	1.2	1.4	1.6	2.0
8	1.65	2.05	1.95	2.15	2.6	4.3	2.9	1.6	1.2	1.4	1.5	1.9
9	1.65	2.05	1.95	2.25	2.8	4.9	2.9	1.5	1.2	1.5	1.5	2.1
10	1.85	2.15	1.95	2.25	2.9	4.5	2.8	1.5	1.2	1.5	1.5	2.1
11	1.95	2.15	1.95	2.15	2.8	4.5	2.8	1.4	1.2	1.5	1.5	2.1
12	1.95	2.25	1.85	2.15	2.7	4.4	2.7	1.4	1.2	1.6	1.5	2.1
13	2.15	2.35	1.85	2.05	2.6	4.3	2.6	1.4	1.1	1.6	1.5	2.1
14	2.25	2.45	1.95	2.05	2.6	4.2	2.5	1.4	1.1	1.7	1.5	2.0
15	2.35	2.45	1.95	2.05	2.5	4.0	2.5	1.3	1.1	1.7	1.5	1.9
16	2.35	2.45	1.95	2.15	2.5	3.8	2.4	1.3	1.1	1.7	1.5	1.8
17	2.35	1.95	1.95	2.05	3.1	3.5	2.4	1.3	1.1	1.7	1.6	1.8
18	2.35	1.95	2.05	2.15	3.5	3.3	2.3	1.3	1.1	1.6	1.6	1.8
19	1.75	1.85	2.05	2.2	3.4	3.2	2.3	1.3	1.0	1.6	1.6	2.1
20	1.75	1.85	2.05	2.5	3.5	3.2	2.2	1.4	1.0	1.6	1.6	2.1
21	1.75	1.85	1.95	2.6	3.4	3.2	2.2	1.4	1.0	1.6	1.6	2.1
22	1.65	1.85	1.95	2.6	3.3	3.4	2.1	1.3	1.0	1.6	1.6	2.0
23	1.65	1.75	1.95	2.8	3.2	3.6	2.1	1.3	1.1	1.5	1.7	2.0
24	1.65	1.75	1.95	3.0	3.1	3.7	2.1	1.2	1.1	1.5	1.7	2.0
25	1.65	1.75	1.95	3.2	3.0	3.7	2.0	1.4	1.1	1.6	1.8	2.0
26	1.65	1.75	1.95	3.4	2.9	3.7	2.0	1.3	1.2	1.7	1.8	2.0
27	1.65	1.65	1.95	3.2	3.0	4.1	2.0	1.3	1.2	1.7	1.7	1.6
28	1.65	1.65	1.95	3.0	3.1	3.9	1.9	1.2	1.3	1.7	1.7	1.6
29	1.65	.....	1.95	2.9	3.1	3.7	1.9	1.2	1.4	1.7	1.7	1.7
30	1.65	.....	1.85	2.8	3.6	3.6	1.8	1.2	1.4	1.7	1.7	1.8
31	1.65	.....	1.85	.....	4.0	.....	1.8	1.2	.....	1.7	.....	1.8

NOTE.—Ice conditions January 1-18, February 1-18, December 6-27. During February the ice increased from 0.3 to 0.9 foot in thickness. Readings are to top of ice.

Station rating table for Bitterroot River near Grantsdale, Mont., from January 1 to December 31, 1905.

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	15	2.10	635	3.10	1,695	4.10	3,435
1.20	50	2.20	725	3.20	1,825	4.20	3,660
1.30	95	2.30	820	3.30	1,965	4.30	3,885
1.40	145	2.40	920	3.40	2,105	4.40	4,110
1.50	200	2.50	1,020	3.50	2,265	4.50	4,335
1.60	260	2.60	1,120	3.60	2,435	4.60	4,560
1.70	325	2.70	1,225	3.70	2,615	4.70	4,785
1.80	395	2.80	1,335	3.80	2,805	4.80	5,010
1.90	470	2.90	1,450	3.90	3,005	4.90	5,235
2.00	550	3.00	1,570	4.00	3,215	5.00	5,460

NOTE.—The above table is applicable only for open-channel conditions. It is based on 16 discharge measurements made during 1904-5. It is well defined throughout.

Estimated monthly discharge of Bitterroot River near Grantsdale, Mont., for 1905.

[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 19-31	392	360	385	9,927	0.248	0.120
February 19-28	428	360	394	7,815	.254	.094
March	592	360	485	29,820	.313	.361
April	2,105	360	915	54,450	.590	.658
May	3,215	920	1,544	94,940	.996	1.15
June	5,235	1,825	3,276	194,900	2.11	2.35
July	2,435	395	1,111	68,310	.717	.827
August	395	50	168	10,330	.108	.124
September	145	5	44	2,636	.029	.032
October	325	145	247	15,190	.159	.183
November	395	200	264	15,710	.170	.190
December 1-5	260	260	260	2,578	.168	.031
The period	.....	.....	.....	506,600	.....	.....

NOTE.—No estimate for ice period.

PRIEST RIVER AT PRIEST RIVER, IDAHO.

This station was established in June, 1903, by T. A. Noble, and discontinued April 30, 1905. It is located at the highway bridge on the road from the railroad station at Priest River to Priest Lake.

The channel is straight for 500 feet above and 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.

Discharge measurements were made from the downstream side of the bridge. The initial point for soundings is the bolt, around which a circle has been painted, at the end of the guard rail at the right bank.

A vertical staff gage is nailed to a pile on the downstream side of the right pier of the bridge. During the early part of 1905 the gage was read once each day by George Young. Bench marks were established as follows: (1) The bolt in the guard rail at the west end of the bridge, which is used as initial point for soundings; elevation, 29.04 feet. (2) A spike driven into a stump under the right approach to the bridge; elevation, 17.48 feet. Elevations refer to the datum of the gage. Bench mark No. 1 is 2,079.7 feet above sea level.

January 18, 1905, a discharge measurement made at this station by Laurgaard and Casteel gave the following results: Width, 127 feet; area of section, 321 square feet; mean velocity, 2.10 feet per second; gage height, 3.22 feet; discharge, 637 second-feet. There was ice along the river banks at the time of the measurement.

Information in regard to this station is contained in the following Water-Supply Papers of the United States Geological Survey:

Description: 100, p. 401; 135, pp. 43-44.
Discharge: 100, p. 402; 135, p. 44.
Discharge, monthly: 135, p. 46.
Gage heights: 100, p. 402; 135, pp. 44-45.
Rating table: 135, p. 45.

Daily gage height, in feet, of Priest River at Priest River, Idaho, for 1905.

Day.	Jan.	Feb.	Mar.	Apr.	Day.	Jan.	Feb.	Mar.	Apr.	Day.	Jan.	Feb.	Mar.	Apr.
1.....	3.22	2.9	3.59	4.68	12.....	3.52	3.52	3.98	4.53	22.....	3.26	3.59	4.59	4.65
2.....	3.1	3.3	3.64	4.65	13.....	3.9	3.71	3.97	4.55	23.....	3.27	3.6	4.59	4.68
3.....	3.22	3.52	3.74	4.61	14.....	4.31	3.7	3.95	4.58	24.....	3.34	3.62	4.68	4.7
4.....	3.23	3.63	3.86	4.57	15.....	3.95	3.62	3.97	4.6	25.....	3.41	3.6	4.69	4.79
5.....	3.3	3.45	3.78	4.54	16.....	3.62	3.65	3.99	4.68	26.....	3.45	3.69	4.68	4.91
6.....	3.31	3.21	3.88	4.55	17.....	3.43	3.66	3.99	4.55	27.....	3.5	3.81	4.69	5.09
7.....	3.3	3.39	3.91	4.55	18.....	3.28	3.67	4.11	4.6	28.....	3.64	3.61	4.69	5.11
8.....	3.31	3.49	3.93	4.57	19.....	3.26	3.61	4.14	4.52	29.....	3.67	.....	4.67	5.12
9.....	3.15	3.49	3.97	4.58	20.....	3.27	3.62	4.25	4.58	30.....	3.48	.....	4.68	5.19
10.....	3.13	3.42	4.01	4.54	21.....	3.27	3.59	4.51	4.62	31.....	3.45	.....	4.69	.....
11.....	3.05	3.05	4.03	4.53										

NOTE.—No ice record.

SPOKANE RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

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

CŒUR D'ALENE LAKE AT CŒUR D'ALENE, IDAHO.

This station was established February 11, 1905, to obtain a record of the fluctuations of the lake surface, and was discontinued September 30, 1905.

A vertical staff gage is nailed to a pile in front of Rosen's boathouse, 400 feet east of the Cœur d'Alene Railroad depot. During 1905 the gage was read once each day by John C. Rosen. The bench mark is a United States Geological Survey standard bench-mark tablet in the southeast corner of Wiggett & Empey Company's brick store building, 37.65 feet above the datum of the gage and 2,157.00 feet above sea level.

Daily gage height, in feet, of Cœur d'Alene Lake at Cœur d'Alene, Idaho, for 1905.

Day.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	.....	1.55	4.25	5.1	5.15	3.1	1.05	0.35
2	.....	1.7	4.2	5.0	5.15	3.05	1.0	.3
3	.....	1.8	4.1	4.85	5.15	2.95	.95	.3
4	.....	2.0	4.0	4.75	5.2	2.9	.95	.3
5	.....	2.2	3.9	4.65	5.3	2.8	.9	.3
6	.....	2.4	3.85	4.4	5.4	2.65	.85	.3
7	.....	2.6	3.85	4.4	5.45	2.55	.8	.3
8	.....	2.7	3.85	4.3	5.45	2.5	.8	.25
9	.....	2.8	3.9	4.35	5.4	2.4	.75	.25
10	.....	2.9	4.0	4.6	5.4	2.3	.7	.25
11	.....	2.95	4.05	4.7	5.3	2.2	.7	.25
12	.....	3.0	4.05	4.85	5.2	2.15	.65	.2
13	.....	3.05	4.0	4.95	5.05	2.05	.65	.2
14	.....	3.05	4.0	5.0	4.95	2.0	.6	.2
15	0.85	3.05	3.9	5.0	4.8	1.9	.6	.2
16	.85	3.0	3.9	5.05	4.65	1.85	.55	.2
17	.8	3.0	3.85	5.1	4.5	1.8	.55	.2
18	.75	3.0	3.85	5.15	4.35	1.7	.5	.2
19	.8	3.15	3.9	5.2	4.2	1.65	.5	.2
20	.8	3.3	4.0	5.2	4.05	1.6	.5	.2
21	.8	3.4	4.15	5.25	3.9	1.55	.5	.2
22	.8	3.55	4.3	5.25	3.8	1.5	.45	.2
23	.9	3.65	4.4	5.25	3.75	1.45	.45	.2
24	.95	3.75	4.55	5.25	3.6	1.45	.45	.15
25	1.05	3.85	4.7	5.25	3.5	1.35	.4	.15
26	1.2	4.0	4.9	5.2	3.45	1.3	.4	.2
27	1.3	4.15	5.1	5.2	3.4	1.25	.4	.25
28	1.45	4.25	5.25	5.15	3.35	1.2	.4	.3
29	.....	4.35	5.25	5.15	3.25	1.15	.4	.35
30	.....	4.4	5.15	5.15	3.15	1.1	.35	.4
31	.....	4.35	.....	5.15	.....	1.1	.35	.....

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 gage datum being 1,880 feet above sea level by city datum and 1,865 feet by Government datum.

March 30, 1904, a cable station was established about one-half mile above the Mission Street Bridge, or 1 mile above the former station at the Oregon Railroad and Navigation Company's bridge. The station is equipped with a cable, stay wire, and tag wire. 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.

Since the date of establishing, owing to various conditions, it has been necessary to put in several gages. During 1905 a vertical gage was fastened to the inside of the most easterly pier on the south side of the Mission Street Bridge, and was used until April 17, 1905, when a new gage was erected 200 feet upstream from the cable, on the right bank. The elevation of the zero is 1,851.926 feet above sea level. From 0 to 21.6 feet the gage is an inclined section on the bank of the river; from 21.6 to 29.2 feet it is a vertical section fastened to a tree.

During 1905 the gage was read once each day, by A. C. Lingle.

Bench marks were established as follows: (1) Top of a granite bowlder 15 feet west of the cable post on the right bank of the river, marked "B. M." cut in the stone; elevation, 30.36 feet; (2) chisel draft on a bowlder between shear poles and water's edge, elevation 27.44 feet. Elevations refer to datum of the gage, which is 1,851.93 feet above sea level.

November 24, 1905, a discharge measurement made at this station by W. C. Sawyer gave the following results: Width, 215 feet; area of section, 1,894 square feet; mean velocity, 1.11 feet per second; gage height, 1.96 feet; discharge, 2,100 second-feet.

Information in regard to this station is contained in the following publications of the United States Geological Survey (Ann=Annual Report; WS=Water-Supply Paper):

Description: Ann 18, iv, pp 359–360; 20, iv, p 510; WS 16, p 177; 28, p 159; 38, pp 370–371; 51, pp 438–439; 66, p 133; 85, pp 196–197; 100, p 396; 135, pp 46–48.
Discharge: Ann 18, iv, p 360; 19, iv, p 460; WS 16, p 177; 28, p 169; 38, p 371; 51, p 49; 135, p 48.
Discharge, monthly: Ann 19, iv, p 488; 20, iv, p 511; 21, iv, p 424; 22, iv, p 443; WS 75, p 200; 85, p 198; 135, pp 50–51.
Discharge, yearly: Ann 20, iv, p 63.
Gage heights: WS 11, p 88; 16, p 177; 28, p 166; 38, p 371; 51, p 439; 66, p 133; 85, p 197; 100, p 397; 135, p 49.
Hydrographs: Ann 19, iv, p 489; 20, iv, p 511; 21, iv, p 425; 22, iv, p 443; WS 75, p 200;
Rating tables: Ann 19, iv, p 488; WS 28, p 170; 39, p 454; 52, p 522; 66, p 177; 85, p 198; 135, p 50.

Daily gage height, in feet, of Spokane River at Spokane, Wash., for 1905.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.94	2.05	2.25	5.0	5.74	5.7	4.07	2.22	1.43	1.42	2.3	2.23
2	2.01	2.06	2.37	4.93	5.63	5.72	4.02	2.15	1.46	1.87	2.31	2.24
3	2.09	2.03	2.47	4.88	5.53	5.76	3.97	2.12	1.32	1.9	2.32	2.24
4	2.12	1.96	2.61	4.82	5.47	5.8	3.9	2.11	1.5	1.72	2.33	2.31
5	2.11	1.96	2.79	4.74	5.4	5.85	3.8	2.05	1.31	1.75	2.31	2.21
6	2.11	1.97	3.0	4.7	5.3	5.87	3.7	2.0	1.36	1.8	2.27	2.23
7	2.1	1.97	3.21	4.65	5.18	5.94	3.63	1.97	1.44	1.92	2.28	2.22
8	2.07	1.99	3.36	4.63	5.1	6.0	3.57	1.9	1.61	2.03	2.27	2.2
9	2.05	1.99	3.49	4.7	5.17	5.92	3.5	1.85	1.63	2.12	2.22	2.2
10	2.02	1.96	3.56	4.73	5.24	5.92	3.42	1.81	1.73	2.14	2.21	2.19
11	1.99	1.92	3.6	4.78	5.42	5.87	3.33	1.94	1.69	2.3	2.15	2.17
12	1.95	1.9	3.7	4.79	5.51	5.82	3.24	1.83	1.62	2.35	2.12	2.15
13	1.9	1.87	3.74	4.8	5.59	5.76	3.16	1.7	1.69	2.43	2.10	2.13
14	1.85	1.85	3.8	4.78	5.67	5.66	3.1	1.7	1.67	2.4	2.10	2.09
15	1.81	1.83	3.83	4.74	5.64	5.52	3.03	1.65	1.7	2.4	2.09	2.05
16	1.8	1.82	3.83	4.71	5.67	5.4	2.97	1.63	1.65	2.38	2.08	2.03
17	1.8	1.8	3.8	4.7	5.7	5.22	2.9	1.57	1.63	2.4	2.07	2.08
18	1.8	1.79	3.82	4.69	5.73	5.17	2.81	1.62	1.66	2.38	2.02	2.1
19	1.8	1.77	3.9	4.73	5.8	5.05	2.8	1.6	1.72	2.36	2.0	2.12
20	1.81	1.78	4.0	4.77	5.8	4.92	2.75	1.58	1.68	2.4	2.0	2.19
21	1.8	1.77	4.15	4.85	5.82	4.8	2.68	1.55	1.57	2.33	2.0	2.2
22	1.79	1.78	4.27	4.96	5.84	4.72	2.62	1.53	1.71	2.32	1.99	2.2
23	1.8	1.78	4.37	5.08	5.82	4.62	2.58	1.52	1.67	2.3	2.0	2.21
24	1.81	1.78	4.48	5.15	5.84	4.57	2.53	1.5	1.51	2.28	1.92	2.2
25	1.81	1.84	4.55	5.3	5.81	4.46	2.49	1.46	1.52	2.35	2.03	2.19
26	1.85	1.92	4.64	5.44	5.81	4.4	2.43	1.44	1.5	2.36	2.1	2.2
27	1.86	2.0	4.74	5.61	5.81	4.35	2.4	1.44	1.49	2.21	2.2	2.2
28	1.92	2.11	4.88	5.74	5.8	4.3	2.34	1.4	1.3	2.23	2.17	2.18
29	1.99	.....	4.95	5.78	5.8	4.24	2.3	1.38	1.32	2.29	2.14	2.17
30	2.03	.....	5.0	5.76	5.78	4.17	2.27	1.4	1.3	2.3	2.19	2.16
31	2.04	.....	5.03	.....	5.78	.....	2.24	1.52	.....	2.31	.....	2.17

NOTE.—No ice record.

Station rating table for Spokane River at Spokane, Wash., from April 1, 1904, to December 31, 1905.

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	4.30	6,090	6.80	11,340
1.10	1,030	2.80	3,420	4.40	6,280	7.00	11,830
1.20	1,130	2.90	3,660	4.50	6,470	7.20	12,330
1.30	1,240	3.00	3,740	4.60	6,660	7.40	12,850
1.40	1,360	3.10	3,910	4.70	6,850	7.60	13,380
1.50	1,490	3.20	4,080	4.80	7,050	7.80	13,930
1.60	1,620	3.30	4,250	4.90	7,250	8.00	14,490
1.70	1.760	3.40	4,420	5.00	7,450	8.20	15,050
1.80	1,900	3.50	4,600	5.20	7,850	8.40	15,610
1.90	2,040	3.60	4,780	5.40	8,250	8.60	16,190
2.00	2,190	3.70	4,960	5.60	8,660	8.80	16,780
2.10	2,340	3.80	5,140	5.80	9,080	9.00	17,380
2.20	2,490	3.90	5,330	6.00	9,510	9.50	18,980
2.30	2,640	4.00	5,520	6.20	9,950	10.00	20,580
2.40	2,790	4.10	5,710	6.40	10,400	10.50	22,280
2.50	2,940	4.20	5,900	6.60	10,860	11.00	23,980
2.60	3.100						

The above table is applicable only for open-channel conditions. It is based on 20 discharge measurements made during 1904 and one made during 1905. It is well defined between gage heights 1.4 feet and 12 feet. Above gage height 11 feet the rating curve is a tangent, the difference being 360 per tenth.

Estimated monthly discharge of Spokane River at Spokane, Wash., for 1905.

[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	2,370	1,886	2,089	128,400	0.522	0.602
February	2,355	1,858	2,047	113,700	.511	.532
March	7,510	2,565	5,223	321,200	1.30	1.50
April	9,038	6,717	7,383	439,300	1.84	2.05
May	9,164	7,650	8,706	535,300	2.17	2.50
June	9,510	5,843	7,974	474,500	1.99	2.22
July	5,653	2,550	3,865	237,600	.965	1.11
August	2,520	1,336	1,789	110,000	.447	.515
September	1,802	1,240	1,555	92,530	.388	.433
October	2,835	1,386	2,472	152,000	.617	.711
November	2,885	2,070	2,411	143,500	.602	.672
December	2,655	2,235	2,454	150,900	.613	.707
The year	9,510	1,240	3,997	2,899,000	.997	13.55

HANGMAN CREEK AT TEKOA, WASH.

This station was established April 1, 1904, by W. W. Schlecht, and discontinued September 30, 1905. It is located at the footbridge across Hangman Creek about 1,000 feet above the mouth of North Fork of Hangman Creek, in Tekoa, Wash. There is a fall of about 2½ feet between the two points.

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 North Fork.

Discharge measurements are made from the downstream side of the footbridge. The initial point for soundings is the center of a telegraph pole on the right bank, marked with a 20-penny nail and zero.

A plain-staff gage is attached to the right pile bent of the bridge. During 1905 the gage was read once each day by A. C. McLaughlin. Bench marks were established as follows: (1) A standard United States Geological Survey tablet marked "2537" set in the vertical wall of a brick house on the corner one square north of the Bank of Tekoa; elevation, 62.11 feet. (2) Top of the head of a 60-penny spike driven into the telegraph pole at the initial point for soundings; elevation, 11.41 feet. Elevations refer to the datum of the gage.

A description of this station, with gage heights, discharge data, and rating table, is contained in Water-Supply Paper No. 135, United States Geological Survey, pages 51–54.

Daily gage height, in feet, of Hangman Creek at Tekoa, Wash., for 1905.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	0.1	0.9	1.9	3.0	1.5	1.7	1.0	0.45	0.2
2	.1	.9	1.8	3.0	1.4	1.65	1.0	.4	.2
3	.15	.5	1.7	2.6	1.4	1.85	.9	.4	.3
4	.1	.5	1.7	2.5	1.3	2.0	.9	.4	.3
5	.1	.5	1.7	2.3	1.3	2.4	.8	.4	.3
6	.9	.4	1.7	2.2	1.2	2.8	.8	.4	.3
7	.9	.4	1.6	2.2	1.0	3.6	.85	.45	.3
8	.8	.4	1.5	2.0	1.0	2.9	.7	[a].3	.3
9	.75	.3	1.5	2.0	1.5	2.3	.7	.3	.3
10	.7	.3	1.5	2.0	1.8	2.0	.7	.3	.3
11	.65	.1	1.5	1.9	1.6	2.0	.7	.3	.3
12	.65	.2	1.5	1.8	1.5	1.9	.6	.3	.3
13	.65	.3	1.47	1.7	2.6	1.8	.6	.3	.3
14	.65	.3	1.47	1.7	2.5	1.5	.6	.3	.3
15	.65	.4	1.47	1.5	2.3	1.55	.6	.3	.3
16	.65	.5	1.47	1.7	2.0	1.3	.65	.3	.3
17	.65	.6	1.47	1.9	1.9	1.3	.65	.3	.4
18	.6	.6	1.3	2.0	1.8	1.2	.65	.3	.4
19	.6	.7	2.0	2.0	1.6	1.15	.65	.3	.4
20	.6	1.2	2.0	2.8	1.6	1.1	.65	.3	.4
21	.6	1.6	2.1	3.6	1.6	1.0	.6	.3	.4
22	.1	1.4	2.1	3.3	1.6	1.0	.6	.3	.4
23	.18	1.5	2.2	2.7	1.7	1.0	.55	.3	.4
24	.26	1.7	2.3	2.3	1.8	1.2	.55	.3	.4
25	.28	1.9	3.0	2.0	2.6	1.2	.55	.3	.4
26	.25	.2	3.6	1.9	2.8	1.0	.55	.3	.5
27	.25	.2	3.8	1.77	2.5	1.15	.5	.2	.5
28	.19	1.9	3.35	1.7	2.2	1.3	.5	.2	.6
29	1.8	.....	3.3	1.5	2.1	1.2	.5	.2	.6
30	1.8	.....	3.3	1.5	1.97	1.0	.45	.2	.6
31	1.8	.....	3.3	.....	1.8	.....	.45	.2	.....

[a] Water standing in pools.

NOTE.—Ice conditions January 22 to February 15 approximately. Gage read to water surface.

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

This station was established September 28, 1904, by T. A. Noble, and discontinued September 30, 1905. It is located 4 miles northwest of Tekoa, Wash., one-fourth mile south of the highway bridge across Hangman Creek, and 300 feet south of J. M. Poole's farm crossing.

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 and cemented gravel, is free from vegetation, and is permanent. There is but one channel at low and two at high water.

Discharge measurements are made by means of a weir 14 feet long. The top of the weir is at the same height as the top of a nail driven into the plank which forms part of the deadman for the bench mark, 7 feet upstream from the weir.

During 1905 a 6-inch hook gage was used once each day by John M. Poole. The bench mark is the top of a 60-penny nail driven into the right-of-way post of the Oregon Railroad and Navigation Company, 40 feet east of the weir; elevation, 8.627 feet above the top of the weir or iron lip.

A description of this station, with gage heights, is contained in Water-Supply Paper No. 135, United States Geological Survey, pages 54–55.

Daily discharge, in second-feet, of Hangman Creek at Poole's ranch, near Tekoa, Wash., for 1905.

Day.	Jan.	Feb.	Mar.	Apr.	Day.	Jan.	Feb.	Mar.	Apr.	Day.	Jan.	Feb.	Mar.	Apr.
1	[a] 16	5	.....	.....	10	7	9	.....	58	18	.....	6	30	.....
2	[b] 22	.....	.....	.....	11	5	5	.....	52	19	.....	8	(e)	.....
3	24	17	.....	.....	12	5	5	.....	45	20	.....	(f)	.....	.....
4	17	12	.....	.....	13	(c)	5	.....	41	22	.....	.....	73	.....
5	13	10	.....	73	14	.....	4	.....	35	23	.....	.....	73	.....
6	10	10	.....	69	15	.....	5	.....	31	24	.....	.....	(f)	.....
7	10	10	.....	65	16	.....	4	[d] 32	.....	30	16	.....	.....	.....
8	9	8	.....	64	17	.....	4	27	.....	31	6	.....	.....	.....
9	8	6	.....	61										

[a] Length of weir 7 feet, January 1.
[b] Length of weir 10 feet, January 2–12, January 30 to February 19.
[c] River frozen up January 13–14.
[d] Length of weir 13 feet, March 16–18.
[e] Length of weir 12 feet 8 inches, March 19–23, April 5–15.
[f] River overflowed, February 20–25, March 24–25.

NORTH FORK OF HANGMAN CREEK AT TEKOA, WASH.

This station was established April 2, 1904, by W. W. Schlecht, and discontinued September 30, 1905. It is located at the highway bridge in Tekoa, Wash., on the road leading north.

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.

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.

A plain-staff gage is fastened 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. During 1905 the gage was read once each day by C. J. McLaughlin. Bench marks were established as follows: (1) A United States Geological Survey standard aluminum tablet set in the vertical wall of a brick house on the corner one square north of the bank in Tekoa, marked "2537;" elevation, 58.29 feet. (2) A point on the concrete abutment of the railroad bridge near the gage; elevation, 8.39 feet. Elevations refer to the datum of the gage.

April 9, 1905, a discharge measurement made at this station by Schlecht and Hohlen gave the following results: Width, 44 feet; area of section, 108 square feet; mean velocity, 1.09 feet per second; gage height, 1.88 feet; discharge, 117 second-feet.

A description of this station, with gage height, discharge data, and rating table, is contained in Water-Supply Paper No. 135, United States Geological Survey, pages 55–57.

Daily gage height, in feet, of North Fork of Hangman Creek at Tekoa, Wash., for 1905.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	0.99	0.8	2.0	2.5	1.8	1.8	1.5	0.35	0.5
2	.99	.8	1.9	2.5	1.7	1.8	1.5	.4	.5
3	1.0	.4	1.9	2.4	1.7	2.4	1.4	.4	.5
4	.97	.4	1.9	2.4	1.7	2.4	1.4	.4	.5
5	.8	.4	1.7	2.4	1.7	2.3	1.4	.4	.5
6	.75	.3	1.4	2.4	1.7	1.4	1.4	.4	.5
7	.65	.3	1.3	2.4	1.7	2.3	1.3	.4	.5
8	.6	.3	1.2	2.3	1.65	2.3	1.3	.4	.5
9	.55	.2	1.0	2.3	1.7	2.1	1.3	.35	.5
10	.55	.2	.9	2.3	1.6	2.0	1.2	.35	.5
11	.55	.2	.9	2.1	1.5	1.9	.9	.35	.5
12	.55	.3	.9	2.0	1.5	1.8	.8	.4	.5
13	.5	.3	.8	1.9	1.6	1.7	.8	.4	.5
14	.5	.4	.8	1.9	2.5	1.7	.35	.5	.5
15	.5	.4	.8	1.8	2.5	1.5	.35	.5	.5
16	.5	.4	.8	1.8	2.4	1.5	.5	.5	.5
17	.5	.5	.8	1.8	2.3	1.5	.5	.5	.5
18	.5	.6	.8	1.9	1.8	1.5	.4	.5	.5
19	.49	.7	.8	2.0	1.8	1.5	.4	.5	.5
20	.49	1.0	.8	2.2	1.8	1.3	.4	.5	.5
21	.48	1.5	1.0	2.3	1.8	1.2	.45	.5	.5
22	.48	1.5	1.3	2.3	1.8	1.2	.45	.5	.5
23	.1	1.4	1.3	2.2	1.9	1.3	.45	.5	.5
24	.15	1.4	1.4	2.1	1.9	1.6	.45	.5	.5
25	.15	1.5	1.5	2.0	1.9	1.5	.45	.5	.5
26	.1	1.7	2.9	2.0	1.9	1.7	.4	.5	.5
27	.1	1.9	2.7	1.9	1.8	1.7	.3	.5	.5
28	.1	2.2	2.5	1.8	1.8	1.65	.3	.5	.6
29	1.1	.....	2.6	1.8	2.3	1.55	.3	.5	.6
30	1.1	.....	2.6	1.8	2.0	1.5	.35	.5	.6
31	1.1	.....	2.6	.....	1.9	.....	.35	.....	.....

NOTE.—Ice conditions during part of January and February. Gage read to water surface.

LITTLE SPOKANE RIVER NEAR SPOKANE, WASH.

This station was established August 3, 1903, by George H. Bliss, and was discontinued March 31, 1905. 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 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.

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.

A wire gage is located on the upstream side of the bridge; length of wire, 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. During 1905 the gage was read once each day by Mary A. Keenan. The bench mark is a wire nail driven into the root of a pine tree 2 feet in diameter, on the north side of the tree, toward the bridge, 60 feet distant from the south end of the bridge; elevation, 21.00 feet above the datum of the gage.

A description of this station, with gage height and discharge data, is contained in Water-Supply Paper No. 135, United States Geological Survey, pages 57–59.

Daily gage height, in feet, of Little Spokane River near Spokane, Wash., for 1905.

Day.	Jan.	Feb.	Mar.	Day.	Jan.	Feb.	Mar.	Day.	Jan.	Feb.	Mar.
1	6.7	6.5	7.0	12	6.35	6.07	7.2	23	6.75	6.5	7.88
2	6.7	6.54	7.1	13	6.4	6.33	7.18	24	6.9	6.89	7.74
3	6.65	6.62	7.2	14	6.59	6.33	7.04	25	6.8	7.15	7.75
4	6.55	6.5	7.3	15	6.75	6.4	7.2	26	7.0	7.09	7.75
5	6.6	6.47	7.35	16	6.59	6.3	7.0	27	6.9	7.1	7.7
6	6.37	6.4	7.2	17	6.38	6.29	6.9	28	7.25	7.0	7.71
7	6.45	6.43	7.1	18	6.4	6.1	6.85	29	7.4	.....	7.65
8	6.3	6.5	6.95	19	6.36	6.35	6.9	30	7.0	.....	7.8
9	6.6	6.4	7.05	20	6.4	6.39	7.32	31	6.7	.....	7.6
10	6.31	6.23	7.15	21	6.45	6.28	7.4				
11	6.45	6.1	7.15	22	6.6	6.1	7.97				

NOTE.—No ice record.

OKANOGAN RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

Okanogan River rises in Okanogan Lake, British Columbia, and flows southward, entering Columbia River near Brewster, Wash. Throughout its course in Canada the river flows through a chain-like series of lakes.

SINLAHEKIN CREEK NEAR LOOMIS, WASH.

This station was established June 13, 1903, by Charles E. Hewitt, and was discontinued March 30, 1905. It is located on the main road between Loomis and Conconully, Wash., 3 miles from Loomis and 19 miles from Conconully.

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 rises more abruptly and is not subject to overflow.

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 fairly stable.

Discharge measurements are made from a plank footbridge. The initial point for soundings is an iron bar driven flush with the ground at the northeast corner of the main part of Mr. R. A. Garrett's house.

The gage is a vertical staff driven into the ground and braced to the gatepost at the northeast corner of Mr. Garrett's yard. During 1905 the gage was read once each day by Mrs. Mary Garrett. The bench mark is the top of the iron bar used as the initial point for sounding: elevation, 11.40 feet above the datum of the gage.

Information in regard to this station is contained in the following Water-Supply Papers of the United States Geological Survey:

Description: 100, p 394; 135, p 59.
Discharge: 100, p. 395
Discharge, monthly: 135, p 61.
Gage heights: 100, p 395; 135, p 60.
Rating table: 135, p 60.

Daily gage height, in feet, of Sinlahekin Creek near Loomis, Wash., for 1905.

Day.	Jan.	Feb.	Mar.	Day.	Jan.	Feb.	Mar.	Day.	Jan.	Feb.	Mar.
1	2.7	2.7	2.6	12	2.7	2.8	2.65	22	2.7	4.3	3.0
2	2.7	2.65	2.6	13	2.7	3.0	2.6	23	2.7	4.0	2.9
3	2.7	2.65	2.6	14	2.75	3.0	2.6	24	2.7	3.5	3.0
4	2.7	2.7	2.6	15	2.85	3.0	2.6	25	2.7	2.9	3.0
5	2.7	2.7	2.6	16	3.2	3.0	2.6	26	2.7	2.6	3.0
6	2.7	2.7	2.6	17	3.5	3.0	2.65	27	2.7	2.6	2.9
7	2.7	2.7	2.6	18	3.3	3.1	2.65	28	2.7	2.6	2.9
8	2.7	2.7	2.6	19	3.0	3.2	2.7	29	2.7	.....	2.8
9	2.7	2.7	2.6	20	3.0	3.7	2.8	30	2.7	.....	2.8
10	2.7	2.7	2.6	21	2.8	5.15	3.25	31	2.7	.....	2.8
11	2.7	2.75	2.7								

NOTE.—No ice record.

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 channel is straight for 100 feet above and 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.

Discharge measurements are made from the footbridge. The initial point for soundings is a nail driven in a birch hub, 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 gage is a vertical staff fastened to a small alder tree on the left bank of the river opposite the house of the observer, R. D. Jones, who during 1905 read the gage once each day. The bench mark is the initial point for soundings; elevation, 4.58 feet above the datum of the gage.

Information in regard to this station is contained in the following Water-Supply Papers of the United States Geological Survey·

Description: 100, pp 389-390; 135, p 63
Discharge: 100, p 390; 135, p 64.
Discharge, monthly: 100, p 392; 135, p 65.
Gage heights: 100, p 391; 135, p 64.
Rating table: 100, p 391; 135, p 65.

Discharge measurements of Salmon Creek near Malott, Wash., in 1905.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Square feet.*	*Feet per second.*	*Feet.*	*Second-feet.*
June 4	O. Laurgaard	28	82	4.43	2.67	362
June 16	do.	27	56	2.72	1.80	154
July 27	do.	25	34	1.22	1.10	41
November 1	do.	24	32	.77	.90	24

Daily gage height, in feet, of Salmon Creek near Malott, Wash., for 1905.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	0.69	0.73	0.94	0.98	1.67	2.18	1.81	0.99	0.93	0.75	0.88	0.61
2	.77	.74	.96	.96	1.62	2.25	1.94	.96	.9	.73	.82	.67
3	.71	.74	.99	.94	1.66	2.3	1.91	.94	.96	.75	.79	.69
4	.72	.75	.99	.9	1.6	2.83	1.88	.92	.83	.75	.81	.7
5	.75	.77	1.0	.97	1.67	2.46	1.75	.92	.82	.88	.81	.71
6	.77	.75	.99	1.08	1.71	2.43	1.69	.88	.75	.92	.79	.75
7	.75	.73	.97	1.10	1.75	2.33	1.62	.83	.73	.98	.78	.75
8	.73	.71	1.0	1.12	1.91	2.24	1.58	.81	.73	1.0	.77	.75
9	.71	.67	1.01	1.15	1.92	2.34	1.54	.79	.74	.88	.76	.74
10	.67	.65	1.02	1.17	1.96	2.31	1.5	.77	.74	.83	.75	.72
11	.68	.66	1.04	1.19	1.88	2.27	1.48	1.12	.73	.83	.77	.73
12	.71	.67	1.05	1.2	1.75	2.24	1.46	1.11	.73	.81	.79	.74
13	.72	.69	1.07	1.21	1.75	2.06	1.45	1.12	.74	.77	.77	.75
14	.74	.68	1.08	1.19	1.71	1.97	1.44	1.1	.79	.75	.76	.75
15	.75	.67	1.1	1.18	1.69	1.91	1.44	1.1	.81	.83	.75	.74
16	.76	.66	1.1	1.25	1.68	1.83	1.43	1.08	.79	.79	.76	.75
17	.77	.71	1.12	1.38	1.75	1.79	1.38	1.08	.81	.81	.77	.76
18	.77	.67	1.12	1.35	1.69	1.76	1.33	1.08	.79	.79	.79	.77
19	.78	.72	1.14	1.38	1.67	1.77	1.29	1.06	.71	.83	.83	.75
20	.78	.73	1.12	1.6	1.62	1.79	1.27	1.04	.69	.85	.75	.75
21	.79	.77	1.1	1.64	1.6	1.83	1.25	1.02	.69	.81	.62	.7
22	.8	.78	1.09	1.67	1.61	1.85	1.17	1.0	.69	.79	.61	.54
23	.82	.82	1.1	1.71	1.71	1.71	1.12	1.0	.67	.79	.62	.58
24	.83	.83	1.1	1.88	1.73	1.88	1.08	.99	.64	.83	.6	.62
25	.83	.83	1.12	2.0	1.85	1.92	1.08	.99	.69	.85	.58	.67
26	.84	.85	1.1	2.04	1.83	2.08	1.0	.96	.83	.9	.57	.73
27	.81	.84	1.09	1.93	1.83	2.12	1.04	.96	.81	.83	.5	.73
28	.79	.85	.92	1.88	1.88	2.09	1.08	.92	.88	.81	.5	.74
29	.79	.....	1.07	1.81	1.88	1.94	1.08	.94	.83	.75	.54	.72
30	.77	.....	1.05	1.74	1.91	1.88	1.04	.92	.79	.64	.55	.71
31	.73	.....	1.02	.....	2.0	.....	1.0	.92	.....	.71	.....	.7

NOTE.—No ice record.

Station rating table for Salmon Creek near Malott, Wash., from January 1 to December 31, 1905.

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	7	1.20	53	1.80	154	2.40	289
0.60	9	1.30	66	1.90	174	2.50	316
0.70	12	1.40	81	2.00	194	2.60	343
0.80	17	1.50	98	2.10	215	2.70	371
0.90	24	1.60	116	2.20	238	2.80	400
1.00	31	1.70	134	2.30	263	2.90	432
1.10	41						

The above table is applicable only for open-channel conditions. It is based on four discharge measurements made during 1905. It is well defined between gage heights 0.8 foot and 2.6 feet.

Estimated monthly discharge of Salmon Creek near Malott, Wash., for 1905.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January	20	11	15.0	922
February	20	10	14.1	783
March	46	25	36.3	2,232
April	202	24	87.5	5,207
May	194	116	146.	8,977
June	410	134	215.	12,790
July	182	31	85.4	5,251
August	43	16	30.3	1,863
September	28	10	16.2	964
October	31	10	18.3	1,125
November	23	7	13.7	815
December	16	8	12.8	787
The year	410	7	57.6	41,720

METHOW RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

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.

METHOW RIVER NEAR PATEROS, WASH.

This station was originally established May 3, 1903, by T. A. Noble, and was located on 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 downstream was used in making the measurement of March 20, 1904.

During the spring of 1904 this bridge also was 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.

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 changes. The section is good, 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 initial point for soundings is a cross marked "I. P." on rock about 10 feet back of the cable support on the left bank.

The gage is located about 500 feet below the cable, 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. 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. During 1905 the gage was read once each day by K. K. Parker. Bench marks were established as follows: (1) A United States Gelogical Survey standard iron post in front of Ives Hotel, at Pateros, Wash.; elevation, 26.05 feet above zero of the gage and 780 feet above sea level. (2) The top of a large white stone, marked "B. M." which is 30 feet northeast of the gage board on the left bank; elevation, of the highest point, 15.20 feet above gage datum.

Information in regard to this station is contained in the following Water-Supply Papers of the United States Geological Survey:

Description: 100, pp 387–388; 135, pp 65–66.
Discharge: 100, p 388; 135, p 66.
Discharge, monthly: 135, p 68.
Gage heights: 100, p 389; 135, p 67.
Rating table: 135, p 67.

Discharge measurements of Methow River near Pateros, Wash., in 1905.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Square feet.*	*Feet per second.*	*Feet.*	*Second-feet.*
May 6	O. Laurgaard	178	730	4.27	6.50	3,116
November 4	do	164	408	1.68	4.60	685
November 28	W. C. Sawyer	155	380	1.62	4.30	618

Daily gage height, in feet, of Methow River near Pateros, Wash., for 1905.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	4.15	4.2	4.1	5.4	6.7	9.1	7.6	4.4	4.35	4.4	4.65	4.2
2	4.15	4.2	4.1	5.3	6.7	9.8	7.55	5.35	4.3	4.45	4.65	4.2
3	4.15	4.15	4.15	5.3	6.7	10.0	7.55	5.35	4.3	4.45	4.65	4.25
4	4.15	4.15	4.15	5.3	6.5	10.4	7.5	5.3	4.25	5.0	4.6	4.25
5	4.15	4.15	4.25	5.3	6.5	10.0	7.4	5.3	4.25	4.45	4.55	4.25
6	4.15	4.1	4.3	5.3	6.5	10.0	7.1	5.2	4.2	4.45	4.55	4.3
7	4.15	4.05	4.3	5.4	6.5	10.0	6.95	5.15	4.2	4.45	4.55	4.25
8	4.1	4.05	4.3	5.4	6.85	10.0	6.9	5.1	4.2	4.6	4.5	4.2
9	4.05	4.1	4.4	5.45	7.9	10.3	6.85	5.0	4.25	4.75	4.5	4.2
10	4.0	4.15	5.0	5.45	7.8	10.2	6.75	4.95	4.25	4.9	4.5	4.2
11	4.0	3.8	5.4	5.45	7.5	10.0	6.6	4.9	4.2	4.9	4.5	4.2
12	4.0	4.2	5.4	5.55	7.45	9.8	6.4	4.85	4.2	4.85	4.5	4.15
13	4.0	4.15	5.4	5.6	7.2	9.7	6.3	4.85	4.2	4.8	4.5	4.15
14	4.0	4.2	5.35	5.65	7.15	8.7	6.25	4.8	4.2	4.75	4.45	4.15
15	4.0	4.2	5.3	5.65	7.1	8.4	6.2	4.75	4.2	4.7	4.4	4.15
16	4.0	4.2	5.3	5.7	7.0	8.3	6.0	4.75	4.2	4.7	4.5	4.15
17	4.0	4.2	5.4	5.75	7.0	8.1	5.95	4.75	4.2	4.7	4.5	4.1
18	4.1	4.2	5.6	5.75	7.0	7.9	5.9	4.7	4.2	4.7	4.5	4.1
19	4.2	4.2	5.7	5.8	7.0	8.0	5.85	4.65	4.2	4.7	4.5	4.1
20	4.2	4.25	5.75	5.9	7.0	8.05	5.8	4.6	4.2	4.65	4.45	4.1
21	4.1	4.2	5.8	6.05	7.0	8.05	5.8	4.5	4.2	4.6	4.4	4.1
22	4.1	4.2	5.7	6.3	6.9	8.05	5.8	4.5	4.2	4.5	4.4	4.1
23	4.1	4.2	5.65	6.8	6.9	8.05	5.8	4.45	4.2	4.5	4.45	4.1
24	4.1	4.15	5.6	7.15	6.8	8.35	5.75	4.45	4.2	4.5	4.45	4.1
25	4.1	4.1	5.6	7.9	6.75	8.25	5.6	4.45	4.25	4.5	4.45	4.1
26	4.1	4.05	5.55	8.0	6.7	8.1	5.65	4.45	4.3	4.5	4.45	4.1
27	4.05	4.1	5.55	7.75	7.0	8.05	5.7	4.4	4.4	4.6	4.4	4.1
28	4.05	4.1	5.5	7.6	7.2	7.9	5.6	4.4	4.4	4.75	4.3	4.1
29	4.0	.....	5.4	7.1	7.7	7.7	5.6	4.4	4.4	4.75	4.25	4.1
30	3.8	.....	5.4	7.0	8.0	7.65	5.55	4.4	4.4	4.7	4.2	4.0
31	4.2	.....	5.4	.....	8.7	.....	5.5	4.35	.....	4.7	.....	4.0

NOTE.—Some ice along shores during February.

Station rating table for Methow River near Pateros, Wash., from January 1 to December 31, 1905.

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	400	5.10	1,166	6.40	2,884	8.20	6,264
3.90	420	5.20	1,266	6.50	3,050	8.40	6,674
4.00	450	5.30	1,372	6.60	3,216	8.60	7,088
4.10	486	5.40	1,484	6.70	3,386	8.80	7,506
4.20	528	5.50	1,602	6.80	3,560	9.00	7,930
4.30	576	5.60	1,724	6.90	3,738	9.20	8,356
4.40	630	5.70	1,854	7.00	3,920	9.40	8,785
4.50	690	5.80	1,988	7.20	4,294	9.60	9,215
4.60	756	5.90	2,128	7.40	4,676	9.80	9,646
4.70	826	6.00	2,272	7.60	5,066	10.00	10,080
4.80	902	6.10	2,420	7.80	5,460	10.20	10,518
4.90	984	6.20	2,572	8.00	5,860	10.40	10,960
5.00	1,072	6.30	2,726				

The above table is applicable only for open-channel conditions. It is based on 10 discharge measurements made during 1903–5. It is well defined.

Estimated monthly discharge of Methow River near Pateros, Wash., for 1905.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January	528	400	480	29,510
February	552	400	506	28,100
March	1,988	486	1,291	79,380
April	5,860	1,372	2,517	149,800
May	7,296	3,050	4,110	252,700
June	10,960	5,164	7,749	461,100
July	5,066	1,602	2,839	174,600
August	1,428	603	899	55,280
September	630	528	553	32,910
October	1,072	630	792	48,700
November	791	528	678	40,340
December	576	450	507	31,170
The year	10,960	400	1,910	1,384,000

NOTE.—Discharge applied as for open channel during February.

CHELAN RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

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 on it.

LAKE CHELAN AT CHELAN, WASH.

A gage is attached to one of the bents of the upper bridge at Chelan, Wash. It is above the controlling dam and gives fluctuations of the lake surface only.

Daily gage height, in feet, of Lake Chelan at Chelan, Wash., for 1905.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	Day.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	2.4	2.25	1.8	2.18	3.05	4.0	17	2.37	1.8	2.2	2.05	3.25	5.7
2	2.45	2.25	1.85	2.15	3.05	4.35	18	2.37	1.8	2.25	2.1	3.25	5.6
3	2.45	2.2	1.9	2.1	3.0	4.8	19	2.37	1.8	2.25	2.1	3.25	5.5
4	2.45	2.2	2.0	2.1	2.9	4.95	20	2.3	1.8	2.3	2.1	3.25	5.45
5	2.4	2.19	2.1	2.05	2.9	5.35	21	2.35	1.8	2.3	2.15	3.25	5.4
6	2.38	2.0	2.2	2.0	2.9	5.45	22	2.33	1.8	2.3	2.2	3.25	5.4
7	2.4	1.95	2.0	2.0	2.95	5.5	23	2.32	1.7	2.3	2.3	3.2	5.35
8	2.48	1.9	2.05	2.0	3.0	5.6	24	2.35	1.8	2.32	2.4	3.15	5.3
9	2.47	1.9	2.1	2.0	3.0	5.8	25	2.48	1.8	2.35	2.55	3.15	5.3
10	2.45	1.9	2.05	1.95	3.15	5.0	26	2.4	1.8	2.32	2.8	3.1	5.28
11	2.42	1.85	2.15	1.95	3.25	6.1	27	2.35	1.85	2.3	2.95	3.15	5.25
12	2.4	1.85	2.25	2.05	3.25	6.25	28	2.3	1.8	2.3	3.0	3.2	5.2
13	2.4	1.8	2.25	1.98	3.3	6.25	29	2 3	.....	2.25	3 05	3.3	5.1
14	2.38	1.8	2.3	2.0	3.25	6.15	30	2.28	.....	2.2	.1	3.5	5.0
15	2.37	1.8	2.2	2.0	3.27	6.0	31	2.25	.....	2.2	.....	3.8	.....
16	2.35	1.8	2.2	2.0	3.25	5.9							

CHELAN RIVER BELOW LAKE CHELAN, WASHINGTON.

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

The channel is straight for 50 feet above and 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.

Discharge measurements are now made from the downstream side of the upper highway bridge. The initial point for soundings is the end vertical on the downstream side of the bridge at the northwest approach.

The gage is a vertical rod 16 feet long attached to the third pile bent of the northwestern approach to the bridge. During 1905 the gage was read once each day by G. L. Richardson. The bench mark is a wire spike driven into a root on the west side of a large cottonwood tree, which is 40 feet downstream from the northwestern approach to the bridge and 30 feet from the river; elevation, 11.86 feet above the datum of the gage.

Information in regard to this station is contained in the following Water-Supply Papers of the United States Geological Survey:

Description: 100, p 387; 135, pp 68-69.
Discharge: 100, p 387; 135, p 69.
Discharge, monthly: 135, p 71.
Gage heights: 100, p 387; 135, pp 69-70.
Rating table: 135, p 70.

Discharge measurements of Chelan River below Lake Chelan, Washington, in 1905.

Date.	Hydrographer.	Width.	Area of section	Mean velocity.	Gage height.	Discharge.
		Feet.	*Square feet.*	*Feet per second.*	*Feet.*	*Second-feet.*
May 4	O. Laurgaard	285	943	4.04	7.68	3,810
November 4	do.	295	1,129	1.09	6.20	1,230
November 27	W. C. Sawyer	292	1,117	.87	5.65	970

Daily gage height, in feet, of Chelan River below Lake Chelan, Washington, for 1905.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	5.4	5.3	5.4	6.75	7.8	8.9	9.5	8.0	5.9	6.2	6.3	5.55
2	5.4	5.3	5.4	6.7	7.8	9.2	9.43	7.9	5.85	6.23	6.25	5.6
3	5.45	5.3	5.43	6.65	7.75	9.4	9.38	7.8	5.85	6.35	6.25	5.6
4	5.4	5.29	5.48	6.65	7.65	9.6	9.35	7.7	5.8	6.55	6.2	5.6
5	5.4	5.29	5.52	6.62	7.65	9.85	9.3	7.6	5.78	6.6	6.15	5.55
6	5.4	5.5	5.56	6.6	7.65	9.95	9.28	7.55	5.8	6.7	6.13	5.5
7	5.4	5.45	5.57	6.6	7.7	10.0	9.22	7.5	5.85	6.9	6.1	5.5
8	5.38	5.45	6.15	6.6	7.75	10.1	9.15	7.55	5.9	6.8	6.1	5.5
9	5.38	5.45	6.18	6.6	7.75	10.2	9.1	7.5	6.0	6.75	6.1	5.5
10	5.37	5.45	6.5	6.58	7.9	10.35	9.05	7.4	6.1	6.6	6.05	5.5
11	5.37	5.4	6.6	6.58	8.0	10.45	9.0	7.35	6.12	6.65	6.0	5.45
12	5.37	5.4	6.65	6.65	8.0	10.6	8.95	7.3	6.15	6.7	5.98	5.4
13	5.37	5.4	6.65	6.6	8.05	10.6	8.9	7.3	6.18	6.75	5.9	5.5
14	5.35	5.38	6.75	6.6	8.0	10.55	8.8	7.25	6.2	6.6	5.88	5.5
15	5.35	5.4	6.8	6.6	8.02	10.4	8.7	7.15	6.2	6.55	5.85	5.5
16	5.35	5.4	6.8	6.6	8.0	10.3	8.6	6.6	6.15	6.5	5.9	5.5
17	5.38	5.4	6.8	6.65	8.0	10.15	8.5	6.6	6.15	6.48	5.8	5.5
18	5.38	5.4	6.9	6.7	8.0	10.05	8.37	5.7	6.1	6.4	5.8	5.5
19	5.32	5.4	6.9	6.7	8.0	10.0	8.25	5.75	6.05	6.38	5.9	5.45
20	5.32	5.4	6.95	6.7	8.0	9.95	8.2	5.75	6.0	6.32	5.9	5.4
21	5.33	5.4	6.95	6.77	8.0	9.9	8.17	5.75	6.1	6.1	5.85	5.4
22	5.33	5.4	6.95	6.85	8.0	9.85	8.2	5.78	6.1	6.25	5.8	5.4
23	5.32	5.37	6.95	7.0	8.0	9.85	8.25	5.78	6.1	6.2	5.7	5.4
24	5.32	5.4	7.03	7.1	7.95	9.8	8.25	5.8	6.2	6.25	5.65	5.4
25	5.35	5.4	7.03	7.3	7.9	9.8	8.25	5.8	6.2	6.2	5.7	5.4
26	5.32	5.4	7.02	7.6	7.85	9.78	8.25	5.85	6.18	6.25	5.8	5.6
27	5.33	5.4	7.0	7.7	7.9	9.75	8.22	5.8	6.18	6.35	5.7	5.5
28	5.32	5.4	7.0	7.75	7.95	9.7	8.2	5.8	6.2	6.3	5.65	5.45
29	5.32	.....	6.9	7.8	8.05	9.6	8.17	5.8	6.2	6.3	5.6	5.4
30	5.3	.....	6.8	7.85	8.2	9.58	8.15	6.0	6.2	6.35	5.6	5.4
31	5.3	.....	6.8	.....	8.6	.....	8.1	5.9	.....	6.3	.....	5.4

NOTE.—No ice record.

Station rating table for Chelan River below Lake Chelan, Washington, from January 1 to December 31, 1905.

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	780	6.50	1,650	7.70	3,630	8.80	5,690
5.40	820	6.60	1,780	7.80	3,810	8.90	5,880
5.50	865	6.70	1,920	7.90	3,990	9.00	6,070
5.60	915	6.80	2,070	8.00	4,170	9.20	6,450
5.70	965	6.90	2,230	8.10	4,360	9.40	6,830
5.80	1,020	7.00	2,390	8.20	4,550	9.60	7,210
5.90	1,080	7.10	2,560	8.30	4,740	9.80	7,600
6.00	1,150	7.20	2,730	8.40	4,930	10.00	8,000
6.10	1,230	7.30	2,910	8.50	5,110	10.20	8,400
6.20	1,320	7.40	3,090	8.60	5,300	10.40	8,800
6.30	1,420	7.50	3,270	8.70	5,500	10.60	9,200
6.40	1,530	7.60	3,450				

The above table is applicable only for open-channel conditions. It is based on nine discharge measurements made during 1904-5. It is fairly well defined between gage heights 5.6 feet and 10.3 feet.

Estimated monthly discharge of Chelan River below Lake Chelan, Washington, for 1905.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January	842	780	803	49,380
February	865	776	817	45,370
March	2,441	820	1,809	111,200
April	3,900	1,754	2,239	133,200
May	5,300	3,540	4,049	249,000
June	9,200	5,880	7,887	469,300
July	7,020	4,360	5,471	336,400
August	4,170	965	2,180	134,000
September	1,320	1,009	1,207	71,820
October	2,230	1,230	1,608	98,870
November	1,508	915	1,115	66,350
December	915	820	856	52,630
The year	9,200	776	2,503	1,818,000

WENATCHEE RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

Wenatchee River has its source on the eastern slope of the Cascade Mountains, and flows southeastward through Wenatchee Lake, entering Columbia River near Wenatchee, Wash.

WENATCHEE 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.

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, 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 swift, especially at the middle of the south span.

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 bolthead in the southeast corner of the bridge, marked zero.

A plain-staff gage is fastened to the downstream edge of the south face of the middle pier. During 1905 the gage was read once each day by A. C. Jones. Bench marks were established as follows: (1) The head of an 8-penny nail driven into a timber at the southeast corner of the middle pier; elevation, 12.98 feet. (2) A bolthead at the southeast corner of the bridge, identical with the initial point; elevation, 16.63 feet. (3) A railroad spike driven into a telephone pole at the left end of the bridge; elevation, 10.91 feet. Elevations refer to the datum of the gage.

A description of this station and gage height and discharge data are contained in Water-Supply Paper No. 135, United States Geological Survey, pages 71–72.

Discharge measurements of Wenatchee River at Cashmere, Wash., in 1905.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Square feet.*	*Feet per second.*	*Feet.*	*Second-feet.*
October 30	W. G. Steward	187	960	2.31	2.90	2,220
November 3	do	185	894	2.23	2.48	1,993
November 14	do	164	799	1.70	1.98	1,357
November 25	do	162	784	1.55	1.87	1,214

Daily gage height, in feet, of Wenatchee River at Cashmere, Wash., for 1905.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.8	1.1	2.5	3.1	4.5	6.9	5.0	2.9	1.6	1.9	2.6	1.9
2	1.8	1.1	2.8	3.0	4.3	7.0	4.9	2.9	1.6	1.9	2.5	1.9
3	1.8	1.2	3.7	2.9	4.2	7.0	5.0	2.9	1.6	3.9	2.5	2.0
4	1.8	1.3	4.1	2.9	4.1	7.1	4.9	2.8	1.6	5.5	2.5	1.9
5	1.7	1.3	4.2	2.8	4.1	6.6	4.8	2.7	1.6	4.3	2.4	1.8
6	1.5	1.3	4.2	3.0	4.3	6.3	4.7	2.6	1.6	4.5	2.3	1.9
7	1.5	1.4	4.1	3.1	4.6	6.2	4.5	2.5	1.6	4.2	2.3	1.8
8	1.5	1.3	4.1	3.2	5.1	6.3	4.4	2.5	1.6	3.9	2.2	1.9
9	1.5	1.2	4.2	3.3	5.5	6.7	4.5	2.5	1.9	3.5	2.2	1.8
10	1.4	1.1	4.4	3.3	5.3	6.9	4.6	2.6	2.0	3.2	2.1	1.7
11	1.3	1.0	4.6	3.3	5.0	6.9	4.5	2.5	1.9	3.1	2.1	1.6
12	1.3	1.8	4.6	3.4	4.8	6.7	4.3	2.5	1.8	3.0	2.1	1.5
13	1.4	1.8	4.3	3.6	4.8	6.4	4.1	2.4	1.8	2.8	2.0	1.4
14	1.4	1.8	4.1	3.7	4.8	5.9	3.8	2.4	1.7	2.7	2.0	1.4
15	1.4	1.8	4.0	3.6	5.0	5.6	3.6	2.3	1.7	2.7	2.0	1.4
16	1.5	1.8	3.9	3.6	4.9	5.5	3.4	2.2	1.6	2.6	1.9	1.4
17	1.5	1.8	4.0	3.5	4.8	5.3	3.3	2.1	1.5	2.5	1.9	1.5
18	1.6	1.8	4.3	3.5	4.8	5.2	3.3	2.1	1.5	2.4	2.0	1.6
19	1.5	1.8	4.3	3.6	4.7	5.3	3.2	2.1	1.5	2.3	2.1	1.6
20	1.5	1.7	4.2	3.8	4.6	5.5	3.3	2.0	1.5	2.2	2.1	1.5
21	1.5	1.6	4.2	4.0	4.5	5.5	3.4	2.0	1.7	2.2	2.0	1.5
22	1.4	1.5	4.1	4.2	4.4	5.6	3.6	1.9	1.9	2.1	2.0	1.4
23	1.4	1.4	4.0	4.7	4.3	5.6	3.7	2.1	1.9	2.1	1.9	1.3
24	1.5	1.5	3.9	5.35	4.2	5.5	3.8	1.8	1.8	2.1	1.9	1.4
25	1.5	1.8	3.8	6.1	4.1	5.4	3.6	1.7	1.8	4.0	1.9	1.4
26	1.4	2.3	3.8	6.25	4.2	5.4	3.5	1.7	1.8	4.1	2.0	1.5
27	1.5	2.4	3.6	6.0	4.6	5.3	3.4	1.7	2.5	3.7	2.1	1.5
28	1.6	2.4	3.5	5.6	5.1	5.4	3.3	1.7	2.2	3.3	2.0	1.5
29	1.5	.....	3.4	5.1	5.6	5.0	3.2	1.7	2.1	3.3	1.9	1.5
30	1.4	.....	3.3	4.8	5.8	4.9	3.0	1.7	2.0	3.1	1.9	1.5
31	1.2	.....	3.1	.....	6.3	.....	3.0	1.7	.....	2.8	.....	1.4

NOTE.—Ice conditions during part of January and February.

Station rating table for Wenatchee River at Cashmere, Wash., from July 27, 1904, to December 31, 1905.

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	550	2.30	1,665	3.60	3,240	4.90	5,150
1.10	615	2.40	1,770	3.70	3,380	5.00	5,300
1.20	685	2.50	1,875	3.80	3,520	5.20	5,620
1.30	755	2.60	1,985	3.90	3,660	5.40	5,940
1.40	830	2.70	2,095	4.00	3,800	5.60	6,260
1.50	910	2.80	2,210	4.10	3,950	5.80	6,580
1.60	990	2.90	2,330	4.20	4,100	6.00	6,900
1.70	1,075	3.00	2,450	4.30	4,250	6.20	7,240
1.80	1,165	3.10	2,580	4.40	4,400	6.40	7,580
1.90	1,260	3.20	2,710	4.50	4,550	6.60	7,920
2.00	1,360	3.30	2,840	4.60	4,700	6.80	8,260
2.10	1,460	3.40	2,970	4.70	4,850	7.00	8,600
2.20	1,560	3.50	3,100	4.80	5,000		

The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1904-5. It is well defined between gage heights 1.8 feet and 3.9 feet.

Estimated monthly discharge of Wenatchee River at Cashmere, Wash., for 1904 and 1905.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
1904.				
July 27-31	3,660	2,970	3,354	33,260
August	2,970	1,360	2,078	127,800
September	1,560	830	1,122	66,760
October	1,360	685	851	52,330
November	1,985	615	1,120	66,640
December	1,665	1,075	1,331	81,840
The period				428,600
1905.				
January	1,165	685	915	56,260
February	1,770	550	1,001	55,590
March	4,700	1,875	3,702	227,600
April	7,325	2,210	3,794	225,800
May	7,410	3,950	4,940	303,800
June	8,780	5,150	6,872	408,900
July	5,300	2,450	3,727	229,200
August	2,330	1,075	1,610	99,000
September	1,875	910	1,133	67,420
October	6,100	1,260	2,660	163,600
November	1,985	1,260	1,476	87,830
December	1,360	755	993	61,060
The year	8,780	550	2,735	1,986,000

NOTE.—Rating table applied as for open channel during entire year.

YAKIMA RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

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 water of Kachess Lake, and 2½ miles above Cleallum it receives the outlet of the last of the three large headwater lakes. Practically its entire summer flow is now used for irrigation. It enters Columbia River 5 miles above Kennewick, 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, and 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 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 is similar in this respect to White River, on the western slope of the Cascade Range. The water of 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 as Goat Rock.

YAKIMA RIVER NEAR MARTIN, WASH.

Lake Keechelus is the uppermost of the three lakes forming the source of Yakima River. At the outlet 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. It is 1,000 feet below the outlet of Lake Keechelus, 800 feet below the dam of the Cascade Lumber Company, and 4 miles northwest of Martin, Wash.

The channel is straight for 500 feet above and 350 feet below the station. Both banks are high, not liable to overflow, and heavily timbered. The current is swift, and there is but one channel at all stages. The bed of the stream is composed of gravel and is free from vegetation and permanent.

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 (right) bank, to which the cable is fastened.

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, when 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. The datum of this gage which is now in use is 0.07 foot higher than the original one. The gage is a vertical rod fastened to an overhanging tree. During 1905 the gage was read twice each day by Christian Hansen. Bench marks were established as follows: (1) 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; elevation, 21.59 feet. (2) 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.;" elevation, 25.22 feet. Elevations refer to the datum of the present gage.

Information in regard to this station is contained in the following Water-Supply Papers of the United States Geological Survey:

Description: 100, p 386; 135, p 74.
Discharge: 100, p 386; 135, p 75.
Discharge, monthly: 135, p 76.
Gage heights: 135, p 75.
Rating table: 135, p 76.

Discharge measurements of Yakima River near Martin, Wash., in 1905.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Square feet.*	*Feet per second.*	*Feet.*	*Second-feet.*
June 5	W. J. Lightfoot	120	344	2.46	8.60	846
June 28	do	118	251	1.52	7.60	381
August 25	W. C. Muldrow	105	130	.59	6.50	78
November 16	do	108	179	.80	6.87	1,430

Daily gage height, in feet, of Yakima River near Martin, Wash., for 1905.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	7.1	6.8	7.5	7.3	7.9	8.8	7.4	6.6	6.4	6.91	7.34	7.24
2	7.2	6.8	7.8	7.2	7.8	8.75	7.4	6.6	6.4	7.15	7.28	7.22
3	7.2	6.8	7.9	7.1	7.7	8.85	7.3	6.6	6.42	7.94	7.23	7.2
4	7.1	6.75	8.0	7.1	7.7	8.65	7.3	6.55	6.42	8.28	7.23	7.14
5	7.1	6.75	8.2	7.1	7.6	8.45	7.3	6.5	6.4	8.32	7.19	7.12
6	7.0	6.75	8.25	7.1	7.7	8.35	7.2	6.5	6.39	8.37	7.14	7.12
7	7.0	6.78	8.2	7.2	7.8	8.3	7.15	6.5	6.4	8.23	7.10	7.1
8	6.9	6.8	8.1	7.2	8.1	8.3	7.1	6.5	6.4	8.17	7.06	7.08
9	6.9	6.8	8.15	7.2	8.3	8.3	7.1	6.5	6.4	8.09	7.04	7.04
10	6.8	6.8	8.25	7.2	8.2	8.25	7.1	6.5	6.4	7.94	7.01	7.02
11	6.8	6.75	8.3	7.2	8.1	8.2	7.1	6.5	6.39	7.82	7.0	6.98
12	6.8	6.7	8.3	7.25	8.0	8.1	7.0	6.4	6.39	7.71	6.94	6.96
13	6.8	6.65	8.15	7.3	8.0	8.0	7.0	6.4	6.42	7.62	6.92	6.92
14	6.8	6.65	8.0	7.4	8.25	7.9	6.9	6.4	6.4	7.56	6.9	6.9
15	6.8	6.65	7.9	7.4	8.4	7.8	6.9	6.5	6.4	7.52	6.89	6.88
16	6.8	6.6	7.9	7.4	8.3	7.7	6.9	6.5	6.4	7.46	6.87	6.86
17	6.8	6.6	7.9	7.4	8.3	7.6	6.9	6.55	6.42	7.44	6.85	6.92
18	6.7	6.6	7.9	7.4	8.2	7.6	6.8	6.6	6.43	7.4	6.88	6.94
19	6.7	6.6	7.9	7.5	8.1	7.55	6.8	6.6	6.42	7.32	6.9	6.92
20	6.7	6.6	7.9	7.65	8.0	7.5	6.8	6.6	6.44	7.26	6.98	6.9
21	6.7	6.7	7.9	7.8	7.9	7.5	6.8	6.6	6.43	7.22	6.94	6.86
22	6.7	6.7	7.9	7.9	7.9	7.45	6.8	6.5	6.44	7.17	6.92	6.85
23	6.7	6.7	7.9	8.15	7.9	7.4	6.7	6.5	6.5	7.11	6.9	6.86
24	6.8	6.8	7.9	8.45	7.95	7.4	6.7	6.5	6.5	7.26	6.88	6.85
25	6.8	6.9	7.8	8.75	8.05	7.4	6.7	6.5	6.52	8.04	6.9	6.88
26	6.8	7.1	7.7	8.8	8.1	7.4	6.7	6.5	6.74	8.09	6.96	6.92
27	6.8	7.2	7.6	8.7	8.1	7.45	6.7	6.5	6.84	7.97	7.02	6.95
28	6.8	7.2	7.6	8.5	8.4	7.5	6.7	6.5	6.87	7.82	7.16	6.94
29	6.9	.....	7.5	8.25	8.5	7.5	6.7	6.5	6.9	7.72	7.32	6.92
30	6.8	.....	7.4	8.0	8.5	7.5	6.6	6.5	6.91	7.56	7.31	6.9
31	6.8	.....	7.3	.....	8.9	.....	6.6	6.4	.....	7.44	.....	6.88

NOTE.—No ice record.

Station rating table for Yakima River near Martin, Wash., from January 1 to December 31, 1905.

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	58	7.00	178	7.70	430	8.40	748
6.40	67	7.10	208	7.80	472	8.50	798
6.50	78	7.20	240	7.90	516	8.60	848
6.60	90	7.30	274	8.00	560	8.70	898
6.70	106	7.40	310	8.10	606	8.80	950
6.80	126	7.50	348	8.20	652	8.90	1,004
6.90	150	7.60	388	8.30	700	9.00	1,058

The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1903–1905 It is well defined.

Estimated monthly discharge of Yakima River near Martin, Wash., for 1905.

[Drainage area, 56 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	240	106	143	8,793	2.55	2.94
February	240	90	124	6,887	2.21	2.30
March	700	274	522	32,100	9.32	10.74
April	950	208	419	24,930	7.48	8.34
May	1,004	388	603	37,080	10.77	12.42
June	977	310	534	31,780	9.54	10.64
July	310	90	169	10,390	3.02	3.48
August	90	67	79.7	4,901	1.42	1.64
September	153	66	80.9	4,814	1.44	1.61
October	734	153	430	26,440	7.68	8.85
November	288	138	191	11,360	3.41	3.80
December	254	138	173	10,640	3.09	3.56
The year	1,004	66	289	210,100	5.16	70.32

YAKIMA RIVER NEAR NORTH YAKIMA, WASH.

This station was established May 5, 1904, by G. H. Bliss, and was discontinued October 15, 1905. It is located at the highway bridge at Selah Gap, 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.

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, and is free from vegetation, and stable. There is one channel at all stages, broken by three bridge piers.

Discharge measurements are made from the downstream side of the bridge. The initial point for soundings is a point marked zero on the top railing near the right end of the bridge, downstream side.

A staff gage is fastened vertically to the south side of the pier at the right end of the four-span highway bridge. During 1905 the gage was read once each day by Patrick Gallagher. The bench mark is the top of the shoe plate on the lower side of the bridge above the pier nearest the right bank; elevation, 16.64 feet above the datum of the gage.

A description of this station, with gage heights, discharge data, and rating table, is contained in Water-Supply Paper No. 135, United States Geological Survey, pages 79–81.

Daily gage height, in feet, of Yakima River near North Yakima, Wash., for 1905.

Day.	June.	July.	Aug.	Sept.	Oct.	Day.	June.	July.	Aug.	Sept.	Oct.
1	.....	4.4	2.6	2.3	.....	17	4.7	3.0	2.4	.....	.....
2	6.3	.....	2.6	2.3	2.8	18	.....	2.9	2.4	2.2	.....
3	6.5	4.2	2.6	2.3	2.8	19	4.4	2.9	2.4	2.2	.....
4	.....	4.1	2.6	2.3	3.6	20	4.2	2.8	2.3	2.2	.....
5	6.8	4.0	2.5	2.3	4.2	21	4.2	2.8	2.3	2.2	.....
6	6.7	3.9	2.5	2.3	4.5	22	4.2	2.8	2.3	2.3	.....
7	6.3	3.7	2.5	2.2	4.6	23	4.3	2.75	2.3	2.3	.....
8	5.8	3.5	2.5	2.2	.....	24	4.3	2.7	2.3	.....	.....
9	5.7	3.5	2.5	2.2	4.3	25	.....	2.7	2.3	2.3	.....
10	5.7	3.4	2.5	2.2	4.0	26	4.3	2.7	2.3	2.4	.....
11	.....	3.4	2.5	2.2	4.0	27	4.3	2.7	.....	2.4	.....
12	5.6	3.3	2.5	2.2	3.9	28	4.9	2.7	2.3	2.5	.....
13	5.4	3.2	.....	2.3	3.8	29	4.7	2.7	2.3	2.6	.....
14	5.2	3.0	2.4	2.3	3.8	30	4.6	2.65	2.3	2.8	.....
15	4.9	3.0	2.4	2.3	.....	31	.....	2.6	2.3	.....	.....
16	4.8	3.0	2.4	2.2	.....						

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 August 14, 1893. The station was originally located at the county bridge at Union Gap, 2 miles below Yakima, Wash. The station was reestablished in August, 1895, a cable and new gage being installed about 1,000 feet below the 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 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 and is free from vegetation and permanent. There is one channel at low water and two channels at ordinary and flood stages.

Discharge measurements are made by means of a cable, car, and tagged wire. The initial point for soundings is a cross chiseled on a rock 2.7 feet from the cable support on the right bank.

The present gage is an inclined rod attached to a willow stump and post set in the ground. During 1905 the gage was read once each day by Hugh Kennedy. Bench marks were established as follows: (1) The top of a large bowlder between two other bowlders 43 feet north of the gage and 6.5 feet east of the fence; elevation, 17.52 feet. (2) The top of a large bowlder under the railroad fence 12 feet north of the gage; elevation, 21.29 feet. (3) The initial point for soundings; elevation, 17.45 feet. The bench marks are marked "B. M." with black paint. Elevations refer to the datum of the gage.

Information in regard to this station is contained in the following publications of the United States Geological Survey (Ann=Annual Report; Bull=Bulletin; WS=Water-Supply Paper):

Description: Ann 14, ii, pp 133–134; 18, iv, pp 356–357; 19, iv, p 479; Bull 140, pp 245–246; WS 16, p 175; 28, p 159; 38, pp 373–374; 51, p 441; 66, p 135; 85, pp 188–189; 100, pp 376–377; 135, pp 81–82.

Discharge. Ann 14, ii, p 134; 18, iv, p 357; 19, iv, p 480; Bull 131, pp 90, 92; 140, p 246; WS 16, p 175; 28, p 169; 38, p 374; 51, p 441; 85, p 189; 100, p 377; 135, p 83.

Discharge, monthly: Ann 18, iv, p 358; 19, iv, p 480; 20, iv, pp 499, 500; 21, iv, p 427; 22, iv, p 447; WS p 75, 202; 85, p 190; 100, p 378; 135, p 84.

Discharge, yearly: Ann 20, iv, p 62.

Gage heights: Bull 140, p 247; WS 11, p 85; 16, p 175; 28, p 165; 38, p 374; 51, p 442; 66, p 135; 85, p 189; 100, p 377; 135, p 83.

Hydrographs: Ann 19, iv, pp 480, 481; 20, iv, p 501; 21, iv, p 428; 22, iv, p 447.

Rainfall and run-off relation: Ann 20, iv, p 500.

Rating tables: Ann 18 iv, p. 357; 19, iv, p. 479; WS 28, p. 170; 39, p. 451; 52, p. 522; 66, p. 177; 85, p 190; 100, p 378; 135, p 84.

Discharge measurements of Yakima River near Yakima, Wash., in 1905.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Square feet.*	*Feet per second.*	*Feet.*	*Second-feet.*
April 19	W. J. Lightfoot	236	1,344	2.92	6.10	3,922
September 2	W. C. Muldrow	230	753	1.04	3.64	780
October 26	do	240	1,250	2.85	5.60	3,567
November 18	Sawyer and Muldrow	238	960	1.67	4.32	1,600

Daily gage height, in feet, of Yakima River near Yakima, Wash., for 1905.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	5.0	4.3	6.0	6.0	6.9	7.7	6.5	4.1	3.6	4.1	5.1	4.7
2	5.0	4.4	6.8	5.9	6.5	7.9	6.4	4.1	3.6	4.15	5.0	4.7
3	5.0	4.5	7.2	5.8	6.1	8.3	6.3	4.1	3.6	4.15	4.9	4.6
4	5.0	4.6	7.8	5.8	6.0	9.1	6.3	4.0	3.6	5.1	4.9	4.65
5	4.9	4.5	7.8	5.9	6.0	8.8	6.0	4.0	3.6	5.8	4.8	4.7
6	4.9	4.4	7.9	5.9	6.0	8.3	6.0	4.0	3.65	6.4	4.8	4.7
7	4.9	4.5	7.9	6.0	6.1	8.0	5.9	3.9	3.68	6.45	4.7	4.7
8	4.9	4.6	7.9	6.0	6.3	7.8	5.7	3.9	3.68	6.4	4.7	4.75
9	4.9	4.6	7.7	5.9	6.4	7.6	5.4	3.8	3.62	6.0	4.6	4.65
10	4.8	4.5	7.9	5.8	7.0	7.6	5.3	3.8	3.62	5.9	4.6	4.5
11	4.6	4.4	7.9	5.8	7.0	7.6	5.3	3.7	3.68	5.8	4.6	4.45
12	4.4	4.0	7.8	5.9	6.7	7.5	5.1	3.7	3.7	5.8	4.55	4.45
13	4.4	3.9	7.9	5.9	6.5	7.5	5.1	3.7	3.7	5.8	4.5	4.45
14	4.4	3.9	7.9	6.1	6.3	7.3	4.9	3.7	3.8	5.4	4.5	4.4
15	4.2	3.9	7.6	6.2	6.4	7.2	4.9	3.6	3.75	5.3	4.4	4.4
16	4.4	3.8	7.3	6.1	6.6	6.9	4.7	3.6	3.7	5.2	4.4	4.3
17	4.6	3.8	7.3	6.0	6.7	6.5	4.6	3.6	3.7	5.15	4.35	4.3
18	4.7	3.8	7.3	6.0	6.6	6.5	4.6	3.6	3.72	5.0	4.35	4.35
19	4.7	3.9	7.4	6.0	6.6	6.4	4.5	3.6	3.7	5.0	4.4	4.3
20	4.7	4.0	7.5	6.0	6.5	6.3	4.4	3.6	3.7	4.9	4.45	4.3
21	4.7	4.9	7.4	5.9	6.4	6.3	4.4	3.7	3.72	4.9	4.45	4.35
22	4.6	5.2	7.3	6.0	6.2	6.3	4.4	3.6	3.8	4.8	4.4	4.35
23	4.6	5.5	7.2	6.3	6.2	6.3	4.3	3.6	3.8	4.7	4.4	4.3
24	4.7	5.5	7.2	6.8	6.2	6.3	4.4	3.6	3.8	4.7	4.4	4.3
25	4.7	5.4	7.1	7.4	6.2	6.4	4.3	3.6	3.8	4.7	4.3	4.35
26	4.7	5.4	7.0	7.8	6.1	6.7	4.2	3.6	3.8	5.0	4.4	4.4
27	4.8	5.4	6.9	8.0	6.1	7.0	4.3	3.6	3.78	5.8	4.5	4.4
28	4.9	5.9	6.6	7.9	6.4	6.9	4.2	3.6	3.9	5.8	4.6	4.3
29	4.8	.....	6.4	7.3	6.7	6.7	4.2	3.6	4.0	5.7	4.7	4.3
30	4.7	.....	6.3	7.0	6.7	6.7	4.2	3.6	4.0	5.6	4.7	4.2
31	4.5	.....	6.3	.....	7.4	.....	4.1	3.6	.....	5.2	.....	4.2

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.

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 and is 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.

Discharge measurements are made from the downstream side of the bridge, which 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.

A standard chain gage is attached to the upstream side of the bridge near the right bank; length of the chain, 28.06 feet. During 1905 the gage was read once each day by J. N. Jacoby. Bench marks were established as follows: (1) A spike in a sill on the east end of the pump of the Prosser Irrigation Company's canal; elevation, 13.87 feet. (2) A spike on an upright bridge timber 20 feet south of the steel and concrete pier on the south bank; elevation, 11.42 feet. (3) The top of the steel cylinder of the concrete pier at the right bank, upstream side; elevation, 23.92 feet. Elevations refer to the datum of the gage.

A description of this station, with gage heights, discharge data, and rating table is contained in Water-Supply Paper No. 135, United States Geological Survey, pages 85–87.

Discharge measurements of Yakima River at Prosser, Wash., in 1905.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Square feet.*	*Feet per second.*	*Feet.*	*Second-feet.*
August 17	Bliss and Muldrow	.....	.....	.....	0.55	[a] 194
September 1	G. H. Bliss	.....	.....	.....	.43	[a] 176
October 22	W. C. Muldrow	130	1,102	1.77	3.76	[b] 1,950

[a] Discharge of river is found by adding the sum of the measured discharges of the power flumes to the estimated discharge of the river below the dam and subtracting the discharge of the pumps:

	Aug. 17.	Sept. 1.
Prosser flume	185	105
Taylor flume	0	58
Estimated for river	20	20
	205	183
Discharge of pumps	9	7
Flow at gage	194	176

[b] Measured at the bridge.

Daily gage height, in feet, of Yakima River at Prosser, Wash., for 1905.

Day.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	5.76	1.76	0.43	1.93	4.26	3.93
2	.....	5.6	1.68	.51	1.76	4.43	3.85
3	.....	5.51	1.68	.51	2.01	4.43	3.85
4	.....	5.43	1.6	.51	2.51	4.18	3.85
5	.....	5.18	1.51	.55	3.93	4.1	3.76
6	.....	4.93	1.43	.51	5.1	4.1	3.85
7	.....	4.6	1.43	.51	5.43	3.93	3.76
8	7.81	4.43	1.35	.55	5.6	3.76	3.68
9	7.68	4.18	1.26	.68	5.26	3.76	3.68
10	7.68	3.93	1.1	.68	5.01	3.68	3.68
11	7.77	3.76	.93	.68	4.85	3.6	3.6
12	7.81	3.43	.76	.85	4.6	3.6	3.51
13	7.43	3.3	.6	1.26	4.43	3.68	3.43
14	7.18	3.3	.51	1.01	4.26	3.68	3.35
15	6.93	3.1	.51	1.18	4.18	3.6	3.26
16	6.35	2.93	.51	1.26	4.01	3.6	3.43
17	6.18	2.8	.51	1.01	3.93	3.68	3.43
18	6.75	2.68	.51	1.26	3.85	3.51	3.51
19	5.68	2.6	.51	1.26	3.85	3.43	3.51
20	5.6	2.43	.51	1.26	3.76	3.43	3.51
21	5.64	2.18	.51	1.35	3.68	3.51	3.43
22	5.51	2.43	.51	1.35	3.76	3.51	3.43
23	5.51	2.1	.47	1.35	3.68	3.51	3.35
24	5.6	2.18	.51	1.6	3.43	3.43	3.35
25	5.6	2.1	.55	1.51	3.51	3.43	3.18
26	5.6	1.93	.55	1.51	3.60	3.43	3.18
27	5.68	1.85	.51	1.68	4.93	3.51	3.1
28	6.1	1.85	.81	1.76	5.01	3.76	3.18
29	6.18	1.85	.43	1.93	4.76	3.93	3.35
30	6.01	1.85	.43	1.93	4.68	3.93	3.43
31	.....	1.68	.43	.....	4.43	.....	.....

NOTE.—Low-water estimates for this station may be obtained by taking the sum of the flow of Yakima River at Kiona; the Kiona Canal and Kiona Water-Supply Canal.

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 Railway station at Kiona, Wash. It is about 23 miles above the mouth of the river.

The channel is straight for 500 feet above and 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 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.

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 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 gage used during 1905 up to December 23 was of the wire type, and was located on the downstream side of the bridge between the fifth and seventh verticals from the right bank; length of the wire, 27.21 feet. The distance from the end of the scale board to the outside edge of the pulley was 2.00 feet.

December 23, 1905, a staff gage was installed, consisting of a vertical section bolted to the downstream side of the pier near the right bank and an inclined section at the foot of the pier. During 1905 the gage was read once each day by H. A. Shandy. Bench marks were established as follows: (1) The top of a spike in the east end of the cap of the first trestle bent on the right bank; elevation, 20.94 feet. (2) A spike on the north side of the stay-wire post on the right bank; elevation, 18.73 feet. (3) A nail in the upstream end of the first trestle bent on the left bank; elevation, 18.73 feet. Elevations refer to the datum of the gage. The United States Geological Survey standard iron bench-mark post, near the Northern Pacific Railway station, has an elevation above sea level of 515 feet, 62.06 feet above the datum of the gage. All bench marks are marked "B. M." with black paint.

Information in regard to this station is contained in the following publications of the United States Geological Survey (Ann = Annual Report; Bull = Bulletin; WS = Water-Supply Paper):

Description: Ann 18, iv, p 358; 19, iv, p 481; Bull 140, p 248; WS 16, p 176; 28, p 159; 38, p 375; 51, p 442; 66, p 136; 85, p 186; 100, pp 373–374; 135, pp 87–88.

Discharge: Ann 18, iv, p 358; 19, iv, p 483; Bull 140, p 248; WS 16, p 176; 28, p 169; 38, p 375; 51, p 442; 66, p 136; 85, p 186; 100, p 374; 135, p 88.

Discharge, monthly: Ann 18, iv, p 359; 19, iv, p 485; 20, iv, pp 499, 502; 21, iv, p 428; 22, iv, p 448; WS 75, p 203; 85, p 188; 100, p 375; 135, p 89.

Discharge, yearly: Ann 20, iv, p 62.

Gage heights: Bull 140, p 249; WS 11, p 83; 16, p 176; 28, p 165; 38, p 375; 51, p 443; 66, p 136; 85, p 187; 100, p 374; 135, p 88.

Hydrographs: Ann 19, iv, p 486; 20, iv, p 502; 21, iv, p 429; 22, iv, p 448; WS 75, p 203.

Rainfall and run-off relation: Ann 20, iv, p 500.

Rating tables: Ann 18, iv, p 359; 19, iv, p 484; WS 28, p 170; 39, p 454; 52, p 522; 66, p 177; 85, p 187; 100, p 375; 135, p 89.

Discharge measurements of Yakima River at Kiona, Wash., in 1905.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height	Discharge.
		Feet.	*Square feet.*	*Feet per second.*	*Feet.*	*Second-feet.*
May 10	W. J. Lightfoot	253	1,527	3.49	7.50	5,327
June 12	do	298	2,008	4.67	8.80	9,377
August 24	W. C. Muldrow	62	70	2.63	2.60	183
September 14	Frank Halfpenny	205	531	.57	2.90	305
September 14[a]	do	125	128	2.26	2.90	290
October 19	W. C. Muldrow	217	1,063	2.19	5.15	2,337
October 22	do	130	1,102	1.77	4.76	1,950
November 22	Muldrow and Sawyer	248	1,008	1.89	5.05	1,905

[a] Made above rapids.

Daily gage height, in feet, of Yakima River at Kiona, Wash., for 1905.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	5.81	4.9	6.65	6.9	7.5	8.2	6.8	3.35	2.4	3.7	5.6	5.3
2	5.65	4.85	7.0	6.7	7.2	8.9	6.7	3.3	2.45	3.75	5.5	5.3
3	5.6	4.8	7.62	6.6	6.8	9.3	6.6	3.35	2.45	3.8	5.4	5.3
4	5.55	4.85	8.48	6.4	6.5	9.9	6.4	3.25	2.4	3.9	5.4	5.3
5	5.55	4.9	8.95	6.2	6.4	10.4	6.1	3.2	2.4	4.7	5.3	5.3
6	5.56	4.9	9.25	6.1	6.3	9.9	6.0	3.2	2.45	5.75	5.3	5.2
7	5.4	4.85	9.38	6.0	6.2	9.5	5.8	3.1	2.5	6.6	5.2	5.15
8	5.4	4.8	9.25	6.3	6.3	9.0	5.5	3.0	2.55	6.7	5.15	5.15
9	5.48	4.82	9.1	6.2	6.8	8.6	5.3	3.0	2.7	6.8	5.15	5.1
10	5.2	4.65	9.2	6.3	7.5	8.8	5.1	2.8	2.8	6.2	5.2	5.1
11	5.1	4.7	9.3	6.3	7.5	8.9	5.0	2.7	2.8	6.0	5.15	5.05
12	4.4	4.3	9.45	6.2	7.3	8.8	4.9	2.5	2.8	5.7	5.1	5.05
13	4.4	4.48	9.4	6.15	6.4	8.3	4.8	2.7	2.85	5.6	5.1	5.0
14	4.5	4.25	9.15	6.3	6.7	7.9	4.7	2.6	2.85	5.4	5.1	5.0
15	5.0	4.45	8.8	6.5	6.6	7.7	4.65	2.5	2.9	5.4	5.05	5.0
16	5.0	4.5	8.55	6.5	6.8	7.4	4.5	2.4	3.0	5.35	5.0	5.0
17	5.2	4.6	8.6	6.4	7.0	7.1	4.2	2.4	3.0	5.3	4.9	5.0
18	5.2	4.6	8.65	6.3	6.9	6.9	4.0	2.5	3.0	5.2	4.9	4.95
19	5.3	4.6	8.75	6.3	6.9	6.7	4.0	2.6	3.0	5.2	5.0	4.95
20	5.3	4.7	8.7	6.3	6.8	6.5	3.9	2.6	3.2	5.1	4.9	4.95
21	5.0	4.7	8.65	6.45	6.5	6.5	3.7	2.6	3.1	5.0	5.0	5.05
22	4.98	5.5	8.6	6.75	6.6	6.4	3.4	2.55	3.1	5.0	5.0	5.1
23	4.9	5.9	8.4	7.0	6.5	6.4	3.8	2.6	3.15	5.0	5.05	5.2
24	4.88	5.9	8.2	7.2	6.5	6.4	4.0	2.5	3.2	5.0	5.0	4.85
25	4.92	5.78	8.0	7.8	6.4	6.6	3.8	2.5	3.3	4.9	4.95	4.85
26	4.96	5.82	8.0	8.55	6.4	6.5	3.7	2.5	3.3	5.0	4.9	4.9
27	5.0	6.3	7.9	9.2	6.2	6.4	3.5	2.5	3.35	5.8	5.0	4.95
28	4.95	6.5	7.6	9.0	6.4	6.7	3.4	2.5	3.4	6.2	5.1	5.0
29	5.2	.....	7.58	8.5	6.7	6.9	3.3	2.5	3.5	6.3	5.3	5.0
30	5.15	.....	7.25	8.2	7.3	7.1	3.35	2.55	3.6	6.4	5.3	4.95
31	5.2	.....	7.0	.....	7.8	.....	3.30	2.4	.....	5.8	.....	4.95

Station rating table for Yakima River at Kiona, Wash., from January 1, 1904, to December 31, 1905.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
2.40	142	3.90	835	5.40	2,420	7.80	6,940
2.50	164	4.00	910	5.50	2,560	8.00	7,400
2.60	188	4.10	990	5.60	2,700	8.20	7,870
2.70	215	4.20	1,070	5.70	2,850	8.40	8,350
2.80	245	4.30	1,160	5.80	3,000	8.60	8,830
2.90	280	4.40	1,250	5.90	3,160	8.80	9,320
3.00	315	4.50	1,350	6.00	3,320	9.00	9,820
3.10	355	4.60	1,450	6.20	3,650	9.20	10,320
3.20	395	4.70	1,560	6.40	3,990	9.40	10,840
3.30	440	4.80	1,670	6.60	4,350	9.60	11,360
3.40	490	4.90	1,780	6.80	4,740	9.80	11,880
3.50	555	5.00	1,900	7.00	5,160	10.00	12,400
3.60	620	5.10	2,020	7.20	5,600	10.20	12,920
3.70	690	5.20	2,150	7.40	6,040	10.40	13,450
3.80	760	5.30	2,280	7.60	6,480		

The above table is applicable only for open-channel conditions. It is based on 16 discharge measurements made during 1902–1905. It is well defined.

Estimated monthly discharge of Yakima River at Kiona, Wash., for 1905.

[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	3,016	1,250	2,126	130,700	0.407	0.469
February	4,170	1,115	1,972	109,500	.377	.393
March	10,970	4,445	8,477	521,200	1.62	1.87
April	10,320	3,320	4,998	297,400	.956	1.07
May	6,940	3,650	4,720	290,200	.902	1.04
June	13,450	3,990	7,143	425,100	1.37	1.53
July	4,740	440	1,757	108,000	.336	.387
August	465	142	240	14,760	.046	.053
September	620	142	304	18,090	.058	.065
October	4,740	690	2,522	155,100	.482	.556
November	2,700	1,780	2,071	123,200	.396	.442
December	2,280	1,725	1,980	121,800	.379	.437
The year	13,450	142	3,192	2,315,000	.611	8.31

CANALS IN YAKIMA 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 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 irrigation canals are Yakima and Naches rivers. The Naches, when it joins the Yakima, has already received the water of the Tieton. Besides these rivers, Wenas, Cowiche, Atanum, Toppenish, and Satus creeks, with some small creeks in the vicinity of Ellensburg, irrigate large areas of land lying in the valleys through which they flow. About 100,000 acres of land are at present under irrigation from these sources, and with the available storage reservoirs at the heads of Yakima, Naches, and Tieton rivers, it is probable that 300,000 acres additional could be irrigated, if the water were used economically.

There are at the present time about 50 irrigating canals in operation in 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. Where water is applied large and very profitable crops of fruit, hay, hops, and grain are raised.

A large area of the best quality of land in Yakima Valley remains unirrigated, but the available water supply, especially at low stages of the streams, is practically exhausted, so that the irrigation of additional land is dependent on the feasibility of storing water, to be used during about two and one-half months of the irrigation season.

There are five reservoir sites available in the Yakima region. These are Lake Clealum, Lake Kachess, and Lake Keechelus, at the head of Yakima River, having a combined capacity of about 370,000 acre-feet; Bumping Lake, at the head of Naches River, with a storage capacity of 22,000 acre-feet, and McAlisters Meadows, on Tieton River, with a storage capacity of 35,000 acre-feet, giving a total of about 427,000 acre-feet, which is enough to maintain a flow of 2,300 second-feet for a period of two and one-half months, or during the dry portion of the irrigation season. This amount of water, with a liberal allowance for loss in transmission, could easily be made to irrigate 150,000 acres of land and might be made to irrigate, with economical use, much more than this amount.

The canals at present in operation in Yakima Valley are mostly in the hands of stock companies and with but few exceptions furnish the farmers under them water enough to supply all demands. Most farmers have taken from the ditches as much water as seemed most convenient for their use; this 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 Yakima Valley. Land that was once valuable is now water-logged and worthless, alkali being everywhere visible.

The following table gives a list of canals on which observations were made during the irrigation season of 1905. The results of measurements of canals and ditches in Yakima Valley made during 1904 are contained in Water-Supply Paper No. 135, United States Geological Survey.

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	
Fogarty	do				Right	
Selah Moxee	North Yakima	8	14 N.	19 E.	Left	27
Taylor	do				Right	4½
Below Naches River and above Atanum Creek.						
Moxee	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	
Below Atanum Creek.						
New Reservation No. 2	Yakima	17	12 N.	19 E.	Right	(a)
Old Reservation No. 1	do	28	12 N.	19 E.	do	12½
Sunnyside	do	28	12 N.	19 E.	Left	38
Benton Water Co	Kiona				do	
Kiona	do	10	9 N.	26 E.	do	9
Kiona Water Supply Co	do				do	
Kennewick	Kennewick	3	10 N.	27 E.	Right	39½
Grosscup's	Kiona	3	10 N.	27 E.	Left	5½

[a] Not completed. Proposed length, 65 miles.

Canals taking water from Naches River.

Canal.	Location.				Bank of river.	Length in miles.
	Nearest town.	Head works.				
		Section.	Township.	Range.		
Selah Valley	North Yakima	35	15 N.	16 E.	Left	20
Below Tieton River 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	
Laswell	do	14	14 N.	17 E.	do	
Yakima Valley	do	24	14 N.	17 E.	do	22
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				do	
McCormick	do				do	
Shearer-Chapman	do				do	
Nelson	do				do	
Naches-Cowiche	do	9	13 N.	18 E.	Right	7
Below Cowiche Creek.						
Broadgauge	North Yakima	10	13 N.	18 E.	Right	3
Power	do	10	13 N.	18 E.	do	6
Shanno-Fruitvale	do	10			do	
Shanno	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	

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., about 5½ miles above Thorp.

The gage is at the headgates. Measurements are made in a flume one-half mile below the gage.

Discharge measurements of Cascade canal near Thorp, Wash., in 1905.

Date.	Hydrographer.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Square feet.	*Feet per second.*	*Feet.*	*Second-feet.*
June 6	W. C. Muldrow	19.2	4.19	3.0	80.0
July 14	do	16.0	3.81	2.65	61.0
August 29	do	15.6	3.77	2.65	59.0
October 6	do	8.0	2.61	1.6	20.9

Daily gage height, in feet, of Cascade canal near Thorp, Wash., for 1905.

Day.	June.	July.	Aug.	Sept.	Day.	June.	July.	Aug.	Sept.	Day.	June.	July.	Aug.	Sept.
1	.....	2.65	2.5	2.6	12	2.9	2.3	2.6	2.6	22	2.7	2.6	2.6	2.55
2	.....	2.65	2.6	2.6	13	2.9	2.2	2.6	2.6	23	2.7	2.6	2.7	2.6
3	.....	2.65	2.7	2.6	14	2.9	2.15	2.6	2.6	24	2.7	2.6	2.7	2.6
4	.....	2.6	2.6	2.6	15	2.8	2.1	2.55	2.6	25	2.7	2.65	2.7	2.65
5	.....	2.5	2.65	2.6	16	2.8	2.1	2.5	2.6	26	2.7	2.65	2.6	2.65
6	.....	2.5	2.5	2.6	17	2.7	2.1	2.6	2.55	27	2.7	2.6	2.6	2.7
7	3.0	2.45	2.5	2.6	18	2.7	2.1	2.6	2.5	28	2.7	2.6	2.7	2.7
8	3.0	2.4	2.45	2.6	19	2.7	2.6	2.7	2.5	29	2.7	2.6	2.65	2.8
9	3.0	2.3	2.6	2.6	20	2.7	2.6	2.7	2.6	30	2.7	2.6	2.6	2.9
10	3.0	2.3	2.55	2.6	21	2.7	2.6	2.7	2.6	31	.....	2.5	2.6	.....
11	3.0	2.3	2.6	2.6										

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.

The gage is attached to a bridge 1½ miles below the head works. Measurements are made from the bridge.

Discharge measurements of West Kittitas canal near Thorp, Wash., in 1905.

Date.	Hydrographer.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Square feet.	*Feet per second.*	*Feet*	*Second-feet.*
June 30	W. C. Muldrow	12.0	1.17	1.10	14.0
July 10	do	27.8	1.80	2.15	50.5
August 29	do	33.5	2.27	2.55	73.7

Daily gage height, in feet, of West Kittitas canal near Thorp, Wash., for 1905.

Day.	July.	Aug.	Sept.	Day.	July.	Aug.	Sept.	Day.	July.	Aug.	Sept.
1	1.1	2.5	2.5	12	2.1	2.5	2.5	22	2.4	2.5	0.3
2	1.1	2.5	2.5	13	2.1	2.5	2.6	23	2.4	2.6	.3
3	1.4	2.5	2.5	14	2.2	2.5	2.6	24	2.4	2.6	2.2
4	1.9	2.5	2.5	15	2.2	2.5	2.6	25	2.4	2.6	.....
5	1.9	2.5	2.5	16	2.4	2.5	2.5	26	2.4	2.5	.....
6	1.9	2.5	2.5	17	2.3	2.5	1.8	27	2.4	2.5	.....
7	2.0	2.5	2.6	18	2.3	2.5	.4	28	2.5	2.5	.7
8	1.9	2.5	2.6	19	2.3	.....	.4	29	2.5	2.5	.7
9	1.8	2.5	2.6	20	2.3	2.1	.4	30	2.5	2.5	.....
10	2.0	2.5	2.6	21	2.4	2.2	.3	31	2.5	2.5	.....
11	2.0	2.5	2.5								

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 gage is about one-fourth mile below the head-gates of the canal, and is attached to a cattle bridge, from which measurements are made.

Discharge measurements of Town canal near Ellensburg, Wash., in 1905.

Date.	Hydrographer.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Square feet.	*Feet per second.*	*Feet.*	*Second-feet.*
July 13	W. C. Muldrow	62	2.13	3.58	132
August 30	do	57	2.15	3.70	122
October 6	do	42	2.07	2.90	86

Daily gage height, in feet, of Town canal near Ellensburg, Wash., for 1905.

Day.	July.	Aug.	Sept.	Oct.	Day.	July.	Aug.	Sept.	Oct.	Day.	July.	Aug.	Sept.	Oct.
1	.....	3.7	3.85	3.4	12	3.65	3.5	3.65	2.25	22	3.9	3.85	3.5	.....
2	.....	3.65	3.35	3.4	13	3.6	3.6	3.65	2.25	23	3.9	3.85	3.6	.....
3	.....	3.7	3.85	3.35	14	3.6	3.6	3.65	.....	24	3.9	3.85	3.6	.....
4	.....	3.7	3.75	3.4	15	3.65	3.65	3.6	.....	25	3.85	3.85	3.6	.....
5	.....	3.65	3.75	3.1	16	3.75	3.8	3.55	.....	26	3.85	3.85	3.6	.....
6	3.75	3.65	3.75	2.15	17	3.75	3.85	3.5	.....	27	3.85	3.9	3.6	.....
7	3.75	3.6	3.85	2.15	18	3.85	3.9	3.5	.....	28	3.8	3.9	3.75	.....
8	3.8	3.6	3.8	2.2	19	3.85	3.9	3.5	.....	29	3.75	3.85	3.4	.....
9	3.8	3.6	3.8	2.2	20	3.9	3.9	3.5	.....	30	3.75	3.85	3.4	.....
10	3.75	3.6	3.7	2.2	21	3.9	3.9	3.5	.....	31	3.7	3 85	.....	.....
11	3.65	3.5	3.65	2.25										

OLSEN CANAL NEAR ELLENSBURG, WASH.

This canal heads in the left bank of Yakima River just below the Town canal.

The gage is attached to a wagon bridge near Charles Kuli's house. Measurements are made from a foot log a short distance above the gage.

Discharge measurements of Olsen canal near Ellensburg, Wash., in 1905.

Date.	Hydrographer.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Square feet.	*Feet per second.*	*Feet.*	*Second-feet.*
July 13	W. C. Muldrow	12.0	1.17	1.95	14.0
August 30	do	14.7	1.56	2.20	23.0
September 21	do	14.1	1.43	2.15	20.1
October 6	do	18.6	.50	2.00	9.3

Daily gage height, in feet, of Olsen canal near Ellensburg, Wash., for 1905.

Day.	Sept.	Oct.	Day.	Sept.	Oct.	Day.	Sept.	Oct.	Day.	Sept.	Oct.
1	.....	2.05	9	1.95	2.3	17	2.3	.....	24	2.2	.....
2	.....	1.95	10	1.9	2.3	18	2.3	.....	25	2.2	.....
3	.....	1.95	11	1.95	2.4	19	2.25	.....	26	2.2	.....
4	1.9	1.95	12	2.3	.....	20	2.2	.....	27	2.2	.....
5	1.9	1.95	13	2.3	.....	21	2.2	.....	28	2.2	.....
6	1.9	2.0	14	2.3	.....	22	2.2	.....	29	2.2	.....
7	1.95	2.0	15	2.25	.....	23	2.2	.....	30	2.05	.....
8	1.95	2.3	16	2.25	.....						

SELAH-MOXEE CANAL NEAR NORTH YAKIMA, WASH.

This canal heads in the left bank of Yakima River just below Yakima Canyon, in sec. 8, T. 14 N., R. 19 E. It is the next important canal below the Olsen canal.

The gage is at a footbridge near Selah siding, 1½ miles below the head-gates. Measurements are made from the footbridge.

Discharge measurements of Selah-Moxee canal near North Yakima, Wash., in 1905.

Date.	Hydrographer.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Square feet.	*Feet per second.*	*Feet.*	*Second-feet.*
July 5	W. C. Muldrow	3.10	1.74	2.3	54.0
August 11	do	41.6	1.64	2.77	68.0
September 9	do	40.5	1.50	2.70	60.7
September 30	do			2.75	61.8
October 12	do	20.0	1.00	1.65	20.0

Daily gage height, in feet, of Selah-Moxee canal near North Yakima, Wash., for 1905.

Day.	July.	Aug.	Sept.	Day.	July.	Aug.	Sept.	Day.	July.	Aug.	Sept.
1	.....	3.0	2.8	12	2.8	2.8	2.8	22	2.8	2.9	2.4
2	.....	2.9	2.9	13	2.8	2.8	2.7	23	2.8	2.9	2.3
3	.....	3.0	2.8	14	2.7	2.8	2.6	24	2.8	3.0	2.2
4	.....	3.0	2.8	15	2.8	2.8	2.4	25	2.8	3.0	2.2
5	2.3	2.9	2.8	16	2.7	2.8	2.4	26	2.9	3.0	2.3
6	2.3	2.9	2.8	17	2.7	2.8	2.4	27	2.9	3.0	2.3
7	2.4	2.9	2.8	18	2.7	2.8	2.4	28	2.9	3.0	2.3
8	2.5	2.8	2.8	19	2.7	3.0	2.4	29	3.0	3.0	2.3
9	2.6	2.8	2.7	20	2.7	2.9	2.4	30	3.0	2.8	2.4
10	2.8	2.9	2.7	21	2.7	3.0	2.4	31	3.0	2.8	.....
11	2.8	2.8	2.7								

TAYLOR CANAL NEAR NORTH YAKIMA, WASH.

This canal heads in the right bank of Yakima River about 4 miles above the mouth of Naches River.

The gage is about 100 feet above the dividing gates. Measurements are made from a foot plank 50 feet below the gage.

Discharge measurements of Taylor canal near North Yakima, Wash., in 1905.

Date.	Hydrographer.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Square feet.	*Feet per second.*	*Feet.*	*Second-feet.*
July 5	W. C. Muldrow	12.0	1.25	.....	15.0
August 18	do	12.0	1.23	0.95	14.6
September 9	do	13.6	1.38	1.10	18.7
October 12	do	5.0	.36	.30	1.8

Daily gage height, in feet, of Taylor canal near North Yakima, Wash., for 1905.

Day.	Aug.	Sept.	Oct.	Day.	Aug.	Sept.	Oct.	Day.	Aug.	Sept.	Oct.
1	.....	1.05	0.55	12	.....	1.1	0.3	22	1.0	1.1	.....
2	.....	1.05	.55	13	.....	1.15	.25	23	1.0	1.1	.....
3	.....	1.05	.55	14	.....	1.15	.3	24	1.1	.65	.....
4	.....	1.05	.5	15	.....	1.1	.....	25	1.05	.65	.....
5	.....	1.05	.5	16	.....	1.1	.....	26	1.05	.6	.....
6	.....	1.0	.5	17	.....	1.1	.....	27	1.05	.6	.....
7	.....	1.05	.5	18	0.95	1.15	.....	28	1.05	.6	.....
8	.....	1.1	.45	19	.95	1.15	.....	29	1.1	.55	.....
9	.....	1.2	.3	20	.9	1.15	.....	30	1.1	.55	.....
10	.....	1.15	.3	21	1.0	1.1	.....	31	1.05	.....	.....
11	.....	1.1	.3								

MOXEE CANAL NEAR NORTH YAKIMA, WASH.

This canal heads in the left bank of Yakima River near the line between secs. 7 and 18, T. 13 N., R. 19 E., opposite the town of North Yakima.

The gage is one-half mile below the head-gates on the Moxee hop ranch, about 300 feet above the foot plank from which measurements are made.

Discharge measurements of Moxee canal near North Yakima, Wash., in 1905.

Date.	Hydrographer.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Square feet.	*Feet per second.*	*Feet.*	*Second-feet.*
July 6	W. C. Muldrow	7.1	1.07	0.50	7.6
August 21	do	17.0	.99	1.05	16.8
August 21	do	13.4	1.00	1.05	13.4
September 26	do	9.3	.81	.80	7.6
October 13	do	5.3	.45	.16	2.3

Daily gage height, in feet, of Moxee canal near North Yakima, Wash., for 1905.

Day.	July.	Aug.	Sept.	Oct.	Day.	July.	Aug.	Sept.	Oct.	Day.	July.	Aug.	Sept.	Oct.
1	.....	1.25	1.1	0.75	12	1.1	1.0	0.9	.15	22	1.0	1.15	0.65	.....
2	.....	1.15	1.0	.75	13	1.15	1.0	.9	.15	23	1.25	1.15	.65	.....
3	.....	1.15	1.0	.75	14	1.15	.9	.9	.15	24	1.25	1.35	.65	.....
4	.....	1.15	1.0	.75	15	1.15	1.0	1.0	.15	25	1.15	1.25	.65	.....
5	.....	.85	1.15	.75	16	1.1	.9	.9	.15	26	1.15	1.15	.65	.....
6	0.5	.65	1.15	.75	17	1.1	.9	.75	.15	27	1.4	1.15	.65	.....
7	.5	.5	1.15	.15	18	1.1	.9	.75	.15	28	1.4	1.25	.75	.....
8	.85	.5	1.15	.15	19	1.0	1.1	.75	.15	29	1.35	1.35	.75	.....
9	.85	.5	1.0	.15	20	1.0	1.1	.65	.15	30	1.25	1.35	.75	.....
10	1.15	1.0	1.0	.15	21	1.0	1.0	.65	.15	31	1.25	1.15	.....	.....
11	.4	1.0	.9	.15										

HUBBARD CANAL NEAR NORTH YAKIMA, WASH.

This canal heads in the left bank of Yakima River near the line between secs. 7 and 18, T. 13 N., R. 19 E., opposite the town of North Yakima.

The gage is about one-half mile below the head-gates, at a small flume near the hop house on the Moxee hop ranch. Measurements are made from a wagon bridge 300 feet below the gage.

The Hubbard and Moxee canals have a common head-gate.

Discharge measurements of Hubbard canal near North Yakima, Wash., in 1905.

Date.	Hydrographer.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Square feet.	*Feet per second.*	*Feet.*	*Second-feet.*
July 6	W. C. Muldrow	20.0	0.72	1.33	14.3
August 21	do	13.1	1.61	1.50	21.1
September 26	do	9.8	1.02	1.20	10.2
October 13	do	8.6	.60	.92	5.1

Daily gage height, in feet, of Hubbard canal near North Yakima, Wash., for 1905.

Day.	July.	Aug.	Sept.	Oct.	Day.	July.	Aug.	Sept.	Oct.	Day.	July.	Aug.	Sept.	Oct.
1	.....	1.75	1.5	1.4	12	1.75	1.15	1.4	1.0	22	1.35	1.5	1.4	.....
2	.....	1.75	1.5	1.4	13	1.75	1.15	1.4	1.0	23	1.4	1.35	1.4	.....
3	.....	1.65	1.5	1.4	14	1.75	1.15	1.4	1.0	24	1.5	1.4	1.25	.....
4	.....	1.65	1.5	1.5	15	1.75	1.35	1.4	1.0	25	1.6	1.4	1.25	.....
5	.....	1.65	1.5	1.5	16	1.65	1.35	1.4	1.0	26	1.6	1.35	1.25	.....
6	1.35	1.65	1.4	1.5	17	1.65	1.25	1.4	1.0	27	1.85	1.25	1.25	.....
7	1.35	1.65	1.5	1.0	18	1.5	1.25	1.4	1.0	28	1.75	1.35	1.25	.....
8	1.5	1.5	1.5	1.0	19	1.5	1.4	1.4	1.0	29	1.75	1.4	1.25	.....
9	1.5	1.5	1.4	1.0	20	1.35	1.4	1.35	1.0	30	1.75	1.6	1.4	.....
10	1.9	1.4	1.4	1.0	21	1.35	1.6	1.35	1.0	31	1.75	1.4	.....	.....
11	1.85	1.35	1.4	1.0										

FOWLER CANAL NEAR NORTH YAKIMA, WASH.

This canal heads in Yakima River, in sec. 18, T. 13 N., R. 19 E.

The gage is in a flume one-half mile below the head-gates, on the Moxie hop ranch, opposite the town of North Yakima. Measurements are made at the gage.

Discharge measurements of Fowler canal near North Yakima, Wash., in 1905.

Date.	Hydrographer.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Square feet.	*Feet per second.*	*Feet.*	*Second-feet.*
July 6	W. C. Muldrow	9.7	2.02	0.75	19.6
August 21	do	11.7	2.04	.92	23.9
September 26	do	9.0	1.48	.55	13.4

Daily gage height, in feet, of Fowler canal near North Yakima, Wash., for 1905.

Day.	July.	Aug.	Sept.	Oct.	Day.	July.	Aug.	Sept.	Oct.	Day.	July.	Aug.	Sept.	Oct.
1	.....	0.9	0.85	0.6	12	.85	.85	.65	.....	22	.9	.9	.5	.....
2	.....	.9	.85	.6	13	.85	.85	.65	.....	23	.85	.9	.5	.....
3	.....	.9	.85	.6	14	.9	.85	.65	.....	24	.9	.9	.65	.....
4	.....	.85	.85	.....	15	.9	.85	.65	.....	25	.9	.9	.6	.....
5	.....	.85	.85	.....	16	.9	.85	.5	.....	26	.9	.9	.6	.....
6	0.75	.85	.75	.....	17	.9	.85	.5	.....	27	.9	.85	.6	.....
7	.75	.85	.65	.....	18	.9	.85	.5	.....	28	.9	.85	.6	.....
8	.75	.85	.65	.....	19	.9	.9	.5	.....	29	.9	.85	.6	.....
9	.65	.85	.65	.....	20	.9	.9	.5	.....	30	.9	.85	.6	.....
10	.85	.85	.65	.....	21	.9	.9	.5	.....	31	.9	.85	.....	.....
11	.9	.85	.65	.....										

NEW RESERVATION CANAL 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.

The gage is at the first wagon bridge below the headworks. Measurements are made from the bridge.

Discharge measurements of New Reservation canal in Yakima Indian Reservation, Wash., in 1905.

Date.	Hydrographer.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Square feet.	*Feet per second.*	*Feet.*	*Second-feet.*
June 16	W. C. Muldrow	60	1.80	1.50	108
August 22	do	112	1.25	2.58	140
September 20	do	.....	.....	1.97	62
September 27	do	79	.69	1.83	55
October 24	do	50	.82	1.04	41

Daily gage height, in feet, of New Reservation canal in Yakima Indian Reservation, Wash., for 1905.

Day.	June.	July.	Aug.	Sept.	Day.	June.	July.	Aug.	Sept.	Day.	June.	July.	Aug	Sept.
1	1.5	1.6	2.25	1.6	12	1.5	2.15	2.55	.....	22	1.65	2.1	2.6	.....
2	1.5	1.6	2.3	1.65	13	1.5	2.15	2.5	.....	23	1.65	2.1	2.6	.....
3	1.5	1.65	2.45	.....	14	1.5	2.2	2.5	.....	24	1.65	2.15	2.6	.....
4	1.15	1.75	2.6	.....	15	1.5	2.2	2.5	.....	25	1.35	2.15	2.6	.....
5	1.0	1.75	2.7	.....	16	1.6	2.25	2.55	.....	26	1.35	2.15	2.0	.....
6	1.0	1.9	2.7	.....	17	1.6	2.2	2.6	.....	27	1.35	2.2	2.0	.....
7	1.1	2.0	2.7	.....	18	1.65	2.15	2.65	.....	28	.85	2.25	1.75	.....
8	1.15	2.25	2.65	.....	19	1.65	2.15	3.0	.....	29	1.35	2.25	1.65	.....
9	1.35	2.05	2.65	.....	20	1.65	2.1	2.65	.....	30	1.45	2.25	1.6	.....
10	1.4	2.1	2.65	.....	21	1.65	2.1	2.65	.....	31	.....	2.25	1.7	.....
11	1.4	2.15	2.6	.....										

OLD RESERVATION CANAL IN YAKIMA INDIAN RESERVATION, WASH.

This canal takes water from Yakima River, heading in its right bank, in sec. 28, T. 12 N., R. 19 E., about 4 miles above Wapato station. It was built by the Government to irrigate lands in the Yakima Indian Reservation.

The gage is at the head-gate. Measurements are made from the railway bridge one-fourth mile below the gage.

Discharge measurements of Old Reservation canal in Yakima Indian Reservation, Wash., in 1905.

Date.	Hydrographer.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Square feet.	*Feet per second.*	*Feet.*	*Second-feet.*
June 16	W. C. Muldrow	37.4	3.85	2.67	144
August 22	do	26.4	3.07	2.08	81.4
October 24	do	17.6	2.01	1.40	35.4

Daily gage height, in feet, of Old Reservation canal in Yakima Indian Reservation, Wash., for 1905.

Day.	May.	June.	July.	Aug.	Day.	May.	June.	July.	Aug.	Day.	May.	June.	July.	Aug.
1	3.35	3.4	3.35	3.1	12	3.35	2.6	3.35	2.65	22	3.35	3.35	3.25	2.25
2	3.35	3.5	3.25	3.1	13	3.25	2.65	3.25	2.6	23	3.25	3.35	3.25	2.25
3	3.35	3.35	3.35	3.1	14	3.25	2.65	3.15	2.5	24	3.35	3.35	3.15	2.25
4	3.35	2.65	3.25	3.1	15	3.25	2.6	3.15	2.35	25	3.35	3.25	3.15	2.25
5	3.35	2.65	3.35	3.0	16	3.25	2.65	3.15	2.25	26	3.35	3.35	3.1	2.15
6	3.4	2.65	3.35	3.0	17	3.25	3.1	3.15	2.25	27	3.25	3.25	3.0	2.15
7	3.5	2.65	3.25	3.0	18	3.35	3.15	3.15	2.41	28	3.25	3.35	3.15	2.15
8	3.6	2.6	3.35	3.0	19	3.35	3.25	3.15	2.25	29	3.35	3.35	3.15	2.15
9	3.6	2.6	3.5	2.9	20	3.35	3.25	3.1	2.25	30	3.4	3.25	3.2	2.25
10	3.35	2.65	3.4	2.85	21	3.35	3.25	3.0	2.25	31	3.35	.....	3.1	2.25
11	3.25	2.6	3.4	2.75										

SUNNYSIDE CANAL NEAR YAKIMA, WASH.

This canal, which is owned and operated by the Washington Irrigation Company, heads in the east bank of Yakima River, 5 miles below the town of Yakima. It is several times larger than any other canal in the Yakima region, the maximum flow being about 670 second-feet.

The gage is in a concrete gage box about 400 feet below the head-gates. Measurements are made from a footbridge about 400 feet below the gage.

Discharge measurements of Sunnyside canal near Yakima, Wash., in 1905.

Date.	Hydrographer.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Square feet.	*Feet per second.*	*Feet.*	*Second-feet.*
June 15	W. C. Muldrow	175	3.00	4.35	526
July 25	do	210	3.09	5.06	649
September 28	do	162	2.90	4.00	469
October 25	do	128	2.35	3.35	301
November 5	do	68.8	2.01	2.00	139

Daily gage height, in feet, of Sunnyside canal near Yakima, Wash., for 1905.

Day.	June.	July.	Aug.	Sept.	Oct.	Day.	June.	July.	Aug.	Sept.	Oct.
1	.....	4.7	5.15	4.75	3.95	17	4.2	5.1	4.6	4.05	3.4
2	.....	4.7	5.15	4.75	3.95	18	4.4	5.1	4.6	3.95	3.4
3	.....	4.7	5.15	4.65	3.95	19	4.5	5.1	4.9	3.95	3.4
4	.....	4.7	5.15	4.65	3.8	20	4.5	5.1	5.1	3.95	3.4
5	.....	4.7	5.15	4.65	3.7	21	4.5	0.0	5.15	3.95	3.5
6	.....	4.8	5.15	4.55	3.7	22	4.6	5.1	5.0	3.95	3.5
7	.....	4.9	5.15	4.55	3.7	23	4.6	0.0	4.65	3.95	3.3
8	.....	4.9	5.15	4.55	3.4	24	4.7	5.1	4.6	3.95	3.3
9	.....	5.0	5.15	4.55	3.4	25	4.7	5.1	4.8	3.95	3.3
10	.....	5.0	5.15	4.55	3.4	26	4.7	5.1	4.8	3.95	3.3
11	.....	5.0	4.9	4.55	3.4	27	4.7	5.15	4.8	3.95	3.3
12	.....	5.0	4.9	4.55	3.4	28	4.7	5.15	4.8	3.95	3.3
13	.....	5.0	4.8	4.4	3.4	29	4.7	5.15	4.8	3.95	3.3
14	.....	5.1	4.75	4.4	3.4	30	4.7	5.15	4.75	3.95	3.3
15	4.2	5.1	4.6	4.4	3.4	31	.....	5.15	4.75	.....	3.3
16	4.2	5.1	4.6	4.15	3.4						

BENTON WATER COMPANY'S CANAL NEAR KIONA, WASH.

This canal takes water from Yakima River near Kiona. It is a new canal, completed late in the irrigation season of 1905.

Discharge measurements of Benton Water Company's canal near Kiona, Wash., in 1905.

Date.	Hydrographer.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Square feet.	*Feet per second.*	*Feet.*	*Second-feet.*
August 23	W. C. Muldrow	8.0	0.86	0.30	6.9
September 13	do	16.1	1.23	.60	19.8

Daily gage height, in feet, of Benton Water Company's canal near Kiona, Wash., for 1905.

Day.	Aug.	Sept.	Oct.	Day.	Aug.	Sept.	Oct.	Day.	Aug.	Sept.	Oct.
1	.....	0.1	1.0	12	.....	0.55	0.3	22	.....	0.9	.....
2	.....	.15	1.0	13	.....	.55	.3	23	0.3	.9	.....
3	.....	.3	1.0	14	.....	.6	.3	24	.3	.9	.....
4	.....	.3	1.0	15	.....	.6	.3	25	.2	.9	.....
5	.....	.4	.4	16	.....	.7	.3	26	.2	.9	.....
6	.....	.5	.4	17	.....	.7	.3	27	.2	.9	.....
7	.....	.5	.4	18	.....	.7	.3	28	.2	.9	.....
8	.....	.5	.4	19	.....	.8	.....	29	.1	1.0	.....
9	.....	.6	.4	20	.....	.8	.....	30	.1	1.0	.....
10	.....	.6	.3	21	.....	.8	.....	31	.1	.....	.....
11	.....	.6	.3								

KIONA CANAL NEAR KIONA, WASH.

This canal heads in the left bank of Yakima River about 5 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.

The gage is about 400 feet below the head-gates. Measurements are made from a foot plank near the gage.

Discharge measurements of Kiona canal near Kiona, Wash., in 1905.

Date.	Hydrographer.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Square feet.	*Feet per second.*	*Feet.*	*Second-feet.*
June 12	W. C. Muldrow	20.4	1.17	3.00	23.9
August 24	do	19.0	1.26	3.00	23.9
August 24	do	6.8	.50	2.00	3.4

Daily gage height, in feet, of Kiona canal near Kiona, Wash., for 1905.

Day.	June.	July.	Aug.	Sept.	Oct.	Day.	June.	July.	Aug.	Sept.	Oct.
1	.....	.....	3.25	3.1	3.0	17	3.15	3.25	3.45	3.0	.....
2	.....	.....	3.3	3.1	3.0	18	3.15	3.15	3.45	3.0	.....
3	.....	.....	3.3	3.1	2.5	19	3.25	3.1	3.4	3.0	.....
4	.....	.....	3.3	3.1	2.5	20	3.25	3.0	3.35	3.0	.....
5	.....	.....	3.3	3.1	2.5	21	3.4	3.0	3.35	3.0	.....
6	.....	.....	3.35	3.1	2.5	22	3.4	3.0	3.1	3.0	.....
7	.....	.....	3.35	3.1	2.5	23	3.4	3.0	3.1	3.0	.....
8	.....	2.9	3.25	3.1	2.5	24	3.6	3.0	3.0	3.0	.....
9	.....	2.9	3.3	3.1	2.5	25	.....	3.0	3.0	3.0	.....
10	.....	3.15	3.4	3.1	2.5	26	.....	2.9	3.0	3.0	.....
11	.....	3.25	3.55	3.1	2.5	27	.....	2.9	3.1	3.0	.....
12	3.0	3.25	3.5	3.1	2.5	28	.....	2.85	3.1	3.0	.....
13	3.1	3.35	3.5	3.1	2.7	29	.....	2.9	3.1	3.0	.....
14	3.1	3.35	3.5	3.1	2.5	30	.....	3.0	3.1	3.0	.....
15	3.1	3.25	3.5	3.1	2.5	31	.....	3.15	3.1	.....	.....
16	3.15	3.25	3.5	3.1	.....						

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

This canal heads in the left bank of Yakima River about 1 mile 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 gage is 200 feet below the footbridge from which measurements are made, near the dwelling of A. A. McAlpin.

Discharge measurements of Kiona Water Supply Company's canal near Kiona, Wash., in 1905.

Date.	Hydrographer.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Square feet.	*Feet per second.*	*Feet.*	*Second-feet.*
September 14	W. C. Muldrow	7.8	0.96	1.50	7.5
October 18	do	9.3	1.07	1.90	10.0

Daily gage height, in feet, of Kiona Water Supply Company's canal near Kiona, Wash., for 1905.

Day.	Aug.	Sept.	Oct.	Day.	Aug.	Sept.	Oct.	Day.	Aug.	Sept.	Oct.
1	.....	1.2	1.8	12	.....	1.3	2.0	22	.....	1.8	.....
2	.....	1.2	1.8	13	.....	1.3	2.0	23	.....	1.8	.....
3	.....	1.1	1.9	14	.....	1.5	2.0	24	.....	1.8	.....
4	.....	1.1	2.0	15	.....	1.6	.....	25	.....	1.8	.....
5	.....	1.1	2.0	16	.....	1.7	.....	26	.....	1.8	.....
6	.....	1.2	2.0	17	.....	1.7	.....	27	0.7	1.8	.....
7	.....	1.2	2.0	18	.....	1.7	.....	28	.9	1.8	.....
8	.....	1.3	2.0	19	.....	1.7	.....	29	1.0	1.8	.....
9	.....	1.3	2.0	20	.....	1.7	.....	30	1.0	1.8	.....
10	.....	1.3	2.0	21	.....	1.7	.....	31	1.1	.....	.....
11	.....	1.3	2.0								

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 Yakima Valley. It takes water from 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.

The gage is at a bridge 1¼ miles below the head-gates. Measurements are made from the bridge.

Discharge measurements of Kennewick canal near Kennewick, Wash., in 1905.

Date.	Hydrographer.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Square feet.	*Feet per second.*	*Feet.*	*Second-feet.*
June 10	W. C. Muldrow	68	1.5	2.83	102
August 23	do	76	2.14	3.42	162
September 14	do	83	2.10	3.47	174

Daily gage height, in feet, of Kennewick canal near Kennewick, Wash., for 1905.

Day.	June.	July.	Aug.	Sept.	Oct.	Day.	June.	July.	Aug.	Sept.	Oct.
1	.....	3.35	3.5	3.25	3.25	17	3.35	3.4	2.9	3.5	3.1
2	.....	3.35	3.5	3.15	3.25	18	3.4	3.4	3.0	3.5	3.1
3	.....	3.35	.....	3.25	3.25	19	1.75	3.4	3.15	3.4	3.1
4	.....	3.4	2.5	3.35	3.15	20	1.75	3.4	3.15	3.35	3.1
5	.....	3.4	.....	3.35	3.25	21	2.9	3.5	3.25	3.35	1.0
6	.....	3.4	2.5	3.4	3.25	22	3.35	3.5	3.35	3.35	2.15
7	.....	3.4	2.75	3.4	3.15	23	3.4	3.5	3.4	3.35	2.85
8	.....	3.8	2.0	3.35	3.0	24	3.4	3.5	3.35	3.35	2.85
9	.....	3.4	2.0	3.25	3.0	25	3.4	3.5	3.25	3.35	2.85
10	2.85	3.4	2.0	3.5	3.0	26	3.35	3.5	3.25	3.35	2.85
11	2.85	3.4	2.4	3.35	2.95	27	3.35	3.5	3.25	3.35	2.85
12	2.85	3.4	2.6	3.4	2.75	28	3.35	3.5	3.15	3.25	2.85
13	2.85	3.4	3.15	3.4	3.1	29	3.35	3.5	3.35	3.35	2.85
14	3.25	3.4	3.1	3.4	3.1	30	3.35	3.5	3.35	3.25	1.15
15	3.25	3.4	3.0	3.4	3.1	31	.....	3.5	3.25	.....	1.15
16	3.35	3.4	2.9	3.5	3.1						

GROSSCUP CANAL NEAR KIONA, WASH.

This canal heads in Yakima River on its left bank at Horn Rapids, directly opposite the intake of the Kennewick canal. The same diversion weir is used for both canals.

The gage is 1 mile below the head-gates, at a highway bridge, from which measurements are made.

Discharge measurements of Grosscup canal near Kiona, Wash., in 1905.

Date.	Hydrographer.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Square feet.	*Feet per second.*	*Feet.*	*Second-feet.*
June 13	W. C. Muldrow	2.9	1.55	0.50	4.5
August 23	do	3.3	1.66	.60	5.5
September 13	do	3.4	1.94	.70	6.6

Daily gage height, in feet, of Grosscup canal near Kiona, Wash., for 1905.

Day.	June.	July.	Aug.	Sept.	Day.	June.	July.	Aug.	Sept.	Day.	June.	July.	Aug.	Sept.
1		0.6	1.0	0.8	12	0.6	.8	.8	.8	22	.7	1.0	.8	.8
2		.6	1.0	.8	13	.6	.8	.8	.8	23	.7	1.0	.8	.8
3		.6	1.0	.8	14	.7	.9	.7	.8	24	.7	1.0	.8	.8
4		.6	1.0	.8	15	.7	1.0	.8	.8	25	.7	1.0	.8	.8
5		.6	1.0	.8	16	.7	1.0	.8	.8	26	.7	1.0	.8	.8
6		.6	0.0	.8	17	.6	1.0	.8	.8	27	.7	1.0	.8	.8
7		.6	0.0	.8	18	.6	1.0	.8	.8	28	.7	1.0	.8	.8
8		.6	.8	.8	19	.7	1.0	.8	.8	29	.7	1.0	.8	.8
9		.6	.8	.8	20	.7	1.0	.8	.8	30	.7	1.0	.8	.8
10		.6	.8	.8	21	.7	1.0	.8	.8	31		1.0	.8	
11		.7	.8	.8										

SELAH VALLEY CANAL NEAR NORTH YAKIMA, WASH.

The only important canal taking water from Naches River above the mouth of Tieton River 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 Power canal it is the largest canal taking water from the Naches.

The gage is in a flume 1 mile below the head-gates. Measurements are made at the gage.

Discharge measurements of Selah Valley canal near North Yakima, Wash., in 1905.

Date.	Hydrographer.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Square feet.	*Feet per second.*	*Feet.*	*Second-feet.*
June 21	W. J. Lightfoot	23.8	2.80	2.50	66.5
July 18	do	26.0	3.23	2.80	84.1
August 3	do	24.6	3.37	2.65	83.0
September 5	do	12.3	1.71	1.20	21.0
October 10	do	13.5	1.89	1.40	25.6

Daily gage height, in feet, of Selah Valley canal near North Yakima, Wash., for 1905.

Day.	June.	July.	Aug.	Sept.	Oct.	Day.	June.	July.	Aug.	Sept.	Oct
1	.....	2.4	2.75	2.7	2.1	17	.....	2.7	0.0	2.35	1.
2	.....	2.4	2.75	.....	2.0	18	2.6	2.75	0.0	2.35	1.
3	.....	2.4	2.75	.....	1.95	19	2.6	2.75	0.0	2.35	1.
4	.....	2.4	2.65	.....	1.9	20	2.6	2.75	1.6	2.35	1.
5	.....	2.4	2.65	1.15	1.9	21	2.6	2.75	1.5	2.3	1.
6	.....	2.4	2.65	1.15	1.8	22	2.55	2.75	2.6	2.35	1.
7	.....	2.5	2.65	2.0	1.6	23	2.55	2.4	2.75	2.25	1.
8	.....	2.6	2.6	2.6	1.4	24	2.55	2.4	2.4	2.25	1.
9	.....	2.6	2.6	2.5	1.4	25	2.55	2.5	2.75	2.25	1.
10	.....	2.6	2.6	2.55	1.35	26	2.55	2.65	2.75	2.15	1.
11	.....	2.6	2.6	2.45	1.35	27	2.15	2.75	2.75	2.05	1.
12	.....	2.6	2.6	2.45	1.35	28	2.4	2.75	2.75	2.1	1.
13	.....	2.6	2.7	2.5	1.35	29	2.4	2.75	2.75	2.1	1.
14	.....	2.6	2.7	2.45	1.35	30	2.4	2.75	2.75	2.1	1.
15	.....	2.65	2.75	2.45	1.4	31	.....	2.75	2.75	.....	1.
16	.....	2.7	2.75	2.4	1.4						

WAPATOX CANAL NEAR NORTH YAKIMA, WASH.

This canal heads in the left bank of Naches River opposite the mouth of Tieton River, i sec. 36, T. 15 N., R. 16 E. It is maintained by a stock company of 100 equal shares.

The gage is 200 feet below the head-gates. Measurements are made from a foot plan 100 feet below the gage.

Discharge measurements of Wapatox canal near North Yakima, Wash., in 1905.

Date.	Hydrographer.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Square feet.	*Feet per second.*	*Feet.*	*Second-feet.*
June 19	W. C. Muldrow	18.3	1.64	1.83	30.
July 18	do	28.0	1.93	2.67	54.
October 10	do	8.5	.82	.66	7.

Daily gage height, in feet, of Wapatox canal near North Yakima, Wash., for 1905.

Day.	June.	July.	Aug.	Sept.	Oct.	Day.	June.	July.	Aug.	Sept.	Oct.
1	.....	2.0	2.5	2.75	0.65	17	.....	2.6	0.0	2.5	.....
2	.....	2.0	2.4	.....	.65	18	.....	2.6	0.0	2.4	.....
3	.....	2.25	2.4	.....	.65	19	2.35	2.75	0.0	2.5	.....
4	.....	2.25	2.3	.....	1.15	20	2.35	2.9	2.9	2.35	.....
5	.....	2.1	2.25	2.65	1.0	21	2.35	2.9	2.85	2.65	.....
6	.....	2.35	2.15	2.65	.65	22	2.35	2.85	2.9	2.4	.....
7	.....	2.35	2.15	2.35	.65	23	2.25	2.85	2.85	2.4	.....
8	.....	2.65	2.25	2.6	.65	24	2.25	2.4	2.9	2.4	.....
9	.....	2.75	2.25	2.6	.65	25	2.25	2.25	2.85	2.35	.....
10	.....	2.95	2.5	2.65	.65	26	2.25	2.4	2.85	2.35	.....
11	.....	2.65	2.5	2.6	.65	27	2.0	2.4	2.8	2.1	.....
12	.....	2.5	2.85	2.6	.65	28	2.0	2.4	3.1	2.0	.....
13	.....	2.6	2.75	2.65	.65	29	2.0	2.4	2.75	1.9	.....
14	.....	2.65	2.65	2.6	.65	30	1.9	2.4	2.85	1.9	.....
15	.....	2.6	2.25	2.5	.....	31	.....	2.6	2.65	.....	.....
16	.....	2.65	2.75	2.4	.....						

FORTUNE CANAL NEAR NORTH YAKIMA, WASH.

This canal heads in the right bank of Naches River on John W. Foster's ranch, 16 miles from North Yakima. Its intake is near that of the Lower Scott canal.

The gage is at a wagon bridge on the road leading to the ford. Measurements are made from the bridge.

Discharge measurements of Fortune canal near North Yakima, Wash., in 1905.

Date.	Hydrographer.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Square feet.	*Feet per second.*	*Feet.*	*Second-feet.*
June 24	W. C. Muldrow	12.5	0.98	.....	12.3
August 16	do	7.7	.60	1.60	4.7
September 4	do	14.1	1.18	2.25	16.0
October 9	do	8.2	.48	1.50	4.0

Daily gage height, in feet, of Fortune canal near North Yakima, Wash., for 1905.

Day.	Aug.	Sept.	Oct.	Day.	Aug.	Sept.	Oct.	Day.	Aug.	Sept.	Oct.
1	.....	1.9	2.2	12	.....	2.1	.8	22	1.7	2.2	.....
2	.....	1.9	1.3	13	.....	2.2	.8	23	1.5	2.2	.....
3	.....	2.2	1.3	14	.....	2.2	.8	24	1.4	2.2	.....
4	.....	2.2	1.6	15	.....	2.1	.8	25	1.0	2.1	.....
5	.....	2.2	1.5	16	1.6	2.2	1.1	26	1.0	2.1	.....
6	.....	2.1	1.6	17	2.1	2.1	1.2	27	1.9	2.3	.....
7	.....	2.1	1.6	18	2.0	2.0	1.0	28	2.2	2.1	.....
8	.....	2.1	1.6	19	1.7	2.0	1.0	29	2.1	2.1	.....
9	.....	2.1	1.5	20	1.8	2.2	1.0	30	2.0	2.1	.....
10	.....	2.1	1.5	21	1.6	2.2	1.0	31	1.9	.....	.....
11	.....	2.1	1.5								

LOWER SCOTT CANAL NEAR NORTH YAKIMA, WASH.

This canal heads in the right bank of Naches River on John W Foster's ranch, 16 miles from North Yakima.

The gage is just below the crossing of the road leading to the ford. Measurements are taken from a footbridge near the gage.

Discharge measurements of Lower Scott canal near North Yakima, Wash., in 1905.

Date.	Hydrographer.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Square feet.	*Feet per second.*	*Feet.*	*Second-feet.*
June 24	W. C. Muldrow	9.9	1.40	.....	14.3
August 16	do	3.5	.94	0.70	3.3
September 4	do	11.5	1.75	1.35	20.2
October 9	do	7.3	1.51	1.05	11.0

Daily gage height, in feet, of Lower Scott canal near North Yakima, Wash., for 1905.

Day.	Aug.	Sept.	Oct.	Day.	Aug.	Sept.	Oct.	Day.	Aug.	Sept.	Oct.
1	.....	0.8	1.1	12	.....	1.1	1.0	22	.6	1.3	.....
2	.....	.8	1.1	13	.....	1.2	1.0	23	.6	1.3	.....
3	.....	1.6	1.1	14	.....	1.2	1.0	24	.5	1.3	.....
4	.....	1.3	1.1	15	.....	1.1	1.0	25	.4	1.0	.....
5	.....	1.1	1.1	16	0.7	1.2	1.2	26	.4	.9	.....
6	.....	1.1	1.1	17	1.0	1.0	1.2	27	.8	1.0	.....
7	.....	1.1	1.1	18	1.0	1.0	1.1	28	1.1	.9	.....
8	.....	1.1	1.1	19	.8	1.0	1.1	29	.9	.9	.....
9	.....	1.1	1.1	20	.9	1.2	1.1	30	.9	.9	.....
10	.....	1.1	1.1	21	.7	1.2	1.1	31	.8	.....	.....
11	.....	1.1	1.0								

CLARK CANAL NEAR NORTH YAKIMA, WASH.

This canal heads in the left bank of Naches River, on D. R. Putnam's ranch, about 16 miles from North Yakima.

The gage is one-half mile below the head-gate. Measurements are made from a foot plank near the gage.

Discharge measurements of Clark canal near North Yakima, Wash., in 1905.

Date.	Hydrographer.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Square feet.	*Feet per second.*	*Feet.*	*Second-feet.*
June 21	W. C. Muldrow	6.2	1.42	.....	8.8
September 4	do	10.0	1.63	1.35	16.3
October 11	do	7.2	.70	.75	5.0

Daily gage height, in feet, of Clark canal near North Yakima, Wash., for 1905.

Day.	Aug.	Sept.	Oct.	Day.	Aug.	Sept.	Oct.	Day.	Aug.	Sept.	Oct.
1	.....	1.4	.....	12	.....	1.3	1.0	22	1.4	1.4	.8
2	.....	1.7	1.3	13	.....	1.5	1.0	23	1.4	1.4	.....
3	.....	1.5	1.5	14	.....	1.5	1.0	24	1.4	.....	.....
4	.....	1.5	1.7	15	.....	1.4	.....	25	1.4	1.5	.....
5	.....	1.05	1.7	16	.....	1.4	1.0	26	1.4	1.5	.....
6	.....	1.4	1.6	17	1.6	.....	.9	27	.....	1.5	.....
7	.....	1.3	1.6	18	1.5	1.3	.9	28	1.6	1.4	.....
8	.....	1.3	.....	19	1.5	1.3	.9	29	1.5	1.3	.....
9	.....	1.4	1.1	20	.....	1.3	.8	30	1.5	1.2	.....
10	.....	.....	1.1	21	1.4	1.4	.8	31	1.4	.....	.....
11	.....	1.3	1.0								

LOWERY CANAL NEAR NORTH YAKIMA, WASH.

This canal heads in the left bank of Naches River, about 16 miles from North Yakima.

The gage is at a bridge about 1,200 feet from Harry Painter's store. Measurements are made in a flume about 800 feet above the gage.

Discharge measurements of Lowery canal near North Yakima, Wash., in 1905.

Date.	Hydrographer.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Square feet.	*Feet per second.*	*Feet.*	*Second-feet.*
June 21	W. C. Muldrow	12.8	1.41	2.20	18.0
August 16	do	12.2	1.01	2.15	12.3
September 4	do	13.3	1.74	2.85	23.1
October 11	do	9.8	1.76	2.35	17.2

Daily gage height, in feet, of Lowery canal near North Yakima, Wash., for 1905.

Day.	June.	July.	Aug.	Sept.	Oct.	Nov.	Day.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	2.2	2.3	2.4	2.3	2.3	17	.....	2.3	2.4	2.3	2.3	2.4
2	.....	2.1	2.3	2.4	2.3	2.3	18	.....	2.3	2.3	2.3	2.3	2.4
3	.....	2.1	2.3	2.4	2.3	2.3	19	.....	2.3	2.3	2.3	2.3	2.4
4	.....	2.2	2.2	2.3	2.3	2.3	20	.....	2.3	2.3	2.3	2.3	2.3
5	.....	2.1	2.2	2.3	2.3	2.3	21	2.2	2.3	2.2	2.3	2.3	2.3
6	.....	2.1	2.2	2.3	2.3	2.4	22	2.2	2.3	2.2	2.4	2.3	2.3
7	.....	2.2	2.2	2.3	2.3	2.4	23	2.1	2.0	2.1	2.4	2.3	2.3
8	.....	2.2	2.1	2.3	2.3	2.3	24	2.2	2.0	2.1	2.3	2.3	2.3
9	.....	2.1	2.1	2.2	2.3	2.4	25	2.3	2.3	2.1	2.3	2.3	2.3
10	.....	2.2	2.1	2.2	2.3	2.4	26	2.4	2.4	2.1	2.3	2.3	2.3
11	.....	2.2	2.1	2.3	2.3	2.4	27	2.2	2.3	2.1	2.3	2.3	2.3
12	.....	2.2	2.1	2.3	2.3	2.4	28	2.2	2.3	2.1	2.3	2.3	2.3
13	.....	2.1	2.1	2.3	2.3	2.4	29	2.2	2.3	2.5	2.3	2.3	2.2
14	.....	2.0	2.1	2.3	2.3	2.4	30	2.2	2.2	2.5	2.3	2.3	2.2
15	.....	2.2	2.1	2.3	2.3	2.4	31	.....	2.2	2.4	.....	2.3	.....
16	.....	2.2	2.3	2.3	2.3	2.4							

GLEED CANAL NEAR NORTH YAKIMA, WASH.

This is the next large canal below the Wapatox. Its intake is on the left bank of Naches River, about 12 miles from North Yakima, in sec. 24, T. 14 N., R. 17 E.

The gage is about three-eighths mile below the head-gates, on Edward Kershaw's ranch, and 600 feet above the forks of the canal. Measurements are made from a foot plank near the gage.

Discharge measurements of Gleed canal near North Yakima, Wash., in 1905.

Date.	Hydrographer.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Square feet.	*Feet per second.*	*Feet*	*Second-feet.*
June 22	W. C. Muldrow	43.5	1.92	2.20	83.9
July 10	do	45.0	1.62	2.40	73.0
July 19	do	43.0	1.72	2.08	74.0
August 5	do	48.0	1.65	2.37	79.0
September 6	do	37.0	1.40	1.65	51.6
October 31	do	2.75	2.76	.25	7.6

Daily gage height, in feet, of Gleed canal near North Yakima, Wash., for 1905.

Day.	May.	June.	July.	Aug.	Sept.	Day.	May.	June.	July.	Aug.	Sept.
1	.....	2.4	1.6	1.9	1.85	17	.....	2.1	2.1	2.0	1.25
2	.....	2.25	2.0	2.0	1.85	18	.....	2.1	2.1	2.0	1.25
3	.....	2.35	2.0	2.0	1.85	19	.....	2.1	2.1	2.0	1.25
4	.....	2.35	2.0	2.0	1.85	20	.....	2.1	2.1	2.0	1.25
5	.....	1.50	2.1	2.0	1.85	21	.....	1.5	2.35	1.9	.....
6	.....	1.50	2.15	2.0	1.65	22	2.0	1.5	2.35	1.85	.....
7	.....	.....	2.15	2.0	1.65	23	2.0	1.5	2.4	1.85	.....
8	.....	.....	2.15	2.0	1.65	24	2.0	1.5	2.25	1.9	.....
9	.....	.....	2.15	2.0	1.65	25	2.0	1.5	2.25	1.9	.....
10	.....	.....	2.25	2.0	1.65	26	2.0	1.5	2.1	1.85	.....
11	.....	.....	2.25	2.0	1.65	27	2.0	1.5	2.0	1.85	.....
12	.....	1.75	1.6	2.0	1.65	28	2.1	1.5	2.0	1.85	.....
13	.....	1.75	1.60	2.0	1.85	29	2.15	1.5	2.0	1.85	.....
14	.....	2.0	2.0	2.0	1.85	30	2.15	1.6	2.0	1.85	.....
15	.....	2.0	2.1	2.1	1.25	31	2.4	.....	2.1	1.85	.....
16	.....	2.0	2.1	2.1	1.25						

Discharge measurements of Gleed canal wasteway near North Yakima, Wash., in 1905.[a]

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Square feet.*	*Feet per second.*	*Feet*	*Second-feet.*
July 10	W. J. Lightfoot	21	29	1.24	.....	36
July 19	do	16	16	2.44	1.40	39

[a] Includes waste from all canals on north side of Naches River.

Daily gage height, in feet, of Gleed canal wasteway near North Yakima, Wash., for 1905.

Day.	July.	Aug.	Sept.	Oct.	Day.	July.	Aug.	Sept.	Oct.	Day.	July.	Aug.	Sept.	Oct.
1	.....	1.4	1.1	1.0	12	.....	1.2	1.1	1.3	22	2.4	1.4	1.0	.....
2	.....	1.4	1.1	1.2	13	.....	1.3	1.1	1.4	23	1.8	1.4	1.1	.....
3	.....	1.2	1.2	1.1	14	.....	1.3	1.1	1.3	24	1.5	1.4	1.1	.....
4	.....	1.0	1.2	1.2	15	.....	1.2	1.1	1.0	25	1.3	1.4	1.1	.....
5	.....	1.3	1.1	1.4	16	.....	1.2	1.1	1.0	26	1.3	1.4	1.1	.....
6	.....	1.4	1.2	1.5	17	.....	1.4	1.1	1.0	27	1.5	1.4	1.1	.....
7	.....	1.4	1.1	1.5	18	.....	1.4	1.1	1.0	28	1.4	1.4	1.0	.....
8	.....	1.3	1.1	1.2	19	1.4	1.4	1.0	.8	29	1.4	1.5	1.0	.....
9	.....	1.2	1.1	1.3	20	1.3	1.3	1.0	.7	30	1.3	1.5	1.1	.....
10	.....	1.3	1.2	1.3	21	1.3	1.4	1.0	.7	31	1.2	1.1	.....	.....
11	.....	1.3	1.2	1.4										

YAKIMA VALLEY CANAL NEAR NORTH YAKIMA, WASH.

This canal heads in the right bank of Naches River, 11 miles from North Yakima, in sec. 24, T. 14 N., R. 17 E.

The gage is in a flume 200 feet below the head-gates. Measurements are made from a footbridge 60 feet above the gage.

Discharge measurements of Yakima Valley canal near North Yakima, Wash., in 1905.

Date.	Hydrographer.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Square feet.	*Feet per second.*	*Feet.*	*Second-feet.*
June 24	W. C. Muldrow	24.8	2.05	2.25	58.4
August 9	do	24.4	2.99	2.35	73.0
September 11	do			2.05	54.6
October 9	do	15.3	2.0	1.35	30.7

Daily gage height, in feet, of Yakima Valley canal near North Yakima, Wash., for 1905.

Day.	June.	July.	Aug.	Sept.	Oct.	Day.	June.	July.	Aug.	Sept.	Oct.
1		2.35	2.3	2.25	1.7	17		2.65	2.2	1.95	
2		2.35	2.3	2.25	1.65	18		2.65	2.2	1.9	
3		2.35	2.3	2.15	1.65	19		2.9	2.2	1.85	
4		2.35		2.15	1.65	20		2.75	2.2	1.85	
5		2.35	1.95	2.15	1.65	21		2.3	2.2	1.8	
6		2.4	1.95	2.15	1.45	22		2.25	2.2	1.85	
7		2.45	1.95	2.15	1.45	23		2.25	2.2	1.75	
8		2.5	2.15	2.1	1.45	24	2.3	2.25	2.2	1.75	
9		2.55	2.2	2.1	1.45	25	2.3	2.25	2.1	1.75	
10		2.65	2.2	2.1	1.45	26	2.35	2.5	2.0	1.75	
11		2.65	2.2	2.05	1.45	27	2.3	2.3	2.2	1.75	
12		2.65	2.2	2.05	1.45	28	2.3	2.3	2.25	1.7	
13		2.65	2.2	2.05	1.45	29	2.3	2.3	2.25	1.7	
14		2.65	2.15	2.05	1.45	30	2.35	2.3	2.25	1.7	
15		2.6	2.15	2.05		31		2.3	2.25		
16		2.65	2.1	2.0							

WHITE & LEACH CANAL NEAR NORTH YAKIMA, WASH.

This canal heads in the left bank of Naches River about 10 miles from North Yakima. The gage is at a wagon bridge on White's ranch. Measurements are made from a footbridge 200 feet above the gage.

Discharge measurements of White & Leach canal near North Yakima, Wash., in 1905.

Date.	Hydrographer.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Square feet.	*Feet per second.*	*Feet.*	*Second-feet.*
June 22	W. C. Muldrow	4.7	2.32		10.9
August 18	do	7.9	1.28	1.40	10.1
September 12	do	4.86	1.22	1.05	6.0

Daily gage height, in feet, of White & Leach canal near North Yakima, Wash., for 1905.

Day.	Aug.	Sept.	Oct.	Day.	Aug.	Sept.	Oct.	Day.	Aug.	Sept.	Oct.
1	.....	0.8	1.1	12	.....	0.9	0.2	22	1.3	1.2	.....
2	.....	1.4	1.3	13	.....	1.3	.2	23	1.2	1.1	.....
3	.....	1.5	1.3	14	.....	1.3	.1	24	1.2	1.2	.....
4	.....	1.3	1.3	15	.....	1.0	.....	25	1.2	1.2	.....
5	.....	1.4	1.3	16	.....	.9	.....	26	1.2	1.3	.....
6	.....	1.2	.8	17	.....	.9	.....	27	1.0	1.3	.....
7	.....	1.2	.5	18	1.4	.9	.....	28	1.4	1.3	.....
8	.....	1.3	.4	19	1.4	.7	.....	29	1.2	1.2	.....
9	.....	1.2	.3	20	1.4	.9	.....	30	1.1	1.1	.....
10	.....	1.2	.3	21	1.4	1.1	.....	31	.9	.....	.....
11	.....	1.0	.2								

McCORMICK CANAL NEAR NORTH YAKIMA, WASH.

This canal heads in the left bank of Naches River about 9 miles from North Yakima. The gage is close to the road on the lower branch of the White & Leach canal, which supplies the McCormick canal after July 1. Measurements are made in a flume 300 feet below the gage.

Discharge measurements of McCormick canal near North Yakima, Wash., in 1905.

Date.	Hydrographer.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Square feet.	*Feet per second.*	*Feet.*	*Second-feet.*
June 22	W. C. Muldrow	4.75	1.76	.....	8.4
August 18	do	5.2	2.25	1.50	11.7
September 12	do	6.8	.70	.95	4.6

Daily gage height, in feet, of McCormick canal near North Yakima, Wash., for 1905.

Day.	Aug.	Sept.	Oct.	Day.	Aug.	Sept.	Oct.	Day.	Aug.	Sept.	Oct.
1	.....	0.9	1.0	12	.....	1.0	0.6	22	1.2	1.2	.....
2	.....	1.1	1.3	13	.....	1.2	.5	23	1.2	1.2	.....
3	.....	1.2	1.4	14	.....	1.2	.5	24	1.2	1.2	.....
4	.....	1.0	1.4	15	.....	1.1	.5	25	1.1	1.2	.....
5	.....	1.1	1.4	16	.....	1.0	.....	26	1.1	1.4	.....
6	.....	1.0	.8	17	.....	1.0	.....	27	1.0	1.3	.....
7	.....	.9	.7	18	1.5	1.0	.....	28	1.2	1.2	.....
8	.....	1.0	.7	19	1.5	1.0	.....	29	1.1	1.1	.....
9	.....	1.0	.7	20	1.5	1.1	.....	30	1.0	1.1	.....
10	.....	1.0	.6	21	1.4	1.2	.....	31	.9	.....	.....
11	.....	.9	.6								

NACHES-COWICHE CANAL NEAR NORTH YAKIMA, WASH.

The intake of this canal is on the right bank of Naches River just below Nelson's bridge at Painted Rocks, in sec. 9, T. 13 N., R. 18 E. About three-eighths of a mile below the intake the canal crosses Cowiche Creek and until about June 1 takes nearly all its water from this source. The amount of water taken from the river gradually increases until about August 1, after which date the entire flow of the canal is drawn from Naches River.

The gage is in a flume on T. B. Nelson's place about one-half mile below the head-gates. Measurements are made from a foot plank near the gage.

Discharge measurements of Naches-Cowiche canal near North Yakima, Wash., in 1905.

Date.	Hydrographer.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Square feet.	*Feet per second.*	*Feet*	*Second-feet.*
June 22	W. C. Muldrow	21.7	1.86	3.09	40.1
July 11	do	23.0	1.91	3.18	44.0
August 9	do	22.4	2.01	3.17	45.0
September 15	do	14.4	1.58	2.35	22.7
September 29	do	15.0	1.13	2.10	16.8

Daily gage height, in feet, of Naches-Cowiche canal near North Yakima, Wash., for 1905.

Day.	June.	July.	Aug.	Sept.	Day.	June.	July.	Aug.	Sept.	Day.	June.	July.	Aug.	Sept.
1	.....	2.35	3.25	3.0	12	.....	3.35	3.15	2.65	22	3.1	3.25	3.15	2.3
2	.....	2.35	3.2	2.75	13	.....	3.25	3.2	2.6	23	3.0	3.25	3.15	2.25
3	.....	2.35	3.2	3.0	14	.....	3.25	3.15	2.25	24	2.4	3.25	3.15	2.3
4	.....	2.35	3.25	3.0	15	.....	3.25	3.15	2.25	25	2.4	3.25	3.15	2.3
5	.....	2.5	3.25	3.0	16	.....	3.25	3.15	2.25	26	2.4	3.25	3.15	2.15
6	.....	3.0	3.25	3.0	17	.....	3.25	3.15	2.3	27	2.5	3.25	3.15	2.2
7	.....	3.0	3.25	2.75	18	.....	3.25	3.15	0.0	28	2.5	3.25	3.15	2.15
8	.....	3.1	3.25	2.75	19	.....	3.2	3.15	2.25	29	2.5	3.25	3.1	2.1
9	.....	3.25	3.25	2.75	20	.....	3.2	3.15	2.25	30	2.25	3.25	3.1	2.1
10	.....	3.25	3.2	2.75	21	.....	3.25	3.15	2.3	31	.....	3.25	3.0	.....
11	.....	3.25	3.25	2.75										

BROADGAUGE CANAL NEAR NORTH YAKIMA, WASH.

This canal is supplied from the wasteway of the Power canal. The gage is about 500 feet below the head-gates, at a bridge from which measurements are made.

Discharge measurements of Broadgauge canal near North Yakima, Wash., in 1905.

Date.	Hydrographer.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Square feet.	*Feet per second.*	*Feet.*	*Second-feet.*
June 23	W. C. Muldrow	2.65	1.29	.....	3.4
August 1	do	8.00	.84	1.25	6.7
August 12	do	9.10	.90	1.45	8.2
September 29	do	5.60	.69	1.00	3.9

Daily gage height, in feet, of Broadgauge canal near North Yakima, Wash., for 1905.

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1		1.5	1.6	1.0	1.6	1.35	0.85
2		1.5	1.5	1.0	1.6	1.0	.85
3		1.25	1.65	1.45	1.0	1.0	.85
4		.7	1.65	1.45	.5	.9	.85
5		1.6	1.65	1.75	.75	.9	.85
6		1.0	1.5	1.75	1.5	.9	.85
7		.95	1.75	1.58	1.5	.9	.85
8		1.0	1.5	1.75	1.65	.9	.85
9		1.45	.35	1.8	1.5	.9	.85
10		1.3	.35	1.85	.9	.9	.85
11		.75	1.5	1.4	1.65	.9	.9
12		.6	1.5	1.4	1.6	.9	.9
13		.6	1.65	1.35	1.6	.9	.9
14		.6	1.65	1.4	1.75	.9	.9
15		1.0	1.65	1.4	1.6	.9	.9
16		1.0	1.65	1.4	1.4	.9	.9
17		1.65	1.65	1.15	.84	.9	.9
18		1.4	1.65	1.5	.84	.9	.9
19		1.75	1.5	1.35	1.35	.9	.9
20		1.7	1.25	1.35	1.35	.85	.9
21		1.7	1.25	1.0	1.35	.85	.9
22		1.7	1.4	.85	1.35	.85	.9
23		1.75	1.0	1.75	1.35	.85	.9
24		.5	1.0	1.85	1.35	.85	.9
25		1.7	1.15	1.9	1.35	.85	.9
26	1.4	1.7	.9	1.85	1.35	.85	.6
27	1.5	1.5	1.15	1.85	1.35	.85	.85
28	1.5	1.5	1.25	1.85	1.35	.85	.65
29	1.5	1.5	1.25	1.75	1.0	.9	.....
30	1.5	1.5	1.5	1.6	1.7	.85	.....
31	1.5	.....	1.42	1.6	.....	.85	.....

POWER CANAL AT NORTH YAKIMA, WASH.

This canal heads in Naches River on its right bank in sec. 10, T. 13 N., R. 18 E., about 4 miles from North Yakima. 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. The wasteway of this canal discharges into Yakima River.

The gage is just below the regulating gates. Measurements are made at the regulating gates and at a small flume which crosses the canal a short distance below the gage.

Discharge measurements of Power canal at North Yakima, Wash., in 1905.

Date.	Hydrographer.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Square feet.	*Feet per second.*	*Feet.*	*Second-feet.*
June 23	W. J. Lightfoot	80	2.23	2.83	180
August 10	do	75	2.40	2.85	180

Daily gage height, in feet, of Power canal at North Yakima, Wash., for 1905.

Day.	June.	July.	Aug.	Sept.	Day.	June.	July.	Aug.	Sept.	Day.	June.	July.	Aug.	Sept.
1	.....	2.65	2.75	2.65	12	.....	2.0	2.65	2.65	22	.....	2.75	2.65	2.75
2	.....	2.65	2.75	2.65	13	.....	2.35	2.65	2.65	23	2.85	2.75	2.65	2.65
3	.....	2.65	2.75	2.65	14	.....	2.75	2.65	2.65	24	2.65	2.75	2.65	2.65
4	.....	2.65	2.75	2.65	15	.....	2.65	2.65	2.65	25	2.65	2.65	2.65	2.65
5	.....	2.65	2.75	2.65	16	.....	2.65	2.65	2.65	26	2.65	2.65	2.65	2.65
6	.....	2.65	2.8	2.65	17	.....	2.65	2.65	2.65	27	2.65	2.75	2.65	2.65
7	.....	2.65	2.8	2.65	18	.....	2.65	2.65	2.65	28	2.65	2.75	2.65	2.65
8	.....	1.35	3.0	2.65	19	.....	2.65	2.65	2.65	29	2.65	2.75	2.65	2.65
9	.....	1.35	2.65	2.65	20	.....	2.75	2.65	2.75	30	2.65	2.75	2.65	2.65
10	.....	1.35	2.65	2.65	21	.....	2.75	2.65	2.75	31	.....	2.75	2.65	.....
11	.....	1.35	2.65	2.65										

SHANNO CANAL AT NORTH YAKIMA, WASH.

This canal is supplied from the wasteway of the Power canal. The gage is near a bridge about 1,200 feet below the head-gates. Measurements are made from a foot plank about 100 feet below the gage.

Discharge measurements of Shanno canal at North Yakima, Wash., in 1905.

Date.	Hydrographer.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Square feet.	*Feet per second.*	*Feet.*	*Second-feet.*
August 12	W. C. Muldrow	19.5	1.66	2.10	32.4
September 1	do	15.3	1.00	1.60	15.4
September 29	do	10.9	.47	1.25	5.2

Daily gage height, in feet, of Shanno canal at North Yakima, Wash., for 1905.

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	2.1	1.0	1.85	2.35	1.2	1.15
2	.....	2.1	1.0	1.85	2.35	1.2	1.15
3	.....	1.65	1.9	1.85	2.25	1.2	1.1
4	.....	1.65	1.9	1.85	2.2	1.2	1.1
5	.....	1.0	1.9	1.85	1.8	1.2	1.0
6	.....	1.0	2.0	1.85	1.8	1.2	1.1
7	.....	1.0	1.9	1.85	1.8	1.2	1.1
8	.....	1.0	2.0	1.85	1.8	1.2	1.1
9	.....	1.0	2.0	1.85	1.8	1.1	1.1
10	.....	1.0	2.0	2.0	1.75	1.1	1.1
11	.....	1.75	2.25	2.0	1.8	1.1	1.1
12	.....	1.75	2.25	2.1	1.85	1.15	1.1
13	.....	1.8	2.35	2.35	1.85	1.1	1.1
14	.....	1.5	2.35	2.5	1.8	1.15	1.1
15	.....	1.4	2.25	2.4	1.85	1.2	1.1
16	.....	1.4	2.25	2.4	1.85	1.15	1.1
17	.....	1.6	2.25	2.4	1.85	1.15	1.05
18	.....	1.6	2.25	2.25	1.9	1.1	1.05
19	.....	1.6	2.25	2.25	1.8	1.1	1.05
20	.....	1.9	2.25	2.25	1.25	1.15	1.05
21	.....	1.9	2.25	2.15	1.25	1.2	1.05

Daily gage height, in feet, of Shanno canal at North Yakima, Wash., for 1905—Continued.

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
22	.....	2.25	2.25	2.1	1.25	1.15	1.05
23	.....	2.4	2.25	2.0	1.25	1.15	1.0
24	.....	2.5	2.35	2.0	1.2	1.15	1.05
25	.....	2.25	2.35	2.0	1.2	1.2	1.0
26	1.0	1.6	2.0	2.0	1.2	1 2	.8
27	1.9	1.6	2.0	2.0	1.2	1.2	.8
28	2.0	1.0	1.5	2.0	1.25	1.2	1.0
29	1.9	1.0	1.5	1.25	1.2	1.15	.....
30	2.0	1.0	1.8	1.75	1.2	1.15	.....
31	2.1	.....	1.85	1.75	.....	1.15	.....

UNION 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 the Union canal crosses the wasteway of the Power canal and takes some additional water from it.

The gage is just below the head-gates. Measurements are made at the end of the flume a short distance below the gage.

Discharge measurements of Union canal at North Yakima, Wash., in 1905.

Date.	Hydrographer.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Square feet.	*Feet per second.*	*Feet.*	*Second-feet.*
July 11	W. C. Muldrow	22.0	2.27	1.66	50.0
August 19	do	23.0	1.79	1.66	42.0
September 15	do	24.0	1 30	1.50	31.2

Daily gage height, in feet, of Union canal at North Yakima, Wash., for 1905.

Day.	June.	July.	Aug.	Sept.	Day.	June.	July.	Aug.	Sept.	Day.	June.	July.	Aug.	Sept.
1	.....	1.15	1.5	1.5	12	.....	1.15	1.6	1.5	22	.....	1.5	1.5	1.5
2	.....	1.15	1.5	1.5	13	.....	1.15	1.6	1.4	23	.....	1.5	1.5	1.5
3	.....	1.15	1.5	1.5	14	.....	1.15	1.6	1.4	24	1.35	1.5	1.5	1.5
4	.....	1.15	1.5	1.5	15	.....	1.15	1.6	1.4	25	1.35	1.65	1.5	1.5
5	.....	1.0	1.6	1.5	16	.....	1.15	1.5	1.4	26	1.35	1.65	1.5	1.5
6	.....	1.0	1.6	1.5	17	.....	1.35	1.5	1.35	27	1.35	1.65	1.5	1.5
7	.....	1.0	1.5	1.5	18	.....	1.4	1.5	1.35	28	1.35	1.65	1.5	1.5
8	.....	1.0	1.5	1.5	19	.....	1.35	1.5	1.35	29	1.15	1.6	1.5	1.5
9	.....	1.0	1.6	1.5	20	.....	1.35	1.5	1.4	30	1.15	1.35	1.5	1.5
10	.....	1.0	1.65	1.5	21	.....	1.35	1.5	1.5	31	.....	1.35	1.5	.....
11	.....	1.0	1.6	1.5										

TOWN CANAL AT NORTH YAKIMA, WASH.

This canal heads in Naches River in the right bank, one-eighth mile above the Northern Pacific Railway bridge and three-fourths mile above the mouth of the river.

The gage is near A. M. Cole's house, one-half mile below the headworks. Measurements are made from a foot plank near the gage.

Discharge measurements of Town canal at North Yakima, Wash., in 1905.

Date.	Hydrographer.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Square feet.	*Feet per second.*	*Feet.*	*Second-feet.*
June 23	W. C. Muldrow	13.2	1.24	1.83	16.6
August 11	do	18.4	1.14	2.17	21.0
September 23	do	12.0	1.22	1.70	14.6

Daily gage height, in feet, of Town canal at North Yakima, Wash., for 1905.

Day.	June.	July.	Aug.	Sept.	Day.	June.	July.	Aug.	Sept.	Day.	June.	July.	Aug.	Sept.
1		1.85	1.65	2.05	12		1.6	1.9	1.9	22		2.0	2.5	1.75
2		1.85	1.7	2.0	13		1.6	1.9	1.9	23	1.85	2.15	1.9	1.75
3		1.75	1.85	2.0	14		2.15	1.75	1.75	24	1.9	2.15	1.75	1.85
4		1.75	1.65	1.9	15		2.15	1.6	1.6	25	1.85	2.1	1.6	1.85
5		1.7	1.4	1.9	16		2.15	1.4	1.4	26	1.85	1.9	1.4	1.85
6		1.65	1.4	1.85	17		2.15	1.35	1.35	27	1.85	1.85	1.5	1.9
7		1.65	1.4	1.8	18		2.1	2.5	1.25	28	1.9	0.0	2.4	1.8
8		1.65	1.75	1.85	19		2.0	2.5	1.25	29	1.9	1.85	2.05	1.75
9		1.6	2.35	1.85	20		2.0	2.5	1.6	30	1.85	1.85	2.1	
10		2.15	2.35	1.85	21		2.0	2.5	1.75	31		1.65	2.1	
11		1.9	2.3	1.85										

Miscellaneous discharge measurements of canals in Yakima River drainage basin.

Date.	Stream.	Locality.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
			Feet.	*Sq. feet.*	*Feet per second.*	*Feet.*	*Second-feet.*
July 13	Fogarty canal	Yakima River, near Ellensburg.					30
October 6	do	do					53
July 6	Granger canal	Yakima River, near North Yakima.					3.6
August 21	do	do					2.6
June 24	Upper Scott canal	Left bank upper Naches Valley.		8.3	0.88		7.3
August 16	do	do		6.7	.55		3.7
September 4	do	do		8.15	.87		7.1
June 24	Cox canal	Left bank Naches River.		2.71	1.31		3.6
June 21	Kelly canal	Right bank Naches River.		1.0	.80		.8
	do	do		3.5	.95		3.2
June 24	Laswell canal	do		6.0	.58		3.5
June 22	Morrisey canal	Left bank Naches River, near North Yakima.					4.0
August 18	do	do					4.0
September 1	R. S. & C. Co.'s canal	At power house of power canal, near North Yakima.					4.5
November 6	do	do					8.5
September 11	Nelson canal	Left bank of Naches River, near North Yakima.					7.4

Miscellaneous discharge measurements of canals in Yakima River drainage basin—Contd.

Date.	Stream.	Locality.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
			Feet.	*Sq. feet.*	*Feet per second.*	*Feet.*	*Second-feet.*
August 7	Union canal	Below power wasteway, in North Yakima.					48
September 15	do	do					10
September 15	Shanno Fruitvale canal.	Right bank Naches River, near North Yakima.		8.0	2.19		17.5
October 12	do	do		4.0	.70		2.8
September 14	Wide hollow waste.	Near Yakima					44
June 9	Prosser power flume.	Prosser	12	118	2.09	22.90	246
August 16	do	do	12	48	3.86	17.25	185
September 1	do	do	12	71	1.48	19.58	105
September 14	do	do	12	82	2.76	20.25	225
September 1	Taylor power flume.	do	12	73	.79		58
September 15	do	do	12	85	.62		53

KACHESS LAKE NEAR EASTON, WASH.

In order to determine the amount of storage in Kachess Lake, which is controlled by a dam at its outlet, a record of the height of the water surface was kept from September 20 to December 31, 1905.

Daily gage height, in feet of Kachess Lake near Easton, Wash., for 1905.

Day.	Sept.	Oct.	Nov.	Dec.	Day.	Sept.	Oct.	Nov.	Dec.	Day.	Sept.	Oct.	Nov.	Dec.
1		0.1	0.95	0.45	12		1.0	0.45	1.25	22	0.3	0.65	0.25	1.1
2		.25	.85	.45	13		1.0	.4	1.25	23	.3	.65	.25	1.05
3		.6	.8	.45	14		.95	.4	1.2	24	.25	.65	.25	1.05
4		.8	.8	.4	15		.9	.35	1.15	25	.2	1.15	.35	1.1
5		.85	.8	.4	16		.9	.3	1.15	26	.3	1.15	.35	1.3
6		1.0	.7	.4	17		.9	.25	1.2	27	.25	1.15	.4	1.3
7		1.2	.6	.4	18		.85	.25	1.2	28	.2	1.15	.5	1.3
8		1.1	.6	.4	19		.85	.3	1.15	29	.15	1.1	.45	1.3
9		1.1	.5	.3	20	0.4	.75	.45	1.15	30	.15	1.2	.45	1.3
10		1.1	.5	1.3	21	.4	.7	.35	1.15	31		1.15		1.25
11		1.0	.45	1.3										

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 the outlet of which a dam has been constructed by the Cascade Canal Company. This dam controls the flow.

The channel is straight for 600 feet above and 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 and is free from vegetation.

Discharge measurements are made by means of a cable, car, tagged wire, and stay wire. The cable 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 gage is an inclined rod on the left bank directly under the cable. During 1905 the gage was read once each day by B. W. Morrow. 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 (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 datum of the gage.

Information in regard to this station is contained in the following Water-Supply Papers of the United States Geological Survey:

Description: 100, pp 385-386; 135 p 90.
Discharge: 100, p 386; 135, p 90.
Discharge, monthly: 135, p 92.
Gage heights: 100, p 386; 135, p 91.
Rating table: 135, p 91.

Discharge measurements of Kachess River near Easton, Wash., in 1905.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity	Gage height.	Discharge.
		Feet.	*Square feet.*	*Feet per second*	*Feet.*	*Second-feet.*
April 26	W. J. Lightfoot	74	189	2.86	5.10	540
June 2	do	76	253	3.68	6.00	931
June 27	do	70	121	2.18	4.10	263
August 25	W. C. Muldrow	70	113	2.10	4.00	238
November 16	do	71	102	1.53	3.72	156

Daily gage height, in feet, of Kachess River near Easton, Wash., for 1905.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	4.3	3.55	3.75	4.45	5.0	6.0	4.25	3.4	3.9	3.6	4.1	3.85
2	4.3	3.55	4.0	2.9	4.8	6.0	4.2	3.75	3.9	3.7	4.05	3.85
3	4.3	3.55	4.3	2.9	4.8	5.8	4.2	3.75	3.9	3.85	4.05	3.85
4	4.25	3.25	4.6	2.9	4.7	5.65	4.2	3.7	3.95	4.0	4.05	3.8
5	4.2	3.25	4.65	2.9	3.2	5.5	4.15	3.65	4.15	4.1	4.0	3.8
6	4.1	3.5	4.8	2.9	3.1	5.4	4.15	3.6	4.1	4.15	4.0	3.8
7	4.05	3.5	4.9	2.9	3.1	5.25	3.7	3.55	4.15	4.2	3.95	3.8
8	3.95	3.5	4.95	2.9	3.1	5.0	3.65	3.6	4.15	4.2	3.95	3.8
9	3.9	3.5	5.0	2.9	3.25	4.7	3.6	3.7	4.2	4.2	3.9	3.75
10	3.85	3.5	4.8	2.9	3.25	4.75	3.6	3.55	4.2	4.2	3.9	3.75
11	3.8	3.5	4.8	2.9	3.5	5.0	3.6	3.5	4.1	4.2	3.85	3.75
12	3.75	3.5	4.85	5.1	3.6	4.7	3.6	3.5	4.05	4.2	3.85	3.7
13	3.75	3.5	4.85	4.8	3.7	4.75	3.6	3.45	4.05	4.2	3.8	3.7
14	3.8	3.45	4.9	4.8	4.0	4.9	3.6	3.4	4.0	4.15	3.75	3.7
15	3.75	3.45	4.85	4.8	4.0	4.85	3.6	3.4	3.9	4.1	3.75	3.65
16	3.7	3.4	4.8	4.8	4.1	4.65	3.6	3.4	3.85	4.1	3.75	3.65
17	3.6	3.4	4.8	4.8	4.3	4.3	3.55	3.4	3.9	4.1	3.7	3.7
18	3.15	3.35	4.8	4.7	4.25	4.3	3.55	3.4	3.85	4.1	3.7	3.7
19	3.65	3.45	4.8	4.65	4.4	4.3	3.5	3.4	3.8	4.05	3.75	3.7
20	3.6	3.42	4.8	4.6	4.4	4.3	3.5	3.4	3.8	4.0	3.75	3.7
21	3.6	3.43	4.8	4.7	4.4	4.3	3.5	3.4	3.75	4.0	3.7	3.65
22	3.6	3.45	4.8	4.7	4.4	4.55	3.5	3.4	3.7	3.95	3.7	3.65
23	3.6	3.45	4.8	4.8	4.5	4.3	3.5	4.0	3.7	3.95	3.7	3.6
24	3.6	3.0	4.8	4.9	4.75	3.9	3.5	4.0	3.7	3.95	3.7	3.6
25	3.6	3.5	4.8	5.0	4.8	3.85	3.5	4.0	3.75	4.2	3.75	3.65
26	3.6	3.5	4.75	5.1	4.8	3.85	3.5	4.0	3.7	4.3	3.8	3.7
27	3.65	3.55	4.75	5.2	4.75	4.1	3.35	4.0	3.6	4.3	3.85	3.75
28	3.65	3.65	4.75	5.15	4.9	4.2	3.3	3.95	3.65	4.3	3.85	3.75
29	3.6	.....	4.6	5.0	5.6	4.3	3.5	3.95	3.6	4.25	3.85	3.75
30	3.6	.....	4.55	5.0	5.5	4.25	3.4	4.0	3.6	4.2	3.85	3.75
31	3.6	.....	4.5	5.0	5.65	.....	3.4	4.0	.....	4.15	.....	3.7

NOTE.—No ice record.

Station rating table for Kachess River near Easton, Wash., from January 1 to December 31, 1905.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
2.90	17	3.70	154	4.50	366	5.30	624
3.00	26	3.80	180	4.60	394	5.40	662
3.10	37	3.90	206	4.70	422	5.50	702
3.20	51	4.00	232	4.80	452	5.60	744
3.30	68	4.10	258	4.90	484	5.70	788
3.40	87	4.20	284	5.00	516	5.80	834
3.50	108	4.30	310	5.10	550	5.90	882
3.60	130	4.40	338	5.20	586	6.00	932

The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1903–1905. It is well defined between gage heights 3.7 feet and 6 feet. Below 3.5 feet the table is uncertain.

Estimated monthly discharge of Kachess River near Easton, Wash., for 1905.

[Drainage area, 63 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	310	44	179	11,010	2.84	3.27
February	142	26	98.9	5,493	1.57	1.64
March	516	167	427	26,260	6.78	7.82
April	586	17	320	19,040	5.08	5.67
May	766	37	324	19,920	5.14	5.93
June	932	193	451	26,840	7.16	7.99
July	297	68	147	9,039	2.33	2.69
August	232	87	146	8,977	2.32	2.68
September	284	130	203	12,080	3.22	3.59
October	310	130	257	15,800	4.08	4.70
November	258	154	192	11,420	3.05	3.40
December	193	130	161	9,900	2.56	2.91
The year	932	17	242	175,800	3.84	52.29

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 channel is straight for 300 feet above and 900 feet below the station. The current is swift. Both banks are high, not liable to overflow, and heavily timbered. The bed of the stream is composed of gravel and is free from vegetation, and permanent.

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 pine tree, 18 inches in diameter, to which the cable is fastened on the left bank.

The original gage was an inclined rod on the left bank 20 feet upstream from the cable. It was injured by flood, and August 28, 1905, was replaced by a similar gage with the datum 0.56 foot higher. All gage heights for 1905 have been reduced to the datum of the old gage. During 1905 the gage was read once each day by Charles M. Davis and E. F. Dunkin. The bench mark is a large spike driven into a root on the downstream side of the blazed tree, to which the cable is fastened, on the left bank; elevation, 17.40 feet above the zero of the gage.

Information in regard to this station is contained in the following Water-Supply Papers of the United States Geological Survey:

Description: 100, pp 384-385; 135, pp 92-93.
Discharge: 100, p 385; 135, p 93.
Discharge, monthly: 135, p 95.
Gage heights: 100, p 385; 135, pp 93-94.
Rating table: 135, p 94.

Discharge measurements of Cleallum River near Roslyn, Wash., in 1905.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Square feet.*	*Feet per second.*	*Feet.*	*Second-feet.*
April 28	W. J. Lightfoot	134	1,009	1.94	4.85	1,963
June 1	do	148	1,187	2.68	6.00	3,182
July 20	do	125	748	.88	2.52	659
August 26	W. C. Muldrow	121	653	.62	2.06	408
September 19	do	75	127	2.11	1.62	268
November 15	do	120	673	.52	2.13	344

Daily gage height, in feet, of Cleallum River near Roslyn, Wash., for 1905.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.0	1.4	2.5	2.4	4.0	5.9	3.6	2.45	1.8	2.15	2.75	2.15
2	2.05	1.35	2.8	2.3	3.7	5.9	3.6	2.4	1.75	2.18	2.65	2.15
3	2.05	1.35	3.4	2.2	3.6	5.7	3.6	2.35	1.70	2.65	2.55	2.1
4	2.0	1.4	4.05	1.85	3.5	5.9	3.5	2.3	1.7	4.45	2.5	2.05
5	1.95	1.4	4.4	1.75	3.5	5.5	3.4	2.3	1.65	4.46	2.45	2.05
6	1.85	1.35	4.4	1.7	3.8	5.1	3.35	2.2	1.65	4.5	2.35	2.1
7	1.8	1.35	4.25	1.6	4.1	5.0	3.25	2.15	1.65	4.3	2.35	2.1
8	1.75	1.4	4.2	1.55	4.7	5.0	3.15	2.15	1.6	4.0	2.3	2.0
9	1.7	1.4	4.25	1.6	5.3	5.3	3.1	2.15	1.65	3.65	2.25	1.95
10	1.6	1.35	4.2	1.7	5.0	5.5	3.1	2.1	1.65	3.44	2.2	1.95
11	1.5	1.3	4.3	1.8	4.8	5.5	3.1	2.15	1.65	3.2	2.15	1.9
12	1.5	1.3	4.4	2.2	4.2	5.3	3.0	2.1	.....	3.05	2.15	1.85
13	1.45	1.25	4.4	2.9	4.1	5.0	2.9	2.1	.....	2.85	2.05	1.85
14	1.4	1.2	4.1	3.0	4.2	4.7	2.85	2.05	.....	2.8	2.05	1.8
15	1.5	1.2	3.9	3.1	4.4	4.2	2.7	2.05	1.65	2.75	2.05	1.8
16	1.5	1.15	3.8	3.3	4.3	4.1	2.6	2.0	.....	2.65	2.00	1.75
17	1.55	1.15	3.7	3.2	4.3	4.0	2.6	2.05	.....	2.65	1.95	1.8
18	1.5	1.1	3.85	3.1	4.2	4.0	2.6	2.3	1.6	2.55	1.95	1.8
19	1.45	1.15	4.0	3.25	4.1	4.0	2.6	2.3	1.6	2.5	1.9	1.75
20	1.4	1.2	4.0	3.4	3.9	4.0	2.5	2.25	1.65	2.45	2.05	1.75
21	1.4	1.2	4.0	3.8	3.8	4.1	2.5	2.2	1.68	2.35	2.05	1.75
22	1.45	1.2	3.95	4.1	3.6	4.1	2.6	2.1	1.73	2.3	2.0	1.75
23	1.4	1.25	3.9	4.6	3.6	4.1	2.6	2.25	1.75	2.25	2.0	1.7
24	1.45	1.35	3.75	4.7	3.5	3.9	2.7	2.2	1.78	2.3	1.95	1.7
25	1.4	1.5	3.3	5.6	3.4	3.9	2.6	2.1	1.82	3.55	1.95	1.7
26	1.4	1.8	3.1	4.8	3.4	3.8	2.6	2.0	1.86	4.25	2.05	1.75
27	1.45	2.05	2.9	5.65	3.8	3.7	2.6	1.95	2.05	4.05	2.15	1.85
28	1.5	2.25	2.7	5.3	4.3	4.0	2.6	1.9	2.15	3.65	2.15	1.8
29	1.5	.....	2.6	4.7	4.9	3.8	2.6	1.9	2.18	3.4	2.15	1.8
30	1.45	.....	2.4	.....	5.0	3.65	2.52	1.85	2.18	3.1	2.15	1.75
31	1.4	.....	2.3	.....	5.4	.....	2.45	1.8	.....	2.9	.....	1.75

NOTE.—No ice record.

Station rating table for Clealum River near Roslyn, Wash., from October 10, 1903, to December 31, 1905.

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	140	2.40	530	3.70	1,130	5.00	2,100
1.20	165	2.50	565	3.80	1,185	5.10	2,190
1.30	190	2.60	605	3.90	1,245	5.20	2,290
1.40	215	2.70	645	4.00	1,310	5.30	2,390
1.50	240	2.80	685	4.10	1,380	5.40	2,490
1.60	270	2.90	725	4.20	1,450	5.50	2,590
1.70	300	3.00	770	4.30	1,520	5.60	2,690
1.80	330	3.10	815	4.40	1,590	5.70	2,790
1.90	360	3.20	865	4.50	1,670	5.80	2,890
2.00	390	3.30	915	4.60	1,750	5.90	2,990
2.10	425	3.40	965	4.70	1,830	6.00	3,100
2.20	460	3.50	1,020	4.80	1,920		
2.30	495	3.60	1,075	4.90	2,010		

The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1903–1905. It is well defined.

Estimated monthly discharge of Clealum River near Roslyn, Wash., for 1905.

[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.
January [a]	408	215	269	16,540	1.31	1.51
February [a]	478	140	211	11,720	1.03	1.07
March	1,590	495	1,155	71,020	5.63	6.49
April	2,740	255	1,012	60,220	4.94	5.51
May	2,490	965	1,450	89,160	7.07	8.15
June	2,990	1,102	1,841	109,600	8.98	10.02
July	1,075	548	733	45,070	3.58	4.13
August	548	330	438	26,930	2.14	2.47
September [b]	453	270	314	18,680	1.53	1.71
October	1,670	442	887	54,540	4.33	4.99
November	665	360	452	26,900	2.20	2.46
December	442	300	352	21,640	1.72	1.98
The year	2,990	140	760	552,000	3.70	50.49

[a] Estimates unreliable owing to probable ice conditions.
[b] Missing gage heights interpolated.

NOTE.—Low-water gage heights prior to August 28 are uncertain.

NACHES RIVER NEAR NILE, WASH.

This station was established June 23, 1904, by G. F. Harley. It is located 1⅜ miles above the highway bridge, 23 miles northwest of North Yakima, and 8 miles southeast of Nile, Wash. The station is 1¾ miles above the junction of Naches and Tieton rivers. 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.

Discharge measurements are made by means of a cable, car, and tagged wire. The cable has a span of 216 feet. The initial point for soundings is the south face of the pine on the north bank to which the cable is fastened.

An inclined staff gage is fastened to timbers buried on the left bank. During 1905 the gage was read once each day by W. H. Johnson. Bench marks were established as follows: (1) 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.;" elevation, 9.85 feet above the zero of the gage. (2) A large spike in the base of a 30-inch pine tree, 115 feet upstream from the north cable support; elevation, 8.76 feet above the zero of the gage. (3) 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;" elevation, 1,660.824 feet above sea level and 9.20 feet above the zero of the gage.

A description of this station, with gage heights, discharge data, and rating table, is contained in Water-Supply Paper No. 135, United States Geological Survey, pages 95–97.

Discharge measurements of Naches River near Nile, Wash., in 1905.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Square feet.*	*Feet per second.*	*Feet.*	*Second-feet.*
June 20	W. J. Lightfoot	190	450	4.76	5.00	2,141
September 5	W. C. Muldrow	140	228	1.41	3.50	321
October 11	do	190	318	2.90	4.25	921
October 30	do	187	259	2.37	4.00	615
November 20	do	142	218	2.07	3.82	449

Daily gage height, in feet, of Naches River near Nile, Wash., for 1905.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.9	3.6	4.4	4.4	4.9	5.6	4.8	4.0	3.6	3.6	3.9	3.75
2	4.0	3.7	4.7	4.3	4.8	5.5	4.7	3.9	3.6	3.7	3.9	3.7
3	4.0	3.6	5.1	4.3	4.8	5.9	4.7	3.9	3.6	3.8	3.9	3.7
4	4.0	3.6	5.2	4.3	4.7	6.1	4.6	3.9	3.6	4.3	3.9	3.7
5	3.9	3.7	5.3	4.3	4.6	5.8	4.6	3.8	3.6	4.3	4.0	3.7
6	3.9	3.6	5.2	4.4	4.7	5.6	4.5	3.8	3.6	4.7	3.9	3.75
7	3.9	3.7	5.2	4.5	4.8	5.5	4.5	3.8	3.5	4.8	3.8	3.8
8	3.8	3.6	5.1	4.5	5.0	5.4	4.4	3.8	3.5	4.6	3.8	3.8
9	3.8	3.7	5.3	4.6	5.3	5.5	4.4	3.8	3.5	4.4	3.8	3.7
10	3.6	3.5	5.4	4.5	5.1	5.6	4.4	3.8	3.5	4.3	3.8	3.7
11	3.6	3.5	5.4	4.5	4.9	5.5	4.3	3.7	3.5	4.2	3.8	3.65
12	3.7	3.4	5.3	4.6	4.8	5.5	4.2	3.7	3.5	4.2	3.7	3.8
13	3.8	3.4	5.1	4.6	4.8	5.4	4.2	3.7	3.6	4.1	3.7	3.75
14	3.8	3.3	5.0	4.6	4.9	5.2	4.1	3.7	3.6	4.1	3.7	3.9
15	3.9	3.3	4.9	4.5	4.9	5.1	4.1	3.7	3.6	4.1	3.7	3.85
16	4.0	3.4	5.0	4.6	4.9	5.0	4.1	3.7	3.5	4.0	3.7	3.8
17	3.8	3.4	5.1	4.5	5.0	4.9	4.0	3.8	3.5	4.0	3.7	3.75
18	3.8	3.5	5.2	4.6	4.9	4.9	4.0	3.8	3.6	4.0	3.7	3.8
19	3.9	3.7	5.1	4.6	4.9	4.8	3.9	3.7	3.6	3.9	3.8	3.7
20	3.8	3.7	5.1	4.8	4.8	4.8	3.9	3.7	3.5	3.9	3.9	3.8
21	3.6	3.8	5.0	4.9	4.7	4.8	4.0	3.7	3.6	3.9	3.85	3.7
22	3.6	3.7	4.9	4.9	4.7	4.9	3.9	3.7	3.6	3.9	3.8	3.7
23	3.6	3.8	4.9	5.0	4.6	4.8	4.0	3.7	3.5	3.9	3.8	3.6

Daily gage height, in feet, of Naches River near Nile, Wash., for 1905—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
24	3.7	3.8	4.8	5.3	4.6	4.7	4.0	3.6	3.5	3.9	3.8	3.6
25	3.6	3.9	4.8	5.6	4.6	4.8	4.0	3.6	3.5	4.1	3.75	3.8
26	3.6	4.1	4.7	5.7	4.5	4.7	3.9	3.6	3 6	4.2	3.8	3.8
27	3.6	4.1	4.6	5.6	4.7	4.9	3.9	3.6	3.7	4.2	3.85	3.7
28	3.8	4.2	4.6	5.4	4.9	5.0	4.0	3.7	3.7	4.1	3.8	3.8
29	3.8	.....	4.5	5.2	5.0	4.8	3.9	3.7	3.7	4.1	3.8	3.75
30	3.7	.....	4.4	5.0	5.1	4.7	3.9	3.7	3.7	4.0	3.8	3.7
31	3.6	.....	4.4	.....	5.3	.....	3.9	3.6	.....	4.0	.....	3.8

NOTE.—No ice record.

Station rating table for Naches River near Nile, Wash., from January 1 to December 31, 1905.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
3.20	160	4.00	630	4.80	1,690	5.60	3,130
3.30	195	4.10	730	4.90	1,850	5.70	3,350
3.40	235	4.20	840	5.00	2,020	5.80	3,570
3.50	280	4.30	960	5.10	2,190	5.90	3,810
3.60	330	4.40	1,090	5.20	2,370	6.00	4,050
3.70	390	4.50	1,230	5.30	2,550	6.10	4,310
3.80	460	4.60	1,380	5.40	2,740	6.20	4,570
3.90	540	4.70	1,530	5.50	2,930		

The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1904–5. It is fairly well defined between gage heights 3.8 feet and 5 feet.

Estimated monthly discharge of Naches River near Nile, Wash., for 1905.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January	630	330	453	27,850
February	840	195	385	21,380
March	2,740	1,090	1,970	121,100
April	3,350	960	1,659	98,720
May	2,550	1,230	1,770	108,800
June	4,310	1,530	2,398	142,700
July	1,690	540	865	53,190
August	630	330	421	25,890
September	390	280	318	18,920
October	1,690	330	770	47,350
November	630	390	467	27,790
December	540	330	422	25,950
The year	4,310	195	992	719,600

NACHES RIVER BELOW MOUTH OF TIETON RIVER, WASHINGTON.

This station was established August 4, 1905, for low-water observations. It was discontinued October 28, 1905. It is located about 500 feet below the mouth of Tieton River and 1,500 feet above the intake of Wapatox canal, near North Yakima, Wash.

The channel is straight for 500 feet above and below the station. The current is swift. Both banks are low and liable to overflow. The right bank is clean; the left wooded. The bed of the stream is composed of gravel and is permanent. There is but one channel at all stages.

Discharge measurements are made by means of a meter suspended from a light cable and operated from the bank. The initial point for soundings is a nail in the stump on the left bank to which the cable is fastened.

A vertical staff gage is spiked to a stump on the left bank. During 1905 the gage was read once each day by F. M. Johnson. The bench mark is a spike in the root of a stump 40 feet north of the initial point for soundings; elevation, 7.33 feet above the datum of the gage.

Discharge measurements of Naches River below mouth of Tieton River, Washington, in 1905.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Square feet.*	*Feet per second.*	*Feet.*	*Second-feet.*
August 4	W. J. Lightfoot	116	361	2.13	3.3	769
September 5	W. C. Muldrow	104	313	1.37	2.8	431
October 11	do	119	433	2.45	3.8	1,061

Daily gage height, in feet, of Naches River below mouth of Tieton River, Washington, for 1905.

Day.	Aug.	Sept.	Oct.	Day.	Aug.	Sept.	Oct.	Day.	Aug.	Sept.	Oct.
1	.....	2.7	2.8	12	3.3	2.8	3.7	22	3.1	3.0	3.1
2	.....	2.7	2.8	13	3.3	3.0	3.7	23	3.0	3.0	3.1
3	.....	2.8	3.3	14	3.2	2.9	3.6	24	3.0	2.9	3.1
4	3.3	2.8	4.8	15	3.8	2.8	3.5	25	3.0	2.8	4.9
5	3.3	2.9	4.7	16	2.9	2.7	3.5	26	2.9	2.9	3.9
6	3.3	2.8	4.7	17	3.2	2.8	3.4	27	2.9	3.1	3.7
7	3.3	2.8	4.7	18	3.2	2.7	3.4	28	3.0	3.0	3.6
8	3.3	2.8	4.4	19	3.3	2.8	3.4	29	2.9	2.9	.....
9	3.3	2.8	4.1	20	3.3	2.8	3.2	30	2.9	2.8	.....
10	3.3	2.8	3.8	21	3.3	2.9	3.2	31	2.8	.....	.....
11	3.3	2.9	3.8								

Station rating table for Naches River below mouth of Tieton River, Washington, from August 4 to October 28, 1905.

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	300	3.20	655	3.90	1,165	4.50	1,670
2.60	340	3.30	720	4.00	1,245	4.60	1,760
2.70	385	3.40	790	4.10	1,325	4.70	1,850
2.80	435	3.50	860	4.20	1,410	4.80	1,940
2.90	485	3.60	935	4.30	1,495	4.90	2,035
3.00	540	3.70	1,010	4.40	1,580	5.00	2,130
3.10	595	3.80	1,085				

The above table is applicable only for open-channel conditions. It is based on three discharge measurements made during 1905. It is not well defined.

Estimated monthly discharge of Naches River below mouth of Tieton River, Washington, for 1905.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
August 4–31	1,085	435	608	33,770
September	595	385	459	27,310
October 1–28	2,035	435	1,051	58,370

NACHES RIVER NEAR NORTH YAKIMA, WASH.

Naches River has its source in the Cascade Mountains, Yakima County, Wash., and flows southeastward, 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. Below the Tieton, almost to the point where it enters the Yakima, the Naches flows over flat bars of gravel in numerous, crooked, and constantly changing channels. These gravel bars are in some instances one-half mile in width.

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.

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

The flood of November, 1896, modified the channel very greatly. On account of the instability of the channel the station was abandoned in February, 1897, though 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 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. September 21, 1903, the station was moved to a location between the railroad and highway bridge.

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, is free from vegetation, and is somewhat shifting.

Discharge measurements are made by means of a cable, car, tagged wire, and a stay wire, 180 feet above the Northern Pacific Railway bridge and 170 feet below the highway bridge, at which discharge measurements were formerly made. The cable has a total span of 280 feet. The initial point for soundings is the south face of the cottonwood tree on the north bank, to which the cable is fastened.

The present gage, known as No. 5, is on the left bank of the river, 30 feet downstream from the railroad bridge. 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.

During 1905 gage heights were observed once each day by Patrick Gallagher. This gage is referred to bench marks as follows: (1) A United States Geological Survey copper plug marked "1090 T;" elevation, 1,089.96 feet above sea level and 19.74 feet 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 1,070.034 feet above sea level. (2) 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 1,089.98 feet. (3) 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.

Information in regard to this station is contained in the following publications of the United States Geological Survey (Ann=Annual Report; Bull=Bulletin; WS=Water-Supply Paper):

Description: Ann 14, ii, p 133; 18, iv, p 355; Bull 131, pp 73–74; 140, pp 244–245; WS 16, p 174; 28, p 158; 38, pp 372–373; 51, p 440; 66, p 133; 85, pp 191–192; 100, pp 379–380; 135, p 98.

Discharge: Ann 14, ii, p 133; 18, iv, p 355; Bull 131, pp 74, 90; 140, p 245; WS 16, p 174; 38, p 373; 51, p 440; 66, p 134; 85, p 192; 100, p 380; 135, p 101.

Discharge, monthly: Ann 18, iv, p 356; 20, iv, pp 499, 503; 21, iv, p 426; 22, iv, p 445; WS 75, p 202; 85, p 194; 100, p 382; 135, p 102.

Discharge, yearly: Ann 20, iv, p 62.

Gage heights: Bull 131, p 74; 140, p 245; WS 11, p 84; 16, p 174; 28, p 164; 38, p 373; 51, p 440; 66, p 134; 85, p 193; 100, p 381; 135, p 101.

Hydrographs: Ann 20, iv, p 503; 21, iv, p 426; 22, iv, p 446.

Rainfall and run-off relation: Ann 20, iv, p 500.

Rating tables: Ann 18, iv, p 356; WS 39, p 454; 52, p 522; 66, p 177; 85, p 193; 100, p 381; 135, p 102.

Discharge measurements of Naches River near North Yakima, Wash., in 1905.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Square feet.*	*Feet per second.*	*Feet.*	*Second-feet.*
September 8	W. C. Muldrow	112	111	0.90	3.60	99
September 23	do	130	194	1.37	4.12	266
November 3	do	121	255	2.06	4.70	522
November 17	do	121	241	1.47	4.32	355

Daily gage height, in feet, of Naches River near North Yakima, Wash., for 1905.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	4.6	5.8	5.6	6.2	6.9	6.3	4.6	3.5	.....	4.8	4.4
2	5.2	4.6	6.2	.....	6.1	6.9	.....	4.5	3.5	4.1	4.8	4.4
3	5.2	4.6	6.8	5.0	6.0	7.1	6.1	4.6	3.6	4.8	4.7	.....
4	5.2	4.6	6.8	5.0	5.8	.....	6.0	4.7	3.6	5.1	4.7	4.4
5	5.1	.....	.....	5.0	5.8	7.5	5.8	4.5	3.6	5.2	.....	4.4
6	5.1	4.6	6.8	5.6	5.8	7.2	5.7	4.45	3.7	5.6	4.7	4.4
7	5.0	4.6	6.8	5.6	.....	7.1	5.6	4.4	3.6	6.1	4.7	4.4
8	.....	4.6	6.8	5.7	6.2	7.0	5.6	4.3	3.6	.....	4.6	4.4
9	4.9	4.6	6.8	.....	6.3	7.1	5.6	4.3	3.6	5.6	4.6	4.4
10	4.8	4.6	6.9	5.7	6.4	7.2	5.6	4.2	3.6	5.4	4.5	.....
11	4.7	4.6	6.9	5.7	6.2	.....	5.5	4.2	3.6	5.3	4.5	4.1
12	4.7	.....	.....	5.7	6.1	7.2	5.4	4.2	3.7	5.2	.....	4.1
13	4.6	4.5	6.8	5.7	6.0	7.0	5.3	4.1	3.8	5.1	4.5	4.1
14	4.6	4.5	6.7	5.7	.....	6.8	5.1	4.0	4.0	5.0	4.4	4.6
15	.....	4.5	6.5	5.7	6.2	6.7	5.0	4.0	3.9	.....	4.4	4.3
16	4.8	4.4	6.5	.....	6.2	6.6	5.0	4.0	3.8	4.9	4.4	4.3
17	4.8	4.4	6.5	5.6	6.2	6.5	5.0	3.9	.....	4.9	4.3	.....
18	4.7	4.4	6.6	5.6	6.2	.....	4.9	3.9	3.8	4.8	4.3	4.3
19	4.7	.....	.....	5.6	6.1	6.3	4.9	4.4	3.8	4.8	.....	4.4

Daily gage height, in feet, of Naches River near North Yakima, Wash., for 1905—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
20	4.6	4.6	6.5	5.7	6.1	6.3	4.9	.....	3.8	4.8	4.5	4.4
21	4.6	4.6	6.5	5.9	6.05	6.3	4.9	4.1	4.0	4.7	4.5	4.3
22	.....	4.6	6.4	6.0	6.0	6.3	5.0	3.9	4.1	.....	4.4	4.3
23	4.6	4.8	6.3	.....	5.9	6.2	5.0	3.9	4.1	4.7	4.4	4.3
24	4.6	5.0	6.3	6.4	5.8	6.2	5.0	3.8	.....	4.6	4.4	.....
25	4.6	5.1	6.2	6.8	5.7	.....	4.9	3.7	4.1	5.0	4.4	4.3
26	4.6	.....	.....	7.0	5.7	6.2	4.8	3.7	4.1	5.3	.....	4.4
27	4.6	5.5	6.1	6.9	5.8	6.2	4.7	.....	4.4	5.2	4.4	4.4
28	4.6	5.6	6.0	6.7	.....	6.5	4.7	3.6	4.3	5.1	4.4	4.3
29	.....	.....	5.9	6.5	6.1	6.3	4.7	3.6	4.2	.....	4.4	4.3
30	4.6	.....	5.8	.....	6.4	6.3	4.65	3.6	4.0	4.9	4.4	4.3
31	4.6	.....	5.7	.....	6.7	.....	4.6	3.5	.....	4.8	.....	.....

Station rating table for Naches River near North Yakima, Wash., from January 1 to December 31, 1905.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
3.50	100	4.60	478	5.60	1,098	6.60	2,128
3.60	118	4.70	530	5.70	1,174	6.70	2,255
3.70	139	4.80	584	5.80	1,253	6.80	2,384
3.80	163	4.90	640	5.90	1,339	6.90	2,515
3.90	190	5.00	698	6.00	1,433	7.00	2,648
4.00	220	5.10	758	6.10	1,535	7.10	2,785
4.10	254	5.20	820	6.20	1,645	7.20	2,926
4.20	292	5.30	884	6.30	1,762	7.30	3,071
4.30	334	5.40	952	6.40	1,882	7.40	3,220
4.40	380	5.50	1,024	6.50	2,004	7.50	3,373
4.50	428						

The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1904 and 1905. It is well defined. Above gage height, 5.6 feet, the table is the same as for 1904.

Estimated monthly discharge of Naches River near North Yakima, Wash., for 1905.

[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	820	478	577	35,480	0.577	0.665
February	1,098	380	537	29,820	.537	.559
March	2,515	1,174	1,977	121,600	1.98	2.28
April	2,648	698	1,371	81,580	1.37	1.53
May	2,255	1,174	1,518	93,340	1.52	1.75
June	3,373	1,645	2,276	135,400	2.28	2.54
July	1,762	478	882	54,232	.882	1.02
August	530	100	268	16,480	.268	.309
September	380	100	184	10,950	.184	.205
October	1,535	237	730	44,890	.730	.842
November	584	334	432	25,710	.432	.482
December	478	254	350	21,520	.350	.404
The year	2,648	100	925	671,000	.926	12.59

NOTE.—Discharge interpolated for missing gage heights.

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, about 22 miles from North Yakima by road.

The channel is straight for several hundred yards above and below the station. The banks do not overflow. The bed of the stream is rocky, with shifting gravel bars, which make it difficult to find suitable cross sections for meter measurements. There is but one channel at all stages. The underground flow at this station is estimated to be as much as 50 per cent of the measured flow.

Discharge measurements are made by means of a cable, car, tagged wire, and stay wire. The initial point for soundings is a cross chiseled in a ledge, with a black ring painted around it, near the west cable supports.

The gage is an inclined staff on the left bank of the stream. During 1905 it was read twice each day by Oscar Cobb. Bench marks were established as follows: (1) A point of rock on a ledge 12 feet from the gage; elevation, 15.67 feet. (2) A nail in a cottonwood stump 40 feet south of the gage; elevation, 15.93 feet. (3) The top of a bowlder 20 feet northwest of the cable-shear legs; elevation, 17.52 feet. Elevations refer to the datum of the gage, which is 1,683.36 feet above sea level.

Information in regard to this station is contained in the following Water-Supply Papers of the United States Geological Survey:

Description: 85, p 194; 100, p 382; 135, p 103.
Discharge: 85, p 195; 100, p 383; 135, p 103.
Discharge, monthly: 85, p 196; 100, p 384; 135, p 105.
Gage heights: 85, p 195; 135, p 104.
Rating table: 85, p 196; 100, p 384; 135, p 104.

Discharge measurements of Tieton River near North Yakima, Wash., in 1905.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Square feet.*	*Feet per second.*	*Feet.*	*Second-feet.*
April 21	W. J. Lightfoot	111	178	3.4	7.90	605
June 20	do	113	230	4.72	8.35	1,085
September 6	W. C. Muldrow	109	126	2.74	7.20	325
October 31	do	98	115	2.09	6.75	241
November 20	W. C. Sawyer	98	110	2.16	6.80	249

Daily gage height, in feet, of Tieton River near North Yakima, Wash., for 1905.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	7.42	6.85	8.05	7.62	8.02	8.95	8.25	7.62	6.85	6.78	6.85	6.58
2	7.35	6.8	8.6	7.62	7.92	9.1	8.2	7.6	6.98	7.2	6.85	6.65
3	7.42	6.82	8.8	7.6	7.95	9.8	8.12	7.6	7.08	7.9	6.85	6.62
4	7.38	6.8	8.8	7.6	7.88	9.25	8.07	7.5	7.12	7.92	6.85	6.62
5	7.28	6.88	8.78	7.62	7.8	8.92	8.07	7.42	7.12	8.4	6.8	6.62
6	7.15	6.88	8.72	7.7	7.9	8.75	8.0	7.4	7.1	8.32	6.78	6.6
7	7.2	6.85	8.62	7.72	8.02	8.68	7.95	7.55	7.1	8.0	6.75	6.64
8	7.1	6.8	8.6	7.75	8.35	8.75	7.95	7.58	7.12	7.67	6.7	6.6
9	6.95	6.8	8.65	7.72	8.35	9.05	8.12	7.62	7.1	7.45	6.7	6.58
10	6.85	6.78	8.7	7.68	8.2	9.0	8.18	7.58	7.1	7.27	6.7	6.58
11	6.72	6.48	8.68	7.65	8.08	8.98	7.98	7.55	7.1	7.2	6.7	6.55
12	6.7	6.48	8.52	7.7	8.02	8.95	7.85	7.55	7.15	7.2	6.58	6.6
13	6.92	6.7	8.38	7.8	8.02	8.7	7.75	7.48	7.3	7.07	6.58	6.6
14	7.02	6.8	8.32	7.72	8.12	8.58	7.65	7.35	7.12	7.0	6.55	6.6
15	7.12	6.78	8.28	7.7	8.12	8.53	7.65	7.22	7.1	7.03	6.4	6.58
16	7.08	6.75	8.3	7.7	8.2	8.45	7.6	7.2	6.95	6.92	6.7	6.6

Daily gage height, in feet, of Tieton River near North Yakima, Wash., for 1905—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
17	7.05	6.78	8.45	7.68	8.3	8.35	7.55	7.55	6.98	6.9	6.62	6.65
18	7.0	6.85	8.48	7.7	8.18	8.35	7.58	7.4	6.8	6.85	6.9	6.65
19	6.95	6.88	8.42	7.78	8.08	8.35	7.65	7.45	6.9	6.87	6.8	6.65
20	6.9	6.9	8.38	7.88	8.08	8.35	7.75	7.45	7.25	6.8	6.85	6.6
21	6.9	6.88	8.28	7.9	7.98	8.35	7.85	7.32	7.25	6.8	6.7	6.58
22	6.9	6.92	8.18	8.0	7.92	8.35	7.95	7.28	7.32	6.8	6.7	6.38
23	6.88	7.1	8.1	8.18	7.88	8.22	8.05	7.2	7.3	6.8	6.7	6.35
24	6.9	7.15	8.08	8.48	7.78	8.23	7.85	7.12	7.25	6.85	6.75	6.6
25	6.92	7.55	8.02	8.78	7.78	8.2	7.7	7.15	7.05	7.95	6.65	6.68
26	6.9	7.65	7.98	8.88	7.8	8.15	7.65	7.1	7.32	7.38	6.65	6.7
27	6.92	7.68	7.92	8.62	8.12	8.3	7.73	7.1	7.1	7.18	6.65	6.65
28	7.02	7.78	7.85	8.4	8.25	8.17	7.7	7.2	6.92	7.0	6.65	6.58
29	6.92	.....	7.78	8.25	8.4	8.05	7.62	7.02	6.82	6.98	6.6	6.55
30	6.85	.....	7.68	8.15	8.5	8.12	7.62	7.05	6.82	6.88	6.65	6.58
31	6.88	.....	7.65	.....	8.78	.....	7.6	6.88	.....	6.85	.....	6.55

Station rating table for Tieton River near North Yakima, Wash., from January 1 to December 31, 1905.

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	195	7.20	335	8.10	755	9.00	1,790
6.40	202	7.30	365	8.20	830	9.10	1,940
6.50	210	7.40	400	8.30	920	9.20	2,090
6.60	220	7.50	440	8.40	1,020	9.30	2,240
6.70	233	7.60	480	8.50	1,130	9.40	2,390
6.80	249	7.70	525	8.60	1,250	9.50	2,540
6.90	267	7.80	575	8.70	1,380	9.60	2,700
7.00	287	7.90	630	8.80	1,510	9.70	2,860
7.10	310	8.00	690	8.90	1,650	9.80	3,020

The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1904 and 1905. It is well defined between gage heights 6.7 feet and 7.3 feet. Above gage height, 8 feet, the table is uncertain.

Estimated monthly discharge of Tieton River near North Yakima, Wash., for 1905.

[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	408	233	296	18,200	1.02	1.18
February	565	208	292	16,220	1.01	1.05
March	1,510	502	1,001	61,550	3.46	3.99
April	1,622	480	694	41,300	2.40	2.68
May	1,484	565	773	47,530	2.67	3.08
June	3,020	722	1,304	77,590	4.51	5.03
July	875	460	612	37,630	2.12	2.44
August	489	263	394	24,230	1.36	1.57
September	372	249	309	18,390	1.07	1.19
October	1,020	246	391	24,040	1.35	1.56
November	267	202	236	14,040	.817	.912
December	233	198	220	13,530	.761	.877
The year	3,020	198	544	394,200	1.88	25.56

SNAKE RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

Snake River is the largest tributary of the Columbia. It rises on the northern 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 for about 20 miles, when 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 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 Teton River into North Fork of Snake River. The Snake empties into Columbia River near Pasco Junction, Wash.

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.

Boise River drains a mountainous and well-wooded country in Elmore County, Idaho, emptying into Snake River near the point where the Snake begins to form the boundary between Idaho and Oregon. 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, father to the west, which drains a more barren country. In the lower course of the Boise a large number of canals divert water to irrigate lands in Boise Valley. The diverson of the water is now so great that frequent complaints of scarcity are heard.

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

Owyhee River rises in northwestern Nevada and flows northwestward through Idaho; Malheur River rises in the mountains of east-central Oregon and empties into Snake River west of Boise; and the Grande Ronde drains the northern slope of the Blue Mountains and empties into Snake River in southeastern 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., the Palouse bends suddenly to the south and enters a canyon, through which it flows to its junction with Snake River. A short distance above the mouth of the river are the Palouse Falls, approximately 180 feet high.

NORTH FORK OF SNAKE RIVER NEAR ORA, IDAHO.

This station was established August 20, 1902, by N. S. Dils. It is located at the North Fork Bridge, 2 miles south of Ora and 10 miles above St. Anthony, Idaho.

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, fairly smooth, and not liable to change. The current is swift.

Discharge measurements are made from the downstream side of the bridge, which consists of four spans resting on three rock-filled crib piers. The bridge is 210 feet long. 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 gage is a vertical staff fastened to the first bridge pier from the north abutment. During 1905 the gage was read once each day by Mrs. Martha J. Fritz. Bench marks were established as follows: (1) A United States Geological Survey aluminum tablet set in a large rock about 30 feet northeast from north end of bridge; elevation, 12.84 feet. (2) A cross on a large flat rock marked "B. M.," 25 feet northeast from north end of bridge; elevation, 11.10 feet. Elevations refer to the datum of the gage.

Information in regard to this station is contained in the following publications of the United States Geological Survey (Ann=Annual Report; WS=Water-Supply Paper):

Description: WS 85, p 215; 100 p 455; 135,, p 170.
Discharge: WS 85, p 215; 100, p 455; 135, p 170.
Discharge, monthly: Ann 11, ii, p 105; WS 100, p 457; 135, p 172.
Gage heigths: WS 85, p 215; 100, p 456; 135, p 171.
Rating table: WS 100, p 456; 135, p 171.

Discharge measurements of North Fork of Snake River near Ora, Idaho, in 1905.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Square feet.*	*Feet per second.*	*Feet.*	*Second-feet.*
April 11	E. C. La Rue	178	393	3.37	2.30	1,325
May 10	do	178	447	3.68	2.55	1,647
June 28	do	176	380	3.12	2.25	1,186
August 29	do	175	347	3.02	2.05	1,049
September 18	do	174	360	2.83	2.05	1,019

Daily gage height, in feet, of North Fork of Snake River near Ora, Idaho, for 1905.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.2	2.1	2.1	2.0	2.7	2.5	2.2	2.1	2.0	2.1	2.0	2.0
2	2.2	2.1	2.1	2.1	2.6	2.5	2.2	2.1	2.0	2.1	2.0	2.0
3	2.1	2.1	2.1	2.1	2.6	2.5	2.2	2.1	2.0	2.1	2.0	2.0
4	2.1	2.1	2.0	2.1	2.6	2.5	2.2	2.1	2.0	2.1	2.0	2.0
5	2.2	2.1	2.0	2.1	2.5	2.4	2.2	2.1	2.0	2.1	2.0	2.0
6	2.2	2.1	2.0	2.1	2.5	2.4	2.1	2.1	2.0	2.1	2.0	2.0
7	2.1	2.1	2.0	2.2	2.5	2.4	2.1	2.1	2.0	2.1	2.0	2.0
8	2.1	2.1	2.0	2.2	2.5	2.4	2.1	2.1	2.0	2.1	2.0	2.0
9	2.1	2.1	2.0	2.3	2.6	2.4	2.1	2.1	2.0	2.1	2.0	2.0
10	2.1	2.1	2.0	2.3	2.6	2.4	2.1	2.1	2.0	2.1	2.0	2.0
11	2.1	2.1	2.0	2.3	2.5	2.4	2.1	2.1	2.0	2.1	2.0	2.0
12	2.1	2.1	2.0	2.3	2.5	2.4	2.1	2.1	2.0	2.1	2.0	2.0
13	2.1	2.1	2.0	2.3	2.6	2.4	2.1	2.1	2.0	2.1	2.0	2.0
14	2.1	2.1	2.0	2.3	2.6	2.4	2.1	2.1	2.0	2.1	2.0	2.0
15	2.2	2.1	2.1	2.3	2.6	2.3	2.1	2.1	2.0	2.1	2.0	2.0
16	2.2	2.1	2.1	2.5	2.6	2.3	2.1	2.1	2.0	2.1	2.0	2.0
17	2.2	2.1	2.1	2.5	2.6	2.3	2.1	2.1	2.0	2.1	2.0	2.0
18	2.2	2.1	2.1	2.4	2.6	2.3	2.1	2.0	2.0	2.1	2.0	2.0
19	2.2	2.2	2.1	2.5	2.6	2.3	2.1	2.0	2.0	2.1	2.0	2.0
20	2.2	2.2	2.1	2.5	2.6	2.3	2.1	2.0	2.0	2.0	2.0	2.0
21	2.2	2.2	2.1	2.6	2.6	2.3	2.1	2.0	2.0	2.0	2.0	2.0
22	2.2	2.2	2.1	2.6	2.6	2.3	2.1	2.0	2.0	2.0	2.0	2.0
23	2.1	2.2	2.1	2.7	2.6	2.3	2.1	2.0	2.0	2.0	2.0	2.0
24	2.1	2.2	2.1	2.9	2.5	2.3	2.1	2.0	2.0	2.0	2.0	2.0
25	2.1	2.2	2.1	2.9	2.5	2.3	2.1	2.0	2.0	2.0	2.0	2.0
26	2.1	2.1	2.1	2.9	2.5	2.2	2.1	2.0	2.0	2.0	2.0	2.0
27	2.1	2.1	2.1	2.9	2.5	2.2	2.1	2.0	2.0	2.0	2.0	2.0
28	2.1	2.1	2.1	2.7	2.5	2.2	2.1	2.0	2.0	2.0	2.0	2.0
29	2.1	.....	2.1	2.7	2.5	2.2	2.1	2.0	2.1	2.0	2.0	2.0
30	2.1	.....	2.1	2.7	2.5	2.2	2.1	2.0	2.1	2.0	2.0	2.0
31	2.1	.....	2.0	.....	2.5	.....	2.1	2.0	.....	2.0	.....	2.0

NOTE.—No ice record.

Station rating table for North Fork of Snake River near Ora, Idaho, from January 1 to December 31, 1905.

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	990	2.30	1,280	2.60	1,730	2.90	2,280
2.10	1,070	2.40	1,420	2.70	1,900	3.00	2,480
2.20	1,160	2.50	1,570	2.80	2,090		

The above table is applicable only for open-channel conditions. It is based on five discharge measurements made during 1905. It is well defined between gage heights 2 feet and 2.6 feet.

Estimated monthly discharge of North Fork of Snake River near Ora, Idaho, for 1905.

[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	1,160	1,070	1,105	67,940	1.06	1.22
February	1,160	1,070	1,092	60,650	1.05	1.09
March	1,070	990	1,039	63,880	.999	1.15
April	2,280	990	1,517	90,270	1.46	1.63
May	1,900	1,570	1,663	102,300	1.60	1.84
June	1,570	1,160	1,345	80,040	1.29	1.44
July	1,160	1,070	1,085	66,720	1.04	1.20
August	1,070	990	1,034	63,580	.994	1.15
September	1,070	990	995	59,210	.957	1.07
October	1,070	990	1,039	63,880	.999	1.15
November	990	990	990	58,910	.952	1.06
December	990	990	990	60,870	.952	1.10
The year	2,280	990	1,158	838,200	1.11	15.10

SNAKE RIVER NEAR MINIDOKA, IDAHO.

This station was originally established August 5, 1895, at Montgomery's ferry, on the stage road from Minidoka to Albion, 4 miles east of Rupert, Idaho, and 10 miles below the diversion dam for the Minidoka irrigation project. 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.

The channel is straight for 2,000 feet above and 1,500 feet below the station. The velocity is low at all stages. Both banks are inclined up to gage height 6 to 9 feet, and then become vertical. Both are clean, sandy, and do not overflow. The bed of the stream is composed of sand and coarse gravel and is practically permanent. There is but one channel at all stages.

Discharge measurements are made from the ferryboat. A tagged wire has been stretched above the ferry cable. The initial point for soundings is the face of the cable support on the right bank.

Since the station was established the gage has several times been disturbed by the shifting quicksand and reestablished. The present gage is a staff constructed in three independent sections on the right bank. The lower inclined section, reading from 0 to 3.3 feet, may move in the quicksand without disturbing the upper sections. Above gage height 6.6 feet

the gage is vertical. During 1905 the gage was read twice each day by George Montgomery. The bench mark is a United States Geological Survey iron post on the right bank, 200 feet below the gage; elevation, 12.67 feet above the datum of the gage.

Information in regard to this station is contained in the following publications of the United States Geological Survey (Ann=Annual Report; Bull=Bulletin; WS=Water-Supply Paper):

Description: Ann 18, iv, pp 334-335; Bull 140, p 241; WS 16, p 165; 58, p 155; 38, pp 351-352; 51, p 426; 66, p 126; 85, pp 213-214; 100, p 443; 135, pp 172-173.

Discharge: Ann 18, iv, p 335; Bull 140, p 241; WS 16, p 165; 28, p 168; 38, p 352; 51, p 426; 66, p 126; 85, p 214; 100, p 444; 135, p 173.

Discharge, monthly: Ann 18, iv, p 336; 19, iv, p 447; 20, iv, pp 473, 474; 21, iv, p 405; WS 100, p 445; 135, p 175.

Discharge, yearly: Ann 20, iv, p 61.

Gage heights: Bull 140, p 231; WS 11, p 80; 16, p 165; 28, p 160; 38, p 352; 66, p 127; 85, p 214; 100, p 444; 135, pp 173-174.

Hydrographs: Ann 19, iv, p 448; 20, iv, p 475; 21, iv, p 406.

Rainfall and run-off relation: Ann 20, iv, p 744.

Rating tables: Ann 18, iv, p 335; 19, iv, p 447; WS 28, p 169; 39, p 453; 100, p 445; 135, p 174.

Discharge measurements of Snake River near Minidoka, Idaho, in 1905.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Square feet.*	*Feet per second.*	*Feet.*	*Second-feet.*
April 21	E. C. La Rue	828	3,938	1.51	3.10	5,949
May 20	do	845	4,818	1.69	3.90	8,138
June 6	do	850	5,718	2.14	5.15	12,220
June 16	Hoyt and La Rue	845	5,588	2.07	5.05	11,560
July 16	E. C. La Rue	795	3,212	1.27	2.40	4,092
August 12	do	770	2,258	.87	1.20	1,963
October 23	do	795	3,269	1.23	2.31	4,009

Daily gage height, in feet, of Snake River near Minidoka, Idaho, for 1905.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	4.45	3.05	3.05	2.95	3.9	4.65	3.75	1.4	1.2	1.35	2.4	2.6
2	4.1	3.05	3.05	2.9	3.9	4.65	3.95	1.4	1.2	1.4	2.4	2.75
3	4.0	2.95	3.15	2.85	3.9	4.65	3.75	1.35	1.15	1.45	2.4	2.8
4	3.85	2.9	3.0	2.75	3.9	4.8	3.6	1.3	1.15	1.55	2.45	2.55
5	3.65	2.85	3.0	2.7	3.95	5.0	3.5	1.25	1.2	1.6	2.5	2.55
6	3.6	2.75	3.15	2.7	4.2	5.1	3.4	1.2	1.2	1.65	2.5	2.55
7	3.5	2.85	3.25	2.6	4.2	5.55	3.35	1.2	1.2	1.7	2.5	2.55
8	3.5	2.9	3.25	2.6	4.2	5.6	3.15	1.2	1.2	1.75	2.5	2.55
9	3.5	3.05	3.05	2.6	4.1	5.3	2.95	1.2	1.2	1.8	2.5	2.55
10	3.5	3.05	2.95	2.7	4.0	5.0	2.8	1.2	1.2	1.85	2.5	2.8
11	3.35	3.35	2.95	2.7	4.0	5.0	2.7	1.2	1.2	1.9	2.5	3.85
12	3.25	3.8	2.85	2.8	4.0	5.35	2.7	1.2	1.2	2.0	2.5	3.65
13	3.3	4.25	2.85	2.95	4.0	5.6	2.6	1.2	1.2	2.1	2.5	3.2
14	3.45	3.75	2.85	2.95	4.0	5.35	2.6	1.2	1.2	2.15	2.5	3.1
15	3.55	3.45	2.85	2.95	4.0	5.15	2.5	1.2	1.2	2.2	2.5	3.1
16	3.65	3.2	2.85	2.95	4.0	5.05	2.4	1.2	1.2	2.25	2.5	3.1
17	3.8	3.1	2.85	2.95	3.9	5.1	2.3	1.2	1.15	2.25	2.5	3.1
18	3.85	2.9	2.85	2.95	3.85	5.25	2.3	1.2	1.15	2.25	2.5	3.1
19	3.95	3.05	2.85	2.95	3.8	5.25	2.15	1.2	1.15	2.25	2.5	3.1
20	4.0	3.35	2.85	3.05	3.8	5.15	2.1	1.2	1.15	2.25	2.5	3.2
21	4.15	3.6	2.85	3.05	4.25	4.9	2.0	1.1	1.15	2.5	2.6	3.35
22	4.2	3.8	2.95	3.05	4.45	4.6	2.0	1.15	1.15	2.4	2.6	3.4
23	3.9	2.75	3.0	3.1	4.6	4.35	1.9	1.2	1.15	2.35	2.6	3.4
24	3.6	2.85	2.85	3.25	4.75	4.1	1.8	1.2	1.2	2.3	2.6	3.4

Daily gage height, in feet, of Snake River near Minidoka, Idaho, for 1905—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
25	3.2	2.85	2.95	3.25	4.7	3.95	1.75	1.2	1.2	2.3	2.6	3.4
26	3.05	2.9	2.95	3.4	4.5	3.9	1.7	1.2	1.2	2.25	2.6	3.3
27	3.05	3.05	3.0	3.6	4.25	3.85	1.6	1.2	1.25	2.25	2.6	3.0
28	3.05	3.05	3.05	3.7	4.15	3.7	1.5	1.15	1.25	2.3	2.6	2.95
29	3.05	.....	3.05	3.8	4.3	3.6	1.5	1.15	1.25	2.3	2.6	3.1
30	3.05	.....	3.05	3.9	4.35	3.7	1.45	1.15	1.25	2.35	2.6	3.0
31	3.05	.....	3.05	.....	4.55	.....	1.4	1.15	.....	2.4	.....	3.1

NOTE.—The river was frozen over January 1–25; February 11–17, 20–22, and December 2, 3, 10–31.

Station rating table for Snake River near Minidoka, Idaho, from January 1 to December 31, 1905.

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	1,880	2.30	3,940	3.50	7,060	4.70	10,580
1.20	1,960	2.40	4,180	3.60	7,340	4.80	10,890
1.30	2,060	2.50	4,430	3.70	7,630	4.90	11,210
1.40	2,190	2.60	4,680	3.80	7,920	5.00	11,540
1.50	2,340	2.70	4,930	3.90	8,210	5.10	11,880
1.60	2,500	2.80	5,180	4.00	8,500	5.20	12,230
1.70	2,670	2.90	5,440	4.10	8,790	5.30	12,590
1.80	2,860	3.00	5,700	4.20	9,080	5.40	12,950
1.90	3,060	3.10	5,970	4.30	9,380	5.50	13,320
2.00	3,270	3.20	6,240	4.40	9,680	5.60	13,700
2.10	3,480	3.30	6,510	4.50	9,980	5.70	14,090
2.20	3,700	3.40	6,780	4.60	10,280		

The above table is applicable only for open-channel conditions. It is based on seven discharge measurements made during 1905. It is well defined between gage heights 1 foot and 5.2 feet.

Estimated monthly discharge of Snake River near Minidoka, Idaho, for 1905.

[Drainage area, 17,900[a] 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	.....	.....	5,800	356,600	0.324	0.374
February	.....	.....	5,550	308,200	.310	.323
March	6,375	5,310	5,641	346,900	.315	.363
April	8,210	4,680	5,780	343,900	.323	.360
May	10,740	7,920	8,925	548,800	.499	.575
June	13,700	7,340	10,910	649,100	.609	.680
July	8,355	2,190	4,545	279,500	.254	.293
August	2,190	1,880	1,976	121,500	.110	.127
September	2,010	1,920	1,955	116,300	.109	.122
October	4,430	2,125	3,415	210,000	.191	.220
November	4,680	4,180	4,484	266,800	.251	.280
December	.....	.....	4,550	279,800	.254	.293
The year	.....	.....	5,294	3,827,000	.296	4.01

[a] Exclusive of drainage areas of lost rivers. Revised since previous reports.

NOTE.—Monthly means for January, February, and December estimated from flow during open periods.

LOW-WATER CONDITIONS ON SNAKE RIVER BETWEEN BLACKFOOT AND SHOSHONE FALLS, IDAHO.

The low-water conditions on Snake River, between Blackfoot and Shoshone Falls, were clearly brought out by a series of measurements made during August, 1905. This investigation was carried on by the Geological Survey in conjunction with the State engineer's office.

The entire supply of upper Snake River available above Blackfoot, Idaho, is used for irrigation during August and September. On August 10 there was 184 second-feet available at the American Falls Power Company canal heading. This canal, which diverts at a point 8 miles above Blackfoot, is to supply water for 80,000 acres of land. Beginning at a point 4 miles above the Blackfoot wagon bridge, Snake River channel was entirely dry for a distance of 10 miles. Following is a summary of the measurements:

Low-water measurements of Snake River and Twin Falls canal in 1905.

Date.	Stream.	Location.	Discharge.
			Second-feet.
August 9	Snake River	Just below mouth of Black River	39
August 10	do	Just above American Falls canal heading	184
August 11	do	Just above American Falls	1,996
August 12	do	At Montgomery's Ferry	1,963
August 14	do	Between Shoshone Falls and Twin Falls	[a]1,348
August 15	Twin Falls canal		1,008

[a] Includes the waste from the Twin Falls canal.

A further investigation was carried on by the United States Geological Survey to determine the loss or gain in Snake River between Montgomery's Ferry and Shoshone Falls. August 22 the discharge of Snake River between Twin Falls and Shoshone Falls was 1,299 second-feet and the discharge from springs between the point of measurement and Shoshone Falls was 17 second-feet, making the total discharge of Snake River at Shoshone Falls 1,316 second-feet.

The result of this investigation may be tabulated as follows:

Loss in Snake River between Montgomery's Ferry and Shoshone Falls in 1905.

Date.		Discharge.	
		Second-feet.	*Second-feet.*
August 22	Total discharge Snake River at Montgomery's Ferry		1,910
Do	Total discharge Snake River at Shoshone Falls	1,316	
Do	Amount diverted by Twin Falls canal	1,008	
August 23	Measured waste from Twin Falls canal reaching the river above Shoshone Falls.		187
Do	Loss by seepage from the Twin Falls canal during the first 20 miles of its course (which is assumed to return to the river.		371
Do	Loss in Snake River between Montgomery's Ferry and Shoshone Falls.	144	
		2,468	2,468

The loss of 371 second-feet in the Twin Falls canal was determined by a special series of measurements made on August 22 and 23, 1905. The canal follows the river at a distance of one-half to 1 mile from its bank, and it is therefore reasonably correct to assume that this seepage all reaches the river.

In September, 1902, a similar investigation was made and the loss between Montgomery's Ferry and Shoshone Falls was found to be 196 second-feet.

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.

The channel is straight above and below the station. Both banks are high, wooded, steep, and not liable to overflow. There is but one channel at all stages. The Brady canal, capacity about 100 second-feet, heads in the right bank of the river between Wilson's mill and the Fremont station.

Discharge measurements are made by means of a cable and car. 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 gage is a vertical staff on the south bank, about 900 feet from Fremont post-office. During 1905 the gage was read twice each day by Mrs. Eva A. Loomis. The bench mark is a standard aluminum tablet set in a rock 20 feet from the gage; elevation, 10.36 feet above the datum of the gage.

Discharge measurements of Fall River at Fremont, Idaho, in 1905.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Square feet.*	*Feet per second.*	*Feet.*	*Second-feet.*
April 12	E. C. La Rue	139	185	2.55	1.95	472
May 11	do	145	284	3.75	2.65	1,065
June 28	do	146	467	5.67	4.00	2,650
August 29	do	140	178	2.16	1.85	384

Daily gage height, in feet, of Fall River at Fremont, Idaho, for 1905.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.0	1.8	2.0	1.6	2.8	3.45	3.7	1.9	1.9	2.0	1.9	1.85
2	2.0	1.8	2.0	1.6	2.8	3.6	3.1	1.9	1.9	1.95	1.9	1.85
3	2.0	1.8	2.0	1.6	2.8	3.7	3.0	1.85	1.9	1.95	1.9	1.85
4	2.0	1.8	2.0	1.6	2.6	3.85	3.1	1.9	1.9	1.95	1.9	1.8
5	2.0	1.8	2.0	1.4	2.65	4.0	3.0	1.9	1.9	1.95	1.85	1.8
6	2.0	1.8	2.0	1.6	2.75	3.8	3.05	1.9	1.85	1.95	1.85	1.8
7	2.0	1.8	2.0	1.8	2.75	3.75	3.15	1.85	1.85	1.85	1.85	1.8
8	2.0	1.8	2.0	1.8	2.9	3.9	2.9	1.85	1.9	1.85	1.85	1.8
9	2.0	1.8	2.0	1.8	2.8	4.0	2.8	1.85	1.9	1.85	1.85	1.8
10	2.0	1.8	2.0	1.8	2.7	4.05	3.05	1.85	1.9	1.85	1.85	.....
11	2.0	1.8	2.0	1.6	2.7	3.75	2.7	1.85	1.9	1.85	1.85	.....
12	2.0	.....	1.8	1.8	2.65	3.6	2.8	1.85	1.9	1.9	1.85	.....
13	2.0	.....	1.8	1.8	2.65	3.75	2.75	1.85	1.9	1.9	1.85	.....
14	2.0	.....	1.8	1.8	2.75	3.85	2.65	1.85	1.9	1.9	1.85	.....
15	2.0	.....	1.8	1.8	2.75	3.75	2.35	1.85	1.9	1.9	1.85	.....
16	2.0	.....	1.8	1.8	2.8	3.6	2.25	1.85	1.9	1.9	1.85	.....
17	1.8	.....	1.8	2.0	2.9	3.5	2.15	1.85	1.9	1.9	1.85	.....
18	1.8	.....	1.8	2.0	3.2	3.6	2.1	1.85	1.9	1.9	1.85	.....
19	1.8	.....	1.8	2.1	3.25	3.1	2.1	1.85	1.9	1.85	1.85	.....
20	1.8	.....	1.8	2.2	3.2	2.9	2.1	1.85	1.9	1.85	1.85	.....

Daily gage height, in feet, of Fall River at Fremont, Idaho, for 1905—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
21	1.8	.....	1.6	2.25	3.2	2.85	2.05	1.85	1.85	1.9	1.85	.....
22	1.8	.....	1.6	2.3	3.25	3.1	2.0	1.85	1.85	1.9	1.85	.....
23	1.8	.....	1.6	2.4	3.5	3.15	1.95	1.85	1.85	1.9	1.85	.....
24	1.8	.....	1.6	2.5	2.85	3.2	1.9	1.85	1.9	1.9	1.85	.....
25	1.8	.....	1.6	2.95	2.9	3.3	1.9	1.85	1.95	1.9	1.85	.....
26	1.8	.....	1.6	3.5	3.0	3.5	1.9	1.9	1.95	1.9	1.85	.....
27	1.8	.....	1.6	2.9	3.2	3.9	1.9	1.9	1.95	1.9	1.85	.....
28	1.8	.....	1.6	2.7	3.35	4.0	1.9	1.9	1.9	1.9	1.85	.....
29	1.8	.....	1.6	2.75	3.6	3.8	1.8	1.9	1.9	1.9	1.85	.....
30	1.8	.....	1.6	2.8	3.5	3.6	1.9	1.9	2.0	1.9	1.85	.....
31	1.8	.....	1.6	.....	3.45	.....	1.9	1.9	.....	1.9	.....	.....

NOTE.—River frozen over February 12–28 and December 12–31.

Station rating table for Fall River at Fremont, Idaho, from October 28, 1904, to December 31, 1905.

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	168	2.10	575	2.80	1,215	3.50	2,030
1.50	210	2.20	655	2.90	1,325	3.60	2,150
1.60	255	2.30	740	3.00	1,440	3.70	2,275
1.70	305	2.40	825	3.10	1,555	3.80	2,400
1.80	365	2.50	915	3.20	1,670	3.90	2,525
1.90	430	2.60	1,010	3.30	1,790	4.00	2,650
2.00	500	2.70	1,110	3.40	1,910		

The above table is applicable only for open-channel conditions. It is based on four discharge measurements made during 1905. It is not well defined.

Estimated monthly discharge of Fall River at Fremont, Idaho, for 1904.

[Drainage area, 390 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
November	575	500	532	31,660	1.36	1.52
December	538	500	510	31,360	1.31	1.51

Estimated monthly discharge of Fall River at Fremont, Idaho, for 1905.

[Drainage area, 390 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	365	435	26,750	1.12	1.29
February 1–11	365	365	365	7,964	.936	.383
March	500	255	374	23,000	.959	1.11
April	2,030	168	620	36,890	1.59	1.77
May	2,150	1,010	1,419	87,250	3.64	4.20
June	2,712	1,270	2,154	128,200	5.52	6.16
July	2,275	365	924	56,820	2.37	2.73
August	430	398	409	25,150	1.05	1.21
September	500	398	430	25,590	1.10	1.23
October	500	398	431	26,500	1.11	1.28
November	430	398	402	23,920	1.03	1.15
December 1–9	398	365	376	6,712	.964	.323
The period				474,700		

NOTE.—No estimate for ice period.

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 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.

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 and 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 abutment.

The gage is a vertical staff spiked to the upstream side of the north abutment of the bridge. During 1905 the gage was read once each day by William Ferguson. Bench marks were established as follows: (1) A United States Geological Survey aluminum tablet set in solid rock about 30 feet northeast of the north end of the bridge; elevation, 13.53 feet. (2) A cross on a large flat rock 40 feet northeast of the right end of the bridge, marked "B. M."; elevation, 14.25 feet. (3) A similar rock 60 feet northwest of the right end of the bridge, similarly marked; elevation, 14.41 feet. Elevations refer to the datum of the gage.

Information in regard to this station is contained in the following Water-Supply Papers of the United States Geological Survey:

Description: 100, p 453; 135, p 177.
Discharge: 100, p 453; 135, p 177.
Discharge, monthly: 100, p 455; 135, p 179.
Gage heights: 100, p 454; 135, p 178.
Rating table: 100, p 454; 135, p 178.

Discharge measurements of Teton River near St. Anthony, Idaho, in 1905.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Square feet.*	*Feet per second.*	*Feet.*	*Second-feet.*
April 13	E. C. La Rue	81	306	1.22	1.30	371
May 12	do	80	349	1.86	1.95	648
June 14	do	80	457	3.29	3.10	1,504
June 29	do	80	407	2.78	2.60	1,131
August 28	do	79.5	322	1.49	1.70	478

Daily gage height, in feet, of Teton River near St. Anthony, Idaho, for 1905.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.1	1.4	1.3	1.4	1.85	3.15	2.55	1.7	1.65	1.5	1.5	1.6
2	2.0	1.4	1.3	1.45	1.95	3.25	2.45	1.7	1.65	1.5	1.5	1.65
3	2.0	1.4	1.3	1.5	1.9	3.4	2.4	1.7	1.65	1.5	1.5	1.65
4	1.95	1.4	1.3	1.5	1.95	3.4	2.35	1.7	1.65	1.5	1.5	1.65
5	1.95	1.4	1.35	1.5	2.0	3.4	2.3	1.7	1.65	1.5	1.5	1.65
6	1.95	1.4	1.35	1.55	2.0	3.1	2.3	1.7	1.65	1.5	1.5	1.55
7	1.95	1.4	1.4	1.6	2.05	3.1	2.3	1.7	1.6	1.5	1.5	1.55
8	1.95	1.4	1.4	1.6	2.1	3.1	2.25	1.7	1.6	1.5	1.5	1.6
9	1.95	1.4	1.4	1.55	2.15	3.2	2.25	1.7	1.6	1.5	1.5	1.6
10	1.95	1.4	1.4	1.5	2.15	3.25	2.25	1.65	1.6	1.5	1.5	1.6
11	2.0	1.6	1.4	1.55	2.1	2.9	2.25	1.65	1.6	1.5	1.5	1.7
12	2.1	1.95	1.4	1.5	2.0	2.9	2.2	1.6	1.55	1.5	1.5	.....
13	2.1	1.95	1.5	1.5	1.85	3.0	2.2	1.6	1.55	1.5	1.5	.....
14	2.1	1.95	1.6	1.5	1.9	3.0	2.15	1.6	1.55	1.5	1.5	.....
15	2.1	2.0	1.7	1.5	1.95	3.0	2.1	1.6	1.5	1.5	1.5	.....
16	2.1	2.0	1.9	1.5	2.1	3.0	2.05	1.55	1.5	1.5	1.5	.....
17	2.15	2.3	2.0	1.5	2.4	2.8	2.0	1.55	1.5	1.5	1.5	.....
18	2.15	2.5	2.2	1.5	2.55	2.7	1.95	1.55	1.5	1.5	1.5	.....
19	2.15	2.5	2.1	1.5	2.7	2.7	1.9	1.55	1.5	1.5	1.5	.....
20	2.15	2.6	1.95	1.55	2.75	2.6	1.9	1.55	1.5	1.55	1.5	.....
21	2.15	2.6	1.8	1.6	2.8	2.4	1.85	1.55	1.5	1.55	1.5	.....
22	2.1	2.5	1.75	1.6	2.8	2.4	1.85	1.6	1.45	1.55	1.5	.....
23	2.0	2.5	1.65	1.6	2.4	2.4	1.8	1.6	1.45	1.55	1.5	.....
24	1.8	2.45	1.6	1.75	2.3	2.4	1.75	1.6	1.45	1.55	1.5	.....
25	1.7	2.4	1.5	1.9	2.25	2.4	1.75	1.65	1.45	1.55	1.5	.....
26	1.4	1.3	1.8	1.8	2.45	2.4	1.75	1.65	1.45	1.5	1.5	.....
27	1.4	1.3	1.9	1.7	2.7	2.4	1.75	1.65	1.45	1.5	1.5	.....
28	1.4	1.3	1.8	1.7	2.9	2.45	1.7	1.65	1.45	1.5	1.5	.....
29	1.4	.....	1.75	1.7	3.05	2.6	1.7	1.65	1.55	1.5	1.55	.....
30	1.4	.....	1.6	1.8	2.8	2.6	1.7	1.65	1.55	1.5	1.55	.....
31	1.4	.....	1.5	.....	2.95	.....	1.7	1.65	.....	1.5	.....	.....

NOTE.—River frozen over January 1 to February 28, and December 12 to 31.

Station rating table for Teton River near St. Anthony, Idaho, from January 1 to December 31, 1905.

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	253	1.90	610	2.50	1,024	3.00	1,417
1.40	310	2.00	674	2.60	1,100	3.10	1,500
1.50	368	2.10	740	2.70	1,177	3.20	1,584
1.60	427	2.20	808	2.80	1,255	3.30	1,669
1.70	487	2.30	878	2.90	1,335	3.40	1,755
1.80	548	2.40	950				

The above table is strictly applicable only for open-channel conditions. It is based on five discharge measurements made during 1905. It is well defined between gage heights 1.5 feet and 3.1 feet.

Estimated monthly discharge of Teton River near St. Anthony, Idaho, for 1905.

[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.
March	808	253	438	26,930	0.456	0.526
April	610	310	416	24,750	.433	.483
May	1,458	579	902	55,460	.940	1.08
June	1,755	950	1,301	77,420	1.36	1.52
July	1,062	487	710	43,660	.740	.853
August	487	398	448	27,550	.467	.538
September	457	339	394	23,440	.410	.457
October	398	368	374	23,000	.390	.450
November	398	368	370	22,020	.385	.430
December 1–11	487	398	438	9,556	.456	.187
The period				333,800		

NOTE.—No estimate for ice period.

SOUTH FORK OF SNAKE RIVER 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.

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.

Discharge measurements are made from a cable and car about 150 feet below the gage. The initial point for soundings is on the inner face of cable support on north side of river.

The gage is an inclined staff. During 1905 it was read once each day by Lizzie Roche and Maria Allen. The bench mark is a United States Geological Survey iron bench-mark post set about 30 feet from the gage; elevation, 10.77 feet above the datum of the gage.

Information in regard to this station is contained in the following Water-Supply Papers of the United States Geological Survey:

Description: 100, p 452; 135, pp 179–180.
Discharge: 100, pp 452, 461; 135, p 180.
Discharge, monthly: 135, p 181.
Gage heights: 100, p 453; 135, p 180.
Rating table: 135, p 181.

Discharge measurements of South Fork of Snake River at Moran, Wyo., in 1905.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Square feet.*	*Feet per second.*	*Feet.*	*Second-feet.*
July 3	E. C. La Rue	202	910	3.60	4.10	3,276
August 19	Charles B. Smith	196	496	1.69	1.75	837

Daily gage height, in feet, of South Fork of Snake River at Moran, Wyo., for 1905.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	0.9	1.3	1.2	1.25	1.65	4.05	4.2	2.35	1.6	1.2	0.9	0.9
2	.9	1.3	1.2	1.25	1.65	4.2	4.15	2.35	1.6	1.2	.9	.9
3	.9	1.3	1.15	1.25	1.65	4.3	4.1	2.3	1.55	1.2	.9	.9
4	.9	1.3	1.15	1.25	1.65	4.35	4.1	2.3	1.5	1.15	.9	.9
5	.9	1.3	1.15	1.25	1.7	4.4	3.95	2.25	1.5	1.15	.9	.9
6	.9	1.3	1.15	1.25	1.7	4.45	3.95	2.25	1.5	1.15	.9	.9
7	.9	1.25	1.15	1.25	1.7	4.6	3.9	2.25	1.5	1.15	.9	.9
8	.9	1.25	1.15	1.25	1.75	5.0	3.8	2.25	1.45	1.15	.9	.9
9	.9	1.25	1.15	1.25	1.8	5.1	3.7	2.2	1.45	1.1	.9	.9
10	.9	1.25	1.15	1.25	1.85	5.15	3.55	2.2	1.45	1.1	.9	.9
11	.9	1.2	1.15	1.25	1.9	5.05	3.5	2.2	1.45	1.1	.9	.9
12	.9	1.2	1.15	1.25	1.9	5.05	3.4	2.2	1.4	1.1	.9	.9
13	.9	1.2	1.15	1.25	1.9	5.0	3.35	2.0	1.35	1.1	.9	.9
14	.9	1.2	1.15	1.25	1.95	5.05	3.3	1.9	1.3	1.1	.9	.9
15	.9	1.2	1.15	1.3	1.95	5.15	3.25	1.85	1.3	1.1	.9	.9
16	.9	1.2	1.15	1.3	1.95	5.1	3.25	1.85	1.25	1.1	.9	.9
17	.9	1.2	1.15	1.35	2.0	5.1	3.25	1.85	1.25	1.1	1.0	.9
18	.9	1.2	1.15	1.35	2.1	5.05	3.15	1.75	1.25	1.1	1.0	.9
19	.9	1.2	1.15	1.4	2.3	5.0	3.1	1.75	1.2	1.2	.9	.9
20	.9	1.2	1.15	1.4	2.3	4.85	3.05	1.75	1.2	1.1	.9	.9
21	.9	1.2	1.2	1.4	2.3	4.65	2.9	1.75	1.2	1.1	.9	.9
22	.9	1.2	1.2	1.45	2.4	4.5	2.9	1.75	1.2	1.1	.9	.9
23	.9	1.2	1.25	1.45	2.45	4.45	2.8	1.7	1.2	1.1	.9	.9
24	.9	1.2	1.25	1.45	2.5	4.35	2.7	1.7	1.2	1.1	.9	.9
25	.9	1.2	1.25	1.5	2.55	4.35	2.6	1.7	1.2	1.05	.9	.9
26	1.0	1.2	1.25	1.55	2.6	4.35	2.55	1.7	1.2	1.05	.9	.9
27	1.0	1.2	1.25	1.55	2.7	4.35	2.55	1.75	1.25	1.05	.9	.9
28	1.1	1.2	1.25	1.6	3.0	4.35	2.55	1.7	1.25	1.0	.9	.9
29	1.2	.....	1.25	1.6	3.05	4.3	2.45	1.7	1.25	1.0	.9	.9
30	1.2	.....	1.25	1.65	3.35	4.25	2.45	1.65	1.25	1.0	.9	.9
31	1.3	.....	1.25	.....	3.8	.....	2.4	1.65	.....	1.0	.....	.9

NOTE.—No ice record.

Station rating table for South Fork of Snake River at Moran, Wyo., from January 1 to December 31, 1905.

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	107	1.40	653	2.70	1,679	4.00	3,145
0.10	126	1.50	719	2.80	1,772	4.20	3,420
0.20	147	1.60	788	2.90	1,868	4.40	3,715
0.30	171	1.70	859	3.00	1,967	4.60	4,130
0.40	197	1.80	932	3.10	2,070	4.80	4,365
0.50	225	1.90	1,007	3.20	2,175	5.00	4,720
0.60	256	2.00	1,084	3.30	2,285	5.20	5,080
0.70	291	2.10	1,163	3.40	2,400	5.40	5,450
0.80	330	2.20	1,244	3.50	2,515	5.60	5,830
0.90	374	2.30	1,327	2.60	2,635	5.80	6,220
1.00	422	2.40	1,412	3.70	2,760	6.00	6,620
1.10	474	2.50	1,499	3.80	2,885	6.20	7,025
1.20	530	2.60	1,588	3.90	3,015	6.40	7,440
1.30	590						

The above table is applicable only for open-channel conditions. It is based on six discharge measurements made during 1903–1905. It is not well defined.

Estimated monthly discharge of South Fork of Snake River at Moran, Wyo., for 1905.

[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.
January	590	374	397	24,410	0.484	0.558
February	590	530	547	30,380	.667	.695
March	560	502	522	32,100	.637	.734
April	824	560	630	37,490	.768	.857
May	2,885	824	1,273	78,270	1.55	1.79
June	4,990	3,212	4,175	248,400	5.09	5.68
July	3,420	1,412	2,352	144,600	2.87	3.31
August	1,370	824	1,014	62,350	1.24	1.43
September	788	530	619	36,830	.755	.842
October	530	422	475	29,210	.579	.668
November	422	374	377	22,430	.460	.513
December	374	374	374	23,000	.456	.526
The year	4,990	374	1,063	769,500	1.30	17.60

SOUTH FORK OF SNAKE RIVER 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.

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 and is free from vegetation and permanent.

Discharge measurements are 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 gage is an inclined staff, located on the north bank one-fourth mile below Carr's ferry and 1 mile above the cable. During 1905 the gage was read once each day by O. J. Carr. Bench marks were established as follows: (1) A United States Geological Survey iron bench-mark post set about 6 feet from the gage; elevation, 11.15 feet. (2) A United States Geological Survey aluminum tablet set in a rock on the left bank about 100 feet above Carr's ferry landing and about 6 feet above high-water mark; elevation, 10.44 feet. This bench mark is for use in high water when ferry service is discontinued. Elevations refer to the datum of the gage.

Information in regard to this station is contained in the following Water-Supply Papers of the United States Geological Survey:

Description: 100, pp 449–450; 135, p 182.
Discharge: 100, p 450; 135, p 183.
Discharge, monthly: 100, p 452; 135, p 184.
Gage heights: 100, pp 450–451; 135, p 183.
Rating table: 100, p 451; 135, p 184.

Discharge measurements of South Fork of Snake River near Lyon, Idaho, in 1905.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Square feet.*	*Feet per second.*	*Feet.*	*Second-feet.*
April 15	E. C. La Rue	260	1,500	2.37	1.85	3,558
May 14	do	265	1,642	3.09	2.60	5,074
June 25	do	283	2,063	5.73	4.85	11,810
June 26	do	283	2,083	5.88	4.90	12,230
July 14	do	269	1,729	4.53	3.70	7,845
September 9	do	258	1,341	2.23	1.50	2,989
November 15	do	251	1,275	1.76	.93	2,236

Daily gage height, in feet, of South Fork of Snake River near Lyon, Idaho, for 1905.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	1.3	2.85	5.0	4.75	2.5	1.7	1.5	1.15	0.85
2	.....	1.3	2.9	5.3	4.7	2.45	1.65	1.45	1.15	.8
3	.....	1.3	3.1	5.5	4.5	2.35	1.6	1.4	1.15	.9
4	.....	1.3	3.05	5.8	4.45	2.35	1.65	1.35	1.15	.9
5	.....	1.3	2.8	5.9	4.4	2.3	1.6	1.35	1.15	.9
6	.....	1.35	2.7	5.7	4.3	2.3	1.6	1.3	1.15	.7
7	.....	1.5	2.7	5.35	4.25	2.25	1.55	1.3	1.1	.7
8	.....	1.8	2.8	5.7	4.2	2.2	1.55	1.3	1.1	.85
9	.....	1.9	3.0	6.1	4.15	2.1	1.5	1.3	1.1	.8
10	.....	2.0	2.85	6.0	4.05	2.1	1.5	1.3	1.05	.6
11	.....	1.8	2.7	5.6	4.0	2.05	1.5	1.3	.95	.6
12	.....	1.7	2.7	5.4	3.9	2.05	1.45	1.3	.95	.6
13	.....	1.75	2.6	5.55	3.85	2.05	1.45	1.3	1.0	.5
14	.....	1.9	2.6	5.85	3.75	2.05	1.4	1.25	1.05	.....
15	1.35	1.8	2.65	5.95	3.7	2.0	1.4	1.25	1.0	.....
16	1.35	1.9	2.75	5.9	3.65	1.9	1.35	1.25	1.05	.....
17	1.4	1.9	3.05	5.65	3.5	1.85	1.35	1.25	.95	.....
18	1.45	1.85	3.55	5.5	3.35	1.8	1.35	1.3	.95	.....
19	1.45	1.9	3.7	5.1	3.25	1.8	1.3	1.25	.95	.....
20	1.45	2.1	3.7	4.85	3.2	1.75	1.3	1.2	.9	.....
21	1.45	2.15	3.9	4.7	3.15	1.7	1.3	1.2	.9	.....

Daily gage height, in feet, of South Fork of Snake River near Lyon, Idaho, for 1905—Continued.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
22	1.4	2.2	3.85	4.7	3.1	1.7	1.3	1.2	0.95	.....
23	1.35	2.25	3.8	4.9	2.95	1.75	1.25	1.2	.95	.....
24	1.35	2.4	3.75	4.85	2.9	1.75	1.3	1.2	.95	.....
25	1.3	2.5	3.75	4.85	2.85	1.75	1.35	1.2	.95	.....
26	1.3	2.7	3.95	4.9	2.8	1.8	1.3	1.2	.95	.....
27	1.45	2.8	4.2	5.1	2.75	1.75	1.3	1.25	.95	.....
28	1.4	2.65	4.6	5.15	2.65	1.75	1.3	1.25	.95	.....
29	1.35	2.5	4.65	5.05	2.6	1.75	1.35	1.2	.9	.....
30	1.35	2.5	4.6	4.85	2.5	1.75	1.5	1.2	.85	.....
31	1.35	.....	4.7	.....	2.5	1.75	.....	1.15	.....	.....

NOTE.—River gorged with ice December 14-31.

Station rating table for South Fork of Snake River near Lyon, Idaho, from March 15 to December 13, 1905.

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	1,800	1.70	3,320	2.90	5,750	4.00	8,760
0.60	1,900	1.80	3,495	3.00	5,980	4.20	9,420
0.70	2,005	1.90	3,680	3.10	6,220	4.40	10,150
0.80	2,115	2.00	3,870	3.20	6,470	4.60	10,920
0.90	2,225	2.10	4,065	3.30	6,730	4.80	11,710
1.00	2,340	2.20	4,265	3.40	7,000	5.00	12,520
1.10	2,460	2.30	4,465	3.50	7,280	5.20	13,370
1.20	2,585	2.40	4,670	3.60	7,560	5.40	14,290
1.30	2,715	2.50	4,880	3.70	7,850	5.60	15,270
1.40	2,855	2.60	5,090	3.80	8,150	5.80	16,280
1.50	3,000	2.70	5,310	3.90	8,450	6.00	17,320
1.60	3,155	2.80	5,530				

The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1903–1905. It is well defined.

Estimated monthly discharge of South Fork Snake River near Lyon, Idaho, for 1905.

[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.
March 15–31	2,928	2,715	2,831	95,460	0.517	0.327
April	5,530	2,715	3,821	227,400	.697	.778
May	11,310	5,090	7,124	438,000	1.30	1.50
June	17,850	11,310	14,220	846,200	2.59	2.89
July	11,510	4,880	7,675	471,900	1.40	1.61
August	4,880	3,320	3,848	236,600	.702	.809
September	3,320	2,650	2,900	172,600	.529	.590
October	3,000	2,522	2,681	164,800	.489	.564
November	2,522	2,170	2,354	140,100	.430	.480
December 1–13	2,225	1,800	2,058	53,070	.376	.182
The period	.....	.....	.....	2,846,000	.....	.....

BLACKFOOT RIVER NEAR PRESTO, IDAHO.

This station was established April 17, 1903, by N. S. Dils. It is located on the ranch of James Just, 2 miles west of Presto and about 15 miles from Blackfoot, Idaho.

The current is sluggish. The banks are high and wooded and will not overflow. The bed of the stream is composed of gravel and is free from vegetation and permanent.

Discharge measurements are made from a cable and car located about one-fourth mile below the gage. The initial point for soundings is a tag marked "I. P." fastened to the inner face of the cable support on the west bank.

The gage is an inclined staff. During 1905 the gage was read once each day by James Just. The bench mark is a copper plug set in the corner stone of Mr. Just's brick house; elevation, 12.18 feet above the datum of the gage.

Information in regard to this station is contained in the following Water-Supply Papers of the United States Geological Survey:

Description: 100, p 447; 135, p 186.
Discharge: 100, p 447; 135, p 186.
Gage heights: 100, p 448; 135, p 187.

Discharge measurements of Blackfoot River near Presto, Idaho, in 1905.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Square feet.*	*Feet per second.*	*Feet.*	*Second-feet.*
April 16	E. C. La Rue	54	197	2.23	2.20	439
May 19	do	55	170	1.63	1.50	277
June 8	do	52	145	1.41	1.00	205
July 9	do	53	105	.90	.30	95

Daily gage height, in feet, of Blackfoot River near Presto, Idaho, for 1905.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	1.4	2.1	1.2	0.5	0.1	0.25	0.55	0.7	0.5
2	.....	1.4	2.1	1.2	.5	.1	.25	.6	.7	.4
3	.....	1.45	2.35	1.15	.4	.1	.2	.6	.65	.6
4	.....	1.6	2.5	1.15	.4	.05	.2	.5	.65	.8
5	0.9	1.6	2.85	1.1	.4	.05	.2	.5	.6	.8
6	.9	1.7	2.9	1.1	.35	.05	.2	.55	.7	.9
7	1.0	1.85	2.8	1.0	.35	.1	.2	.6	.7	.7
8	1.0	2.1	2.55	1.0	.3	.1	.2	.6	.7	.7
9	1.0	2.25	2.25	1.0	.3	.1	.2	.5	.7	.8
10	.9	2.2	2.1	.9	.3	.1	.2	.6	.6	.8
11	.8	2.2	2.15	.9	.3	.15	.2	.6	.6	.75
12	1.0	2.1	2.1	.9	.3	.15	.2	.6	.5	.8
13	.9	2.0	2.05	1.0	.25	.15	.2	.6	.5	.8
14	1.05	2.1	2.0	1.0	.25	.15	.2	.6	.6	.9
15	1.2	2.1	1.9	1.0	.25	.15	.2	.55	.6	.95
16	1.3	2.15	1.7	1.0	.25	.15	.2	.6	.65	1.0
17	1.3	2.25	1.65	.9	.2	.2	.2	.6	.7	1.0
18	1.45	2.2	1.45	.8	.2	.2	.2	.6	.7	1.0
19	1.7	2.3	1.5	.8	.2	.2	.25	.65	.7	.8
20	1.6	2.3	1.5	.8	.2	.2	.25	.65	.7	.7
21	1.6	2.4	1.5	.8	.3	.2	.25	.65	.6	.9
22	1.65	2.5	1.5	.8	.3	.2	.25	.65	.7	.9
23	1.5	2.5	1.5	.8	.2	.25	.3	.7	.75	1.0
24	1.5	2.4	1.45	.8	.2	2.65	.3	.7	.75	1.05

Daily gage height, in feet, of Blackfoot River near Presto, Idaho, for 1905—Continued.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
25	1.4	2.4	1.45	0.7	0.2	1.3	0.3	0.7	0.8	1.0
26	1.55	2.4	1.4	.7	.2	.5	.35	.7	.8	1.0
27	1.7	2.4	1.4	.65	.2	.4	.35	.7	.7	1.1
28	1.7	2.4	1.3	.65	.2	.3	.4	.7	.7	1.0
29	1.7	2.4	1.3	.65	.2	.3	.5	.7	.6	1.0
30	1.75	2.25	1.3	.65	.15	.3	.5	.7	.6	1.0
31	1.6	.....	1.25	.....	.15	.25	.....	.7	.....	1.1

NOTE.—No ice record.

Station rating table for Blackfoot River near Presto, Idaho, from January 1, 1904, to December 31, 1905.

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	59	1.40	269	2.80	577	4.40	1,155
.10	70	1.50	287	2.90	606	4.60	1,240
.20	82	1.60	306	3.00	636	4.80	1,340
.30	94	1.70	325	3.10	668	5.00	1,440
.40	107	1.80	345	3.20	701	5.20	1,540
.50	121	1.90	365	3.30	735	5.40	1,640
.60	135	2.00	386	3.40	770	5.60	1,760
.70	150	2.10	407	3.50	805	5.80	1,880
.80	166	2.20	429	3.60	840	6.00	2,000
.90	182	2.30	451	3.70	875	6.20	2,120
1.00	199	2.40	474	3.80	915	6.40	2,240
1.10	216	2.50	498	3.90	955	6.60	2,380
1.20	233	2.60	523	4.00	995	6.80	2,520
1.30	251	2.70	549	4.20	1,075	7.00	2,660

The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1904–5. It is well defined between gage heights 0.3 foot and 2.7 feet.

Estimated monthly discharge of Blackfoot River near Presto, Idaho, for 1904 and 1905.

[Drainage area, 1,016 square miles.]

Month	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
1904.						
June	975	233	536	31,890	0.528	0.589
July	216	150	179	11,010	.176	.203
August	182	150	161	9,900	.158	.182
September	216	182	198	11,780	.195	.218
October	269	216	251	15,430	.247	.285
November	269	216	230	13,680	.226	.252
December 1–10	269	216	238	4,721	.234	.087
The period	.....	.....	.....	98,410	.....	.....

Estimated monthly discharge of Blackfoot River near Presto, Idaho, for 1904 and 1905—Continued.

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
1905.						
March 5–31	335	166	256	13,710	0.252	0.253
April	498	269	412	24,520	.406	.453
May	606	242	368	22,630	.362	.417
June	233	142	183	10,890	.180	.201
July	121	76	91.2	5,608	.090	.104
August	536	64	100	6,149	.098	.113
September	121	82	89.0	5,296	.088	.098
October	150	121	138	8,485	.136	.157
November	166	121	145	8,628	.143	.160
December	216	107	177	10,880	.174	.201
The period				116,800		

NOTE.—No estimate for ice period.

BIG LOST RIVER NEAR MACKAY, IDAHO.

This station was established November 12, 1903, by Fred Stockton. It is located 3½ miles above Mackay, Idaho, above "The Narrows."

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.

Discharge measurements are made from a cable. 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 permanent gage was set November 3, 1904, at "The Narrows," about a mile below the cable. It is located back of Joseph Cresto's house and consists of a post set vertically and securely anchored. During 1905 the gage was read once each day by Joseph Cresto. The bench mark is a United States Geological Survey iron bench-mark post set about 15 feet from the gage; elevation, 9.83 feet above the datum of the gage.

Information in regard to this station is contained in the following Water-Supply Papers of the United States Geological Survey:

Description: 100, p 447; 135, pp 187–188.
Discharge: 135, p 188.
Discharge, monthly: 135, p 189.
Gage heights: 100, p 447; 135, p 188.
Rating table: 135, p 189.

Discharge measurements of Big Lost River near Mackay, Idaho, in 1905.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Square feet.*	*Feet per second.*	*Feet.*	*Second-feet.*
April 18	E. C. La Rue	37	74	1.84	2.50	136
May 15	do	37	72	1.72	2.45	124
June 10	do	51	193	5.12	5.15	987
July 11	do	44	151	4.17	4.10	629
September 21	do	37	89	1.75	2.65	156
November 22	do	38	93	1.89	2.80	176

Daily gage height, in feet, of Big Lost River near Mackay, Idaho, for 1905.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.7	2.65	2.6	2.6	2.5	3.9	4.5	3.15	2.75	2.7	2.8	2.8
2	2.7	2.65	2.6	2.6	2.5	4.3	4.6	3.1	2.75	2.7	2.8	2.8
3	2.7	2.65	2.6	2.6	2.5	4.5	4.4	3.1	2.75	2.7	2.8	2.8
4	2.7	2.65	2.6	2.55	2.5	4.5	4.35	3.1	2.75	2.7	2.8	2.8
5	2.7	2.65	2.6	2.55	2.5	4.8	4.3	3.05	2.7	2.7	2.8	2.75
6	2.7	2.65	2.6	2.55	2.5	4.85	4.3	3.05	2.7	2.7	2.8	2.75
7	2.7	2.65	2.6	2.55	2.5	4.6	4.3	3.05	2.7	2.7	2.8	2.75
8	2.7	2.65	2.6	2.55	2.5	4.5	4.3	3.05	2.7	2.75	2.8	2.75
9	2.7	2.65	2.6	2.55	2.5	5.0	4.25	3.05	2.7	2.75	2.8	2.75
10	2.7	2.65	2.6	2.55	2.5	5.15	4.25	3.0	2.7	2.75	2.8	2.75
11	2.7	2.65	2.6	2.55	2.5	4.8	4.1	3.0	2.7	2.75	2.8	2.75
12	2.7	2.65	2.6	2.5	2.5	5.2	4.05	3.0	2.7	2.75	2.8	2.75
13	2.7	2.65	2.6	2.5	2.5	5.35	4.0	2.95	2.7	2.75	2.8	2.75
14	2.7	2.65	2.6	2.5	2.45	5.4	3.85	2.95	2.7	2.75	2.8	2.75
15	2.7	2.65	2.6	2.5	2.45	5.2	3.7	2.9	2.7	2.75	2.8	2.75
16	2.7	2.65	2.6	2.5	2.45	4.95	3.7	2.9	2.7	2.75	2.8	2.75
17	2.7	2.65	2.6	2.5	2.45	4.95	3.6	2.9	2.7	2.75	2.8	2.75
18	2.7	2.65	2.6	2.5	2.45	4.9	3.55	2.9	2.7	2.75	2.8	2.75
19	2.7	2.65	2.6	2.5	2.45	4.5	3.5	2.9	2.65	2.8	2.8	2.75
20	2.7	2.65	2.6	2.5	2.45	4.5	3.45	2.9	2.65	2.8	2.8	2.75
21	2.7	2.6	2.6	2.5	2.45	4.5	3.4	2.9	2.65	2.8	2.8	2.75
22	2.7	2.6	2.6	2.5	2.5	4.8	3.4	2.85	2.65	2.8	2.8	2.75
23	2.7	2.6	2.6	2.5	2.55	5.0	3.45	2.85	2.65	2.8	2.8	2.75
24	2.7	2.6	2.6	2.5	2.55	4.9	3.4	2.85	2.65	2.8	2.8	2.75
25	2.65	2.6	2.6	2.5	2.55	4.75	3.4	2.8	2.65	2.8	2.8	2.7
26	2.65	2.6	2.6	2.5	2.55	4.6	3.35	2.8	2.65	2.8	2.8	2.7
27	2.65	2.6	2.6	2.5	2.55	4.6	3.3	2.8	2.65	2.8	2.8	2.7
28	2.65	2.6	2.6	2.5	2.65	4.5	3.3	2.8	2.65	2.8	2.8	2.7
29	2.65	.....	2.6	2.5	2.9	4.4	3.3	2.8	2.65	2.8	2.8	2.7
30	2.65	.....	2.6	2.5	3.1	4.4	3.25	2.75	2.65	2.8	2.8	2.7
31	2.65	.....	2.6	.....	3.3	.....	3.2	2.75	.....	2.8	.....	2.7

NOTE.—No ice record.

Station rating table for Big Lost River near Mackay, Idaho, from January 1 to December 31, 1905.

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	129	3.30	313	4.10	592	4.80	868
2.60	145	3.40	345	4.20	630	4.90	909
2.70	163	3.50	378	4.30	669	5.00	950
2.80	183	3.60	412	4.40	708	5.10	992
2.90	205	3.70	447	4.50	748	5.20	1,034
3.00	229	3.80	482	4.60	788	5.30	1,077
3.10	255	3.90	518	4.70	828	5.40	1,120
3.20	283	4.00	555				

The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1904–5. It is well defined.

Estimated monthly discharge of Big Lost River near Mackay, Idaho, for 1905.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January	163	154	161	9,900
February	154	145	151	8,386
March	145	145	145	8,916
April	145	129	133	7,914
May	313	122	142	8,731
June	1,120	518	847	50,400
July	788	283	489	30,070
August	269	173	214	13,160
September	173	154	161	9,580
October	183	163	175	10,760
November	183	183	183	10,890
December	183	163	172	10,580
The year	1,120	122	248	179,300

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 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.

Discharge measurements are made from a cable and car located about three-fourths of a mile above Mr. 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 gage is a vertical staff located about one-fourth mile from the ranch house. During 1905 the gage was read once each day by Frank Uehren and J. S. Fullmer. The bench mark is a United States Geological Survey iron bench-mark post about 10 feet from the gage; elevation, 7.49 feet above the datum of the gage.

A description of this station, with gage heights, discharge data, and rating table is contained in Water-Supply Paper No. 135, United States Geological Survey, pages 190–192.

Discharge measurements of Big Lost River near Chilly, Idaho, in 1905.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Square feet.*	*Feet per second.*	*Feet.*	*Second-feet.*
April 18	E. C. La Rue	81	109	1.01	1.57	110
May 16	do	82	142	1.53	2.10	217
June 11	do	84	247	4.08	4.25	1,007
July 12	do	83	221	3.04	3.50	671
September 22	do	82	103	.85	1.45	88
November 21	do	81	101	.87	1.45	88

Daily gage height, in feet, of Big Lost River near Chilly, Idaho, for 1905.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.3	1.4	1.3	1.4	1.9	4.55	3.65	2.3	1.9	1.7	1.5	1.5
2	1.3	1.4	1.3	1.5	1.9	4.7	3.65	2.4	1.85	1.7.	1.5	1.5
3	1.4	1.4	1.3	1.5	1.9	4.5	3.65	2.4	1.8	1.7	1.5	1.7
4	1.35	1.45	1.4	1.4	1.8	4.1	3.9	2.3	1.8	1.65	1.5	1.5
5	1.3	1.4	1.4	1.5	1.8	4.5	3.7	2.4	1.8	1.65	1.5	1.5
6	1.3	1.4	1.4	1.6	1.8	3.95	3.55	2.3	1.8	1.65	1.5	1.4
7	1.4	1.4	1.4	1.6	1.8	4.0	3.8	2.3	1.75	1.65	1.5	1.4
8	1.3	1.4	1.4	1.6	2.0	4.5	3.5	2.3	1.75	1.65	1.5	1.35
9	1.3	1.35	1.4	1.6	2.0	4.6	3.45	2.2	1.75	1.65	1.5	1.3
10	1.35	1.5	1.4	1.6	2.0	4.1	3.55	2.2	1.75	1.7	1.5	1.3
11	1.5	1.65	1.4	1.5	1.9	4.2	3.55	2.15	1.7	1.7	1.6	1.3
12	1.5	1.8	1.5	1.6	1.9	4.9	3.5	2.15	1.7	1.65	1.65	1.3
13	1.5	1.6	1.5	1.6	1.9	4.9	3.4	2.05	1.7	1.65	1.65	1.3
14	1.5	1.6	1.5	1.6	1.9	4.9	3.1	2.05	1.7	1.65	1.7	1.3
15	1.4	1.5	1.5	1.6	1.9	4.75	3.1	2.0	1.7	1.65	1.8	1.35
16	1.4	1.5	1.5	1.7	2.0	4.1	3.0	2.0	1.7	1.65	2.0	1.35
17	1.4	1.5	1.5	1.7	2.65	3.9	3.0	2.0	1.7	1.6	1.9	1.3
18	1.4	1.6	1.5	1.7	2.95	3.8	2.7	1.9	1.7	1.6	1.9	1.35
19	.....	1.7	1.4	1.7	2.95	3.45	2.75	1.9	1.7	1.6	1.9	1.35
20	.....	1.5	1.4	1.7	3.1	3.5	2.8	1.9	1.7	1.6	1.9	1.4
21	1.5	1.5	1.4	1.7	3.05	3.95	2.7	1.9	1.65	1.6	1.45	1.35
22	1.4	1.4	1.4	1.7	2.75	4.15	2.75	1.9	1.65	1.6	1.45	1.35
23	1.4	1.4	1.4	1.7	2.65	4.2	2.7	1.9	1.65	1.6	1.45	1.3
24	1.4	1.4	1.4	1.8	2.5	3.95	2.6	1.85	1.7	1.5	1.45	1.3
25	1.4	1.5	1.4	1.8	2.7	3.7	2.4	1.9	1.7	1.5	1.5	1.35
26	1.4	1.3	1.4	1.9	2.85	3.9	2.5	1.9	1.65	1.5	1.5	1.35
27	1.4	1.3	1.4	1.9	3.15	3.9	2.55	1.9	1.65	1.5	1.5	1.35
28	1.4	1.3	1.4	1.9	3.45	3.6	2.5	1.9	1.65	1.5	1.5	1.35
29	1.4	.....	1.5	1.9	3.25	3.7	2.3	1.85	1.65	1.5	1.5	1.35
30	1.4	.....	1.5	1.9	3.4	3.7	2.3	1.8	1.7	1.5	1.5	1.4
31	1.35	.....	1.4	.....	3.7	.....	2.3	1.85	.....	1.5	.....	1.35

NOTE.—No ice record.

Station rating table for Big Lost River near Chilly, Idaho, from January 1 to December 31, 1905.

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	65	2.30	267	3.20	553	4.10	937
1.40	80	2.40	293	3.30	591	4.20	985
1.50	96	2.50	320	3.40	630	4.30	1,034
1.60	114	2.60	349	3.50	670	4.40	1,084
1.70	133	2.70	379	3.60	712	4.50	1,135
1.80	153	2.80	411	3.70	755	4.60	1,188
1.90	174	2.90	445	3.80	799	4.70	1,242
2.00	195	3.00	480	3.90	844	4.80	1,298
2.10	218	3.10	516	4.00	890	4.90	1,355
2.20	242						

The above table is applicable only for open-channel conditions. It is based on six discharge measurements made during 1905 and one during 1904. It is well defined.

Estimated monthly discharge of Big Lost River near Chilly, Idaho, for 1905.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January	96	65	79.4	4,882
February	153	65	92.1	5,115
March	96	65	86.3	5,306
April	174	80	127	7,557
May	755	153	326	20,040
June	1,355	650	973	57,900
July	844	267	517	31,790
August	293	153	211	12,970
September	174	124	137	8,152
October	133	96	116	7,133
November	195	88	114	6,783
December	133	65	75.6	4,648
The year	1,355	65	238	172,300

NOTE.—Missing gage heights interpolated.

BIG WOOD RIVER NEAR GIMLET, IDAHO.

This station was established by Fred Stockton April 25, 1904, and was discontinued May 31, 1905. The station is located on a wagon bridge on the road from Hailey to Ketchum, near Gimlet, a small station on the Oregon Short Line Railroad, about 6 miles from Hailey and 6 miles from Ketchum. The wagon bridge is about 200 feet below the railroad bridge crossing Big Wood River.

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. The stream has but one channel in either high or low water.

Discharge measurements are made from the bridge. The initial point for soundings is a tag marked "I. P." nailed on the hand rail on the downstream side of the bridge.

The gage is a staff, spiked against a timber on the upstream side of the north abutment to the wagon bridge. During 1905 the gage was read once each day by A. C. Comstock. The bench mark is a United States Geological Survey iron bench-mark post set in the door-yard of the first ranch house above Gimlet; elevation, 5,544 feet above sea level and 15.09 feet above the datum of the gage.

A description of this station, with gage heights and discharge data, is contained in Water-Supply Paper No. 135, United States Geological Survey, pages 192–193.

Discharge measurements of Big Wood River near Gimlet, Idaho, in 1905.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height	Discharge.
		Feet.	*Square feet.*	*Feet per second.*	*Feet.*	*Second-feet.*
April 22	E. C. LaRue	40	165	1.92	1.05	317
May 22	do	40	178	2.84	1.60	505

Daily gage height, in feet, of Big Wood River near Gimlet, Idaho, for 1905.

Day.	Jan.	Feb.	Mar.	Apr.	May.	Day.	Jan.	Feb.	Mar.	Apr.	May.
1	0.6	0.6	0.55	0.6	1.05	17	0.6	0.6	0.7	0.9	1.35
2	.6	.6	.55	.65	1.05	18	.6	.6	.7	.9	1.5
3	.6	.6	.5	.7	1.0	19	.6	.6	.7	.9	1.7
4	.6	.6	.55	.7	1.0	20	.6	.6	.7	.95	1.8
5	.6	.6	.55	.8	1.0	21	.6	.6	.7	.95	1.7
6	.6	.6	.6	.95	1.0	22	.6	.6	.7	1.0	1.6
7	.6	.6	.6	.95	1.05	23	.6	.6	.7	1.0	1.6
8	.6	.6	.6	.95	1.1	24	.6	.6	.7	1.0	1.65
9	.6	.6	.65	1.0	1.1	25	.6	.6	.7	1.0	1.7
10	.6	.6	.65	1.0	1.05	26	.6	.6	.7	1.1	1.8
11	.6	.6	.65	1.0	1.05	27	.6	.6	.7	1.1	1.75
12	.6	.6	.65	1.0	1.05	28	.6	.6	.7	1.1	1.6
13	.6	.6	.65	.95	1.05	29	.6	.....	.65	1.1	1.7
14	.6	.6	.7	.95	1.1	30	.6	.....	.6	1.1	1.7
15	.6	.6	.7	.95	1.2	31	.6	.....	.6	.....	1.75
16	.6	.6	.7	.95	1.2						

NOTE.—No ice record.

BIG WOOD RIVER NEAR SHOSHONE, IDAHO.

This station was established June 5, 1905, by E. C. La Rue. It is located at A. D. Silva's ranch, 1 mile below the steel wagon bridge and 7 miles northwest of Shoshone, Idaho, the nearest railway point. The water is sluggish during low stages, but rather swift during high water. Both banks are high and not liable to overflow. Measurements are made from a boat, held by a cable. The initial point for soundings is a post on the right bank which is used as a support for the tag wire. The gage is a vertical staff on the right bank, 100 yards below the cable. During 1905 the gage was read once each day by A. D. Silva. The bench mark is a standard United States Geological Survey iron post set about 3 feet from the southeast corner of Mr. Silva's house; elevation, 13.12 feet above the datum of the gage.

Daily gage height, in feet, of Big Wood River near Shoshone, Idaho, for 1905.

Day.	June.	July.	Day.	June.	July.	Day.	June.	July.	Day.	June.	July.
1	.....	2.75	9	3.55	2.85	17	3.7	2.5	25	3.0	2.0
2	.....	2.75	10	3.75	2.8	18	3.75	2.5	26	2.95	1.95
3	.....	2.75	11	3.7	2.8	19	3.55	2.4	27	2.9	1.9
4	.....	2.75	12	3.6	2.75	20	3.3	2.35	28	2.9	(a)
5	3.75	2.7	13	3.75	2.7	21	3.1	2.2	29	2.9	.....
6	3.9	2.7	14	3.85	2.65	22	2.95	2.2	30	2.85	.....
7	3.7	2.6	15	3.8	2.6	23	2.95	2.15			
8	3.5	2.5	16	3.8	2.55	24	3.0	2.1			

a River dry remainder of year.

LITTLE WOOD RIVER NEAR CAREY, IDAHO.

This station was established April 28, 1904, by William G. Davies, and was discontinued May 31, 1905. The station is located 7 miles upstream from Carey on the Carey-Muldoon road, about one-half mile above the dam at the head of the east and west side canals, and above the slough or delta section of the river. It is 15 miles from Picabo, the nearest railroad point.

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.

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 the west bank.

The gage is a vertical staff bolted to a lava wall on the east bank of the river. During 1905 the gage was read once each day by Mrs. F. M. Ford. The bench mark is a United States Geological Survey aluminum bench mark tablet set 3 feet from the gage in solid lava; elevation, 6.00 feet above the datum of the gage.

A description of this station and gage height and discharge data are contained in Water-Supply Paper No. 135, United States Geological Survey, pages 193–195.

Discharge measurements of Little Wood River near Carey, Idaho, in 1905.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Square-feet.*	*Feet per second.*	*Feet.*	*Second-feet.*
April 23	E. C. La Rue	39	91	1.53	1.42	139
May 23	do	42	100	1.84	1.65	184

Daily gage height, in feet, of Little Wood River near Carey, Idaho, for 1905.

Day.	Jan.	Feb.	Mar.	Apr.	May.	Day.	Jan.	Feb.	Mar.	Apr.	May.
1	1.0	1.0	1.8	1.1	1.4	17	1.8	1.3	1.1	1.1	1.3
2	1.0	1.1	1.7	1.1	1.5	18	1.6	1.4	1.0	1.1	1.4
3	1.0	1.1	1.2	1.1	1.7	19	1.6	1.4	1.1	1.2	1.6
4	1.1	1.1	1.0	1.1	1.6	20	1.6	1.6	1.1	1.2	1.6
5	1.1	1.1	1.0	1.2	1.6	21	1.0	1.6	1.1	1.1	1.7
6	1.1	1.1	1.0	1.3	1.6	22	1.0	1.6	1.1	1.4	1.7
7	1.1	1.1	1.0	1.6	1.5	23	1.0	1.6	1.1	1.4	1.7
8	1.0	1.1	1.0	1.4	1.6	24	1.0	1.6	1.1	1.4	1.6
9	1.0	1.1	1.0	1.3	1.6	25	1.0	1.6	1.1	1.4	1.6
10	1.0	1.0	1.0	1.2	1.6	26	1.0	1.7	1.1	1.4	1.5
11	1.0	1.0	1.0	1.2	1.6	27	1.0	1.7	1.1	1.5	1.6
12	1.6	1.0	1.0	1.2	1.6	28	1.0	1.8	1.1	1.5	1.7
13	1.6	1.0	1.2	1.1	1.6	29	.9	.....	1.1	1.5	1.7
14	1.7	1.0	1.2	1.1	1.5	30	.9	.....	1.1	1.4	1.7
15	1.7	1.0	1.2	1.2	1.4	31	.9	.....	1.1	.....	1.7
16	1.8	1.2	1.2	1.2	1.4						

SUCCOR CREEK NEAR HOMEDALE, IDAHO.

This station was established March 19, 1903, by N. S. Dils. It was originally located at a small truss bridge built to carry a flume, about one-half mile above the mouth of the river. The station was moved January 31, 1905, about half a mile upstream to a location 1 mile west of Homedale and about 17 miles from Caldwell, the nearest railroad station. It is near the Caldwell-Jordan Valley stage road, 1 mile west of Mussel's ferry on Snake River, one-fourth 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 river channel is straight for about 200 feet above and below the station. The bed of the stream is gravelly and has one channel at all stages. The right bank is low, slopes uniformly, and may overflow during high water. The left bank is high and not liable to overflow.

Discharge measurements are made from a cable and car. The initial point for soundings is the inside face of the cable support on the left bank of the stream.

The gage is an inclined staff on the left bank of the stream, about one-third mile above the house of Mrs. Minnie Tracy, who during 1905 read the gage once each day. The bench

mark is a United States Geological Survey iron bench-mark post, 10 feet back from the gage; elevation, 9.88 feet above gage datum.

Information in regard to this station is contained in the following Water-Supply Papers of the United States Geological Survey:

Description: 100, p 440; 135, pp 195–196.
Discharge: 100, p 440; 135, p 196.
Discharge, monthly: 100, p 441.
Gage heights: 100, p 440; 135, p 196.
Rating table: 100, p 441.

Discharge measurements of Succor Creek near Homedale, Idaho, in 1905.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Square-feet.*	*Feet per second.*	*Feet.*	*Second-feet.*
February 1	W. C. Davies	24	17	1.19	2.49	20
February 24	J. B. Bond	34	36	3.00	3.20	108
April 1	La Rue and Bond	32	24	2.17	2.90	52
April 28	E. C. La Rue	27	17	1.24	2.55	21
June 3	do	4	1.2	1.10	2.25	1.4

Daily gage height, in feet, of Succor Creek near Homedale, Idaho, for 1905.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	Dec.
1	3.65	2.5	2.7	3.1	2.3	2.45	1.9
2	3.55	2.3	2.7	3.3	2.2	2.35	1.9
3	3.5	2.3	2.75	3.4	2.25	2.2	1.9
4	3.5	2.4	2.7	3.2	2.35	2.4	1.95
5	3.45	2.45	2.7	3.1	2.35	2.9	1.95
6	3.45	2.3	2.7	3.0	2.35	2.6	1.95
7	3.45	2.4	2.65	2.95	2.25	2.7	1.95
8	3.45	2.35	2.6	2.9	2.25	3.75	1.95
9	3.45	2.25	2.6	2.85	2.2	2.8	1.95
10	3.45	2.4	2.6	2.95	2.2	2.7	1.95
11	3.45	2.2	2.65	2.95	2.1	2.7	1.95
12	3.45	2.4	2.65	2.75	2.25	6.85	1.95
13	3.45	2.4	2.6	2.7	2.15	2.5	1.95
14	3.45	2.4	2.65	2.65	2.1	2.5	1.9
15	(a)	2.5	2.65	2.7	2.1	2.3	1.9
16	.....	2.45	2.65	2.45	2.1	2.3	1.9
17	.....	2.5	2.65	2.45	1.9	2.2	1.9
18	.....	2.2	2.65	2.4	1.95	2.2	1.95
19	.....	2.2	2.65	2.4	2.0	2.15	1.95
20	.....	2.45	2.75	2.6	1.95	2.15	1.95
21	.....	3.45	2.7	2.65	1.9	2.1	1.95
22	.....	3.0	2.7	2.7	1.9	2.0	1.95
23	.....	3.2	2.65	2.6	1.9	2.0	1.95
24	.....	3.1	2.55	2.6	1.95	2.0	1.95
25	.....	3.0	2.65	2.7	1.95	2.0	1.95
26	.....	3.0	2.65	2.6	7.30	1.95	1.95
27	.....	2.8	3.4	2.6	2.85	1.9	1.95
28	.....	2.75	3.0	2.6	2.6	1.9	1.95
29	.....	.....	3.2	2.4	2.6	1.9	1.95
30	.....	.....	3.6	2.3	2.5	1.9	1.95
31	.....	.....	3.25	.....	2.5	.....	1.95

(a) Gage washed out.

NOTE.—Creek dry July 1 to November 30.

Estimated monthly discharge of Succor Creek near Homedale, Idaho, for 1905.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January 1–14	203	154	161	4,470
February	154	1	29.2	1,622
March	189	22	47.0	2,890
April	143	3	46.3	2,755
May	2,500	.2	86.3	5,306
June	2,050	.2	86.7	5,159
July	.....	.....	.0	0
August	.....	.....	.0	0
September	.....	.....	.0	0
October	.....	.....	.0	0
November	.....	.....	.0	0
December	.3	.2	.28	17
The period	.....	.....	.....	22,220

NOTE.—These estimates are based on five discharge measurements and slope measurements and are only approximate.

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. Owyhee ditch takes water from the river about 6 miles above.

The channel is straight for 200 feet above and 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.

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.

A standard chain gage is attached to the upstream side of the bridge, near the center of the left span; length of the chain, 26.40 feet. During 1905 the gage was read once each day by D. T. Rigsby and Gilder Watson. The bench mark is the top of the steel caisson at its outer edge directly above the old gage; elevation, 18.60 feet above the gage datum.

Information in regard to this station is contained in the following publications of the United States Geological Survey (Ann=Annual Report; Bull=Bulletin; WS=Water-Supply Paper):

Description: Bull 131, pp 66–67; WS 100, pp 445–446; 135, pp 196–197.
Discharge: WS 100, p 446; 135, p 197.
Discharge, monthly: WS 135, p 199.
Discharge, flood: Ann 11, part 2, p 86.
Gage heights: Bull 131, p 67; WS 100, p 446; WS 135, p 197–198.
Rating table: Bull 131, p 67; WS 135, p 198.

Discharge measurements of Owyhee River near Owyhee, Oreg., in 1905.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Square feet.*	*Feet per second.*	*Feet.*	*Second-feet.*
January 26	Smith and Johnson	287	547	1.30	3.50	709
March 6	Smith and Griffin	286	594	1.45	3.69	862
March 13	P. H. Johnson	284	578	1.75	3.90	1,010
March 25	Johnson and Smith	287	628	1.64	3.88	1,033
April 14	Smith and Griffin	289	629	1.54	3.90	966
May 12	Griffin and Hall	284	567	1.54	3.70	874
June 6	E. N. Smith	286	566	1.26	3.55	710
June 20	do	138	310	1.17	3.01	362
July 3	do	128	235	.44	2.38	104
July 17[a]	Yates and Smith	27	20	.80	1.93	16
August 15[a]	E. N. Smith	27	17.2	.43	1.89	7.4
September 12[a]	W. C. Sawyer	33	11.8	.79	1.90	8.8
October 13[a]	Sawyer and Hall	44	21	1.17	2.03	25
November 9	R. S. Hall	130	250	.53	2.52	131
December 28	do	130	244	.87	3.05	212

[a] Wading ¼ mile above bridge.

Daily gage height, in feet, of Owyhee River near Owyhee, Oreg., for 1905.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.2	3.1	3.75	4.0	4.3	.....	2.45	1.8	1.85	1.9	2.3	2.78
2	3.0	3.15	3.8	4.1	4.25	.....	2.4	1.8	1.85	2.0	2.3	2.78
3	2.9	3.1	3.7	4.0	4.2	.....	2.38	1.8	1.88	2.0	2.31	2.7
4	2.8	3.15	3.65	4.9	4.05	.....	2.35	1.8	1.85	1.9	2.31	2.68
5	2.75	3.1	3.6	3.8	4.05	.....	2.25	1.8	1.85	2.0	2.31	2.68
6	2.8	3.1	3.6	4.1	4.1	.....	2.25	1.8	1.85	2.0	[c]2.5	2.58
7	3.0	3.05	3.8	[a]4.15	4.05	.....	2.0	1.8	1.85	2.0	2.5	2.68
8	2.9	3.1	3.9	4.0	4.0	.....	2.05	1.8	1.85	1.95	2.5	2.68
9	2.95	3.05	3.95	3.9	4.05	.....	2.05	1.8	1.85	1.95	2.5	2.68
10	2.9	2.6	4.0	3.9	3.9	.....	2.0	1.8	2.0	2.0	2.5	2.68
11	3.0	2.6	3.95	3.85	3.8	.....	1.95	1.8	1.9	2.05	2.5	2.68
12	2.9	3.05	3.9	3.9	3.7	.....	1.95	1.8	1.9	2.05	2.5	2.68
13	3.0	3.2	3.95	4.0	3.7	.....	1.95	1.8	1.9	2.03	2.52	2.68
14	2.9	3.35	4.0	3.9	3.8	3.35	1.95	1.8	1.9	2.03	2.52	2.75
15	3.1	3.2	4.1	3.8	3.85	3.25	1.9	1.8	1.9	2.03	2.6	2.78
16	3.2	3.0	4.0	3.8	3.9	3.2	1.9	1.8	1.9	2.05	2.6	2.98
17	4.9	2.9	4.1	3.8	3.9	3.15	[b]2.15	1.8	2.0	2.05	2.61	2.98
18	4.7	3.2	[a]4.0	3.75	3.85	3.1	1.9	1.82	1.9	2.05	2.6	2.98
19	4.6	3.15	3.2	3.7	3.8	3.05	1.9	1.82	1.9	2.05	2.6	2.88
20	4.0	3.0	3.8	3.7	3.85	3.0	1.85	1.83	1.9	2.05	2.6	2.95
21	3.5	3.2	3.6	3.8	.....	2.96	1.85	1.85	1.9	2.05	2.6	2.65
22	3.3	3.6	3.5	3.95	.....	2.9	1.85	1.9	1.9	2.1	2.6	2.68
23	3.6	3.65	3.6	4.3	.....	2.85	1.85	1.9	1.95	2.1	2.6	2.68
24	5.0	4.9	[b]4.1	4.7	.....	2.79	1.85	1.9	2.0	2.1	2.6	2.78
25	4.2	4.5	3.9	4.0	.....	2.75	1.85	1.9	1.95	2.12	2.62	2.88
26	3.6	3.9	3.7	[b]4.5	.....	2.75	1.84	1.9	1.9	2.10	2.62	2.98
27	3.5	4.0	3.6	4.3	.....	2.6	1.83	1.85	1.95	2.15	2.62	2.98
28	3.45	3.8	3.55	4.3	.....	2.55	1.82	1.85	1.9	2.15	2.62	3.05
29	3.5	.....	3.9	4.35	.....	2.55	1.82	1.85	1.9	2.15	2.62	3.05
30	3.4	.....	4.15	4.4	.....	2.55	[b]2.45	1.85	1.95	[c]2.3	3.0	3.05
31	3.3	.....	4.1	.....	.....	.....	1.87	1.85	.....	2.3	.....	3.05

[a] Water turned into Owyhee ditch.
[b] Water turned from Owyhee ditch into river.
[c] Part of water turned from Owyhee ditch into river.

NOTE.—No ice record.

Station rating table for Owyhee River near Owyhee, Oreg., from January 1 to December 31, 1905.

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	4	2.70	208	3.50	673	4.30	1,410
1.90	10	2.80	254	3.60	748	4.40	1,525
2.00	20	2.90	304	3.70	826	4.50	1,650
2.10	38	3.00	358	3.80	910	4.60	1,780
2.20	58	3.10	414	3.90	1,000	4.70	1,920
2.30	80	3.20	473	4.00	1,095	4.80	2,070
2.40	104	3.30	535	4.10	1,195	4.90	2,220
2.50	132	3.40	602	4.20	1,300	5.00	2,380
2.60	168						

The above table is applicable only for open-channel conditions. It is based on 15 discharge measurements made during 1905 and one during 1904. It is well defined throughout.

Estimated monthly discharge of Owyhee River near Owyhee, Oreg., for 1905.

[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.
January [a]	2,380	231	707	43,470	0.072	0.083
February [a]	2,200	168	600	33,320	.061	.064
March	1,248	473	941	57,860	.095	.110
April	2,220	826	1,173	69,800	.119	.133
May 1-20	1,410	826	1,059	42,010	.107	.080
June 14-30	568	150	317	10,690	.032	.020
July	118	5	31.9	1,962	.0032	.0037
August	10	4	5.7	349	.00058	.00067
September	20	7	10.8	643	.0011	.0012
October	80	10	31.4	1,931	.0032	.0037
November	358	80	151	8,985	.015	.017
December [a]	386	161	263	16,170	.027	.031
The period				287,200		

[a] Estimates may be somewhat large on account of possible ice condition.

NOTE.—To obtain the total discharge of Owyhee River the monthly estimates of Owyhee ditch should be added. See p. 120.

DITCHES IN OWYHEE RIVER VALLEY, OREGON.

OWYHEE DITCH NEAR OWYHEE, OREG.

This ditch diverts water from the left bank of Owyhee River, about 6 miles above Owyhee Bridge, which is used for a river gaging station.

The measurements were made just above Wilson's ranch, about 2 miles below the head of the ditch.

There are five wasteways on the ditch—the Fletcher, half a mile below the station; Cow Hollow, Lockett Gulch, Emerson, and one near the end of the ditch. The first two are above the river gaging station.

Discharge measurements of Owyhee ditch near Owyhee, Oreg., in 1904 and 1905.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
1904.		*Feet.*	*Square feet.*	*Feet per second.*	*Feet.*	*Second-feet.*
June 18	Sawyer and Torkelson				(a)	154
July 1	M. W. Torkelson					207
July 13	do					178
August 10	Torkelson and Smith					142
September 2	E. N. Smith					156
September 12	do					111
September 19	do					117
October 12	do					41.9
1905.						
March 24	E. N. Smith		9.4	0.64	0.78	6.0
April 14	do		61.5	2.42	2.95	149
May 12	do	27.3	67.3	2.68	3.12	180
June 5	do	27.0	66.9	2.75	3.17	184
July 17	do	27.5	65.5	2.39	3.00	157
July 31	do	26.5	55.2	2.23	2.60	123
July 31	W. C. Sawyer	26.5	55.2	2.19	2.60	121
August 15	E. N. Smith	27.0	54.8	2.06	2.53	113
September 12	W. C. Sawyer	26.5	53.6	1.99	2.65	107
October 2	Hawthorne and Griffin	26.5	60.4	2.12	2.88	128
October 13	Sawyer and Hall	26.5	59.4	2.26	2.85	134

a No gage established during 1904.

Daily gage height, in feet, of Owyhee ditch near Owyhee, Oreg., for 1905.

Day.	May.	June.	July.	Aug.	Sept.	Day.	May.	June	July.	Aug.	Sept.
1					2.5	17	3.5		3.0	2.6	
2		3.4		2.6		18		3.0	3.3	2.6	2.8
3			3.4	2.5		19	3.4			2.6	
4				2.5	2.6	20			3.0		2.7
5		3.3		2.5		21		2.8	2.9		
6			3.4	2.5	2.65	22	3.5		2.8	2.6	
7		3.4	3.4	2.6		23		2.8			2.7
8			3.4	2.5	2.70	24	3.5			2.6	
9		3.5	3.4	2.5		25		3.4			2.7
10				2.5		26	3.5		2.8	2.6	
11	3.1	3.5		2.6		27		3.6	2.7		2.7
12	3.2		3.3	2.3		28			2.7		
13	3.3			2.5		29	3.5	3.5	2.65	2.55	
14		3.1		2.6		30			2.5		
15	3.5			2.5		31	3.4		2.6	2.5	
16		3.0		2.6							

Station rating table for Owyhee ditch near Owyhee, Oreg., from March 24 to September 6, 1905.

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	4.5	1.50	38	2.30	94	3.00	154
.80	7	1.60	44	2.40	102	3.10	163
.90	10	1.70	50	2.50	110	3.20	172
1.00	14	1.80	57	2.60	118	3.30	181
1.10	18	1.90	64	2.70	127	3.40	190
1.20	23	2.00	71	2.80	136	3.50	200
1.30	28	2.10	78	2.90	145	3.60	210
1.40	33	2.20	86				

The above table is applicable only for open-channel conditions. It is based on seven discharge measurements made during 1905. It is well defined between gage heights 2.5 feet and 3 feet. The table has been extended beyond these limits. After September 6 the table does not apply on account of back water from a diversion wing.

Estimated monthly discharge of Owyhee ditch near Owyhee, Oreg., for 1905.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
May 11-31	200	163	194	8,080
June	210	136	177	10,530
July	190	110	162	9,961
August	118	94	114	7,010
September	127	107	114	6,783

Discharge measurements of wasteways of Owyhee ditch in 1905.

FLETCHER WASTEWAY NEAR OWYHEE, OREG.

Date.	Hydrographer.	Discharge.
		Second-feet.
May 12	E. N. Smith	2.0
October 13	W. C. Sawyer	6.3

COW HOLLOW WASTEWAY NEAR OWYHEE, OREG.

May 12	E. N. Smith	1.5
June 6	do	2.1
October 2	Hawthorne and Griffin	5.1

LOCKETT'S GULCH WASTEWAY NEAR ARCADIA, OREG.

May 11	E. N. Smith	1.4
June 6	do	21.3
October 3	Hawthorne and Griffin	14.6
October 13	Sawyer and Hall	33.4

EMERSON WASTEWAY NEAR ARCADIA, OREG.

May 11	E. N. Smith	6.3
June 20	do	43.7
July 3	do	20.3
October 3	Hawthorne and Griffin	40.7
October 14	Sawyer and Hall	54.1
November 10	R. S. Hall	16.6

Discharge measurements of wasteways of Owyhee ditch in 1905—Continued.

WASTEWAY NEAR ONTARIO, OREG.

Date.	Hydrographer.	Discharge.
		Second-feet.
October 14	R. S. Hall	1.8

WILSON DITCH NEAR ONTARIO, OREG.

This ditch diverts water from the left bank of Snake River above Nyssa during the spring. All the water during the latter part of the last season was waste and seepage from the Owyhee ditch.

In 1904 measurements were made at Nyssa. The first measurement in 1905 was made at Nyssa, the last three 1 mile above Ontario, and the others about 2 miles above Ontario at Joseph Morton's ranch.

Discharge measurements of Wilson ditch near Ontario, Oreg., in 1904 and 1905.

Date.	Hydrographer.	Discharge.
1904.		*Second-feet.*
July 13	M. W. Torkelson	20.2
August 10	Torkelson and Smith	3.3
September 1	E. N. Smith	4.0
1905.		
May 11	E. N. Smith	9.2
May 19	do	9.0
June 7	do	7.3
July 3	do	8.5
August 1	do	0.9
August 16	do	1.3
September 13	W. C. Sawyer	2.3
October 14	Sawyer and Hall	5.2

BOISE RIVER NEAR HIGHLAND, IDAHO.

This station was established on July 27, 1905, by E. C. La Rue, to replace the Boise station. A temporary station was maintained at Highland from March 23 to July 27, 1905. The permanent station is located 2 miles below the mouth of Moores Creek, 3 miles southwest of Highland post-office, about 8 miles above the old Boise station, and 15 miles east of Boise, the nearest railway point.

The channel is straight for 500 feet above the cable and 200 feet below. The water is rather swift during all stages. The right bank is very firm, rather steep, and not liable to overflow. The left bank is composed of broken lava rock and is rather steep, leading to a vertical lava cliff 30 feet in height. The bed of the stream is very firm, as it is composed of broken lava rock and granite bowlders.

Discharge measurements are made by means of a cable, car, tagged wire, and stay wire. The initial point for soundings is the inner face of the right cable support.

The gage is an inclined staff in two sections on the right bank, 200 feet downstream from the cable support. During 1905 the gage was read once each day by Nettie Smythe. The bench mark is a United States Geological Survey aluminum tablet set in a large bowlder on the right bank, 400 feet below the cable support; elevation, 25.44 feet above the datum of the gage.

Discharge measurements of Boise River near Highland, Idaho, in 1905.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Square feet.*	*Feet per second.*	*Feet.*	*Second-feet.*
March 30	E. C. La Rue	183	726	2.50	4.30	1,818
April 27	do	208	1,110	4.12	6.61	4,569
May 25	do	207	852	3.79	6.20	3,233
May 26	do	208	853	4.01	6.35	3,424
July 19	do	185	408	2.40	3.70	981
July 28	do	165	261	3.24	[a] 3.55	845
August 19	do	140	192	3.28	[b] 3.15	630
October 2	do	145	216	2.85	3.18	615
October 19	Grover and La Rue	140	196	3.52	3.31	689

[a] Gage height at temporary station=3.30 on July 28.
[b] Gage height at temporary station=2.95 on August 19.

NOTE.—The first five measurements were made at the temporary station and the next four made at the permanent station.

Daily gage height, in feet, of Boise River near Highland, Idaho, for 1905.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	4.1	5.85	8.0	5.2	3.5	3.0	3.2	3.35	3.25
2	.....	4.2	5.95	8.1	5.2	3.4	3.0	3.2	3.3	3.25
3	.....	4.25	6.05	7.9	5.1	3.4	3.0	3.15	3.3	3.25
4	.....	4.35	6.0	7.6	5.0	3.4	3.0	3.15	3.25	3.2
5	.....	4.5	5.85	7.5	4.9	3.4	3.0	3.15	3.25	3.0
6	.....	4.85	5.75	7.35	4.8	3.4	3.0	3.1	3.2	3.0
7	.....	5.3	5.75	7.3	4.7	3.3	3.0	3.1	3.2	2.9
8	.....	5.4	5.8	7.6	4.6	3.25	3.0	3.2	3.25	2.8
9	.....	5.5	6.1	7.6	4.5	3.2	3.0	3.2	3.3	2.8
10	.....	5.3	6.0	7.4	4.4	3.2	3.0	3.25	3.25	2.7
11	.....	5.1	5.75	7.4	4.35	3.2	3.0	3.25	3.25	2.7
12	.....	5.0	5.7	7.35	4.25	3.2	3.0	3.25	3.25	2.8
13	.....	5.1	5.55	7.45	4.15	3.2	3.0	3.25	3.25	2.9
14	.....	5.05	5.45	7.35	4.05	3.15	3.0	3.3	3.25	3.1
15	.....	5.05	5.5	7.05	4.0	3.15	3.0	3.3	3.25	3.25
16	.....	5.2	5.55	6.75	3.95	3.15	3.0	3.35	3.25	3.7
17	.....	5.35	6.1	6.6	3.85	3.15	3.0	3.4	3.25	3.7
18	4.45	5.25	7.0	6.5	3.8	3.15	3.05	3.35	3.25	3.7
19	4.35	5.5	7.1	6.1	3.75	3.15	3.05	3.3	3.25	3.6
20	4.15	5.8	7.1	5.95	3.7	3.1	3.05	3.25	3.25	3.5
21	4.1	5.8	7.1	6.1	3.65	3.1	3.05	3.3	3.25	3.45
22	4.1	5.75	6.75	6.0	3.6	3.05	3.05	3.35	3.3	3.0
23	4.1	5.9	6.7	5.95	3.55	3.05	3.05	3.35	3.3	2.9
24	4.1	5.9	6.5	5.9	3.45	3.05	3.05	3.4	3.3	2.9
25	4.1	6.2	6.3	5.9	3.4	3.05	3.1	3.45	3.3	3.05
26	4.45	6.5	6.35	5.8	3.35	3.05	3.1	3.4	3.3	3.15
27	4.6	6.6	7.2	5.7	3.3	3.05	3.15	3.35	3.3	3.15
28	4.35	6.3	7.0	5.6	3.3	3.05	3.15	3.35	3.3	3.4
29	4.35	6.1	7.6	5.45	3.25	3.0	3.2	3.35	3.25	3.5
30	4.3	6.0	7.4	5.3	3.2	3.0	3.2	3.35	3.25	3.4
31	4.1	.....	7.45	.....	3.15	3.0	.....	3.35	.....	3.25

NOTE.—No ice record.

Daily discharge, in second-feet, of Boise River near Highland, Idaho, for 1905.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	1,650	3,350	6,070	2,150	820	560	650	730	675
2	.....	1,710	3,470	6,260	2,150	760	560	650	700	675
3	.....	1,750	3,590	5,890	2,060	760	560	625	700	675
4	.....	1,840	3,490	5,380	1,970	760	560	625	675	650
5	.....	1,970	3,260	5,180	1,870	760	560	625	675	560
6	.....	2,320	3,100	4,940	1,790	760	560	600	650	560
7	.....	2,810	3,080	4,860	1,710	700	560	600	650	520
8	.....	2,920	3,120	5,360	1,630	675	560	650	675	480
9	.....	3,050	3,510	5,360	1,550	650	560	650	700	480
10	.....	2,810	3,350	5,010	1,470	650	560	675	675	450
11	.....	2,570	2,980	5,010	1,430	650	560	675	675	450
12	.....	2,470	2,900	4,920	1,350	650	560	675	675	480
13	.....	2,570	2,710	5,090	1,270	650	560	675	675	520
14	.....	2,490	2,580	4,930	1,210	625	560	700	675	600
15	.....	2,490	2,610	4,460	1,170	625	560	700	675	675
16	.....	2,660	2,650	4,000	1,140	625	560	730	675	940
17	.....	2,820	3,300	3,990	1,070	625	560	760	675	940
18	1,9[illegible]	2,710	4,000	3,650	1,030	625	580	730	675	940
19	1,850	2,980	4,740	3,110	1,010	625	580	700	675	880
20	1,660	3,380	4,710	2,930	990	600	580	675	675	820
21	1,630	3,380	4,670	3,120	970	600	580	700	675	790
22	1,630	3,320	4,100	2,990	950	580	580	730	700	560
23	1,630	3,540	3,990	2,930	930	580	580	730	700	520
24	1,640	3,540	3,670	2,880	880	580	580	760	700	520
25	1,640	3,950	3,360	2,880	860	580	600	790	700	580
26	1,940	4,410	3,430	2,770	840	580	600	760	700	625
27	2,090	4,570	4,700	2,670	820	580	625	730	700	625
28	1,860	4,070	4,380	2,560	820	580	625	730	700	760
29	1,860	3,760	5,360	2,390	810	560	650	730	675	820
30	1,820	3,590	5,030	2,240	780	560	650	730	675	760
31	1,650	.....	5,120	.....	750	560	.....	730	.....	675

NOTE.—March 18 to July 31 discharge obtained indirectly; August 1 to December 31 discharge obtained from rating table based on four measurements made at permanent station.

Estimated monthly discharge of Boise River near Highland, Idaho, for 1905.

[Drainage area, 2,614 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 18–31	2,090	1,630	1,774	49,260	0.679	0.354
April	4,570	1,650	2,937	174,800	1.12	1.25
May	5,360	2,580	3,707	227,900	1.42	1.64
June	6,260	2,240	4,121	245,200	1.58	1.76
July	2,150	750	1,272	78,210	.487	.562
August	820	560	643	39,540	.246	.284
September	650	560	578	34,390	.221	.247
October	790	600	693	42,610	.265	.306
November	730	650	684	40,700	.262	.292
December	940	450	652	40,090	.249	.287
The period	.....	.....	.....	972,700	.....	.....

MALHEUR RIVER NEAR WESTFALL, OREG.

This station was established December 15, 1903, by John H. Lewis, and was discontinued October 31, 1905. It is located 3 miles below the Harper ranch, near Westfall, 22 miles above Vale, Oreg.

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 and is free from vegetation and shifting. There is but one channel at low water and the main channel and two sloughs at high stages.

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.

The original gage was a staff attached vertically to a frame bent of a bridge which formerly occupied this site, on the left bank. An inclined gage was established on the right bank, 50 feet above the cable, July 27, 1904, the datum being changed. During 1905 the gage was read at varying intervals by Clarence Vines. The bench mark is a nail in the top of the post to which the stay wire is fastened; elevation, 15.92 feet above the datum of the inclined gage.

Information in regard to this station is contained in the following Water-Supply Papers of the United States Geological Survey:

Description: 100, pp 427–428; 135, p 203.
Discharge: 100, p 428; 135, p 204.
Discharge, monthly: 135, p 205.
Gage heights: 100, p 428; 135, p 204.
Rating table: 135, p 205.

Discharge measurements of Malheur River near Westfall, Oreg., in 1905.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Square feet*	*Feet per second.*	*Feet*	*Second-feet.*
February 6	Smith and Griffin	188	135	2.12	5.78	286
March 3	Smith and Johnson	195	437	3.70	7.09	1,618
March 4	E. N. Smith	197	459	3.65	7.20	1,680
March 13	do	202	532	3.74	7.72	1,990
March 14	do	202	550	4.10	7.82	2,250
March 28	J. M. Griffin	193	303	3.42	6.70	1,035
April 17	do	192	232	2.44	6.40	567
May 19	Griffin and Smith	189	133	2.48	5.83	304
June 13	E. N. Smith	189	157	2.38	5.89	374
June 19	do	188	119	2.00	5.70	236
July 18	Smith and Yates	44	32	1.38	5.13	44
September 1	E. N. Smith	34	20	1.01	4.94	20

Daily gage height, in feet, of Malheur River near Westfall, Oreg., for 1905.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1				6.5	6.2	5.9				
2				6.5	6.2		5.5		4.9	
3			7.1	6.7	6.2					
4			7.2	6.9	6.1					
5			7.0	7.0	6.1	5.8		4.9		
6			7.0	6.7	6.1					
7			7.1	6.6	6.0		5.4			5.3
8			7.0	6.6	6.0					
9			6.8	6.7	6.0	5.8			5.0	
10			6.9	6.7	6.0					
11			7.1	6.7	6.0		5.3			
12			7.4	6.7	6.0			4.6		
13			7.7	6.6	6.0	5.9				
14			7.8	6.5	5.9		5.2			5.4
15			7.4	6.5	5.8					
16			7.2	6.5	5.8	5.8			5.1	
17			7.1	6.4	5.7					
18			6.9	6.4	5.7		5.1			
19			6.9	6.4	5.6	5.6				
20			7.0	6.4						
21			7.4	6.4			5.0			5.5
22			7.2	6.4	5.6			4.95		
23			6.9	6.3		5.6			5.2	
24	9.0		6.9	6.3						
25	7.3		6.9	6.3						
26	7.0		6.7	6.3	5.7	5.5		4.9		
27	6.5		6.7	6.3						
28			6.7	6.3			4.9			5.6
29			6.6	6.3						
30			6.6	6.2	6.7	5.5			5.2	
31			6.5				4.9			

NOTE.—Owing to distance of observer from gage, daily readings were made only during high water.

Station rating table for Malheur River near Westfall, Oreg., from January 1 to October 31, 1905.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
4.60	15	5.80	297	6.90	1,242	8.00	2,580
4.70	16	5.90	360	7.00	1,350	8.10	2,725
4.80	17	6.00	430	7.10	1,459	8.20	2,874
4.90	19	6.10	503	7.20	1,569	8.30	3,028
5.00	25	6.20	580	7.30	1,681	8.40	3,187
5.10	40	6.30	661	7.40	1,796	8.50	3,350
5.20	59	6.40	747	7.50	1,915	8.60	3,515
5.30	82	6.50	840	7.60	2,038	8.70	3,682
5.40	110	6.60	936	7.70	2,165	8.80	3,851
5.50	146	6.70	1,035	7.80	2,298	8.90	4,024
5.60	189	6.80	1,137	7.90	2,437	9.00	4,200
5.70	239						

The above table is applicable only for open-channel conditions. It is based on 12 discharge measurements made during 1905. It is fairly well defined throughout.

Estimated monthly discharge of Malheur River near Westfall, Oreg., for 1905.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
March 3–31	2,298	840	1,386	79,730
April	1,350	580	850	50,580
May	1,035	189	413	25,390
June	360	146	253	15,000
July	146	19	62.5	3,843
August	21	15	18.5	1,138
September	59	19	40.4	2,404
October	189	82	132	8,116
The period				186,300

NOTE.—Gage heights were interpolated for days when there was no reading.

MALHEUR RIVER AT VALE, OREG.

This station was established May 20, 1903, by N. S. Dils. It is located at the steel highway bridge one-eighth mile southeast of Vale, Oreg. A station has been maintained here at intervals since 1890.

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, and is composed of firm earth, covered with small sagebrush, and is liable to overflow at high water, when 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 and is free from vegetation and liable to shift. There is but one channel at all stages, with the exception of the above-mentioned sloughs. The lower portion of the drainage area is covered with sagebrush, and the snow is melted very rapidly by warm winds, causing sudden floods of considerable height but of short duration.

Discharge measurements were originally made from the upstream side of the bridge. March 2, 1904, a cable, car, and tagged and stay wires were installed about one-fourth mile downstream, directly opposite the town of Vale. The initial point for soundings is the zero of the tagged wire on the left bank.

The original gage was replaced July 25, 1904, by a standard chain gage attached to the downstream side of the bridge, near the center of the span; length of chain, 30.41 feet. The datum is the same. During 1905 the gage was read twice each day by Isaac McCumsey and Z. G. Wilson. The bench mark is the top surface of the east steel caisson at the north end of the bridge; elevation, 21.63 feet above the datum of the gage and 2,236.56 feet above sea level.

Information in regard to this station is contained in the following publications of the United States Geological Survey (Ann=Annual Report; Bull=Bulletin; WS=Water-Supply Paper):

Description: Ann 18, iv, p 348; Bull 131, p 68; 140, p 242; WS 16, p 169; 100, pp 424–425; 135, p 206.
Discharge: Ann 11, ii, p 88; 18, iv, p 348; Bull 131, pp 68, 92; 140, p 242; WS 16, p 169; 100, p 425; 135, p 207.
Discharge, monthly: Ann 11, ii, p 106; 12, ii, pp 358, 361; 13, iii, p 98; 18, iv, pp 349–350; WS 100, p 427; 135, p 208.
Discharge, yearly: Ann 13, iii, p 99; 20, iv, p 62.
Gage heights: Bull 140, p 243; WS 11, p 83; 16, p 169; 100, p 426; 135, p 207.
Hydrograph: Ann 12, ii, p 344.
Rating tables: Ann 18, iv, p 349; WS 100, p 426; 135, p 208.

Discharge measurements of Malheur River at Vale, Oreg., in 1905.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Square feet.*	*Feet per second.*	*Feet.*	*Second-feet.*
January 25	Smith and Johnson	148	647	2.95	7.00	1,900
January 28	do	117	360	2.20	5.50	800
February 4	do	105	250	1.22	4.68	306
February 8	E. N. Smith	102	228	.99	4.40	226
February 23	Smith and Griffin	140	453	2.55	6.15	1,155
February 24	do	148	570	3.74	7.00	2,130
March 2	E. N. Smith	139	560	2.90	6.46	1,620
March 9	J. M. Griffin	133	491	2.87	6.45	1,405
March 14	P. H. Johnson	150	764	3.38	7.35	2,580
March 18	do	144	540	2.87	6.40	1,550
March 22	Smith and Johnson	141	570	3.13	6.80	1,780
March 27	do	134	465	2.75	6.08	1,281
April 11	J. M. Griffin	138	435	2.56	6.10	1,110
April 19	do	130	350	2.10	5.60	740
April 26	do	123	280	1.90	5.30	533
May 17	do	101	166	1.07	4.40	178
June 5	E. N. Smith	109	235	1.46	4.70	343
June 12	do	108	227	1.76	5.00	410
June 26	do	100	146	.79	4.15	115
July 4	do	92	120	.67	3.90	80
July 10	do	92	95	.40	3.78	38.0
July 21	do	21	30	1.15	3.71	34.7
July 29	do	20	25	1.10	3.67	27.6
August 4	do	20	22	1.02	3.62	22.5
August 11	do	20	18.3	1.09	3.59	16.9
August 17	do	19	17.3	.79	3.58	13.7
September 8	G. Stubblefield	20	19.7	.95	3.62	18.7
October 14	R. S. Hall	10	9.4	4.75	3.90	48
November 4	do	38	52	1.72	4.10	90
December 27	do	99	136	85	4.30	115

Daily gage height, in feet, of Malheur River at Vale, Oreg., for 1905.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	4.35	4.85	6.35	5.9	5.13	4.45	4.0	3.62	3.56	3.8	4.15	4.28
2	4.75	4.7	6.5	6.0	5.1	4.47	4.0	3.63	3.57	3.81	4.06	4.19
3	4.6	4.7	6.55	6.3	5.1	4.38	4.0	3.6	3.58	3.84	4.08	4.29
4	4.8	4.7	6.45	6.45	4.97	4.45	3.9	3.6	3.6	3.86	4.1	4.43
5	4.7	4.6	6.7	6.25	4.92	4.7	3.9	3.57	3.6	3.86	4.11	4.41
6	4.6	4.6	6.6	5.97	4.88	4.6	3.9	3.6	3.6	3.88	4.16	4.35
7	4.6	4.55	6.75	5.9	4.77	4.7	3.85	3.59	3.6	3.88	4.14	4.37
8	4.6	4.5	6.75	6.23	4.7	5.05	3.85	3.56	3.62	3.86	4.16	4.4
9	4.4	4.45	6.45	6.3	4.63	5.05	3.77	3.54	3.63	3.86	4.17	4.05
10	4.2	4.45	6.4	6.13	4.6	5.02	3.73	3.59	3.63	3.88	4.16	4.36
11	4.25	4.4	6.5	6.12	4.52	5.1	3.7	3.56	3.66	3.86	4.2	4.31
12	4.25	4.45	6.8	6.0	4.5	4.97	3.65	3.59	3.68	3.9	4.16	3.9
13	4.25	4.25	7.1	5.85	4.5	4.85	3.62	3.58	3.68	3.9	4.18	3.79
14	4.35	4.4	7.3	5.85	4.5	4.7	3.6	3.54	3.69	3.9	4.11	3.92
15	4.15	4.5	7.15	5.78	4.45	4.63	3.6	3.54	3.68	3.9	4.19	4.24
16	4.30	4.55	6.7	5.67	4.4	4.52	3.68	3.49	3.69	3.98	4.2	4.15
17	4.55	4.5	6.5	5.55	4.33	4.5	3.67	3.54	3.72	4.01	4.21	4.2

Daily gage height, in feet, of Malheur River at Vale, Oreg., for 1905—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
18	5.4	4.4	6.4	5.5	4.2	4.45	3.7	3.54	3.76	4.07	4.26	4.28
19	5.05	4.35	6.45	5.6	4.2	4.65	3.75	3.55	3.78	4.06	4.2	4.3
20	5.4	4.5	6.45	5.5	4.2	4.4	3.75	3.58	3.79	4.1	4.24	4.36
21	5.35	4.6	6.8	5.5	4.2	4.32	3.7	3.58	3.8	4.12	4.24	4.47
22	5.15	5.95	6.8	5.5	4.2	4.25	3.7	3.59	3.8	4.1	4.22	4.82
23	5.6	6.3	6.55	5.43	4.17	4.2	3.65	3.59	3.82	4.08	4.18	4.72
24	7.95	6.95	6.45	5.42	4.15	4.15	3.65	3.6	3.84	4.1	4.08	4.3
25	6.92	7.25	6.35	5.4	4.15	4.15	3.65	3.61	3.82	4.12	4.18	4.42
26	6.17	7.1	6.22	5.35	4.15	4.15	3.62	3.59	3.82	4.1	4.26	4.31
27	5.74	6.85	6.08	5.28	4.25	4.1	3.6	3.57	3.83	4.13	4.31	4.27
28	5.5	6.55	6.12	5.3	4.6	4.5	3.6	3.58	3.84	4.14	4.34	4.64
29	5.35	.....	6.05	5.32	4.58	4.0	3.6	3.57	3.82	4.18	4.33	4.5
30	5.15	.....	5.98	5.23	4.9	4.3	3.62	3.58	3.83	4.14	4.34	4.34
31	5.0	.....	5.9	.....	4.65	.....	3.63	3.57	.....	4.14	.....	4.31

NOTE.—Ice conditions during part of January and December.

Daily discharge, in second-feet, of Malheur River at Vale, Oreg., for 1905.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	132	386	1,524	1,088	452	239	88	20	14	44	109	140
2	258	318	1,673	1,168	436	247	98	22	15	46	90	118
3	204	318	1,725	1,382	436	214	98	18	16	50	94	142
4	277	318	1,673	1,524	372	239	78	18	18	54	98	182
5	239	277	1,778	1,338	349	340	78	15	18	54	100	176
6	204	277	1,572	1,065	331	298	78	18	18	57	111	159
7	204	277	1,778	1,013	285	318	60	17	18	57	107	165
8	204	258	1,725	1,276	277	490	60	14	20	54	111	173
9	145	239	1,426	1,293	250	462	40	12	22	54	113	88
10	98	239	1,382	1,151	239	446	34	17	22	57	111	162
11	109	222	1,475	1,143	211	462	30	14	25	54	120	148
12	109	239	1,887	1,050	204	396	24	17	28	60	111	60
13	109	159	2,237	940	204	340	20	16	28	60	116	43
14	132	204	2,486	940	204	277	18	12	29	60	100	64
15	88	239	2,298	890	188	250	18	12	28	60	118	130
16	120	258	1,778	814	173	211	28	7	29	74	120	109
17	188	222	1,622	733	153	204	26	12	34	80	122	120
18	575	188	1,524	700	120	188	30	12	38	92	135	140
19	386	173	1,572	766	120	258	37	13	41	90	120	145
20	575	222	1,524	700	120	173	37	16	43	98	130	162
21	546	239	1,832	700	120	151	30	16	44	102	130	195
22	436	1,013	1,778	700	132	132	30	17	44	98	125	327
23	706	1,293	1,524	624	125	120	24	17	47	94	116	285
24	3,098	2,058	1,475	618	120	109	24	18	50	98	94	145
25	1,800	2,423	1,428	605	120	109	24	19	47	102	116	179
26	1,168	2,237	1,355	575	120	109	20	17	47	98	135	148
27	911	2,000	1,281	534	159	98	18	15	50	105	148	138
28	800	1,673	1,225	546	277	204	18	16	50	107	156	254
29	700	.....	1,250	558	269	88	18	15	47	116	153	204
30	575	.....	1,192	506	410	159	20	16	48	107	156	156
31	490	.....	1,088	.....	298	.....	22	15	.....	107	.....	148

NOTE.—Owing to changeable bed the daily discharge has been obtained indirectly.

Estimated monthly discharge of Malheur River at Vale, Oreg., for 1905.

[Drainage area, 4,190 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	3,098	88	503	30,930	0.120	0.138
February	2,423	159	642	35,660	.153	.159
March	2,486	1,088	1,616	99,360	.386	.445
April	1,524	506	898	53,440	.214	.239
May	452	120	235	14,450	.056	.065
June	490	88	244	14,520	.058	.065
July	98	18	39.6	2,435	.0095	.011
August	22	7	15.6	959	.0037	.0043
September	50	14	32.6	1,940	.0078	.0087
October	116	44	77.1	4,741	.018	.021
November	156	90	119	7,081	.028	.031
December	327	43	155	9,531	.037	.043
The year	3,098	7	381	275,000	.098	1.23

NOTE.—Estimates during January and December may be slightly large owing to ice conditions.

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.

Discharge measurements are made from the iron bridge to which the gage is fastened, consisting of two spans and wooden approaches.

A standard chain gage is attached to the upstream hand rail of the bridge, near the left bank; length of the chain, 21.72 feet. In 1905 the gage was read weekly during a portion of January and February and daily during the remainder of the year by R. N. Linebarger.

A description of this station is contained in Water-Supply Paper No. 135, United States Geological Survey, page 109.

Discharge measurements of Malheur River at McLaughlin's bridge, near Vale, Oreg., in 1905.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Square feet.*	*Feet per second.*	*Feet.*	*Second-feet.*
January 28	Smith and Johnson	84	160	4.56	3.80	730
February 27	do	110	310	4.87	4.70	1,510
March 2	Griffin and Johnson	98	290	4.55	4.50	1,320
March 12	E. N. Smith	112	[illegible]	4.93	5.00	1,750
March 14	do	153	409	5.21	5.41	2,133
April 1	Smith and Griffin	96	223	4.35	4.00	970
April 17	J. M. Griffin	90	260	3.43	3.90	890
April 30	do	112	127	3.76	3.60	478
May 6	do	79	138	3.15	3.35	434
May 16	do	76	128	2.30	3.00	294
June 14	E. N. Smith	78	143	2.39	3.10	342
June 28	do	74	99	1.10	2.60	112
July 18	Yates and Smith	67	73	.49	2.30	36
July 28	Smith and Sawyer	67	82	.41	2.21	34
August 4	E. N. Smith	16	9.8	1.60	2.18	16
August 12[a]	do	14	8.2	1.16	2.12	10
September 2	do	16	9.3	1.50	2.12	14
October 12[b]	Sawyer and Hall	38	23	2.78	2.38	64
November 6	R. S. Hall	73	98	1.23	2.58	120

[a] One-half mile above bridge.

[b] About 300 feet above bridge.

Daily gage height, in feet, of Malheur River at McLaughlin's bridge, near Vale, Oreg., for 1905.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.0	3.2	4.6	4.0	3.45	2.93	2.6	2.2	2.12	2.4	2.6	3.0
2	3.0	3.1	4.56	4.07	3.5	2.95	2.5	2.18	2.12	2.4	2.6	2.9
3	3.0	3.1	4.59	4.45	3.5	2.9	2.5	2.2	2.15	2.4	2.6	2.8
4	3.0	3.05	4.66	4.6	3.45	3.0	2.48	2.18	2.15	2.4	2.6	2.8
5	3.0	3.0	4.65	4.27	3.4	3.1	2.45	2.15	2.15	2.4	2.6	2.75
6	2.97	3.0	4.62	4.1	3.3	3.1	2.43	2.15	2.15	2.4	2.6	2.65
7	3.0	2.9	4.8	7.1	3.2	3.25	2.4	2.15	2.18	2.4	2.6	2.65
8	3.0	2.9	4.7	4.15	3.1	3.7	2.4	2.12	2.18	2.4	2.6	2.7
9	3.05	2.9	4.55	4.27	3.05	3.3	2.4	2.15	2.2	2.4	2.6	2.7
10	3.05	2.9	4.65	4.25	3.05	3.4	2.33	2.15	2.22	2.4	2.6	2.7
11	3.1	3.25	4.7	4.25	3.0	3.3	2.25	2.13	2.22	2.4	2.6	2.75
12	3.1	3.4	5.0	4.15	3.07	3.27	2.2	2.15	2.22	2.4	2.6	2.9
13	3.1	3.5	5.42	4.0	3.0	3.05	2.25	2.15	2.22	2.38	2.6	2.95
14	3.15	3.4	5.45	4.0	2.9	3.07	2.25	2.1	2.24	2.4	2.6	3.0
15	3.4	3.3	5.2	4.0	2.9	3.0	2.35	2.15	2.25	2.45	2.6	3.0
16	3.65	3.2	4.8	3.92	2.85	2.95	2.35	2.1	2.25	2.48	2.6	3.0
17	3.9	3.1	4.6	3.85	2.82	2.9	2.35	2.1	2.28	2.5	2.6	3.0
18	4.15	3.05	4.52	3.85	2.8	2.85	2.33	2.1	2.3	2.52	2.6	3.0
19	4.4	3.4	4.5	3.8	2.75	2.85	2.3	2.12	2.3	2.52	2.65	3.0
20	4.65	4.0	4.5	3.8	2.73	2.83	2.27	2.12	2.32	2.55	2.62	3.0
21	4.85	4.4	5.0	3.87	.....	2.75	2.25	2.12	2.35	2.57	2.62	3.0
22	4.75	4.88	4.85	3.8	2.7	2.7	2.23	2.14	2.35	2.57	2.62	3.0
23	5.5	4.22	4.5	3.75	2.7	2.67	2.2	2.13	2.35	2.57	2.62	3.0
24	6.6	5.18	4.5	3.75	2.7	2.65	2.2	2.13	2.35	2.58	2.6	3.0
25	5.0	5.35	4.4	3.7	2.7	2.65	2.2	2.14	2.35	2.6	2.6	3.0
26	4.45	5.3	4.2	3.7	2.9	2.6	2.2	2.14	2.4	2.6	2.5	3.0
27	4.05	4.85	4.15	3.75	2.75	2.6	2.25	2.14	2.4	2.6	2.5	3.0
28	3.8	4.65	4.25	3.75	3.3	2.6	2.2	2.15	2.4	2.6	2.5	3.0
29	3.6	.....	4.1	3.72	2.95	2.6	2.2	2.12	2.4	2.6	2.6	3.0
30	3.5	.....	4.05	3.6	2.98	2.6	2.19	2.12	2.4	2.6	2.6	3.0
31	3.3	.....	4.0	.....	3.0	.....	2.18	2.12	2.6	2.6	.....	3.0

NOTE.—Ice conditions during part of January and February and all of December. Gage heights to top of ice.

Station rating table for Malheur River at McLaughlin's bridge, near Vale, Oreg., from March 1 to April 15 and May 16 to December 31, 1905.

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	2	3.[illegible]	396	4.40	1,259	5.50	2,220
2.10	11	3.30	455	4.50	1,340	5.60	2,319
2.20	24	3.40	516	4.60	1,423	5.70	2,422
2.30	42	3.50	580	4.70	1,507	5.80	2,528
2.40	64	3.60	648	4.80	1,593	5.90	2,634
2.50	90	3.70	717	4.90	1,679	6.00	2,740
2.60	122	3.80	789	5.00	1,766	6.20	2,953
2.70	159	3.90	864	5.10	1,854	6.40	3,170
2.80	200	4.00	940	5.20	1,942	6.60	3,392
2.90	243	4.10	1,018	5.30	2,032	6.80	3,622
3.00	290	4.20	1,098	5.40	2,125	7.00	3,860
3.10	341	4.30	1,178				

The above table is applicable only for open-channel conditions. It is based on 15 discharge measurements made during 1905. It is well defined between gage heights 2.1 feet and 5.4 feet.

NOTE.—On account of the shifting channel the rating table does not apply prior to March 1 and between April 16 and May 15. Estimates during those intervals were computed by the indirect method. In the computation missing gage heights were interpolated.

Estimated monthly discharge of Malheur River at McLaughlin's bridge, near Vale, Oreg., for 1905.

[Drainage area, 3,320 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	2,980	260	751	46,180	0.226	0.261
February	2,080	210	726	40,320	.219	.228
March	2,170	940	1,438	88,420	.433	.499
April	3,980	485	971	57,780	.292	.326
May	475	160	283	17,400	.085	.098
June	715	122	274	16,300	.083	.093
July	122	22	47.0	2,890	.014	.016
August	24	11	15.8	972	.0048	.0055
September	64	13	37.1	2,208	.011	.012
October	122	44	87.7	5,392	.026	.030
November	140	90	120	7,140	.036	.040
December	290	140	251	15,430	.076	.088
The year	3,980	11	417	300,400	.126	1.696

MALHEUR RIVER AT HALLIDAY'S BRIDGE, NEAR ONTARIO, OREG.

This station was established December 8, 1904, by W. C. Sawyer, and discontinued July 31, 1905. It is located at Halliday's bridge, 10 miles west of Ontario, on the road to Vale, and 5 miles below the mouth of Willow Creek.

The channel is straight for 800 feet above and below the station. The right bank is high and clean. The left bank is high and clean, but overflows during very high water. The bed of the stream is composed of sand and is free from vegetation and shifting. There is but one channel at all stages.

Discharge measurements are made from the upstream side of the single-span 110-foot steel highway bridge supported upon steel caissons. The initial point for soundings is a point on the upstream side of the bridge, 20 feet outside of the center of the truss pin on the right bank.

A standard chain gage is attached to the upstream hand rail; length of chain, 23.7 feet. During 1905 the gage was read by T. W. Halliday. Bench marks were established as follows: (1) The south end of the bed plate upon which the south end of the upstream truss rests upon the concrete pier; elevation, 18.99 feet. (2) The north end of the bed plate upon which the north end of the upstream truss rests; elevation, 18.89 feet. Elevations refer to the datum of the gage.

Discharge measurements of Malheur River at Halliday's bridge, near Ontario, Oreg., in 1905.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Square-feet.*	*Feet per second.*	*Feet.*	*Second-feet.*
January 25	E. N. Smith	93	595	2.75	5.16	1,637
January 26	Smith and Johnson	93	550	2.74	4.96	1,507
January 30	Sawyer and Griffin	94	354	1.30	3.60	460
February 24	J. M. Griffin	85	549	3.75	5.55	2,060
March 1	do	92	532	2.77	4.80	1,475
March 25	W. C. Sawyer	94	516	2.70	4.74	1,399
March 27	do	94	448	2.45	4.41	1,098
April 11	Smith and Griffin	95	421	2.41	4.36	1,014
May 3	do	94	281	1.54	3.20	432
June 21	E. N. Smith	92	167	.53	2.15	89
November 10	R. S. Hall	92	170	.65	2.20	110
December 29	do	90	106	.71	2.29	75

Daily gage height, in feet, of Malheur River at Halliday's bridge, near Ontario, Oreg., for 1905.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.
1	2.7	3.2	4.85	4.15	3.3	2.38	1.67
2	2.7	3.1	4.95	4.22	3.27	2.25	1.67
3	2.8	3.0	4.95	4.58	3.2	2.2	1.58
4	2.85	2.9	4.9	4.77	3.1	2.27	1.62
5	2.8	2.9	5.1	4.53	3.1	2.55	1.5
6	2.6	2.8	5.15	4.27	3.08	2.55	1.5
7	2.6	2.7	5.2	4.18	2.97	2.65	1.45
8	2.35	2.6	5.1	4.25	2.93	2.8	1.5
9	2.3	2.7	4.95	4.32	2.85	3.0	1.5
10	2.35	2.5	4.85	4.35	2.55	3.47	1.4
11	2.35	2.4	5.0	4.37	2.45	2.97	1.4
12	2.3	2.8	5.25	4.23	2.43	2.85	1.3
13	2.35	2.5	5.4	4.12	2.4	2.7	1.3
14	2.35	2.65	.....	4.05	2.35	2.55	1.4
15	2.35	2.7	.....	4.0	2.35	2.4	1.4
16	2.5	2.8	5.0	3.83	2.3	2.3	1.4
17	2.45	2.7	4.85	3.8	2.25	2.25	1.4
18	3.85	2.7	4.85	3.75	2.17	2.25	1.4
19	3.85	2.7	4.75	3.75	2.22	2.5	1.4
20	4.5	2.8	4.85	3.75	2.0	2.17	1.28
21	4.3	3.25	5.15	3.75	1.95	2.1	1.35
22	3.85	4.75	5.2	3.7	1.9	2.03	1.35
23	5.0	5.15	5.0	3.65	1.93	1.92	1.4
24	7.15	5.65	4.85	3.6	1.9	1.85	1.4
25	5.9	5.85	4.7	3.55	1.87	1.85	1.4
26	4.8	5.6	4.6	3.48	1.85	1.83	1.38
27	4.35	5.35	4.4	3.45	2.08	1.77	1.35
28	3.95	5.05	4.35	3.47	2.47	1.68	1.35
29	3.6	.....	4.25	3.52	2.5	1.67	1.35
30	3.4	.....	4.2	3.38	2.33	1.73	1.4
31	3.3	.....	4.2	.....	2.27	.....	1.4

NOTE.—No ice record.

Station rating table for Malheur River at Halliday's bridge, near Ontario, Oreg., from January 1 to July 31, 1905.

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	9	2.40	145	3.40	481	4.40	1,098
1.50	17	2.50	170	3.50	525	4.50	1,174
1.60	26	2.60	197	3.60	575	4.60	1,252
1.70	36	2.70	226	3.70	630	4.70	1,332
1.80	47	2.80	257	3.80	689	4.80	1,413
1.90	59	2.90	290	3.90	752	4.90	1,495
2.00	72	3.00	325	4.00	817	5.00	1,578
2.10	87	3.10	361	4.10	885	5.20	1,748
2.20	104	3.20	399	4.20	954	5.40	1,925
2.30	123	3.30	439	4.30	1,025	5.60	2,110

The above table is applicable only for open-channel conditions. It is based on 12 discharge measurements made during 1904–5. It is well defined between gage heights 1.3 feet and 5.5 feet. The table has been extended beyond these limits. Above gage height 5.5 feet the rating curve is a tangent, the difference being 95 per tenth.

Estimated monthly discharge of Malheur River at Halliday's bridge, near Ontario, Oreg., for 1905.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January	3,582	123	635	39,040
February	2,158	170	663	36,820
March	1,925	954	1,484	91,250
April	1,388	473	810	48,200
May	439	53	183	11,250
June	512	33	149	8,866
July	33	3	11.6	713
The period				236,100

DITCHES IN MALHEUR RIVER VALLEY, OREGON.

VINES DITCH ABOVE VALE, OREG.

This ditch diverts water from the right bank of Malheur River about 1 mile above the mouth of Malheur Canyon and 14 miles above Vale.

The gage and measuring section was half a mile below the mouth of the canyon.

Discharge measurements of Vines ditch above Vale, Oreg., in 1904 and 1905.

Date.	Hydrographer.	Discharge.
1904.		*Second-feet.*
June 29	M. W. Torkelson	1.23
September 23	E. N. Smith	.60
August 5	M. W. Torkelson	.32
1905.		
June 14	E. N. Smith	3.7
June 28	do	1.3
September 30	Hawthorne and Griffin	1.0
October 12	Hall and Sawyer	1.7
November 6	R. S. Hall	.9

MALHEUR FARMERS' CANAL ABOVE VALE, OREG.

This canal diverts water from the left bank of Malheur River one-fourth mile above the mouth of Malheur Canyon and about 13 miles above Vale.

The gage and measuring section was located a short distance below the waste gate.

Discharge measurements of Malheur Farmers' canal above Vale, Oreg., in 1904 and 1905.

Date.	Hydrographer.	Discharge.
1904.		*Second-feet.*
June 24	Torkelson and Hawthorne	54.0
July 5	M. W. Torkelson	33.3
July 27	do	16.6
August 5	do	11.4
September 23	E. N. Smith	5.0
1905.		
May 5	J. M. Griffin	83.6
May 16	Smith and Griffin	50.8
June 27	E. N. Smith	17.4
July 12	do	27.6
September 30	T. H. Hawthorne	16.7
November 6	R. S. Hall	10.5

M'LAUGHLIN DITCH ABOVE VALE, OREG.

Water diverted from the right bank of Malheur River 1 mile below the mouth of Malheur Canyon, 12 miles above Vale, is divided one-fourth mile below the point of diversion, the left branch being the McLaughlin ditch and the right the "J. H."

The McLaughlin ditch was measured at the dividing flume.

The McLaughlin ditch was the only one above the Nevada ditch which carried water between July 15 and about September 25, the Nevada having established a prior right over all of the others.

Discharge measurements of McLaughlin ditch above Vale, Oreg., in 1904 and 1905.

Date.	Hydrographer.	Discharge.
1904.		*Second-feet.*
June 25	M. W. Torkelson	10.8
July 6	do	10.2
July 22	do	6.2
August 25	Sawyer and Smith	2.1
September 23	E. N. Smith	13.2
1905.		
May 16	Smith and Griffin	19.2
June 14	E. N. Smith	4.2
June 28	do	8.7
July 12	do	5.6
July 28	do	7.1
August 3	do	4.0
August 12	do	2.7
August 22	do	2.5
September 2	do	1.5
September 30	do	.7
October 12	W. C. Sawyer	.5
November 6	R. S. Hall	.5

"J. H." DITCH ABOVE VALE, OREG.

The gage and measuring section on the "J. H." ditch was located one-half mile below the point of diversion from the McLaughlin ditch.

Discharge measurements of "J. H." ditch above Vale, Oreg., in 1904 and 1905.

Date.	Hydrographer.	Discharge.
1904.		*Second-feet.*
June 25	M. W. Torkelson	8.3
July 6	do	9.6
July 22	do	8.7
August 5	do	7.1
1905.		
May 16	Smith and Griffin	7.7
June 15	E. N. Smith	11.1
June 28	do	6.4
July 12	do	.3
September 2	do	1.0
September 30	Hawthorne and Griffin	.6
October 12	W. C. Sawyer	.8

LINEBARGER DITCH ABOVE VALE, OREG.

The Linebarger ditch diverted water from the right bank of Malheur River 10 miles above Vale, Oreg., from May 1 to June 14, 1905. June 14, 1905, a discharge measurement made by E. N. Smith gave a discharge of 2.7 second-feet.

GELLERMAN & FROHMAN DITCH ABOVE VALE, OREG.

This ditch diverts water from the left bank of Malheur River about 8 miles above Vale. The gage and measuring section were located at Ricker's ranch.

Discharge measurements of Gellerman & Frohman ditch above Vale, Oreg., in 1904 and 1905.

Date.	Hydrographer.	Discharge.
1904.		*Second-feet.*
June 25	M. W. Torkelson	13.5
July 30	do	4.5
September 23	E. N. Smith	1.6
1905.		
May 5	J. M. Griffin	64.7
May 15	E. N. Smith	70.7
June 12	do	42.8
June 27	do	25.6
July 12	do	8.6
October 12	Sawyer and Hall	1.1

SAND HOLLOW DITCH ABOVE VALE, OREG.

This ditch diverts water from the right bank of Malheur River 6 miles above Vale. The gaging station was located at High's ranch.

Discharge measurements of Sand Hollow ditch above Vale, Oreg., in 1904 and 1905.

Date.	Hydrographer.	Discharge.
1904.		*Second-feet.*
June 29	M. W. Torkelson	12.4
July 30	do	5.6
August 9	do	2.9
September 23	E. N. Smith	6.0
1905.		
May 17	Smith and Griffin	12.6
June 16	E. N. Smith	6.4
June 29	do	7.5
July 13	do	3.3
October 12	Sawyer and Hall	5.8
November 16	R. S. Hall	6.1

HOPE MILL DITCH AT VALE, OREG.

This ditch diverts water from the left bank of Malheur River 2 miles above Vale. Its water was formerly used by a mill one-half mile south of Vale and returned to the river. Gagings were made just above the Bully Creek crossing.

Discharge measurements of Hope Mill ditch at Vale, Oreg., in 1905.

Date.	Hydrographer.	Discharge.
		Second-feet.
May 1	J. M. Griffin	12.3
June 10	E. N. Smith	9.9
June 27	do	8.2
July 8	do	.8
October 12	Sawyer and Hall	5.2
November 4	R. S. Hall	5.6

NEVADA DITCH BELOW VALE, OREG.

This ditch diverts water from the right bank of Malheur River 1 mile below Vale. Measurements were made 1,000 feet below the head-gate.

Discharge measurements of Nevada ditch below Vale, Oreg., in 1904 and 1905.

Date.	Hydrographer.	Discharge.
1904.		*Second-feet.*
July 12	M. W. Torkelson	107.0
July 20	do	64.1
August 6	Torkelson and Smith	46.5
August 23	Sawyer and Smith	43.0
September 7	E. N. Smith	34.0
September 8	do	18.2
September 24	do	49.9

Discharge measurements of Nevada ditch below Vale, Oreg., in 1904 and 1905—Continued.

Date.	Hydrographer.	Discharge.
1905.		*Second-feet.*
April 25	Smith and Grffin	48.7
May 25	W. C. Sawyer	69.3
June 7	E. N. Smith	99.9
July 13	.....do	24.0
July 21	.....do	34.7
July 29	.....do	27.6
August 4	.....do	22.5
August 11	.....do	16.9
August 17	.....do	13.7
August 29	Smith and Eno	14.3
September 16	G. Stubblefield	25.9
September 24	Hawthorne and Stubblefield	37.5
October 4	Hawthorne and Griffin	39.2
October 10	Hall and Hawthorne	37.2

Discharge measurements of wasteways of Nevada ditch in 1905.

McGREGOR WASTEWAY BELOW VALE, OREG.

Date.	Hydrographer.	Discharge.
		Second-feet.
May 18	Smith and Griffin	0.9
June 21	E. N. Smith	24.3
October 4	R. S. Hall	15.9
October 14	.....do	.3

COTTON WASTEWAY ABOVE ONTARIO, OREG.

May 10	E. N. Smith	41.3
June 21	.....do	6.9
October 4	Hawthorne and Griffin	1.2
October 15	R. S. Hall	.5

BROSNAN DITCH NEAR ONTARIO, OREG.

This ditch diverts water from the left bank of Malheur River 3 miles west of Ontario.

Discharge measurements of Brosnan ditch near Ontario, Oreg., in 1905.

Date.	Hydrographer.	Discharge.
		Second-feet.
June 7	E. N. Smith	0.4
October 4	Hawthorne and Griffin	3.9

BULLY CREEK ABOVE VALE, OREG.

This station was established January 27, 1905. It is near the location of the original station on Bully Creek, one-fourth mile below Warm Springs stage station, 15 miles above Vale, Oreg.

The channel is straight for 50 feet above and 300 feet below the station. The current is swift. The right bank is high, but composed of soft soil, and may wash away for 70 feet, until the hillside is reached. The left bank is high and rocky, but may overflow a road 11 feet wide until the vertical cliff is reached. The bed of the stream is composed of gravel and is shifting. There is but one channel at all stages.

Discharge measurements are made by means of a cable, car, tagged wire, and stay wire. The initial point for soundings is the stream face of the bolt to which the cable is anchored at the left bank.

The gage is in two sections. The lower section, reading from 0 to 7.6 feet, is nailed in an inclined position to posts embedded in riprap on the left bank. The upper section is a vertical staff, reading from 7.6 feet to 11 feet, fastened to the cliff. During 1905 the gage was read once each day by F. O'Neill. Bench marks were established as follows:

(1) A cut on a shoulder of the cliff 11 feet upstream from the vertical portion of the gage; elevation, 9.08 feet. (2) A standard copper bolt cemented in the solid rock 2½ feet upstream from the gage on the hill side of the road; elevation, 7.61 feet. Elevations refer to the datum of the gage.

Information in regard to station formerly maintained near this point is contained in the following Water-Supply Papers of the United States Geological Survey:

Description: 100, p 428; 135, pp 211–212.
Discharge: 100, p 429; 135, p 212.
Gage height: 100, p 429; 135, p 213.

Discharge measurements of Bully Creek above Vale, Oreg., in 1905.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Square feet.*	*Feet per second.*	*Feet.*	*Second-feet.*
January 30	Smith and Johnson	37	30	0.86	2.18	27
February 22	Smith and Griffin	34	41	2.07	2.66	85
February 23	E. N. Smith	34	38	1.82	2.58	69
February 25	do	53	80	3.66	3.40	294
March 9	Smith and Griffin	48	72	2.98	3.10	215
April 20	E. N. Smith	29	29	1.14	2.35	33
June 9	do	26	16	.75	2.00	12.0
June 26[a]	do	10	4.7	.94	1.88	4.4
July 8	do	8.7	4.3	.39	1.79	1.7
August 8[b]	do				1.69	.3
December 30[c]	R. S. Hall	12	7.8	.78	2.17	6.1

[a] Made one-half mile above cable. [b] Weir measurement. [c] Ice.

Daily gage height, in feet, of Bully Creek above Vale, Oreg., for 1905.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	2.12	3.3	2.96	2.0	2.0	2.0	1.7	1.64	1.76	1.8	1.9
2	.....	2.1	3.28	3.2	2.0	2.0	2.0	1.7	1.64	1.76	1.8	1.9
3	.....	2.1	3.3	3.0	2.0	2.0	2.0	1.7	1.64	1.76	1.8	1.9
4	.....	2.1	3.38	2.94	2.0	2.0	2.0	1.7	1.64	1.78	1.8	1.92
5	.....	2.1	3.62	2.94	2.0	2.0	1.9	1.7	1.64	1.78	1.82	1.94
6	.....	2.1	3.55	2.9	2.0	2.0	1.9	1.7	1.64	1.78	1.82	1.96
7	.....	2.6	3.45	2.8	2.0	2.0	1.86	1.7	1.64	1.78	1.84	1.96
8	.....	2.6	3.20	2.8	2.0	2.0	1.8	1.68	1.64	1.78	1.84	1.98
9	.....	2.6	3.1	2.75	2.0	2.0	1.8	1.68	1.64	1.78	1.84	1.98
10	.....	2.6	3.1	2.75	2.0	2.0	1.8	1.68	1.64	1.78	1.86	1.98
11	.....	2.6	3.1	2.7	2.0	2.0	1.8	1.68	1.64	1.8	1.88	2.0
12	.....	2.18	3.34	2.65	2.0	2.0	1.8	1.66	1.64	1.8	1.9	2.0

Daily gage height, in feet, of Bully Creek above Vale, Oreg., for 1905—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
13	.....	2.3	3.3	2.6	2.0	2.0	1.8	1.66	1.6	1.8	1.9	2.0
14	.....	2.2	3.3	2.6	2.0	2.0	1.8	1.66	1.6	1.8	1.9	2.02
15	.....	2.2	3.1	2.6	2.0	2.0	1.8	1.64	1.6	1.8	1.9	2.02
16	.....	2.3	2.98	2.56	2.0	2.0	1.8	1.64	1.68	1.8	1.9	2.02
17	.....	2.42	2.98	2.5	2.0	2.0	1.8	1.64	1.7	1.8	1.9	2.04
18	.....	2.22	3.0	2.46	2.0	2.0	1.8	1.64	1.7	1.8	1.9	2.04
19	.....	2.2	3.0	2.4	2.0	2.0	1.8	1.64	1.7	1.8	1.9	2.04
20	.....	2.2	3.1	2.35	2.0	2.0	1.8	1.64	1.7	1.8	1.9	2.06
21	.....	2.45	3.56	2.26	2.0	2.0	1.8	1.64	1.7	1.8	1.9	2.06
22	.....	2.7	3.26	2.22	2.0	2.0	1.8	1.64	1.7	1.8	1.9	2.08
23	.....	2.7	3.12	2.22	2.0	2.0	1.8	1.64	1.7	1.8	1.9	2.08
24	2.36	3.4	3.2	2.2	2.0	2.0	1.8	1.64	1.7	1.8	1.9	2.08
25	2.32	3.4	3.0	2.18	2.0	2.0	1.7	1.64	1.72	1.8	1.9	2.1
26	2.21	3.44	3.0	2.1	2.0	2.0	1.7	1.64	1.72	1.8	1.9	2.1
27	2.18	3.4	2.94	2.04	2.0	2.0	1.7	1.64	1.72	1.8	1.9	2.12
28	2.23	3.2	2.9	2.0	2.0	2.0	1.7	1.64	1.74	1.8	1.9	2.14
29	2.19	.....	2.9	2.0	2.0	2.0	1.7	1.64	1.74	1.8	1.9	2.16
30	2.18	.....	2.9	2.0	2.0	2.0	1.7	1.64	1.74	1.8	1.9	2.18
31	2.14	.....	2.95	.....	2.0	.....	1.7	1.64	.....	1.8	.....	2.18

Station rating table for Bully Creek above Vale, Oreg., from January 24 to December 31, 1905.

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	0.0	2.20	24	2.80	120	3.30	261
1.70	.3	2.30	32	2.90	146	3.40	292
1.80	2.0	2.40	41	3.00	174	3.50	324
1.90	6.0	2.50	54	3.10	202	3.60	358
2.00	11	2.60	72	3.20	231	3.70	394
2.10	17	2.70	96				

The above table is applicable only for open-channel conditions. It is based on 11 discharge measurements made during 1905. It is well defined between gage heights 1.7 feet and 3.4 feet.

Estimated monthly discharge of Bully Creek above Vale, Oreg., for 1905.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January 24–31	37	19	26.5	421
February	305	17	84.5	4,693
March	365	146	224	13,770
April	231	11	77.1	4,588
May	11	11	11.0	676
June	11	11	11.0	655
July	11	.3	3.11	191
August	.3	.1	.17	10
September	.9	.1	.30	18
October	2	1.2	1.83	112
November	6	2	4.93	293
December	6	6	6.00	369
The year	365	.1	37.5	25,800

NOTE.—December estimate reduced on account of ice conditions.

BULLY CREEK AT VALE, OREG.

This station was established April 8, 1904, by John H. Lewis, and discontinued December 31, 1905. 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. Except for a few days when the 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 backwater from Malheur River.

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.

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.

A standard chain gage is attached to the bridge; length of chain, 17.22 feet. During 1905 the gage was read once each day by Isaac McCumsey and Z. G. Wilson. Bench marks were established as follows: (1) The top surface of the north projecting floor beam on the east side of the bridge; elevation, 15.36 feet. (2) 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; elevation, 18.80 feet. Elevations refer to the datum of the gage.

A description of this station, with gage heights and discharge data, is contained in Water-Supply Paper No. 135, United States Geological Survey, pages 213–215.

Discharge measurements of Bully Creek at Vale, Oreg., in 1905.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Square feet.*	*Feet per second.*	*Feet.*	*Second-feet.*
January 25	E. N. Smith	40	18.9	0.86	3.70	16.1
February 1	P. H. Johnson	40	18.5	1.13	3.70	20.9
February 11	J. M. Griffin	40	12	.82	3.60	9.9
February 23	Griffin and Smith	42	43	1.72	4.32	74
February 25	J. M. Griffin	42	114	3.91	5.95	447
March 2	E. N. Smith	48	105	4.09	5.43	429
March 3	P. H. Johnson	49	116	4.45	5.63	516
March 9	J. M. Griffin	32	45	3.22	4.80	145
March 23	Smith and Johnson	46	86	3.48	4.98	299
March 30	J. M. Griffin	43	58	2.55	4.40	146
April 11	do	40	34	2.68	3.95	91
April 27	do	26	10.6	2.23	3.29	23.7
June 10	E. N. Smith	31	25	3.00	3.75	75
June 27[a]	do	18	17.8	1.50	3.48	28.7
July 29	do	11	5.7	.82	3.05	4.7
September 11	W. C. Sawyer	6	2.9	.62	3.05	1.8
October 12	Sawyer and Hall	10	2.7	.79	3.05	2.1
November 7[a]	R. S. Hall	17	8.5	.88	3.26	7.6
December 27	do	14	6.2	1.09	3.17	6.8

[a] Made at different section.

Daily gage height, in feet, of Bully Creek at Vale, Oreg., for 1905.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.7	3.7	5.3	4.3	3.3	3.4	3.3	3.1	3.02	3.05	3.05	3.35
2	3.6	3.7	5.5	4.6	3.25	3.4	3.3	3.1	3.03	3.06	3.05	3.4
3	3.6	3.7	5.5	4.6	3.3	3.4	3.3	3.1	3.03	3.04	3.21	3.49
4	3.5	3.7	6.7	4.4	3.3	3.4	3.3	3.0	3.03	3.04	3.25	3.41
5	3.5	3.7	5.4	4.3	3.25	3.6	3.3	3.0	3.03	3.03	3.23	3.5
6	3.5	3.6	5.7	4.2	3.3	3.6	3.3	3.0	3.05	3.03	3.21	3.32
7	3.5	3.6	5.45	4.15	3.25	3.75	3.3	3.0	3.04	3.04	3.31	3.55
8	3.5	3.4	4.95	4.1	3.2	3.8	3.3	3.02	3.03	3.04	3.21	3.45
9	3.5	3.6	4.75	4.0	3.2	3.8	3.3	3.01	3.03	3.04	3.16	3.35
10	3.5	3.6	4.6	4.0	3.25	3.75	3.3	3.0	3.03	3.06	3.1	3.45
11	3.5	3.6	4.6	3.95	3.25	3.7	3.2	3.01	3.03	3.04	3.1	3.25
12	3.5	3.5	4.9	3.9	3.25	3.65	3.25	3.01	3.04	3.05	3.1	3.2
13	3.5	3.5	5.1	4.0	3.3	3.6	3.25	3.01	3.03	3.04	3.09	3.2
14	3.3	3.7	5.0	3.75	3.3	3.8	3.2	3.01	3.04	3.05	3.61	3.12
15	3.4	3.7	4.8	3.6	3.3	3.85	3.2	3.0	3.02	3.04	3.11	3.12
16	3.4	3.5	4.7	3.6	3.3	3.65	3.2	3.01	3.04	3.05	3.09	3.2
17	3.5	3.6	4.6	3.5	3.3	3.65	3.2	3.0	3.03	3.06	3.1	3.17
18	3.5	3.6	4.5	3.45	3.3	3.65	3.2	3.0	3.04	3.06	3.06	3.2
19	3.5	3.5	4.5	3.4	3.3	3.7	3.2	3.0	3.04	3.05	3.19	3.23
20	3.5	3.5	4.4	3.4	3.3	3.6	3.2	3.0	3.04	3.05	3.23	3.45
21	3.5	3.7	5.1	3.3	3.3	3.6	3.2	3.01	3.04	3.04	3.2	3.32
22	3.5	3.95	5.0	3.3	3.3	3.7	3.15	3.0	3.04	3.06	3.25	3.17
23	3.6	4.45	5.1	3.25	3.3	3.6	3.15	3.0	3.06	3.06	3.28	3.3
24	4.2	5.4	4.8	3.25	3.3	3.6	3.1	3.01	3.06	3.08	3.16	3.2
25	3.7	5.75	4.8	3.25	3.3	3.6	3.1	3.01	3.07	3.08	3.19	3.29
26	3.8	5.55	4.5	3.3	3.3	3.6	3.1	3.0	3.08	3.08	3.42	3.2
27	3.8	5.6	4.6	3.25	3.3	3.5	3.1	3.01	3.08	3.06	3.47	3.2
28	3.8	5.4	4.4	3.3	3.45	3.4	3.1	3.02	3.04	3.05	3.32	3.16
29	3.8	.....	4.4	3.3	3.45	3.4	3.1	3.01	3.04	3.03	3.34	3.19
30	3.65	.....	4.4	3.3	3.4	3.35	3.1	3.02	3.03	3.06	3.36	3.17
31	3.65	.....	4.4	.....	3.4	.....	3.0	3.02	.....	3.03	.....	3.14

NOTE.—No ice record.

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.

The channel is straight for 100 feet above and below the station, and the current is swift. Both banks are high, clean, and do not overflow. The bed of the stream is composed of rock and gravel and is free from vegetation, and permanent. There is but one channel at all stages.

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.

A staff gage is attached to an immense bowlder at the mouth of the canyon, about one-half mile below the cable. During 1905 the gage was read once each day by S. P. Colt. The bench mark 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; elevation, 5.74 feet above the datum of the gage.

A description of this station, with gage heights and discharge data, is contained in Water-Supply Paper No. 135, United States Geological Survey, pages 215–216.

Discharge measurements of Willow Creek near Malheur, Oreg., in 1905.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Square feet.*	*Feet per second.*	*Feet.*	*Second-feet.*
March 2[a]	W. C. Sawyer	16	18.7	1.97	1.63	36.8
March 2	do	15	15.0	2.61	1.52	37.6
March 23	do	14	15.3	2.93	1.68	45.3
September 14	do	8.2	4.5	.93	.65	4.2
November 23	R. S. Hall	4.3	2.0	.40	.32	.8

[a] Made by wading.

Daily gage height, in feet, of Willow Creek near Malheur, Oreg., for 1905.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	1.0	1.25	1.54	0.96	0.56	0.85	.....	.....	0.8	.....	.....
2	1.0	1.0	1.52	1.64	1.0	.78	.....	.....	.....	.8	.....	.....
3	.....	1.0	1.6	1.6	1.12	.82	.....	.....	.....	.8	.....	.....
4	.....	1.0	1.5	1.52	1.12	.94	.55	.....	.....	.8	0.5	.....
5	.....	1.0	1.7	1.48	1.06	1.0	.5	.....	.....	.8	.5	0.5
6	.....	1.0	1.88	1.36	1.0	1.04	.5	.....	.....	.8	.5	.5
7	.....	1.2	2.1	1.32	1.0	.94	.5	.....	.....	.8	.5	.5
8	.....	1.15	1.94	1.3	.....	1.14	.5	.....	.....	.85	.5	.5
9	.....	1.0	1.94	1.24	.....	1.0	.....	.....	.....	.85	.5	.5
10	.....	1.05	1.96	1.26	.....	.98	.....	.....	.....	.9	.5	.....
11	.....	1.3	1.86	1.26	1.1	1.0	.....	.....	.....	.9	.5	.....
12	.....	1.0	1.84	1.18	1.14	1.65	.....	.....	.....	.9	.5	.....
13	.....	1.1	1.8	1.06	.....	1.25	.....	.....	.....	.9	.45	.....
14	.....	1.2	1.66	1.0	.....	1.15	.....	.....	.....	.9	.45	.....
15	0.8	1.3	1.58	.8	.....	1.1	.....	.....	.....	.9	.45	.....
16	.85	1.2	1.5	.78	.....	1.0	.....	.....	.....	.9	.45	.....
17	.85	1.3	1.56	.78	.....	1.0	.....	.....	.....	.9	.4	.....
18	.9	1.4	1.9	.82	.....	.5	.....	.....	.....	.9	.4	.....
19	.9	1.45	1.62	1.18	.8	.9	.....	.....	.....	.8	.4	.....
20	.95	1.05	1.8	1.2	.76	.82	.....	.....	.....	.8	.4	.....
21	1.0	.....	1.66	1.06	.76	.84	.....	.....	.....	.8	.4	.....
22	.95	1.45	1.74	1.06	.76	.66	.....	.....	.....	.8	.4	.....
23	1.0	1.45	1.64	1.0	.9	.52	.....	.....	.....	.8	.35	.....
24	1.05	1.2	1.58	.86	.74	.54	.....	.....	.8	.8	.35	.....
25	1.05	1.6	1.54	.85	.84	.....	.....	.....	.8	.8	.35	.....
26	1.1	1.6	1.44	.98	.84	.....	.....	.....	.8	.8	.35	.....
27	1.05	1.9	1.38	.94	.84	.92	.....	.....	.8	.85	.35	.....
28	1.1	1.7	1.36	.82	.8	.....	.....	.....	.8	.85	.....	.....
29	1.0	.....	1.5	.86	.82	.6	.....	.....	.8	.85	.....	.....
30	1.15	.....	1.4	.94	.....	.65	.....	.....	.8	.85	.....	.....
31	1.0	.....	1.52	.....	.96	.....	.....	.....	.....	.85	.....	.....

NOTE.—Creek dry July 15 to August 24.

Station rating table for Willow Creek near Malheur, Oreg., from January 1 to December 31, 1905.

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	0.5	0.80	7.0	1.30	24	1.80	53
.40	1.2	.90	9.5	1.40	29	1.90	61
.50	2.2	1.00	12.5	1.50	34	2.00	69
.60	3.5	1.10	16	1.60	40	2.10	78
.70	5.0	1.20	20	1.70	46	2.20	87

The above table is applicable only for open-channel conditions. It is based on five discharge measurements made during 1905. It is fairly well defined.

Estimated monthly discharge of Willow Creek near Malheur, Oreg., for 1905.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January 15–31	18.0	7.0	12.2	410
February	61.0	12.5	23.4	1,300
March	78.0	22.0	44.5	2,736
April	42.5	6.5	18.3	1,089
May	17.5	6.0	11.1	682
June	43.0	2.0	10.5	625
July	8.2	.0	1.4	86
August	2.0	.0	.45	28
September	7.0	2.0	4.7	280
October	9.5	7.0	8.0	492
November 1–27	6.7	.8	2.0	106
The period				7,834

NOTE.—Water was taken from the creek above the gage by Beer's ditch from April 8 to July 3, July 15 to August 24, and September 8–12. The estimated amount diverted by the ditch is as follows:

	Acre-feet.		Acre-feet.
April 8–30	92	July 1–3; 15–31	60
May	124	August 1–24	58
June	120	September 8–12	20

The estimate for Willow Creek does not include this diversion.

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.

Over two-thirds of the drainage area is practically free from timber. The river bottom is irrigated and cultivated and the higher lands are covered with sagebrush. The headwaters of the creek and its tributaries drain the southern slopes of the Burnt River Mountains, which are covered with stunted pines and junipers. The Eldorado mining ditch brings a small volume of water at irregular intervals into the creek from the headwaters of Burnt River. The flow of the creek is also affected by reservoirs used for mining purposes on some of its other tributaries.

The channel is slightly curved for about 200 feet above and straight for 200 feet below the station and is 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.

Discharge measurements are made from the downstream side of the wooden highway bridge. 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.

A standard chain gage is attached to the downstream side of the bridge; length of chain, 18.06 feet. During 1905 the gage was read once each day by Emory Cole. Bench marks were established as follows: (1) A group of three spikes driven into a post at the corner of the fence about 40 feet east of the initial point; elevation, 14.92 feet. (2) A cross painted on the top of the stone of east abutment, 6.5 feet from the initial point and marked "B. M."; elevation, 14.79 feet. (3) 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; elevation, 14.97 feet. Elevations refer to the datum of the gage.

A description of this station with gage heights, discharge data, and rating table is contained in Water-Supply Paper No. 135, United States Geological Survey, pages 216–218.

Discharge measurements of Willow Creek near Dell, Oreg., in 1905.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Square-feet.*	*Feet per second.*	*Feet.*	*Second-feet.*
January 31	Smith and Johnson	47	15	1.36	2.30	20.3
March 3	J. M. Griffin	42	30	1.44	2.81	44
March 4	do	43	38	1.54	3.00	58
March 7	Smith and Griffin	53	54	1.81	3.50	98
March 15	Smith and Johnson	52	51	1.83	3.55	93
April 4	Smith and Griffin	41	13.2	1.75	2.68	23.1
April 28	do	27	10.5	1.66	2.30	17.4
June 3	E. N. Smith	24	6.0	1.67	2.10	11.0
June 23	do	18	5.4	1.14	2.02	6.2
July 11	do	5	1.3	.20	.....	.2
November 7	R. S. Hall	8	2.9	.94	1.88	2.7

Daily gage height, in feet, of Willow Creek near Dell, Oreg., for 1905.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.6	.....	.....	3.1	2.5	2.75	2.2	1.8	1.65	2.0	2.0	2.0
2	2.7	2.3	3.4	3.2	2.6	2.7	2.2	1.8	1.65	2.05	2.0	2.0
3	2.7	2.3	2.8	2.9	2.75	2.7	2.2	1.8	1.65	2.05	2.0	2.1
4	2.8	2.4	2.95	2.75	2.5	2.6	2.3	1.7	1.65	2.0	1.9	2.1
5	2.7	2.3	3.4	2.6	2.6	2.5	2.3	1.7	1.65	2.0	1.9	2.1
6	2.8	2.4	3.5	2.5	2.6	2.5	2.2	1.8	1.65	2.0	2.0	2.1
7	2.75	2.4	3.4	2.6	2.7	2.55	2.1	1.8	1.65	2.0	2.0	2.1
8	2.75	2.4	3.5	2.7	2.8	2.5	2.1	1.7	1.65	2.1	2.0	2.1
9	2.75	2.4	3.4	2.75	2.75	2.45	2.0	1.7	1.65	2.1	2.0	2.2
10	2.8	2.4	3.5	2.75	2.7	2.4	2.0	1.7	1.65	2.0	2.0	2.2
11	.....	2.5	3.3	2.75	2.7	.....	1.9	1.7	1.65	2.0	2.1	2.3
12	2.8	2.5	.....	2.7	2.6	.....	1.8	1.7	1.65	2.0	2.0	2.2
13	2.8	2.8	.....	2.7	2.7	.....	1.8	1.7	1.65	2.0	2.0	2.2
14	2.8	3.0	3.8	2.7	2.8	2.5	1.8	1.7	1.65	2.0	2.0	2.4
15	3.2	3.0	4.2	2.5	2.6	2.5	1.8	1.7	1.65	2.0	2.1	2.4
16	3.2	3.0	.....	2.5	2.7	.....	1.8	1.7	1.65	2.1	2.1	2.3
17	3.2	2.85	3.3	2.4	2.7	2.5	1.8	1.65	1.65	2.1	2.0	2.3
18	3.2	3.0	3.2	2.4	2.7	2.55	1.7	1.65	1.65	2.15	2.1	2.3
19	3.3	3.0	3.2	2.4	2.7	2.6	1.8	1.65	1.65	2.15	2.1	.....
20	3.3	3.0	3.2	2.3	2.8	2.5	1.8	1.65	1.65	2.1	2.1	.....
21	3.4	3.0	3.3	2.4	2.8	2.4	1.8	1.65	1.85	2.1	2.0	.....
22	3.4	3.3	3.4	2.4	2.7	2.4	1.7	1.65	1.85	2.1	2.0	.....

Daily gage height, in feet, of Willow Creek near Dell, Oreg., for 1905—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
23	3.3	3.85	3.2	2.3	2.7	2.3	1.7	1.65	1.85	2.1	2.0	.....
24	3.3	3.4	3.2	2.2	2.75	2.3	1.7	1.65	1.9	2.1	1.9	.....
25	3.3	3.4	3.2	2.3	2.7	2.3	1.8	1.65	2.0	2.1	2.0	.....
26	3.4	3.4	3.2	2.3	2.8	2.3	1.7	1.65	2.0	1.9	2.1	.....
27	3.4	3.6	3.2	2.4	2.7	2.3	1.7	1.65	2.05	1.9	2.1	.....
28	3.4	3.5	3.3	2.5	2.75	2.2	1.8	1.65	2.0	2.1	2.1	.....
29	3.0	.....	3.3	2.5	3.0	2.2	1.8	1.65	2.05	1.9	2.0	.....
30	2.7	.....	3.2	2.4	.....	2.3	1.7	1.65	1.95	2.0	2.1	.....
31	.....	.....	3.2	.....	2.8	.....	1.7	1.65	.....	2.0	.....	.....

NOTE.—No ice record.

Station rating table for Willow Creek near Dell, Oreg., from January 1 to March 13 and April 6 to December 31, 1905.

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	0.5	2.30	18	2.90	51	3.50	98
1.80	1	2.40	22	3.00	58	3.60	107
1.90	3	2.50	27	3.10	65	3.70	116
2.00	6	2.60	33	3.20	73	3.80	126
2.10	10	2.70	39	3.30	81	3.90	136
2.20	14	2.80	45	3.40	89	4.00	146

The above table is applicable only for open-channel conditions. It is based on 10 discharge measurements made during 1905. It is well defined below gage height 5 feet. On account of a change in the channel, which lasted from March 14 to April 5, a supplementary rating table is required during that period.

Station rating table for Willow Creek near Dell, Oreg., from March 14 to April 5, 1905.

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	19	3.10	53	3.50	88	3.90	130
2.70	25	3.20	61	3.60	98	4.00	142
2.80	31	3.30	70	3.70	108	4.10	154
2.90	38	3.40	79	3.80	119	4.20	166
3.00	45						

The above table is applicable only for open-channel conditions. It is based on two discharge measurements made in March and April, 1905. It is fairly well defined.

Estimated monthly discharge of Willow Creek near Dell, Oreg., for 1905.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January	89	18	59.6	3,665
February	131	18	51.5	2,860
March	166	45	80.5	4,950
April	61	14	29.6	1,761
May	58	27	39.8	2,447
June	42	14	25.4	1,511
July	18	.5	4.6	283
August	1	.0	.34	21
September	8	.0	1.5	89
October	12	3	7.3	449
November	10	3	7.0	417
The period				18,450

NOTE.—Discharge was interpolated for missing gage heights.

DITCHES IN WILLOW CREEK VALLEY NEAR VALE, OREG.

The following measurements were made of ditches diverting water from Willow Creek below Cole's ranch, 28 miles above Vale:

Discharge measurements of ditches in Willow Creek Valley above Vale, Oreg.

COLE'S DITCH NEAR DELL.

Date.	Hydrographer.	Discharge.
1904.		*Second-feet.*
July 8	M. W. Torkelson	1.9
August 3	do	1.4
September 3	E. N. Smith	1.5
1905.		
April 27	Smith and Griffin	7.0
June 2	E. N. Smith	3.1
July 10	do	.7
September 28	J. M. Griffin	.5
November 8	R. S. Hall	.14

COMPANY DITCH.

1904.		
July 8	M. W. Torkelson	8.5
August 3	do	.3
September 3	E. N. Smith	1.2
1905.		
April 28	Smith and Griffin	15.4
June 3	E. N. Smith	12.6
June 23	do	8.1
July 11	do	.3
September 28	J. M. Griffin	4.5

Discharge measurements of ditches in Willow Creek Valley above Vale, Oreg.—Continued.

PATRICK FAULKNER DITCH.

Date.	Hydrographer.	Discharge.
1904.		*Second-feet.*
September 3	E. N. Smith	0.4
1905.		
April 29	Smith and Griffin	1.5
June 1	E. N. Smith	1.4
July 11	do	.76
August 10	do	.09

LARRY FAULKNER DITCH.

1905.		
April 29	Smith and Griffin	3.3

GRAY DITCH.

1905.		
August 9	E. N. Smith	4.1

HARRIS DITCH.

1905.		
April 29	Smith and Griffin	0.5

LOGAN DITCH.

1904.		
August 3	M. W. Torkelson	1.2
1905.		
April 28	E. N. Smith	5.4
June 2	do	.22
July 11	do	.33
September 28	J. M. Griffin	.67

BECKER CREEK LOGAN DITCH.

1905.		
April 28	Smith and Griffin	0.5

NORWOOD DITCH.

1905.		
April 27	Smith and Griffin	2.5
June 2	E. N. Smith	.37
June 23	do	.3

PETERSON AND TETER DITCH.

1905.		
April 29	E. N. Smith	3.1

Discharge measurements of ditches in Willow Creek Valley above Vale, Oreg.—Continued.

SCOTT DITCH.

Date.	Hydrographer.	Discharge.
1904.		*Second-feet.*
July 7	M. W. Torkelson[a]	1.9
July 7	do[b]	5.2
1905.		
April 28	Smith and Griffin[c]	3.8
June 2	E. N. Smith[c]	1.3
June 23	do[c]	1.6

TURNER DITCH.

1904.		
August 3	M. W. Torkelson	2.2
September 3	E. N. Smith	1.8
1905.		
April 28	Smith and Griffin	1.4
June 3	E. N. Smith	3.1
July 11	do	.27
June 23	do	1.2
August 25	do	.6

[a] Upper Scott ditch. [b] Lower Scott ditch. [c] Above diversion.

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 Railway. The station is above all important diversions and above the point where the river enters the valley which surrounds Baker City. Above the station the river drains the eastern slope of a spur of the Blue Mountains. A large portion of the area has been cleared of timber.

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 and is free from vegetation and permanent. There is but one channel at all stages.

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.

A staff gage is fastened vertically to a tree on the left bank, about 400 feet below the house of R. M. Garrett, who during 1905 read the gage twice each day. 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; elevation, 8.00 feet above the datum of the gage.

Information in regard to this station is contained in the following Water-Supply Papers of the United States Geological Survey:

Description: 100, pp 430–431; 135, p 221.
Discharge: 100, p 431; 135, p 222.
Discharge, monthly: 135, p 223.
Gage heights: 100, p 431; 135, p 222.
Rating table: 135, p 223.

Discharge measurements of Powder River near Baker City, Oreg., in 1905.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Square feet.*	*Feet per second.*	*Feet.*	*Second-feet.*
March 28	W. C. Sawyer	40	54.0	2.78	2.94	151
May 23	do	40	58.0	2.97	3.10	172
August 1	do	25	15.1	1.00	1.91	15.3
November 13[a]	R. S. Hall	39	26.3	.43	2.11	11.3

[a] River partly covered with ice.

Daily gage height, in feet, of Powder River near Baker City, Oreg., for 1905.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.15	2.15	2.7	2.85	3.35	3.55	2.45	2.05	1.65	1.95	2.05	2.1
2	2.05	2.1	2.6	2.85	3.4	3.45	2.55	2.0	1.65	1.95	2.1	2.05
3	1.95	2.1	2.7	2.95	3.4	3.45	2.45	1.9	1.6	1.85	2.05	2.0
4	2.0	2.25	3.0	3.05	3.25	3.45	2.35	1.85	1.7	2.05	2.05	2.05
5	2.0	2.25	2.95	2.95	3.15	3.45	2.25	1.8	1.6	1.95	2.05	2.1
6	2.0	2.05	3.05	2.95	3.05	3.3	2.15	1.8	1.55	1.95	2.0	2.1
7	2.0	2.15	3.05	3.15	3.25	3.2	1.95	1.8	1.55	2.0	2.1	2.1
8	1.95	2.2	2.95	3.35	3.25	3.25	1.9	1.85	1.6	2.05	2.05	2.05
9	1.9	2.15	2.95	3.35	3.15	3.25	1.75	1.75	1.6	2.0	2.05	2.05
10	1.9	2.05	3.05	3.25	3.05	3.15	1.95	1.85	1.6	2.05	2.05	2.0
11	1.9	2.0	3.0	3.15	3.05	3.1	2.15	1.85	1.55	2.05	2.05	2.1
12	1.9	2.15	3.3	3.2	3.05	3.05	2.0	1.85	1.55	2.05	2.0	2.1
13	1.9	2.15	3.35	3.05	3.05	3.0	2.05	1.8	1.55	2.05	2.1	2.1
14	1.9	2.25	3.25	3.05	3.0	3.05	2.05	1.85	1.55	1.85	2.1	2.1
15	1.9	2.25	3.45	3.15	2.95	3.05	2.05	1.85	1.55	2.0	2.0	2.1
16	2.0	2.25	3.45	3.05	3.05	2.95	2.05	1.8	1.55	1.95	2.0	2.1
17	2.15	2.3	3.45	3.15	3.25	2.85	2.0	1.85	1.6	2.0	2.05	2.05
18	2.25	2.35	3.35	3.05	3.35	2.85	2.05	1.75	1.55	1.95	2.1	2.05
19	2.35	2.25	3.25	3.15	3.25	2.75	1.85	1.75	1.55	1.95	2.1	2.05
20	2.25	2.25	3.15	3.1	3.25	2.85	1.85	1.7	1.6	1.95	2.05	2.1
21	2.35	2.25	3.15	3.1	3.25	2.75	1.95	1.65	1.6	2.1	2.0	2.1
22	2.35	2.3	3.15	3.1	3.25	2.6	1.95	1.65	1.75	2.1	2.0	2.1
23	2.4	2.4	3.1	3.1	3.10	2.65	2.05	1.6	1.7	2.05	2.05	2.1
24	2.3	2.35	3.15	3.2	3.15	2.65	2.0	1.65	1.65	2.05	2.05	2.1
25	2.45	2.25	3.05	3.25	3.05	2.65	1.85	1.7	1.65	2.0	2.05	2.0
26	2.35	2.35	2.95	3.4	3.05	2.6	1.9	1.65	1.75	2.05	2.05	2.0
27	2.35	2.55	2.9	3.45	3.1	2.55	1.9	1.6	1.65	2.0	2.05	2.0
28	2.2	2.4	2.9	3.45	3.15	2.55	1.85	1.65	1.75	2.1	2.05	2.0
29	2.15	.....	2.85	3.35	3.0	2.6	1.85	1.65	1.75	2.1	2.1	2.05
30	2.2	.....	2.85	3.45	3.15	2.45	1.9	1.65	1.95	2.05	2.1	2.1
31	2.15	.....	2.65	.....	3.35	.....	2.05	1.6	.....	2.05	.....	2.1

NOTE.—Ice conditions during January, February, November, and December. Gage heights are to water surface. They are only approximate owing to changing ice conditions.

Station rating table for Powder River near Baker City, Oreg., from January 1, 1904, to December 31, 1905.

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	2	2.80	120	4.30	571	5.70	1,048
1.40	2.5	2.90	140	4.40	605	5.80	1,082
1.50	3	3.00	161	4.50	639	5.90	1,116
1.60	4	3.10	184	4.60	673	6.00	1,150
1.70	7	3.20	209	4.70	707	6.20	1,218
1.80	11	3.30	237	4.80	741	6.40	1,286
1.90	16	3.40	267	4.90	775	6.60	1,354
2.00	22	3.50	299	5.00	810	6.80	1,422
2.10	30	3.60	333	5.10	844	7.00	1,490
2.20	38	3.70	367	5.20	878	7.20	1,558
2.30	48	3.80	401	5.30	912	7.40	1,626
2.40	60	3.90	435	5.40	946	7.60	1,694
2.50	72	4.00	469	5.50	980	7.80	1,762
2.60	86	4.10	503	5.60	1,014	8.00	1,830
2.70	102	4.20	537				

The above table is applicable only for open-channel conditions. It is based on 11 discharge measurements made during 1903–1905. It is fairly well defined above gage height 1.7 feet.

Estimated monthly discharge of Powder River near Baker City, Oreg., for 1905.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
March	283	86	179	11,010
April	283	130	201	11,960
May	267	150	202	12,420
June	316	66	164	9,759
July	79	9	27.0	1,660
August	26	4	10.0	615
September	19	3.5	5.4	321
October	30	13	23.1	1,420
The period				49,160

NOTE.—Reliable estimates could not be prepared during January, February, November, and December on account of ice conditions.

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 drainage area above this station lies almost wholly in the northern and eastern slopes of the Blue Mountains, the greater portion being well timbered.

The channel is straight for 100 feet above and 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 stages 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 and is 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.

Discharge measurements are made from the downstream side of the two-span bridge, which is supported by two timber-crib abutments and by one middle crib pier. The initial point for soundings is at a 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 gage is a staff driven vertically into the ground at the downstream end of the middle bridge pier and bolted at the upper end to the log pier. During 1905 the gage was read once daily at ordinary stages and twice daily during floods by Jay Hawes. Bench marks were established as follows: (1) The head of a bolt through the lower chord of the bridge, 7.5 feet from the timber to which the gage is attached; elevation, 13.80 feet. (2) 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; elevation, 12.81 feet. Elevations refer to the datum of the gage.

Information in regard to this station is contained in the following Water-Supply Papers of the United States Geological Survey:

Description: 100, p 420; 135, p 224.
Discharge: 100, p 420; 135, p 225.
Discharge, monthly: 135, p 226.
Gage heights: 100, p 421; 135, p 225.
Rating table: 135, p 226.

Discharge measurements of Grande Ronde River at Hilgard, Oreg., in 1905.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Square-feet.*	*Feet per second.*	*Feet.*	*Second-feet.*
March 4	W. C. Sawyer	69	260	1.91	3.95	498
May 16	do	70	293	2.17	4.10	636
August 2 [a]	do	28	35	1.27	2.86	44.1
November 14	R. S. Hall	67	188	.26	2.86	48.9

[a] Made at different section.

Daily gage height, in feet, of Grande Ronde River at Hilgard, Oreg., for 1905.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.0	3.1	3.8	3.95	4.3	3.8	2.2	2.85	2.65	2.7	2.85	2.8
2	3.0	3.1	4.0	3.92	4.1	3.9	2.3	2.85	2.6	[a] 3.7	2.8	2.85
3	3.05	3.0	4.0	4.0	4.3	3.9	3.0	2.85	2.6	2.85	2.8	2.8
4	2.95	3.0	4.0	4.0	5.0	3.9	3.1	2.85	2.62	2.7	2.8	2.8
5	2.9	3.0	3.95	4.1	5.2	3.85	3.2	2.85	2.8	2.7	[a] 3.8	2.75
6	2.9	3.0	3.92	4.1	5.3	3.75	3.1	2.85	2.7	2.7	2.8	2.75
7	2.9	3.05	3.9	4.15	[a] 6.8	3.7	3.1	2.85	2.7	2.7	2.75	2.8
8	3.0	3.02	3.85	4.05	5.8	3.72	3.1	2.85	2.7	2.7	2.8	2.8
9	3.0	3.0	3.85	4.0	5.2	3.75	3.0	2.85	2.7	2.75	2.85	2.8
10	2.95	2.9	3.9	3.95	5.5	3.7	2.75	2.85	2.65	2.75	2.85	2.8
11	2.92	2.8	3.6	4.0	[a] 6.2	3.7	2.75	2.85	2.65	2.75	2.85	2.85
12	2.85	3.1	3.6	4.1	5.8	3.65	2.75	2.85	2.7	[a] 3.3	2.75	2.85
13	3.0	3.1	3.65	4.1	5.6	3.65	2.85	2.85	2.68	2.75	2.7	2.85
14	3.05	3.1	3.8	3.9	5.4	3.68	2.95	2.85	2.7	2.75	2.7	2.8
15	3.0	3.2	3.85	3.85	5.2	3.4	2.9	2.85	2.7	2.75	2.8	2.8
16	3.0	3.3	3.67	3.85	4.1	3.1	2.9	2.85	2.72	2.8	2.8	2.85
17	3.0	3.3	3.65	3.82	4.3	3.0	2.95	2.85	2.6	2.85	2.8	2.8
18	3.0	3.3	3.6	3.9	4.1	3.0	2.98	2.85	2.6	2.85	[a] 3.0	2.8

[a] River flooded to run logs. Water stored during preceding night. No change in normal flow.

Daily gage height, in feet, of Grande Ronde River at Hilgard, Oreg., for 1905—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
19	3.0	3.2	3.62	3.85	4.1	3.05	2.99	2.85	2.65	2.85	2.85	2.8
20	3.0	3.2	3.7	3.85	4.1	3.05	2.9	2.8	2.65	2.8	2.8	2.8
21	3.0	3.35	3.97	4.0	4.1	2.7	2.85	2.85	2.7	2.8	2.8	2.8
22	3.0	3.45	3.97	4.25	4.0	2.5	2.85	2.85	2.7	2.85	2.75	2.8
23	3.1	3.6	3.95	4.0	4.0	2.3	2.8	2.8	2.65	2.8	2.75	3.0
24	3.3	3.45	3.8	4.0	4.0	2.3	2.8	2.8	2.7	2.85	2.8	2.9
25	3.3	3.7	3.75	4.1	3.9	2.2	2.8	2.85	2.7	2.85	2.8	2.85
26	3.25	3.9	4.1	[a] 4.65	3.85	2.2	2.8	2.8	2.7	2.85	2.8	2.9
27	3.35	3.85	4.1	4.25	3.8	3.3	2.8	2.8	2.72	[a] 3.1	2.85	3.1
28	3.5	3.8	4.0	4.3	3.8	3.25	2.85	2.8	2.7	2.85	2.85	3.1
29	3.4	.....	4.0	4.55	3.8	2.35	2.85	2.75	2.7	2.8	2.85	3.1
30	3.2	.....	3.9	4.5	3.8	2.2	2.85	2.7	2.68	2.75	2.85	3.1
31	3.1	.....	3.9	.....	3.75	.....	2.85	2.7	.....	2.75	.....	3.1

[a] River flooded to run logs. Water stored during preceding night. No change in normal flow.

NOTE.—Ice conditions during part of January, February, and December.

Station rating table for Grande Ronde River at Hilgard, Oreg., from January 1 to December 31, 1905.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
2.20	3	3.40	228	4.60	1,070	5.80	2,466
2.30	5	3.50	272	4.70	1,170	5.90	2,592
2.40	8	3.60	320	4.80	1,275	6.00	2,717
2.50	12	3.70	370	4.90	1,384	6.20	2,969
2.60	18	3.80	425	5.00	1,495	6.40	3,221
2.70	26	3.90	485	5.10	1,608	6.60	3,473
2.80	38	4.00	550	5.20	1,725	6.80	3,725
2.90	58	4.10	620	5.30	1,846	7.00	3,977
3.00	84	4.20	700	5.40	1,968	7.20	4,229
3.10	114	4.30	785	5.50	2,092	7.40	4,481
3.20	148	4.40	875	5.60	2,216	7.60	4,733
3.30	186	4.50	970	5.70	2,341	7.80	4,985

The above table is applicable only for open-channel conditions. It is based on nine discharge measurements made during 1904–5. It is well defined between gage heights 2.8 feet and 5.5 feet. Below gage height 2.8 feet the table is very uncertain. The table has been extended beyond these limits. Above gage heights 4.7 feet the table is the same as in 1904.

Estimated monthly discharge of Grande Ronde River at Hilgard, Oreg., for 1905.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January	272	48	108	6,641
February	485	38	180	9,997
March	620	320	461	28,350
April	1,020	440	597	35,520
May	2,466	398	1,127	69,300
June	485	3	227	13,510
July	148	3	60.6	3,726
August	48	26	44.1	2,712
September	38	18	24.3	1,446
October	48	26	37.1	2,281
November	48	26	39.6	2,356
December	114	32	54.6	3,357
The year	3,725	3	247	179,200

NOTE.—Extremely low gage heights probably due to storage above.

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, a broad, flat, fertile valley in which much of the water is used for the irrigation of fruit, sugar beets, and other crops. The valley contains over 200 square miles, its width being about 12 miles and its length more than 20. Its upper end is about 6 miles below the Hilgard station. Some water is received from a number of small streams rising in the hills which surround the valley.

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 bent at high water.

Discharge measurements are made from the downstream side of the bridge, which 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.

A standard chain gage is attached to the upstream side of the bridge, near the center of the stream; length of chain, 22.00 feet. During 1905 the gage was read once each day by John Graham. The bench mark is the top surface of the steel caisson directly over the gage; elevation, 15.14 feet above the datum of the gage.

Information in regard to this station is contained in the following Water-Supply Papers of United States Geological Survey:

Description: 100, p 419; 135, pp 226-227.
Discharge: 100, p 419; 135, p 227.
Discharge, monthly: 135, p 229.
Gage heights: 100, p 419; 135, pp 227-228.
Rating table: 135, p 228.

Discharge measurements of Grande Ronde River at Elgin, Oreg., in 1905.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Square feet.*	*Feet per second.*	*Feet.*	*Second-feet.*
April 1	W. C. Sawyer	86	336	2.60	3.25	872
May 22	do	92	356	2.81	3.48	1,000
September 21	do	32	27	1.37	1.48	37.5
November 30	R. S. Hall	88	221	.36	1.74	80

Daily gage height, in feet, of Grande Ronde River at Elgin, Oreg., for 1905.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.6	2.25	3.0	3.25	3.5	3.2	2.3	1.4	1.35	1.7	1.7	1.75
2	2.45	2.4	2.95	3.2	3.5	3.25	2.3	1.4	1.35	1.65	1.7	1.75
3	2.45	2.1	3.05	3.35	3.55	3.25	2.2	1.35	1.35	1.65	1.7	1.7
4	2.25	2.05	3.1	3.3	3.75	3.25	2.15	1.35	1.35	1.65	1.7	1.75
5	2.25	2.05	3.1	3.3	4.0	3.3	.....	1.35	1.35	1.65	1.7	1.8
6	2.2	2.05	3.05	3.5	4.05	3.3	2.1	1.35	1.35	1.7	1.75	1.8
7	2.1	2.0	3.05	3.5	4.05	3.3	2.05	1.35	1.35	1.65	1.85	1.8
8	2.1	1.9	2.95	3.6	4.16	3.2	1.9	1.35	1.35	1.65	1.85	1.75
9	1.95	1.95	2.95	3.6	4.15	3.1	1.8	1.35	1.35	1.65	1.65	1.75
10	2.0	1.95	2.8	3.6	4.15	3.1	1.75	1.35	1.35	1.65	1.55	.....
11	2.1	[a] 3.05	2.8	3.45	4.1	3.05	1.7	1.35	1.4	1.65	1.55	2.15
12	2.1	[a] 3.2	2.8	3.4	4.0	3.05	1.7	1.35	1.4	1.7	1.55	2.15
13	2.05	[a] 2.7	2.75	3.3	3.9	3.05	1.65	1.35	1.4	1.75	1.55	1.95
14	2.05	[a] 2.3	2.85	3.2	3.9	3.05	1.65	1.35	1.4	1.8	1.55	1.85
15	2.05	1.95	3.0	3.1	3.8	3.0	1.65	1.35	1.4	1.8	1.65	1.9
16	2.05	1.95	3.1	3.15	3.75	2.95	1.65	1.35	1.4	1.7	1.7	1.9
17	2.05	2.05	3.0	3.15	3.7	2.8	1.6	1.4	1.4	1.7	1.7	1.85
18	2.05	1.9	2.85	3.1	3.75	2.7	1.6	1.4	1.4	1.7	1.7	1.85
19	2.1	1.9	3.0	3.1	3.75	2.65	1.55	1.4	1.45	1.7	1.7	1.85
20	2.2	1.95	3.0	3.15	3.65	2.6	1.55	1.4	1.45	1.7	1.75	1.85
21	2.05	2.1	3.15	3.4	3.55	2.55	1.6	1.35	1.5	1.75	1.7	1.85
22	.....	2.2	3.2	3.4	3.5	2.45	1.55	1.35	1.5	1.75	1.6	2.0
23	2.45	2.3	3.25	.....	3.4	2.45	1.5	1.35	1.5	1.75	1.65	1.8
24	2.45	2.4	3.2	3.45	3.4	2.5	1.5	1.35	1.5	1.75	1.85	1.9
25	2.45	2.6	3.15	3.6	3.4	2.3	1.5	1.35	1.5	1.75	1.65	1.8
26	2.55	2.8	3.2	3.65	3.3	2.45	1.5	1.35	1.5	1.75	1.55	1.95
27	2.55	3.0	3.3	3.7	3.2	2.45	1.45	1.35	1.65	2.0	1.65	1.85
28	2.55	3.0	.....	3.6	3.25	2.45	1.45	1.35	1.65	2.0	1.6	[a] 2.0
29	2.65	.....	3.35	3.6	3.2	2.45	1.4	1.3	1.7	2.0	1.95	[a] 1.95
30	2.45	.....	3.3	3.5	3.2	2.4	1.4	1.35	1.7	1.75	1.75	[a] 1.9
31	2.3	.....	3.2	.....	3.2	.....	1.4	1.35	.....	1.75	.....	[a] 1.9

[a] Rise caused by ice gorges; no increased flow.

Station rating table for Grande Ronde River at Elgin, Oreg., from January 1 to December 31, 1905.

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	15	2.10	205	2.90	590	3.70	1,310
1.40	27	2.20	240	3.00	655	3.80	1,430
1.50	42	2.30	280	3.10	725	3.90	1,560
1.60	60	2.40	325	3.20	805	4.00	1,700
1.70	82	2.50	370	3.30	890	4.10	1,840
1.80	108	2.60	420	3.40	980	4.20	1,990
1.90	138	2.70	475	3.50	1,080		
2.00	170	2.80	530	3.60	1,190		

The above table is applicable only for open-channel conditions. It is based on 11 discharge measurements made during 1904-5. It is well defined between gage heights 1.5 feet and 3.5 feet.

Estimated monthly discharge of Grande Ronde River at Elgin, Oreg., for 1905.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January	448	154	269	16,540
February	655	138	244	13,550
March	935	502	703	43,230
April	1,310	725	983	58,490
May	1,930	805	1,308	80,430
June	890	280	588	34,990
July	280	27	98.7	6,069
August	27	15	22.0	1,353
September	82	21	35.1	2,089
October	170	71	92.8	5,706
November	123	51	74.6	4,439
December	222	82	127	7,809
The year	1,930	15	379	274,700

NOTE.—Discharge interpolated for missing gage heights.

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 channel is curved above the station, but is 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, 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.

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.

An inclined gage is located on the left bank just below the ferry. During 1905 the gage was read once each day by M. W. Zindel, who is paid by the Lewiston Water and Power Company. The bench mark is a point on a rock 29 feet downstream from the gage; elevation, 9.00 feet above the datum of the gage.

A description of this station, with gage heights and discharge data, is contained in Water-Supply Paper No. 135, United States Geological Survey, pages 229–230.

Daily gage height, in feet, of Grande Ronde River at Zindel, Wash., for 1905.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.65	2.7	3.4	4.0	4.0	4.8	3.3	2.2	2.0	2.3	2.4	2.3
2	2.5	2.65	3.5	3.9	4.0	5.0	3.3	2.2	2.0	2.3	2.35	2.3
3	2.5	2.6	3.6	3.9	4.1	4.9	3.3	2.2	2.0	2.3	2.3	2.3
4	2.5	2.4	3.75	3.9	4.1	5.1	3.3	2.2	2.0	2.25	2.3	2.3
5	2.5	2.5	3.75	4.0	4.1	5.0	3.3	2.2	2.0	2.2	2.3	2.3
6	2.55	2.5	3.6	4.0	4.4	4.8	3.3	2.2	2.0	2.25	2.25	2.3
7	2.3	2.5	3.6	4.1	4.4	4.7	3.2	2.1	2.0	2.3	2.25	2.3
8	2.3	2.45	3.6	4.2	4.4	4.6	3.1	2.0	2.0	2.3	2.25	2.1
9	2.25	2.4	3.6	4.2	4.5	5.1	3.0	2.0	2.0	2.3	2.2	2.1
10	2.25	2.3	3.5	4.2	4.6	4.5	3.0	2.0	2.0	2.3	2.2	2.0
11	2.2	2.3	3.4	4.0	4.8	4.8	3.0	2.0	1.95	2.3	2.2	2.0
12	2.2	2.25	3.3	3.9	4.8	4.8	2.9	2.0	1.95	2.3	2.2	2.25
13	2.2	2.2	3.4	3.8	4.7	4.0	2.7	2.0	2.0	2.35	2.2	2.25

Daily gage height, in feet, of Grande Ronde River at Zindel, Wash., for 1905—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
14	2.25	2.2	3.4	3.7	4.5	4.0	2.7	2.0	2.0	2.35	2.2	2.25
15	2.25	2.2	3.4	3.7	4.3	3.9	2.6	2.0	2.0	2.35	2.2	2.3
16	2.25	2.2	3.5	3.7	4.2	3.9	2.5	2.0	2.0	2.35	2.2	2.3
17	2.3	2.25	3.7	3.7	4.55	3.8	2.5	2.0	2.0	2.35	2.25	2.3
18	2.3	2.3	3.8	3.8	4.5	3.8	2.5	2.0	2.0	2.3	2.25	2.3
19	2.4	2.3	3.7	3.9	4.4	3.8	2.5	2.0	2.0	2.3	2.25	2.3
20	2.4	2.4	3.8	4.1	4.4	3.8	2.5	2.0	2.0	2.3	2.25	2.3
21	2.4	2.95	3.8	4.1	4.4	3.7	2.3	2.0	2.0	2.3	2.2	2.3
22	2.4	2.9	3.8	4.1	4.2	3.7	2.3	2.0	2.0	2.3	2.2	2.25
23	2.4	2.9	3.9	4.2	4.2	3.7	2.3	2.0	2.0	2.3	2.2	2.1
24	2.8	3.1	3.9	4.3	4.1	3.9	2.3	2.0	2.0	2.3	2.2	2.1
25	3.2	3.2	4.1	4.3	4.0	3.8	2.3	2.0	2.0	2.3	2.25	2.25
26	3.1	3.35	4.1	4.5	3.9	3.8	2.2	2.0	2.0	2.4	2.3	2.3
27	3.2	3.5	4.3	4.6	4.0	3.6	2.2	2.0	2.1	2.5	2.6	2.3
28	3.1	3.4	4.2	4.6	4.1	3.6	2.2	2.0	2.1	2.4	2.6	2.3
29	3.1	.....	4.2	4.2	4.2	3.4	2.2	2.0	2.3	2.4	2.4	2.25
30	3.0	.....	4.3	4.1	4.3	3.4	2.2	2.0	2.3	2.4	2.3	2.25
31	2.8	.....	4.3	.....	4.4	.....	2.2	2.0	.....	2.4	.....	2.25

WALLOWA LAKE NEAR JOSEPH, OREG.

July 15, 1905, a gage was placed on the upstream side of the controlling dam at the outlet of Wallowa Lake and was read twice each week during the remainder of the year. It is fastened to the crib pier nearest the right bank. Its datum is the floor of the sluiceway.

Daily gage height, in feet, of Wallowa Lake near Joseph, Oreg., for 1905.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	.....	.....	.....	0.65	.....	16	.....	1.0	0.75	.....	.....	0.6
2	.....	2.1	0.85	.....	.....	0.6	18	.....	.....	.....	0.7	0.6	.....
4	.....	.....	.....	0.8	.65	.....	19	4.2	1.0	.65	.....	.....	.....
5	.....	1.6	.....	.....	.....	.....	21	.....	.....	.....	.7	.....	.....
6	.....	.....	.8	.....	.65	.6	22	3.7	.....	.....	.....	.6	.....
7	.....	.....	.....	.8	.....	.....	23	.....	.9	.7	.....	.....	.6
9	.....	.....	.75	.....	.....	.6	25	.....	.....	.....	.7	.6	.....
10	.....	1.3	.....	.....	.....	.....	26	3.6	.....	.....	.....	.....	.....
11	.....	.....	.....	.....	.6	.....	27	.....	.....	.75	.....	.....	.6
12	.....	1.1	.....	.....	.....	.....	28	.....	.....	.....	.65	.....	.....
13	.....	.....	.8	.....	.....	.6	29	3.1	.....	.....	.....	.6	.....
15	4.5	.....	.....	.....	.....	.....	30	.....	.9	.85	.....	.....	.....

WALLOWA RIVER NEAR JOSEPH, OREG.

This station was established November 12, 1903, by John H. Lewis. It is located 500 feet below the outlet of Wallowa Lake, about 1¼ miles above Joseph, Oreg.

The channel is straight for 100 feet above and 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, is free from vegetation, and is not liable to shift. There is but one channel at all stages.

Discharge measurements are made from a footbridge, which 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 original gage was a vertical staff located on Wallowa Lake near the outlet. On account of the construction of a controlling dam at the outlet, this gage was rendered useless. From March 30 to July 12, 1905, readings were taken on a temporary gage about 100 feet below the dam. July 12, 1905, a permanent vertical rod gage was established on the right bank of the river, about 50 feet above the footbridge. The readings on the temporary gage have been reduced to correspond with those on the permanent one. During 1905 the gage was read once each day by F. L. Bedingfield. The new gage is referred to the following bench mark: A cross cut in the highest point of the rock to which the gage is attached; elevation, 4.10 feet above the datum of the gage.

Four irrigation ditches divert a considerable portion of the water between the station and the town of Joseph, and gages have been read on them twice weekly since July 12.

Information in regard to this station is contained in the following Water-Supply Papers of the United States Geological Survey:

Description: 100, p 418; 135, pp 230–231.
Discharge: 100, p 418; 135, p 231.
Discharge, monthly: 135, p 232.
Gage heights: 100, p 418; 135, p 231.
Rating table: 135, p 232.

Discharge measurements of Wallowa River near Joseph, Oreg., in 1905.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Square feet.*	*Feet per second.*	*Feet.*	*Second-feet.*
March 30	W. C. Sawyer	27	34.5	2.37	1.51	82
May 18	do	27	42.0	2.43	2.20	102
July 10	do	28	50.0	4.08	2.43	202
July 11	do	27	36.1	3.62	2.30	131
July 11	do	28	52.0	4.63	2.58	239
July 11	do	27	29.5	2.82	2.17	83
July 12	do	30	61.0	5.20	2.74	319
September 19	do	27	25.5	2.31	2.05	59
November 27	R. S. Hall	28	32.4	2.33	2.02	76

Daily gage height, in feet, of Wallowa River near Joseph, Oreg., for 1905.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.4	1.2	1.2	2.0	2.15	2.95	2.7	2.8	2.15	2.1	2.0	1.9
2	1.4	1.2	1.2	2.0	2.15	3.15	2.6	2.8	.....	2.1	2.0	1.9
3	1.4	1.2	1.2	2.0	2.15	3.2	2.6	2.7	2.1	2.1	2.0	1.9
4	1.4	1.2	1.2	2.0	2.15	3.2	2.6	2.7	2.1	2.1	2.0	1.9
5	1.3	1.2	1.2	2.0	.....	3.3	2.6	2.6	2.1	2.1	2.0	1.9
6	1.3	1.2	1.2	2.0	2.15	3.35	2.7	2.55	2.1	2.15	2.0	1.9
7	1.3	1.2	1.2	2.0	2.15	3.3	2.75	2.5	2.1	2.2	2.0	.....
8	1.3	1.2	1.2	2.0	2.15	3.2	2.75	2.5	2.1	2.2	2.0	1.9
9	1.3	1.1	1.2	2.0	2.15	3.05	2.6	2.5	2.1	2.2	2.0	1.9
10	.....	1.1	1.2	2.05	2.05	3.05	2.6	2.4	2.1	2.1	2.0	1.9
11	1.3	1.2	1.2	2.05	2.05	3.15	2.6	2.4	2.1	2.1	2.0	1.9
12	1.3	1.2	1.2	2.0	2.05	3.05	2.5	2.4	2.1	2.1	2.0	1.9
13	1.3	1.2	.....	2.0	2.05	3.15	2.8	2.4	2.1	2.1	2.0	1.9
14	1.3	1.2	.....	.....	2.05	3.15	2.8	2.4	2.1	2.1	2.0	1.9

Daily gage height, in feet, of Wallowa River near Joseph, Oreg., for 1905—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
15	1.3	1.2	1.2	2.0	2.0	3.05	2.7	2.35	2.1	2.1	2.0	1.9
16	1.3	1.2	1.3	2.0	2.0	3.05	2.7	2.3	2.05	2.1	2.0	1.9
17	1.3	1.2	1.3	2.05	2.0	3.05	2.6	2.3	2.0	2.1	2.0	1.9
18	1.3	1.2	1.3	2.05	2.0	3.05	2.6	2.3	2.05	2.1	2.0	1.9
19	1.3	1.2	1.3	2.05	2.2	2.95	2.6	2.3	2.0	2.1	2.0	1.9
20	1.2	.....	1.4	2.05	2.15	2.85	2.7	2.25	2.0	2.1	2.0	1.9
21	1.2	1.3	.....	2.1	2.1	2.9	2.8	2.25	2.0	2.1	2.0	1.9
22	1.3	1.2	.....	2.1	2.1	2.9	2.8	2.3	2.0	2.05	1.95	1.9
23	1.3	1.2	.....	2.1	2.15	2.9	2.8	2.25	2.0	2.05	1.95	1.9
24	.....	1.2	1.4	2.1	2.25	2.85	2.7	2.25	.....	2.05	1.9	1.9
25	.....	1.2	.....	2.1	2.3	2.8	2.8	2.25	2.0	2.05	1.9	1.9
26	1.3	1.2	1.4	2.1	2.2	2.8	2.6	2.25	2.0	2.05	1.9	1.9
27	1.3	1.2	1.4	2.1	2.2	2.75	2.7	2.2	2.0	2.05	1.95	1.9
28	1.3	1.2	.....	2.1	2.1	2.6	2.7	2.2	2.05	2.0	1.95	1.9
29	1.3	.....	1.5	2.15	2.15	2.6	2.7	2.2	2.2	2.0	1.95	1.9
30	.....	.....	1.6	2.15	2.15	2.6	.....	2.2	2.2	2.0	1.95	1.95
31	1.3	.....	2.0	.....	2.9	.....	2.8	2.2	.....	2.0	.....	1.9

NOTE.—Gage heights, January 1 to March 30, refer to lake-gage datum. During the remainder of the year gage heights refer to new gage.

Station rating table for Wallowa River near Joseph, Oreg., from November 13, 1903, to March 30, 1905.

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	2.80	344	3.60	609
1.30	63	2.10	175	2.90	374	3.70	643
1.40	73	2.20	195	3.00	406	3.80	677
1.50	85	2.30	216	3.10	439	3.90	711
1.60	97	2.40	238	3.20	473	4.00	745
1.70	110	2.50	262	3.30	507		
1.80	125	2.60	288	3.40	541		
1.90	141	2.70	315	3.50	575		

The above table is applicable only for open-channel conditions. It is based on six discharge measurements made during 1903–4. It is well defined between gage heights 1.5 feet and 3 feet.

Station rating table for Wallowa River near Joseph, Oreg., from March 31 to December 31, 1905.

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	35	2.30	135	2.70	299	3.10	527
2.00	54	2.40	170	2.80	350	3.20	597
2.10	77	2.50	209	2.90	405	3.30	675
2.20	104	2.60	252	3.00	464		

The above table is applicable only for open-channel conditions. It is based on eight discharge measurements made during 1905. It is well defined between gage heights 2 feet and 2.8 feet.

Estimated monthly discharge of Wallowa River near Joseph, Oreg., for 1905.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January	73	53	63.6	3,911
February	63	45	53.0	2,943
March	97	53	62.6	3,849
April	90	54	64.7	3,850
May	405	54	94.0	5,780
June	717	252	473	28,140
July	350	209	293	18,020
August	350	104	172	10,580
September	104	54	70.8	4,213
October	104	54	74.7	4,593
November	54	35	50.1	2,981
December	44	35	35.3	2,170
The year	717	35	126	91,030

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 takes water from the river about 300 feet above the bridge on the right bank.

The channel is straight for 400 feet above and 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, is 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.

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.

A staff gage is fastened vertically to the downstream side of the timber crib pier on the right bank. During 1905 the gage was read once each day by L. S. Johnson. Bench marks were established as follows: (1) 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; elevation, 6.60 feet. (2) A square chisel draft on top of a rock near the rail fence across the ditch 50 feet from the right end of the bridge; elevation, 8.10 feet. Elevations refer to the datum of the gage.

Information in regard to this station is contained in the following Water-Supply Papers of the United States Geological Survey:

Description: 100, p 417; 135, pp 232-233.
Discharge: 100, p 417; 135, p 233.
Discharge, monthly: 135, p 234.
Gage heights: 100, p 417; 135, pp 233-234.
Rating table: 135, p 234.

Discharge measurements of Wallowa River near Wallowa, Oreg., in 1905.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Square-feet.*	*Feet per second.*	*Feet.*	*Second-feet.*
March 31	W. C. Sawyer	81.5	93	3.45	1.93	322
May 19	do	88.0	173	4.71	2.86	816
July 8	do	86.0	142	4.32	2.56	614
September 18	do	84.0	80	2.49	1.72	199
November 29	R. S. Hall	82.0	98	2.65	1.90	261

Daily gage height, in feet, of Wallowa River near Wallowa, Oreg., for 1905.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.0	1.7	1.9	2.0	2.4	3.9	2.8	1.9	1.7	2.0	2.0	1.85
2	1.9	1.8	1.9	2.0	2.4	3.9	2.8	1.9	1.7	1.9	2.0	1.85
3	1.9	1.8	2.0	2.0	2.5	4.0	2.8	1.9	1.7	1.9	2.0	1.85
4	1.8	1.8	2.0	2.0	2.5	4.0	2.8	1.9	1.7	1.9	1.95	1.9
5	1.7	1.8	2.0	2.0	2.5	3.8	2.8	1.9	1.7	1.85	1.95	1.9
6	1.8	1.8	2.0	2.1	2.5	3.7	2.8	1.8	1.7	1.85	1.95	1.9
7	1.8	1.8	2.0	2.1	2.6	3.6	2.8	1.8	1.7	2.0	1.95	1.9
8	1.8	1.8	2.0	2.3	2.7	3.7	2.5	1.8	1.7	2.0	1.95	1.9
9	1.8	1.7	2.0	2.3	2.8	4.2	2.5	1.7	1.7	2.0	1.95	1.75
10	1.8	1.7	2.0	2.3	2.2	4.0	2.5	1.7	1.7	2.0	1.95	1.7
11	1.7	1.5	2.0	2.2	2.6	4.0	2.3	1.7	1.7	2.0	1.9	1.7
12	1.8	1.5	2.0	2.2	2.5	4.0	2.3	1.7	1.7	2.0	1.9	2.0
13	2.2	2.0	2.0	2.2	2.5	3.9	2.3	1.7	1.7	2.0	1.9	2.4
14	1.8	2.3	2.1	2.1	2.5	3.8	2.3	1.7	1.7	2.0	1.9	2.4
15	1.8	2.3	2.1	2.1	2.4	3.6	2.2	1.6	1.7	2.05	1.9	2.4
16	1.8	2.5	2.1	2.1	2.5	3.9	2.2	1.6	1.8	2.1	1.85	2.0
17	1.8	2.5	2.1	2.1	3.0	3.7	2.2	1.7	1.8	2.0	1.85	1.8
18	1.8	2.5	2.1	2.0	2.9	3.0	2.0	1.7	1.8	2.0	1.95	1.8
19	1.8	1.7	2.1	2.1	2.9	3.0	2.0	1.7	1.7	2.0	1.95	1.8
20	1.8	1.9	2.1	2.1	3.0	3.1	2.0	1.7	1.7	2.0	1.95	1.8
21	1.8	2.0	2.1	2.2	2.8	3.1	1.9	1.7	1.7	2.0	1.9	1.8
22	1.8	2.0	2.1	2.2	2.7	3.1	1.8	1.7	1.7	2.0	1.85	1.8
23	1.8	2.0	2.0	2.3	2.6	3.1	1.8	1.7	1.7	2.0	1.8	1.8
24	1.9	2.0	2.0	2.4	2.5	3.2	1.8	1.7	1.7	2.0	1.8	1.8
25	2.3	2.0	2.0	2.5	2.5	3.1	1.8	1.7	1.7	2.05	1.85	1.85
26	2.0	2.0	2.1	2.8	2.6	3.0	1.9	1.7	1.7	2.1	2.0	1.8
27	2.0	2.0	2.1	2.7	2.9	2.9	1.9	1.7	1.9	2.05	2.0	1.8
28	2.0	2.0	2.0	2.5	3.0	2.8	1.8	1.7	2.05	2.05	1.9	1.8
29	1.9	.....	2.0	2.4	3.0	2.7	1.9	1.7	2.0	2.05	1.9	1.8
30	1.9	.....	2.0	2.5	3.2	2.9	1.9	1.7	2.0	2.0	1.9	1.8
31	1.8	.....	2.0	.....	3.5	.....	1.9	1.7	.....	2.0	.....	1.8

NOTE.—Anchor ice during part of January, February, and December.

Station rating table for Wallowa River near Wallowa, Oreg., from January 1 to December 31, 1905.

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	140	2.20	412	2.90	862	3.60	1,616
1.60	168	2.30	462	3.00	960	3.70	1,730
1.70	200	2.40	514	3.10	1,063	3.80	1,844
1.80	236	2.50	568	3.20	1,169	3.90	1,958
1.90	276	2.60	626	3.30	1,277	4.00	2,072
2.00	318	2.70	693	3.40	1,388	4.10	2,186
2.10	364	2.80	772	3.50	1,502	4.20	2,300

The above table is applicable only for open-channel conditions. It is based on nine discharge measurements made during 1903–1905. It is fairly well defined between gage heights 1.7 feet and 3.1 feet.
The table has been extended beyond these limits.
Above gage height 2.6 feet the table is the same as that of 1904.

Estimated monthly discharge of Wallowa River near Wallowa, Oreg., for 1905.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January	462	200	264	16,230
February	318	140	228	12,660
March	364	276	332	20,410
April	772	318	431	25,650
May	1,502	412	715	43,960
June	2,300	693	1,505	89,550
July	772	236	451	27,730
August	276	168	214	13,160
September	341	200	219	13,030
October	364	256	317	19,490
November	318	236	285	16,960
December	514	200	274	16,850
The year	2,300	140	436	315,700

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, 12 miles from Elgin, Oreg. The station is in Wallowa Canyon about 9 miles below the lower end of Wallowa Valley.

The channel is straight for 100 feet above and 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, and is free from vegetation and not liable to shift. There is but one channel at all stages.

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 gage is in two sections, located under the lower side of the bridge on the left bank. The lower or inclined section reads from 1.7 to 3 feet. The upper or vertical section reads from 3 to 10 feet. During 1905 the gage was read once each day by Samuel Spores and G. W. Weir. Bench marks were established as follows: (1) The highest point of the rock to which the vertical section of the gage is fastened, 6 inches from the gage rod; elevation, 9.60 feet. (2) The center of the hole in the rock in which the bolt supporting vertical rod is set; elevation, 7.07 feet. Elevations refer to the datum of the gage.

Information in regard to this station is contained in the following Water-Supply Papers of the United States Geological Survey:

Description: 100, pp 416–417; 135, p 235.
Discharge: 100, p 417; 135, p 235.
Discharge, monthly: 135, p 237.
Gage heights: 100, p 417; 135, p 236.
Rating table: 135, p 236.

Discharge measurements of Wallowa River near Elgin, Oreg., in 1905.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Square feet.*	*Feet per second.*	*Feet.*	*Second-feet.*
April 1	W. C. Sawyer	140	218	3.66	2.85	800
May 20	do	161	383	4.84	3.86	1,854
July 7	do	160	296	3.74	3.27	1,107
September 16	do	145	138	2.16	2.18	298
November 30 [a]	R. S. Hall	172	209	1.70	2.34	358

[a] Made at different section.

Daily gage height, in feet, of Wallowa River near Elgin, Oreg., for 1905.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.5	2.4	2.7	2.9	3.2	4.9	3.3	2.4	2.0	2.45	2.5	2.3
2	2.5	2.4	2.7	2.9	3.2	5.0	3.5	2.4	2.0	2.4	2.6	2.3
3	2.5	2.4	2.8	2.9	3.3	5.0	3.5	2.4	2.0	2.4	2.6	2.3
4	2.3	2.4	2.8	2.9	3.3	4.9	3.5	2.4	2.0	2.35	2.6	2.3
5	2.3	2.3	2.8	3.0	3.5	4.7	3.5	2.4	2.0	2.35	2.55	2.3
6	2.3	2.3	2.8	3.0	3.5	4.4	3.4	2.3	2.0	2.35	2.5	2.3
7	2.3	2.3	2.8	3.1	3.6	4.4	3.4	2.3	2.0	2.6	2.5	2.3
8	2.2	2.2	2.7	3.1	3.7	4.6	3.3	2.3	2.0	2.55	2.5	2.3
9	2.2	2.1	2.7	3.1	3.7	5.0	3.2	2.3	2.0	2.55	2.5	2.3
10	2.1	2.0	2.7	3.1	3.6	4.9	3.2	2.3	2.0	2.5	2.5	2.05
11	2.1	2.0	2.7	3.0	3.5	4.9	3.1	2.3	2.0	2.55	2.45	2.05
12	2.2	2.0	2.7	3.0	3.4	4.8	2.9	2.3	2.0	2.6	2.45	2.1
13	2.3	2.0	2.7	3.0	3.3	4.6	2.8	2.2	2.0	2.6	2.45	2.1
14	2.3	2.2	2.9	2.9	3.3	4.4	2.6	2.1	2.0	2.6	2.4	2.1
15	2.4	2.2	2.9	2.9	3.3	4.2	2.7	2.1	2.0	2.7	2.4	2.15
16	2.4	2.3	2.9	2.9	3.4	3.6	2.6	2.1	2.0	2.65	2.4	2.15
17	2.4	2.4	2.8	2.9	3.9	3.5	2.6	2.1	2.2	2.7	2.4	2.2
18	2.4	2.6	2.8	2.8	3.8	3.8	2.5	2.1	2.2	2.6	2.4	2.2
19	2.4	2.5	2.8	2.8	3.8	3.8	2.5	2.1	2.2	2.6	2.45	2.2
20	2.3	2.5	2.8	2.9	4.0	3.9	2.5	2.0	2.2	2.6	2.5	2.3
21	2.3	2.5	2.8	2.9	3.7	4.0	2.5	2.0	2.2	2.6	2.5	2.4
22	2.3	2.5	2.8	3.0	3.6	4.1	2.5	2.0	2.2	2.55	2.5	2.3
23	2.3	2.5	2.8	3.2	3.5	3.9	2.5	2.0	2.2	2.6	2.35	2.35
24	2.4	2.6	2.8	3.3	3.4	4.0	2.5	2.0	2.2	2.65	2.35	2.3
25	2.8	2.7	2.8	3.4	3.3	3.8	2.5	2.0	2.2	2.65	2.4	2.4
26	2.6	2.7	2.8	3.7	3.4	3.7	2.5	2.0	2.2	2.8	2.4	2.5
27	2.6	2.7	2.9	3.5	3.8	3.6	2.5	2.0	2.25	2.7	2.35	2.6
28	2.6	2.7	2.9	3.3	3.8	3.5	2.5	2.0	2.5	2.6	2.3	2.4
29	2.5	.....	2.9	3.2	3.9	3.4	2.4	2.0	2.6	2.6	2.3	2.4
30	2.4	.....	2.9	3.3	4.2	3.3	2.4	2.0	2.45	2.6	2.3	2.4
31	2.4	.....	2.9	.....	4.9	.....	2.4	2.0	.....	2.55	.....	2.85

NOTE.—No ice record.

Station rating table for Wallowa River near Elgin, Oreg., from January 1 to December 31, 1905.

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	215	2.80	680	3.60	1,550	4.40	2,670
2.10	255	2.90	770	3.70	1,680	4.50	2,830
2.20	300	3.00	870	3.80	1,810	4.60	2,990
2.30	350	3.10	970	3.90	1,940	4.70	3,150
2.40	405	3.20	1,080	4.00	2,080	4.80	3,310
2.50	465	3.30	1,190	4.10	2,220	4.90	3,480
2.60	530	3.40	1,310	4.20	2,370	5.00	3,650
2.70	600	3.50	1,430	4.30	2,520		

The above table is applicable only for open-channel conditions. It is based on eight discharge measurements made during 1903–1905. It is well defined between gage heights 2.2 feet and 4 feet.

Estimated monthly discharge of Wallowa River near Elgin, Oreg., for 1905.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January	680	255	396	24,350
February	600	215	401	22,270
March	770	600	683	42,000
April	1,680	680	944	56,170
May	3,480	1,080	1,581	97,210
June	3,650	1,190	2,451	145,800
July	1,430	405	768	47,220
August	405	215	287	17,650
September	530	215	273	16,240
October	680	378	512	31,480
November	530	350	434	25,820
December	725	235	355	21,830
The year	3,650	215	740	548,000

DITCHES IN WALLOWA RIVER VALLEY, OREGON.

SILVER LAKE DITCH NEAR JOSEPH, OREG.

This ditch diverts water from the right bank of Wallowa River about 1 mile above Joseph and one-eighth mile below the outlet of Wallowa Lake. Its head is 75 feet below the river gaging station.

The gage is a vertical rod on the left bank one-fourth mile below the bend, and is read twice a week by F. L. Bedingfield.

Discharge measurements of Silver Lake ditch near Joseph, Oreg., in 1905.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Square feet*	*Feet per second*	*Feet.*	*Second-feet*
July 12	W. C. Sawyer	12	20.5	3.61	1.30	74.1
September 19	do	11	10.4	1.55	.43	16.1
November 27	do	10	6.2	.47	.10	2.9

Daily gage height, in feet, of Silver Lake ditch near Joseph, Oreg., for 1905.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1					0.45		16		1.0	0.45			0.05
2		(a)	0.5			0.05	18				0.5	0.1	
4				0.3	.2		19	1.3	1.0				
5		1.2					20			.35			
6			.45			.05	21				.3		
7				.3			22	1.3				.1	
8					.2		23		1.0	.3			.05
9			.5			.05	25				.45	.1	
10		1.1		.5			26	1.0	1.0				
11					.2		27			.3			.05
12		(a)					28				.45		
13			.45			.05	29	1.0				.0	
15	1.3						30		.9	.3			.25

a Dry.

FARMERS AND CITIZENS DITCH NEAR JOSEPH, OREG.

This ditch diverts water from the right bank of Wallowa River a few hundred feet below the head of the Silver Lake ditch.

The gage is vertical and is attached to the left side of the flume near the lower end.

The zero of the gage is the bottom of the flume. The gage was read twice a week by F. L. Bedingfield.

Discharge measurements of Farmers and Citizens ditch near Joseph, Oreg., in 1905.

Date.	Hydrographer.	Width	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Square feet.*	*Feet per second.*	*Feet.*	*Second-feet.*
July 11	W. C. Sawyer	11.4	22.4	3.06	1.93	68.5
November 27	R. S. Hall	11.8	10.0	1.12	.75	11.2

Daily gage height, in feet, of Farmers and Citizens ditch near Joseph, Oreg., for 1905.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1					0.65		16		1.5	0.8			0.5
2		1.9	0.9			0.5	18				0.7	0.6	
4				0.7	.7		19	2.0	1.4				
5		1.9					20			.8			
6			.9			.5	21				.7		
7				.75			22	2.1				.7	
8					.7		23		1.0	.6			.55
9			.85			.5	25				.7	.5	
10		1.9		.7			26	.3	.9				
11					.65		27			.6			.5
12		1.8					28				.65		
13			.85			.5	29	1.7				.75	
15	1.9						30		.9	.7			.4

GRANGER DITCH AT JOSEPH, OREG.

This ditch diverts water from the right bank of Wallowa River in the upper part of Joseph.

The gage is a vertical rod attached to the lower side of a wagon bridge a short distance below the lower end of the flume.

Gagings were made from this bridge.

Discharge measurements of Granger ditch at Joseph, Oreg., in 1905.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Square feet.*	*Feet per second.*	*Feet.*	*Second-feet.*
July 12	W. C. Sawyer	12.5	20.6	3.73	1.34	76.9
November 27	R. S. Hall	13.8	9.4	.98	.30	9.1

Daily gage height, in feet, of Granger ditch at Joseph, Oreg., for 1905.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1					0.4		16		0.5	0.4			0.25
2		2.2	0.4			0.3	18				0.5	0.4	
4				0.5	.4		19	0.6	.4				
5		1.0					20			.35			
6			.4				21				.5		
7				.55			22	1.7				.4	
8					.4		23		.5	.5			.25
9			.4			.3	25				.5	.35	
10		.4		.55			26	1.8	.4				
11					.35		27			.6			.25
12		.9					28				.4		
13			.4			.3	29	1.8				.35	
15	1.0						30		.35	.5			.25

BIG BEND DITCH AT JOSEPH, OREG.

This ditch diverts water from the right bank of Wallowa River in the upper part of Joseph.

The gage is attached to the side of the flume near the lower end. The zero of the gage is the bottom of the flume.

Gagings were made from the wagon bridge below the end of the flume.

Discharge measuzements of Big Bend ditch at Joseph, Oreg., in 1905.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Square feet.*	*Feet per second.*	*Feet.*	*Second-feet.*
July 12	W. C. Sawyer	15.0	21.2	3.43	1.10	72.7
November 27	R. S. Hall	12.5	5.2	1.57	.40	8.2

Daily gage height, in feet, of Big Bend ditch at Joseph, Oreg., for 1905.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1					0.5		16		0.25	.25			0.4
2		1.2	0.35			0.2	18				0.5	0.6	
4				0.3	.6		19	0.8	.3				
5		.7					20			.55			
6			.35			.3	21				.5		
7				.4			22	1.1				.0	
8					.6		23		.2	0.6			.3
9			.35			.3	25				.45	.65	
10		.3		.5			26	.9	.2				
11					.45		27			.7			.25
12		.5					28				.45		
13			.5			.3	29	.9				.3	
15	0.9						30		.3	.55			.25

COMPANY DITCH NEAR WALLOWA, OREG.

This ditch diverts the water from the right bank of Wallowa River about 1,000 feet above the river gaging station.

The gage is a vertical rod on the right bank nearly opposite the river gaging station. Gagings were made from the bridge at the gage.

Discharge measurements of Company ditch near Wallowa, Oreg., in 1905.

Date.	Hydrographer.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Square feet.	*Feet per second.*	*Feet.*	*Second-feet.*
May 19	W. C. Sawyer	13.8	1.78	2.60	24.6
July 8	do	10.8	1.09	2.15	11.8
September 18	do	8.3	.77	1.82	6.4
November 28	R. S. Hall	7.6	1.03	1.90	7.8

Daily gage heights, in feet, of Company ditch near Wallowa, Oreg., for 1905.

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
2						1.9		
3							2.0	
4								1.9
6						1.85	1.95	
8			2.15					1.9
9				1.7		2.0		
10							1.95	
11								1.7
13						2.0	1.9	
15					1.7			
16						2.1		
17							1.85	
18					1.82			1.8
19	2.6							
20						2.0	1.95	
22					1.8			

Daily gage heights, in feet, of Company ditch near Wallowa, Oreg., for 1905—Continued.

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
23						2.0		
24							1.8	
25					1.75			
27						2.05	2.0	
28							1.9	
29					2.0			
30						2.0		

Estimated monthly discharge of Company ditch near Wallowa, Oreg., for 1905.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
May (22 days)	25	25	25.0	1,091
June	35	35	35.0	2,083
July	20	6	11.5	707
August	8	5	5.55	341
September	9	5	5.9	351
October	11	7	8.87	545
November	9	6	7.93	472
December	12	5	7.32	450
The period				6,040

NOTE.—Discharge estimated between May 10 and September 15.

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.

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 and is free from vegetation and fairly permanent. There is one channel at low and two channels at high stages.

Discharge measurements are made from 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 over the mean edge of the left abutment, and marked zero. At low water the current near the right bank may flow diagonally toward the center of the stream; at such times it is advisable to make the measurements from the upstream side of the bridge. During high stages the water at the upstream side is too swift for accurate measurements.

A staff gage is fastened vertically to the downstream face of the left abutment. During 1905 the gage was read once each day by M. E. Turner. Bench marks were established as follows: (1) 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, marked "U. S. G. S. B. M.;" elevation, 6.44 feet. (2) 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.;" elevation, 7.57 feet. Elevations refer to the datum of the gage.

A description of this station and gage height and discharge data are contained in Water-Supply Paper No. 135, United States Geological Survey, pages 237–239.

Daily gage height, in feet, of Asotin Creek 1¼ miles above Asotin, Wash., for 1905.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.4	2.3	2.7	3.1	3.2	3.1	2.8	2.1	2.2	2.4	2.4	2.4
2	2.3	2.3	2.7	3.0	3.2	3.1	2.8	2.1	2.3	2.4	2.4	2.4
3	2.3	2.3	2.8	3.0	3.3	3.4	2.7	2.1	2.3	2.4	2.4	2.4
4	2.3	2.3	2.8	3.0	3.3	3.3	2.7	2.1	2.2	2.4	2.4	2.4
5	2.3	2.3	2.8	3.0	3.2	3.3	2.7	2.1	2.2	2.4	2.4	2.4
6	2.3	2.3	2.8	3.0	3.2	3.3	2.7	2.1	2.3	2.4	2.4	2.4
7	2.3	2.3	2.8	3.1	3.2	3.2	2.6	2.1	2.3	2.4	2.4	2.4
8	2.3	2.3	2.8	3.1	3.2	3.2	2.6	2.1	2.3	2.4	2.4	2.4
9	2.3	2.3	2.8	3.2	3.3	3.2	2.5	2.1	2.3	2.4	2.4	2.4
10	2.2	2.3	2.8	3.2	3.3	3.2	2.4	2.1	2.3	2.4	2.4	2.4
11	2.2	2.0	2.8	3.1	3.3	3.1	2.4	2.1	2.3	2.4	2.4	2.4
12	2.3	2.0	2.8	3.1	3.3	3.4	2.4	2.1	2.3	2.4	2.4	2.4
13	2.3	2.8	2.8	3.1	3.3	3.1	2.3	2.1	2.3	2.4	2.4	2.4
14	2.4	2.8	2.8	3.1	3.3	3.0	2.3	2.1	2.3	2.4	2.4	2.4
15	2.3	2.8	2.8	3.1	3.3	2.9	2.2	2.1	2.3	2.4	2.4	2.4
16	2.3	2.9	2.8	3.1	3.2	2.9	2.2	2.1	2.4	2.4	2.4	2.4
17	2.3	2.9	2.8	3.1	3.3	2.8	2.2	2.2	2.4	2.4	2.4	2.4
18	2.3	3.0	3.0	3.1	3.3	2.8	2.2	2.3	2.4	2.4	2.4	2.4
19	2.3	2.9	3.0	3.1	3.2	2.8	2.2	2.3	2.3	2.4	2.4	2.4
20	2.2	3.1	3.0	3.3	3.2	2.7	2.2	2.3	2.3	2.4	2.4	2.4
21	2.2	3.1	3.0	3.2	3.2	2.7	2.1	2.3	2.3	2.4	2.4	2.4
22	2.2	2.7	3.0	3.2	3.2	2.6	2.1	2.3	2.3	2.4	2.4	2.4
23	2.2	2.6	3.0	3.2	3.2	2.7	2.1	2.3	2.3	2.4	2.4	2.4
24	2.4	2.6	3.0	3.3	3.1	2.8	2.1	2.3	2.3	2.4	2.4	2.4
25	2.3	2.6	3.0	3.3	3.1	2.9	2.1	2.3	2.3	2.4	2.4	2.4
26	2.3	2.6	3.3	3.3	3.1	3.0	2.1	2.2	2.3	2.4	2.4	2.4
27	2.3	2.7	3.2	3.2	3.1	3.0	2.1	2.2	3.1	2.4	2.4	2.4
28	2.3	2.7	3.2	3.2	3.1	3.0	2.1	2.2	2.7	2.4	2.4	2.4
29	2.3	.....	3.2	3.2	3.1	2.8	2.1	2.2	2.5	2.4	2.4	2.4
30	2.3	.....	3.2	3.2	3.1	2.8	2.1	2.2	2.5	2.4	2.4	2.4
31	2.3	.....	3.1	.....	3.1	.....	2.1	2.2	.....	2.4	2.4	2.4

NOTE.—No ice record.

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 headgate of Shelman's irrigation ditch.

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 and is free from vegetation and fairly permanent. There is one channel at ordinary and two at extreme high stages.

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.

A staff gage is fastened to a tree on the left bank. During 1905 the gage was read once each day by J. W. Whittaker. 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.;" elevation, 10.00 feet above the datum of the gage.

A description of this station, with gage heights and discharge data, is contained in Water-Supply Paper No. 135, United States Geological Survey, pages 239–240.

Daily gage height, in feet, of Asotin Creek at Shelman's ranch, near Asotin, Wash., for 1905.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.7	1.82	1.85	1.7	1.45	1.45	1.5	1.5	1.5
2	1.7	1.78	1.92	1.65	1.45	1.45	1.5	1.5	1.5
3	1.7	1.8	2.6	1.62	1.45	1.45	1.5	1.5	1.5
4	1.65	1.8	2.5	1.65	1.45	1.45	1.5	1.5	1.5
5	1.65	1.8	2.47	1.62	1.45	1.45	1.5	1.5	1.5
6	1.65	1.8	2.45	1.6	1.45	1.45	1.5	1.45	1.5
7	1.75	1.8	2.45	1.55	1.45	1.45	1.5	1.45	1.5
8	1.75	1.8	2.45	1.55	1.45	1.45	1.5	1.48	1.5
9	1.77	1.8	2.42	1.55	1.45	1.45	1.5	1.5	1.45
10	1.75	1.82	2.38	1.55	1.45	1.45	1.5	1.5	1.5
11	1.75	1.85	2.35	1.55	1.45	1.45	1.5	1.5	1.5
12	1.75	1.8	2.5	1.5	1.45	1.45	1.5	1.5	1.5
13	1.75	1.8	2.5	1.5	1.45	1.45	1.5	1.5	1.5
14	1.7	1.8	2.45	1.5	1.45	1.45	1.5	1.5	1.5
15	1.72	1.82	2.4	1.5	1.45	1.45	1.5	1.45	1.5
16	1.7	1.85	2.37	1.5	1.45	1.45	1.5	1.5	1.5
17	1.7	1.9	2.27	1.5	1.45	1.45	1.5	1.5	1.5
18	1.7	1.9	2.25	1.5	1.45	1.45	1.5	1.5	1.5
19	1.8	1.9	2.25	1.5	1.45	1.45	1.5	1.5	1.5
20	1.8	1.9	2.25	1.5	1.45	1.45	1.5	1.45	1.5
21	1.82	1.85	2.25	1.5	1.45	1.45	1.5	1.48	1.45
22	1.82	1.85	2.25	1.45	1.45	1.45	1.5	1.5	1.45
23	1.8	1.85	2.25	1.45	1.45	1.45	1.5	1.5	1.45
24	1.82	1.8	2.25	1.45	1.45	1.45	1.5	1.5	1.45
25	1.85	1.8	2.62	1.45	1.45	1.45	1.55	1.5	1.45
26	1.85	1.8	1.82	1.45	1.45	1.5	1.5	1.5	1.55
27	1.85	1.75	2.25	1.45	1.45	1.65	1.5	1.5	1.5
28	1.85	1.8	1.7	1.45	1.45	1.6	1.5	1.5	1.5
29	1.85	1.85	1.72	1.45	1.45	1.5	1.55	1.5	1.5
30	1.85	1.85	1.6	1.45	1.45	1.5	1.55	1.5	1.5
31	.....	1.85	.....	1.45	1.45	.....	1.5	.....	1.45

PALOUSE RIVER AT ELBERTON, WASH.

This station was established May 6, 1904, by W. G. Steward, and was discontinued September 30, 1905, owing to changes in the dam near by. It is located at the highway bridge about one-half mile above the depot in Elberton, Wash.

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 (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, is free from vegetation, and is shifting. All the water flows in one channel at low and in two at high stages.

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. 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.

A staff gage is fastened vertically to the south end of the face of the left abutment of the bridge. During 1905 the gage was read once each day by W. B. Peoples. Bench marks were established as follows: (1) 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; elevation, 2,198.05 feet above sea level and 5.80 feet above the datum of the gage. (2) A square black-paint mark on the southeast window sill of the hotel; elevation, 2,203.91 feet above sea level and 11.66 feet above the datum of the gage. (3) 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; elevation, 2,206.01 feet above sea level and 13.76 feet above the datum of the gage.

May 24, 1905, a discharge measurement made at this station by W. J. Lightfoot gave the following results: Width, 68 feet; area of section, 116 square feet; mean velocity, 1.93 feet per second; gage height, 2.3 feet; discharge, 224 second-feet.

A description of this station, with gage heights, discharge data, and rating table, is contained in Water-Supply Paper No. 135, United States Geological Survey, pages 240–243.

Daily gage height, in feet, of Palouse River at Elberton, Wash., for 1905.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	1.7	1.8	2.0	2.3	2.0	2.2	1.6	0.8	0.7
2	1.9	1.8	2.2	2.10	1.9	2.0	1.6	1.0	.7
3	1.8	1.8	2.0	2.0	2.0	1.5	1.6	.9	.7
4	1.7	1.8	1.9	2.5	2.0	2.3	1.4	.8	.7
5	1.6	1.8	2.7	2.2	1.9	3.0	1.1	.8	.7
6	2.0	1.8	1.7	2.0	1.4	2.7	1.1	.8	.7
7	1.9	1.9	2.6	1.7	1.3	3.5	2.1	.7	.7
8	1.7	1.8	2.0	2.4	1.9	3.0	1.3	.7	.7
9	1.7	1.8	1.8	2.3	1.4	2.9	1.5	.7	.7
10	1.7	1.7	2.0	2.3	1.9	2.6	1.3	1.2	.7
11	1.7	1.6	2.6	2.3	1.4	2.4	1.1	.9	.7
12	1.7	1.6	1.7	2.3	2.2	2.3	1.4	.7	.7
13	1.6	1.6	1.7	2.4	2.5	2.2	1.1	.8	.7
14	1.6	1.6	2.0	2.0	2.0	2.0	.9	.7	.7
15	1.6	1.6	1.7	1.7	2.0	2.0	1.2	.7	.8
16	1.7	1.6	1.7	2.5	2.0	1.9	1.0	.7	.8
17	1.6	1.6	1.8	1.7	2.0	1.3	1.0	.7	.8
18	1.5	1.6	2.7	1.8	2.0	1.6	1.4	1.0	.8
19	1.7	1.6	1.9	2.4	1.5	1.2	1.1	.8	.9
20	1.7	1.6	1.7	3.5	2.3	2.15	1.0	.5	.8
21	1.6	1.6	3.3	3.6	2.0	1.8	1.1	.7	.8
22	1.6	1.8	1.6	2.0	2.2	1.2	1.1	.7	.9
23	1.7	1.8	2.6	2.4	2.3	1.2	.8	.7	1.3
24	1.9	1.8	1.8	2.0	2.3	1.6	1.2	.7	1.4
25	1.8	1.8	3.7	3.7	2.9	1.1	1.0	.6	1.4
26	1.8	2.0	2.9	2.3	3.3	1.2	1.3	.6	1.4
27	1.9	2.2	3.7	2.4	2.9	1.8	1.1	.6	1.3
28	1.9	2.0	2.7	2.2	1.8	2.0	1.1	1.1	1.2
29	1.9	.....	3.0	2.0	2.8	1.8	.9	.9	1.0
30	2.0	.....	2.5	2.0	2.5	1.7	.9	.9	1.0
31	2.0	.....	2.4	.....	2.5	.....	.9	.8	.....

NOTE.—Sudden changes are due to flow being controlled by dam.

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 flows in a general southwesterly direction through a rolling country. Six miles below Hooper, Wash., the river bends suddenly to the south and enters its canyon, through which it flows to its junction with Snake River. For some distance above Hooper the river consists of a succession of 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 130 feet in height.

The measurements of Palouse River are of value in showing the amount of water that could be utilized for irrigation on lands of Washtucna Valley and in the section north of Pasco.

The gaging station at Hooper, Wash., was originally established April 1, 1897, by the land department of the Northern Pacific Railway. The United States Geological Survey assumed charge September 9, 1897, and moved the station about 1 mile downstream.

The channel is straight for 200 feet above and 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, but bowlders in the bed make it difficult to obtain accurate results at this point at low water. There is but one channel at all stages.

Discharge measurements are made by means of a cable, car, tagged wire, and stay wire. The initial point for soundings is the cable post on the left bank.

Owing to various conditions it has been necessary to use several gages, all having the same datum. The present gage, known as gage No. 4, is in two sections. The lower section is inclined, the upper is vertical. During 1905 the gage was read once each day by Frank Hill. Bench marks were established as follows: (1) The highest point on a ledge of rock on the left bank 200 feet below the cable; elevation, 7.60 feet. (2) 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; elevation, 10.88 feet. Elevations refer to the datum of the gage.

Information in regard to this station is contained in the following publications of the United States Geological Survey (Ann=Annual Report; WS=Water-Supply Paper):

Description: WS 16, p 172; 28, p 155; 38, pp 360–361; 51, p 443; 66, p 136; 85, pp 203–204; 100, pp 413–414; 135, pp 243–244.

Discharge: Ann 19, iv, p 460; WS 16, p 172; 28, p 168; 51, p 444; 85, p 204; 100, p 414; 135, p 245.

Discharge, monthly: Ann 20, iv, pp 489, 514; 21, iv, p 414; 22, iv, p 452; WS 75, p 206; 85, p 205; 135. p. 247.

Discharge, yearly: Ann 20, iv, p 62.

Gage heights: WS 16, p 172; 28, p 162; 38, p 361; 51, p 444; 66, p 137; 85, p 204; 100, p 415; 135, pp 245–246,

Hydrographs: Ann 20, iv, p 490; 21, iv, p 415; 22, iv, p 452.

Rainfall and run-off relation: Ann 20, iv, p 514.

Rating tables: WS 28, p 170; 39, p 454; 52, p 522; 66, p 177; 85, p 205; 135, p 246.

Discharge measurements of Palouse River at Hooper, Wash., in 1905.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Square feet*	*Feet per second*	*Feet.*	*Second-feet.*
May 18	W. J. Lightfoot	84	153	1.72	2.30	264
November 23	W. C. Sawyer	66	74	.74	1.13	55

Daily gage height, in feet, of Palouse River at Hooper, Wash., for 1905.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.6	2.55	2.5	3.8	2.4	2.75	1.85	0.85	0.65	0.8	1.3	1.45
2	2.0	3.0	2.5	3.8	2.3	2.45	1.85	.85	.65	.95	1.1	2.35
3	1.75	2.2	2.45	3.4	2.3	2.6	1.8	.85	.65	1.0	1.35	1.95
4	1.7	2.7	2.4	2.85	2.3	2.4	1.75	.8	.65	1.0	1.3	1.65
5	2.05	2.45	2.3	3.1	2.25	2.0	1.6	.8	.6	1.0	1.4	1.45
6	1.75	2.3	2.15	2.9	2.2	2.55	1.55	.8	.6	1.4	1.65	1.55
7	1.5	2.3	2.55	2.65	2.1	3.0	1.45	.8	.6	1.3	1.55	1.7
8	1.5	2.2	2.25	2.6	2.0	3.75	1.35	.8	.6	1.6	1.45	1.6
9	1.5	2.1	2.65	2.65	1.85	3.35	1.35	.8	.6	1.7	1.35	2.0
10	1.45	2.05	2.5	2.8	2.10	3.1	1.4	.8	.6	1.5	1.2	1.75
11	1.4	[a]3.1	2.3	2.6	2.0	2.85	1.4	.8	.6	1.5	1.2	1.55
12	1.4	1.8	2.3	2.55	2.1	2.7	1.3	.75	.6	1.45	1.3	1.45
13	1.4	1.8	2.55	2.55	2.05	2.5	1.25	.75	.6	1.3	1.2	1.4
14	1.4	1.95	2.1	2.5	2.6	2.35	1.2	.75	.65	1.4	1.2	1.4
15	1.3	1.9	2.4	2.5	3.0	2.3	1.2	.75	.7	1.4	1.2	1.5
16	1.3	1.95	2.15	2.2	2.6	2.15	1.2	.75	.7	1.4	1.4	1.5
17	1.45	1.9	2.45	2.15	3.1	2.05	1.2	.75	.7	1.35	1.5	1.6
18	1.5	1.95	2.1	2.55	2.3	2.0	1.15	.75	.7	1.35	1.4	1.75
19	1.5	1.9	2.05	2.25	2.95	1.75	1.15	.75	.7	1.3	1.35	1.65
20	1.5	2.0	2.6	2.35	2.2	1.95	1.15	.75	.7	1.3	1.3	1.8
21	1.5	1.95	2.35	2.65	1.9	1.70	1.1	.75	.7	1.3	1.25	1.75
22	1.5	1.95	2.8	2.95	2.3	1.55	1.1	.7	.7	1.7	1.2	1.75
23	1.6	2.05	2.8	2.95	2.95	2.05	1.1	.7	.7	1.5	1.1	1.7
24	2.45	2.15	2.5	3.75	2.35	1.70	1.05	.7	.7	1.4	1.25	1.6
25	3.45	2.45	2.6	3.3	2.45	1.6	1.05	.7	.7	1.3	1.35	1.95
26	3.0	2.4	2.75	3.2	2.5	2.15	1.0	.7	.7	1.2	1.35	1.8
27	2.75	2.4	3.3	3.2	3.45	1.8	1.9	.7	.75	1.2	1.25	2.0
28	2.7	2.45	4.2	2.6	3.25	1.65	.85	.7	.75	1.5	1.2	1.7
29	2.85	.....	4.2	2.5	3.25	2.0	.85	.65	.75	1.65	1.35	1.5
30	2.8	.....	4.1	2.45	2.6	1.7	.85	.65	.75	1.4	1.4	1.6
31	2.7	.....	3.7	.....	2.6	.....	.85	.65	.....	1.35	.....	1.5

[a] Backwater from ice gorge.

Station rating table for Palouse River at Hooper, Wash., from January 1 to December 31, 1905.

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	19	1.60	116	2.50	296	3.40	540
0.70	24	1.70	132	2.60	320	3.50	570
0.80	30	1.80	150	2.70	344	3.60	602
0.90	36	1.90	168	2.80	370	3.70	634
1.00	44	2.00	188	2.90	396	3.80	666
1.10	52	2.10	208	3.00	424	3.90	700
1.20	62	2.20	228	3.10	452	4.00	734
1.30	74	2.30	250	3.20	480	4.10	768
1.40	88	2.40	272	3.30	510	4.20	802
1.50	102						

The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1904–5. It is not well defined.

Estimated monthly discharge of Palouse River at Hooper, Wash., for 1905.

[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	555	74	181	11,130	0.082	0.094
February	424	150	225	12,500	.102	.106
March	802	198	348	21,400	.157	.181
April	666	218	380	22,610	.172	.192
May	555	159	294	18,080	.133	.153
June	650	109	258	15,350	.117	.130
July	159	33	73.9	4,544	.033	.038
August	33	22	27.2	1,672	.012	.014
September	27	19	22.2	1,321	.010	.011
October	132	30	82.2	5,054	.037	.043
November	124	52	76.9	4,576	.035	.039
December	261	88	126	7,747	.057	.066
The year	802	19	175	126,000	.079	1.07

NOTE.—Owing to backwater February 11, the discharge was interpolated between the discharges for February 10 and 12.

ROCK CREEK NEAR ST. JOHN, WASH.

This station was established October 15, 1903, by G. H. Bliss, and discontinued September 30, 1905. 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 channel is straight for 200 feet above and 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.

At high stages discharge measurements are made from the downstream side of the highway bridge. 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 handrail.

The gage is a vertical rod fastened to the fifth pile bent of the southeast (left) bank approach. Bench marks were established as follows: (1) A spike driven into the downstream side of the top of the sill of the third pile bent from the left-bank approach; elevation, 12.52 feet. (2) 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; elevation, 16.70 feet. Elevations refer to the datum of the gage.

May 20, 1905, a discharge measurement made at this station by W. J. Lightfoot gave the following results: Width, 111 feet; area of section, 76 square feet; mean velocity, 0.29 foot per second; gage height, 10.8 feet; discharge, 22 second-feet.

Information in regard to this station is contained in the following Water-Supply Papers of the United States Geological Survey.

Description: 100, pp 415–416; 135, pp 247–248.
Discharge: 100, p 416; 135, p 248.
Discharge, monthly: 135, p 249.
Gage heights: 100, p 416; 135, p 248.
Rating table: 135, p 249.

Daily gage height, in feet, of Rock Creek near St. John, Wash., for 1905.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	10.54	12.05	11.42	11.38	11.18	10.8	10.72	10.34	9.9
2	10.6	11.95	11.42	11.38	11.18	10.8	10.72	10.32	9.9
3	10.6	11.95	11.4	11.38	11.16	10.85	10.7	10.3	9.88
4	10.62	11.95	11.4	11.38	11.16	10.85	10.7	10.28	9.88
5	10.62	11.9	11.4	11.38	11.16	10.85	10.68	10.26	9.86
6	10.65	11.85	11.4	11.38	11.16	10.85	10.68	10.24	9.86
7	10.65	11.8	11.38	11.38	11.14	10.85	10.65	10.22	9.84
8	10.65	11.75	11.38	11.38	11.14	10.82	10.65	10.2	9.84
9	10.68	11.75	11.38	11.35	11.12	10.82	10.62	10.18	9.82
10	10.68	11.75	11.38	11.35	11.12	10.8	10.62	10.16	9.82
11	10.68	11.7	11.38	11.33	11.1	10.8	10.6	10.14	9.82
12	10.68	11.65	11.35	11.32	11.1	10.8	10.6	10.12	9.82
13	10.68	11.6	11.35	11.3	11.08	10.8	10.58	10.1	9.84
14	10.7	11.55	11.3	11.3	11.08	10.78	10.55	10.1	9.84
15	10.7	11.5	11.3	11.28	11.04	10.78	10.52	10.08	9.82
16	10.7	11.46	11.28	11.28	11.0	10.75	10.5	10.08	9.82
17	10.7	11.4	11.25	11.28	11.0	10.75	10.5	10.06	9.8
18	10.7	11.4	11.25	11.27	10.95	10.75	10.5	10.06	9.8
19	10.7	11.4	11.25	11.25	10.9	10.72	10.5	10.05	9.8
20	10.7	11.4	11.25	11.25	10.85	10.72	10.48	10.04	9.8
21	10.7	11.4	11.25	11.23	10.8	10.72	10.48	10.02	9.78
22	10.7	11.4	11.25	11.23	10.8	10.7	10.48	10.02	9.78
23	10.85	11.4	11.25	11.22	10.8	10.7	10.45	10.0	9.78
24	11.35	11.4	11.3	11.22	10.8	10.7	10.45	10.0	9.76
25	12.0	11.42	11.35	11.2	10.8	10.8	10.45	10.0	9.76
26	12.12	11.42	11.35	11.2	10.8	10.8	10.42	9.98	9.76
27	12.18	11.45	11.38	11.2	10.8	10.78	10.42	9.98	9.76
28	12.2	11.45	11.4	11.18	10.8	10.75	10.4	9.96	9.76
29	12.2	.....	11.4	11.18	10.8	10.75	10.38	9.94	9.76
30	12.2	.....	11.4	11.18	10.8	10.74	10.38	9.92	9.76
31	12.15	.....	11.38	.....	10.8	.....	10.36	9.92	.....

Station rating table for Rock Creek near St. John, Wash., from October 15, 1903, to December 31, 1905.

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	0.0	10.60	14	11.20	59	11.80	134
10.10	.5	10.70	19	11.30	70	11.90	149
10.20	1.5	10.80	25	11.40	82	12.00	165
10.30	3	10.90	32	11.50	94	12.10	183
10.40	6	11.00	40	11.60	107	12.20	203
10.50	10	11.10	49	11.70	120	14.00	940

The above table is applicable only for open-channel conditions. It is based on eight discharge measurements made during 1903–1905. It is well defined.

Estimated monthly discharge of Rock Creek near St. John, Wash., for 1905.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January	203	12	59.2	3,640
February	174	82	110	6,109
March	84	64	75.2	4,624
April	80	57	69.0	4,106
May	57	25	39.6	2,435
June	28	19	23.7	1,410
July	20	5	11.8	726
August	4	0	.89	55
September	0	0	.00	0
The period				23,100

COW CREEK NEAR KEYSTONE, WASH.

This station was established November 10, 1904, by Calvin Casteel, and discontinued September 30, 1905. 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.

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.

Discharge measurements are made from the upstream side of the single-span bridge. 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.

A staff gage is fastened vertically to a post of the bridge at the upper left end. During 1905 the gage was read once each day by S. A. Fulquartz. The bench mark is a United States Geological Survey standard aluminum tablet set in a large bowlder, 125 feet up Cow Creek from the Sprague-Ritzville road Crossing, on the right bank; elevation, 1,883.15 feet above sea level and 4.19 feet above the datum of the gage.

May 15, 1905, a discharge measurement made at this station by W. J. Lightfoot gave the following results: Width, 18.6 feet; area of section, 12 square feet; mean velocity, 1.08 feet per second; gage height, 0.90 foot; discharge, 13 second-feet.

A description of this station, with gage heights and discharge data, is contained in Water-Supply Paper No. 135, United States Geological Survey, page 250.

Daily gage height, in feet, of Cow Creek near Keystone, Wash., for 1905.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	0.87	1.25	1.06	1.01	0.9	0.76	0.65	0.27	0.0
2	.88	1.18	1.06	1.01	.9	.74	.63	.26	.0
3	.88	1.13	1.06	1.0	.89	.78	.6	.25	.0
4	.87	1.09	1.06	.99	.89	.79	.57	.24	.0
5	.88	1.08	1.06	.98	.87	.8	.55	.24	.0
6	.89	1.06	1.05	.98	.87	.81	.54	.21	.0
7	.89	1.05	1.05	.97	.88	.82	.52	.18	.0
8	.88	1.12	1.05	.97	.87	.82	.51	.17	.0
9	.88	1.15	1.05	.96	.87	.81	.5	.14	.0
10	.90	1.2	1.06	.95	.88	.81	.5	.12	.0
11	.94	1.22	1.07	.95	.88	.79	.48	.10	.0
12	.98	1.1	1.09	.9	.89	.75	.45	.04	.0
13	.98	1.0	1.1	.9	.89	.7	.42	.02	.0

Daily gage height, in feet, of Cow Creek near Keystone, Wash., for 1905—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
14	0.98	1.02	1.08	0.91	0.89	0.66	0.41	0.01	0.0
15	.98	1.01	1.05	.92	.88	.66	.4	.0	.0
16	.9	1.0	1.02	.94	.88	.67	.4	.0	.0
17	.88	.98	1.0	.96	.88	.67	.39	.0	.0
18	.88	.98	.99	.97	.87	.66	.39	.0	.0
19	.89	.99	.99	.97	.87	.66	.38	.0	.0
20	.9	1.01	.98	.97	.87	.67	.37	.0	.0
21	.91	1.02	.98	.96	.84	.66	.37	.0	.0
22	.9	1.04	.99	.96	.8	.67	.36	.0	.0
23	.89	1.07	.99	.97	.79	.68	.35	.0	.0
24	.89	1.07	.98	.97	.79	.7	.32	.0	.0
25	.95	1.08	.98	.98	.8	.68	.32	.0	.0
26	1.0	1.07	.99	.97	.79	.67	.3	.0	.0
27	1.07	1.06	1.0	.96	.78	.67	.31	.0	.0
28	1.08	1.06	1.0	.97	.78	.66	.32	.0	.0
29	1.06	.....	1.01	.98	.77	.65	.33	.0	.0
30	1.04	.....	1.01	.9	.77	.65	.31	.0	.0
31	1.25	.....	1.0	.....	.76	.....	.29	.0	.0

WALLA WALLA RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

Walla Walla River, the drainage basin of which is one of the best irrigated and most productive localities in either Washington or Oregon, enters Columbia River from the east near the town of Wallula, Wash.

SOUTH FORK OF WALLA WALLA RIVER 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 North and South forks, 6 miles from Milton.

The channel is straight for 100 feet above and 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, is free from vegetation, and is not liable to shift to any considerable extent.

Discharge measurements are made from the upstream side of the single-span highway bridge one-fourth mile above the mouth of 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 gage is a vertical timber, secured to a stump on the right bank three-fourths of a mile above the highway bridge and directly back of the house of the observer, Harry Huber, who, during 1905, read the gage once each day. Bench marks were established as follows: (1) A 20-penny nail driven into a cottonwood tree 1 foot in diameter 15 feet above the gage rod; elevation, 7.00 feet. (2) A 20-penny nail driven into the tree to which the gage is attached; elevation, 7.00 feet. Elevations refer to the datum of the gage.

Information in regard to this station is contained in the following Water-Supply Papers of United States Geological Survey:

Description: 100, p 371; 135, pp 251–252.
Discharge: 100, p 372; 135, p 252.
Discharge, monthly: 135, p 253.
Gage heights: 100, pp 372–373; 135, pp 252–253.
Rating table: 135, p 253.

Discharge measurements of South Fork of Walla Walla River near Milton, Oreg., for 1905.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Square feet.*	*Feet per second.*	*Feet.*	*Second-feet.*
February 8	W. C. Sawyer	40	30	5.11	1.51	153
March 18	H. A. Yates	47	49	3.94	1.67	193
May 5	J. H. Lewis	45	56	4.61	1.78	270
July 21	W. C. Sawyer	29	27	3.63	1.48	98
August 12[a]	Sawyer and Lewis	29	36	2.82	1.50	101
September 14	P. A. Cupper	40	47	2.68	1.65	124
October 16[a]	do	35	46	2.96	1.65	136
October 20[a]	do	34	43	2.73	1.60	116
November 21[a]	do	31	42	2.73	1.48	114
December 28[a]	do	33	40	3.07	1.55	121

[a] Made at different section.

Daily gage height, in feet, of South Fork of Walla Walla River near Milton, Oreg., for 1905.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.75	1.6	1.65	1.75	1.8	1.7	1.7	1.6	1.5	1.6	1.5	1.55
2	1.7	1.6	1.65	1.8	1.75	1.7	1.65	1.5	1.55	1.6	1.5	1.6
3	1.65	1.6	1.7	1.8	1.75	1.75	1.6	1.5	1.5	.....	.....	1.7
4	1.6	1.55	1.7	1.8	.....	1.7	1.6	1.5	1.6	1.6	.....	1.65
5	1.6	1.55	1.65	1.8	1.8	1.7	1.6	1.6	1.6	1.6	1.45	1.65
6	1.6	1.55	1.65	1.8	1.8	1.7	1.6	1.5	1.5	.....	1.5	1.7
7	1.6	1.55	1.65	1.8	1.8	1.65	1.6	1.5	1.55	1.65	1.5	1.7
8	1.55	.....	1.65	.....	1.85	1.65	1.6	1.5	1.55	1.7	1.45	1.65
9	1.55	.....	1.6	1.85	1.85	1.65	1.5	1.5	1.6	1.65	1.5	1.65
10	.....	.....	1.6	1.8	1.83	.....	1.6	1.5	1.5	1.6	1.45	1.6
11	1.55	1.5	1.6	1.75	1.9	1.6	1.5	1.5	1.5	1.6	1.45	1.6
12	1.55	1.7	1.6	1.75	1.95	1.6	1.5	1.5	1.5	1.6	1.5	1.6
13	1.55	1.7	1.6	1.75	1.95	1.55	1.5	1.5	1.6	1.6	1.45	1.55
14	1.5	1.5	1.65	1.7	1.9	1.7	1.5	1.5	1.6	1.6	1.45	.....
15	1.5	1.5	.....	1.7	1.85	1.65	1.5	1.5	1.6	1.6	1.5	1.5
16	1.55	1.45	1.65	1.75	1.8	1.7	1.5	1.5	1.6	1.6	1.5	1.5
17	1.55	1.45	1.7	1.75	1.9	1.7	1.5	1.55	1.55	1.6	1.5	1.6
18	1.55	1.5	1.7	1.75	1.85	1.7	1.5	1.5	1.6	1.65	1.5	1.65
19	1.55	1.5	1.7	2.0	1.85	1.65	1.5	1.45	1.55	1.6	1.5	1.6
20	1.6	1.5	1.6	2.0	1.8	1.65	1.5	1.45	1.6	1.6	1.5	1.6
21	1.55	1.5	1.75	1.95	1.75	1.6	1.5	1.55	1.6	1.6	1.5	1.6
22	1.6	.....	1.7	1.95	1.75	1.6	1.5	1.55	1.55	.....	1.5	1.6
23	1.7	1.6	1.7	1.95	1.75	1.65	1.5	1.5	1.6	1.5	1.5	1.55
24	1.75	1.65	2.15	1.95	.....	1.7	1.5	1.5	1.6	1.5	1.5	1.55
25	1.8	1.7	2.0	1.95	.....	1.7	1.5	1.55	1.6	1.55	1.5	.....
26	1.7	1.75	2.2	1.95	1.75	1.7	1.5	1.5	1.6	1.55	1.6	.....
27	1.7	.....	2.0	1.9	1.75	1.7	1.5	1.5	1.6	1.6	1.5	.....
28	1.7	.....	1.95	1.9	1.7	1.7	1.5	1.5	1.6	.....	1.5	1.6
29	1.7	.....	1.85	1.85	1.7	1.7	1.6	1.55	1.6	1.7	1.5	1.55
30	1.65	.....	1.75	1.8	1.7	1.7	1.5	1.55	1.6	1.65	.....	1.55
31	1.65	.....	1.75	.....	1.7	.....	1.6	1.5	.....	1.5	.....	1.55

Station rating table for South Fork of Walla Walla River near Milton, Oreg., from January 1 to December 31, 1905.

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	106	1.70	214	1.90	340	2.10	480
1.60	156	1.80	276	2.00	412	2.20	552

The above table is applicable only for open-channel conditions. It is based on six discharge measurements made during 1905. It is well defined. The table has been extended beyond these limits.

Estimated monthly discharge of South Fork of Walla Walla River near Milton, Oreg., for 1905.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January	276	106	167	10,270
February	244	84	142	7,886
March	552	156	239	14,700
April	412	214	300	17,850
May	378	214	277	17,030
June	244	130	196	11,660
July	214	106	127	7,809
August	156	84	112	6,887
September	156	106	141	8,390
October	214	106	157	9,654
November	156	84	103	6,129
December	214	106	155	9,531
The year	552	84	176	127,800

WALLA WALLA RIVER ABOVE MILTON, OREG.

This station was established August 12, 1905, to replace the station at Milton, Oreg., one-half mile below. It is located near the old city reservoir, 1¼ miles above Milton. About 25 feet above the gage there is a curve in the low-water channel, but in high water it is nearly straight. Below, the channel is straight for about 400 feet. There are riffles a short distance above and below the cable. The channel is composed of coarse gravel and cobbles and may shift to some extent. Both banks are low, but seldom overflow beyond the limit of the cable.

Discharge measurements are made by means of a cable and car. The initial point for soundings is the zero of the tagged wire on the right bank.

The gage is a vertical staff on the right bank, 24 feet above the cable. During 1905 the gage was read once each day by L. Martin. The bench mark is a spike under the corner of the roof of the old reservoir; elevation, 9.71 feet above the datum of the gage.

Discharge measurements of Walla Walla River above Milton, Oreg., in 1905.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Square feet.*	*Feet per second.*	*Feet.*	*Second-feet.*
August 12	Lewis and Sawyer	42	48	2.13	3.83	103
September 6	W. C. Sawyer	43	47	2.22	3.85	104
October 6	P. A. Cupper	43	54	2.47	3.95	133
October 21	do	44	55	2.36	3.95	129
November 21	do	43	53	2.52	3.98	132
December 28	do	42	62	2.78	4.05	173

Daily gage height, in feet, of Walla Walla River above Milton, Oreg., for 1905.

Day.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	3.88	3.92	4.0	4.02	17	3.88	3.9	3.98	3.95	4.15
2	.....	3.82	3.92	4.0	4.1	18	3.85	3.9	3.98	3.98	4.18
3	.....	3.82	3.9	3.98	4.22	19	3.88	3.9	3.98	4.0	4.2
4	.....	3.85	3.9	4.0	4.25	20	3.85	3.9	3.98	4.0	4.15
5	.....	3.85	3.92	3.98	4.22	21	3.88	3.9	3.9	3.98	4.15
6	.....	3.85	3.98	3.98	4.2	22	3.88	3.88	3.95	3.98	4.12
7	.....	3.85	4.0	3.98	4.2	23	3.85	3.88	3.98	3.95	4.10
8	.....	3.85	4.0	3.95	4.2	24	3.85	3.88	4.0	3.95	4.08
9	.....	3.85	3.98	3.95	4.18	25	3.88	3.88	4.05	3.95	4.08
10	.....	3.82	3.95	4.0	4.12	26	3.88	3.9	4.1	4.12	4.08
11	.....	3.85	3.95	3.98	4.12	27	3.88	3.95	4.0	4.12	4.08
12	3.82	3.88	3.92	3.96	4.08	28	3.85	3.98	4.0	4.08	4.05
13	3.85	3.9	3.9	3.95	4.05	29	3.88	3.92	3.98	4.02	4.05
14	3.88	3.9	3.9	3.95	4.02	30	3.88	3.92	4.0	4.05	4.05
15	3.88	3.9	3.98	3.95	4.02	31	3.9	.....	4.0	.....	4.05
16	3.9	3.9	3.95	3.92	4.02						

Station rating table for Walla Walla River above Milton, Oreg., from August 12 to December 31, 1905.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
3.80	94	4.00	147	4.20	207
3.90	120	4.10	175	4.30	240

The above table is applicable only for open-channel conditions. It is based on six discharge measurements made during 1905. It is well defined to gage height 4 feet.

Estimated monthly discharge of Walla Walla River above Milton, Oreg., for 1905.

Month	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
August 12–31	120	99	112	4,442
September	142	99	115	6,843
October	175	120	138	8,485
November	181	125	144	8,569
December	224	153	181	11,130

WALLA WALLA RIVER AT MILTON, OREG.

This station was established February 14, 1903, by T. A. Noble. Owing to the influence of a diversion dam just below the station was abandoned September 30, 1905, the station 1¼ miles above Milton taking its place.

The channel is straight for 80 feet above and 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, is free from vegetation, and is liable to shift.

During 1903 discharge measurements were made from a cable. Measurements made at this point include the discharge of the irrigation ditch just below the gage. 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. The ditch has to be measured separately, but its discharge is included in the estimate given below. Another irrigation ditch is taken out on the left bank just below the bridge; this is included in the measurements made at the bridge. 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 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. During 1905 the gage was read once each day by S. L. Smith. 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; elevation, 4.37 feet above the datum of the gage.

Information in regard to this station is contained in the following Water-Supply Papers of the United States Geological Survey:

Description: 100, p 368; 135, p 254.
Discharge: 100, p 369; 135, p 254.
Discharge, monthly: 100, p 370; 155, p 256.
Gage heights: 100, pp 369-370; 135, p 255.
Rating table: 100, p 370; 135, p 255.

Discharge measurements of Walla Walla River at Milton, Oreg., in 1905.

Date.	Hydrographer.	Gage height.	Discharge.	Remarks.
		Feet.	*Second-feet.*	
February 8	W. C. Sawyer	1.71	190	78 second-feet in ditch included.
March 18	H. A. Yates	1.85	240	64 second-feet in ditch included.
May 5	J. H. Lewis	1.75	378	77 second-feet in ditch included.
July 21	W. C. Sawyer	1.64	98	52 second-feet in ditch included.
August 11	Sawyer and Lewis	1.42	90	Do.
September 1	Sawyer and Cupper	1.37	95	53 second-feet in ditch included.

Daily gage height, in feet, of Walla Walla River at Milton, Oreg., for 1905.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	1.74	1.54	1.81	1.7	1.65	1.55	1.94	1.48	1.4
2	1.69	1.51	1.8	1.78	1.62	1.55	1.88	1.46	1.39
3	1.56	1.52	1.8	1.76	1.7	2.11	1.88	1.45	1.4
4	1.56	1.74	1.8	1.75	1.72	2.06	1.86	1.44	1.41
5	1.56	1.74	1.79	1.74	1.72	2.03	1.84	1.43	1.41
6	1.53	1.72	1.78	1.73	1.72	2.0	1.82	1.4	1.41
7	1.48	1.72	1.76	1.75	1.67	1.97	1.78	1.36	1.41
8	1.45	1.71	1.75	1.78	1.66	1.95	1.68	1.36	1.4
9	1.48	1.71	1.74	1.78	1.86	1.92	1.58	1.36	1.4
10	1.5	1.71	1.78	1.8	1.92	1.9	1.5	1.36	1.41
11	1.51	1.68	1.81	1.74	2.02	1.82	1.5	1.37	1.42
12	1.52	1.66	1.82	1.67	1.99	1.78	1.73	1.37	1.43
13	1.51	1.64	1.84	1.68	1.93	1.74	1.7	1.36	1.45
14	1.49	1.62	1.84	1.69	1.85	1.72	1.7	1.37	1.46
15	1.5	1.61	1.84	1.66	1.8	1.7	1.66	1.38	1.46
16	1.51	1.61	1.83	1.66	1.75	1.7	1.65	1.4	1.45
17	1.5	1.7	1.84	1.64	1.73	1.72	1.63	1.46	1.45
18	1.51	1.74	1.84	1.66	1.71	1.64	1.62	1.44	1.45
19	1.49	1.8	1.84	1.66	1.68	1.57	1.6	1.43	1.45
20	1.53	1.79	1.84	1.7	1.64	1.64	1.62	1.42	1.46
21	1.51	1.76	1.95	1.8	1.62	1.64	1.64	1.43	1.46

Daily gage height, in feet, of Walla Walla River at Milton, Oreg., for 1905—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
22	1.51	1.72	1.98	1.94	1.6	1.8	1.63	1.43	1.46
23	1.59	1.8	1.95	1.88	1.59	1.85	1.62	1.43	1.46
24	1.76	1.88	2.13	1.91	1.63	2.06	1.61	1.42	1.47
25	1.8	1.97	2.01	1.95	1.65	2.12	1.58	1.42	1.47
26	1.76	1.87	2.12	1.91	1.65	2.1	1.45	1.41	1.48
27	1.73	1.84	2.05	1.88	1.65	2.06	1.49	1.41	1.6
28	1.71	1.82	1.91	1.85	1.64	2.04	1.5	1.41	1.6
29	1.68	.....	1.81	1.7	1.62	2.02	1.5	1.42	1.58
30	1.66	.....	1.81	1.69	1.6	1.95	1.48	1.42	1.56
31	1.6	.....	1.72	.....	1.58	.....	1.46	1.41	.....

Estimated monthly discharge of Walla Walla River at Milton, Oreg., for 1905.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January	280	150	194	11,930
February	305	150	200	11,110
March	410	200	260	15,990
April	540	245	369	21,950
May	610	275	363	22,320
June	280	170	216	12,850
July	225	100	129	7,932
August	145	97	103	6,333
September	114	100	104	6,188
The period	.....	.....	.....	116,600

NOTE.—Owing to changeable conditions at this station during 1905 no rating table can be published and the monthly estimates, which are based on a series of curves, each covering a short period, are only approximate.

UMATILLA RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

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

UMATILLA RIVER AT GIBBON, OREG.

This station was established by C. C. Babb July 22, 1896.

The channel is straight for 100 feet above and below the station. 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.

Discharge measurements are made by means of a cable and car. The initial point for soundings is the face of the tree on the right bank, to which the cable is attached.

Several gages were used from time to time, owing to the varying conditions. October 15, 1904, a vertical staff gage was fastened 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. No relation has been established between this and previous gages. During 1905 the gage was read once each day by Walter Swart. The bench mark is a square chisel draft and the letters "B. M." cut in the rock about 15 feet from the gage, 10 feet downstream; elevation, 5.17 feet above the datum of the gage.

Information in regard to this station is contained in the following publications of the United States Geological Survey (Ann=Annual Report; WS=Water-Supply Paper):

Description: Ann 18, iv, p 361; 19, iv, p 493; WS 16, p 180; 28, p 159; 38, pp 376–377; 51, p 444; 66, p 137; 85, pp 183–184; 100, pp 366–367; 135, pp 256–257.

Discharge: Ann 18, iv, p 361; WS 16, p 180; 28, p 169; 85, p 184; 100, p 367; 135, p 257.

Discharge, monthly: Ann 19, iv, p 494; 20, iv, p 515; 21, iv, p 430; 22, iv, p 453; WS 75, p 206; 85, p 185.

Discharge, yearly: Ann 20, iv, p 63.

Gage heights: WS 11, p 88; 16, p 180; 28, p 167; 38, p 377; 51, p 445; 66, p 137; 85, p 184; 100, pp 367–368; 135, pp 257–258.

Hydrographs: Ann 19, iv, p 494; 20, iv, p 515; 21, iv, p 430; 22, iv, p 453.

Rating tables: Ann 19, iv, p 493; WS 28, p 170; 39, p 454; 52, p 522; 66, p 177; 85, p 185.

Discharge measurements of Umatilla River at Gibbon, Oreg., in 1905.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Square feet.*	*Feet per second.*	*Feet.*	*Second-feet.*
March 3	J. H. Lewis	100	85	6.36	2.00	540
March 10	W. C. Sawyer	53	69	5.93	1.75	410
March 28	J. H. Lewis	106	143	6.85	2.50	979
April 7	W. C. Sawyer	110	167	6.57	2.65	1,094
May 6	do	101	102	6.43	2.10	660
August 5[a]	do	34	41	1.41	1.10	58
August 26	do	34	38	1.39	1.10	53
October 19[a]	Sawyer and Hall	37	49	1.73	1.22	85
December 2[a]	R. S. Hall	48	63	2.53	1.39	160

[a] Made at different section.

Daily gage height, in feet, of Umatilla River at Gibbon, Oreg., for 1905.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.5	1.6	2.0	2.3	1.8	1.55	1.3	1.1	1.1	1.25	1.2	1.35
2	1.5	1.5	2.0	2.4	1.9	1.7	1.3	1.1	1.1	1.2	1.2	1.4
3	1.5	1.5	2.0	.....	2.0	1.65	1.3	1.1	1.1	1.15	1.2	1.52
4	1.4	1.5	1.9	2.5	2.0	.....	1.3	1.1	1.1	1.15	1.2	1.65
5	1.4	1.5	1.9	2.8	2.0	1.6	1.3	1.1	1.1	1.2	1.2	1.62
6	1.4	1.5	1.9	2.8	2.1	1.6	1.3	1.1	1.1	1.2	1.2	1.6
7	1.4	1.5	1.8	2.65	.....	1.6	1.25	1.1	1.1	1.2	1.2	1.6
8	1.4	1.5	1.8	2.5	.....	1.55	1.25	1.1	1.1	1.2	1.2	1.6
9	1.4	1.5	1.75	2.5	2.1	1.5	1.25	1.1	1.1	1.2	1.2	1.6
10	1.4	1.5	1.75	2.3	2.1	1.5	1.25	1.1	1.1	1.2	1.2	1.6
11	1.4	1.5	1.7	2.1	2.25	1.45	1.2	1.1	1.1	1.2	1.2	1.4
12	1.4	1.5	1.7	2.2	2.2	1.4	1.2	1.1	1.1	1.2	1.2	1.4
13	1.3	1.5	1.8	2.1	2.1	1.4	1.15	1.1	1.1	1.2	1.2	1.4
14	1.3	1.5	1.8	2.0	2.0	1.35	1.15	1.1	1.1	1.2	1.2	1.4
15	1.3	1.5	1.8	2.0	1.95	1.35	1.1	1.1	1.1	1.2	1.2	1.4
16	1.3	1.5	1.8	2.0	1.9	1.35	1.1	1.1	1.1	1.2	1.2	1.4
17	1.3	1.4	1.8	1.95	1.85	1.3	1.1	1.1	1.1	1.2	1.2	1.5
18	1.3	1.4	1.8	1.9	1.8	1.3	1.1	1.1	1.1	1.2	1.2	1.55
19	1.3	1.4	1.8	2.0	1.8	1.3	1.1	1.1	1.1	1.2	1.2	1.55
20	1.3	1.4	1.8	2.1	1.8	1.25	1.1	1.1	1.1	1.2	1.2	1.55
21	1.3	1.4	2.0	2.2	1.7	1.25	1.1	1.1	1.1	1.2	1.2	1.6
22	1.3	1.4	.....	2.3	1.5	1.25	1.1	1.1	1.1	1.2	1.2	1.6
23	1.6	1.5	2.0	2.3	1.7	1.25	1.1	1.1	1.1	1.2	1.2	1.55
24	2.0	1.6	2.4	2.2	1.85	1.3	1.1	1.1	1.1	1.2	1.2	1.5
25	2.2	2.0	2.2	2.1	1.9	.....	1.1	1.1	1.1	1.2	1.2	.....

Daily gage height, in feet, of Umatilla River at Gibbon, Oreg., for 1905—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
26	2.0	2.0	.....	2.0	1.8	1.35	1.1	.....	1.1	1.2	1.3	1.45
27	.....	2.0	2.6	1.9	1.8	1.4	1.1	1.1	1.1	1.2	1.3	1.4
28	1.9	2.0	2.45	1.8	1.75	1.35	1.1	1.1	1.1	1.2	1.3	1.4
29	1.8	.....	2.35	1.7	1.7	1.35	1.1	1.1	1.3	1.2	1.3	1.4
30	1.8	.....	2.3	1.7	1.65	1.35	1.1	1.1	1.3	1.2	1.35	1.4
31	1.8	.....	2.2	.....	1.6	.....	1.1	1.1	.....	1.2	.....	1.4

NOTE.—Ice conditions during part of February.

Station rating table for Umatilla River at Gibbon, Oreg., from October 15, 1904, to December 31, 1905.

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	32	1.60	282	2.10	638	2.60	1,060
1.10	56	1.70	346	2.20	718	2.70	1,150
1.20	82	1.80	414	2.30	800	2.80	1,240
1.30	120	1.90	486	2.40	885	2.90	1,330
1.40	168	2.00	560	2.50	970	3.00	1,420
1.50	222						

The above table is applicable only for open-channel conditions. It is based on 9 discharge measurements made during 1905. It is well defined.

Estimated monthly discharge of Umatilla River at Gibbon, Oreg., for 1904 and 1905.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
1904.				
October 15–31	90	56	78.4	2,644
November	120	56	78.9	4,695
December	346	82	117	7,194
1905.				
January	718	120	250	15,370
February	560	168	263	14,610
March	1,060	346	554	34,060
April	1,240	346	721	42,900
May	759	222	489	30,070
June	346	101	182	10,830
July	120	56	76.7	4,716
August	56	56	56.0	3,443
September	120	56	60.3	3,588
October	101	69	81.8	5,030
November	144	82	89.1	5,302
December	314	144	220	13,530
The year	1,240	56	254	183,400

NOTE.—Discharge interpolated for missing gage heights.

UMATILLA RIVER AT PENDLETON, OREG.

This station was established May 22, 1903, by F. W. Huber and discontinued June 11, 1905. It is located at the Main Street Bridge at Pendleton, Oreg.

The channel is straight for 250 feet above and 200 feet below the railroad bridge from which discharge measurements are made. 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.

Discharge measurements are made from the Oregon Railroad and Navigation Company's bridge, about 1 mile downstream from the Main Street Bridge. 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, with 116 feet of trestle approach on the right bank and 34 feet on the left bank.

The gage is a vertical staff fastened to the middle of the left (south) side of the center pier of the Main Street Bridge. During 1905 the gage was read by the staff of the Geological Survey office at Pendleton. 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; elevation, 16.50 feet above the datum of the gage.

The flour-mill ditch (Byer's) takes 100 second-feet or less of water about 1½ miles 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 restored. The gage was read only when the flow was normal.

A short distance above the bridge at which the gage is located water is taken out of the river by the Farmers' mill ditch. The water is returned to the river at a point about 1,500 feet above the railroad bridge. The Farmers' mill ditch does not affect the reading of the gage when above 4 feet. For low stages of the river the amount of water in the ditch should be taken out from the measured discharge in making a curve and rating table, and should then be added to the discharge taken from the table. June 15, 1904, a gage was placed on the Farmers' mill ditch and read from that time until the station was abandoned.

Information in regard to this station is contained in the following publications of the United States Geological Survey (Bull=Bulletin; WS=Water-Supply Paper):

Description: Bull 131, p 68; WS 100, pp 362–363; 135, pp 258–259.
Discharge: Bull 131, pp 69, 90; WS 100, p 364; 135, p 259.
Discharge, monthly: Bull 131, p 69.
Gage heights: WS 100, p 364; 135, p 260.

Discharge measurements of Umatilla River at Pendleton, Oreg., in 1905.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.	Remarks.
		Feet.	*Square feet.*	*Feet per second.*	*Feet.*	*Second-feet.*	
January 28	Williams and Yates.	90	294	2.24	4.60	657	128 second-feet in ditch included.
February 24	Lewis and Yates	83	211	1.30	4.19	275	58 second-feet in ditch included.
February 27	W. C. Sawyer	92	269	2.29	4.58	615	120 second-feet in ditch included.
March 24	H. S. Williams	100	318	2.98	4.99	941	240 second-feet in ditch included.
March 28	Lewis and Yates	100	352	3.69	5.20	1,302	166 second-feet in ditch included.
June 8	W. C. Sawyer	80	207	1.35	4.26	280	29 second-feet in ditch included.
June 26	Sawyer and King	80	194	.84	4.17	162	Ditch dry.
August 28[a]	Sawyer and Landes.	16	16.6	2.22	.....	36.9	
September 9[a]	W. C. Sawyer	27	22.8	1.79	.....	40.4	
October 19[a]	do	45	52	1.37	.....	72	
November 15[a]	R. S. Hall	45	52	1.43	.....	79	
November 17	do	76	90	.29	.....	56	
November 17	do	76	90	.33	.....	63	
December 7	do	73	248	1.07	.....	264	
December 7	do	73	248	1.10	.....	273	
December 26	do	73	242	.98	.....	237	

[a] Measurements made above head of Byer's mill ditch.

Daily gage height, in feet, of Umatilla River at Pendleton, Oreg., for 1905.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	Day.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	4.05	4.35	4.52	4.99	4.5	4.45	17	3.87	4.03	4.38	4.65	.....	.....
2	4.0	4.28	4.5	5.21	4.45	4.4	18	3.88	4.02	4.38	4.65	4.55	.....
3	4.0	4.23	4.52	5.25	4.5	4.37	19	3.88	4.0	4.38	4.63	4.5	.....
4	3.98	4.19	4.52	5.15	4.6	4.35	20	3.88	4.02	4.39	4.77	4.45	.....
5	3.97	4.14	4.52	5.22	4.7	4.33	21	3.9	4.02	4.48	4.80	4.45	.....
6	3.95	4.11	4.5	5.3	4.73	4.3	22	.....	4.07	4.58	4.80	4.4	.....
7	3.92	4.1	4.49	5.25	4.72	4.28	23	4.0	4.1	4.62	4.85	4.42	.....
8	3.9	4.09	4.42	5.15	4.67	4.26	24	4.48	4.19	5.0	4.82	4.5	.....
9	3.9	4.08	4.38	5.05	4.8	4.24	25	4.78	4.39	4.98	4.78	4.55	.....
10	3.9	4.08	4.35	4.95	4.78	4.2	26	4.61	4.56	5.33	4.75	4.52	.....
11	3.9	4.1	4.38	4.85	4.82	4.18	27	4.6	4.58	5.45	4.66	4.55	.....
12	3.9	4.0	4.37	4.83	4.85	.....	28	4.61	4.5	5.3	4.6	4.5	.....
13	3.8	4.1	4.32	4.78	4.8	.....	29	4.59	.....	5.12	4.55	4.5	.....
14	3.8	4.05	4.4	4.75	4.75	.....	30	4.5	.....	5.05	4.52	4.45	.....
15	3.86	4.0	4.4	4.65	4.68	.....	31	4.41	.....	.....	.....	4.45	.....
16	3.84	4.0	4.38	4.65	4.65	.....							

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, a station of the Oregon Railroad and Navigation Company, at what is known as the Yoakum wagon bridge.

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.

Discharge measurements are made from the single-span wagon bridge. The initial point for soundings is the end of the lower chord of the upstream side on the left bank.

The gage is a vertical staff attached to the right abutment of the bridge. During 1905 readings have been made once each day by Luther Dehaven. 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, downstream side; elevation, 13.00 feet above the datum of the gage.

Information in regard to this station is contained in the following Water-Supply Papers of the United States Geological Survey:

Description: 100, pp 360–361; 135, pp 260–261.
Discharge: 100, p 361; 135, p 261.
Discharge, monthly: 100, p 362; 135, p 263.
Gage heights: 100, p 361; 135, pp 261–262.
Rating table: 100, p 362; 135, p 262.

Discharge measurements of Umatilla River at Yoakum, Oreg., in 1905.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Square feet.*	*Feet per second.*	*Feet.*	*Second-feet.*
February 25	J. H. Lewis	76	209	2.12	4.28	444
March 24	Lewis and Yates	76	296	3.99	5.48	1,180
May 8	W. C. Sawyer	76	273	3.14	4.93	856
June 30	do	76	129	1.36	3.37	175
August 18[a]	do	49	30	.80	2.66	24
September 1	F. C. Dillard	73	96	.55	2.98	54
October 1[a]	W. C. Sawyer	60	47	1.28	3.00	60
October 21	Sawyer and Hall	74	120	.61	3.12	74
December 12	R. S. Hall	76	188	1.52	3.98	287

[a] Measurements made at different section.

Daily gage height, in feet, of Umatilla River at Yoakum, Oreg., for 1905.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	4.0	4.3	4.5	5.5	4.4	4.1	3.3	2.6	2.7	3.0	3.3	3.4
2	4.0	4.2	4.6	6.1	4.3	4.1	3.1	2.6	2.7	3.0	3.3	3.5
3	3.9	4.1	4.6	6.0	4.4	4.1	3.1	2.6	2.7	3.0	3.3	3.6
4	3.9	4.0	4.6	6.0	4.7	4.1	3.1	2.6	2.7	3.0	3.3	4.1
5	3.9	4.0	4.6	6.0	5.0	4.1	3.1	2.6	2.7	3.0	3.3	4.1
6	3.9	3.9	4.6	6.0	5.0	4.1	3.0	2.6	2.7	3.1	3.3	4.1
7	3.9	3.9	4.6	6.0	5.0	4.1	3.0	2.6	2.7	3.2	3.3	4.1
8	3.8	3.8	4.5	6.0	4.9	3.9	3.0	2.6	2.7	3.2	3.3	4.3
9	3.7	3.8	4.4	5.7	5.2	3.9	3.0	2.6	2.75	3.2	3.3	4.3
10	3.7	3.7	4.4	5.6	5.2	3.9	3.0	2.6	2.75	3.1	3.2	4.3
11	3.7	3.6	4.4	5.4	5.2	3.8	3.0	2.6	2.75	3.1	3.2	4.2
12	3.7	3.5	4.4	5.2	5.3	3.7	3.0	2.6	3.12	3.1	3.2	4.0
13	3.6	3.5	4.4	5.1	5.2	3.7	3.0	2.6	3.5	3.1	3.2	4.0
14	3.5	3.5	4.4	5.0	5.0	3.6	3.0	2.6	2.8	3.1	3.2	3.9
15	3.5	3.5	4.4	4.9	4.9	3.5	3.0	2.6	2.9	3.3	3.2	3.9
16	3.5	3.5	4.4	4.9	4.7	3.4	3.0	2.6	2.9	3.3	3.2	3.8
17	3.5	3.5	4.4	4.8	4.7	3.4	3.0	2.7	2.9	3.3	3.2	3.8
18	3.5	3.5	4.4	4.9	4.6	3.4	2.9	2.7	2.9	3.2	3.2	4.0
19	3.5	3.9	4.4	5.0	4.5	3.3	2.9	2.7	2.9	3.1	3.3	4.1
20	3.6	3.7	4.4	5.0	4.4	3.2	2.9	2.7	2.9	3.1	3.3	4.1

Daily gage height, in feet, of Umatilla River at Yoakum, Oreg., for 1905—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
21	3.6	3.6	4.5	5.0	4.4	3.2	2.9	2.7	2.9	3.1	3.3	4.1
22	3.7	3.5	4.7	5.0	4.3	3.2	2.9	2.7	2.9	3.1	3.3	4.1
23	3.8	3.6	4.8	5.0	4.3	4.0	2.8	2.7	2.9	3.1	3.3	4.1
24	4.3	4.0	5.4	5.0	4.4	3.6	2.8	2.7	2.9	3.1	3.3	4.1
25	4.8	4.3	5.5	5.0	4.4	3.5	2.7	2.7	2.9	3.1	3.3	4.5
26	4.8	4.4	5.9	4.9	4.4	3.4	2.7	2.7	3.1	3.1	3.3	4.5
27	4.7	4.4	6.2	4.6	4.3	3.4	2.7	2.7	3.2	3.1	3.3	4.4
28	4.7	4.4	6.0	4.6	4.3	3.4	2.6	2.7	3.0	3.2	3.3	4.5
29	4.5	.....	5.8	4.5	4.2	3.4	2.6	2.7	3.0	3.2	3.4	4.5
30	4.4	.....	5.5	4.4	4.2	3.2	2.6	2.7	3.0	3.2	3.4	4.3
31	4.3	.....	5.5	.....	4.1	.....	2.6	2.7	.....	3.2	.....	4.3

Station rating table for Umatilla River at Yoakum, Oreg., from January 1 to December 31, 1905.

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	20	3.60	182	4.50	565	5.40	1,270
2.70	28	3.70	210	4.60	630	5.50	1,360
2.80	37	3.80	240	4.70	700	5.60	1,455
2.90	47	3.90	275	4.80	770	5.70	1,550
3.00	59	4.00	315	4.90	845	5.80	1,645
3.10	73	4.10	355	5.00	925	5.90	1,740
3.20	90	4.20	400	5.10	1,005	6.00	1,840
3.30	110	4.30	450	5.20	1,090	6.10	1,940
3.40	132	4.40	505	5.30	1,180	6.20	2,040
3.50	156						

The above table is applicable only for open-channel conditions. It is based on 16 discharge measurements made during 1904–5. It is well defined.

Estimated monthly discharge of Umatilla River at Yoakum, Oreg., for 1905.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January	770	156	320	19,680
February	505	156	273	15,160
March	2,040	505	826	50,790
April	1,940	505	1,153	68,610
May	1,180	355	683	42,000
June	355	90	212	12,620
July	110	20	51.1	3,142
August	28	20	23.9	1,470
September	156	28	48.2	2,868
October	110	59	78.7	4,839
November	132	90	105	6,248
December	565	132	368	22,630
The year	2,040	20	345.	250,100

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. 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. For estimate of flow in the ditch see page 201.

The channel is straight for 500 feet above and 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 and is free from vegetation and permanent. Owing to the rapids just above Umatilla backwater from Columbia River does not affect the gage heights at the station.

Discharge measurements are made by means of a cable, car, tagged wire, and stay wire. The initial point for soundings is the zero mark on the tagged wire, directly over the vertical portion of the left bank.

An inclined gage is placed on the left bank 45 feet below the cable, and is in two sections. The lower section reads from 1.2 to 3.5 feet. The upper section reads from 3.5 to 10.8 feet. During 1905 the gage was read every other day during ordinary stages and once each day during floods by B. V. Pompella. The bench mark is the head of a bolt cemented in the solid rock 1½ feet upstream from the gage rod; elevation, 10.30 feet above the datum of the gage.

Information in regard to this station is contained in the following Water-Supply Papers of the United States Geological Survey:

Description: 100, p 359; 135, pp 263–264.
Discharge: 100, p 360; 135, p 264.
Discharge, monthly: 135, p 266.
Gage heights: 100, p 360; 135, pp 264–265.
Rating table: 135, p 265.

Discharge measurements of Umatilla River near Umatilla, Oreg., in 1905.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Square feet.*	*Feet per second.*	*Feet.*	*Second-feet.*
February 28	J. H. Lewis	170	218	2.78	3.37	606
March 27	do	177	379	4.54	4.22	1,722
April 10	do	186	330	4.17	3.95	1,377
May 12	W. C. Sawyer	175	280	3.94	3.70	1,103
July 19	do				1.60	[a]0.1
September 26	do	7.3	4.7	.85	1.82	4.0
October 25	Sawyer and Hall	31	38	1.63	2.41	62
December 6	R. S. Hall	167	148	2.06	3.00	304

[a]Estimated.

Daily gage height, in feet, of Umatilla River near Umatilla, Oreg., for 1905.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.8	.....	.....	3.85	.....	3.05	2.3	.....	1.6	1.9	.....	.....
2	.....	3.15	3.35	.....	3.15	.....	.....	1.6	.....	.....	2.43	2.68
3	2.85	.....	.....	4.2	.....	2.95	2.1	.....	1.6	2.2	.....	.....
4	.....	3.05	3.4	.....	3.25	.....	.....	1.61	.....	.....	2.43	2.7
5	2.85	.....	.....	4.1	.....	2.9	1.8	.....	1.6	2.18	.....	.....
6	.....	3.0	3.4	4.2	3.6	.....	.....	1.61	.....	.....	2.43	3.0
7	2.8	.....	.....	.....	.....	2.9	1.7	.....	1.6	2.21	.....	.....
8	.....	2.9	3.3	4.15	3.6	.....	.....	1.61	.....	.....	2.41	3.0
9	2.8	.....	.....	.....	.....	2.8	1.65	.....	1.6	2.25	.....	.....
10	.....	2.9	3.2	3.95	3.7	.....	.....	1.6	.....	.....	2.4	3.0
11	2.8	.....	.....	.....	.....	2.7	1.6	.....	1.62	2.3	.....	.....
12	.....	2.9	3.2	3.7	3.8	.....	.....	1.6	.....	.....	2.4	2.95
13	2.95	.....	.....	.....	.....	2.6	1.55	.....	2.27	2.3	.....	.....
14	.....	2.75	3.2	3.65	3.7	.....	.....	1.7	.....	.....	2.4	2.9
15	2.95	.....	.....	.....	.....	2.45	1.5	.....	2.35	2.36	.....	.....
16	.....	2.8	3.15	3.5	3.45	.....	.....	1.6	.....	.....	2.45	2.85
17	2.9	.....	.....	.....	.....	2.3	1.5	.....	2.1	2.4	.....	.....
18	.....	2.8	3.2	3.45	3.4	.....	.....	1.6	.....	.....	2.42	2.9
19	2.7	.....	.....	.....	.....	2.2	1.6	.....	2.0	2.41	.....	.....
20	.....	2.8	3.15	3.4	3.2	.....	.....	1.6	.....	.....	2.45	3.1
21	2.7	.....	.....	.....	.....	2.2	1.6	.....	1.89	2.43	.....	.....
22	.....	2.8	3.25	3.55	3.1	.....	.....	1.6	.....	.....	2.5	3.0
23	2.75	.....	.....	.....	.....	1.9	1.6	.....	1.89	2.42	.....	.....
24	.....	2.85	3.5	3.6	3.1	.....	.....	1.6	.....	.....	2.5	2.95
25	3.15	.....	.....	.....	.....	2.2	1.59	.....	1.89	2.45	.....	.....
26	.....	3.15	3.8	3.5	3.2	2.4	.....	1.6	.....	.....	2.5	2.95
27	3.45	.....	4.22	.....	.....	2.35	1.6	.....	1.8	2.5	.....	.....
28	.....	3.37	4.3	3.4	3.15	.....	.....	1.6	.....	.....	2.55	2.9
29	3.4	.....	4.3	.....	.....	2.3	1.65	.....	1.89	2.5	.....	.....
30	.....	.....	4.0	3.2	3.1	.....	.....	1.6	.....	.....	2.65	2.9
31	3.3	.....	.....	.....	.....	.....	1.6	.....	.....	2.43	.....	.....

Station rating table for Umatilla River near Umatilla, Oreg., from January 1 to December 31, 1905.

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	13	2.60	110	3.20	480	3.80	1,170
2.10	21	2.70	145	3.30	580	3.90	1,310
2.20	32	2.80	190	3.40	690	4.00	1,450
2.30	45	2.90	245	3.50	800	4.10	1,590
2.40	62	3.00	310	3.60	920	4.20	1,740
2.50	83	3.10	390	3.70	1,040	4.30	1,890

The above table is applicable only for open-channel conditions. It is based on 16 discharge measurements made during 1903–1905. It is well defined.

Estimated monthly discharge of Umatilla River near Umatilla, Oreg., for 1905.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January	745	145	307	18,880
February	557	168	283	15,720
March	1,890	435	764	46,980
April	1,740	480	1,085	64,560
May	1,170	390	670	41,200
June	350	8	122	7,260
July	45	.0	4.62	218
August	1.5	.1	.21	35
September	54	.1	11	654
October	83	8	53.2	3,271
November	128	62	75.8	4,510
December	390	138	263	16,170
The year	1,890	.0	303	219,500

NOTE.—Mean for actual number of days recorded taken as the mean for the entire month.

DITCHES IN UMATILLA RIVER VALLEY, OREGON.

FARMERS' MILL DITCH AT PENDLETON, OREG.

Water is taken from Umatilla River just above the Main Street Bridge (upon a pier of which the river gage is located), is used to furnish power for the Farmers' flour mill, and then returned to the river above the railroad bridge at which river measurements were made.

The flow is not uniform during the low-water season because of storage in Byer's mill ditch above, and consequently measurements were discontinued.

Discharge measurements of Farmers' mill ditch at Pendleton, Oreg., in 1905.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Square feet.*	*Feet per second.*	*Feet*	*Second-feet.*
February 24	Lewis and Yates	24	28.3	2.13	0.82	60
February 27	Sawyer and Yates	28	43.3	2.80	1.35	121
April 6	do	23	41.8	4.98	1.66	201

Daily gage height, in feet, of Farmers' mill ditch at Pendleton, Oreg., for 1905.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	Day.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	1.1	0.93	1.29	1.31	0.7	0.5	17	1.02	0.52	1.08	0.9	.....	.....
2	1.09	.92	1.28	1.55	.6	.45	18	1.03	.46	1.08	.85	0.7	.....
3	1.09	.85	1.29	1.58	.7	.51	19	1.03	.45	1.08	.82	.65	.....
4	1.08	.81	1.29	1.5	.8	.5	20	1.03	.45	1.09	1.05	.6	.....
5	1.08	.76	1.29	1.55	.97	.48	21	1.09	.5	1.23	1.12	.57	.....
6	1.07	.71	1.28	1.65	1.0	.45	22	.....	.57	1.33	1.1	.55	.....
7	1.06	.68	1.22	1.61	1.0	.4	23	1.28	.67	1.48	1.12	.55	.....
8	1.06	.65	1.18	1.48	.95	.38	24	1.33	.78	1.76	1.12	.65	.....
9	1.05	.6	1.08	1.35	1.1	.34	25	1.6	1.18	1.7	1.08	.75	.....
10	1.05	.6	1.05	1.28	1.06	.3	26	1.51	1.34	1.86	1.02	.78	.....
11	1.05	.7	1.05	1.15	1.12	.28	27	1.38	1.34	1.88	.92	.78	.....
12	1.05	.55	1.03	1.12	1.18	.28	28	1.39	1.3	1.7	.83	.7	.....
13	1.05	1.01	.98	1.08	1.12	.....	29	1.35	.....	1.49	.73	.69	.....
14	1.05	1.0	1.11	1.02	1.05	.....	30	1.27	[illegible]	1.38	.7	.6	.....
15	1.02	.78	1.11	.92	.95	.....	31	1.13	.....	.....	.....	.55	.....
16	1.02	.6	1.08	.9	.85	.....							

HORSESHOE IRRIGATION COMPANY'S DITCH AT YOAKUM, OREG.

This ditch was dug during the latter part of 1904, and plans are being considered to enlarge and extend it. It diverts water from the left bank of Umatilla River, 1 mile above Yoakum, at Dehaven's ranch. No measurements were made during 1905. No water was used after the last of July.

SLUSHER & GOULD DITCH NEAR NOLIN, OREG.

This ditch diverts water from the left bank of Umatilla River, 1½ miles above Nolin, Oreg., and 8 miles above Echo.

Measurements were made in a flume near the head of the ditch.

Discharge measurements of Slusher & Gould ditch near Nolin, Oreg., in 1905.

Date.	Hydrographer.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Square feet.	*Feet per second.*	*Feet.*	*Second-feet.*
August 18	W. C. Sawyer	2.29	0.76	0.71	1.74
September 9	F. C. Dillard	1.23	.46	.44	.56
September 19	do	.58	.53	.30	.31
September 25	do	1.14	.57	.44	.65
September 29	do	1.51	.64	.55	.96
October 4	do	1.32	.59	.50	.78
October 10	do	1.55	.44	.48	.68
October 17	do	1.13	.48	.46	.54
October 23	do	1.21	.45	.49	.55
October 30	do	1.18	.47	.48	.56
November 7	do	1.04	.46	.44	.48
November 13	do	.59	.36	.30	.21
November 20	do	1.03	38	.40	.39
December 21	do	3.16	.75	.80	2.38

LISLE & CRANE DITCH NEAR ECHO, OREG.

This ditch diverts water from the right bank of Umatilla River, 2 miles below Nolin.

Measurements were made in a flume just below where the ditch is crossed by the Oregon Railroad and Navigation Company's track.

Discharge measurements of Lisle & Crane ditch near Echo, Oreg., in 1905.

Date.	Hydrographer.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Square feet.	*Feet per second.*	*Feet.*	*Second-feet.*
August 18	W. C. Sawyer	8.62	0.52	.....	4.50
August 30	Sawyer and Dillard	4.29	.65	1.26	2.79
September 9	F. C. Dillard	5.72	1.20	1.61	6.86
September 14	do	5.06	.97	1.43	4.92
September 19	do	5.64	1.16	1.55	6.54
September 25	do	5.27	1.02	1.48	5.40
September 29	do	6.27	1.27	1.68	7.99
October 9	do	5.86	1.17	1.61	6.84
October 12	do	4.37	.59	1.27	2.58

CHARLES LISLE DITCH AT ECHO, OREG.

This ditch diverts water from the left bank of Umatilla River, 2½ miles above Echo.

Discharge measurements of Charles Lisle ditch at Echo, Oreg., in 1905.

Date.	Hydrographer.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Square feet.	*Feet per second.*	*Feet.*	*Second-feet.*
August 18	W. C. Sawyer	4.78	2.98	0.62	1.42
August 30	F. C. Dillard	4.86	.18	.64	.88
September 8	do	11.37	.42	1.31	4.74
September 19	do	9.70	.51	1.16	4.96
September 25	do	6.24	.49	.81	3.04
October 4	do	5.17	.47	.71	2.44
October 7	do	5.65	.43	.76	2.41
October 9	do	5.58	.44	.77	2.44
October 12	do	5.64	.4	.78	2.26
October 17	do	5.70	.45	.79	2.53
October 21	do	5.93	.32	.80	1.88
October 23	do	5.69	.38	.80	2.18
October 26	do	5.91	.32	.82	1.92
October 30	do	6.25	.32	.87	1.98
November 2	do	6.24	.29	.88	1.82
November 7	do	6.40	.25	.87	1.59
November 10	do	6.51	.24	.90	1.56
November 13	do	6.84	.24	.91	1.66
November 16	do	7.01	.24	.96	1.66
November 21	do	7.66	.20	1.01	1.5
November 23	do	7.48	.21	1.00	1.55
December 5	do	7.57	.24	1.00	1.82
December 12	do	7.14	.24	.96	1.73

HENRIETTA MILL DITCH AT ECHO, OREG.

This ditch diverts water from the right bank of Umatilla River, 2 miles above Echo.

The water was formerly used to furnish power for the Henrietta flour mill in Echo. At present a portion of the water is used for irrigation and the remainder wasted into the river below the mill.

Discharge measurements of Henrietta mill ditch at Echo, Oreg., in 1905.

Date	Hydrographer.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Square feet.	*Feet per second.*	*Feet.*	*Second-feet.*
August 18	W. C. Sawyer	6.47	0.80	1.19	5.20
August 19	do	5.56	.92	1.14	5.10
August 30	Sawyer and Dillard	3.55	.40	.69	1.42
September 8	F. C. Dillard	2.99	.42		1.26
September 23	do	2.95	.60	.79	1.76
September 25	do	2.16	.51	.67	1.11
October 4	do	1.45	.4	.57	.58
October 7	do	1.30	.38	.55	.49
October 9	do	1.09	.38	.52	.41
October 12	do	1.04	.36	.50	.37
October 17	do	.79	.33	.43	.26
October 21	do	.70	.21	.40	.15
October 23	do	.66	.23	.40	.15
October 26	do	.55	.40	.40	.22
October 30	do	3.00	.42	.80	1.27
November 2	do	2.87	.35	.80	1.01
November 7	do	2.75	.30	.77	.83
November 10	do	2.55	.31	.73	.78
November 13	do	2.43	.3	.70	.73
November 16	do	2.51	.27	.74	.69
November 21	do	2.5	.26	.70	.64
November 24	do	1.85	.21	.63	.38
December 5	do	1.19	.23	.48	.27
December 12	do	1.17	.21	.50	.25
December 21	do	7.38	.77	1.61	5.66
December 27	do	7.2	.78	1.57	5.58

Discharge measurements of Henrietta mill ditch wasteway at Echo, Oreg., in 1905.

Date.	Hydrographer.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Square feet.	*Feet per second.*	*Feet.*	*Second-feet.*
August 19	W. C. Sawyer	2.35	0.45		1.05
August 30	Sawyer and Dillard	2.52	.47	0.53	1.19
September 8		2.06	.39	.44	.8
September 23	F. C. Dillard	.49	.37		.18
September 23	do	2.19	.44	.50	.96
September 26	do	1.84	.35	.44	.65
October 5	do	1.49	.27	.34	.46
October 10	do	1.11	.23	.28	.26
October 13	do	.89	.19	.19	.17
October 17	do	.65	.20	.19	.13
October 21	do	.55	.18	.12	.10
October 24	do	.46	.13	.13	.06
October 30	do	1.98	.38	.45	.75
November 3	do	2.14	.30	.44	.64
November 8	do	1.78	.28	.39	.49
November 13	do	1.34	.25	.33	.33
November 16	do	1.56	.19	.38	.30
November 24	do	1.81	.11	.42	.19

WILSON & CO.'S DITCH AT ECHO, OREG.

This ditch diverts water from the right bank of Umatilla River 2 miles above Echo, just below the Henrietta mill diversion.

Measurements were made about 500 feet below the waste gate.

The ditch was dug during 1904.

Discharge measurements of Wilson & Co.'s ditch at Echo, Oreg., in 1905.

Date.	Hydrographer.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Square feet.	*Feet per second.*	*Feet.*	*Second-feet.*
August 18	W. C. Sawyer	7.4	0.73	2.07	5.41
August 19	do	6.58	.76	1.84	4.99
August 30	Sawyer and Dillard	2.43	.20	1.22	.48
September 8	F. C. Dillard	3.25	.39	1.50	1.26
September 23	do	8.98	.38	2.20	3.41
September 25	do	8.64	.37	2.19	3.18
October 4	do	4.13	.32	1.64	1.32
October 7	do	5.00	.33	1.75	1.66
October 9	do	5.45	.35	1.82	1.93
October 12	do	5.33	.86	2.80	4.56
October 17	do	5.72	.37	1.91	2.11
October 21	do	4.73	.32	1.72	1.52
October 23	do	4.28	.31	1.65	1.34
October 26	do	4.94	.34	1.77	1.69
October 30	do	5.40	.34	1.81	1.86
November 2	do	4.57	.32	1.72	1.47
November 7	do	4.60	.31	1.70	1.42

ALLEN DITCH AT ECHO, OREG.

This ditch diverts water from the left bank of Umatilla River 1 mile above Echo.

During the latter portion of 1905 a portion of the water was wasted into the Pioneer ditch and some into the river.

Measurements were made one-eighth mile below the head gate.

Discharge measurements of Allen ditch at Echo, Oreg., in 1905.

Date.	Hydrographer.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Square feet.	*Feet per second.*	*Feet.*	*Second-feet.*
August 19	W. C. Sawyer	10.73	0.65	.....	6.97
August 29	Sawyer and Dillard	14.80	.58	.....	8.57
September 8	F. C. Dillard	14.84	.76	.....	11.21
September 16	do	5.52	.57	0.42	3.14
September 19	do	4.97	.62	.41	3.07
September 23	do	12.66	1.34	.99	16.58
September 25	do	13.30	1.29	1.0	17.30
September 30	Sawyer and Dillard	15.71	1.47	1.07	23.13
October 4	F. C. Dillard	15.30	1.42	1.01	21.64
October 7	do	11.96	1.05	.69	12.52
October 9	do	11.81	1.0	.68	11.85
October 12	do	11.76	1.02	.67	11.97
October 17	do	11.05	1.04	.65	11.51
October 21	do	11.65	1.04	.65	12.11

Discharge measurements of Allen ditch at Echo, Oreg., in 1905—Continued.

Date.	Hydrographer.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Square feet.	*Feet per second.*	*Feet.*	*Second-feet.*
October 24	F. C. Dillard	11.57	1.05	0.63	12.17
October 27	do	16.21	.74	1.17	12.08
October 31	do	15.88	.75	1.15	11.94
November 3	do	16.04	.76	1.14	12.14
November 8	do	15.88	.74	1.16	11.70
November 11	do	15.54	.73	1.15	11.52
November 14	do	15.92	.75	1.17	11.97
November 17	do	15.93	.75	1.16	11.89
November 21	do	17.06	.68	1.29	11.55
November 24	do	15.44	.79	1.12	12.17
December 5	do	25.90	.30	.92	7.76
December 13	do	13.12	.26	.92	3.44
December 21	do	15.89	.97	1.21	15.40

Discharge measurements of Allen ditch wasteway at Echo, Oreg., in 1905.

Date	Hydrographer.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Square feet.	*Feet per second.*	*Feet.*	*Second-feet.*
September 23	F. C. Dillard	1.23	0.10	.....	0.12
September 30	Sawyer and Dillard	2.74	1.18	.....	3.24
October 5	F. C. Dillard	2.64	1.13	.....	2.98
October 7	do	2.54	.94	.....	2.40
October 9	do	2.35	.97	.....	2.28
October 12	do	2.86	1.03	.....	2.94
October 18	do	2.66	.94	0.48	2.53
October 21	do	2.58	.90	.48	2.31
October 24	do	2.65	.91	.47	2.42
October 26	do	1.80	.18	.25	.32
October 31	do	1.78	.12	.25	.22
November 2	do	1.79	.21	.36	.37
December 13	do	2.41	.48	.....	1.17
December 21	do	4.86	2.23	.81	10.08
December 27	do	5.21	1.71	.80	8.89

HINKLE DITCH AT ECHO, OREG.

This ditch diverts water from the left bank of Umatilla River 1 mile above Echo. The ditch was dry during August, September, and most of October. Measurements were made at a wagon bridge just below the waste gate. The waste is so arranged that water may be turned into the Allen ditch or the Allen ditch wasteway.

Discharge measurements of Hinkle ditch at Echo, Oreg., in 1905.

Date.	Hydrographer.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Square feet.	*Feet per second.*	*Feet.*	*Second-feet.*
October 27	F. C. Dillard	7.27	0.81	1.36	5.86
October 31	do	7.97	.79	1.39	6.29
November 2	do	9.37	.71	1.39	6.60
November 8	do	8.24	.69	1.33	5.71
November 10	do	10.13	.76	1.50	7.70
November 14	do	11.69	.83	1.52	9.65
November 16	do	10.83	.74	1.52	8.00
November 21	do	13.69	1.00	1.74	13.78
November 23	do	13.91	.95	1.74	13.24
November 30	do	13.57	.93	1.76	12.69
December 5	do	11.73	.97	1.60	11.40
December 27	do	13.28	.97	1.71	12.87

PIONEER DITCH AT ECHO, OREG.

This ditch diverts water from the left bank of Umatilla River west of the city of Echo. All of the water during the latter part of September, October, and November was waste from the Allen ditch. During December a small portion of the water came directly from the river. Measurements were made from the wagon bridge just below the Allen ditch wasteway.

Discharge measurements of Pioneer ditch at Echo, Oreg., in 1905.

Date.	Hydrographer.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Square feet.	*Feet per second.*	*Feet.*	*Second-feet.*
September 23	F. C. Dillard	6 30	0.66	0.94	4.14
September 25	do	2.52	.52	.51	1.31
September 30	Sawyer and Dillard	6.62	.94	1.09	6.22
October 5	F. C. Dillard	6.16	.84	.95	5.20
October 7	do	5.05	.69	.84	3.50
October 9	do	5.78	.74	.91	4.25
October 12	do	7.85	.84	1.09	6.63
October 18	do	8.73	.89	1.18	7.72
October 21	do	9.26	.84	1.23	7.74
October 24	do	9.47	.81	1.26	7.64
October 26	do	3.92	.67	.70	2.62
October 31	do	4.32	.61	.76	2.62
November 2	do	3.10	.52	.60	1.61
November 8	do	10.31	.81	1.32	8.34
November 10	do	10.28	.83	1.36	8.52
November 14	do	11.40	.85	1.48	9.65
November 16	do	9.71	.80	1.34	7.78
November 21	do	10.80	.85	1.43	8.63
November 23	do	10.66	.86	1.43	9.13
December 13	do	12.55	1.03	1.58	12.98
December 21	do	4.42	.58	.74	2.54
December 27	do	3.39	.50	.73	1.71

MAXWELL DITCH AT ECHO, OREG.

This ditch diverts water from the left bank of Umatilla River 2 miles below Echo. Measurements were made 1,000 feet below the head gate. At a point 1 mile below the head the water is carried under the river in a siphon and the surplus wasted into the river.

Discharge measurements of Maxwell ditch at Echo, Oreg., in 1905.

Date.	Hydrographer.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Square feet.	*Feet per second.*	*Feet.*	*Second-feet.*
August 8	Sawyer and Dillard	2.36	0.68	.....	1.61
August 30	F. C. Dillard	1.68	.39	.....	.49
September 8	do	1.09	.91	.....	.99
September 16	do	3.02	.96	0.52	2.89
September 19	do	2.81	.80	.47	2.25
September 25	do	3.22	.92	.52	2.96
September 30	Sawyer and Dillard	6.70	1.48	1.02	9.90
October 5	F. C. Dillard	8.02	1.70	1.24	13.65
October 7	do	6.72	1.48	1.00	9.92
October 9	do	6.34	1.51	.98	9.61
October 12	do	6.32	1.5	.95	9.46
October 18	do	5.78	1.43	.89	8.25
October 21	do	5.92	1.45	.88	8.62
October 24	do	5.73	1.44	.88	8.25
October 26	do	5.16	1.45	.85	7.48
October 31	do	4.92	1.28	.75	6.28
November 2	do	4.93	1.25	.75	6.19
November 8	do	5.00	1.18	.69	5.92
November 10	do	4.40	1.20	.69	5.30
November 14	do	4.33	1.21	.69	5.23
November 16	do	4.34	1.24	.68	5.38
November 21	do	4.07	1.16	.66	4.72
November 23	do	4.13	1.12	.64	4.64
December 13	do	2.72	.83	.44	2.26
December 21	do	2.09	.67	.45	1.39
December 27	do	1.97	.57	.33	1.13

Discharge measurements of Maxwell ditch wasteway at Echo, Oreg., in 1905.

Date.	Hydrographer.	Discharge.
		Second-feet.
October 5	F. C. Dillard	1.02
October 10	do	1.11
October 13	do	1.21
October 18	do	1.14
October 21	do	1.28
October 24	do	1.30
October 26	do	1.40
October 31	do	2.29
November 2	do	2.07

HERMISTON DITCH NEAR HERMISTON, OREG.

This ditch diverts water from the right bank of Umatilla River, 5 miles below Fosters, Oreg. Measurements were made just below the head-gate and below the second waste gate.

Discharge measurements of Hermiston ditch below head-gate near Hermiston, Oreg., in 1905.

Date	Hydrographer.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Square feet.	*Feet per second.*	*Feet.*	*Second-feet.*
August 9	W. C. Sawyer	6.53	0.6	.....	3.92
September 15	F. C. Dillard	19.15	1.24	.....	23.83
September 22	do	8.89	.81	0.21	7.20
September 27	do	11.31	.79	.39	8.99
September 30	Sawyer and Dillard	13.02	.86	.48	11.14
October 3	F. C. Dillard	13.35	.88	.49	11.77
October 6	do	13.1	.85	.49	11.18
October 11	do	13.99	.84	.50	11.80
October 14	do	13.28	.82	.54	10.90
October 20	do	13.86	.89	.50	12.28
October 25	do	13.22	.93	.48	12.18
October 28	do	12.65	.9	.47	11.38
November 1	do	13.09	.8	.47	11.16
November 3	do	14.31	.78	.53	11.10
November 9	do	13.95	.79	.52	10.93
November 15	do	14.00	.81	.55	11.30
November 18	do	13.94	.8	.54	11.16
November 22	do	13.83	.77	.54	10.63
November 25	do	14.33	.77	.56	10.99
December 6	do	14.02	.81	.....	11.31
December 14	do	13.82	.77	.....	10.60

Discharge measurements of Hermiston ditch below second wasteway near Hermiston, Oreg., in 1905.

Date.	Hydrographer.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Square feet.	*Feet per second.*	*Feet.*	*Second-feet.*
August 9	W. C. Sawyer	4.25	0.62	.....	2.73
September 22	F. C. Dillard	4.74	1.30	0.45	6.17
September 27	do	3.15	1.12	.30	3.54
September 30	Sawyer and Dillard	4.22	1.31	.45	5.55
October 3	F. C. Dillard	4.75	1.34	.50	6.38
October 6	do	5.50	1.48	.65	8.17
October 11	do	3.76	1.09	.35	4.10
October 14	do	2.93	1.01	.28	2.96
October 20	do	5.78	1.50	.70	8.69
October 25	do	5.69	1.48	.70	8.42
October 28	do	5.31	1.44	.62	7.66
November 1	do	4.73	1.21	.50	5.73
November 3	do	2.60	.99	.20	2.58

BEITLE DITCH NEAR HERMISTON, OREG.

This ditch is now owned by D. C. Brownell, and diverts water from the right bank of Umatilla River west of Hermiston. Measurements were made just below the waste gate.

Discharge measurements of Beitle ditch near Hermiston, Oreg., in 1905.

Date.	Hydrographer.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Square feet.	*Feet per second.*	*Feet.*	*Second-feet.*
August 9		1.87	0.52		0.96
September 15	F. C. Dillard	1.76	.61	0.71	1.08
October 3	do	1.04	.163	.50	.17
October 11	do	1.35	.40	.63	.54
October 14	do	1.39	.45	.64	.62
October 20	do	2.03	.69	.81	1.40
October 25	do	.74	.95	.46	.07

OREGON LAND AND WATER COMPANY'S DITCH AT UMATILLA, OREG.

This ditch diverts water from the left bank of Umatilla River 2 miles above Umatilla. Measurements were made opposite the river gaging station below the upper flume and waste gate, one-fourth mile below the diversion point. The gage was read every other day by B. V. Pompella and Clyde E. Niles.

Discharge measurements of Oregon Land and Water Company's ditch at Umatilla, Oreg., in 1905.

Date.	Hydrographer.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Square feet.	*Feet per second.*	*Feet.*	*Second-feet.*
February 28	J. H. Lewis	15.8	1.74	2.00	27.5
March 27	do	14.6	1.56	1.87	22.9
April 10	do	16.1	1.84	2.00	29.6
May 12	W. C. Sawyer	17.6	2.05	2.13	36.1
July 19	do	12.4	1.47	1.83	18.2
September 15	F. C. Dillard	12.5	1.28	1.83	16.0
September 26	W. C. Sawyer	10.6	1.19	1.65	12.7
October 25	R. S. Hall			.75	0.0
November 4	F. C. Dillard	10.3	.96	1.53	9.8
November 9	do	9.2	1.09	1.54	9.4

Daily gage height, in feet of Oregon Land and Water Company's ditch at Umatilla, Oreg., for 1905.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	1.8	.....	2.35	2.4	.....	1.71	1.68	.....
2	1.95	.....	2.0	.....	.....	1.73	.....	.....	1.53
3	.....	1.8	.....	2.15	2.4	.....	1.73	1.71	.....
4	1.9	.....	2.0	.....	.....	1.7	.....	.....	1.53
5	.....	1.8	.....	2.15	2.2	.....	1.75	1.55	.....
6	1.95	1.8	2.0	.....	.....	1.7	.....	.....	1.53
7	.....	.....	.....	2.15	2.0	.....	1.75	1.57	.....
8	1.95	2.0	2.15	.....	.....	1.72	.....	.....	1.53
9	.....	.....	.....	2.4	1.95	.....	1.77	1.57	.....
10	2.0	2.0	2.15	.....	.....	1.72	.....	.....	1.67
11	.....	.....	.....	2.4	1.9	.....	1.77	1.58	.....
12	2.0	2.0	2.15	.....	.....	1.72	.....	.....	1.67
13	.....	.....	.....	2.25	1.9	.....	1.77	1.43	.....
14	2.0	2.0	1.9	.....	.....	1.67	.....	(a)	1.67
15	.....	.....	.....	2.1	1.85	.....	1.9	.....	.....
16	1.85	2.0	2.15	.....	.....	1.75	.....	.....	.....
17	.....	.....	.....	2.4	1.85	.....	1.88	.....	.....
18	1.85	2.0	1.8	.....	.....	1.73	.....	.....	.....
19	.....	.....	.....	2.4	1.83	.....	1.86	.....	.....
20	1.85	1.95	2.05	.....	.....	1.71	.....	.....	.....
21	.....	.....	.....	2.4	1.83	.....	1.68	.....	.....
22	1.85	2.1	2.05	.....	.....	1.7	.....	.....	.....
23	.....	.....	.....	2.4	1.82	.....	1.65	.....	.....
24	1.9	2.1	2.4	.....	.....	1.7	.....	.....	.....
25	.....	.....	.....	2.4	1.8	.....	1.67	.....	.....
26	1.9	2.1	2.2	.....	.....	1.7	.....	.....	.....
27	1.87	.....	.....	2.35	1.79	.....	1.68	.....	.....
28	1.9	2.1	2.3	.....	.....	1.7	.....	.....	.....
29	1.9	.....	.....	2.4	1.81	.....	1.68	.....	.....
30	1.85	2.1	2.4	.....	.....	1.7	.....	.....	.....
31	.....	.....	.....	.....	1.8	.....	.....	1.53	.....

(a) Dry October 14–30.

Station rating table for Oregon Land and Water Company's ditch at Umatilla, Oreg., from January 1 to December 31, 1905.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
0.75	0.0	1.20	3.2	1.70	14.5	2.20	41.0
.80	.1	1.30	4.5	1.80	18.5	2.30	50.0
.90	.5	1.40	6.3	1.90	23.1	2.40	60.0
1.00	1.2	1.50	8.5	2.00	28.2	2.50	73.0
1.10	2.1	1.60	11.1	2.10	34.0		

The above table is applicable only for open-channel conditions. It is based on ten discharge measurements made during 1905. It is well defined between gage heights 1.65 feet and 2.1 feet.

Estimated monthly discharge of Oregon Land and Water Company's ditch at Umatilla, Oreg., for 1905.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
March	28.2	19.6	23.8	1,463
April	34.0	18.5	27.5	1,636
May	60.0	18.5	36.9	2,269
June	60.0	34.0	52.2	3,106
July	60.0	18.1	26.8	1,648
August	17.1	13.4	15.0	922
September	23.1	12.7	16.6	988
October	14.9	0	4.89	301
November	13.4	9.2	10.8	300
The period				12,630

NOTE.—Mean for actual number of days recorded taken as the mean for the entire month.

BROWNELL DITCH AT UMATILLA, OREG.

This ditch diverts water from the right bank of Umatilla River 1½ miles above Umatilla, Oreg., and a few hundred feet below the river-gaging station. Measurements were made below the Oregon Railroad and Navigation Company's sidetrack.

Discharge measurements of Brownell ditch at Umatilla, Oreg., in 1905.

Date.	Hydrographer.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Square feet.	*Feet per second.*	*Feet.*	*Second-feet.*
May 12	W. C. Sawyer	7.50	0.73		5.50
September 26	do	3.80	1.03	1.17	3.90
October 25	R. S. Hall	3.28	.65	1.05	2.13
October 28	F. C. Dillard	2.95	.58	1.05	1.72
November 1	do	2.79	.50	1.02	1.41
November 3	do	2.77	.51	1.00	1.41
November 9	do	3.06	.64	1.09	1.95
November 15	do	3.06	.65	1.09	1.98
November 18	do	3.06	.65	1.09	1.98
November 22	do	3.09	.63	1.09	1.96
November 25	do	3.08	.64	1.09	1.98
December 6	R. S. Hall	3.28	.82	1.11	2.70
December 14	F. C. Dillard	3.28	.68	1.12	2.23
December 20	Dillard and Hall	3.47	.74	1.14	2.58

BOWMAN DITCH AT UMATILLA, OREG.

This ditch diverts water from the right bank of Umatilla River one-half mile above Umatilla. December 20, 1905, a discharge measurement made by Dillard and Hall gave a discharge of 0.33 second-foot.

SPRINGS IN UMATILLA RIVER VALLEY.

The following discharge measurements were made in 1905, by F. C. Dillard, of springs in Umatilla River Valley:

Gillette Springs outlet, near Echo, Oreg., October 2, 1.95 second-feet.

Cold Springs, near Hermiston, Oreg., September 27, 1.65 second-feet; October 6, 1.50 second-feet.

WILLOW CREEK DRAINAGE BASIN.

DESCRIPTION OF BASIN.

Willow Creek rises on the northern slopes of the western spur of the Blue Mountains and flows northwestward, entering Columbia River at Willows, Oreg.

WILLOW CREEK NEAR ARLINGTON, OREG.

This station was established December 17, 1904. It is located at the wagon bridge at Rhea Siding, 9 miles from Arlington, Oreg. The station is maintained as a flood station and miscellaneous measurements only are made during the summer season.

The channel is curved, but in high water is fairly straight for 100 feet. Both banks are high and clean and overflow but rarely. The bed of the stream is composed of rocks and gravel and is free from vegetation and permanent. There is but one channel.

Discharge measurements are made from the bridge or by wading.

A vertical-staff gage is fastened to a bent of the bridge. During 1905 the gage was read once each day by C. H. Curtis.

Discharge measurements of Willow Creek near Arlington, Oreg., in 1905.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Square feet.*	*Feet per second.*	*Feet.*	*Second-feet.*
March 16	W. C. Sawyer	12	8	2.21	3.38	17.6
March 26	J. H. Lewis	27	25	2.26	3.77	56
April 9	do	24	28	2.46	3.85	69
May 31	W. C. Sawyer	14	56	2.82	4.40	157
May 31	do	18	63	2.98	4.50	187
May 31	do	14	46	2.19	4.18	112
August 17	do	5	1.5	.85	3.00	1.3
October 24	Sawyer and Hall	4	2.3	1.59	3.11	3.7
December 19	Hall and Dillard	9	6.5	1.79	3.29	11.6

NOTE.—These measurements were made at different sections.

Daily gage height, in feet, of Willow Creek near Arlington, Oreg., for 1905.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Day.	Mar.	Apr.	May.	June.	July.	Aug.
1	3.7	3.8	2.9	3.75	3.0	3.0	17	3.7	3.4	3.25	3.0	2.9	3.0
2	3.7	4.0	2.8	3.75	3.0	3.0	18	3.7	3.5	3.25	3.0	2.9	3.0
3	3.7	4.1	2.8	3.7	3.0	2.8	19	3.7	3.4	3.3	3.0	2.8	3.1
4	3.6	4.1	2.9	3.7	3.0	2.8	20	3.8	3.35	3.3	3.0	2.8	3.1
5	3.6	4.0	2.8	3.7	3.0	2.8	21	3.8	3.35	3.3	3.0	2.8	.....
6	3.6	3.95	2.8	3.7	3.0	2.9	22	3.8	3.3	3.3	2.95	2.8	.....
7	3.6	3.9	2.8	3.55	2.8	3.0	23	3.8	3.1	3.2	2.9	2.8	.....
8	3.5	3.9	2.8	3.45	2.8	3.0	24	3.9	3.0	3.2	2.8	2.8	.....
9	3.5	3.85	2.8	3.45	2.8	3.0	25	4.0	3.0	3.3	5.4	2.8	.....
10	3.5	3.85	2.8	3.45	3.0	3.0	26	3.9	3.0	3.3	4.9	2.8	.....
11	3.5	3.85	2.8	3.4	2.95	2.9	27	3.9	2.9	3.3	3.6	2.8	.....
12	3.5	3.8	2.8	3.4	2.9	2.9	28	3.9	2.9	3.3	3.45	2.8	.....
13	3.5	3.5	2.8	3.4	2.9	2.8	29	3.9	2.9	3.3	3.3	2.9	.....
14	3.5	3.45	3.5	3.3	2.9	3.0	30	3.9	2.9	3.3	3.0	2.9	.....
15	3.6	3.45	3.5	3.2	2.9	3.0	31	3.9	.....	4.33	.....	3.0	.....
16	3.6	3.4	3.3	3.2	2.9	3.0							

Station rating table for Willow Creek near Arlington, Oreg., from March 1 to August 20, 1905.

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	0.3	3.50	28	4.20	120	4.90	299
2.90	.6	3.60	38	4.30	139	5.00	333
3.00	1.3	3.70	48	4.40	160	5.10	369
3.10	3.8	3.80	60	4.50	183	5.20	406
3.20	7	3.90	73	4.60	209	5.30	445
3.30	13	4.00	87	4.70	237	5.40	488
3.40	20	4.10	103	4.80	267		

The above table is applicable only for open-channel conditions. It is based on eight discharge measurements made during 1905. It is well defined between gage heights 3 feet and 4.5 feet. The table has been extended beyond these limits.

Estimated monthly discharge of Willow Creek near Arlington, Oreg., for 1905.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
March	87	28	50.0	3,074
April	103	.6	38.1	2,267
May	145	.3	12.3	756
June	488	.3	45.5	2,707
July	1.3	.3	.67	41
August 1-20	3.8	.3	1.24	49
The period				8,894

JOHN DAY RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

John Day River enters Columbia River from the south. For about 90 miles above its mouth the river flows in a northerly direction through a rolling country partly desert and partly cultivated and comprising, approximately, 2,000 square miles. This portion of the river receives a number of small tributaries, but only one of importance—Rock Creek—which joins the river a mile above the gaging station at McDonald. The river channel is for the most part several hundred feet below the level of the surrounding country, and as the river bottom is narrow very little water is used for irrigation.

In the upper section the river flows in a westerly direction and is joined by three important tributaries—North, Middle, and South forks. The first two flow in a westerly direction also, but the latter comes from the south. This upper portion of the river drains a country much of which is from 4,000 to 10,000 feet in elevation and which includes the western slopes of the Blue Mountains. The higher portions are still well timbered.

JOHN DAY RIVER AT M'DONALD, OREG.

This station was established November 14, 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.

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.

Discharge measurements are made by means of a car suspended from the ferry cable. The car is provided with steel blocks and lever for passing the ferry traveler. The initial point for soundings is the face of the support on the right bank.

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. During 1905 the gage was read once each day by William Murray. The bench mark is the top of the corner stone under the southeast corner of a barn near the gage; elevation, 15.32 feet above the datum of the gage.

A description of this station, with gage heights and discharge data, is contained in Water-Supply Paper No. 135, United States Geological Survey, page 268.

Discharge measurements of John Day River at McDonald, Oreg., in 1905.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Square feet.*	*Feet per second.*	*Feet.*	*Second-feet.*
February 24	W. C. Sawyer	278	953	2.07	3.20	1,970
March 17	do	285	1,067	2.48	3.66	2,653
March 25	J. H. Lewis	300	1,214	2.89	4.10	3,504
April 8	do	304	1,252	3.05	4.28	3,798
May 10	W. C. Sawyer	308	1,393	3.59	4.70	5,006
May 11	do	310	1,368	3.54	4.68	4,850
June 1	do	277	1,047	2.27	3.58	2,484
August 16 [a]	do	50	50	2.14	1.25	107
August 17 [a]	do	58	48	2.29	1.25	109
October 23	Sawyer and Hall	258	578	.60	1.75	350
October 24	W. C. Sawyer	258	556	.60	1.73	336

[a] Made at different section.

Daily gage height, in feet, of John Day River at McDonald, Oreg., for 1905.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.5	2.8	3.45	3.8	3.9	3.55	2.5	1.35	1.2	1.5	1.85	1.9
2	2.85	2.7	3.5	3.75	4.05	3.55	2.37	1.35	1.2	1.52	1.8	1.85
3	2.5	2.6	3.53	3.92	4.0	3.55	2.3	1.3	1.2	1.6	1.8	1.8
4	2.3	2.55	3.7	4.15	4.2	3.57	2.23	1.35	1.2	1.6	1.7	1.8
5	2.3	2.45	3.8	4.1	4.55	3.65	2.2	1.4	1.2	1.6	1.7	1.8
6	2.25	2.45	3.8	4.08	4.55	3.53	2.1	1.35	1.2	1.55	1.7	1.95
7	2.2	2.4	3.75	4.15	4.5	3.45	2.02	1.35	1.2	1.65	1.75	1.9
8	2.0	2.3	3.7	4.3	4.45	3.37	2.0	1.35	1.2	1.6	1.75	1.85
9	1.9	2.4	3.6	4.35	4.43	3.3	1.93	1.35	1.2	1.55	1.75	1.8
10	1.95	2.3	3.52	4.45	4.77	3.2	1.9	1.3	1.2	1.55	1.75	1.8
11	1.8	2.3	3.48	4.4	4.63	3.2	1.8	1.3	1.2	1.6	1.7	1.75
12	1.8	2.2	3.5	4.2	4.52	3.15	1.75	1.3	1.25	1.62	1.7	1.65
13	1.7	2.1	3.5	4.02	4.3	3.12	1.7	1.25	1.25	1.65	1.75	1.6
14	1.7	1.9	3.52	3.92	4.15	3.13	1.67	1.25	1.48	1.65	1.75	1.7
15	1.8	1.7	3.63	3.8	4.05	3.02	1.65	1.25	1.65	1.65	1.75	1.65
16	1.8	1.8	3.7	3.7	3.97	2.9	1.63	1.2	1.4	1.65	1.75	1.6
17	2.1	1.9	3.65	3.75	3.9	2.83	1.6	1.2	1.35	1.65	1.7	1.7
18	2.6	2.1	3.72	3.75	3.95	2.78	1.6	1.2	1.3	1.7	1.7	1.85
19	2.6	2.25	4.03	3.7	4.08	2.75	1.6	1.2	1.3	1.7	1.7	1.85
20	2.5	2.8	4.0	3.7	3.97	2.75	1.55	1.2	1.3	1.7	1.7	1.9
21	2.4	2.6	3.9	3.8	3.85	2.62	1.55	1.2	1.3	1.75	1.7	1.9
22	2.5	3.1	4.2	3.93	3.8	2.53	1.5	1.2	1.3	1.8	1.8	1.88
23	2.4	3.3	4.3	3.92	3.75	2.45	1.47	1.2	1.3	1.75	1.8	1.85
24	2.6	3.2	4.07	3.88	3.67	2.65	1.45	1.2	1.3	1.75	1.8	1.85

Daily gage height, in feet, of John Day River at McDonald, Oreg., for 1905—Continued.

Date.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
25	3.5	3.3	4.0	3.85	3.6	2.57	1.42	1.2	1.3	1.75	1.8	1.68
26	3.5	3.25	4.08	3.9	3.5	2.5	1.4	1.2	1.35	1.75	1.7	1.65
27	3.4	3.37	4.0	4.0	3.4	2.68	1.4	1.2	1.35	1.75	1.65	1.75
28	3.2	3.5	4.27	4.45	3.35	2.6	1.37	1.2	1.4	1.8	1.6	1.88
29	3.3	.....	4.1	4.17	3.43	2.6	1.35	1.2	1.4	1.85	1.7	1.9
30	3.2	.....	3.95	3.98	3.4	2.5	1.35	1.2	1.5	1.9	1.9	1.85
31	3.3	.....	3.88	.....	4.05	.....	1.35	1.2	.....	1.9	.....	1.8

NOTE.—During the frozen period the ice was kept clear for several hundred feet above and below gage

Station rating table for John Day River at McDonald, Oreg., from November 14, 1904, to December 31, 1905.

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	88	2.20	750	3.10	1,798	4.00	3,280
1.30	128	2.30	852	3.20	1,930	4.10	3,486
1.40	170	2.40	958	3.30	2,072	4.20	3,700
1.50	215	2.50	1,070	3.40	2,219	4.30	3,922
1.60	266	2.60	1,183	3.50	2,375	4.40	4,154
1.70	326	2.70	1,300	3.60	2,539	4.50	4,400
1.80	396	2.80	1,420	3.70	2,711	4.60	4,659
1.90	474	2.90	1,543	3.80	2,892	4.70	4,930
2.00	560	3.00	1,670	3.90	3,082	4.80	5,218
2.10	652						

The above table is applicable only for open-channel conditions. It is based on 11 discharge measurements made during 1904-5. It is well defined between gage heights 1.25 feet and 4.75 feet.

Estimated monthly discharge of John Day River at McDonald, Oreg., for 1904 and 1905.

[Drainage area, 8,000 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
1904.						
November 14-30	516	326	456	15,380	0.057	0.036
December	569	295	489	30,070	.061	.070
1905.						
January	2,375	326	1,093	67,200	0.137	0.158
February	2,375	326	1,181	65,590	.148	.154
March	3,922	2,296	2,921	179,600	.365	.421
April	4,275	2,711	3,296	196,100	.412	.460
May	5,130	2,145	3,395	208,700	.424	.489
June	2,624	1,014	1,705	101,500	.213	.238
July	1,070	149	391	24,040	.049	.056
August	170	88	112	6,887	.014	.016
September	295	88	129	7,676	.016	.018
October	474	215	318	19,550	.040	.046
November	474	266	355	21,120	.044	.049
December	516	266	397	24,410	.050	.058
The year	5,130	88	1,274	922,400	.159	2.16

NOTE.—No correction made for ice conditions.

ROCK CREEK NEAR ARLINGTON, OREG.

Rock Creek drains a high, rolling country containing very little timber. This station was established February 25, 1905. It is located at the highway bridge at Rockville station, Oreg., on the Condon branch of the Oregon Railroad and Navigation Company's line, and is about 6 miles above the mouth of Rock Creek and about 20 miles from Arlington, Oreg.

The channel is straight for 75 feet above and 100 feet below the station. The current is moderate above and sluggish below. The right bank is high and clean. Some water crosses the road at the left bank during very high water. The bed of the stream is composed of sand and gravel and is free from vegetation and permanent. There is but one channel at all stages.

Discharge measurements are made from the upstream side of the single-span wooden bridge. The initial point for soundings is the face of the right abutment.

The elevation of the water surface is determined by measuring down by means of a graduated rod. Between February 25 and August 19, 1905, gage-height observations were taken once each day by W. A. Nugent. The bench mark is the top of a projecting beam from the upstream side of the bridge, at the left bank, marked with black paint; elevation, 15.00 feet above the datum of the gage.

Discharge measurements of Rock Creek near Arlington, Oreg., in 1905.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Square feet.*	*Feet per second.*	*Feet.*	*Second-feet.*
February 25	W. C. Sawyer	45	77	2.61	6.81	201
March 18	do	29	37	1.24	5.77	46
March 26[a]	J. H. Lewis	35	74	2.10	6.91	155
April 8	do	35	49	1.70	6.15	83
May 10	W. C. Sawyer	30	38	1.03	5.85	39
August 17	do	.....	.....	.....	.....	.0
October 24	do	.....	.....	.....	5.07	.3
December 5	R. S. Hall	.....	.....	.....	5.06	[b].1

[a] Made at different section. [b] Estimated.

Daily gage height, in feet, of Rock Creek near Arlington, Oreg., for 1905.

Day.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.
1	.....	6.2	6.25	5.3	5.8	5.3	5.0
2	.....	6.1	6.25	5.45	5.6	5.2	5.3
3	.....	6.2	6.65	5.4	5.55	5.05	5.05
4	.....	6.15	6.45	5.45	5.4	5.0	5.0
5	.....	6.15	6.4	5.55	5.4	5.05	5.0
6	.....	6.15	6.3	5.6	5.4	5.05	5.0
7	.....	6.0	6.15	5.6	5.4	5.05	5.0
8	.....	5.95	6.1	5.6	5.35	5.05	5.0
9	.....	5.9	6.05	5.55	5.35	5.1	5.0
10	.....	5.8	6.1	5.85	5.3	5.1	5.0
11	.....	5.7	6.05	5.83	5.3	5.05	5.0
12	.....	5.7	5.95	5.75	5.25	5.05	5.0
13	.....	5.65	5.85	5.7	5.25	5.05	4.95
14	.....	5.75	5.85	5.7	5.2	5.05	4.95
15	.....	5.7	5.8	5.6	5.2	5.05	4.95
16	.....	5.7	5.8	5.55	5.1	5.0	4.95
17	.....	5.65	5.8	5.5	5.1	5.0	4.95
18	.....	5.75	5.75	5.5	5.1	5.0	5.1

Daily gage height, in feet, of Rock Creek near Arlington, Oreg., for 1905—Continued.

Day.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.
19	.....	6.1	5.7	5.5	5.15	5.0	5.0
20	.....	6.1	5.7	5.45	5.05	5.0	.....
21	.....	6.1	5.7	5.45	5.05	5.0	.....
22	.....	6.65	5.65	5.4	5.05	5.0	.....
23	.....	6.4	5.7	5.4	5.05	5.0	.....
24	.....	6.78	5.7	5.45	5.05	5.0	.....
25	6 8	7.0	5.6	5.45	5.05	4.95	.....
26	6.2	6.7	5.4	5.45	5.2	4.95	.....
27	6.25	7.0	5.4	5.45	5.5	4.95	.....
28	6.15	6.6	5.45	5.4	5.35	4.95	.....
29	.....	6.45	5.4	5.35	5.3	5.0	.....
30	.....	6.35	5.3	5.35	5.35	5.0	.....
31	.....	6.2	.....	5.3	.....	5.0	.....

Station rating table for Rock Creek near Arlington, Oreg., from February 25 to August 19, 1905

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
5.00	0	5.60	28	6.10	76	6.60	165
5.10	2	5.70	36	6.20	88	6.70	178
5.20	6	5.80	45	6.30	102	6.80	202
5.30	10	5.90	54	6.40	118	6.90	228
5.40	15	6.00	64	6.50	136	7.00	256
5.50	21						

The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1905. It is fairly well defined.

Estimated monthly discharge of Rock Creek near Arlington, Oreg., for 1905.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
March	256	32	93.2	5,731
April	167	10	57.5	3,422
May	50	10	22.7	1,396
June	45	1	10.2	607
July	10	0	.97	60

DESCHUTES RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

Deschutes River rises on the eastern slopes of the Cascade Mountains, in Klamath County, Oreg., and flows northward, entering Columbia River at Deschutes, Oreg. Its principal tributaries are West Fork, Squaw Creek, and Spring River from the west, and Crooked River and Willow and Trout creeks from the east.

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.

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 and is free from vegetation and permanent. There is but one channel at all stages.

Discharge measurements are made from the downstream side of the bridge. The initial point for soundings is a point marked with black paint at the west end of the bridge, downstream side.

A staff gage is fastened vertically to the sixteenth bent of the bridge, 335 feet from the initial point for soundings. During 1905 the gage was read once each day by Dr. W. S. Nichol, who was paid by the Deschutes Irrigation and Power Company. 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; elevation, 5.20 feet above the datum of the gage.

A description of this station, with gage heights and discharge data, is contained in Water-Supply Paper No. 135, United States Geological Survey, page 269.

Discharge measurements of Deschutes River near Bend, Oreg., in 1905.

Date	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Square feet.*	*Feet per second.*	*Feet.*	*Second-feet.*
February 7	I. Landes	375	828	2.54	2.00	2,100
March 6	do	375	828	2.63	1.95	2,166
April 20	do	375	797	2.57	1.90	2,050
May 21	do	375	706	2.67	1.69	1,887
August 10	do	375	654	2.43	1.55	1,590
September 22	do	370	623	2.43	1.46	1,516
October 27	do	370	634	2.35	1.50	1,490
November 15	do	370	600	2.24	1.40	1,346
December 7	do	370	597	2.02	1.40	1,209

Daily gage height, in feet, of Deschutes River near Bend, Oreg., for 1905.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.0	2.1	1.9	2.0	1.9	1.7	1.6	1.6	1.5	1.5	1.5	1.4
2	2.0	2.1	1.9	1.9	1.9	1.7	1.6	1.6	1.5	1.5	1.5	1.4
3	2.0	2.1	1.9	1.9	1.9	1.7	1.6	1.6	1.5	1.5	1.5	1.4
4	2.0	2.1	1.9	1.9	1.9	1.7	1.6	1.5	1.5	1.5	1.5	1.4
5	2.0	2.1	1.9	1.9	1.9	1.7	1.6	1.5	1.5	1.5	1.5	1.4
6	2.0	2.1	1.9	1.9	1.9	1.7	1.6	1.5	1.5	1.5	1.5	1.4
7	2.0	2.0	1.9	1.9	1.9	1.7	1.6	1.5	1.5	1.5	1.5	1.4
8	2.0	2.0	1.9	1.9	1.9	1.7	1.6	1.6	1.5	1.5	1.4	1.4
9	2.0	2.0	1.9	1.9	1.9	1.7	1.6	1.6	1.5	1.5	1.4	1.4
10	2.0	2.0	1.9	1.9	1.9	1.7	1.6	1.6	1.5	1.5	1.4	1.4
11	2.0	1.9	1.9	1.9	1.9	1.7	1.6	1.6	1.5	1.5	1.4	1.4
12	1.9	1.9	1.9	1.9	1.9	1.7	1.6	1.6	1.5	1.5	1.4	1.4
13	1.9	1.9	1.9	1.9	1.9	1.7	1.6	1.6	1.5	1.5	1.4	1.4
14	1.9	2.0	1.9	1.9	1.9	1.7	1.6	1.5	1.5	1.5	1.4	1.4
15	1.9	2.1	1.9	1.9	1.9	1.7	1.6	1.5	1.5	1.5	1.4	1.4
16	1.9	2.0	1.9	1.9	2.0	1.7	1.6	1.5	1.5	1.5	1.4	1.4
17	2.0	1.8	1.9	1.9	2.0	1.6	1.6	1.5	1.5	1.5	1.5	1.4
18	2.0	1.8	1.9	1.9	1.9	1.6	1.6	1.5	1.5	1.5	1.5	1.4

Daily gage height, in feet, of Deschutes River near Bend, Oreg., for 1905—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
19	2.0	1.8	1.9	1.9	1.7	1.6	1.6	1.5	1.5	1.5	1.5	1.4
20	2.0	1.8	2.0	1.9	1.7	1.7	1.6	1.5	1.5	1.5	1.5	1.4
21	2.0	1.9	2.0	1.9	1.7	1.7	1.6	1.5	1.5	1.5	1.5	1.4
22	2.0	1.9	2.0	1.9	1.7	1.6	1.6	1.5	1.5	1.5	1.5	1.3
23	2.0	1.9	2.0	1.9	1.7	1.6	1.6	1.5	1.5	1.5	1.5	1.3
24	2.0	1.9	2.0	1.9	1.7	1.6	1.6	1.5	1.5	1.5	1.5	1.4
25	2.0	1.9	2.0	1.9	1.7	1.6	1.6	1.5	1.5	1.5	1.5	1.5
26	2.0	1.9	2.0	1.8	1.7	1.6	1.6	1.5	1.5	1.5	1.5	1.5
27	2.1	1.9	2.0	1.8	1.7	1.6	1.6	1.5	1.5	1.5	1.5	1.5
28	2.1	1.9	2.0	1.8	1.7	1.6	1.6	1.5	1.5	1.5	1.4	1.5
29	2.2	.....	2.0	1.8	1.7	1.6	1.6	1.5	1.5	.....	1.4	1.5
30	2.3	.....	2.0	1.9	1.7	1.6	1.6	1.5	1.5	.....	1.4	1.5
31	2.1	.....	2.0	.....	1.7	.....	1.6	1.5	.....	.....	.....	1.5

Station rating table for Deschutes River near Bend, Oreg., from December 22, 1904, to December 31, 1905.

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	1,220	1.60	1,630	1.90	2,075	2.20	2,535
1.40	1,350	1.70	1,775	2.00	2,225	2.30	2,695
1.50	1,490	1.80	1,925	2.10	2,375		

The above table is applicable only for open-channel conditions. It is based on 11 discharge measurements made during 1904–5. It is fairly well defined.

Estimated monthly discharge of Deschutes River near Bend, Oreg., for 1905.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January	2,695	2,075	2,240	137,700
February	2,375	1,925	2,161	120,000
March	2,225	2,075	2,133	131,200
April	2,225	1,925	2,060	122,600
May	2,225	1,775	1,959	120,500
June	1,775	1,630	1,712	101,900
July	1,630	1,630	1,630	100,200
August	1,630	1,490	1,531	94,140
September	1,490	1,490	1,490	88,660
October[a]	1,490	1,490	1,490	91,620
November	1,490	1,350	1,434	85,330
December	1,490	1,220	1,373	84,420
The year	2,695	1,220	1,768	1,278,000

[a] Discharge interpolated October 29—31.

EAST FORK OF DESCHUTES RIVER 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. The drainage basin is high, composed of a pumice-stone soil, and covered largely with a growth of black pines.

The current is swift and the channel curved with both banks low and clean. The left bank is liable to overflow at high water. The bed of the stream is composed of gravel and sand and is free from vegetation and 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.

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.

A staff gage is fastened to logs projecting from a milk house belonging to the observer. During 1905 the gage was read once each day by Charles Graves. The bench mark is a 60-penny nail in the base of a jack-pine tree used for a gatepost in the fence of Mr. Graves's yard; elevation, 7.87 feet above the datum of the gage.

A description of this station, with gage heights, is contained in Water-Supply Paper No. 135, pages 269–270.

Discharge measurements of East Fork of Deschutes River at Odell, Oreg., in 1905.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Square feet.*	*Feet per second.*	*Feet.*	*Second-feet.*
January 31	I. Landes	24	31.0	2.03	2.50	63
March 9	do	24	35.7	1.30	2.45	56
April 26	do	24	40.0	1.93	2.65	77
April 29	do	25	39.2	1.89	2.64	74
June 25	do	22	35.0	1.57	2.45	55
June 25	do	22	35.0	1.54	2.45	54
August 4	H. W. King	24	29.2	1.04	2.18	30.3
October 6	I. Landes	22	28.1	1.03	2.15	29.1
October 30	do	22	24.0	1.30	2.18	31.1

Daily gage height, in feet, of East Fork of Deschutes River at Odell, Oreg., for 1905.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.5	2.4	2.5	2.5	2.7	2.6	2.35	2.1	2.1	2.18	2.29	2.3
2	2.65	2.5	2.5	2.5	2.65	2.6	2.3	2.15	2.1	2.18	2.05	2.2
3	2.6	2.7	2.5	2.5	2.65	2.6	2.3	2.15	2.1	2.15	1.95	2.2
4	2.65	2.5	2.5	2.5	2.6	2.6	2.65	2.15	2.1	2.15	2.18	2.2
5	2.65	2.5	2.5	2.5	2.6	2.6	2.65	2.15	2.1	2.15	2.12	2.18
6	2.6	2.5	2.5	2.6	2.6	2.65	2.65	2.2	2.1	2.15	2.0	2.18
7	2.6	2.3	2.5	2.55	2.6	2.65	2.2	2.25	2.1	2.25	2.0	2.18
8	2.5	2.6	2.5	2.55	2.7	2.6	2.1	2.15	2.1	2.3	2.02	2.2
9	2.6	2.65	2.5	2.55	2.8	2.6	2.2	2.18	2.1	2.3	2.05	2.2
10	2.5	2.65	2.5	2.5	2.7	2.65	2.15	2.18	2.1	2.25	2.05	2.18
11	2.5	2.58	2.5	2.5	2.7	2.6	2.2	2.2	2.1	2.2	2.03	2.18
12	2.6	2.6	2.5	2.5	2.65	2.6	2.2	2.15	2.1	2.2	1.95	2.18
13	2.65	2.7	2.55	2.5	2.6	2.6	2.2	2.15	2.1	2.18	2.25	2.2
14	2.7	2.7	2.55	2.5	2.6	2.6	2.2	2.15	2.1	2.18	2.3	2.4
15	2.9	2.8	2.5	2.55	2.6	2.6	2.25	2.18	2.1	2.18	2.2	2.4

Daily gage height, in feet, of East Fork of Deschutes River at Odell, Oreg., for 1905—Cont'd.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
16	3.1	2.7	2.5	2.55	2.6	2.55	2.2	2.18	2.1	2.2	2.2	2.4
17	2.9	2.7	2.5	2.5	2.7	2.5	2.25	2.13	2.1	2.2	2.1	2.4
18	2.8	2.8	2.55	2.7	2.7	2.5	2.2	2.15	2.1	2.2	2.1	2.3
19	2.7	2.8	2.5	2.5	2.7	2.5	2.2	2.15	2.1	2.2	2.1	2.3
20	2.7	2.9	2.55	2.5	2.7	2.5	2.2	2.13	2.1	2.18	2.1	2.3
21	2.7	2.8	2.6	2.52	2.7	2.5	2.2	2.12	2.1	2.18	2.15	1.9
22	2.7	2.7	2.65	2.5	2.65	2.4	2.15	2.11	2.1	2.18	2.0	2.9
23	2.7	2.7	2.55	2.55	2.6	2.45	2.15	2.11	2.1	2.18	1.9	2.6
24	2.7	2.7	2.6	2.55	2.6	2.45	2.15	2.11	2.1	2.18	1.8	2.9
25	2.7	2.6	2.65	2.55	2.6	2.4	2.15	2.11	2.1	2.18	1.85	2.9
26	2.6	2.6	2.6	2.6	2.6	2.4	2.1	2.11	2.1	2.2	1.9	2.9
27	2.6	2.5	2.65	2.7	2.6	2.4	2.1	2.11	2.13	2.2	2.1	2.9
28	2.6	2.5	2.6	2.7	2.6	2.4	2.1	2.11	2.15	2.2	2.1	2.0
29	2.7	.....	2.5	2.7	2.6	2.35	2.0	2.11	2.15	2.19	2.1	1.9
30	2.5	.....	2.8	2.65	2.6	2.35	2.1	2.11	2.18	2.18	2.1	1.9
31	2.5	.....	2.5	.....	2.6	.....	2.1	2.11	.....	2.18	.....	1.8

NOTE.—Ice conditions, January 10 to February 28.

Station rating table for East Fork of Deschutes River at Odell, Oreg., from December 26, 1904, to December 31, 1905.

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	10	2.20	32	2.60	70	2.90	104
1.90	14	2.30	41	2.70	81	3.00	117
2.00	19	2.40	50	2.80	92	3.10	131
2.10	25	2.50	60				

The above table is applicable only for open-channel conditions. It is based on nine discharge measurements made during 1905. It is well defined between gage heights 2.1 feet and 2.7 feet.

Estimated monthly discharge of East Fork of Deschutes River at Odell, Oreg., for 1905.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January	131	60	76.6	4,710
February	104	41	74.0	4,110
March	92	60	64.7	3,978
April	81	60	65.4	3,892
May	92	70	74.7	4,593
June	76	46	62.8	3,737
July	76	19	35.1	2,158
August	36	25	28.0	1,722
September	31	25	25.5	1,517
October	41	28	31.9	1,962
November	41	10	23.6	1,404
December	104	10	45.6	2,804
The year	131	10	50.7	36,590

NOTE.—No correction made for ice conditions.

DESCHUTES RIVER NEAR LAVA, OREG.

This station was established February 17, 1905. It is located about 1 mile north of Lava, Oreg. The river has its source in Crescent Lake, receives the waters of East Fork about 30 miles above the station, and joins West Fork, which is larger and is locally known as Big River, a short distance below the station. A considerable portion of the basin is timbered.

The channel is straight for 200 feet above and 100 feet below the station. The current is swift. Both banks are high and clean. The bed of the stream is composed of clay and is free from vegetation and permanent. There is but one channel at all stages.

Discharge measurements are made by means of a cable, car, tagged wire, and stay wire. The initial point for soundings is the center of the mud sill under the shear legs of the cable support on the east bank of the river.

An inclined staff gage is fastened to the right bank. During 1905 the gage was read once each day by Mrs. C. B. Allen. The bench mark is a copper bolt set in the base of a large jack-pine tree about 75 feet below the cable and near the east end of the wagon bridge; elevation, 11.38 feet above the datum of the gage.

Discharge measurements of Deschutes River near Lava, Oreg., in 1905.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Square feet.*	*Feet per second.*	*Feet.*	*Second-feet.*
March 2	I. Landes	82	195	1.47	6.44	286
April 24	do	82	183	1.52	6.20	277
May 23	do	82	182	1.48	6.34	270
June 23	do	82	169	1.17	6.00	198
June 23	do	82	170	1.22	6.00	208
August 9	do	79	125	.83	5.29	104
November 18	do	51	110	.90	5.00	100
December 8	do	51	107	.92	5.08	[a]107

[a] Narrow strip of ice along each bank.

Daily gage height, in feet, of Deschutes River near Lava, Oreg., for 1905.

Day.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1		6.45	6.55	6.35	6.3	5.95	5.4	5.05	5.15	5.15	5.1
2		6.45	6.55	6.4	6.3	5.85	5.4	5.05	5.2	5.1	5.1
3		6.45	6.55	6.45	6.4	5.85	5.4	5.05	5.1	5.05	5.1
4		6.5	6.55	6.5	6.45	5.8	5.3	5.0	5.1	5.05	5.1
5		6.5	6.5	6.4	6.4	5.8	5.3	5.0	5.1	5.05	5.0
6		6.5	6.5	6.35	6.4	5.75	5.3	5.0	5.1	5.0	5.0
7		6.5	6.45	6.3	6.4	5.7	5.3	5.0	5.15	5.0	4.95
8		6.5	6.45	6.4	6.35	5.7	5.3	5.0	5.2	5.0	5.15
9		6.45	6.45	6.45	6.3	5.65	5.3	5.0	5.3	5.0	4.9
10		6.4	6.45	6.5	6.3	5.6	5.3	5.0	5.3	5.0	5.0
11		6.4	6.4	6.55	6.25	5.55	5.3	5.0	5.2	5.0	5.0
12		6.4	6.3	6.55	6.25	5.55	5.3	5.0	5.2	5.0	5.0
13		6.4	6.3	6.5	6.3	5.55	5.25	5.05	5.15	5.0	5.0
14		6.4	6.3	6.4	6.2	5.55	5.2	5.05	5.15	4.9	5.0
15		6.45	6.3	6.35	6.2	5.5	5.2	5.05	5.15	4.85	5.05
16		6.5	6.35	6.4	6.15	5.5	5.2	5.05	5.2	4.9	5.1
17	6.3	6.5	6.35	6.3	6.15	5.5	5.2	5.05	5.2	5.0	5.1
18	6.32	6.5	6.35	6.3	6.1	5.5	5.2	5.05	5.25	5.0	5.1
19	6.4	6.5	6.35	6.3	6.1	5.5	5.2	5.05	5.2	5.1	5.15

Daily gage height, in feet, of Deschutes River near Lava, Oreg., for 1905—Continued.

Day.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
20	6.7	6.55	6.3	6.3	6.1	5.45	5.15	5.0	5.2	5.1	5.2
21	6.75	6.65	6.3	6.3	6.05	5.4	5.15	5.0	5.2	5.1	5.3
22	6.6	6.75	6.25	6.35	6.0	5.4	5.1	5.0	5.2	5.0	5.2
23	6.65	6.75	6.25	6.35	6.0	5.4	5.1	5.0	5.15	5.0	5.05
24	6.4	6.7	6.2	6.3	6.0	5.4	5.1	5.0	5.15	5.0	5.15
25	6.5	6.7	6.2	6.25	6.05	5.4	5.1	5.0	5.15	5.0	5.15
26	6.5	6.75	6.2	6.35	6.0	5.35	5.1	5.0	5.15	5.0	5.25
27	6.45	6.75	6.2	6.3	6.1	5.3	5.1	5.0	5.15	5.1	5.3
28	6.4	6.8	6.2	6.35	6.05	5.3	5.1	5.05	5.15	5.1	5.3
29	.....	6.75	6.25	6.35	6.0	5.3	5.05	5.05	5.15	5.0	5.3
30	.....	6.65	6.3	6.35	6.0	5.3	5.05	5.1	5.15	5.0	5.3
31	.....	6.55	.....	6.3	.....	5.3	5.05	.....	5.15	.....	5.3

Station rating table for Deschutes River near Lava, Oreg., from January 17 to December 31, 1905.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
4.80	76	5.40	125	5.90	188	6.40	283
4.90	82	5.50	135	6.00	205	6.50	305
5.00	89	5.60	147	6.10	223	6.60	329
5.10	97	5.70	160	6.20	242	6.70	355
5.20	106	5.80	173	6.30	262	6.80	382
5.30	115						

The above table is applicable only for open-channel conditions. It is based on eight discharge measurements made during 1905. It is well defined between gage heights 5 feet and 6.5 feet.

Estimated monthly discharge of Deschutes River near Lava, Oreg., for 1905.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
February 17–28	368	262	306	7,283
March	382	283	319	19,620
April	317	242	274	16,300
May	317	252	278	17,090
June	294	205	241	14,340
July	196	115	141	8,670
August	125	93	107	6,579
September	97	89	90.9	5,409
October	115	97	100	6,149
November	102	79	90.6	5,391
December	115	82	99.2	6,100
The period				112,900

WEST FORK OF DESCHUTES RIVER NEAR LAVA, OREG.

This station was established February 20, 1905. It is located about 1½ miles west of Lava, Oreg. This branch of the river rises in five small lakes in a high, timbered country, and as a consequence has a very uniform flow.

The channel is slightly curved and the current is swift. Both banks are low, wooded, and not liable to overflow. The bed of the stream is composed of gravel and is free from vegetation and permanent. There is but one channel at all stages.

Discharge measurements are made by means of a cable and car. The initial point for soundings is the center of the mud sill under the shear legs of the cable support on the north bank of the river, and is marked with a brass nail.

An inclined staff gage is set on the right bank. During 1905 the gage was read once each week by David Hill. The bench mark is a 60-penny nail driven into the base of a large yellow pine near the gage; elevation, 19.33 feet above the datum of the gage.

Discharge measurements of West Fork of Deschutes River near Lava, Oreg., in 1905.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Square feet.*	*Feet per second.*	*Feet.*	*Second-feet.*
March 3	I. Landes	101	544	2.10	8.89	1,144
April 25	do	100	517	2.09	8.59	1,081
May 23	do	101	520	2.05	8.60	1,064
June 23	do	101	499	2.07	8.44	1,033
August 9	do	101	482	2.06	8.24	993
October 8	do	101	472	2.09	8.20	986
October 28	do	101	456	2.03	8.01	926
November 17	do	100	444	2.06	7.87	917
December 9	do	99	443	1.96	7.74	870
December 27	do	127	446	2.02	7.77	903
December 27	do	99	446	2.02	7.77	904

Daily gage height, in feet, of West Fork of Deschutes River near Lava, Oreg., for 1905.

Day.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1		8.9	8.8								
2		8.9	8.8	8.65				8.15			7.8
3		8.9	8.77			8.4					
4		8.9	8.7							7.95	
5		8.93	8.7		8.6						
6		8.95									
7		8.95	8.7				8.2		8.2		
8		8.92									
9		8.9		8.7				8.25			7.7
10		8.9				8.3					
11		8.9	8.6							7.9	
12		8.85			8.5						
13		8.8					8.2				
14		8.8							8.05		
15		8.8									
16		8.83		8.6				8.01			7.8
17		8.8				8.3				7.9	
18		8.8	8.6								7.75
19		8.82			8.45						
20	8.8	8.82		8.6			8.2				

Daily gage height, in feet, of West Fork of Deschutes River near Lava, Oreg., in 1905—Con.

Day.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
21	8.8	8.98							8.05		7.7
22	8.8	8.98		8.6							
23	8.85	8.9						8.01			8.0
24	8.9	8.92				8.3					
25	8.87	8.9	8.6							7.8	7.7
26	8.85	8.92			8.45		8.2				
27	8.88	8.95									
28	8.87	8.88							8.0		7.65
29		8.9		8.6							
30		8.8						8.02			7.8
31		8.72				8.25					

Station rating table for West Fork of Deschutes River near Lava, Oreg., from February 20 to December 31, 1905.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
7.60	867	8.00	942	8.40	1,027	8.80	1,123
7.70	883	8.10	963	8.50	1,050	8.90	1,148
7.80	902	8.20	984	8.60	1,074	9.00	1,173
7.90	922	8.30	1,005	8.70	1,098		

The above table is applicable only for open-channel conditions. It is based on 11 discharge measurements made during 1905. It is well defined between gage heights 7.7 feet and 8.9 feet.

Estimated monthly discharge of West Fork of Deschutes River near Lava, Oreg., for 1905.

Month.	Discharge in second-feet			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
February 20–28	1,148	1,123	1,135	20,260
March	1,168	1,103	1,142	70,220
April	1,123	1,074	1,083	64,440
May	1,098	1,074	1,081	66,470
June	1,074	1,038	1,050	62,480
July	1,027	994	1,007	61,920
August	984	984	984	60,500
September	994	944	961	57,180
October	984	942	958	58,900
November	932	902	920	54,740
December	942	875	895	55,030
The period				632,100

NOTE.—Owing to the steady flow of the river the mean discharge for the days in each month when the gage height was recorded has been taken as the monthly mean.

CANALS IN DESCHUTES RIVER VALLEY, OREGON.

FINDLEY'S DITCH NEAR ROSLAND, OREG.

May 24, 1905, a discharge measurement made of this ditch by Ivan Landes gave a discharge of 3.9 second-feet.

CENTRAL OREGON CANAL NEAR BEND, OREG.

The gage on the Central Oregon canal is vertical and attached to the south side of the flume opposite station 88 on the Pilot Butte canal. The zero of the gage is the bottom of the flume. Measurements were made in the flume. The gage was read during a portion of the year by G. A. Wilson and Z. T. Gideon.

Discharge measurements of Central Oregon canal near Bend, Oreg., in 1905.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Square feet.*	*Feet per second.*	*Feet.*	*Second-feet.*
May 22	Ivan Landes	13.2	15.8	4.40	1.20	69.5
June 22	do	13.3	12.0	3.62	.90	43.4
August 10	do	13.3	7.98	2.71	.60	21.6
September 22	do	13.3	14.8	3.70	1.11	54.8
November 16	do	13.3	15.8	3.74	1.19	59.2

Daily gage height, in feet, of Central Oregon canal near Bend, Oreg., for 1905.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1				0.98	0.0	0.6	0.75	1.15	1.22	1.3
2				.95	1.0	.0	.7	.58	1.05	1.3
3				.95	.85	.7	.7	.82	1.12	1.3
4				1.0	.0	.7	.8	.0	1.12	1.35
5				.95	.0	.7	.78	.42	1.22	1.4
6				1.15	.0	.7	1.1	.85	1.22	1.38
7				.82	.0	.7	1.08	.95	1.2	1.35
8				.32	.0	.7	.78	1.05	1.1	1.45
9				.3	.7	.7	.7	.52	1.2	1.35
10				.45	.83	.7	.65	.85	1.25	1.35
11	0.52			.82	.75	.7	.68	.85	1.25	1.4
12	.52			.85	.98	.7	.65	1.15	1.25	1.4
13	.52			1.0	.9	.7	.7	1.15	1.25	1.15
14	.0			1.0	.7	.7	1.2	1.2	1.25	.85
15	.0			1.3	.0	.0	1.2	1.2	1.25	.9
16	.65			.82	.7	.7	1.25	1.0	1.25	1.4
17	.65			.8	.6	.7	1.25	1.0	1.2	1.5
18				.95	.82	.0	1.0	1.0	1.22	1.45
19				.95	.3	.7	1.0	1.0	1.3	1.4
20				.0	.7	.62	1.0	1.0	1.3	1.4
21				.0	.7	.52	1.1	1.0	1.32	1.4
22				.85	.0	.55	1.15	1.0	1.35	1.1
23				.85	.7	.52	1.12	1.0	1.35	.4
24				.85	.7	.55	1.1	1.1	.62	.0
25				.85	.7	.9	.55	1.1	.48	.0
26				.85	.0	1.0	.65	1.27	1.1	.0
27				.85	.35	.85	.95	.1	1.3	.0
28				.92	.6	.9	.55	1.12	1.3	.42
29				.85	.0	.9	1.15	1.05	1.3	.0
30				.85	.6	.9	1.12	1.15	1.38	.0
31					.6	.9		1.3		.0

Station rating table for Central Oregon canal near Bend, Oreg., for 1905.

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	0.70	28	1.40	84	2.00	153
.10	2	.80	34	1.50	94	2.10	166
.20	5	.90	41	1.60	105	2.20	180
.30	8	1.00	48	1.70	116	2.30	194
.40	12	1.10	56	1.80	128	2.40	209
.50	17	1.20	65	1.90	140	2.50	224
.60	22	1.30	74				

The above table is applicable only for open-channel conditions. It is based on five discharge measurements made during 1905. It is fairly well defined.

Estimated monthly discharge of Central Oregon canal near Bend, Oreg., for 1905.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
March (7 days)	25	0	14.9	207
June	74	0	36.6	2,178
July	48	0	19.5	1,199
August	48	0	26.8	1,648
September	70	20	43.4	2,582
October	105	0	45.9	2,822
November	82	16	65.6	3,904
December	94	0	54.8	3,370
The period				17,900

PILOT BUTTE CANAL NEAR BEND, OREG.

Water is diverted from the right bank of Deschutes River about 3 miles above Bend by the Deschutes Irrigation and Power Company. About 2 miles above Bend the ditch divides, forming the Central Oregon canal on the right and the Pilot Butte canal on the left.

The gage on Pilot Butte canal is a vertical rod on the south bank at canal-survey station 88+25, a short distance below the division point and waste weir. The bench mark is a copper bolt cemented in the rock about 2 feet from the gage. Its elevation is 4.76 feet above the datum of the gage. Measurements were made during 1905 by wading. The gage was read during a portion of the year by G. A. Wilson and Z. T. Gideon, employees of the Deschutes Irrigation and Power Company.

Discharge measurements of Pilot Butte canal near Bend, Oreg., in 1905.

Date.	Hydrographer	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Square feet.*	*Feet per second.*	*Feet.*	*Second-feet.*
May 17	Ivan Landes	31.0	22.0	1.00	1.70	22.1
June 22	do	32.0	40.6	1.52	2.11	61.7
August 10	do	32.0	47.0	1.72	2.30	80.8
September 22	do	31.5	38.7	1.29	2.03	49.8
November 16	do	30.0	28.8	1.96	2.02	56.6

Daily gage height, in feet, of Pilot Butte canal near Bend, Oreg., for 1905.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	1.92	.....	1.1	0.0	1.4	2.22	2.25	2.05	1.65
2	.....	1.78	.....	1.15	1.25	.7	2.38	2.22	2.05	1.65
3	.....	1.78	.....	1.12	1.25	1.4	2.38	1.12	2.05	1.65
4	.....	1.78	.....	1.15	1.25	1.4	2.4	2.25	2.05	1.8
5	.....	1.78	.....	1.15	1.25	1.4	2.4	2.25	2.05	1.95
6	1.72	.....	.....	.6	1.25	1.4	2.3	2.25	2.05	1.95
7	.....	.....	.....	1.12	.0	1.4	2.2	2.25	2.05	1.95
8	1.72	.....	.....	1.05	.0	1.4	2.35	2.25	2.05	1.8
9	1.73	.....	.....	1.1	1.25	.0	2.2	2.25	2.05	1.95
10	1.73	.....	.....	1.1	1.16	1.4	2.15	2.25	2.05	1.95
11	1.47	.....	.....	1.1	1.35	.0	2.2	2.25	2.05	1.65
12	1.47	.....	.....	1.1	1.0	1.4	2.3	2.25	2.05	1.6
13	1.47	.....	.....	1.1	.98	.0	2.25	2.22	2.05	1.78
14	1.64	.....	.....	1.1	1.3	1.4	2.2	2.25	2.05	1.95
15	1.64	.....	.....	.55	.0	.35	2.18	2.25	2.05	1.6
16	1.76	.....	.....	1.15	1.2	1.4	2.2	2.25	2.05	.8
17	1.76	.....	.....	1.18	1.35	1.4	2.22	2.25	2.05	.0
18	2.0	.....	.....	1.15	1.05	.0	2.25	2.18	2.05	1.85
19	2.0	.....	.....	1.15	1.12	1.45	2.25	2.2	2.05	1.95
20	1.34	.....	.....	.4	1.4	1.4	2.25	2.18	2.05	1.95
21	1.34	.....	.....	.4	1.4	1.4	2.2	2.18	2.05	1.95
22	1.72	.....	.....	1.25	0.0	1.38	2.2	2.12	2.0	.98
23	1.81	.....	.....	1.25	1.4	1.38	2.22	2.1	2.0	.0
24	1.8	.....	.....	1.25	1.4	1.4	2.25	2.1	2.0	.0
25	1.8	.....	.....	1.25	1.4	1.35	2.24	2.1	1.87	.0
26	1.8	.....	.....	1.25	.8	1.4	2.22	2.1	1.82	1.92
27	1.8	.....	.....	1.25	1.5	1.38	2.22	2.1	2.0	1.95
28	1.92	.....	.....	1.12	1.35	1.4	2.3	2.1	2.0	.98
29	1.92	.....	.....	1.25	.0	.....	2.25	2.1	2.0	.0
30	1.92	.....	.....	1.25	1.4	.....	2.28	2.05	2.0	.0
31	1.92	.....	.....	.....	1.4	.....	.....	2.05	.....	.0

NOTE.—Gage readings June 1 to August 28 on weir above waste gate. Length of weir 15 feet with end contractions.

Station rating table for Pilot Butte canal near Bend, Oreg., from March 6 to December 31, 1905.

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	2	1.40	10	1.80	30	2.20	70
1.10	3	1.50	14	1.90	39	2.30	81
1.20	5	1.60	18	2.00	49	2.40	93
1.30	7	1.70	23	2.10	59		

The above table is applicable only for open-channel conditions. It is based on five discharge measurements made during 1905. It is well defined between gage heights 1.7 feet and 2.4 feet.

Estimated monthly discharge of Pilot Butte canal near Bend, Oreg., for 1905.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
March (26 days)	49	8	27.2	1,403
April (5 days)	41	29	31.4	311
June	68.6	12.6	55.7	3,314
July	89.9	.0	56.3	3,462
August	85.7	.0	66.8	4,107
September	93	65	76.3	4,540
October	76	3	66.8	4,107
November	54	32	51.3	3,053
December	44	.0	23.2	1,426
The period				25,720

NOTE.—Discharge approximated March 7 and August 29–31.

COLUMBIA SOUTHERN CANAL NEAR BEND, OREG.

This canal diverts water from the left bank of Tumallo Creek directly west of Bend, Oreg.

Discharge measurements of Columbia Southern canal near Bend, Oreg., in 1905.

Date.	Hydrographer.	Discharge.
		Second-feet.
June 21	Ivan Landes	48.3
August 10	do	69.4

CARMICHAEL DITCH AT PRINEVILLE, OREG.

This ditch diverts water from Crooked River at Prineville, Oreg.

Discharge measurements of Carmichael ditch at Prineville, Oreg., in 1905.

Date.	Hydrographer.	Discharge.
		Second-feet.
May 18	Ivan Landes	34.7
June 19	do	15.7
August 11	do	7.1

HOOD RIVER DRAINAGE BASIN.

Hood River rises on the northern slopes of Mount Hood and flows northwestward, entering Columbia River at Hood River, Oreg.

HOOD RIVER AT WINANS CITY, OREG.

This station was established November 17, 1905, by L. R. Allen. It is located 300 feet below the junction of the main forks of the river, at Winans City, 10½ miles above Hood River post-office, Oreg.

The channel is straight for 300 feet above and below the station. Both banks are high, rocky, slightly wooded, and do not overflow. The bed of the stream is of coarse gravel and is free from vegetation and shifting. There is but one channel at all stages. The stream has much fall at all points, and the current is almost a continuous rapid.

Discharge measurements are made by means of a cable, car, tagged wire, and stay line. The initial point for soundings is a tin tag soldered to the tag wire 2.5 feet from the anchorage on the left bank.

The gage is a staff in two sections. The lower section is inclined and securely fastened to the rock and tree above. The upper section is vertical, and is fastened to an alder tree. The total height of the gage is 20 feet. It is read once each day by W. R. Winans. The bench mark is the highest point on large rock about 15 feet south of the inclined portion of the gage; elevation, 18.20 feet above the datum of the gage.

Discharge measurements of Hood River at Winans City, Oreg., in 1905.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Square feet.*	*Feet per second.*	*Feet.*	*Second-feet.*
November 17	L. R. Allen	90	147	3.36	0.57	493
December 23	do	90	180	4.27	1.03	767

Daily gage height, in feet, of Hood River at Winans City, Oreg., for 1905.

Day.	Nov.	Dec.	Day.	Nov.	Dec.	Day.	Nov.	Dec.	Day.	Nov.	Dec.
1		0.7	9		1.0	17		1.8	25	0.7	0.7
2		.7	10		1.0	18		1.6	26	1.3	1.7
3		.7	11		1.0	19	1.5	1.6	27	1.0	1.6
4		.7	12		.9	20	1.0	1.4	28	.9	1.5
5		.8	13		.8	21	.8	1.2	29	.8	1.3
6		.8	14		.7	22	.8	1.2	30	.7	1.0
7		.9	15		.7	23	.8	1.0	31		.8
8		.9	16		.7	24	.7	.8			

WILLAMETTE RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

Willamette River is formed by the junction of Coast Fork and Middle Fork near Eugene, Oreg. Coast Fork rises on the eastern slope of the Coast Range and Middle Fork rises on the western slope of the Cascade Mountains. A short distance below the junction the Willamette receives the waters of McKenzie Fork, a large stream from the east. Other tributaries of note are Santiam, Luckiamute, Molalla, and Clackamas rivers.

MIDDLE FORK OF WILLAMETTE RIVER AT JASPER, OREG.

This station was established September 16, 1905, by L. R. Allen. It is located at Jasper Ferry, Jasper post-office, Oreg., 2 miles above Natron, and 3 miles below the mouth of Fall Creek.

The channel is straight for 800 feet above and 700 feet below the station. The current is swift. The right bank is high, covered with brush, and not liable to overflow. The left bank is lower, clear of brush, and is liable to overflow during extreme floods. The bed of the stream is composed of gravel or small bowlders and is free from vegetation and shifting. There is but one channel at all stages. The accuracy of measurements may be affected by floating logs.

Discharge measurements are made by means of a cable, car, tagged wire, and stay line. The initial point for soundings is a tin tag on the tagged wire 17 feet from the cable support on the right bank.

The gage is a vertical staff 18 feet long spiked to a tree on the right bank, 30 feet above the cable. During 1905 the gage was read once each day by W. H. Eaton. The bench mark is the top of three 30-penny nails driven into the left sill near the first vertical rod of a bridge across a small creek, 400 feet below the cable; elevation, 21.43 feet above the datum of the gage.

Discharge measurements of Middle Fork of Willamette River at Jasper, Oreg., in 1905.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Square feet.*	*Feet per second.*	*Feet.*	*Second-feet.*
September 16	L. R. Allen	322	652	1.16	1.25	758
December 29	do	354	1,366	2.88	3.27	3,925

Daily gage height, in feet, of Middle Fork of Willamette River at Jasper, Oreg., for 1905.

Day.	Sept.	Oct.	Nov.	Dec.	Day.	Sept.	Oct.	Nov.	Dec.	Day.	Sept.	Oct.	Nov.	Dec.
1	.....	1.5	1.7	3.2	12	.....	1.7	1.5	2.5	23	1.2	1.8	2.0	2.5
2	.....	1.5	1.7	3.2	13	.....	1.7	1.5	2.4	24	1.2	1.7	1.9	2.4
3	.....	1.4	1.7	3.4	14	.....	1.7	1.4	2.3	25	1.2	1.9	1.8	2.3
4	.....	1.4	1.7	3.6	15	.....	1.6	1.4	2.3	26	1.3	2.8	1.8	3.6
5	.....	1.4	1.7	3.2	16	.....	2.5	1.4	2.2	27	1.5	2.4	2.8	4.1
6	.....	1.9	1.7	3.1	17	1.3	2.1	1.4	2.3	28	1.9	2.2	2.5	3.9
7	.....	3.1	1.6	3.2	18	1.3	2.6	1.7	2.4	29	1.7	1.9	2.4	3.4
8	.....	2.8	1.6	3.5	19	1.3	2.5	1.9	2.5	30	1.6	1.9	3.1	3.5
9	.....	2.2	1.6	3.1	20	1.3	2.1	3.0	2.9	31	.....	1.8	.....	4.1
10	.....	1.9	1.5	2.9	21	1.3	2.0	2.3	2.8					
11	.....	1.8	1.5	2.6	22	1.2	1.9	2.1	2.6					

COAST FORK OF WILLAMETTE RIVER NEAR GOSHEN, OREG.

This station was established August 23, 1905, by L. R. Allen. It is located at the highway bridge 3 miles east of Goshen, Oreg., 9 miles southeast of Eugene, and about 4 miles above the junction of Coast and Middle forks of Willamette River.

The channel is straight for 500 feet above and 800 feet below the station. The water flows with an even current. Both banks are covered with undergrowth and liable to overflow during flood stages. The bed of the stream is of coarse gravel or small bowlders, is free from vegetation, and is liable to shift during high water. There is but one channel at all stages, broken by the piers of the bridge.

Discharge measurements are made from the downstream side of the highway bridge, 530 feet in length, including approaches. The initial point for soundings is two 6-penny nails driven into the first plank of the left approach of the bridge, downstream side. Low-water measurements are made by wading about 100 feet below the bridge.

The gage is in two sections. The lower section is a vertical staff fastened to an old pier in the center of the stream; the upper section is a vertical scale painted on the lower bridge caisson on the left bank. The total length of the gage is 18 feet. During 1905 the gage was read once each day by John D. West. The bench mark is the top of a large circular washer over the center of the bridge caisson on which the upper portion of the gage is painted; elevation, 26.25 feet above the datum of the gage.

Discharge measurements of Coast Fork of Willamette River near Goshen, Oreg., in 1905.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Square feet.*	*Feet per second.*	*Feet.*	*Second-feet.*
August 23	L. R. Allen	80	47	1.42	0.30	68
November 7	do	165	204	.89	.67	182
December 29	do	241	677	2.82	2.78	1,908

Daily gage height, in feet, of Coast Fork of Willamette River near Goshen, Oreg., for 1905

Day.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	0.25	.....	1.0	2.9	17	.....	0.25	1.5	0.4	1.5
2	.....	.25	.....	.9	3.0	18	.....	.25	1.3	.6	1.5
3	.....	.25	.....	.8	3.1	19	.....	.25	1.3	1.0	1.9
4	.....	.25	0.5	.6	3.3	20	.....	.25	1.1	2.3	3.1
5	.....	.25	.5	.6	2.8	21	.....	.....	1.0	1.9	3.0
6	.....	.25	.5	.5	2.5	22	.....	.....	1.0	1.5	2.5
7	.....	.25	1.4	.5	2.7	23	0.3	.....	.9	1.3	2.0
8	.....	.2	2.3	.5	3.2	24	.3	.....	.8	1.3	1.9
9	.....	.2	1.5	.4	2.6	25	.3	.....	.9	1.2	1.7
10	.....	.2	1.01	.4	2.2	26	.3	.....	2.0	1.0	2.2
11	.....	.2	1.0	.4	2.0	27	.3	.....	1.7	2.2	3.7
12	.....	.2	.8	.4	2.0	28	.3	.....	1.5	2.3	3.3
13	.....	.25	.7	.4	1.9	29	.25	.....	1.3	1.9	2.8
14	.....	.25	.6	.3	1.5	30	.25	.....	1.2	3.0	3.0
15	.....	.25	.7	.3	1.3	31	.25	.....	1.0	.....	5.0
16	.....	.25	1.9	.3	1.5						

M'KENZIE RIVER AT HENDRICKS FERRY, OREG.

This station was established September 12, 1905, by L. R. Allen. It is located at Hendricks Ferry, 11 miles above Springfield, about 3 miles above the mouth of Camp Creek.

The channel is straight for 500 feet above and 800 feet below the station. The current is swift. The right bank is comparatively high, clean, and liable to overflow during extreme floods. The left bank is somewhat higher, covered with brush, and does not overflow. The bed of the stream is composed of coarse gravel or small bowlders and is free from vegetation and shifting. There is but one channel at all stages. The accuracy of measurements may be affected by floating logs during the running season.

Discharge measurements are made by means of a cable, car, tagged wire, and stay line. The initial point for soundings is a tin tag on the tagged wire 6 feet from the cable support on the left bank.

The gage is a vertical staff spiked to a willow tree about 250 feet above the cable, on the left bank. During 1905 the gage was read once each day by Grant Hendricks. The bench mark is the top of a three-fourths-inch bolt cemented in the rock about 30 feet below the gage rod, on the left bank; elevation, 14.22 feet above the datum of the gage and 571.61 feet above sea level, the latter elevation being obtained from a bench mark set by a professor and students of the University of Oregon.

Discharge measurements of McKenzie River at Hendricks Ferry, Oreg., in 1905.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Square feet.*	*Feet per second.*	*Feet.*	*Second-feet.*
September 12	L. R. Allen	395	928	1.69	1.30	1,571
November 10	do	398	880	2.05	1.12	1,806
December 30	do	404	1,369	3.58	2.65	4,897

Daily gage height, in feet, of McKenzie River at Hendricks Ferry, Oreg., for 1905.

Day.	Sept.	Oct.	Nov.	Dec.	Day.	Sept.	Oct.	Nov.	Dec.	Day.	Sept.	Oct.	Nov.	Dec.
1	.....	1.5	1.3	2.0	12	1.3	1.45	1.1	1.9	22	1.3	1.4	1.55	1.95
2	.....	1.5	1.3	2.2	13	1.35	1.5	1.1	1.85	23	1.3	1.3	1.4	1.8
3	.....	1.45	1.25	2.4	14	1.3	1.7	1.1	1.8	24	1.3	1.3	1.35	1.85
4	.....	1.5	1.25	2.45	15	1.3	2.3	1.1	1.75	25	1.7	1.85	1.25	1.7
5	.....	1.55	1.2	2.2	16	1.3	1.9	1.1	1.75	26	1.55	2.1	1.8	3.4
6	.....	1.75	1.2	2.2	17	1.3	1.5	1.1	2.35	27	1.5	1.75	1.8	3.1
7	.....	2.8	1.2	2.9	18	1.3	1.9	1.3	2.2	28	1.5	1.6	1.75	2.6
8	.....	2.3	1.2	2.9	19	1.3	1.6	1.8	2.1	29	1.5	1.5	1.9	2.24
9	.....	1.8	1.1	2.4	20	1.3	1.5	1.75	2.2	30	1.5	1.4	2.3	2.8
10	.....	1.7	1.1	2.2	21	1.3	1.4	1.6	1.9	31	.....	1.35	.....	2.7
11	.....	1.4	1.1	2.0										

WILLAMETTE RIVER AT ALBANY, OREG.

This station was established July 21, 1905, by L. R. Allen. It is located at the Corvallis and Eastern Railroad bridge at Albany, Oreg., just above the mouth of Calipooia Creek and 7 miles above the mouth of Santiam River.

The channel is slightly curved for about half a mile above and straight for half a mile below the station. The current is uniform and has a medium velocity. The right bank is high, composed of sand and fine gravel, covered with brush, and does not overflow. The left bank is low, composed of sand and gravel, covered with brush, and subject to overflow during high water. The bed of the stream is of sand and fine gravel, is free from vegetation, and is liable to shift during high water. There is one channel at low and two at high stages, broken by the piers of the bridge.

Discharge measurements are made from the upstream side of the railway bridge. The initial point for soundings is a large nail driven into the upstream guard rail over the center of the right-bank pier.

The gage is a vertical staff fastened to the lower end of the right-bank bridge pier. The gage reads to 36 feet. During 1905 the gage was read once each day by Fred Aldrich. The bench mark is the top of a railroad spike driven into a cross sill over the second pier from the right bank, downstream side; elevation, 48.05 feet above the datum of the gage.

July 20, 1905, a discharge measurement made at this station by L. R. Allen gave the following results: Area of section, 3,724 square feet; mean velocity, 0.92 foot per second; gage height, 3.29 feet; discharge, 3,433 second-feet.

Daily gage height, in feet, of Willamette River at Albany, Oreg., for 1905.

Day.	Sept.	Oct.	Nov.	Dec.	Day.	Sept.	Oct.	Nov.	Dec.	Day.	Sept.	Oct.	Nov.	Dec.
1	2.3	2.8	3.4	5.35	12	2.2	3.5	2.7	5.05	22	2.2	3.5	4.25	6.65
2	2.3	2.8	3.2	5.6	13	2.2	3.2	2.7	4.1	23	2.2	3.5	3.1	5.75
3	2.3	2.8	3.1	6.25	14	2.2	3.2	2.6	4.75	24	2.2	3.3	3.6	5.7
4	2.3	2.8	3.05	6.5	15	2.2	2.11	2.7	4.7	25	2.2	3.2	3.5	5.1
5	2.05	2.8	3.1	6.55	16	2.2	2.11	2.6	4.45	26	2.2	3.2	3.45	5.5
6	2.05	2.95	3.1	5.6	17	2.2	3.1	2.6	4.45	27	2.3	4.3	3.4	7.6
7	2.2	2.11	2.11	5.5	18	2.2	3.1	2.6	4.8	28	2.4	4.1	4.55	7.6
8	2.2	3.11	2.11	6.2	19	2.2	4.05	2.6	4.9	29	2.7	3.11	4.5	7.8
9	2.2	4.9	2.10	6.85	20	2.2	3.11	3.65	5.75	30	2.7	3.7	4.55	7.45
10	2.2	4.2	2.10	5.6	21	2.2	3.7	4.45	6.75	31	.....	3.5	.....	8.8
11	2.2	3.7	2.7	5.6										

SANTIAM RIVER AT JEFFERSON, OREG.

This station was established July 19, 1905, by L. R. Allen. It is located at the Southern Pacific Railroad bridge at Jefferson, Oreg., 2½ miles below the junction of North and South forks.

The channel is straight for 500 feet above and 700 feet below the station. The current is uniform and sluggish at low water. The right bank is comparatively high, clean at the station, and liable to overflow but little during extreme high water. The left bank is low, clean, and liable to overflow. The bed of the stream is composed of rock and coarse gravel, is free from vegetation, and is liable to shift during floods. There is but one channel at low water, broken by the piers of the bridge, but during floods water runs over the left bank and through a slough several hundred feet to the right of the main channel. The accuracy of measurements may be affected by rafts of logs at the mill near by during low water.

Discharge measurements are made from the upstream side of the Southern Pacific Railroad bridge. The initial point for soundings is on the upstream guard rail, near the end of the rail on the right-bank trestle.

The gage is a vertical staff fastened to the lower side of the bridge piers. During 1905 the gage was read once each day by C. Alsted. The bench mark is the top of four 30-penny nails driven into the cross sill over the center of the right-bank pier; elevation, 35.22 feet above the datum of the gage.

July 18, 1905, a discharge measurement made at this station by L. R. Allen gave the following results: Width, 326 feet; area of section, 2,659 square feet; mean velocity, 0.31 foot per second; gage height, 3.41 feet; discharge, 817 second-feet.

Daily gage height, in feet, of Santiam River at Jefferson, Oreg., for 1905.

Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.
1	.....	4.5	6.15	12	5.0	3.8	5.8	22	4.65	5.0	6.0
2	.....	4.4	6.85	13	4.8	3.7	5.5	23	4.5	4.7	5.8
3	.....	4.3	6.95	14	4.6	3.7	5.4	24	4.5	4.5	5.5
4	.....	4.2	6.9	15	4.8	3.6	5.2	25	4.8	4.4	5.4
5	.....	4.15	6.5	16	5.9	3.6	5.2	26	6.5	4.5	7.6
6	.....	4.1	6.5	17	5.4	3.6	6.2	27	5.8	5.6	7.4
7	.....	4.0	6.9	18	5.7	3.9	6.6	28	5.4	5.3	6.8
8	7.5	4.0	7.4	19	5.4	4.5	6.5	29	5.0	5.3	6.5
9	6.6	3.9	6.8	20	5.0	6.1	6.8	30	4.8	6.0	6.8
10	5.95	3.9	6.2	21	4.8	5.35	6.5	31	4.6	.....	6.95
11	5.4	3.8	6.0								

NORTH FORK OF SANTIAM RIVER NEAR MEHAMA, OREG.

This station was established July 11, 1905, by L. R. Allen. It is located just below the highway bridge at Mehama, Oreg., about 1½ miles north of Lyons, the nearest railroad station. The station is about 12 miles below the junction of Little North Fork and North Fork.

The channel is straight for about 600 feet above and 300 feet below the station. The current is swift and regular. The right bank is high, rocky, timbered, and does not overflow. The left bank is low, covered with some brush, and is subject to overflow during floods. The bed of the stream is of rock or coarse gravel, free from vegetation, and liable to shift slightly during floods.

Discharge measurements are made by means of a cable, car, tagged wire, and stay wire. The initial point for soundings is zero of the tagged wire, 25 feet from the cable support on the right bank.

The gage is a staff in two sections. The lower section is inclined. The upper section is vertical, being fastened at the lower end to the inclined section. During 1905 the gage was read once each day by F. U. Hull. The bench mark is the top of a 1-inch bolt cemented in soft sandstone near the gage rod; elevation, 12.60 feet above the datum of the gage.

Discharge measurements of North Fork of Santiam River near Mehama, Oreg., in 1905.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Square feet.*	*Feet per second.*	*Feet.*	*Second-feet.*
July 11	L. R. Allen	160	756	1.38	2.90	1,048
October 18	do	202	1,013	3.51	4.44	3,556
November 16	J. H. Lewis	155	756	1.29	2.90	973
December 12	L. R. Allen	250	927	3.11	4.24	2,881

Daily gage height, in feet, of North Fork of Santiam River near Mehama, Oreg., for 1905.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	2.65	2.5	3.35	3.55	4.3	17	2.8	2.6	2.6	4.4	2.9	5.75
2	.....	2.65	2.5	3.55	3.4	5.0	18	2.8	2.6	2.55	4.45	3.35	5.4
3	.....	2.65	2.5	3.4	3.4	5.3	19	2.75	2.6	2.55	4.15	4.8	5.4
4	.....	2.65	2.5	6.8	3.4	5.1	20	2.75	2.55	2.55	3.95	4.6	5.05
5	.....	2.65	2.5	5.1	3.4	5.0	21	2.75	2.55	2.55	3.8	4.0	4.75
6	.....	2.65	2.5	5.35	3.25	5.1	22	2.75	2.55	2.55	3.7	3.8	4.45
7	.....	2.65	2.5	6.6	3.2	5.5	23	2.75	2.55	2.5	3.6	3.7	4.3
8	.....	2.65	2.45	5.9	3.15	5.6	24	2.7	2.55	2.5	3.65	3.55	4.1
9	.....	2.6	2.45	5.2	3.1	5.0	25	2.7	2.5	4.35	5.1	3.5	4.0
10	.....	2.6	2.45	4.7	3.1	4.7	26	2.7	2.5	4.35	5.2	4.4	5.9
11	.....	2.6	2.45	4.3	3.1	4.4	27	2.7	2.5	3.25	4.6	4.2	5.25
12	2.9	2.6	2.55	4.1	3.0	4.3	28	2.7	2.55	3.35	4.25	4.0	4.9
13	2.9	2.6	2.8	3.9	3.0	4.15	29	2.7	2.55	3.35	4.0	4.1	4.55
14	2.8	2.6	2.7	3.7	2.95	4.1	30	2.65	2.55	3.5	3.85	4.55	4.7
15	2.8	2.6	2.55	4.9	2.9	4.1	31	2.65	2.5	.....	3.65	.....	4.6
16	2.8	2.5	2.5	4.6	2.9	4.1							

SOUTH FORK OF SANTIAM RIVER AT WATERLOO, OREG.

This station was established July 28, 1905, by L. R. Allen. It is located about one-half mile below the highway bridge at Waterloo, Oreg. The station is about 4 miles above the mouth of Hamilton Creek, and about 3 miles above a dam which diverts water into a canal for the use of the town of Albany.

The channel is straight for 800 feet above and below the station. The current has a good uniform velocity. Both banks are fairly high and thickly covered with undergrowth, but are liable to overflow during extreme floods. The bed of the stream is of coarse gravel or small bowlders, is free from vegetation, and is liable to shift during floods. There is but one channel at all stages.

Discharge measurements are made by means of a cable, car, tagged wire, and stay line. The initial point for soundings is a tin tag on the tagged wire, 2½ feet from the cable support at the right bank.

The gage is on the right bank about 100 feet below the cable. It is a staff in two sections, the lower inclined, the upper vertical. During 1905 the gage was read once each day by John B. Hudelson. Bench marks were established as follows: (1) The top of a three-fourths-inch bolt cemented in rock near the lower portion of the gage rod; elevation, 2.88

feet. (2) The top of five 30-penny nails driven into the root of a large fir tree about 300 feet below the cable on the right bank; elevation, 24.70 feet. Elevations refer to the datum of the gage.

July 28, 1905, a discharge measurement made at this station by L. R. Allen gave the following results: Width, 150 feet; area of section, 246 square feet; mean velocity, 1.52 feet per second; gage height, 1.06 feet; discharge, 375 second-feet.

Daily gage height, in feet, of South Fork of Santiam River at Waterloo, Oreg., for 1905.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	1.05	0.8	1.9	2.1	3.4	17	.....	1.0	.9	2.9	1.4	4.0
2	.....	1.0	.8	1.5	2.0	3.9	18	.....	1.0	.9	3.3	1.8	3.7
3	.....	1.0	.8	1.6	2.2	4.2	19	.....	1.0	.9	2.4	2.0	3.8
4	.....	1.0	.7	4.5	1.9	4.2	20	.....	1.0	.9	2.5	3.2	4.0
5	.....	1.0	.7	3.0	1.9	3.2	21	.....	1.0	.8	2.3	2.2	3.6
6	.....	1.0	.7	3.1	1.9	3.9	22	.....	.9	.8	2.2	2.3	3.3
7	.....	1.0	.7	3.5	1.7	4.5	23	.....	.9	.8	2.2	2.1	3.1
8	.....	1.0	.6	4.4	1.6	4.9	24	.....	.9	.8	2.0	2.0	2.7
9	.....	1.0	.6	3.6	1.6	4.9	25	.....	.9	.8	2.3	1.9	2.7
10	.....	1.0	.6	3.0	1.5	4.5	26	.....	.8	1.0	3.9	2.0	3.5
11	.....	1.0	.6	2.6	1.5	3.2	27	.....	.8	1.9	2.8	3.1	4.4
12	.....	1.0	.7	2.3	1.5	3.0	28	.....	.8	1.8	2.3	2.8	4.2
13	.....	1.0	.7	2.2	1.4	3.0	29	1.05	.8	1.8	2.5	2.6	3.7
14	.....	1.0	.9	2.0	1.4	2.7	30	1.05	.8	1.5	2.3	3.4	4.0
15	.....	1.0	.8	2.4	1.4	2.7	31	1.05	.8	.....	2.3	.....	4.2
16	.....	1.0	.8	3.9	1.4	2.7							

LUCKIAMUTE RIVER NEAR SUVER, OREG.

This station was established August 18, 1905, by L. R. Allen. It is located just below Helmick bridge on the public highway, 4 miles northwest of Suver, Oreg., 2 miles west of Parkers Station, and about 3 miles below the junction of the main forks of the river.

The channel is straight for 300 feet above and below the station. The current is regular.

Both banks are high, covered with brush, and liable to overflow during extreme floods. The bed of the stream is of sand, is free from vegetation, and shifts during floods. There is but one channel at all stages.

Discharge measurements are made by means of a cable, car, tagged wire, and stay line. The initial point for soundings is a tag on the tagged line 7.2 feet from the cable support on the right bank.

The gage is on the left bank at the bridge. It is in two sections, the lower inclined, the upper vertical, both being secured to posts supporting the bridge. The gage rod reads to 32.8 feet. During 1905 the gage was read once each day by Maggie J. Evans. The bench mark is the top of three 30-penny nails driven into the cross sill of the bridge, downstream side, 5 feet from the end of the first panel from the left bank; elevation, 39.86 feet above the datum of the gage.

Discharge measurements of Luckiamute River near Suver, Oreg., in 1905.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Square feet.*	*Feet per second.*	*Feet.*	*Second-feet.*
August 18	L. R. Allen	45	121	0.60	1.47	73
October 7	do	79	571	2.07	8.57	1,182

Daily gage height, in feet, of Luckiamute River near Suver, Oreg., for 1905.

Day.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	0.95	2.5	2.8	6.6	17	.....	1.3	3.5	2.0	8.4
2	.....	.9	2.2	2.55	7.3	18	.....	1.1	3.5	2.1	12.0
3	.....	.95	2.5	2.75	7.55	19	.....	1.25	3.4	3.0	10.7
4	.....	1.2	9.0	2.45	7.15	20	1.25	1.5	3.3	7.75	14.35
5	.....	1.0	6.2	2.6	6.45	21	1.2	1.2	3.0	5.5	13.15
6	.....	1.5	7.1	2.4	7.25	22	1.25	1.1	3.0	4.5	11.4
7	.....	1.5	7.5	2.2	7.30	23	1.5	1.1	2.85	4.15	9.75
8	.....	.95	7.7	2.3	7.0	24	1.1	1.1	2.8	3.75	9.2
9	.....	.95	6.65	2.05	6.25	25	.95	1.15	2.95	3.5	8.3
10	.....	1.0	6.35	2.15	6.0	26	1.0	1.8	3.65	3.2	15.4
11	.....	1.0	4.55	2.15	5.8	27	.95	3.2	3.1	3.7	15.2
12	.....	1.0	4.5	2.1	5.1	28	1.5	3.5	3.35	3.5	13.0
13	.....	1.1	3.6	2.0	5.1	29	1.1	2.75	2.8	3.6	12.2
14	.....	1.1	3.3	2.05	4.8	30	1.4	2.6	2.8	5.55	12.4
15	.....	1.5	3.3	2.0	4.35	31	1.0	.....	2.7	.....	18.65
16	.....	1.0	4.15	2.0	4.2						

MOLALLA RIVER AT DICKEY PRAIRIE, OREG.

This station was established November 1, 1905, by L. R. Allen. It is located at Dickey Prairie, 3 miles below the junction of the forks of the river, 3½ miles southeast of Molalla, Oreg.

The channel is straight for 400 feet above and below the station. The current is swift and somewhat rough. The right bank is low, wooded, and subject to overflow. The left bank is fairly high, covered with brush, and not liable to overflow. The bed of the stream is of coarse gravel or small bowlders, free from vegetation, and shifting. There is but one channel during low and ordinary stages, but during extreme high water there is a slough on the right bank, which will have to be measured by wading.

Discharge measurements are made by means of a cable, car, tagged line, and stay wire. The initial point for soundings is a tin tag on the tagged wire 7 feet from the cable support on the right bank.

The gage is a staff in two sections on the left bank, about 200 feet above the cable. The lower section is inclined and fastened to the rock. The upper section is vertical and fastened to an alder tree. The total height of the gage is 14.00 feet. It is read once each day by Raymond Dickey. The bench mark is the top of three 30-penny nails driven into a bench made on the root of a fir tree about 20 feet south and 30 feet west of the gage; elevation, 14.85 feet above the datum of the gage.

November 2, 1905, a discharge measurement made at this station by L. R. Allen gave the following results: Width, 106 feet; area of section, 226 square feet; mean velocity, 1.68 feet per second; gage height, 1.83 feet; discharge, 376 second-feet.

Daily gage height, in feet, of Molalla River at Dickey Prairie, Oreg., for 1905.

Day.	Nov.	Dec.	Day.	Nov.	Dec.	Day.	Nov.	Dec.	Day.	Nov.	Dec.
1	1.85	2.8	9	1.45	3.2	17	1.25	3.8	25	1.85	2.4
2	1.8	4.5	10	1.4	2.9	18	1.6	3.5	26	2.9	3.7
3	1.75	4.0	11	1.4	2.7	19	3.7	3.4	27	2.55	3.4
4	1.75	3.6	12	1.35	2.55	20	2.9	3.2	28	2.4	3.1
5	1.7	3.8	13	1.35	2.45	21	2.5	3.1	29	2.6	2.8
6	1.6	3.8	14	1.3	2.3	22	2.25	2.85	30	2.9	3.2
7	1.55	3.85	15	1.3	2.25	23	2.05	2.7	31	.....	3.0
8	1.5	3.5	16	1.25	2.45	24	1.9	2.45			

CLACKAMAS RIVER NEAR BARTON, OREG.

This station was established October 2, 1905, by L. R. Allen. It is located 2½ miles below Barton, Oreg., 1½ miles below the mouth of Deep Creek.

The channel is straight for 500 feet above and 600 feet below the station. The current is swift. The right bank is comparatively high, clean, and liable to overflow during extreme floods. The left bank is high, covered with brush, and does not overflow. The bed of the stream is of coarse gravel or small bowlders, free from vegetation, and shifting. There is but one channel at all stages.

Discharge measurements are made by means of a cable, car, tagged wire, and stay wire. The initial point for soundings is the tin tag on the tagged wire 1.7 feet from the cable support on the right bank.

The gage is a staff in two sections, on the right bank at the cable. The lower section is inclined, the upper section is vertical. During 1905 the gage was read once each day by Le Roy Breithaupt. Bench marks were established as follows: (1) The top of three 30-penny nails driven into the sill at the northwest corner of an old barn southeast of the gage; elevation, 19.21 feet. (2) The top of the head of a bolt driven into a large alder tree by the upright portion of the gage; elevation, 16.09 feet. Elevations refer to the datum of the gage.

October 2, 1905, a discharge measurement made at this station by L. R. Allen gave the following results: Width, 310 feet; area of section, 704 square feet; mean velocity, 2.27 feet per second; gage height, 3.30 feet; discharge, 1,598 second-feet.

Daily gage height, in feet, of Clackamas River near Barton, Oreg., for 1905.

Day.	Nov.	Dec.	Day.	Nov.	Dec.	Day.	Nov.	Dec.	Day.	Nov.	Dec.
1	.....	4.23	9	.....	4.8	17	2.9	4.6	25	3.55	4.0
2	.....	5.47	10	.....	4.5	18	3.1	5.3	26	3.8	5.1
3	.....	5.3	11	.....	4.3	19	3.62	5.25	27	4.33	5.05
4	.....	5.1	12	3.0	4.12	20	4.7	5.2	28	4.1	4.75
5	.....	4.8	13	3.0	4.0	21	4.1	4.8	29	4.1	4.55
6	.....	4.8	14	3.0	3.9	22	3.82	4.6	30	4.19	4.5
7	.....	4.9	15	3.0	3.8	23	3.7	4.33	31	.....	4.8
8	.....	5.13	16	3.0	3.8	24	3.5	4.1			

MISCELLANEOUS MEASUREMENTS.

The following miscellaneous discharge measurements were made in the Columbia River drainage basin in Oregon in 1905:

Miscellaneous discharge measurements made in Columbia River drainage basin in Oregon in 1905.

Date.	Stream.	Locality.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
			Feet.	*Square feet.*	*Ft. per second*	*Feet.*	*Sec.-feet.*
January 8	Bear Creek	Wallowa	29.2	33.5	2.54	.....	75.2
March 31	....do	....do	30.5	34.6	1.56	.....	54.5
May 19	....do	....do	35.5	66.8	4.56	.....	305
September 18	....do	....do	.....	.....	.....	.....	.5
November 29	....do	....do	19.3	14.9	.81	.....	12.1
November 5	Birch Creek	Pendleton	11.3	4.4	.77	.....	3.4
December 23	....do	....do	14.5	10.1	2.40	.....	24.2
March 3	Burnt River	Huntington	42.8	53.2	3.69	.....	196
March 24	....do	....do	43.5	96.5	4.07	.....	393
September 14	....do.[a]	....do	.....	.....	.....	.....	.....

[a] Dry for about two months.

Miscellaneous discharge measurements made in Columbia River drainage basin in Oregon in 1905—Continued.

Date.	Stream.	Locality.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
			Feet.	*Square feet.*	*Ft. per second.*	*Feet.*	*Sec.-feet.*
November 22	Burnt River	Huntington	27	17.4	1.94	.....	33.9
June 10	Canyon Creek	Canyon City	26	18.8	2.63	.....	49.4
August 3	Crescent Creek	Outlet Crescent Lake	26	29	2.96	.....	85.8
April 15	Crooked River	NE. ¼ SW. ¼ sec. 5, T. 17 S., R. 17 E., Willamette meridian.	83	287	2.19	.....	628
April 18	do	Forest	90	301	2.45	.....	737
May 19	do	do	85	162	1.67	.....	270
June 10	do	do	24	23	1.35	.....	54
August 11	do	Prineville	17	5.6	1.67	.....	9.4
November 10	do	do	26	16.5	3.09	.....	51
December 3	do	Forest	55	75	1.05	.....	79
March 4	Deschutes River	B. West's farm	107	658	3.16	.....	2,080
May 26	do	Royce's ranch	22.5	27	2.98	.....	80.4
May 28	do	Black Rock Ford	73	81.9	2.40	.....	197
June 27	do	Royce's ranch	23	21.5	2.13	.....	45.8
Do	do	Black Rock Ford	73	80.4	1.92	.....	154
August 3	do	Royce's ranch	20	12.1	1.28	.....	15.4
October 28	do	SW. ¼ SW. ¼ sec. 31, T. 19, R. 11 E.	106	584	2.59	.....	1,501
November 17	do	B. West's farm	106	574	2.63	.....	1,460
December 10	do	do	106	575	2.39	.....	1,375
April 26	East Fork of Deschutes River.	½ mile below gaging station at Odell.	44	34.8	1.78	.....	68.4
April 29	do	do	43	36.8	1.78	.....	65.7
June 25	do	do	43	33	1.51	.....	50
Do	do	do	43	33	1.33	.....	44
March 5	Deschutes Irrigation and Power Company's flume.	Near Bend	5.3	5	4.50	.....	22.5
June 10	John Day River	John Day City	30	81.4	3.30	.....	269
September	McKay Creek	Pendleton	.....	.....	.....	.....	Dry.
November 16	do	do	14.2	5.8	.71	.....	4.1
December 23	do	do	38	85.7	1.02	.....	87.1
September 20	Minam River	At mouth near Elgin	62.5	56.7	1.09	.....	61.9
April 16	Ochoco River	Prineville	21	21.4	2.44	.....	52.2
May 18	do	do	37	28.7	1.74	.....	50
December 3	do	do	12	5.5	.76	.....	4.2
May 28	Odell Lake Outlet	Odell Lake	45	54.5	2.18	.....	119
June 26	do	do	45	49.4	1.84	.....	90.8
August 3	do	do	38	22.7	1.88	.....	42.6
September 12	Owyhee River	Wilson's ranch, Owyhee	20	4.6	1.04	.....	4.8
October 13	do	do	29.5	12.5	1.10	.....	13.7
March 8	Pauline Creek	Rosland	8	5.5	2.22	.....	12.1
May 24	do	do	7	4.9	1.62	.....	8
June 24	do	do	7	3.4	1.12	.....	3.8
October 25	Quigley Creek	3 miles from Hailey, Idaho.	4.9	1.72	1.69	.....	2.91
October 12	Sandy	Salmon River post-office	92.5	322	4.35	1.82	1,400
March 17	Satas	Alfalfa	38	103	1.91	.....	197
April 2	do	do	64	100	2.25	1.52	225
October 3	Silver Creek	Thompson's Valley	12.5	8.4	1.31	.....	11
December 4	Squaw Creek	Sisters, above diversions	30	29	1.67	.....	49
December 5	do	do	31	30	1.69	.....	50

Miscellaneous discharge measurements made in Columbia River drainage basin in Oregon in 1905—Continued.

Date.	Stream.	Locality.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
			Feet.	*Square feet.*	*Ft. per second.*	*Feet.*	*Sec.-feet.*
February 8	Tumallo Creek	Bend	26	37.6	3.17	.....	120
March 6	....do	....do	26	36.9	3.17	.....	117
June 21	....do	....do	25	39	3.44	.....	134
August 10	....do	....do	18	8.9	1.18	.....	10.6
November 26	....do	....do	24	32	3.00	.....	97
December 6	....do	....do	25	33	2.11	.....	70
September 28	Umatilla River	Fosters	62	45.7	.42	.....	19
October 2	....do	....do	62	50.2	.65	1.00	32.6
October 5	....do	....do	61.8	44.8	.42	.87	18.5
October 10	....do	....do	66	55.2	.78	1.09	43
October 18	....do	....do	69.4	60.5	.95	1.17	57.6
October 24	....do	....do	69	60.3	.83	1.15	50.1
October 26	....do	....do	70	63.9	.93	1.18	59.7
October 31	....do	....do	71.5	65.4	1.05	1.22	68.5
August 9	....do	Below Echo, in sec. 16, T. 4, R. 28 E.	19.5	22.6	.73	.....	16.5
September 30	....do	....do	17.3	22.1	.82	.....	18.1
September 19	Wallowa River	Wallowa Falls above Wallowa Lake.	21	21	1.57	.....	33
November 16	Wild Horse Creek	Rug's ranch, Pendleton	3.2	.9	.51	.....	.46
December 23	....do	....do	3	.96	1.77	.....	1.7
December 14	South Fork of Yamhill River.	Sheridan	122	428	1.36	.....	583

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.

WHITE RIVER DRAINAGE BASIN.

White River has its source near Mount Rainier and flows into Puget Sound near Seattle, Wash. Cedar River is a tributary of White River.

CEDAR RIVER NEAR RAVENSDALE, WASH.

This station was established September 27, 1902, by T. A. Noble. It 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 channel is straight. The right bank is steep; the left bank has a sloping gravelly beach. The bed is permanent, rocky near the right bank, and of sand and gravel near the left bank.

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 conditions suitable for gaging 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. 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 49, page 112, Transactions of the American Society of Civil Engineers.

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, at a point 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 gage is a plain staff, to which is attached a hook gage and vernier reading to thousandths. When this gage is at zero the hook is level with the crest of the dam. It is fastened securely to the head-gates above the dam, and during 1905 was 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.

Information in regard to this station is contained in the following Water-Supply Papers of the United States Geological Survey:

Description: 100, pp 463–464; 135, pp 276–277.
Discharge: 100, p 464; 135, p 277.
Discharge, monthly: 100, p 465; 135, p 278.
Gage heights: 100, p 464; 135, p 277.
Rating table: 100, p 465; 135, p 278.

Daily gage height, in feet, of Cedar River near Ravensdale, Wash., for 1905.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.53	1.30	0.93	1.27	1.04	1.72	1.01	0.67	0.58	0.50	1.06	1.20
2	1.64	1.19	1.41	1.22	1.07	1.64	.98	.67	.58	.71	.98	1.32
3	1.71	1.72	1.76	1.17	1.06	1.70	.96	.67	.57	1.53	.97	1.36
4	1.72	1.58	1.79	1.07	1.02	1.93	.93	.67	.57	1.49	.98	1.38
5	1.64	1.51	1.73	1.05	.99	1.81	.91	.66	.56	1.70	.94	1.40
6	1.50	1.48	1.63	1.06	.98	1.71	.88	.65	.56	1.88	.90	1.38
7	1.35	1.47	1.51	1.09	1.02	1.69	.86	.65	.54	1.78	.90	1.43
8	1.30	1.43	1.47	1.09	.91	1.58	.85	.64	.55	1.98	.87	1.44
9	1.21	1.40	1.44	1.08	1.25	1.51	.81	.65	.54	1.82	.83	1.40
10	1.14	1.38	1.48	1.06	1.14	1.45	.78	.64	.54	1.69	.78	1.36
11	1.08	1.32	1.47	1.08	1.11	1.36	.77	.64	.54	1.50	.76	1.28
12	1.04	1.28	1.48	1.05	1.06	1.31	.77	.63	.54	1.39	.76	1.24
13	.96	1.25	1.38	1.04	1.15	1.18	.76	.61	.59	1.35	.74	1.17
14	.99	1.18	1.27	1.08	1.29	1.12	.84	.62	.58	1.27	.72	1.14
15	.95	.97	1.17	1.06	1.46	1.09	.77	.60	.57	1.32	.72	1.12
16	.92	.73	1.08	1.05	1.47	1.05	.77	.61	.57	1.26	.72	1.09
17	.89	.69	1.05	1.04	1.44	.99	.81	.63	.56	1.26	.71	1.27
18	.88	.71	1.04	1.03	1.37	.97	.79	.61	.56	1.24	.74	1.34
19	.86	.76	1.05	1.08	1.29	.94	.77	.59	.57	1.17	1.15	1.38
20	.87	.74	1.10	1.46	1.25	.98	.75	.58	.58	1.11	1.10	1.42
21	.86	.77	1.17	1.51	1.32	.95	.73	.58	.57	1.07	1.04	1.38
22	.86	.74	1.26	1.49	1.42	.92	.72	.58	.55	1.03	1.02	1.32
23	.88	.76	1.30	1.47	1.91	.90	.71	.57	.53	.99	.98	1.28
24	.99	.78	1.50	1.47	2.74	.89	.71	.50	.54	1.02	.94	1.35
25	1.03	.77	1.55	1.54	2.46	.92	.70	.56	.60	1.47	1.30	1.37
26	1.02	.76	1.57	1.55	2.13	.91	.70	.56	.63	1.49	1.60	1.71
27	1.40	.74	1.61	1.46	1.95	1.00	.69	.56	.60	1.41	1.65	1.79
28	1.66	.83	1.54	1.39	1.96	1.22	.69	.58	.60	1.29	1.54	1.65
29	1.69	.....	1.46	1.28	1.91	1.19	.69	.58	.61	1.23	1.39	1.53
30	1.55	.....	1.33	1.18	1.80	1.06	.68	.58	.60	1.15	1.29	1.49
31	1.43	.....	1.26	.....	1.75	.....	.68	.58	.....	1.09	.....	1.39

SNOHOMISH RIVER DRAINAGE BASIN.

Snoqualmie and Skykomish rivers unite to form the Snohomish, which flows into Puget Sound about 10 miles beyond the junction, near Everett, Wash. The Stilaguamish lies north of the Skykomish and has a parallel course.

SOUTH FORK OF SKYKOMISH RIVER NEAR INDEX, WASH.

This station was established October 6, 1902, by T. A. Noble, and was discontinued September 30, 1905. It is located about 2 miles above Index and about 300 feet from the railroad track.

The channel is straight for 500 feet above and 300 feet below the station. Both banks are of solid rock and 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.

Discharge measurements are made by means of a cable and car. The initial point for for soundings is on the left bank at a plug driven in the solid rock 10 feet from the edge of the stream at low water.

A staff gage is fastened to the solid rock A hook gage is used for reading to hundredths of a foot. During 1905 the gage was read once each day by Louis G. Heybrook. The bench mark is a cross cut in the rock about 6 feet above low water and 40 feet downstream from the gage; elevation, 9.232 feet above the datum of the gage and 679.158 feet above sea level, as obtained from the Great Northern Railway.

Information in regard to this station is contained in the following Water-Supply Papers of the United States Geological Survey:

Description: 85, p 222; 100, pp 471–472; 135, pp 278–279.
Discharge: 85, p 223.
Discharge, monthly: 100, p 474; 135, p 280.
Gage heights: 85, p 223; 100, pp 472–473; 135, p 279.
Rating table: 100, p 473; 135, p 280.

Daily gage height, in feet, of South Fork of Skykomish River near Index, Wash., for 1905.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	3.55	2.93	5.72	3.14	3.53	7.02	3.71	1.83	1.51
2	4.72	2.71	6.85	3.07	3.2	6.21	3.45	1.81	1.34
3	5.25	2.78	7.2	3.02	3.24	8.1	3.31	1.66	1.33
4	5.4	2.6	7.1	2.94	3.21	7.45	3.28	1.62	1.28
5	5.43	2.46	6.41	3.27	3.6	5.7	3.25	1.62	1.15
6	3.88	2.15	5.72	3.45	3.87	5.56	3.19	1.6	1.12
7	3.55	2.38	5.21	3.91	4.48	5.61	3.02	1.58	1.08
8	3.21	2.15	5.21	4.39	5.66	5.98	2.92	1.53	1.34
9	2.98	2.04	5.62	3.75	5.31	6.21	3.04	1.56	1.86
10	3.8	1.97	6.1	3.22	4.44	6.1	2.98	1.54	1.62
11	2.52	1.66	6.81	3.21	4.02	5.81	2.83	1.48	1.43
12	2.38	1.6	5.28	3.42	3.89	5.48	2.43	1.43	1.41
13	2.23	1.64	4.72	3.74	3.54	5.45	2.35	1.41	1.45
14	2.2	1.63	4.46	3.72	6.6	5.38	2.61	1.4	1.34
15	2.18	1.61	4.49	3.45	5.21	4.8	2.48	1.98	1.32
16	2.18	1.58	4.5	3.31	4.72	4.13	2.5	4.43	1.31
17	2.19	1.52	4.47	3.21	5.37	4.23	2.48	4.74	1.56
18	2.12	1.45	4.71	3.47	4.42	4.32	2.29	3.16	2.21

Daily gage height, in feet, of South Fork of Skykomish River near Index, Wash., for 1905.—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
19	2.22	2.12	4.51	4.0	4.25	4.29	2.22	2.32	2.0
20	2.2	2.4	4.34	4.62	4.14	4.41	2.26	2.17	3.81
21	2.08	3.1	4.61	4.63	4.09	4.35	2.34	1.9	2.74
22	2.18	4.48	4.48	5.12	4.25	4.12	2.31	1.68	2.45
23	2.31	5.0	4.48	5.52	4.32	3.91	2.19	1.53	2.7
24	3.02	5.4	4.92	6.13	4.81	3.81	2.12	1.45	2.85
25	3.2	7.75	4.94	6.58	4.56	3.49	2.0	1.21	2.9
26	2.92	5.12	4.73	6.22	4.78	4.06	1.94	1.18	6.55
27	6.18	5.21	4.2	6.2	5.38	4.82	1.88	1.23	4.8
28	5.95	5.58	4.15	4.5	5.69	4.51	2.03	1.19	3.82
29	4.10	.....	3.81	3.98	5.89	4.34	1.98	1.25	3.76
30	3.78	.....	3.48	3.62	6.41	3.81	1.95	1.28	3.85
31	3.31	.....	3.24	.....	7.12	.....	1.91	2.0	.....

SNOQUALMIE RIVER NEAR SNOQUALMIE FALLS, WASH.

This station was originally established by T. A. Noble September 14, 1902, and was discontinued September 30, 1905. The gage was originally located below the falls, but was destroyed by the flood of December 1, 1902. November 2, 1902, another gage was placed about 3 miles above Snoqualmie Falls post-office.

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 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.

Discharge measurements are made by means of a cable and car. The initial point for soundings is a spike driven into a large maple stump on the right bank, about 4 feet above the ground.

The present gage, established January 7, 1903, is in two sections. During 1905 the gage was read once each day by E. C. Reinig. The bench mark is the initial point for soundings; elevation, 27.83 feet above the datum of the gage.

Information in regard to this station is contained in the following Water-Supply Papers of the United States Geological Survey:

Description: 85, pp 220–221; 100, pp 468–469; 135, p 281.
Discharge: 85, p 221; 100, p 469.
Discharge, monthly: 100, p 471; 135, p 284.
Gage heights: 85, pp 221–222; 100, pp 469–470; 135, p 282.
Rating table: 100, p 470; 135, p 283.

Daily gage height, in feet, of Snoqualmie River near Snoqualmie Falls, Wash., for 1905.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	3.93	2.96	6.23	3.0	3.01	6.13	2.71	1.24	1.05
2	5.73	2.75	7.85	2.97	3.67	5.1	2.64	1.19	.93
3	6.15	2.63	6.54	2.84	2.59	7.37	2.51	1.13	.85
4	4.77	2.44	5.6	2.06	2.53	6.7	2.44	1.09	.83
5	4.21	2.31	5.13	3.28	2.61	6.17	2.37	1.05	.79
6	3.55	2.2	4.46	3.31	2.97	5.45	2.29	1.0	.75
7	3.33	2.23	4.31	3.59	4.02	5.2	2.2	.99	.71
8	3.05	2.26	3.98	3.23	4.38	4.99	2.19	1.0	.92
9	2.8	2.19	4.21	3.02	5.06	4.92	2.21	.98	1.02
10	2.61	2.11	4.5	2.85	5.0	4.87	2.12	.96	.98
11	2.43	2.05	4.21	2.81	5.23	4.61	1.97	.94	.9
12	2.16	1.87	3.94	2.79	6.62	3.92	1.82	.9	.85
13	2.0	1.63	3.67	3.24	7.21	3.75	1.74	.85	1.1
14	2.19	1.6	3.56	3.12	7.42	3.41	1.98	.8	1.25
15	2.27	1.58	3.4	2.97	5.29	3.32	2.21	.82	1.11
16	2.38	1.55	3.49	2.84	4.41	3.16	2.52	1.45	1.23
17	2.35	1.54	3.58	3.19	4.22	3.09	2.58	4.41	1.45
18	2.33	1.84	3.4	3.47	4.12	3.01	2.34	2.62	2.08
19	2.2	2.63	3.91	3.64	4.02	2.93	2.29	2.31	1.85
20	2.19	3.22	4.1	3.89	3.96	2.94	2.17	1.87	2.61
21	2.18	4.3	4.35	4.23	3.81	2.92	2.03	1.82	2.12
22	2.21	4.43	4.56	4.45	4.61	2.91	1.92	1.72	1.8
23	2.45	4.61	4.61	4.97	5.3	2.89	1.8	1.56	1.71
24	4.1	6.2	4.79	5.21	8.05	2.9	1.73	1.42	1.92
25	3.82	5.69	4.69	5.26	7.01	2.91	1.58	1.36	2.0
26	4.67	5.20	4.5	4.92	5.68	2.99	1.45	1.21	5.62
27	5.82	4.27	4.34	4.92	5.63	3.32	1.43	1.16	4.27
28	5.89	4.36	3.92	3.63	5.6	3.21	1.41	1.02	3.35
29	4.53	.....	3.61	3.42	5.57	2.96	1.38	1.07	3.27
30	3.97	.....	3.29	3.0	5.53	2.81	1.32	1.09	3.16
31	3.34	.....	3.13	.....	5.5	.....	1.27	1.06	.....

INDEX.

CLASSIFICATION OF THE PUBLICATIONS OF THE UNITED STATES GEOLOGICAL SURVEY.

[Water-Supply Paper No. 178.]

The publications of the United States Geological Survey consist of (1) Annual Reports, (2) Monographs, (3) Professional Papers, (4) Bulletins, (5) Mineral Resources, (6) Water-Supply and Irrigation Papers, (7) Topographic Atlas of United States—folios and separate sheets thereof, (8) Geologic Atlas of United States—folios thereof. The classes numbered 2, 7, and 8 are sold at cost of publication; the others are distributed free. A circular giving complete lists may be had on application.

Most of the above publications may be obtained or consulted in the following ways:

1. A limited number are delivered to the Director of the Survey, from whom they may be obtained, free of charge (except classes 2, 7, and 8), on application.

2. A certain number are delivered to Senators and Representatives in Congress, for distribution.

3. Other copies are deposited with the Superintendent of Documents, Washington, D. C., from whom they may be had at practically cost.

4. Copies of all Government publications are furnished to the principal public libraries in the large cities throughout the United States, where they may be consulted by those interested.

The Professional Papers, Bulletins, and Water-Supply Papers treat of a variety of subjects, and the total number issued is large. They have therefore been classified into the following series: A, Economic geology; B, Descriptive geology; C, Systematic geology and paleontology; D, Petrography and mineralogy; E, Chemistry and physics; F, Geography; G, Miscellaneous; H, Forestry; I, Irrigation; J, Water storage; K, Pumping water; L, Quality of water; M, General hydrographic investigations; N, Water power; O, Underground waters; P, Hydrographic progress reports.

Series P.—The hydrographic progress reports contain the results of stream measurements. A report is issued for every calendar year, containing the results of data collected during that year. These reports were first published as a part of the Director's annual report or as a bulletin; they are now published as water-supply and irrigation papers. The following is a list, by years, of the publications containing the progress reports of stream measurements. A detailed index of these reports (1888–1903) is published as 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, 36, 37, 38, and 39; Twenty-first Annual Report, Part IV.
1900. Water-Supply Papers Nos. 47, 48, 49, 50, 51, and 52; 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, 125, 126, 127, 128, and 129.
West of Mississippi River, Water-Supply Papers Nos. 130, 131, 132, 133, 134, and 135.
1905. East of Mississippi River, Nos. 165, 166, 167, 168, 169, 170, and 171.
West of Mississippi River, Nos. 171, 172, 173, 174, 175, 176, 177, and 178.

The Geological Survey and the Reclamation Service have suboffices in different parts of the United States, from which hydrographic and reclamation work in the respective localities is carried on, and where data may be obtained on application. These offices are located as follows:

Boston, Mass., 6 Beacon street; Utica, N. Y., 75 Arcade; Atlanta, Ga., 409 Temple court; Austin, Tex., University of Texas; Chicago, Ill., 876 Federal Building; Belle Fourche, S. Dak.; Cody, Wyo.; Denver, Colo., Chamber of Commerce Building; Salt Lake, Utah; Los Angeles, Cal., 1108 Union Trust Building; Phoenix, Ariz.; Carlsbad, N. Mex.; El Paso, Tex.; Billings, Mont.; Huntley, Mont.; Hazen, Nev.; Boise, Idaho; North Yakima, Wash.; Portland, Oreg., 351 Washington street.

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JULY, 1906.

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